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Reducing hospital length of stay
by improving quality and safety of care?

For reasons of consistency within this thesis, some terms have been standardised throughout the text. As a consequence the text may differ in this respect from the articles that have been published.

The studies presented in this thesis have been performed at Tranzo, Scientific Centre for Care and Welfare of Tilburg University and at the Scientific Institute for Quality of Healthcare (IQ healthcare). This institute is part of the Nijmegen Centre of Evidence Based Practice (NCEBP), one of the approved research institutes of the Radboud University Nijmegen Medical Centre.

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Nijmegen, 2012

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Reducing hospital length of stay by improving quality and safety of care?

Proefschrift

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aan de Radboud Universiteit Nijmegen
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volgens besluit van het college van decanen
in het openbaar te verdedigen op woensdag 12 december 2012
om 13.00 uur precies

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1

General introduction

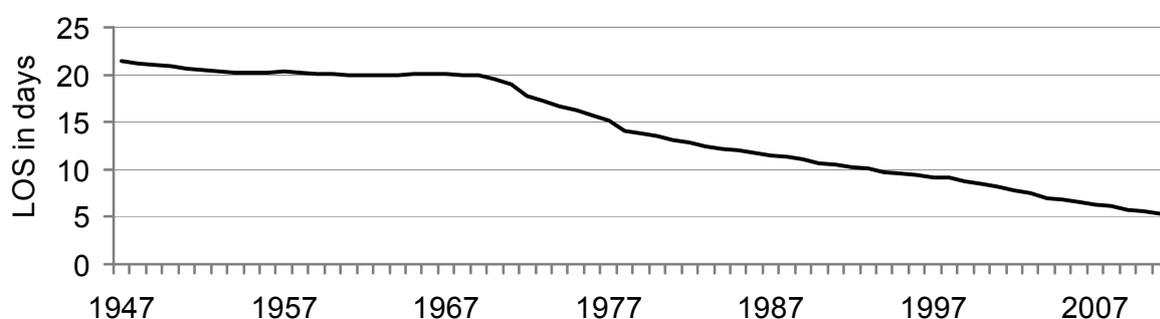
This thesis is about reducing the length of stay in hospital and asks the question whether this reduction can be carried out while at the same time improving the quality and safety of care.

Hospital length of stay (LOS) is defined as the number of days in which a patient is admitted onto a clinical ward of a hospital*. There is substantial variation between hospitals in the mean LOS.¹⁻⁵ This is not only true for the Netherlands but for other countries as well. However there is a general trend towards shorter hospital LOS. Hospitals want to reduce the number of hospital days for several reasons -see below- and the challenge is to do this while simultaneously improving the quality and safety of hospital care.

Length of stay reduction

The reduction of hospital LOS has a long history. The average stay in hospital has been declining for decades. In 1947, the average stay was 21.4 days in the Netherlands. In the fifties and sixties the LOS stabilized around 20 days and from then on the LOS reduced on average by 0.4 days per year. In 2000 the average was 8.5 days and in the subsequent years a further decrease led to an average of 5.3 days in 2011, see Figure 1.⁶⁻⁸

Figure 1. Average length of stay in Dutch hospitals.



Source: 1947–1977 in 5-year intervals by CBS; 1978–2011 yearly data LMR.

The continuous reduction of LOS is all the more remarkable considering that there are two main developments which have the effect of increasing the average clinical LOS. These are:

- The introduction of day care in the 1980s that resulted in many, short term, clinical admissions being dealt with instead as day care^{9,10};

* The day of admission -when admitted before 8 pm- and the day of discharge are both included and patients who were admitted for day care are excluded.

- The ageing of the patient population. In general the complexity of care given to the elderly is higher, due to more comorbidity and frailty of the patients and as a consequence the LOS tends to be longer.

However the overall reduction was influenced by several major changes in health care. In the second half of the 20th century, diseases such as tuberculosis, that were dominant before the Second World War, almost disappeared from hospital care. In addition, treatments for other diseases changed radically, for example the introduction of laparoscopic interventions. The attitude towards hospitals changed. Hospitals used to be institutions where patients were admitted 'until they were completely recovered'. In the second part of the twentieth century there was a strong growth in the number of nursing home beds.¹¹ This enabled patients to be referred to nursing homes or other care facilities at an earlier stage. Hospitals changed into institutions where there is no time anymore to "rest". The assumption is that patients only stay in a hospital for investigations and interventions. The recovery comes afterwards, at home, with or without home care, or in a setting like a home for the elderly or a nursing home. In the 1990s the capacity of facilities for receiving patients after hospital treatment was not enough to transfer all these patients. This resulted in bed blockers, hospital patients waiting to be transferred to aftercare facilities.^{12,13} In response the first intermediate care department was opened in the Netherlands in 1993. This was a nursing home ward within a hospital building. In 2006, 40% of all Dutch hospitals made provision for intermediate care departments, mostly run by a nursing home.^{14,15} This second enlargement in the capacity in aftercare facilities again enabled hospital wards to discharge patients at an earlier stage.

One of the main reasons for hospitals to reduce LOS is the expected financial gain. The introduction in 2006 of the new financing system, the diagnosis treatment combinations or DBC system, allowed for a greater influence from market forces and provided a strong incentive to reduce LOS.^{16,17} In this new financing system hospitals receive a fixed amount per patient group, as negotiated with the health insurers. However, a hospital that is able to reduce LOS, might save costs while the prices paid by the insurers are fixed.

A major incentive to reduce LOS in the years prior to the introduction of the DBC system was to get building plans accepted. The Ministry of Health wanted to reduce the number of hospital beds from 3.8 to 2.0 per 1,000 inhabitants. Building plans that were not based on this standard, risked being rejected. Other reasons for hospitals to

reduce LOS were to solve problems with shortages of personnel or with bed shortages.

Despite the reduction of LOS so far, the expectation is that a further reduction is still possible, because:

- Compared to other OECD countries, the LOS in the Netherlands may be below average, but remains longer than 10 out of 25 other countries that published their LOS of 2009⁷;
- There remains a substantial variation in LOS between Dutch hospitals.

The causes for variations in length of stay

A valid comparison of LOS requires case mix adjustment. Throughout this thesis we adjusted the LOS data for age, diagnosis and procedure. Apart from case mix differences, variations in LOS may be due to three underlying aspects of care:

1. First, there may be differences between hospitals in their specific health care approach. Physicians may differ in their opinion about the best way to treat certain patient groups. For example, LOS can be influenced by the moment antibiotic treatment is switched from intravenous to oral administration.
2. Second, there may be variation in the quality or service level of the care, like different waiting times for diagnostic tests or interventions, or differences in the quality or frequency of communication between doctors, nurses and the patient's family. Sub-optimal communication may cause misunderstandings about treatment and discharge, which may cause a prolonged LOS.
3. Third, there may be variation in the safety of care. Unsafe care may lead to complications and complications often lead to an extended LOS.¹⁸⁻²⁹

Theoretically, if the variation is caused by option 2 and/or 3 it must be possible to reduce LOS and simultaneously improve the quality and safety of care. If the variation is only caused by the first option, it is important to implement just those changes in treatment that do not negatively affect the quality of care.

The level of analysis of the LOS

Westert concluded that the hospital ward is the best level to analyse differences in LOS. Analyses on the hospital or the regional level are less suitable due to underlying variations at a lower level. He also showed that physicians tend to align their LOS for a certain procedure with what is commonplace among colleagues within the same hospital. Physicians who are employed in several hospitals work with different LOS per hospital. They adapt to the hospital or ward culture.¹ De Jong also shows that, in particular, variations in medical practice are the result of the different

circumstances and environments of the hospital or ward in which physicians work, and less the result of individual preferences.³⁰

We chose in our studies, as far as possible, the hospital ward as the level of research.

Objective and outline

The central question of this thesis is whether the reduction of LOS in hospitals can be combined with improving the quality and safety of care.

In **Chapter 2** we start with a description of the methods used to standardise hospital LOS. This chapter handles the question:

What is the degree of variation in LOS and which efficiency gain is possible in Dutch hospitals?

For this question we assessed the development of, and the variation in, LOS in Dutch hospitals. We determined the potential reduction in hospital days if all hospitals achieved an average LOS equal to that of benchmark hospitals.

In **Chapter 3** the central question is:

How do hospitals reduce length of stay?

It presents an approach from the ward level to developing interventions designed to shorten LOS. The approach consists of an analytical tool that we developed for the selection of appropriate interventions. Between 1999 and 2009 this approach has been applied in twenty-one clinical wards in twelve hospitals. We present the complete inventory of all interventions.

Chapter 4 focuses on patient satisfaction with the main question:

Are patients more or less satisfied with the care delivered on wards with a shorter length of stay?

We investigate the relationship between LOS and patient satisfaction on the level of hospital wards. The underlying hypothesis is that good quality of care leads both to shorter LOS and to patients that are more satisfied.

Chapter 5 presents the first Dutch experiences with a new outcome indicator: Unexpectedly long length of stay (UL-LOS).

Since 2009 this indicator has been used by the Dutch Health Care Inspectorate. This indicator focuses on complications and not on the general quality of care. Therefore, the indicator was based on a prolonged LOS of more than 50%. The chapter answers the questions:

How variable between different hospitals is the indicator Unexpectedly long length of stay? And how consistent or stable is it over time? We also ask what is the relationship between the UL-LOS and other general quality indicators such as the hospital standardised mortality ratio (HSMR)?

In **Chapter 6** we present the findings of the use of LOS data to identify patient records in which an adverse event occurred.

We investigate whether a priori selection of patient records using two formal quality indicators -Standardised Mortality Ratio (SMR) and Unexpectedly Long Length Of Stay (UL-LOS)- leads to more records with adverse events compared to a random selection of patient records.

Finally, in **Chapter 7**, the main findings of this thesis are summarised and discussed, together with the methodological considerations of this study and the implications for policy makers, supervisors and future research.

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2

Benchmarking and reducing length of stay in Dutch hospitals

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Abstract

Background: To assess the development of and variation in lengths of stay in Dutch hospitals and to determine the potential reduction in hospital days if all Dutch hospitals would have an average length of stay equal to that of benchmark hospitals.

Methods: The potential reduction was calculated using data obtained from 69 hospitals that participated in the National Medical Registration (LMR). For each hospital, the average length of stay was adjusted for differences in type of admission (clinical or day-care admission) and case mix (age, diagnosis and procedure). We calculated the number of hospital days that theoretically could be saved by (i) counting unnecessary clinical admissions as day cases whenever possible, and (ii) treating all remaining clinical patients with a length of stay equal to the benchmark (15th percentile length of stay hospital).

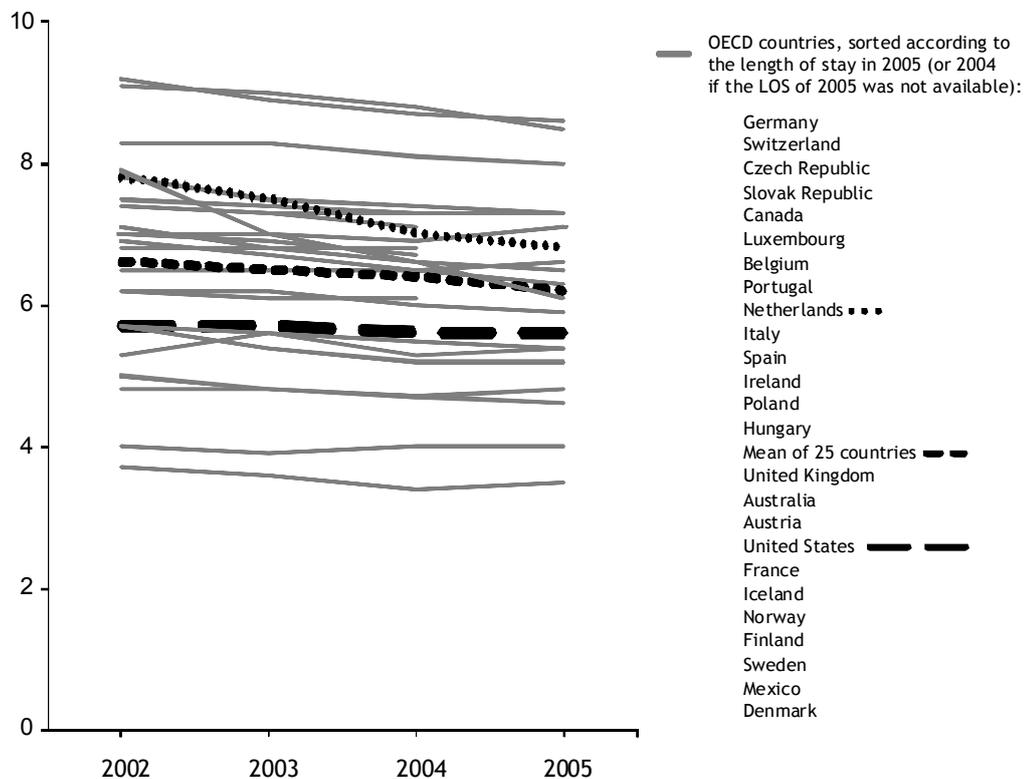
Results: The average (mean) length of stay in Dutch hospitals decreased from 14 days in 1980 to 7 days in 2006. In 2006 more than 80% of all hospitals reached an average length of stay shorter than the 15th percentile hospital in the year 2000. In 2006 the mean length of stay ranged from 5.1 to 8.7 days. If the average length of stay of the 15th percentile hospital in 2006 is identified as the standard that other hospitals can achieve, a 14% reduction of hospital days can be attained. This percentage varied substantially across medical specialties. Extrapolating the potential reduction of hospital days of the 69 hospitals to all 98 Dutch hospitals yielded a total savings of 1.8 million hospital days (2006). The average length of stay in Dutch hospitals if all hospitals were able to treat their patients as the 15th percentile hospital would be 6 days and the number of day cases would increase by 13%.

Conclusion: Hospitals in the Netherlands vary substantially in case mix adjusted length of stay. Benchmarking -using the method presented- shows the potential for efficiency improvement which can be realized by decreasing inputs (e.g. available beds for inpatient care). Future research should focus on the effect of length of stay reduction programs on outputs such as quality of care.

Background

“Reducing length of hospital stay is a policy aim for many health care systems and is thought to indicate efficiency”.¹ The average length of stay of patients in Dutch hospitals has been decreasing for decades. In spite of this reduction, the length of stay in the Netherlands was longer than the combined mean length of stay of 25 OECD countries (Figure 1) during the period 2002-2005. In 2005 the mean length of stay in the Netherlands (6.8 days) exceeded the mean of the 25 OECD countries combined (6.2 days) by ten percent. Dutch lengths of stay exceeded those in the United States by 21 percent (2005). A study of the Netherlands Board for Health Facilities also showed that a further reduction of lengths of stay in Dutch hospitals might be possible.^{2,3}

Figure 1. 25 OECD countries: Average length of stay in days for acute care.



Source: OECD HEALTH DATA, 2007.

These findings may be explainable because until 2005, the financing system in the Netherlands did not encourage length of stay reduction. Hospitals were paid through a system based, in part, on hospital patient days. Medical specialists were paid separately from this system, mostly on the basis of a lump sum. Hospitals still had several reasons to reduce length of stay. For example, the Dutch Ministry of Health Care encouraged hospitals to reduce the number of beds from 3.8 to 2.0 beds per 1000 inhabitants. Hospitals feared that their new building plans would only be

accepted if they anticipated this objective to reach 2.0 beds per 1000 inhabitants.⁴ Other reasons for hospitals to reduce lengths of stay included shortages of personnel and reductions in admissions caused by bed shortages. These relatively indirect incentives to reduce length of stay applied to hospitals, but not to medical specialists.

Recently, the introduction of a new financing system for hospitals, the Diagnosis Treatment Combination system (in Dutch: DBC) substantially increased the incentive for Dutch hospitals to shorten lengths of stay. This is a Dutch variation of the Diagnosis Related Group system; hospitals are paid for every DBC. At the start of the DBC-system the prices of 10% of all DBC's were negotiable between hospitals and health insurance companies. This percentage is growing. The objective is that 65-70% of all hospital care will be negotiable in 2011. For medical specialists the financing system will also change. The lump sum will be abolished and some kind of competitive system will be introduced as an intermediate phase to entirely free prices. The essence of the new financing system is to reorganise health care on a free market-basis. This new financing system gives hospitals and specialists a strong motivation to reduce costs and lengths of stay.

These developments raise the question, how many hospital days potentially could be reduced in the Netherlands in the near future? Brownell et al. (1995) determined the potential savings by reducing length of stay in eight major acute care hospitals in Manitoba.⁵ Hanning (2007) benchmarked the length of stay in Australia in private cases in private facilities.⁶ Both found that a substantial proportion of days could be eliminated if hospitals worked as efficiently as the benchmark.

In this study we present a method to make a realistic calculation of the potential reduction of hospital days. We will assess the development of lengths of stay in Dutch hospitals and calculate the potential reduction of length of stay if all hospitals would work as efficiently as the benchmark (the 15th percentile hospital).

Methods

Setting: 69 hospitals

For this study, we used hospital data that were registered in the National Medical Registration (Landelijke Medische Registratie, LMR). All data were provided by research Institute Prismant. In the LMR, data are available of admissions in general and academic hospitals in the Netherlands. This information includes medical data such as diagnoses and surgical procedures as well as patient specific data, including age, gender and hospital stay. The LMR is not based on DBC's but diagnoses are classified by the ICD-9 and procedures by the Dutch Classification System of Procedures. There have been no major changes to these classification systems between 1991 and 2006.

Participation in the LMR is voluntary. Until 2004, the participation percentage of hospitals to the LMR was nearly 100%. Since 2005 some hospitals (2005: 2, 2006: 11) stopped their participation to the LMR because of the introduction of a second hospital registration: the registration of DBC's. This registration is obligatory and these hospitals gave priority to the DBC-registration instead of prejudicing the LMR-registration. Despite this diminishing number of participating hospitals we decided to use the 2006 data, the most recent available.

In 2006, the total number of general and academic hospitals in the Netherlands was 96; 11 of these hospitals did not participate in the LMR and 16 hospitals participated but did not register their procedures in the LMR. We excluded both of these groups in our analysis. Sixty nine hospitals (72% of the total) did contribute to this study. The excluded hospitals did not have a specific pattern in their lengths of stay. In 2004 their combined average length of stay was the same as the combined average length of stay of the 69 hospitals that were included in our study. For this reason we assumed that the data used in this study were representative of all Dutch hospitals.

A specialty was included if it had 100 or more clinical discharges. For eleven specialties, a number of hospitals were excluded because they produced too few discharges. The number of hospitals that were excluded varied from 57 hospitals for ophthalmology (a specialty that mainly works in outpatient clinics) to 1 hospital for orthopaedic surgery.

Standardisation

In order to compare length of stay between hospitals we applied two adjustments:

1. Adjustment for differences in the policy of admission (clinical or day-care admission)

Dutch hospitals differ in their admission policies. In principle, there is a choice between outpatient-care, day-care and clinical admission. Outpatients are treated in outpatient departments, where they consult a doctor, nurse or paramedic. Day-care is defined as care given in a specific centre for day-care to patients that only stay for several hours during the day (no overnight). Clinical patients are treated in the clinical department. They occupy a bed on a clinical ward and they intend to stay one or more overnight(s). Some hospitals tend to treat patients presenting for small procedures in day-care, while other hospitals have a larger threshold to treat in day-care. They tend to treat these patients on a clinical ward. If these patients are admitted in a clinical department, their (relatively short) length of stay contributes to the overall mean length of stay, while it does not if these patients are treated in day-care. Thus, hospitals with a larger threshold to treat patients in day-care more easily reach a short mean length of stay. In order to correct for this we excluded all

hospital days of patients admitted on a clinical ward while they in principle could have been treated in day-care. In our study the hospital stay of these patients was analyzed separately. This is in accordance with the recommendation Hanning⁶ made to differentiate between same-day and overnight cases in benchmarking length of stay.

Admissions that could in principle have been treated in day-care were selected on the basis of the occurrence of the main procedure in day-care. We listed all day-care procedures that were performed at least 50 times in the Netherlands in 1997 in at least 5 hospitals. Clinical admissions with a main procedure that appeared on this list were counted as admissions that could in principle have been treated in day-care if they also complied with all of the following conditions:

- Non-acute admission;
- Admission not for delivery;
- Patient did not die in hospital;
- Maximum clinical length of stay of three days;
- Only one specialty was responsible during the stay (no transfer to another specialty);
- No transfer to another hospital.

The year 1997 was used as reference to ensure that admissions really could be treated in day-care and to avoid discussions between professionals. Therefore, there is a chance for underestimation.

2. Adjustment for case mix

A valid comparison of lengths of stay requires case mix adjustment. Therefore we computed for each hospital specialty a ratio of actual length of stay to expected length of stay. The expected length of stay was computed by Prismant. For each specialty the expected length of stay was based on the characteristics of its patients and the national mean length of stay that is associated with these characteristics.⁷ A ratio higher than one indicates that the length of stay is higher than if its patients had national length of stay rates. The following characteristics (variables) were taken into account:

- Age, divided in 5 classes: 0, 1-14, 15-44, 45-64, 65+ years;
- Primary diagnosis. This is the main diagnosis that led to the admission; it includes about 1,000 diagnoses classified by the ICD9 in three digits;
- Procedures, classified by the Dutch Classification System of Procedures. The procedures considered depend on the diagnosis of the patient. On average it includes five procedure groups.

Together these three parameters produced about $5 \times 5 \times 1,000 = 25,000$ cells for which the mean length of stay is taken as the expected length of stay. An exception

was made for patients with a length of stay of 100 hospital days and longer and for patients who died in hospital. For the latter two groups the expected length of stay was kept equal to the actual length of stay and consequently the ratio of actual length of stay to expected length of stay always was 1.

15th percentile hospital

In an Australian benchmark Hanning used the minimum length of stay as the standard (at state level).⁶ Brownell used the hospital with the shortest overall length of stay to calculate the potential savings.⁵ For our calculation of the potential length of stay reduction, we used the 15th percentile hospital as the benchmark value. The 15th percentile hospital of each specialty was determined by ranking the quotients of actual to expected length of stay of all hospitals with 100 or more discharges for each specialty. The hospital with the lowest ratio of actual to expected length of stay was identified as the hospital with the shortest length of stay. For each specialty the length of stay at the 15th percentile hospital in this ranking was used as the standard for calculating the potential reduction of length of stay in all hospitals with a longer length of stay. For 2006, we calculated how many hospital days Dutch hospitals could have reduced if they had all been at least as efficient with their beds as the 15th percentile hospital.

Experiences gained in our consultancy practice have shown that setting a realistic goal motivates medical specialists to reduce the length of stay. In the first years of our consultancy practice we used the minimum as the standard, but medical specialists had many problems with this approach. They continued emphasizing potential 'rest'-variation which was not standardised for. The use of the minimum as a standard discouraged them to work on improving the health care process. They saw it as an unattainable goal. By using the 15th percentile and not the minimum we captured potential rest variation which was not adjusted for.

Calculation of the potential reduction of length of stay in Dutch hospitals

To calculate the length of stay reduction that Dutch hospitals can achieve based on the results of the 15th percentile hospitals, we distinguished between hospital days that could be gained by substitution from clinical to day-care and hospital days that could be gained by treating clinical patients with a shorter length of stay.

An example for internal medicine:

- In the 69 hospitals of this study the total number of hospital days in clinic and day-care was 1,467,522;
- 215,587 patients were treated in day-care and 501 were treated in clinic only for 1 day;

- 3,965 patients were admitted in clinic for a 2-day (2,867 patients) or 3-day (1,098 patients) stays but could potentially have been treated in day-care;
- Treating them in day-care would save $2,867 + 1,098 + 1,098 = 5,063$ hospital days, which is 0.3% of all hospital days in clinic and day-care combined;
- Without the (potential) day-care patients the total number of hospital days was 1,242,406, generated by 139,904 patients;
- The 15th percentile hospital had a ratio of actual to expected length of stay of 0.95. Using this ratio to all expected lengths of stay of every hospital, the total gain in hospital days could be 162,868, which equalled 11.1% of all hospital days in clinic and day-care combined.

As a result, for internal medicine the hospital days that could be gained by substitution from clinical to day-care was 0.3%. Hospital days that could be gained by treating clinical patients with a shorter length of stay amounted to 11.1%. The combined level was 11.4%.

Results

1. Development of length of stay in Dutch hospitals

The length of stay in Dutch hospitals has been decreasing nearly every year since data have become available. In 1978 (which is the first year for which data from the LMR could be used) patients stayed in hospital for an average of 14.1 days, while in 2006 the average length of stay was reduced to only 6.6 days. This amounted to an average decrease of 0.3 days per year. In Figure 2 we have also plotted 5-year interval data made available by the CBS. This information dates back to 1947 when the average length of stay was 21.4 hospital days.⁸

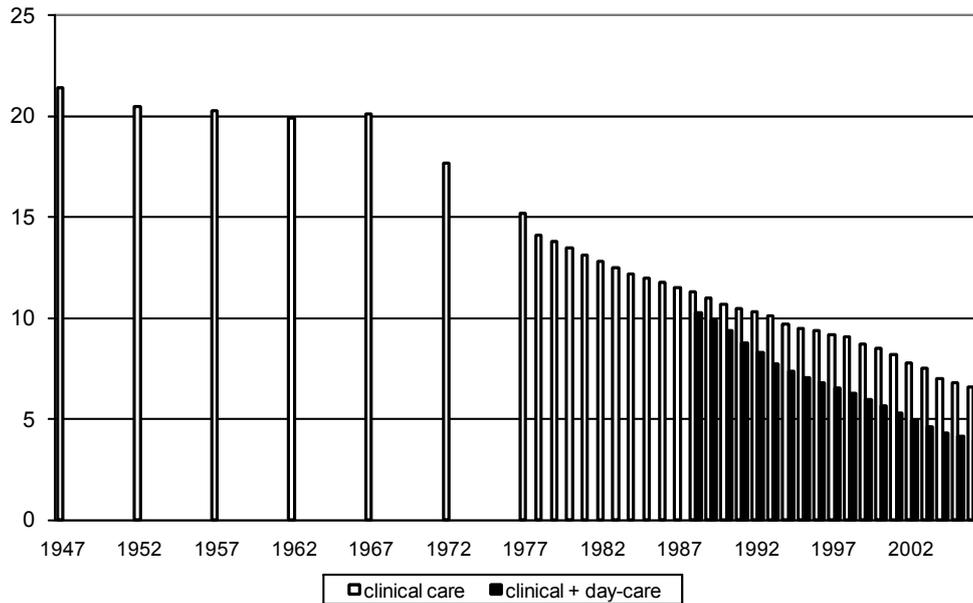
Variation in length of stay between hospitals

In 2000, the shortest average length of stay was 5.7 days while the longest was 11.3 days. The 15th percentile hospital had an average length of stay of 7.4 days.

In 2006 more than 80% of all hospitals reached an average length of stay shorter than the 15th percentile hospital in the year 2000. Between 2000 and 2006 the 15th percentile decreased from 7.4 to 5.7 hospital days. The difference between the longest length of stay and the shortest length of stay also declined during this period: In 2000, the longest length of stay (11.3 days) was 2.0 times longer than the shortest length of stay (5.7 days), while in 2006 it was 1.7 times as long (longest 8.7 days and shortest 5.1 days).

Substantial variation in length of stay among hospitals will occur because not all hospitals have the same specialty (to the same extent) and also within a specialty hospitals can have a different patient mix.

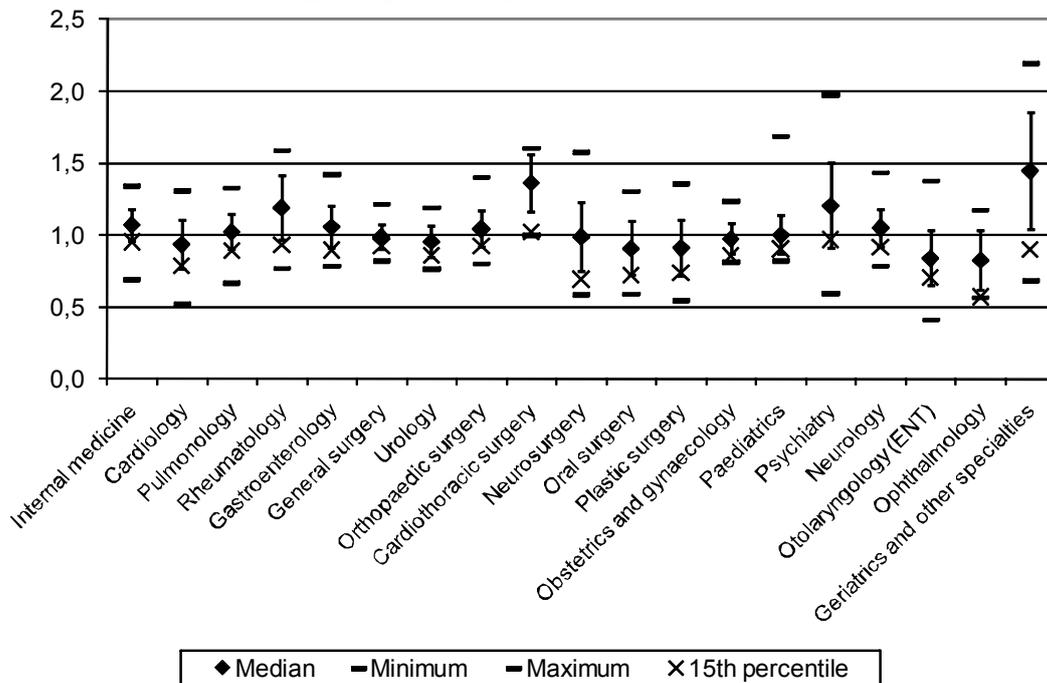
Figure 2. Average length of stay in Dutch hospitals 'clinical care' and 'clinical + day-care'.



Source: 1947–1977 in 5-year intervals by CBS; 1978–2006 yearly data by LMR Prismant.

Figure 3 shows the variation in average length of stay for the separate specialties in 2006. For each specialty the national range is identified from hospital-scores of the quotient of the actual length of stay and the expected length of stay. The figure shows that the greatest range of lengths of stay can be found in geriatrics and other specialties and psychiatry.

Figure 3. Variation in average length of stay for separate specialties, 2006.



2. Potential reduction of hospital days in Dutch hospitals

In Table 1 we show the percentage of hospital days that could have been saved if all hospitals had substituted their potential day-care patients to day-care and treated their patients as efficiently as the 15th percentile hospital. This saving is expressed as a percentage of the total number of admissions in clinical and day-care.

In the last column of Table 1, we have calculated the total potential reduction of hospital days by applying the percentages of column 3 (Percentage hospital days to gain by substitution to day care and reduction length of stay to 15th percentile hospital) to all hospital days in all Dutch hospitals.

Expressed in absolute numbers internal medicine is the specialty that has the largest number of hospital days to save, but expressed in percentages this potential reduction is the smallest. The standard deviation of the mean length of stay for internal medicine is relatively small when adjusted for case mix (0.11).

Table 1. Percentage of hospital days that could have been saved

| | % hospital days (clinical and day care) to gain by | | | Extrapolation to all Dutch hospitals: number of hospital days to gain |
|----------------------------------|--|--|---|---|
| | substitution to day care | reduction length of stay to 15th percentile hospital | substitution to day care AND reduction length of stay to 15th percentile hospital | |
| Internal medicine | 0.3% | 11.1% | 11.4% | 248231 |
| Cardiology | 1.2% | 16.5% | 17.7% | 243766 |
| Pulmonology | 0.2% | 12.9% | 13.1% | 114951 |
| Rheumatology | 0.1% | 17.3% | 17.4% | 14357 |
| Gastroenterology | 1.4% | 11.5% | 12.9% | 51784 |
| General surgery | 2.5% | 9.1% | 11.6% | 243697 |
| Urology | 4.7% | 9.8% | 14.5% | 60074 |
| Orthopaedic surgery | 2.6% | 10.7% | 13.3% | 127051 |
| Cardiothoracic surgery | 0.0% | 22.2% | 22.2% | 34833 |
| Neurosurgery | 0.4% | 26.9% | 27.3% | 48463 |
| Oral surgery | 3.2% | 15.8% | 18.9% | 8712 |
| Plastic surgery | 4.1% | 14.1% | 18.2% | 28022 |
| Obstetrics and gynaecology | 0.5% | 11.5% | 12.0% | 126912 |
| Paediatrics | 0.2% | 11.4% | 11.6% | 100307 |
| Psychiatry | 0.0% | 19.1% | 19.1% | 84182 |
| Neurology | 0.1% | 11.8% | 11.9% | 106441 |
| Otolaryngology (ENT) | 13.2% | 10.5% | 23.7% | 72756 |
| Ophthalmology | 5.5% | 13.9% | 19.4% | 37975 |
| Geriatrics and other specialties | 0.2% | 38.7% | 38.9% | 71924 |
| TOTAL | 1.4% | 12.9% | 14.3% | 1824441 |

Therefore, the potential percentage reduction generated by reducing lengths of stay to the 15th percentile hospital is relatively small, but because internal medicine is the largest specialty (in number of admissions), the absolute number of hospital days that can be saved is the highest of all specialties.

For general surgery, the second largest specialty in the Netherlands, the data are similar. The standard deviation for general surgery is the smallest of all specialties (0.09). The percentage of hospital days that could be saved is 11.6%. In comparison with Internal Medicine a larger portion of days could be gained by substitution to day-care.

'Geriatrics and other specialties' has the largest percentage of hospital days that could be saved by reducing length of stay to the 15th percentile. The standard deviation is 0.40. This specialty mostly treats older multi-problem patients with multiple secondary diagnoses. They often are in need of long-term care in a nursing home or the community and may block hospital beds. They cannot leave the hospital in case of lacking nursing home capacity, insufficient home care arrangements or slow referral procedures. The differences in lengths of stay between hospitals that do not have problems in transferring these patients to long-term care facilities and hospitals that do have these problems are substantial.

Overall the average length of stay in Dutch hospitals -if all hospitals would be able to treat their patients like the 15th percentile hospital- would be 6.0 days and day-care (that is not included in this length of stay) would grow by 13%.

Discussion

Implications for policy and practice

The continuous reduction of length of stay is all the more remarkable considering two main developments with an increasing effect on the average clinical length of stay:

1. Since the eighties of the last century many hospitals have introduced day-care and have increasingly substituted (short-term) clinical admissions for day-care.^{9,10}
2. Another development which had an increasing effect on the average length of stay is the ageing of the patient population. In 1978, 19% of the admissions were 65 years or older. In 2006, this increased to 48%. On average, elderly people stay longer in hospitals than younger ones; in 2006 the 0-64-year-old patient stayed an average 5.2 days in hospital and the patients aged more than 64 years stayed an average of 9.1 days.

In spite of these two developments the average length of stay decreased from year to year. We expect this to continue because in the coming years, the financing system in Dutch hospitals will more and more be based on market forces and the reimbursement through payments per diem will be abolished (as in the United States more than two decades ago¹¹). The increased competition among hospitals will

increase interest in length of stay reduction in order to increase capacity for additional admissions and improve financial performance.

Limitations of the study

Chance of underestimation

The potential reduction in length of stay may in fact be higher because of two methodological choices. First, we have chosen to use a 1997 list of treatments that could have been performed in day care. This list could have been longer if we had used more recent data as a reference. Currently, we are planning to update the list. Probably a new list will show more possibilities to substitute inpatient care into day-care. Until now, the health care system in the Netherlands gave only few incentives to treat patients in day-care. Updating the list at this moment will also give an underestimation of the possibilities for day-care. We think that, when the changes in the financing system have been carried out entirely, an update will clearly show more possibilities for day-care.

Second, in our standardisation for patient mix, the expected length of stay was not used for patients with a length of stay of 100 hospital days and longer and for patients who died in hospital. For these two groups the realised length of stay was used instead of the expected length of stay. This means that the results are without the potential gain in efficiency for these two groups. However, it concerns a small number of patients. Only 0.1% of all patients had a length of stay of 100 hospital days and longer and 2.4% of all patients died in hospital.

Specialty as a variable for length of stay

The variation in the quotients of actual length of stay and expected length of stay shows that for several specialties the mean score is not 1. This is the case especially for cardiothoracic surgery and for 'other specialties'. For these two specialties it is 'normal' that the quotient of actual and expected length of stay is higher than 1.0. For 'other specialties' it is known that many hospitals created a special ward for patients that could not be discharged in time to next care facilities like nursing homes. The length of stay of these patients was longer because of these waiting days and the hospitals booked for these patients an administrative transfer to 'other specialties'. The code 'other specialties' is also used for geriatrics. This specialty treats patients that may have the same age group, diagnosis- and procedure group as patients treated by other specialty, but often the patients treated by geriatrics have a more complex syndrome and stay longer in hospital because of their frailty. The variables for standardisation (age group, diagnosis- and procedure group) do not seem to be sufficient for patients that are discharged by these two specialties. The variable 'specialty' should also been taken into account. Because we did our analysis

for each separate specialty this was no problem for this study, but if length of stay is benchmarked on the level of hospitals, 'specialty' is a variable that should be taken into account.

Lack of data based on severity of illness

For a large part of the data, adjustment for age, primary diagnosis and procedure amounts to an adjustment for severity of illness. However, we realise that there may still be residual case mix related variation that is not adjusted for. We did not adjust for variations in comorbidities. Neither did we account for variations between elective versus emergency cases. Both parameters were recorded in the LMR, but the completeness of the registration of these items varies between hospitals. We realise that the presence or absence of a large number of comorbidities and/or emergency cases at hospital level will affect overall length of stay of a particular hospital. However, this potential residual variation that is not adjusted for is one of the reasons why we used the 15th percentile as benchmark and not the minimum. If a more sophisticated comparison data based on severity of illness were available, it would be possible to identify which subpopulations (younger, older, diagnosis, procedure, long stay, short stay) were generating the largest numbers of excess days. This could be possible in the future because the Dutch hospital information system will be upgraded in 2010.

Perspectives for future research

Length of stay is often used as an indicator of efficiency.^{6,11-13} Efficiency can be described as the relationship between input and output. From a hospital perspective a length of stay reduction may increase efficiency by increasing the output (number of patients) or decreasing the inputs (e.g. available beds for inpatient care). Both may be realised by reducing 'waiting'-days during a hospital stay or by minimising time between examinations, consultations and procedures. However, if the reduction in lengths of stay results in increased intensity of care (and consequently cost) the efficiency improvement may be smaller. In addition, the reduction of hospital days will mainly be a reduction of 'low care' days. The more intensive and expensive patients remain in the hospital.

From a health system perspective, efficiency also depends on the efficiency of other sectors and on health outcomes.¹⁴ When length of stay reduction is realised by a quicker transfer to follow-up care, the costs of care may be passed. Quicker discharge may increase the pressure on other health care sectors (and their cost) and as a result, the efficiency of the health care system may not improve. Therefore, more insight into the relationship between length of stay and quality of care in the hospital is needed.¹⁵⁻¹⁷ Shorter lengths of stay may also lead to a better quality of

care, and, conversely, a better quality of care can lead to a shorter length of stay. For example fewer hospital days will reduce the chance for complications such as infections and fewer complications will lead to shorter lengths of stay.

On the contrary, we did not find research that showed that shorter lengths of stay in hospitals is related to adverse quality.^{1,5,15,18} Only for some specific procedures or diagnoses there is information concerning the limits of hospital stay reduction.¹⁹

Brownell stated that ‘reassuringly, shorter stays have not been found to be related to adverse patient outcomes. In fact, a study of almost 4000 US hospitals showed that hospitals that discharged patients more efficiently had lower post discharge death rates’.⁵ Finally, Harrison observed: ‘Improving hospital efficiency by shortening length of stay does not appear to result in increased rates of readmission or numbers of physician visits within 30 days after discharge from hospital. Research is needed to identify optimal lengths of stay and expected readmission rates’.¹⁶

If quality improvement leads to shorter lengths of stay and shorter lengths of stay can lead to a better quality of care, we are curious if hospitals with shorter length of stay have better outcomes than hospitals with a longer length of stay. In future work we will investigate the connection between length of stay and quality of care.

Conclusion

The length of stay in Dutch hospitals has been decreasing for decades. Between 1978 and 2006 the average decrease was 0.3 days per year. In 2006 more than 80% of all hospitals reached an average length of stay lower than the 15th percentile hospital in the year 2000. In 2006 the length of stay ranged from 5.1 to 8.7 among the 69 hospitals. Still, a further reduction of lengths of stay is possible. If all hospitals had substituted their potential day-care patients to day-care and if the average length of stay of the 15th percentile hospital in 2006 is taken as the standard, a 14% reduction of all hospital days would be attained. This percentage varied substantially across medical specialties (e.g. internal medicine 11% and ENT specialty 24%). Extrapolating the potential reduction of lengths of stay of the 69 hospitals (that participate in the LMR) to all 98 Dutch hospitals yields a total reduction of 1.8 million hospital days.

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3

Fifty ways to reduce length of stay: An inventory of how hospital staff would reduce the length of stay in their hospital

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Abstract

Purpose and setting: In this study we present a bottom up approach to developing interventions to shorten lengths of stay. Between 1999 and 2009 we applied the approach in 21 Dutch clinical wards in 12 hospitals. We present the complete inventory of all interventions.

Design: We organised, on the hospital ward level, structured meetings with the staff in order to first identify barriers to reduce the length of stay and then later to link them to interventions. The key components of the approach were a benchmark with the fifteenth percentile and the use of a matrix, that on one side was arranged along the main phases of the care process -the admission, stay and discharge- and on the other side to the degree to which the length of stay could be shortened by the medical specialists and nurses themselves or by involving others.

Findings and conclusions: The matrix consists of a wide variety of interventions that mainly cover what we found in published research. As a bottom up approach is more likely to succeed, we would advise wards that have to reduce length of stay to make the inventory themselves, using appropriate benchmark data, and by using the matrix.

Introduction

In the Netherlands, as well as in many other economically developed countries, the average length of stay of hospital patients has been decreasing for decades. In Dutch hospitals it decreased from 11.5 days in 1989 to 9.2 days in 1999 and 5.6 days in 2009 (OECD data¹). The Netherlands are following an international trend of continuing reductions in length of stay. From an international perspective the mean length of stay in the Netherlands in 2009 was 0.7 days below the average level with Japan at the top and Mexico at the bottom (OECD data¹). Dutch hospitals had several incentives to reduce the number of clinical days.

The most important were financial reasons which became more important since a new financing system was introduced in the Netherlands in 2006.^{2,3}

Although it was attractive for hospitals to reduce the length of stay as much as possible, they did not all succeed in reaching this reduction to the same degree. If all Dutch hospitals were as efficient as the benchmark hospitals, then a total gain of at least 1.8 million hospital days, or 14% of all hospital days, would have been attainable for 2006.⁴ The inter-hospital variation in length of stay is still substantial - even after standardising for case mix - not only in the Netherlands, but also in other countries.⁵⁻¹¹

There are many studies which look at reducing length of stay through specific interventions in specific patient groups.¹²⁻³⁴ But beyond all these very specific suggestions, there is little insight in literature into a more overall view on the hospital ward level of all measures which professionals, especially the more generic specialties, choose to reduce length of stay. In addition to these gaps in the literature, we noted that in previous projects our physicians were not very willing to implement measures to reduce length of stay that they did not 'invent' themselves. In this study we present a bottom up approach to developing interventions to shorten lengths of stay. We applied the approach in 21 Dutch clinical wards and present the complete inventory of all interventions the hospital staff on these clinical wards found necessary to reduce the number of hospital days. The findings of this study could help other hospitals in choosing their optimal way of reducing length of stay.

Materials and methods

Setting

We supported 12 Dutch hospitals in their request to develop interventions that would reduce lengths of stay. Their requests for support were made in different years within the period 1999-2009. For six hospitals our support was on one ward, for three hospitals on two and for three hospitals on three. This gave a total of 21 hospital wards: eight internal medicine wards, five general surgery wards, three pulmonology wards, two cardiology wards, one orthopaedic surgery ward and two neurology

wards. It concerned 12 wards in general hospitals and nine in tertiary teaching hospitals. No university medical centres were included in the study. All of the wards had relatively long lengths of stay and wanted to reduce them. 18 of the 21 wards had percentile scores above 60%, see Table 1.

Table 1. Percentile scores of each ward in the year before we started to support them in reducing LOS

| | | percentile score in the year before we started to support the ward in reducing LOS |
|----|---------------------------------|---|
| 1 | Hospital 1, internal medicine | 66% |
| 2 | Hospital 2, internal medicine | 85% |
| 3 | Hospital 3, internal medicine | 96% |
| 4 | Hospital 3, pulmonology | 100% |
| 5 | Hospital 3, general surgery | 85% |
| 6 | Hospital 4, internal medicine | 45% |
| 7 | Hospital 4, pulmonology | 83% |
| 8 | Hospital 4, cardiology | 97% |
| 9 | Hospital 5, internal medicine | 69% |
| 10 | Hospital 5, general surgery | 89% |
| 11 | Hospital 6, internal medicine | 64% |
| 12 | Hospital 6, general surgery | 98% |
| 13 | Hospital 7, internal medicine | 78% |
| 14 | Hospital 8, internal medicine | 85% |
| 15 | Hospital 9, pulmonology | 49% |
| 16 | Hospital 10, cardiology | 41% |
| 17 | Hospital 10, neurology | 100% |
| 18 | Hospital 10, general surgery | 76% |
| 19 | Hospital 11, neurology | 87% |
| 20 | Hospital 11 orthopaedic surgery | 88% |
| 21 | Hospital 12, general surgery | 88% |

Study design

The 21 clinical wards in our study were assigned by the hospitals' board of directors to work on reducing hospital days. We developed a bottom up approach, with key features of action research.³⁵ Implementation theory³⁶ teaches us that for a successful implementation it is important to involve the professionals, not only because of their expertise, but also to get them motivated to implement new interventions. In action research studies, research is designed, carried out, and integrated by the participants in partnership with the researchers.³⁷ In our case the study was designed by the researchers with the co-operation of the professionals. Every ward carried out this design in exactly the same way; from the bottom up and by the professionals. Our role as external researchers was to coordinate the process without introducing the obstacles or interventions to reducing length of stay. We simply provided them with an approach of how to come to the inventory themselves.

The advantage of this approach was that it helps to make the results of research more generally applicable. Another strength of action research is its ability to influence practice positively while simultaneously gathering data to share with a wider audience.³⁸

We systematically followed the following approach in order to get valid and reliable results:

1. For each ward we began by explaining with the ward's manager the approach and discussing the list of those invited for the meetings.
2. For the meetings we invited the ward's manager, all physicians working on the ward (depending on the ward this involved 1-20 persons), a representation from the nurses (1-5 persons), someone who represented the medical registration ward who therefore knew how the registration of diagnosis and procedures took place and an employee concerned with the quality of care who works at the hospital level.
3. Crucial to our approach was ensuring that the physicians and nurses were given the responsibility for developing the interventions themselves. This bottom up method was chosen to ensure the support of the professionals for the project and to gather measures that were feasible. For the professionals it was also important that this approach allowed them to exclude suggestions that would result in a reduction in quality. In other words they were able to combine the pressures for reducing lengths of stay with the benefits for their patients that are aimed at improving the overall quality of care.
4. In all cases we used the data that Dutch hospitals collect in the National Medical Registration (Landelijke Medische Registratie, LMR). All data were provided by the research institute Prismant. For each diagnosis that was treated on the ward, we benchmarked the length of stay with all other Dutch hospitals. A valid comparison of lengths of stay requires an adjustment for case mix. Therefore, we computed a ratio of actual length of stay to expected length of stay. The expected length of stay was based on the characteristics of the patients and the national mean length of stay that is associated with these characteristics.³⁹ A ratio higher than 1 indicates that the length of stay is higher than if its patients had national length of stay rates. The following characteristics were taken into account:
 - Age, divided into 5 classes: 0, 1-14, 15-44, 45-64, 65+ years;
 - Primary diagnosis. This is the main diagnosis that led to the admission. It includes about 1000 diagnoses classified by the ICD9 in three digits;
 - Procedures, classified by the Dutch Classification System of Procedures. The procedures considered depend on the diagnosis of the patient. On average it includes five procedure groups.

5. On the basis of this benchmarking, we calculated the number of hospital days that could be eliminated if the clinical ward had worked at least as efficiently with their beds as the 15th percentile ward of all Dutch hospital wards in that specific specialty. We chose the 15th percentile as the goal to achieve because we experienced that this was a goal professionals found realistic. In earlier projects we noticed that their willingness to co-operate on the project was adversely affected when we used the minimum lengths of stay as the goal to achieve. They produced arguments such as ‘our aim is not to be the quickest’ or ‘the hospital with the minimum length of stay is probably not comparable with our hospital’. By introducing the 15th percentile as the goal, they avoided these types of objections: “the length of stay that 15% of all hospitals have achieved already, has also to be feasible for our ward”.
6. We organised structured meetings with the physicians and nurses on the ward. This was carried out separately for all wards in the year in which they asked for our support. All meetings were conducted by the same person (IB), who worked at that time for the research institute Prismant. The aim of these meetings was to identify barriers against reducing the length of stay and to link interventions to the barriers. All the meetings were organised using a common structure. In the first meeting we gave a presentation on the length of stay data of the ward compared with all wards of the same specialty in other Dutch hospitals that participated in the National Medical Registration. We presented the standardized length of stay data at the level of diagnosis. We used comparisons with the 15th percentile ward, to determine the goals for improvement. The two or three meetings that followed focused on identifying the main causes for patients’ current lengths of stay by using the data of benchmark hospitals and developing an inventory of measures needed to shorten lengths of stay.
7. We offered to exchange the experiences of benchmark hospitals with all departments, but only pulmonology wards asked for this exchange. The other wards preferred to develop their interventions without consulting benchmark hospitals.
8. In order to identify first the main causes for patients’ current length of stay, all participants presented in general terms their ideas about the measures that should be taken to reduce lengths of stay. Next, we presented the length of stay data of the ward for each separate diagnosis, and compared this with the length of stay data of the benchmark hospitals. In cases where the ward clearly had longer lengths of stay than the benchmark hospitals, the professionals identified obstacles and developed interventions to reduce length of stay by using the inventory tool (see matrix).

9. Finally, in one or two subsequent meetings, the interventions were examined more extensively and a list of priorities for reducing the length of stay in hospital was established.

In the later stages the actual process of change was planned, carried out and evaluated. This paper concerns only the inventory of interventions to reduce lengths of stay according to hospital staff and not the evaluation of the interventions. We guaranteed the participating wards anonymity and confidentiality.

Matrix

We developed a matrix as a tool to identify and classify all interventions the physicians and nurses proposed to shorten lengths of stay (see Table 2). The purpose of the matrix was to guide the professionals, in a structured way. They used the axes of the matrix to identify barriers and to find solutions to reduce lengths of stay.

The matrix consists “horizontally” -that is over a period of time- of the three main phases of clinical care: admission, stay and discharge. By this we aimed to challenge the teams to consider all the phases of care and to be as comprehensive as possible in developing strategies for reducing hospital stays. “Vertically” -that is involving different participants at any one moment- we partitioned the matrix to consider the degree to which the lengths of stay could be shortened by the medical specialists and nurses themselves or by involving other actors. By other actors we mean people not just within their own hospital but also people or organisations from outside the hospital, such as nursing homes. We based this classification on our experience that, without making this distinction, clinical wards, in particular, raise problems with processes carried out by other carers and mainly propose actions which others have to take. By integrating the role of the professionals themselves within the matrix, the teams were challenged to think about their own roles in the process of reducing lengths of stay.

Data analysis and synthesis

One of the researchers (IB) directed the meetings and a colleague wrote the minutes. These were systematically interpreted by using summaries and keywords that represented the text as accurately as possible. Most of the measures were introduced by the professionals in using the classification of the matrix. However, sometimes they brought in measures that crossed the boundary of the specific cell of the matrix. In these cases we had to put the measure in the correct cell of the matrix. We also had to place in the matrix all measures that participants brought in during the first round where there was a more general inventory of measures (see Section 2.2, nr.8). The places of all the measures in the matrix were checked by the first researcher (IB). One of the other researchers (RBK) did the same. Afterwards both checked the

results and discussed the differences. In all cases they agreed, in conclusion, whether and where measures to reduce lengths of stay had to be placed in the matrix.

Results

We present here the strategies the 21 wards developed to reduce the number of hospital days. The solutions were proposed by the physicians and nurses working on these wards and vary from structural changes such as the creation of observation units, to softer, cultural changes such as the improvement of communication and leadership. All the interventions are summarised in the 3 x 3 matrix (Table 2). For each cell of the matrix the interventions are sorted by the number of wards that mentioned them.

Table 2. Matrix to identify and classify measures to reduce LOS filled with the interventions of the 21 wards to reduce lengths of stay including their frequencies between brackets.

| (247) | ADMISSION (78) | STAY (76) | DISCHARGE (93) |
|-------------------------------|---|---|---|
| PROFESSIONALS THEMSELVES (99) | Admit elective patients on the day treatment actually starts and, in case of acute admissions, provide the plan of treatment quickly after admission (13) | Change guidelines or pathways for specific patient groups (17) | Be more active in making 'rounds' and give more attention to the possibilities for discharge (11) |
| | Elective admissions: Give patients medication and information. Plan as far as possible in advance for diagnostic tests and interventions (7) | Intensify supervision and communication from physicians to residents (3) | Work up to an expected discharge date (7) |
| | On admission anticipate and evaluate the discharge situation: arrange follow-up care in time (7) | Improve communication and cooperation between physicians and nurses (3) | Optimise discharge procedure (7) |
| | Follow a restrained admission policy (6) | Choose carefully the treatment methodology, for instance classic operation or laparoscopic. (2) | Stipulate conditions at which discharge at weekends is possible (2) |
| | Prevent admissions that result from a hectic environment in the outpatient department (5) | Centre specific patient groups (2) | Do not let the patients stay until the results are received (1) |
| | Do not occupy clinical beds with day-care patients (1) | Develop plan for expediting treatment. Do not wait until making 'rounds' (2) | |
| | Organise meetings in order to discuss patients in a way that does not create treatment waiting times (1) | Organise Joint care treatment (1) | |
| | | Show restraint in applying for consultations (1) | |
| | (40) | (31) | (28) |

| (247) | ADMISSION (78) | STAY (76) | DISCHARGE (93) |
|---|--|--|---|
| INVOLVING OTHER DEPARTMENTS WITHIN THE HOSPITAL (77) | Make use of specialised nurses to prevent, or expedite, clinical care (9) | Reduce waiting times for diagnostic tests or interventions: inside one's own hospital (16) | Develop a team of effective discharge planners (6) |
| | Set up an observatory for questionable admissions (6) | Improve cooperation between physicians: inside their own hospital (11) | Arrange effective aftercare in the outpatient department (5) |
| | Admit patients through the right specialty (4) | Optimise the number of beds for each ward and make arrangements about 'own beds' so that these beds will not be occupied by other specialties) (6) | |
| | Prevent admissions that are admitted to get round a waiting list for ambulatory patients (3) | Shorten waiting times for the operating theatre (3) | |
| | Optimise the admission office (2) | Optimise cooperation with paramedics and stimulate early rehabilitation (2) | |
| | | Improve postoperative pain relief (2) | |
| | | Take other wards' schedules into consideration (1) | |
| | | Improve accessibility in cases of hospitals with more than one location (1) | |
| | (24) | (42) | (11) |
| INVOLVING PEOPLE OR ORGANIZATIONS OUTSIDE THE HOSPITAL (71) | Avoid admissions only because patients do not get help from other providers and services (9) | Reduce waiting times for diagnostic tests or interventions: outside one's own hospital (2) | Make good use of the next health care facilities (18) |
| | Make medical specialists more accessible for general practitioners (5) | Improve cooperation between physicians: among hospitals (1) | Arrange follow up care in order to avoid delays discharging patients (14) |
| | | | Create more possibilities to treat patients at home (8) |
| | | | Be clear to patients and families about the discharge. Do not create false expectations (7) |
| | | | Transfer terminal patients to hospices (4) |
| | | | Restrict the patient's freedom of choice for nursing homes (3) |
| | (14) | (3) | (54) |

On admission

On admission, the most frequently mentioned measure to reduce the number of hospital days was to admit elective patients on the day the treatment actually starts.

In the case of acute admissions it entailed providing the plan of treatment immediately after admission so that the treatment starts as quickly as possible.

The professionals found it important to do as much as possible in advance, especially for elective admissions. Information, pre-operative screening, medication and planning for diagnostic tests and interventions could often be done in advance and this avoided unnecessary preoperative days in the hospital. They also decided to organize meetings to discuss patients in such a way as not to extend treatment waiting times. For example, in one hospital the vascular meetings were only on Wednesdays, and vascular patients that were admitted on Thursday had to wait almost one week before their case would be discussed. The solution was to organise these meetings more frequently.

The professionals also found it important to admit patients immediately to the right specialty. They experienced that transfers from one ward to another often created delays that extended the hospital stay by several days. For example, patients with heart failure should be admitted immediately to cardiology and not, at first, to a general internal medicine ward.

Other strategies mentioned to reduce hospital days concerned opportunities to prevent or expedite clinical admissions. For example, in some hospitals clinical care was provided because the outpatient care was not properly organised elsewhere in the community. For example one professional said: 'Sometimes we admit patients for venous thrombosis. If we make proper arrangements with home care these patients never need to be admitted'.

In some cases, in particular the elderly, were being treated on a quiet clinical ward instead of in the turbulent outpatient department. A better organisation of the outpatient department with more capacity, and more time for diagnosis and analysis of patients could prevent many of these admissions.

At the emergency department the intake was often carried out by junior doctors, who did not always get enough supervision from the senior staff, and, if in doubt, admitted patients that did not necessarily need to be admitted. Their solution to this problem was to create an observation unit where patients could stay for several hours allowing more time to decide whether to admit or discharge the patient.

Some hospitals decided to start, or expand existing, specialised nursing consultations in the outpatient department. This too aimed to prevent or expedite clinical care. For example: nurses specialised in diabetic care; nurses specialised in pain management; nurses specialised in geriatrics; social care nurses for patients with unclear complaints; COPD-consultants or a specialised outpatient department for chronic heart failure patients.

Some hospitals had to deal with unnecessary admissions because of a long diagnostic waiting list for patients at the outpatient department. These hospitals distinguished

waiting times between patients inside and those outside the hospital. They gave priority to the patients inside the hospital. By being admitted the patient could avoid the longer waiting list for the outpatient department. This was solved by creating new rules for the waiting list system in which the patients in the outpatient department enjoyed a more equal priority on the waiting list.

On several clinical wards, patients were admitted not because they required hospital care, but because they had difficulties in staying at home on their own or because they needed to leave their home for more care. But there was not yet any place available in a nursing home or a home for the elderly. However these patients needed care and not cure. General practitioners had difficulties in admitting patients to residential community care, especially on Sundays. For the patients that could stay at home if they received more attention from their GP, it was important that the GP could consult the hospital staff easily in order to discuss how best to cope with some specific problems of the very frail elderly. Hospitals where medical staff were not easily accessible realised during the meetings that this caused unnecessary admissions. They started to improve the communication and co-operation with general practitioners, nursing homes and homes for the elderly. Here, hospital staff often had to ensure they were available to GPs for consultation.

Finally, even during an admission, the staff thought it was important to take the patient's eventual discharge into account. This allowed nurses to prepare a complete overview of the home situation and meant hospitals could, at an early stage, anticipate problems to be expected when the patient is discharged. For patients with geriatric symptoms an additional anamnesis should be carried out in time.

During stay

Seventeen of the twenty-one wards proposed various ideas for changing guidelines or introducing clinical pathways for specific patient groups in order to reduce lengths of stay. One example was an earlier change from intravenous to oral antibiotics for patients with pneumonia, appendicitis or erysipelas. For some specific patient groups the staff indicated that the type of treatment could have a major influence on the length of stay. By adopting a more conservative approach to treatment for patients with spine diseases as opposed to treatment by surgery, for example, or simply adopting a classic intervention rather than laparoscopic one.

During the hospital stay, the most common problem to be addressed was the waiting time for diagnostic tests and interventions. One professional said: 'We often have to wait a long time for X-ray results which means an unnecessarily long wait before the next step in the diagnostic process can be made. One of my patients has been admitted last Tuesday and at this moment (one week later) still no result has been received'. According to the ward staff in our study, waiting times could be reduced

by increasing the number of assistants, working hours or diagnostic facilities. In addition, they indicated that for elective patients, appointments for diagnostic tests and consultations could be made in advance so that the patient admitted does not have to wait for these. For some consulting specialties the diagnostic tests required can usually be identified before patients are invited to a consultation. The request for these diagnostic tests could be arranged before the consultation takes place. And patients admitted in hospital awaiting (the results of) diagnostic tests could be discharged and then admitted again once the test can be done or the results are known.

Patients, especially those that were admitted onto a ward of a “non-operating specialty”, such as internal medicine, often had to wait to be operated on. They indicated that it would help to transfer the patient to the ward of the operating specialty. In situations where patients simply had to wait, some patients could be discharged for the duration of the waiting time and admitted again when they can be operated on.

They also emphasised the importance of having nurses specialising in pain management to check the patients, because they found that often pain was the cause of a substantial delay in hospitalisation. Better, postoperative, pain relief could not only reduce the number of hospital days, but also improve the quality of care for the patient. Often postoperative pain relief could start before the operation was carried out.

In several cases the ward organisation could be improved. The hospital rule, ‘a bed is a bed, even if it is a bed belonging to a different specialty’, turned out to have some disadvantages. Physicians from wards with potentially available beds were afraid that ‘their beds’ would be used by another specialty and because of this fear they tended to occupy their beds as quickly as possible. This occurred even if little could be done to treat of the patient at that moment. This created unnecessary hospital days. When patients were given a bed on a ward belonging to a different specialty, these patients also tended to have a longer length of stay because the nurses on this ‘strange’ ward did not really know what to do with these patients. An extra problem was that the treating physicians sometimes omitted these patients from their rounds.

The professionals also found that they could reduce the length of stay by treating some specific patients on the same ward, for example diabetes or vascular surgery patients. Treatment on the same ward meant the staff were more experienced. For patients who were given a hip or knee operation they wanted to reduce the length of stay through a joint care programme. Before surgery, patients received detailed information about the surgery and rehabilitation and all were admitted on the same day. The surgery and rehabilitation was carried out together so that patients stimulate each other to achieve recovery.

The medical professionals also recommended some more, softer, cultural changes that could improve the quality of care and reduce lengths of stay. The best possible communication and co-operation was required between nurses and physicians. This requirement also had to include the communication and co-operation between physicians inside and outside the hospital, and with junior doctors and paramedics. The treating physician needed to communicate the treatment strategy clearly so that nurses knew exactly what should be done for each patient. Physicians needed to listen carefully to the information they receive from nursing observations and nurses needed to ask all the questions for which they needed to have an answer. In many cases the ward professionals found that communication with staff, especially working in the weekends, could be improved.

According to the staff, consultations, transfers and multidisciplinary treatments, often lead to delays because of bad co-operation. To ensure the best quality of treatment and to reduce the length of stay, a timely and smooth cooperation between physicians is needed. For example, one professional said: 'We have agreed that a consultation has to be done within 48 h, but unfortunately this is not the usual practice'.

In some cases they doubted whether there really was a need for consultation suggesting the standard agreements about when to ask for consultation should be evaluated.

In several hospitals the medical staff expressed their doubts about whether they gave enough support to residents. They believed that more intensive supervision and communication with residents could prevent unnecessary hospital stays. They suggested that sometimes there is a psychological threshold resulting in a long delay before residents will ask senior staff questions. They collect their questions, resulting in delays to both treatment and discharge. Physicians saw the need to make themselves more accessible to residents and to give precise instructions about under which conditions a patient can be discharged. One way of achieving better communication with residents was to invite them to meetings each morning with nursing staff.

Several wards also mentioned that the co-operation with paramedics could be improved in order to expedite rehabilitation, resulting in a better and quicker discharge. The staff of the clinical ward therefore needed to inform paramedics in time and make clear agreements about the rehabilitation programme.

At discharge

At discharge a seamless transfer of care to the next health care facilities is of utmost importance. In order to create this seamless transfer, ward professionals found it necessary to communicate and co-operate as far as possible with the health care

facilities receiving the patient, especially where the capacity of beds seems to be a problem. For example, one professional said: 'Good contacts with the nursing homes are very valuable. Our contacts used to be better. We should build them up again'.

Concerns about bed capacity could often be solved by creating new 'in-between' beds. For example a 'nursing home ward' situated within the hospital and run by the nursing home or a nursing home bed in a home for the elderly. The ward professionals also mentioned the option of giving hospital-related care at home. For example, patients can be taught how to inject anticoagulants in case of thrombosis, to stay at home with a drip or with drains, and stoma care can be organised at home. Patients who remained in the hospital awaiting a place in their first choice of nursing home could make a horizontal transfer into another nursing home rather than waiting for the first choice. Terminal patients could be better off with intensive homecare or by a transfer to a hospice or nursing home.

For a well-organised discharge, it was important that the patients' families are informed in a timely manner about the expected day of discharge. For example for the family of a frail elderly patient it was important that they were well informed if the hospital intended to discharge the patient home. Sometimes the family may have instead expected the hospital to arrange a place in a long-term care facility, such as a nursing home.

On several wards the staff realised themselves that physicians, nurses, patients and their families retained an outdated notion of standard lengths of stay and worked towards a discharge that was unnecessarily late. They should try to distance themselves, the patients and their families, from these outdated fixed numbers of days in hospital by giving more attention and publicity to recent lengths of stay per diagnosis.

On many wards discharge was regularly delayed because action was not taken in advance. Staff needed to be alert to the need to arrange things promptly, for example to stop a drip-feed in time, to work towards the right level of haemoglobin, to arrange for a prescription of support stockings in time. It could have been helpful to plan the whole stay of the patient based on the expected date of discharge and work up to discharge on this day. In case of delay nurses needed to register the reasons why the admission took longer. These reasons could then be evaluated and lessons learned.

During discharge the same problem sometimes arose with junior doctors as on admission. They hesitated, not daring to make a decision to discharge. More often the treating physicians themselves needed to do the rounds and check which patient could be discharged. And in addition they had to give more instructions to the juniors.

Nurses complained that physicians sometimes decided very late that the patient could be discharged. This behaviour left nursing staff in difficulties in trying to arrange the discharge on the same day. It was useful to have a clear discharge protocol. On the other hand nurses needed to co-operate in a smooth way: arranging a discharge did not always require 24 h.

In some hospitals the conditions for discharging patients at weekends could have been stipulated. During the week physicians were required to make plans for what could be done at the weekend and the hospital then had to facilitate discharging patients at the weekend in a better way. For example, at weekends there should be no problem changing beds for discharge and admission. They also found it important to conduct ward rounds more often at the weekends and to make the rounds earlier in the day so that subsequent actions could be taken on the same day.

Nurses or medical social workers, who have been trained in assessing patients' potential needs, could help patients transfer home and then care for themselves. Sometimes this included arranging interim care with a home health agency, or making referrals to outpatient services in order to bridge the gap between hospitalisation and independence. Some patients could have had a shorter length of stay if they had been seen sooner or more often in the outpatient department after their discharge. Neither was it necessary to let patients stay until the results of diagnostic tests are known. Results could be provided in the outpatient department. The proper arrangement of aftercare in the outpatient department using specialised nurses stimulated a quicker discharge from hospital. Examples are wound and stoma care treatment. Another example of good aftercare was contacting all patients a day after they have been discharged.

Difference between diagnostic and operating specialties

Some of the proposed solutions were specific to the specialty. The next solutions were proposed by more examining or diagnostic specialties only such as internal medicine or cardiology.

- Prevent admissions that result from a hectic environment in the outpatient department
- Set up an observatory for questionable admissions
- Prevent admissions that are made to circumvent a waiting list for ambulatory patients
- Make medical specialists more accessible to general practitioners

The next remarks were made by operating specialties only such as general or orthopaedic surgery.

- Do not occupy clinical beds with day-care patients

- Organise meetings in order to discuss patients in a way that does not create treatment waiting times
- Organise joint care treatment
- Improve postoperative pain relief

Discussion

We developed a bottom up approach to carry out an inventory of interventions aimed at reducing hospital length of stay. Between 1999 and 2009 we applied this approach at 21 clinical wards. The key components of the approach were a benchmark with the 15th percentile and the use of a matrix, that on one side was arranged along the main phases of the care process - the admission, stay and discharge - and on the other side to the degree to which the length of stay could be shortened by the medical specialists and nurses themselves or by involving others.

The professionals themselves filled in the matrix with, in total, 48 interventions that could be suggested to other wards for reducing their length of stay. The three most intensively filled cells of the matrix follow the diagonal of the matrix. In these cells the key measures to reduce the length of stay were:

1. Interventions (n=40) on admission by the professionals themselves, with the most frequently mentioned measure (n=13) being to admit elective patients on the day the treatment actually starts and in the case of acute patients, to provide a plan of treatment immediately after admission.
2. Interventions (n=42) during the stay involving other departments within the hospital, with the most frequently mentioned measure (n=16) to reduce waiting times for diagnostic tests or interventions.
3. Interventions (n=54) on discharge involving people or organisations outside the hospital. The importance of making good use of the next health care facilities is mentioned by nearly all wards (n=18).

The distribution of actions along the diagonal of the matrix, shows that the professionals indicate that as the care process progresses they are less able to influence the number of hospital days on their own. During the care process they are increasingly dependent on the cooperation of others. At first this is inside the hospital but later on, by the time that the discharge of the patient is approaching, they are also increasingly dependent on cooperation from outside the hospital in order to expedite the patient flow. In practice this means that while trying to reduce LOS in hospitals with staff, using, for example, this matrix, attention should be paid especially to the stages of the process on which professionals have less influence.

The measures the professionals proposed to reduce length of stay appear, to a large extent, to be measures in which there is evidence in literature that they really do

work. Table 3 gives an overview of the measures for which we found evidence in literature that they reduce length of stay. Table 3 also gives the gaps between what professionals proposed to put into practice and the evidence found in literature.

Table 3. The matches and the gaps between interventions proposed by the professionals and evidence-based measures found in literature

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| <p>Matches between interventions proposed by the professionals and evidence found in literature:</p> <ul style="list-style-type: none"> • Admitting on the day of surgery⁴⁰ • Introducing a pre-operative education programme to encourage patients to play an active role in their recovery process after surgery⁴¹. And in addition treating patients in a joint care programme^{42,43} • Surgical pre-assessment, planning the admission, post-operative care and planning a safe discharge⁴⁴, early imaging with CT, MRI, or nuclear scintigraphy, particularly on the day before or the day of admission⁴⁵ • Preventing admissions of patients not needing inpatient care⁴⁶⁻⁴⁸ • Utilising specialised nurse practitioners or other advanced professionals⁴⁹⁻⁵¹ • Creating an observation unit that gives more time to decide whether or not to admit the patient⁵² • Stimulating that patients initially are seen by the right specialty⁵³ • Performing same-day major surgery⁴⁷ • Optimising guidelines and protocols or introducing clinical pathways for specific patient groups in order to reduce the length of stay and often with improvements of quality of care¹²⁻³⁴ • Treating patients in a fast-track or accelerated care programme⁵⁴⁻⁶² • Choosing a laparoscopic rather than a classic intervention (open surgery)⁶³⁻⁷⁰ although readmission rates for laparoscopic treatment may be higher⁷¹ • Implementing an acute stroke unit⁷² • Being aware that consultations, transfers and fragmentation of care often lead to delays^{73,74} • Reducing waiting times for examinations^{8,48} • Stimulating early rehabilitation and physical activity⁷⁵⁻⁷⁷, also in the weekends⁷⁸ • Reducing the impact of the day of admission - for example Thursdays or Fridays or days when there is less staffing - on the length of stay⁷⁹⁻⁸¹ • Optimising pain management⁸² • Daily rounding^{40,83-85} • Registering the reasons why admissions take longer. These reasons could be evaluated and lessons learned⁸⁶ • Early discharge planning⁴⁰ • Taking care of aftercare: calling all patients a day after they have been discharged or close nursing follow-up⁸⁷⁻⁸⁹ • Accelerating discharge⁴⁷. The transfer to health care facilities receiving the patient can often be carried out more swiftly⁵ and some hospital-related care can be given at home⁹⁰⁻⁹² or with more support in the community⁹³ |
| <p>Gap 1: Evidence-based interventions found in literature, but not proposed by the professionals:</p> <ul style="list-style-type: none"> • Optimising the nutritional status of a patient⁹⁴⁻⁹⁹ • Optimising the nurse or surgeon staffing (for example more or higher registered nurses or surgeons with more expertise)¹⁰⁰⁻¹⁰² |
| <p>Gap 2: Interventions proposed by the professionals but not found in any supporting literature:</p> <ul style="list-style-type: none"> • Make medical specialists more accessible for general practitioners • Optimise the number of beds for each ward and make arrangements about 'own beds', so that these beds will not be occupied by other specialties • Restrict the patient's freedom of choice for nursing homes |

Items where there was evidence found in literature, but which were not proposed by the professionals, included optimising the nutritional status and optimising the nurse

or surgeon staffing levels. At the time the meetings took place, these received little attention in the Netherlands as being important issues in the length of stay of the patient. The findings of our study concern the years 1999-2009 and the literature in Table 3 also includes evidence published in 2010 and 2011.

The measures, for which we found no supporting literature, but which were proposed by the professionals, seem to be more or less specific to the Dutch situation. For example in the Netherlands all patients need a referral from their general practitioner to visit a medical specialist. The general practitioner has to ensure that patients are not unnecessarily referred to secondary care. For the general practitioner this is much better if the medical specialist can easily be consulted. If this is not the case then the general practitioner might refer the patient unnecessarily to a hospital. Another situation that may be specific to the Netherlands is how beds are allocated to medical wards. Since hospitals often have a shortage of beds they implement the rule that if a doctor needs a bed for his patient and the ward is full, he may use an empty bed on another ward. The last Dutch example of how length of stay could increase unnecessarily is the practice of giving patients the freedom of choice of nursing homes. This freedom is increasingly restricted.

This analysis shows that more research is needed to assess the effectiveness of the specific Dutch measures, in particular concerning the co-operation between GPs and hospitals and concerning the allocation of beds.

What was hardly mentioned by the professionals themselves, but what certainly influenced the length of stay, were the projects -specifically aimed at reducing the length of stay in hospitals- itself. From the day the projects started physicians, participating in these projects, were more aware of the length of stay of patients and treated their patients, and conducted their rounds, with an attitude more geared towards discharge. Driven to shorten lengths of stay, they immediately realised a part of the reduction even without taking 'real' measurements. The awareness that they had to reduce length of stay, alone made them more critical of whether a patient really had to stay any longer in hospital or could be discharged. This study teaches us that regular feedback of data about the progress of the reduction in LOS keeps the professionals even more aware of the need to shorten length of stay.^{5,103}

Limitations

In our design we chose a bottom up approach, with key features of action research. Action research has some limitations such as³⁸:

- Dilemmas associated with anonymity and confidentiality: Our study concerned 21 wards, which made it easy to guarantee the participating wards anonymity and confidentiality.

- Difficulties with changing practice with an ever-changing workforce: Meyer describes how there were an enormous number of changes in staff within the period of a year. For the Dutch wards in our study this was not at all the case. The turnover of staff members was low.

David¹⁰⁴ and Vallenga et al.¹⁰⁵ describe possible ethical dilemmas regarding group dynamics and regarding the interaction between researchers and professionals because of the close collaboration. The researchers were conscious of this limitation and tried to keep the necessary distance and not to interfere with the professional discussions.

Another limitation of our study is the fact that we did not take into consideration contextual differences between hospital wards. We cannot draw conclusions about how different interventions apply to different organizational and clinical contexts. Moreover, in our study, a selected number of hospitals participated, namely those that pushed themselves to intervention, often with a relatively long mean length of stay. This might reduce the possibility of making general conclusions. We expect the matrix will still be useful even if it were to be applied to hospitals with an average or relatively short length of stay, but the extent to which the cells of the matrix will be filled, of course, may differ. How far we can draw general conclusions from this study is also limited by the fact that we worked with a selected group of specialties. Wards that ask for assistance in reducing lengths of stay are often wards with a large number of inpatient admissions. The benefit of reducing the length of stay is greater for larger wards than it is for small clinical wards such as ophthalmology.

The measures for shortening lengths of stay addressed in this study are interventions which medical specialists and nurses developed themselves. They were very critical and transparent regarding their own behaviour, but we can expect that there are also measures that these clinicians did not identify or mention themselves. We limited the interventions to those which clinical professionals thought were relevant, because this improved their chances of success.

It is difficult to draw conclusions about the effectiveness of the tool or the impact of each intervention. Much of the effectiveness of the tool depends on the extent to which hospitals genuinely carry out the plans they made. We have no information about the way in which they continued these efforts. If we had, we would not be able to draw conclusions about the impact of each intervention because the number of interventions is too big to separate the effects in an accurate manner.

Finally, it must be stressed that achieving further reductions in hospitalisation should not be at the cost of the quality of care. It is important to monitor quality as well as the number of days spent in hospital. The length of stay should only be reduced by measures that guarantee the same, or better, quality of care.

Conclusions

From literature we know that there are many interventions to reduce length of stay. When we give professionals themselves the opportunity to bring in all relevant measures that are necessary to reduce length of stay, they will come up with a wide variety of interventions that mainly cover what we find in published research. A bottom up approach is more likely to succeed. We would therefore, advise wards that have to reduce length of stay to make the inventory themselves, using appropriate benchmark data, and by using the axes of the matrix.

Practitioners who want to reduce the number of days spent in hospital have to realise that as the care process progresses, they are less capable of influencing the number of hospital days on their own. During the care process they are increasingly dependent on the co-operation of others. At first this is within the hospital but by the time that the discharge of the patient is approaching they are also increasingly dependent on the co-operation outside the hospital to expedite the patient flow.

In some cases there was a discrepancy between the interventions that came up in our study and that which we found in the literature. For some there is not yet any evidence if, and to what degree, they shorten lengths of stay. They seem to be very specific to the Dutch situation.

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4

Is the length of stay in hospital correlated with patient satisfaction?

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Abstract

Objective: To investigate the correlation between length of stay (LOS) and patient satisfaction on the level of hospital wards. The underlying hypothesis is that good quality of care leads both to shorter LOS and to patients that are more satisfied.

Design: We used standardised LOS and standardised patient satisfaction data from seven specialisms: internal medicine, cardiology, pulmonology, neurology, general surgery, orthopaedic surgery and obstetrics and gynaecology in the period 2003-2010. All LOS data were derived from the National Medical Registration and patient satisfaction scores were measured by a questionnaire covering six aspects of care. The LOS data were standardised for the year of discharge, age, primary diagnosis and procedure. Patient satisfaction data were standardised for the year, age, education and health status.

Setting: One hundred and eighty-eight Dutch hospital wards.

Participants: The patient satisfaction data were gathered by questionnaires returned by 102 815 patients.

Main Outcome Measure: Pearson correlations and two-tailed significance. between standardised mean LOS and standardised mean patient satisfaction score.

Results: We found no correlation between LOS and patient satisfaction in six out of seven specialties. We only found significantly higher patient satisfaction scores in pulmonology for some specific items on hospitals wards with a shorter LOS. These items concerned the reception on the ward, the information provided by nurses on admission, the expertise of the nursing staff, the way information was transferred from one person to another and respect for patients' privacy such as in conversations, and during physical examinations.

Conclusions: We found no evidence that hospital wards with a relatively short mean LOS had higher, or lower, patient satisfaction than hospital wards with a relatively long LOS, with the exception of pulmonology.

Introduction

In the Netherlands, as in many other countries, hospitals have been reducing lengths of stay (LOS) for many years. This reduction reflects the introduction of new medical technologies as well as pressures for cost containment.¹⁻³ In the Netherlands the average LOS dropped by 5.6 days between 1990 and 2009.⁴

An abundance of literature shows large variations across hospitals in the specific LOS for procedures and diagnoses. After years of reducing average LOS, the case mix adjusted variation in LOS is still substantial.¹ It seems that this remaining variation reflects the underlying processes in hospitals that cause these differences. Hospitals seem to vary in a variety of factors. For example in waiting times, in effective cooperation and communication between care professionals and in the availability and use, both of clinical pathways and standards.^{5,6} Moreover, the number and severity of adverse events could lead to variations in LOS between hospitals. Treating patients with unqualified staff, who may not adhere to guidelines, will result in more adverse events, which may lead to a significantly longer LOS.⁷⁻¹⁹ So making the best use of the logistics of the care process such as examinations, treatment and communication will reduce waiting times and, as a consequence, the LOS.^{5,20} But, in addition, the prevention of adverse events will also lead to a shorter LOS. As a consequence, we expect a correlation between LOS and quality indicators.

Patient satisfaction is seen as an important indicator that embraces various aspects of the quality of care.²¹⁻³¹ It is our hypothesis that differences across hospitals in the underlying processes as mentioned above can be identified by measuring differences in patient satisfaction. Good quality of care might lead both to shorter LOS and to patients that are more satisfied.^{32,33} Thus, we expect a negative correlation between LOS and patient satisfaction (see Fig. 1).

Figure 1. Model of the correlation between Quality of care, Length of stay and Patient satisfaction

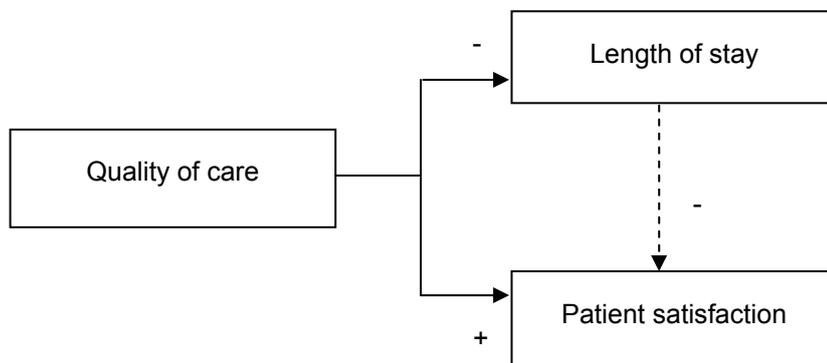


Figure legend: + positive correlation; - negative correlation

There is hardly any research on how patients in general appreciate the actual length of a hospital stay. Some studies have focused on the relationship between LOS and patient satisfaction for a specific diagnosis or treatment. These studies show that a reduced LOS does not adversely affect patient satisfaction.^{32,34-37} Carmel³⁸ found a significant correlation between patients with a long LOS and their satisfaction with surgical ward nurses. Rosenheck et al. also found a positive relationship between LOS and patient satisfaction among psychiatric patients.³⁹ Other studies showed no clear relationship between LOS and patient satisfaction.^{21,40,41}

There is a lack of research on the hospital ward level within health systems which share the same organizational context. Questions remain such as: ‘Do hospital wards with a relatively short LOS have a higher patient satisfaction?’ Therefore, the purpose of this paper is to investigate whether we can find evidence for this correlation in an extensive dataset gathered in Dutch hospitals.

Methods

Data

All LOS data were derived from the National Medical Registration (Landelijke Medische Registratie, LMR) which contains data on admissions in general and university hospitals in the Netherlands. This information includes medical data such as diagnoses and surgical procedures as well as data specific to patients, including age and hospital stay. The LMR diagnoses are classified by the ICD-9 CM and procedures by the Dutch Classification System of Procedures. We used the LOS data of 188 hospital wards for which both patient satisfaction data and LOS data were available. We used data from seven specialisms where a reduction in the LOS may have the largest impact on the national number of hospital days.¹ These specialisms are: internal medicine, cardiology, pulmonology, neurology, general surgery, orthopaedic surgery and obstetrics and gynaecology.

We used patient satisfaction data from 188 hospital wards gathered by an independent research organization, Kiwa Prismant, in the period 2003-2010 using the “Core questionnaire for the assessment of Patient Satisfaction” (COPS).^{42,43} The COPS is a short core questionnaire to measure patient satisfaction, based on the needs of clinical patients in university hospitals. The questionnaire was developed to compare satisfaction scores between hospitals, and to identify opportunities for improvements in the quality of care. The clinical COPS consists of six dimensions, each dimension is constructed by two, three or four questions: admission procedure (three items), nursing care (two items), medical care (two items), information (four items), autonomy (three items) and discharge and aftercare (three items). Factor analysis showed a good reliability of these dimensions (Cronbach’s alpha ranging between 0.80 and 0.88).

Originally COPS was developed in university hospitals.⁴⁴ Since 2004, general hospitals too use the COPS as an instrument for measuring patient satisfaction. Most hospital wards participated several times with the COPS, but for this study each hospital ward is only taken into account once. We used the data from the clinical wards, day care data were excluded. See Appendix 1 for the exact content of the COPS.

Data preparation

The LOS and satisfaction scores were based on the actual, and the expected observations for a ward.

The LOS scores have been expressed in the quotients of the mean observed and mean expected LOS for all patients admitted onto the clinical ward in the same year as the year when the patient satisfaction was measured. A ratio >1 indicates that the mean observed LOS was higher than the mean expected LOS. Day care and clinical patients that could have been treated in day care were excluded. The mean expected LOS of the ward was based on expectations for every individual patient, taking into account the following characteristics of the patients:

- Year of discharge;
- Age (divided into five classes: 0, 1-14, 15-44, 45-64, 65+ years);
- The primary diagnosis that resulted in the admission, including about 1000 diagnoses classified by the ICD9 in three digits;
- Procedures, classified by the Dutch Classification System of Procedures. The procedures considered depend on the diagnosis of the patient.

The expected LOS of an individual patient concerned the Dutch national mean LOS that was associated with these characteristics.⁴⁵ An exception was made for patients with an extreme LOS (100 hospital days or longer), and for patients who died in hospital. For the latter two groups the expected LOS was kept equal to the actual LOS and consequently the ratio of actual LOS to the expected LOS was always 1.

The satisfaction questionnaire contained 16 questions about six aspects of care, see Appendix 1. The answer categories for each question were on an asymmetrical 5-point Likert-type scale ranging from 'unsatisfied', 'somewhat satisfied', 'rather satisfied', 'quite satisfied' to 'very satisfied'.

To calculate the expected score we used all patient satisfaction data gathered by Kiwa Prismant from Dutch general and university hospital wards since 2003. This resulted in a database with 102 815 patients included in one of the seven specialisms mentioned above.

Each patient has an actual score on the sixteen questions of the questionnaire. The expected score per patient was based on the national mean patient satisfaction score and the characteristics that influence patient satisfaction scores⁴²:

- Year: We used two-year periods, because the number of participating hospital wards would otherwise be too small for some specialisms: 2003-2004, 2005-2006, 2007-2008 and 2009-2010).
- Age: We divided patients into five age groups: younger than 20, 20-39, 40-54, 55-59 and 60 years and older.
- Education: We divided patients into five categories: none, lower, middle, higher, and university.
- Health status: We divided patients into five categories: bad, moderate, good, very good and excellent.

As a national mean patient satisfaction score per specialism we used all scores of all patients of all hospitals per 2-year period.

In order to standardise the patient satisfaction scores, we used the ratio of the observed patient satisfaction score and the expected score. A ratio >1 indicates a higher patient satisfaction score than expected. A ratio <1 indicates a lower patient satisfaction score than might be expected, based on the national mean. We calculated the mean standardised patient satisfaction score (per specialism) per hospital ward by adding all scores of all patients of this ward together, divided by the number of patients.

Eventually, this resulted per specialism in a standardised mean patient satisfaction score per ward on each of the 16 questions of the questionnaire.

Analysis

For all 188 hospital wards in this study, we calculated the Pearson correlations and the two-tailed significance between standardised mean LOS and standardised mean patient satisfaction score. Every hospital ward was counted only once and priority was given to the most recent data and the highest response rates.

Results

The LOS data had an overall standard deviation of the quotients of mean observed and mean expected LOS of 0.14. The standard deviation was largest in cardiology (0.16) and smallest in general surgery (0.11), see Table 1.

Table 1. Median, minimum, maximum and standard deviations of the quotients of mean observed and mean expected LOS^a

| | Median | Minimum | Maximum | Standard deviation |
|-----------------------------------|---------------|----------------|----------------|---------------------------|
| Pulmonology (n=23) | 0.93 | 0.82 | 1.22 | 0.12 |
| Obstetrics and gynaecology (n=27) | 1.00 | 0.76 | 1.26 | 0.12 |
| Cardiology (n=25) | 0.86 | 0.58 | 1.24 | 0.16 |
| General surgery (n=30) | 0.99 | 0.79 | 1.28 | 0.11 |
| Internal medicine (n=28) | 1.05 | 0.74 | 1.29 | 0.12 |
| Neurology (n=27) | 1.01 | 0.74 | 1.26 | 0.12 |
| Orthopaedic surgery (n=28) | 0.97 | 0.80 | 1.37 | 0.15 |
| Overall | 0.99 | 0.58 | 1.37 | 0.14 |

^a The quotients are calculated by dividing the mean observed LOS by the mean expected LOS. Day care and clinical patients that could have been treated in day care were excluded. The mean expected LOS of the ward was based on expectations for every individual patient, taking into account the following characteristics of the patients: Year of discharge, age, primary diagnosis that resulted in the admission and procedure. The procedures considered depend on the diagnosis of the patient. The expected LOS of an individual patient concerned the Dutch national mean LOS that was associated with these characteristics. An exception was made for patients with an extreme LOS (100 hospital days or longer), and for patients who died in hospital. For the latter two groups the expected LOS was kept equal to the actual LOS.

On the 16 items of the COPS the patient satisfaction data had a mean standard deviation ranging from 0.03 to 0.05. The standard deviation was largest in the item transfer of information to external professionals in neurology (0.06) and smallest in the item information provided by nurse on admission in general surgery (0.02), see Table 2.

Table 2. Median, minimum, maximum and standard deviations of the quotients of mean observed and mean expected patient satisfaction scores^{a b}

| | Admission | | Nursing care | | Medical care | | Information | |
|--|--------------|----------------------|--------------------|--------------|--------------------|--------------|-------------------|--------------------|
| | Reception | Information provided | Personal attention | Expertise | Personal attention | Expertise | Clarity by nurses | Clarity by doctors |
| <i>Pulmonology (n=23)</i> | | | | | | | | |
| median | 0.994 | 0.991 | 0.998 | 0.994 | 0.995 | 0.999 | 0.998 | 1.000 |
| minimum | 0.912 | 0.908 | 0.937 | 0.927 | 0.897 | 0.892 | 0.896 | 0.896 |
| maximum | 1.063 | 1.062 | 1.072 | 1.071 | 1.060 | 1.072 | 1.087 | 1.049 |
| SD | 0.029 | 0.030 | 0.036 | 0.033 | 0.038 | 0.040 | 0.036 | 0.034 |
| <i>Obstetrics and gynaecology (n=27)</i> | | | | | | | | |
| median | 1.000 | 0.991 | 0.989 | 0.987 | 1.013 | 1.002 | 0.995 | 1.000 |
| minimum | 0.934 | 0.917 | 0.920 | 0.928 | 0.882 | 0.925 | 0.930 | 0.866 |
| maximum | 1.074 | 1.068 | 1.075 | 1.059 | 1.073 | 1.049 | 1.048 | 1.064 |
| SD | 0.035 | 0.032 | 0.041 | 0.033 | 0.046 | 0.033 | 0.036 | 0.043 |
| <i>Cardiology (n=25)</i> | | | | | | | | |
| median | 1.003 | 0.996 | 1.001 | 1.001 | 1.002 | 0.999 | 1.004 | 1.000 |
| minimum | 0.951 | 0.934 | 0.923 | 0.931 | 0.879 | 0.907 | 0.883 | 0.847 |
| maximum | 1.064 | 1.059 | 1.060 | 1.062 | 1.053 | 1.051 | 1.065 | 1.050 |
| SD | 0.026 | 0.031 | 0.028 | 0.031 | 0.034 | 0.030 | 0.036 | 0.037 |
| <i>General surgery (n=30)</i> | | | | | | | | |
| median | 1.000 | 1.003 | 0.991 | 0.987 | 1.001 | 0.994 | 0.987 | 0.997 |
| minimum | 0.924 | 0.951 | 0.912 | 0.936 | 0.885 | 0.913 | 0.932 | 0.897 |
| maximum | 1.048 | 1.041 | 1.081 | 1.095 | 1.062 | 1.060 | 1.068 | 1.068 |
| SD | 0.031 | 0.023 | 0.033 | 0.032 | 0.044 | 0.036 | 0.035 | 0.044 |
| <i>Internal medicine (n=28)</i> | | | | | | | | |
| median | 0.993 | 0.993 | 0.988 | 0.979 | 0.985 | 0.990 | 0.987 | 0.980 |
| minimum | 0.915 | 0.901 | 0.876 | 0.901 | 0.890 | 0.897 | 0.861 | 0.902 |
| maximum | 1.078 | 1.075 | 1.055 | 1.062 | 1.057 | 1.056 | 1.071 | 1.068 |
| SD | 0.035 | 0.0380 | 0.042 | 0.034 | 0.043 | 0.041 | 0.048 | 0.044 |
| <i>Neurology (n=27)</i> | | | | | | | | |
| median | 1.001 | 1.002 | 0.996 | 0.998 | 1.003 | 1.006 | 1.005 | 0.994 |
| minimum | 0.907 | 0.933 | 0.872 | 0.905 | 0.864 | 0.898 | 0.859 | 0.809 |
| maximum | 1.051 | 1.061 | 1.077 | 1.063 | 1.062 | 1.061 | 1.058 | 1.094 |
| SD | 0.038 | 0.034 | 0.042 | 0.035 | 0.048 | 0.041 | 0.048 | 0.053 |
| <i>Orthopaedic surgery (n=28)</i> | | | | | | | | |
| median | 0.992 | 0.997 | 0.997 | 0.999 | 1.002 | 0.999 | 1.003 | 0.997 |
| minimum | 0.938 | 0.941 | 0.918 | 0.937 | 0.893 | 0.936 | 0.933 | 0.911 |
| maximum | 1.049 | 1.040 | 1.066 | 1.050 | 1.076 | 1.074 | 1.053 | 1.076 |
| SD | 0.027 | 0.025 | 0.033 | 0.029 | 0.047 | 0.035 | 0.032 | 0.043 |
| Mean SD per item | 0.032 | 0.030 | 0.036 | 0.032 | 0.043 | 0.036 | 0.039 | 0.043 |

smallest standard deviation per item

largest standard deviation per item

^a The quotients are calculated by dividing the observed patient satisfaction score by the expected patient satisfaction score; The expected score is based on the national mean score and on the patient characteristics age, education and health status. The mean standardised patient satisfaction score per specialism and per hospital ward was calculated by adding all scores of all patients in this ward together, divided by the number of patients. This resulted in a mean standardised score per specialism per ward on all items of the questionnaire.

^b See Appendix 1 for the complete description of the 16 items mentioned above under the 6 dimensions.

Table 2. Continued

| | Information | | Patient autonomy | | | Aftercare | | |
|--|--------------|--------------|------------------|----------------------------|--------------|-------------------------------|-----------------------|---------------------|
| | Transferred | Rapidity | Self-sufficient | Participation in decisions | Privacy | Information further treatment | Information passed on | Procedure discharge |
| <i>Pulmonology (n=23)</i> | | | | | | | | |
| median | 0.990 | 1.005 | 0.997 | 0.997 | 0.999 | 1.000 | 1.002 | 1.002 |
| minimum | 0.904 | 0.905 | 0.940 | 0.927 | 0.933 | 0.916 | 0.881 | 0.855 |
| maximum | 1.060 | 1.084 | 1.040 | 1.043 | 1.071 | 1.093 | 1.071 | 1.046 |
| SD | 0.032 | 0.047 | 0.028 | 0.031 | 0.034 | 0.038 | 0.051 | 0.045 |
| <i>Obstetrics & gynaec. (n=27)</i> | | | | | | | | |
| median | 0.994 | 1.001 | 0.992 | 1.002 | 0.996 | 1.009 | 0.993 | 0.989 |
| minimum | 0.876 | 0.872 | 0.939 | 0.907 | 0.924 | 0.897 | 0.899 | 0.900 |
| maximum | 1.080 | 1.069 | 1.041 | 1.058 | 1.054 | 1.067 | 1.070 | 1.080 |
| SD | 0.047 | 0.049 | 0.027 | 0.040 | 0.038 | 0.045 | 0.044 | 0.044 |
| <i>Cardiology (n=25)</i> | | | | | | | | |
| median | 1.003 | 1.013 | 1.004 | 0.994 | 1.003 | 1.005 | 0.992 | 0.999 |
| minimum | 0.877 | 0.848 | 0.912 | 0.867 | 0.922 | 0.809 | 0.879 | 0.811 |
| maximum | 1.050 | 1.049 | 1.056 | 1.049 | 1.041 | 1.072 | 1.085 | 1.065 |
| SD | 0.037 | 0.041 | 0.027 | 0.035 | 0.027 | 0.047 | 0.042 | 0.046 |
| <i>General surgery (n=30)</i> | | | | | | | | |
| median | 0.988 | 0.997 | 0.997 | 1.005 | 0.997 | 0.986 | 0.999 | 0.990 |
| minimum | 0.911 | 0.927 | 0.924 | 0.905 | 0.924 | 0.903 | 0.912 | 0.900 |
| maximum | 1.065 | 1.084 | 1.038 | 1.051 | 1.041 | 1.080 | 1.069 | 1.096 |
| SD | 0.041 | 0.038 | 0.028 | 0.034 | 0.035 | 0.046 | 0.046 | 0.048 |
| <i>Internal medicine (n=28)</i> | | | | | | | | |
| median | 0.982 | 0.990 | 0.985 | 0.992 | 0.977 | 0.984 | 0.995 | 1.000 |
| minimum | 0.867 | 0.888 | 0.917 | 0.837 | 0.922 | 0.834 | 0.853 | 1.072 |
| maximum | 1.086 | 1.084 | 1.075 | 1.089 | 1.057 | 1.084 | 1.092 | 0.824 |
| SD | 0.051 | 0.051 | 0.038 | 0.060 | 0.034 | 0.057 | 0.058 | 0.051 |
| <i>Neurology (n=27)</i> | | | | | | | | |
| median | 0.996 | 1.011 | 0.994 | 0.999 | 1.010 | 1.005 | 1.003 | 1.009 |
| minimum | 0.885 | 0.832 | 0.939 | 0.887 | 0.909 | 0.868 | 0.854 | 0.876 |
| maximum | 1.091 | 1.120 | 1.070 | 1.088 | 1.071 | 1.137 | 1.118 | 1.103 |
| SD | 0.050 | 0.060 | 0.031 | 0.044 | 0.041 | 0.053 | 0.062 | 0.050 |
| <i>Orthopaedic surgery (n=28)</i> | | | | | | | | |
| median | 0.993 | 0.995 | 1.006 | 0.992 | 1.000 | 1.005 | 1.007 | 1.005 |
| minimum | 0.911 | 0.897 | 0.913 | 0.934 | 0.930 | 0.919 | 0.866 | 0.902 |
| maximum | 1.082 | 1.074 | 1.062 | 1.059 | 1.053 | 1.057 | 1.073 | 1.073 |
| SD | 0.042 | 0.039 | 0.032 | 0.034 | 0.029 | 0.035 | 0.045 | 0.043 |
| Mean SD per item | 0.043 | 0.046 | 0.030 | 0.040 | 0.034 | 0.046 | 0.050 | 0.047 |

SD = Standard deviation

Table 3 shows the Pearson correlation and the two-tailed significance between the standardised mean LOS and the standardised mean patient satisfaction score, on each question of the Core Questionnaire and for each of the seven medical wards (pulmonology, obstetrics and gynaecology, cardiology, general surgery, internal medicine, neurology and orthopaedic surgery).

Table 3. Correlations between standardised mean length of stay and standardised mean patient satisfaction score for the 16 questions of the Core Questionnaire ^b

| | Admission | | Nursing care | | Medical care | | Information | |
|--|--------------|----------------------|--------------------|--------------|--------------------|--------------|-------------------|--------------------|
| | Reception | Information provided | Personal attention | Expertise | Personal attention | Expertise | Clarity by nurses | Clarity by doctors |
| <i>Pulmonology (n=23)</i> | | | | | | | | |
| Pearson Correlation ^a | -0.55 | -0.61 | -0.50 | -0.54 | -0.43 | -0.47 | -0.52 | -0.49 |
| Significance (two-tailed) | 0.0060 | 0.0021 | 0.0160 | 0.0084 | 0.0383 | 0.0250 | 0.0104 | 0.0163 |
| <i>Obstetrics and gynaecology (n=27)</i> | | | | | | | | |
| Pearson Correlation ^a | -0.02 | 0.17 | 0.06 | 0.12 | 0.27 | 0.16 | 0.25 | 0.39 |
| Significance (two-tailed) | 0.9297 | 0.3905 | 0.7726 | 0.5347 | 0.1787 | 0.4157 | 0.1997 | 0.0418 |
| <i>Cardiology (n=25)</i> | | | | | | | | |
| Pearson Correlation ^a | 0.11 | -0.16 | 0.10 | 0.07 | -0.07 | -0.18 | 0.02 | -0.09 |
| Significance (two-tailed) | 0.6131 | 0.4544 | 0.6380 | 0.7388 | 0.7274 | 0.3783 | 0.9261 | 0.6758 |
| <i>General surgery (n=30)</i> | | | | | | | | |
| Pearson Correlation ^a | -0.25 | 0.03 | -0.25 | -0.22 | 0.29 | 0.19 | -0.13 | 0.20 |
| Significance (two-tailed) | 0.1847 | 0.8584 | 0.1876 | 0.2385 | 0.1141 | 0.3129 | 0.4772 | 0.2896 |
| <i>Internal medicine (n=28)</i> | | | | | | | | |
| Pearson Correlation ^a | -0.17 | -0.14 | -0.21 | -0.11 | 0.02 | -0.02 | -0.10 | -0.05 |
| Significance (two-tailed) | 0.3820 | 0.4656 | 0.2755 | 0.5933 | 0.9050 | 0.9232 | 0.6015 | 0.7899 |
| <i>Neurology (n=27)</i> | | | | | | | | |
| Pearson Correlation ^a | 0.19 | 0.00 | 0.28 | 0.22 | -0.07 | -0.01 | -0.10 | -0.13 |
| Significance (two-tailed) | 0.3385 | 0.9912 | 0.1556 | 0.2694 | 0.7317 | 0.9507 | 0.6256 | 0.5041 |
| <i>Orthopaedic surgery (n=28)</i> | | | | | | | | |
| Pearson Correlation ^a | 0.06 | -0.03 | -0.09 | -0.17 | 0.08 | 0.01 | -0.23 | -0.05 |
| Significance (two-tailed) | 0.7508 | 0.8924 | 0.6367 | 0.3829 | 0.6884 | 0.9713 | 0.2338 | 0.8078 |

correlation is significant at the 0.05 level (2-tailed) correlation is significant at the 0.01 level (2-tailed)

^a The Pearson correlations were calculated between standardised mean LOS and standardised mean patient satisfaction score.

^b See Appendix 1 for the complete description of the 16 items mentioned above under the 6 dimensions.

For six out of seven specialisms no significant correlations at the 0.01 significance level were found. For these specialisms, we found no evidence that patients who stayed on wards with a relatively short mean LOS were less or more satisfied than patients who stayed on wards with a longer mean LOS.

Pulmonology is an exception. We observed 5 out of 16 items of patient satisfaction with significant correlations with LOS at the 0.01 significance level. On these five questions, patients were more satisfied on the wards with the shorter mean LOS. This concerned the satisfaction about the reception on the ward ($r^2=-0.55$; $P=0.006$); the information provided by nurses on admission ($r^2=-0.61$; $P=0.002$); the expertise of the nursing staff ($r^2=-0.54$; $P=0.008$); the way information was transferred from one person to another ($r^2=-0.58$; $P=0.004$) and the respect for patients' privacy such as

Table 3. Continued

| | Information | | Patient autonomy | | | Aftercare | | |
|--|--------------|----------|------------------|----------------------------|-------------------|-------------------------------|-----------------------|---------------------|
| | Transferred | Rapidity | Self-sufficient | Participation in decisions | Privacy respected | Information further treatment | Information passed on | Procedure discharge |
| <i>Pulmonology (n=23)</i> | | | | | | | | |
| Pearson r^a | -0.58 | -0.39 | -0.37 | -0.36 | -0.61 | -0.30 | -0.46 | -0.50 |
| Sig. (2-tailed) | 0.0039 | 0.0649 | 0.0853 | 0.0897 | 0.0021 | 0.1640 | 0.0270 | 0.0143 |
| <i>Obstetrics & gynaecology (n=27)</i> | | | | | | | | |
| Pearson r^a | 0.32 | 0.28 | 0.08 | 0.10 | 0.10 | 0.20 | 0.23 | 0.12 |
| Sig. (2-tailed) | 0.1068 | 0.1589 | 0.6756 | 0.6059 | 0.6312 | 0.3200 | 0.2509 | 0.5632 |
| <i>Cardiology (n=25)</i> | | | | | | | | |
| Pearson r^a | 0.02 | 0.14 | 0.20 | 0.01 | 0.02 | 0.29 | 0.43 | 0.33 |
| Sig. (2-tailed) | 0.9108 | 0.5159 | 0.3327 | 0.9718 | 0.9208 | 0.1587 | 0.0306 | 0.1082 |
| <i>General surgery (n=30)</i> | | | | | | | | |
| Pearson r^a | -0.14 | -0.06 | -0.05 | 0.19 | 0.19 | 0.01 | -0.14 | -0.02 |
| Sig. (2-tailed) | 0.4550 | 0.7616 | 0.7787 | 0.3152 | 0.3264 | 0.9408 | 0.4755 | 0.9221 |
| <i>Internal medicine (n=28)</i> | | | | | | | | |
| Pearson r^a | -0.07 | 0.05 | -0.04 | -0.07 | -0.12 | -0.03 | -0.08 | -0.13 |
| Sig. (2-tailed) | 0.7231 | 0.8107 | 0.8595 | 0.7408 | 0.5522 | 0.8681 | 0.6911 | 0.5036 |
| <i>Neurology (n=27)</i> | | | | | | | | |
| Pearson r^a | 0.08 | 0.03 | 0.22 | 0.01 | -0.05 | 0.12 | 0.17 | 0.11 |
| Sig. (2-tailed) | 0.6967 | 0.8754 | 0.2686 | 0.9596 | 0.7931 | 0.5353 | 0.3945 | 0.5734 |
| <i>Orthopaedic surgery (n=28)</i> | | | | | | | | |
| Pearson r^a | -0.03 | -0.18 | 0.15 | -0.11 | 0.24 | 0.06 | 0.18 | 0.09 |
| Sig. (2-tailed) | 0.8612 | 0.3478 | 0.4550 | 0.5852 | 0.2194 | 0.7798 | 0.3666 | 0.6545 |

in conversations with doctors during physical examinations and during visiting times ($r^2 = -0.61$; $P = 0.002$).

Discussion

As stated in the Introduction, in the literature, good quality of care is often associated with shorter stays and shorter stays are not often associated with an adverse effect on patient satisfaction. For six out of seven specialisms we found no correlation between LOS and patient satisfaction, which means that we found no evidence that hospital wards with a relatively short mean LOS had higher, or lower, patient satisfaction than hospital wards with a relatively long LOS. The exception was pulmonology where we found significantly higher patient satisfaction scores for some specific items on hospital wards with a shorter LOS.

The negative correlations for pulmonology are significant and should result in further research. Our findings concern the admission, the (transfer of) information, the expertise of the nursing staff and the privacy. Without pretending to be complete we

found some suggestions in literature that might contain some explanations for the negative correlations between LOS and patient satisfaction at pulmonology wards.

Firstly, pulmonary diseases are characterised by the complexity of their care, indicated by a long hospital stay and the involvement of several health care professionals. Clear communication towards pulmonary patients could be difficult. This will influence their satisfaction.

Secondly, communication and information are essential for all wards. Patients who are well informed are more satisfied and are more willing to accommodate doctors' recommendations. In chronic respiratory diseases the emphasis on information is based on treatment, symptom relief, and the prevention of the progression of the illness. Information on the prognoses of the disease is important to patients, but this need is not always fulfilled for pulmonary patients.⁴⁶

Thirdly, patients with lung cancer -who form an important part of the pulmonary group- are less satisfied with the care received from physicians than other patients with cancer. They encounter more unfulfilled psychological and social needs compared to other cancer groups.⁴⁷

Fourthly, in pulmonary patients, psychiatric comorbidity is highly prevalent. It also plays a part in the development of functional deterioration and in determining poor medical outcomes. For example delirium with cognitive disturbance is an acute psychopathological disturbance that usually improves considerably during the hospitalization.⁴⁸

As is common in literature we used patient satisfaction in this study as an indicator of the quality of care.^{21,23} Patient satisfaction and patient experiences have been used extensively in Dutch hospitals in the last decade for comparing hospitals' quality of care and for making quality improvements.^{43,49-51} We assumed that, in cases where the quality of care is better, patients know that the quality is better and as a result of this they will be more satisfied concerning the care they received. But two crucial questions need answering. Firstly, are patients really capable of distinguishing between good and inferior quality of care and, secondly, are the questions asked by the patient satisfaction questionnaire suitable to measure this? For patients with adverse outcomes, post-discharge, we know that they negatively influence patients' overall evaluation of the quality of their care.²⁴ However, we hesitate to suggest they are more negative simply because of the adverse outcome or whether this is also because of the lower quality of care, even if this did not result in an adverse outcome. Concerning the second question we doubt whether the patient satisfaction questionnaire really tackles the quality of care. It tackles the patients' possibly subjective perception of the quality of care. The questions in the questionnaire include more or less subjective topics like dignity, personal treatment and

information given by the professionals. ‘Objective’ topics about the logistics and organization of care are not included in the questionnaire. Since patient satisfaction is influenced by patients’ personal relationships with healthcare professionals such as doctors and nurses²⁵, a longer LOS might also influence the satisfaction in a positive way. A longer LOS allows for the development of more meaningful personal relationships.

Because we doubt whether the patient satisfaction questionnaire tackles the quality of care sufficiently, we suggest asking patients more directly how long they stayed in hospital and how they experienced their LOS. In future this could be done in the patient satisfaction questionnaire or in one of the Consumer Quality Indexes. This is in line with literature supporting the relationship between patient-centred care and clinical benefits such as the survival of acute myocardial infarction and lower patient mortality rates.^{26,27} Also better compliance, recovery and reduced admission and readmission rates are associated with patient-centred care.²⁸ Therefore, in the future, patient reports about their care should be accompanied by assessments of their clinical outcomes.²⁶⁻²⁸

Limitations

We could not study the characteristics of the non-responders of the patient satisfaction surveys, because of their anonymity. Although the response rate was reasonable²⁹, it could be that only extremely satisfied, or dissatisfied patients returned the questionnaire. However, former research showed that the impact of a non-response bias on satisfaction questionnaires of hospitalised patients is relatively small.^{30,31} For LOS data there were no non-responders. Hospitals that participated in the LMR, participated with all their clinical patients.

In the Netherlands patient satisfaction data have been gathered separately from information about LOS. Kiwa Prismant received the questionnaires anonymously and it was not possible to link the outcomes on the patient level to the LOS of the individual patient. Therefore our analysis is carried out at the level of the ward. No conclusions can be drawn on the level of the individual patients. From this year however, the satisfaction questionnaire has been extended to include a question about the LOS of the patient. In the future it will be possible to make a study of the relationship between the LOS and patient satisfaction on the patient level.

Conclusion

We found no evidence that hospital wards with a relatively short mean LOS had higher, or lower, patient satisfaction than hospital wards with a relatively long LOS, with the exception of pulmonology.

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APPENDIX 1

Patient Satisfaction Questionnaire

1. Admission procedure :

- How satisfied were you with the reception on the ward?
- How satisfied were you with the information provided by nurses on admission?

2. Nursing care :

- How satisfied were you with the personal attention of the nurses?
- How satisfied were you with the expertise of the nursing staff?

3. Medical care :

- How satisfied were you with the personal attention of the doctors?
- How satisfied were you with the expertise of the doctors?

4. Information :

- How satisfied were you with the clarity of information given by nurses?
- How satisfied were you with the clarity of information given by doctors?
- How satisfied were you with the way the information was transferred from one person to another?
- How satisfied were you with the speed of the results of the diagnostic tests?

5. Patient autonomy :

- How satisfied were you with the degree of encouragement to be self-sufficient?
- How satisfied were you with the degree to which you could participate in treatment decisions?
- How satisfied were you with the privacy you were given such as in conversations with doctors during physical examinations and during visiting times?

6. Aftercare :

- How satisfied were you with the information provided about further treatment?
- How satisfied were you with the transfer of information to external professionals, such as your GP?
- How satisfied were you with the discharge procedure?

5

Unexpectedly long hospital stays as an indicator of risk of unsafe care. Dutch experiences with a new outcome indicator.

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Submitted for publication.

Abstract

Background: Hospital adverse events often result in a longer length of stay. We developed a new indicator that uses the unexpectedly long length of stay (UL-LOS) as a potential risk factor for unsafe care. The Dutch Health Care Inspectorate added the indicator to their indicator framework and uses it in addition to the Hospital Standardised Mortality Ratio (HSMR) to monitor patient safety in hospitals. We measure the variability of the new indicator across hospitals and the stability over time. We also examine the correlation between the UL-LOS and the HSMR. Finally we give a research programme to improve the validity of the indicator.

Methods: The indicator is based on a prolonged length of stay of more than 50%. In order to compare hospitals properly we used data of standardised length of stay. The standardisation was based on patients' age, primary diagnosis and main procedure. We used the indicator separately for three strata of hospitals: 31 general hospitals, 24 tertiary teaching hospitals and 8 university medical centres.

Results: The UL-LOS indicator showed considerable variability between the Dutch hospitals: from 8.0% to 21.4% in 2010. The university medical centres had a relatively high score on this indicator compared with the tertiary teaching hospitals and general hospitals. The stability of the indicator over time was quite high and the indicator had a significant positive correlation with the HSMR. The Pearson correlation between UL-LOS and HSMR was 0.53. This means that in general, hospitals with more patients with an unexpectedly long length of stay were also the hospitals with higher standardised mortality.

Conclusions: The new outcome indicator is based on the assumption that complications often prolong the patient's hospital stay. A higher percentage of patients with a UL-LOS compared to the national average may indicate shortcomings in the quality or safety of care delivered by the hospital. This indicator is already corrected for age, principal diagnosis and surgical requirement, but further variables could usefully be added. The indicator does have clear strengths: its ability to reveal the variations between hospitals, its relatively small confidence intervals and its stability over time.

Background

For about ten years promoting practice based on quality indicators is seen as an essential component in optimising safety in healthcare.

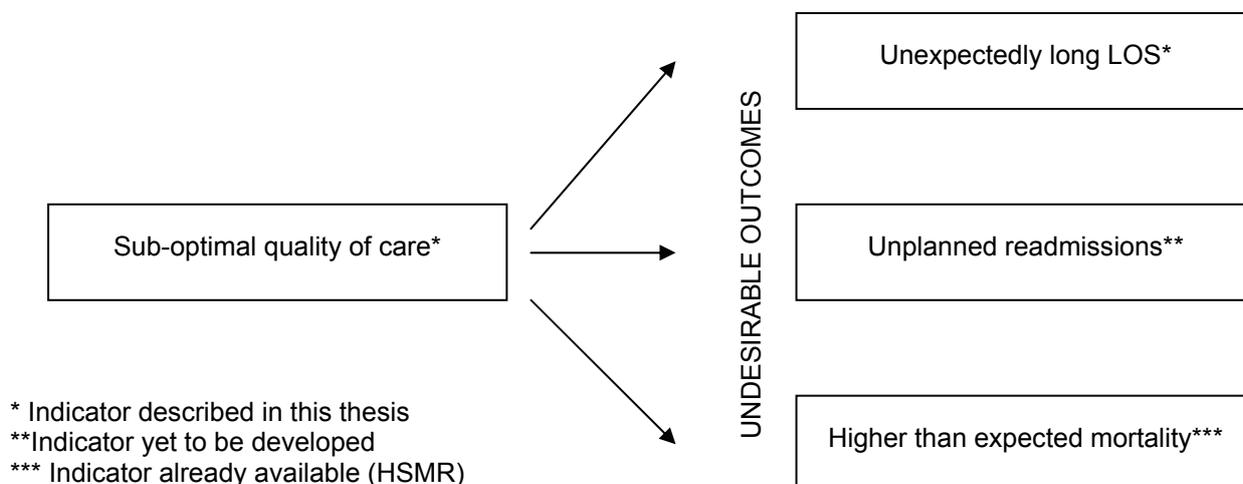
In the Netherlands, like in other countries, a large number of indicators have been developed and introduced to monitor the quality and safety of hospital care¹⁻³. It was always clear that these indicator sets have to be evaluated regularly. Process indicators, in particular, tend to reach a ceiling after several years. Beyond this, further improvement is not feasible. David Reeves and colleagues gave a useful overview of criteria on which eight process measures were removed from the UK Quality and Outcomes Framework⁴. In the Netherlands the same process is going on. Indicators that no longer meet the requirements are being removed and simultaneously new indicators are being developed.

The Dutch Health Care Inspectorate, which uses indicators in the supervision of hospital care, uses a framework that embraces eighteen major types of treatment, such as intensive care or care for children. One of these eighteen embraces some general quality indicators, such as the annual evaluation of how physicians function, monitored by a process indicator, and the hospital standardised mortality ratio (HSMR), which is an outcome indicator.

For this category of general quality indicators, we developed a new patient safety indicator that uses the unexpectedly long length of stay (UL-LOS) as a potential risk factor for unsafe care. Research has shown that hospital adverse events often result in a longer length of stay⁵⁻¹⁷, and in several studies of adverse events, a long length of stay was used as an important trigger for selecting medical records¹⁸⁻²⁰.

Brock et al. advocate treating time related outcomes like LOS and mortality as competing risks²¹. The new indicator should be part of an interrelated indicator model as shown in Figure 1. This model consists of three possible negative outcomes of hospital care: unexpectedly long length of stay (UL-LOS); unplanned readmissions and higher than expected mortality. These indicators can be seen as a cohesive set since a degree of substitution -or competition- between them is possible. For example, if poor quality of care results in a higher mortality rate, the patients concerned possibly will not be included in indicators which consider unplanned readmissions or UL-LOS. Conversely, patients included in the indicators for these two undesirable outcomes will not be included in the HSMR.

Figure 1. General outcome indicators which may reveal poor, or ‘sub-optimal’, quality of clinical hospital care



The HSMR has already been available in Dutch hospitals since 2006. The UL- LOS is the new indicator that is the subject of this paper; however an indicator for unplanned readmissions is not yet available and should be developed in the near future.

As far back as 1999 Silber et al. had already published research about an indicator called ‘conditional length of stay’. This was based on LOS-data and took into account the fact that patient stays tend to become prolonged after complications. They developed this indicator by testing if LOS distributions display an ‘extended’ pattern of decreasing hazards after a transition point. This would suggest that ‘the longer a patient has stayed in the hospital, the longer a patient will likely stay in the hospital’. Or, alternatively, there is the possibility that ‘the longer a patient has stayed in the hospital, the faster a patient will likely be discharged from the hospital’²².

In the Netherlands, we have developed the indicator by using standardised LOS data and a standard cut-off point to distinguish between ‘normal’ variation in LOS and variation in LOS caused by complications.

The Dutch Health Care Inspectorate added it to the indicator framework used to monitor patient safety in hospitals. In this paper we measure the variability of the indicator across hospitals and the stability over time. We also examine the correlation between the two existing indicators of the model: the UL-LOS and the Hospital Standardised Mortality Ratio (HSMR), as they are both supposed to be an indicator of risk of unsafe care. We expect a positive relationship between the two indicators, as reduced quality of care leads to more adverse events, and more adverse events lead to more patients with prolonged hospitalisation as well as to more deaths. However, the relationship can only be moderately positive, because the two indicators are competitive. The paper also includes a research programme to

improve the validity of the indicator in order to get an even stronger signal for the risk of unsafe care.

Methods

Data

To design the indicator, we used routinely registered administrative data from the National Medical Registration (LMR). Dutch Hospital Data (DHD) granted us permission to use the data. The LMR contains data of hospital admissions including medical data such as diagnosis and surgical procedures as well as patient-specific data such as age and hospital stay²³. The LMR also includes the variable ‘expected length of stay’, which is generated by indirect standardisation based on the following three patient characteristics:

- Age: Divided into 5 categories: 0, 1-14, 15-44, 45-64, 65+ years;
- Primary diagnosis: This is the main diagnosis that led to the admission; it includes about 1,000 diagnoses classified by the ICD9 in three digits;
- The main procedure: Classified by the Dutch Classification System of Procedures. The procedures considered depend on the diagnosis of the patient. On average it includes five procedure groups.

Together these three parameters produced $5 \times 5 \times 1,000 = 25,000$ cells for which the mean length of stay is taken as the expected length of stay.

The indicator could only be calculated for hospitals that were participating in the LMR and that recorded the procedures in the LMR. For our study this resulted in the use of data of the year 2010 of 63 out of 91 Dutch hospitals. These were made up of 31 general hospitals, 24 tertiary teaching hospitals (TTHs) and 8 university medical centres (UMCs). These three hospital groups vary in size and in complexity of diseases they treat. In addition our standardisation method will never cover 100% of all case mix differences between hospitals. Therefore, we used the indicator for these three groups of hospitals separately. We assume a proper comparison of hospitals within the three hospital groups is justified given this combination of stratification and standardisation. Furthermore, case mix differences between Dutch hospitals within the three groups are not that big. Dutch hospitals within the three groups do have about the same degree of specialisation and the same financing system. Because an existing registration was used, the introduction of the indicator did not cause an extra registration burden.

Definition UL-LOS indicator

The indicator ‘percentage of patients with an unexpectedly long length of stay’ is defined as the percentage of clinically admitted patients with an actual hospital stay that was more than 50% longer than expected². We excluded from this indicator patients who died in hospital.

We used the threshold of 50% longer than expected, because with this threshold we especially wanted to include the patients that stayed longer because of complications and adverse events, and not the patients that just stayed a little bit longer in hospital because of variations in the treatment, such as in logistics. Table 1 gives the percentages of patients with a longer than expected LOS for ten different threshold groups between 0 and 100%. After the threshold of 50% the percentages are beneath 2%. We have put the limit at 50% since our first experiences with case studies (See Chapter 6) showed that the number of adverse events clearly increased from a longer than expected length of stay of 50% or more.

Table 1. All Dutch hospital patients divided by LOS-groups.

| | | Percentage of patients 2009 | Percentage of patients 2010 |
|--------------|---|-----------------------------|-----------------------------|
| UL-LOS | observed LOS >100% longer than expected LOS | 8,1% | 7,9% |
| | observed LOS 90-100% longer than expected LOS | 0,9% | 0,9% |
| | observed LOS 80-90% longer than expected LOS | 1,2% | 1,0% |
| | observed LOS 70-80% longer than expected LOS | 1,1% | 1,1% |
| | observed LOS 60-70% longer than expected LOS | 1,2% | 1,3% |
| | observed LOS 50-60% longer than expected LOS | 1,6% | 1,7% |
| NON UL-LOS | observed LOS 40-50% longer than expected LOS | 2,2% | 2,0% |
| | observed LOS 30-40% longer than expected LOS | 2,1% | 2,2% |
| | observed LOS 20-30% longer than expected LOS | 3,1% | 2,9% |
| | observed LOS 10-20% longer than expected LOS | 3,2% | 3,5% |
| | observed LOS <10% longer than expected LOS | 4,6% | 5,0% |
| | observed LOS ≤ expected LOS | 68,6% | 68,5% |
| | deceased patients | 2,1% | 2,0% |
| TOTAL | | 100,0% | 100,0% |

Analyses

We measured the variability of the indicator across hospitals. To find out whether the indicator is stable over time, we determined the correlation between the percentages per hospital in ‘2008 and 2009’, ‘2009 and 2010’ and ‘2008 and 2010’. To analyse whether the indicator could identify risks of unsafe care, we correlated the results of the UL-LOS with the HSMRs for the year 2009. Therefore we calculated the

Pearson correlations and the 2-tailed Sig. between the unexpectedly long lengths of stay and HSMRs.

Correlation with the HSMR

The HSMR consists of the quotients of observed mortality and expected mortality in 50 diagnostic groups (CCS) in which 80% of all hospital mortality took place. The expected mortality was based on the following characteristics of the patients: age, sex, CCS-subgroup, comorbidity (Charlson index), urgency, social deprivation, source organisation type, month and year. Jarman et al published the Dutch 2009 model²⁴.

As with the UL-LOS, the HSMR could only be calculated for hospitals that participated in the LMR. Some additional criteria were used in order to decide whether to include or exclude a hospital from our analyses. To be included in our analyses, hospitals had to:

- Avoid the use of vague diagnostic codes (this had to be less than 2% of the admissions);
- Perform an adequate registration of the urgency of the admission (more than 30% of the admissions had to be marked as urgent);
- Perform an adequate registration of the comorbidity of patients (the mean number of secondary diagnosis per admission had to be more than 0,5).

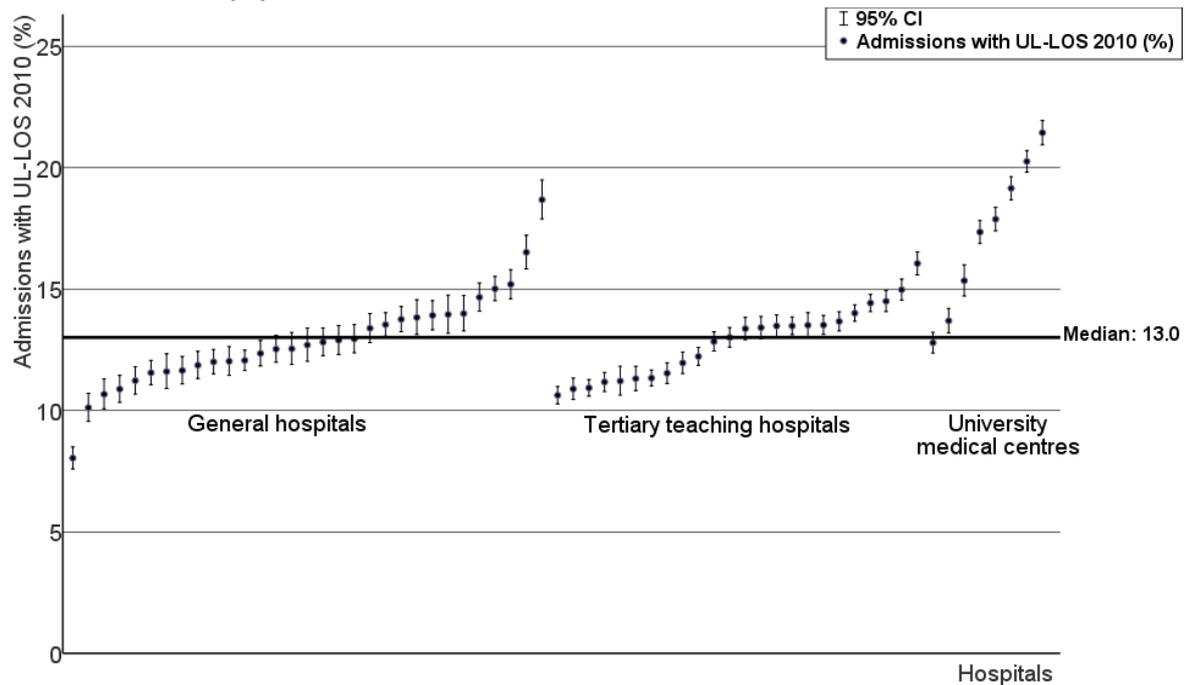
And in addition to this the HSMR had to count for more than 70% of all deaths in hospital and the hospital had to have more than 50 expected deaths per year. All these additional criteria resulted in 50 hospitals remaining for our correlation study between UL-LOS and HSMR for the year 2009.

Results

Variability across hospitals

In Figure 2 the percentage of unexpectedly long length of stay is given for the 63 hospitals in our study. The figure also shows the 95% confidence limits. A distinction has been made between general hospitals, TTHs and UMCs. The national median of the percentage of clinical admissions with a UL-LOS was 13.0%. The UMCs had a relatively high score on this indicator compared with the TTHs and general hospitals.

Figure 2. Percentage of admissions with an unexpectedly long length of stay (UL-LOS) for the hospitals in our study, defined by type of hospital: general hospitals (N=31), tertiary teaching hospitals (TTHs) (N=24) and University Medical Centres (UMCs) (N=8); LMR 2010

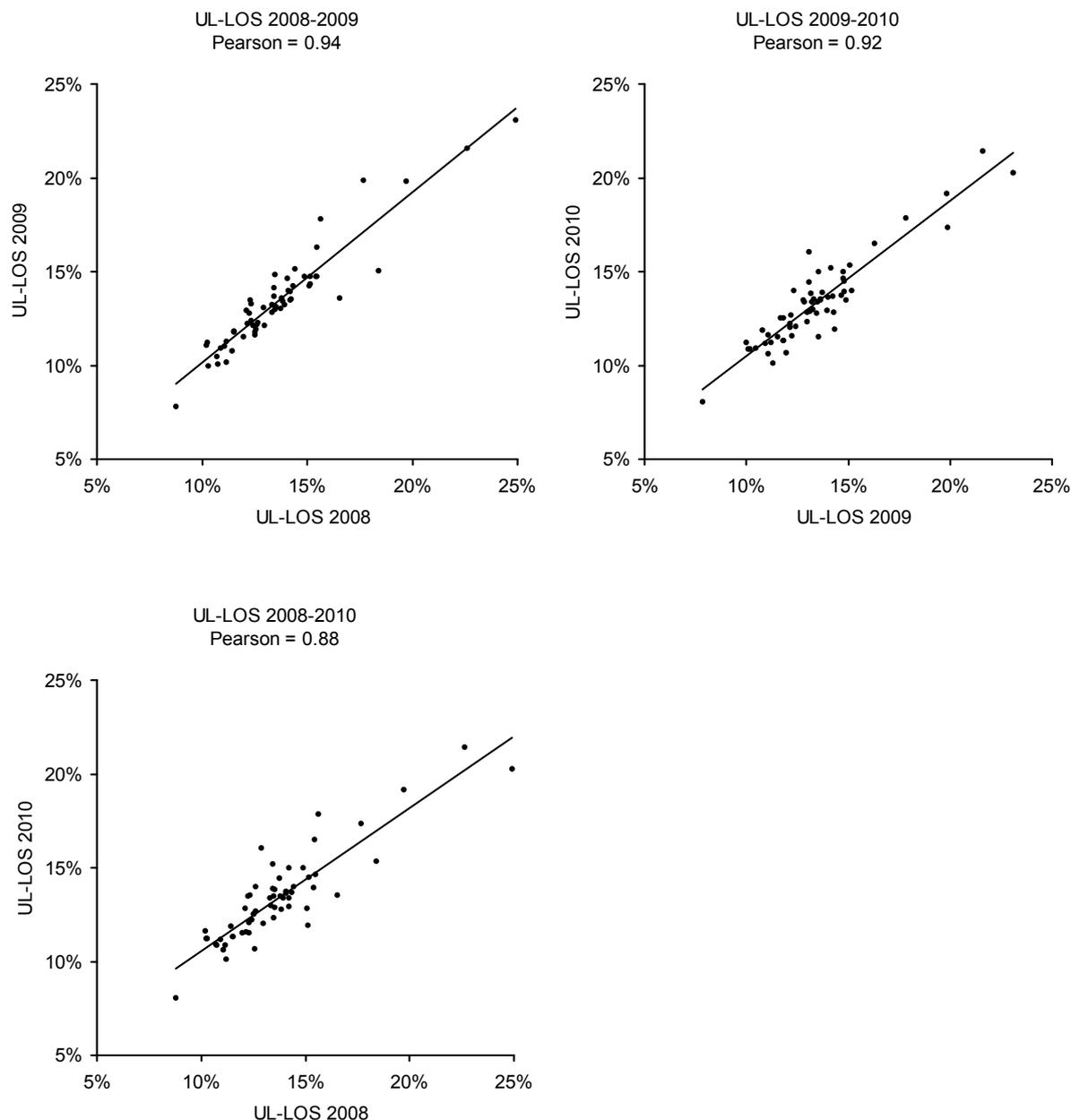


For the UMCs the variation of the percentages was between 12.8% and 21.4%, with a median of 17.6%. The TTHs varied between 10.6% and 16.1%, with a median of 13.2%. For the general hospitals the variation was between 8.0% and 18.7%, with a median of 12.7%. We found no significant difference between tertiary teaching hospitals and general hospitals, $t(53) = 0.11$; $p = .91$.

Stability over time

To explore the stability of the indicator, we also calculated the indicator for the years 2008 and 2009 with the same formula. Figure 3 shows the stability of the indicator through the years 2008-2009-2010. Between 2008 and 2009 as well as between 2009 and 2010 the Pearson correlation is high: 0.94 and 0.92 respectively.

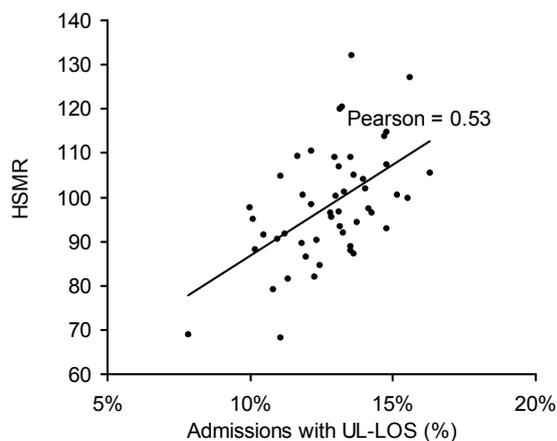
Figure 3. Correlation between the years 2008, 2009 and 2010 for the percentage of admissions with an unexpectedly long length of stay (UL-LOS) per hospital. LMR 2008 (N=61), 2009 (N=61) en 2010 (N=63)



Correlation with the HSMR

Figure 4 shows the correlation between the UL-LOS indicator and the HSMR for the year 2009. The Pearson correlation between the two indicators was reliable ($r=.53$, $p < 0.001$).

Figure 4. 50 hospitals plotted by hospital standardised mortality ratio (HSMR) and percentage of admissions with an unexpectedly long length of stay (UL- LOS); 2009.



Discussion

In this study, we calculated a new patient safety indicator for Dutch hospitals that, to the best of our knowledge, has not been described in the literature till now. The new indicator is defined as the percentage of clinically admitted patients with an actual hospital stay that was more than 50% longer than expected. The indicator shows considerable variability between the Dutch hospitals: from 8.0% to 21.4% in 2010. It also showed serious variation within homogenous groups of hospitals. The stability of the indicator over three years was quite high and the indicator had a significant positive correlation with the HSMR. This means that in general, hospitals with more patients with a UL-LOS were also the hospitals with higher standardised mortality.

The percentages, especially of the UMCs, differed from the national median. The high score for the UMCs could indicate that there is insufficient adjustment for the specific patient categories admitted to the UMCs. The current indicator corrects for differences in age, principal diagnosis and procedures. But there are probably more variables involved in a prolonged hospital stay. The case mix adjustment is more limited than for example the HSMR. Further research is needed to determine which other patient characteristics play a significant role in a prolonged length of stay. An obvious one would be the patient comorbidity. However, since the current registration does not differentiate between comorbidity present at admission and comorbidity occurring during the hospital stay (complications), it is inappropriate to standardise for comorbidity. Standardisation for complications that occur during the hospital stay would 'hide' unsafe care. It is a shortcoming of the Dutch hospital

registration that hospitals make almost no distinction between the secondary diagnoses on admission and those that arise during the hospital stay.

A strength of the UL-LOS indicator is the fact that the confidence intervals are relatively small. The sample size consists of all clinical admissions.

The indicator uses a threshold of a length of stay of 50% longer than expected. This threshold is based on our first experiences with reviewing hospital records based on LOS. There is no evidence that the threshold has to be exactly 50%. A more detailed study is needed to determine the appropriateness of this threshold. Further research is also needed to determine to what extent the proportion of patients which crosses the threshold can vary for each combination of age, main diagnosis and procedure. If the variations between hospitals are large, and the case mix clearly differs, this will present a number of unequal opportunities that will result in crossing the 50% threshold. We might need to vary the threshold for different diagnostic groups.

In terms of evaluation of care it is becoming increasingly common for hospitals to study patient records retrospectively, especially in cases of deceased patients^{25,26}. This new indicator might be a good research tool to identify patient records where improvements can be made in patient care. The indicator provides insight into the percentage of patients that stayed at least 50% longer than expected. The assumption is that in this group relatively many patients have had to deal with unexpected developments in their disease, resulting in complications that cause a prolonged stay. It could be much more effective for hospitals to review records of hospital admissions selected by this indicator compared to randomly selected patient records. Reviewing records takes considerable time and by using this indicator for selection, time could be saved by reviewing fewer records from which, probably, more lessons may be learnt.

Hospital management might also have financial reasons to be interested in the new indicator in addition to the quality and safety aspects of the UL-LOS indicator. In truth a longer than expected length of stay costs money in the present Dutch financing system. Although the indicator is not developed for financial purposes, the use of the indicator may, as a beneficial side effect, also reduce the total amount of hospital days.

Conclusion

The relatively new outcome indicator 'Percentage of patients with an unexpectedly long LOS' is based on the assumption that complications often prolong the patient's hospital stay. A higher percentage of patients with a UL-LOS compared to the national average, after a correction is made for case mix variations, may indicate shortcomings in the quality or safety of care delivered by the hospital. This indicator is already corrected for age, principal diagnosis and surgical requirement, but further variables could usefully be added. Moreover, the indicator currently 'counts' all patients whose actual LOS exceeds the expected duration by 50% or more. We contend that this cut-off point should be set separately for each patient group. That said, the indicator does have clear strengths: its ability to reveal the variations between hospitals, its relatively small confidence intervals and its stability over time.

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6

Record reviewing with a priori patient selection: standardised mortality ratios and unexpectedly long length of stay as tools for identifying adverse events

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Abstract

Objective: To investigate whether a priori selection of patient records using Standardised Mortality Ratio (SMR) and Unexpectedly Long Length of Stay (UL-LOS) leads to more records with adverse events (AEs) compared to random selection.

Design: Our study was done at Tergooiziekenhuizen in the Netherlands. To investigate the opportunities of the SMR, we looked for AEs in records of two patient groups with the highest SMRs, namely, 'congestive heart failure, non-hypertensive' and 'other lower respiratory diseases'. We compared the number of AEs in these groups with previously published studies with random selection of patients' records. To investigate the opportunities of the UL-LOS we looked for AEs in all records of patients with colorectal cancer. Within this group, we compared the number of AEs found in records of patients with a UL-LOS with the number found in records of patients who did not have a UL-LOS.

Results: 47% of the patient records selected using SMRs contained one or more AEs compared to 3% to 17% in studies with random selection of patient records. In the records of patients with colorectal cancer who had a UL-LOS, 51% of the records contained one or more AEs compared to 9% in the reference group of non-UL-LOS patients. By using the UL-LOS indicator to select records within the colorectal cancer patient group, we selected 66% of the records. These represent 91% of all records with one or more AEs.

Conclusions: A priori selection of patient records using high SMRs or the UL-LOS indicator appears to be a powerful selection method which could be an effective way for healthcare professionals to identify opportunities to improve patient safety in their day-to-day work.

Introduction

Diminishing the number of patient-related adverse events is one of the top priorities for hospitals. A common way to achieve this is to learn from incidents and take action to prevent recurrence. To identify the adverse events, retrospective patient record review has become the 'gold standard' internationally.¹⁻⁵ By retrospectively reviewing patient records, healthcare professionals are able to identify adverse events that occurred during the care process. Several studies on retrospective patient record review in different countries have shown a wide range of incidences of adverse events, varying from 2.9% to 16.6% with a median overall incidence of adverse events of 9.2%.⁶⁻⁸ In the Netherlands, a recent nationwide study showed a 5.7% chance (95% confidence interval 5.1% to 6.4%) of finding adverse events when looking at all admissions.^{5,9} Among hospital patients who died, there appeared to be a 10.7% chance (95% confidence interval 9.8% to 11.7%) of finding adverse events. This implies that, with random selection from all hospital records, a healthcare professional will review 18 records to find one adverse event, or 9 records when reviewing randomly selected patient records of patients who died at the hospital. These results show that although this method has been proved very advantageous in finding adverse events, there is an important disadvantage: record reviewing is very time-consuming. Although most Dutch hospitals want to analyse their patient records for adverse events in order to identify patient safety opportunities, many hospitals are not able to mobilise enough physicians who can spend many hours reviewing patient records.

Looking for more efficient ways to organise patient record reviewing, we investigated how to increase the chance of finding adverse events. Previous research has shown strong relationships between adverse events and outcomes of quality indicators at patient and hospital level.¹⁰⁻¹² For instance, one study identified a relationship between complications and increased mortality and length of stay (LOS).¹³ Other research showed excess mortality was attributable to potentially preventable non-obstetric adverse events.¹⁴ A more recent study on the United States Veterans Health Administration data replicated these relationships between adverse events and patient safety indicators of the Agency for Healthcare Research and Quality.¹⁵ Some more recent studies have suggested a reverse process, and claim that quality indicators such as SMRs can be used to signal a potential safety problem. For instance, when SMRs for particular patient groups are higher than the national average, one should analyse these groups more closely.¹⁶ Moreover, several other studies have shown that adverse events often lead to prolonged LOS, and prolonged LOS could signal safety issues.¹⁷⁻²⁶ Departing from this previous work, we hypothesised whether patient safety indicators that are related to mortality and LOS

could be used for selecting patient records in order to find more adverse events and save the valuable time of those reviewing patient records.

To do this, we conducted a retrospective review of patient records that had been selected on the basis of two patient safety indicators already in use by Dutch hospitals and derived from administrative medical data: Standardised Mortality Ratios (SMRs) and Unexpectedly Long Length of Stay (UL-LOS). SMRs are used in many countries as patient safety indicators.^{16,27} The UL-LOS indicator has been developed recently.²⁸ Both the SMRs and the UL-LOS are calculated using data from an existing Dutch hospital registry: the National Medical Registration (LMR).

To test the hypothesis that looking for adverse events can be done efficiently by selecting patient records using SMRs and UL-LOS, we conducted a pilot study in Tergooiziekenhuizen, a general hospital in the Netherlands. This article describes the pilot study. The results of this study might help hospitals organise their record-reviewing process in the most efficient way by using two quality indicators already available to them through existing registries.

Methods

The quality indicators SMR and UL-LOS

In our study, we used the SMRs of the Dutch Hospital Standardised Mortality Ratio (HSMR) model from August 2009 and the quality indicator UL-LOS 2009 to make the a priori selection. The methodology for calculating these two quality indicators is beyond the scope of this paper. Therefore, we only briefly describe both indicators and refer to the relevant literature for detailed information.

The HSMR is an internationally used ratio that compares hospital mortality with the national average. The HSMR for a hospital is made up of several SMR values. An SMR is a collection of different diagnostic groups (ICD-9) that are categorised on the basis of Clinical Classifications Software (CCS) groups. Each SMR value is calculated by dividing the observed mortality by the expected mortality. In the Netherlands, the HSMR includes 50 SMRs, which are responsible for 80% of all Dutch hospital mortality. The expected mortality is calculated by logistic regression modelling, taking the following patient characteristics into account: age, sex, diagnostic subgroup, comorbidity, urgency, social deprivation, source organisation type, month, and year.²⁹

The UL-LOS is a LOS that is more than 50% longer than expected.²⁸ The expected value is based on the mean LOS of patients from the same age group and the same primary diagnosis/procedure group. Patients who died in the hospital are excluded. UL-LOS as well as SMRs are quality indicators Dutch hospitals use for their quality-improvement programmes. The Dutch Health Care Inspectorate uses them in its supervision of hospital care.

Setting

The study was done in 2010 and 2011 at Tergooiziekenhuizen, a general hospital with nearly 30,000 clinical admissions a year. We used data and patient records from 2009. The hospital board gave us permission to use the data.

Reference groups

To assess the impact of the use of the SMRs we compared the number of adverse events found in the records selected using SMRs with the number of adverse events found in other studies.⁵⁻⁹ For the records selected with the UL-LOS indicator, we used a reference group that consisted of comparable patients who were treated at Tergooiziekenhuizen without a UL-LOS.

Analysis with the IHI Global Trigger Tool

A nurse used the IHI (Institute for Healthcare Improvement) Global Trigger Tool to search all selected patient records for triggers.²⁷ Triggers may contain clues for identifying possible adverse events. This instrument adapts the classification from the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) Index for Categorizing Errors. Although originally developed for categorising medication errors, these definitions can be easily applied to any type of adverse event. The IHI Global Trigger Tool was developed to identify adverse events, determine the harm to the patient, and whether the adverse event was the result of a commission. According to the IHI, only cases of commission should be counted. In line with the methodology of the Dutch national adverse events studies^{5,9}, we also counted cases of omission, as these are also a valuable source of possible quality improvement.

Accordingly, the tool excludes the categories A to D from the NCC MERP Index, because these categories describe incidents that do not cause harm. We used the categories E to I, which do describe harm that may have contributed to or resulted in:

- Category E: temporary harm to the patient and required intervention;
- Category F: temporary harm to the patient and required initial or prolonged hospitalisation;
- Category G: permanent patient harm;
- Category H: intervention required to sustain life; and
- Category I: contributed to patient death.

A surgeon and an internist-nephrologist investigated and looked for adverse events in the patient records in which the nurse had found triggers. The physicians and nurses were trained according to the IHI Trigger Tool implementation programme. The patient records were randomly divided between the physicians. They analysed these

records in the same room in order to discuss difficult cases and make use of each other's expertise. If necessary, they consulted other physicians in the hospital to make their judgments as accurate as possible. The harm caused by an adverse event was categorised according to the NCC MERP Index as indicated above. They also classified the adverse events into five categories: care, operation, medication, intensive care (IC), and other.

A priori record selection using SMRs

We first selected the diagnosis groups with SMRs that were significantly higher than the national average. We selected the two groups with the highest SMRs, namely 'congestive heart failure, non-hypertensive' and 'other lower respiratory disease'. Subsequently, we selected from these groups patients who were older than 84 years of age and patients who had been admitted in the evening and during the weekend in 2008. These subgroups had relatively high SMR values compared to the national average. Then all of these records were screened by a nurse for the presence of triggers with the IHI Trigger Tool. Patient records with triggers were forwarded to the physicians to be investigated for adverse events and the possible harm to patients.

A priori record selection with UL-LOS

We also selected all records of patients with an admission for colorectal cancer in 2009. Patients with colorectal cancer are generally considered to be a homogenous population in terms of LOS, and are relatively vulnerable to adverse events³⁰. We excluded duplicated records, records of palliative patients, and patients who died in the hospital. Then we selected patient records with a UL-LOS. A nurse screened all these selected records for the presence of triggers with the Trigger tool. Patient records with triggers were forwarded to the physicians to be investigated for adverse events and the possible harm to patients. We categorised all records on the basis of the ration between actual and expected LOS, into four groups: 1) actual LOS shorter, equal or less than 50% longer than expected; 2) actual LOS 50% - 99% longer than expected; 3) Actual LOS 100% - 199% longer than expected; 4) Actual LOS 200% or more above the expected LOS. The last three categories together, form the patient group with a UL-LOS, and the first one is the patient group we call non-UL-LOS.

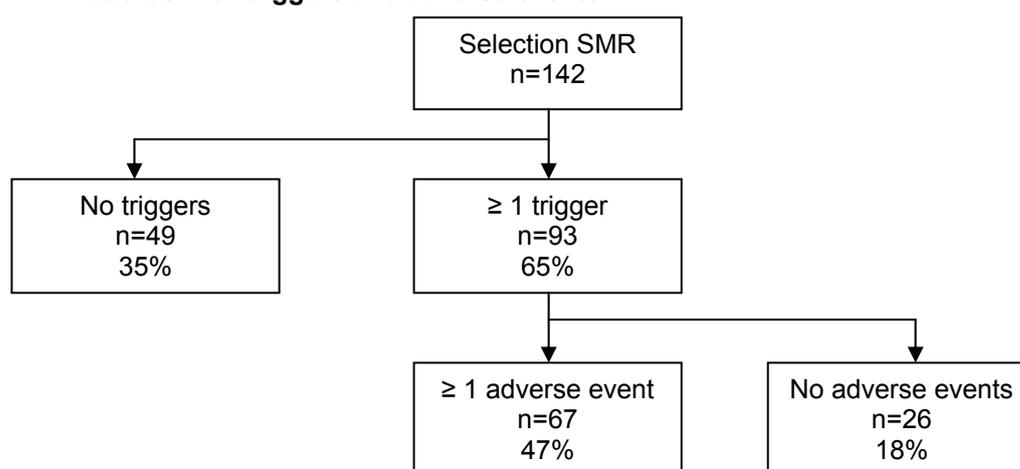
Results

SMR-based record selection

The selection of records of patients with 'congestive heart failure, non-hypertensive' and 'other lower respiratory disease' who were older than 84 years of age and had been admitted in the evening and during the weekend resulted in 142 records. The nurses' use of the Trigger tool showed that 49 patient records (35%) had no triggers

and 93 patient records contained one or more triggers (65%). When the physicians reviewed these 93 records it was revealed that 67 records (47% of the originally selected 142 patient records) included one or more adverse events: 43 records contained one adverse event; 14 records contained two adverse events; 6 records contained three adverse events, and 4 records contained four adverse events (see Figure 1).

Figure 1. Schematic representation of records selected with the SMRs and the number of records with triggers and adverse events.



n = number of patient records
% is of total selection of patient records

In Table 1 we show the severity of harm to the patient according to the type of adverse event, classified according to the NCC MERP Index. The majority of adverse events were categorised as care-related (55%). A substantial number of the adverse events were considered to have contributed to the patient's death, category I (19%).

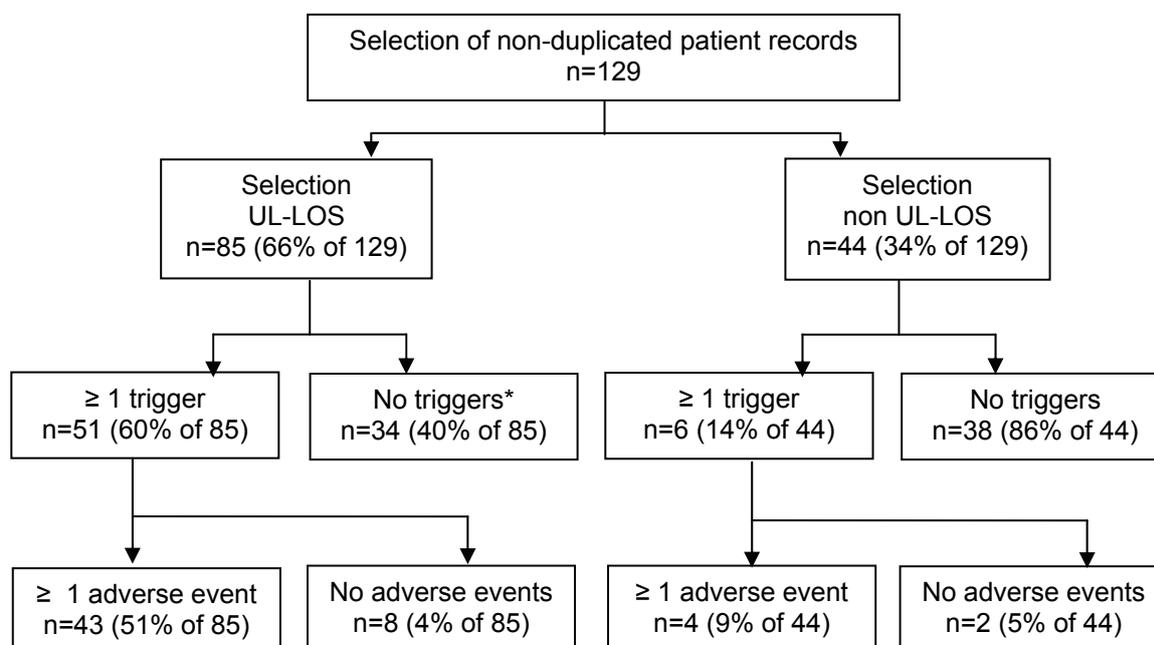
Table 1. Number of adverse events according to severity rating and type. The adverse events were found after selecting patient records using the highest SMRs.

| | | Type of adverse event | | | | | Total | |
|----------------------------------|--|-----------------------|---------|-----------|-----|-------|-------|------|
| | | Care | Medical | Operation | IC | Other | | |
| Severity rating of adverse event | E: temporary harm to the patient and required intervention | 15 | 10 | 0 | 2 | 2 | 29 | 28% |
| | F: temporary harm to the patient and required initial or prolonged hospitalisation | 11 | 1 | 0 | 2 | 1 | 15 | 14% |
| | G: permanent patient harm | 9 | 3 | 1 | 2 | 8 | 23 | 22% |
| | H: intervention required to sustain life | 10 | 0 | 1 | 3 | 4 | 18 | 17% |
| | I: contributed to patient death | 13 | 2 | 1 | 2 | 2 | 20 | 19% |
| Total | | 58 | 16 | 3 | 11 | 17 | 105 | |
| | | 55% | 15% | 3% | 11% | 16% | | 100% |

UL-LOS-based record selection

In 2009, the hospital in our study admitted, treated, and discharged 191 patients with colorectal cancer. From this group, we excluded the duplicated patient records and patients who were admitted for palliative care which resulted in 129 unique patient records. From this group, we selected 85 patients with a UL-LOS (66%). Screening by our nurse with the trigger tool revealed that 51 of these UL-LOS records contained one or more triggers. Thus, 27% of 191 records remained to be reviewed by our physicians. Of these records, 43 patient records included one or more adverse events: 27 records contained one adverse event; 10 records contained two adverse events; 4 records contained three adverse events; and 2 records contained four adverse events (see Figure 2).

Figure 2. Schematic representation of records selected with the UL-LOS indicator and the number of records with triggers and adverse events.



* Only trigger: increased length of stay
 n =number of patient records
 % is of total selection of patient records

In Table 2, we present the physicians' classification. The adverse events were classified mainly as operation-related (45%); 60% of the adverse events were considered to have resulted in temporary harm to the patient, and required initial or prolonged hospitalisation (category F).

Table 2. Number, type, and severity ratings of adverse events found in records of patients admitted with colorectal cancer and a UL-LOS

| | | Type of adverse event | | | | | Total | |
|----------------------------------|--|-----------------------|---------|-----------|----|-------|-------|------|
| | | Care | Medical | Operation | IC | Other | | |
| Severity rating of adverse event | E: temporary harm to the patient and required intervention | 7 | 2 | 3 | 1 | 4 | 17 | 25% |
| | F: temporary harm to the patient and required initial or prolonged hospitalisation | 9 | 4 | 21 | 2 | 4 | 40 | 60% |
| | G: permanent patient harm | 0 | 0 | 4 | 0 | 1 | 5 | 7% |
| | H: intervention required to sustain life | 1 | 0 | 1 | 0 | 0 | 2 | 3% |
| | I: contributed to patient death | 1 | 0 | 1 | 0 | 1 | 3 | 4% |
| Total | | 18 | 6 | 30 | 3 | 10 | 67 | |
| | | 27% | 9% | 45% | 4% | 15% | | 100% |

The reference group: non-UL-LOS patients

Table 3 below shows the number of records with adverse events compared between UL-LOS and non-UL-LOS patients. In the non-UL-LOS group, in 9% (4 out of 44) of the reviewed records, at least one adverse event was found, compared to 51% (43 out of 85) in the UL-LOS group. As displayed in Table 3 below, within the UL-LOS, we also compare three categories. This analysis shows that the longer the actual LOS was than expected, the more records with at least 1 AE were found.

Table 3. Number of adverse events compared between UL-LOS and non-UL-LOS patients and within the UL-LOS categories

| | N records | N records containing at least 1 trigger | N (and % of) records containing at least 1 adverse event |
|---|-----------|---|--|
| Non-UL-LOS patients | 44 | 6 | 4 (9%) |
| All patients with a UL-LOS | 85 | 51 | 43 (51%) |
| - Of which patients with an actual LOS of 50%-99% longer than expected | 33 | 14 | 9 (27%) |
| - Of which patients with an actual LOS of 100%-199% longer than expected | 32 | 22 | 20 (63%) |
| - Of which patients with an actual LOS of 200% or more above the expected LOS | 20 | 15 | 14 (70%) |

Discussion

In line with our hypothesis, selections based on SMRs and UL-LOS appear to be efficient methods to search for adverse events. With a priori selection using SMRs, we found adverse events in 47% of the records of the patients who died in the hospital, while other studies using random selection found adverse events in 3% to 17% of the records.⁵⁻⁹ With a priori selection using the UL-LOS indicator, we found adverse events in 51% of the records, compared to 9% in the non-UL-LOS group. By reviewing

only the UL-LOS group (66%), we found 91% (43 out of 47) of all records with adverse events in the colorectal patient group. We were not surprised to find more adverse events after SMR or UL-LOS selection compared with random selection. However, we were surprised by the degree to which these percentages differed (47% versus 3-17%, and 51% versus 6%). This difference and the fact that almost all adverse events can be found by concentrating on records of patients with a UL-LOS and triggers is encouraging for hospitals struggling with a sparse capacity of reviewing physicians.

The percentages of records in which adverse events were identified in the different categories of UL-LOS show that the present formal quality indicator used by the Dutch Health Care Inspectorate identifies most adverse events. Our results show a rise in the percentage in which at least one adverse event was found from 50% onwards. However, it also rises from 100% onwards. A more detailed study is needed to determine the appropriateness of the 50% threshold. These results apply to colorectal cancer. Future research could also investigate whether this threshold is appropriate for all diagnostic groups or whether we need varying percentages.²⁸

An interesting finding is that only 45% of the adverse events in a group of surgical patients such as those with colorectal cancer is related to the classification 'operation'. It seems that quality of care is determined by the whole chain of care, not only by the quality of the organisation in the operating room or the professionals performing the operation.

Important and frequently used indicators in patient safety policy are mortality, LOS, and readmission. Selection using UL-LOS concentrates on the patients who are discharged from the hospital alive, and selection using SMRs on the patients who died in the hospital. Because of these differences, both indicators can lead to different types of adverse events. The difference in severity between the two groups could be an indication of this. Both selection methods could have complementary results when both are used as input for patient safety improvement programmes. Developing an indicator based on readmissions and analysing its use for patient record selection could be a next step in optimising the efficiency of reviewing patient records.

Limitations

An important limitation of this study is that we identified the number of adverse events only within a specific patient group and only in one hospital. Further research should show whether identifying adverse events in more patient groups and in more hospitals, gives comparable results.

Another limitation is the fact that although we chose to have two physicians analysing the patient records together, both of them analysed separate records and both did this only once. They discussed difficult cases. We did not measure the interrater reliability. Our main concern was to organise the review process as

efficiently as possible. Therefore, we chose parallel record reviewing. However, further research should show whether parallel analysis is reliable enough compared with consecutive analysis, which still contends with poor reliability.^{9,27}

The results of this study are encouraging in showing that hospitals can and will use quality indicators based on administrative data for patient safety policy. This type of hospital data is usually easily available without an extra administrative burden for hospitals. Earlier research has shown the reliability of using administrative data in relation to clinical data.³¹ However, the reliability of indicators such as SMRs and UL-LOS depends on the quality of coding in hospitals.³² Also in the Netherlands, the quality of administrative hospital data is subject to debate. If the quality of data coding in hospitals were to improve, the selection efficiency of quality indicators such as SMRs and UL-LOS would probably be more accurate.

This study also shows that even though intense methodological discussions are taking place in several journals about the reliability of using SMRs for benchmarking hospitals³³⁻³⁶, this indicator can still be very useful in patient safety policy. In Dutch practice, SMRs are already being used by 68 of 94 hospitals to increase patient safety and to improve the quality of care.³⁷

Conclusion

Easily available selection methods may be a powerful way of finding a majority of adverse events while limiting the number of patient records to be reviewed and thereby saving the reviewing physicians' valuable time. This could help hospitals to organise their patient safety policy as efficiently as possible.

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7

General discussion

This thesis examines the possibility of reducing hospital length of stay by improving the quality and safety of care. This chapter provides a summary of the research questions followed by the main conclusions of the research itself. A number of comments relating to methodological aspects are then offered followed by an examination of the implications of the research findings for policy and external supervision. The chapter concludes with a research agenda.

Research questions

Chapter 2 considers the variation in length of stay (LOS) between hospitals, at the level of the individual ward or department. Taking factors such as age, diagnosis and surgical requirement into account, we have calculated the possible reduction in LOS which could be achieved if all Dutch hospitals were to meet the level of efficiency represented by the 15th percentile of the current benchmark ranking.

Chapter 3 is concerned with the measures which medical specialists and nursing staff can take to reduce LOS in their respective hospitals, and the extent to which these measures correspond with those described in the existing literature.

Chapter 4 presents the findings of a study examining the relationship between LOS, at the level of the individual ward or department, and patient satisfaction. The underlying hypothesis is that providing care of good quality has a twofold effect: it not only reduces LOS but also increases patient satisfaction.

Chapters 5 and 6 describe a new outcome indicator which is based on LOS data. This has been included by the Dutch Health Care Inspectorate in a set of indicators with which it monitors the safety of hospital care. The first results based on this indicator have been analysed and their correlation with the Hospital Standardised Mortality Ratio (HMSR) established (Chapter 5). Here, the underlying hypothesis is that the incidence of adverse events is likely to be higher among those patients with an unexpectedly long LOS, compared to those whose LOS is more in keeping with the norm (Chapter 6).

Main conclusions

Hospital days can be further reduced

Hospitals in the Netherlands differ substantially in terms of LOS, even when corrected for case mix. If all hospitals were to bring their LOS, per department, to the level represented by the 15th percentile in the benchmark ranking, the total reduction would be in the order of 1.8 million days (2006). Because such a reduction may be expected to result in a significant financial advantage, particularly within the

new health care system, it forms an attractive target for hospital managers: “Better care, lower costs^{*}”.

Professionals come up with a wide variety of interventions to reduce LOS

Hospitals are motivated to reduce LOS, but how do they do so in practice? What measures have they implemented? This research gives an inventory of the measures introduced by 21 hospital wards which have already taken action in this respect. To collect the measures we developed a matrix that consists ‘horizontally’ -that is over a period of time- of the three main phases of clinical care: admission, stay and discharge. ‘Vertically’ -that is involving different participants at any one moment- we partitioned the matrix to consider the degree to which the lengths of stay could be shortened by the medical specialists and nurses themselves or by involving other actors.

The matrix includes about fifty different interventions which have been introduced, not only with a view to reducing LOS, but also in order to improve the overall quality of care. Most measures are similar or identical to those described in published research.

No correlation between LOS and patient satisfaction was noted

We investigated the possible correlation between LOS and patient satisfaction. We found no evidence that hospital wards with a relatively short mean LOS had higher, or lower, patient satisfaction than hospital wards with a relatively long LOS.

The first conclusion to be drawn is that the reduced LOS has not yet become ‘too short’, at least from the patient’s own perspective. Second, there is no evidence to support the hypothesis that shorter LOS and high patient satisfaction are both the product of good quality of care.

The indicator ‘Percentage of patients with an unexpectedly long LOS’ must be further refined if it is to become a powerful indicator of the risk of unsafe care

The relatively new outcome indicator ‘Percentage of patients with an unexpectedly long LOS’ (UL-LOS) is based on the assumption that complications often prolong the patient’s stay in hospital.

A higher percentage of patients with a UL-LOS compared to the national average, after a correction is made for the case mix, may indicate shortcomings in the quality or safety of care delivered by the hospital. This indicator is already corrected for age, principal diagnosis and surgical requirement, but further variables could usefully

* This is the motto of a large-scale American programme, the ‘Partnership for Patients Project’, which seeks to improve the quality, safety and affordability of health care services. See: www.healthcare.gov/compare/partnership-for-patients.

be added. Moreover, the indicator currently ‘counts’ all patients whose actual LOS exceeds the expected duration by fifty per cent or more. We contend that this cut-off point should be set separately for each patient group. That said, the indicator does have clear strengths: its ability to reveal the variations between hospitals, its relatively small confidence intervals and its stability over time.

More efficient patient record reviewing: scrutinize and analyse the records of patients with an unexpectedly long LOS

Patient record reviewing is useful to identify opportunities for improving patient safety²⁻⁷. It is, however, time-consuming. Our study suggests that an a priori selection of patient records using the UL-LOS indicator is a powerful selection method. It results in the identification of a greater number of records showing adverse events than any random selection. It will therefore save investigators a lot of time.

Reducing LOS can go hand in hand with improving the quality and safety of care

This thesis confirms that efforts to reduce LOS can effectively be combined with efforts to improve the safety and quality of care. The variation in LOS includes an efficiency component, a quality component and a safety component. In order to reduce LOS, hospitals must ensure that the care process is structured so as to avoid unnecessary waiting time. In addition, there must be good communication between care providers, and between the professionals and the patient. It is essential to ensure that care is provided in a safe and responsible manner, and that it is of the highest possible quality. This will promote patient recovery, reducing the risk of avoidable complications which would necessitate a longer LOS.

Comments on the research methodology

In each of the five part-studies we conducted, the research methodology was subject to certain constraints as described in the relevant chapters. Here, some general remarks are in order.

The calculation of expected LOS takes into account only the age, principal diagnosis and surgical requirement of the patient

In this thesis, we make frequent reference to the key figure ‘expected LOS’, as calculated annually by the National Medical Register (LMR), the system which collects and collates hospital data in the Netherlands. There is a standard calculation method which incorporates certain corrections. The expected LOS for each patient therefore takes into account the age (group) and the combination of principal diagnosis and surgical requirement. The ‘expected LOS’ key figure was developed several decades ago, since when the calculation method used by the LMR has remained unchanged. Of

course, the figures themselves are recalculated each year on the basis of the latest national data.

Age, diagnosis and surgical procedures are not the only aspects which can influence LOS. There may, for example, be comorbidity whereby the patient is suffering from other conditions at the time of admission. Our research has been subject to the limitations of the current calculation method.

The calculation of expected LOS excludes admissions of one hundred days or more, and excludes deceased patients

The LMR's calculation of expected LOS excludes all admissions of 100 days or more, and excludes patients who die during the admission period. The expected LOS is then reported as equal to the actual LOS. In some cases this may lead to some underreporting, resulting in an artificially low estimate of the number of days by which LOS can be reduced were all hospitals to achieve the level of efficiency represented by the 15th percentile in the current benchmark ranking. The indicator 'Percentage of patients with UL-LOS' does however include those who spend one hundred or more days in hospital, even though no 'expected LOS' has been calculated.

No analysis of readmissions

This thesis is concerned with reducing hospital length of stay but does not take readmissions into consideration. It is possible that the number of readmissions will rise if the LOS (of the first admission) is too short. The LMR fails to distinguish adequately between first admissions and any subsequent readmissions. It is only possible to study readmissions in a responsible manner by establishing probability links within the LMR data. We have not attempted to do so on this occasion.

Implications for policy and external supervision

Working on quality and safety in health care

This thesis demonstrates that hospitals wishing to reduce the number of clinical admission days must devote particular attention to improving the care process. That process must be structured as efficiently as possible, whereby patients do not have to wait unnecessarily between the various tests and interventions, professionals work together effectively, and there is clear communication between all concerned. Where follow-up care is required, the necessary arrangements must be in place to ensure a smooth patient throughflow. It is also important to prevent complications to the greatest extent possible, since complications will often necessitate a longer LOS. Reducing LOS across the board will therefore rely on efforts to improve both the quality and safety of care provision.

Reduction of LOS and reduction of costs

It is generally assumed that a reduction in LOS will translate directly into a reduction in costs. However, some notes should be placed. First, the days which are cut from the total LOS are often those on which the patient is waiting for e.g. tests to be conducted. The cost represented by these days is probably somewhat lower than that of the more labour-intensive periods of actual treatment or surgical intervention. If the 'waiting days' are removed from the equation, the average medical and nursing intensity will actually increase, which means that any reduction in staffing costs will not be in direct proportion to the reduction in LOS. The same may apply when improving the quality and safety of care. The reduction in costs will not be in direct proportion to the reduction in LOS since some improvements, such as structural modifications to the operating theatre, will require capital investment. In many cases it will be possible to reduce LOS by ensuring a better through flow of patients to follow-up care provisions. While this will indeed reduce costs for the hospital itself, some of those costs are actually being shifted elsewhere in the chain.

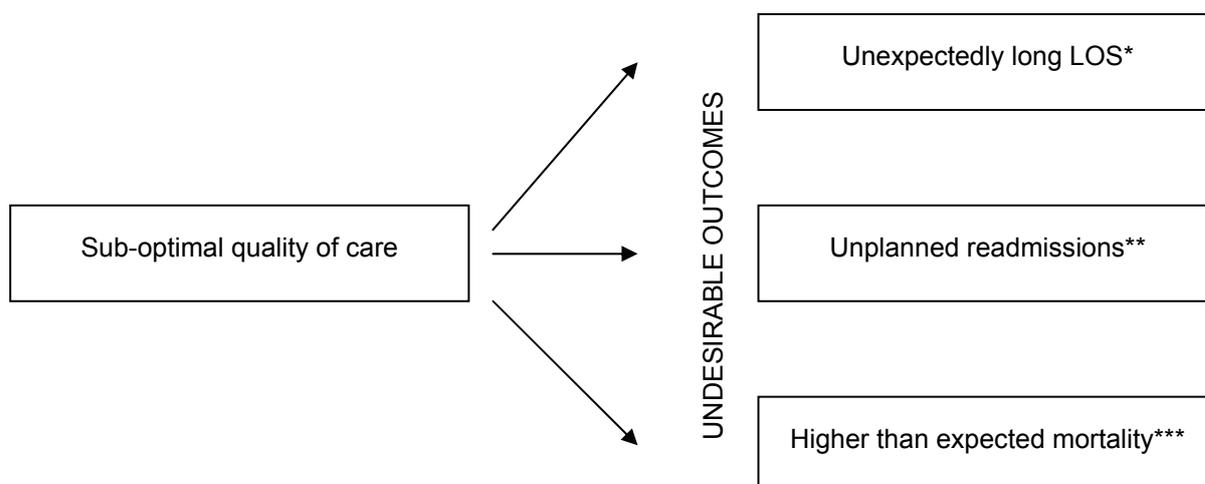
Examining the indicators as a cohesive set

Since 2006, the Netherlands has been developing the HSMR, an indicator based on mortality in hospitals. This indicator has led to different discussions that on one hand stressed the strengths of the HSMR, and on the other hand pointed out the risks of misinterpretation⁸⁻¹³.

In any case, an indicator which is based solely on hospital mortality falls short in its ability to reveal the effect of complications. The picture it presents is merely 'the tip of the iceberg' since the vast majority of complications do not lead to actual death, but do lead to other forms of adverse health impact. Does the indicator 'Percentage of patients with UL-LOS' go any way towards filling in the rest of the picture? In this thesis we demonstrate that it does indeed identify such patients more readily, and reveals a higher than average number of adverse events. The indicator is concerned with all complications which lead to a substantial increase in LOS. All patients who died in the hospital are excluded from the indicator. It therefore complements the HSMR. Thus the indicator is not concerned with deaths following complications, the tip of the iceberg, but examines the broader picture.

However, this indicator also fails to reveal a substantial part of the hidden iceberg, namely the undesirable outcomes which become manifest only after the patient has been discharged.

Figure 1. Indicators which may reveal poor, or “sub-optimal”, quality in clinical hospital care



* Indicator described in this thesis

**Indicator yet to be developed

*** Indicator already available (HSMR)

Figure 1 shows the interrelated indicator model of the three possible negative outcomes of hospital care: Unexpectedly long LOS; Unplanned readmissions; and Higher than expected mortality. The Health Care Inspectorate could use this indicator model in its supervision of hospitals. It is essential, if this indicator model is to be applied in the external supervision, that the three are refined further and developed as a cohesive set. In principle all three indicators can continue to be calculated using the hospital data already available, whereupon there will be no additional administrative burden.

It is important to avoid assessing these three indicators in isolation. They must be analysed as a cohesive set since a degree of substitution between them is possible. For example, if poor quality results in a higher mortality rate, the patients concerned will not be included in indicators which consider unplanned readmissions or UL-LOS. Conversely, patients included in the indicators for these two undesirable outcomes will not be included in the HSMR.

As yet, no indicator of unplanned readmissions is in general use. Such an indicator should be developed. Efforts to do so form an important item on the research agenda for safety in health care. Other countries have been working on developing such an indicator for some time¹⁴⁻¹⁹.

The importance of good medical data

The registration systems currently used to collect and collate hospital data in the Netherlands cannot provide an accurate picture of the quality of care due to the poor quality of data in several hospitals. Correction for case mix is essential, however, it is difficult given this shortcoming.

For many years, the Netherlands has been in the extremely fortunate position of having an effective data registration system - the LMR - which relies on the voluntary participation of all general and academic hospitals. The system was the idea of Dick Hoogendoorn, a general practitioner working in Olst-Wijhe. In 1959 he began to record medical and administrative data from the four local hospitals in Zwolle and Deventer. Many other hospitals soon joined the system on a voluntary basis, whereupon the Medical Registration Foundation (SMR) was set up in 1963 to guide its further development to become the National Medical Registration system. For several decades the register ran as a well-oiled machine, the reliability of the data being regarded as good to excellent.²⁰ This was partly because medical data and financial data were recorded separately, each type with its own dedicated processes. The LMR could therefore focus on information of purely medical relevance, rather than clouding the issue with financial considerations. However, the introduction of a new financing system with the mandatory registration of Diagnosis Treatment Combinations (DBC), which entailed an additional administrative burden, made it increasingly difficult to maintain the (voluntary) LMR at the same level of quality. In 2005, some hospitals withdrew from the LMR altogether, while some others reduced the number of staff responsible for coding data. Today, the majority of hospitals acknowledge the importance of reliable medical data, prompted in part by international obligations as well as the desire to monitor the quality of care. The introduction of the HSMR indicator has played a significant role, since a lower quality of data registration will often be reflected by unfavourable HSMR scores. If, for example, a hospital fails to record a patient's secondary diagnoses (comorbidity), the HSMR score will be artificially high because the information fails to take into account all complicating factors. Both the quality of the LMR and the number of hospitals taking part have risen once more in recent years. Investments are being made to enable the registration system to meet all modern requirements, whereupon it will become known as the Landelijke Basisregistratie Ziekenhuiszorg (National Basic Registration System for Hospital Care; LBZ).

The reliability of indicators such as HSMR and UL-LOS is very much dependent on the quality of the recorded data. Definitions are also extremely important. It is essential to ensure that the medical data provides a complete and accurate account of the actual situation, especially when the registration system is also used for the purposes of financial control. For example, the financial definition of a 'first visit' to an outpatient's department is not the same as the medical definition. If the patient is under treatment for more than one year, a 'first visit' could be billed again at the beginning of the second year. From the medical perspective, it is clearly a follow-up appointment. Similarly, for the new LBZ the proposal is made to change the

definition of the 'principal diagnosis' to address financial considerations. Within the LMR, the principal diagnosis was always the condition which prompted the patient's admission to hospital. For the LBZ, the proposal is to define the diagnosis as the condition which accounts for the greatest use of resources²¹. This makes it more difficult to gain a full picture of the quality of the care provided, since it is impossible to distinguish between a condition with which the patient presents at the hospital and a condition which he or she develops during the course of treatment. A solution to this problem must be found if the quality of care provision is to be monitored effectively.

Research agenda

Improved case mix correction

As stated in our remarks on the methodological constraints, the case mix correction applied to the 'percentage of patients with UL-LOS' must be further improved if this indicator is to offer the best possible information about the quality and safety of care. Not only must the registration of medical data be complete and of good quality, the method by which the case mix correction is applied must also be optimised.

Case mix correction relies on the key figure 'expected LOS', as calculated for every clinical patient admission. The method by which this figure is calculated has remained unaltered for several decades. It dates from the time of the very first computers, which had very limited processing power and were therefore slow. Under this method, a number of patient categories are defined based on three criteria:

- age group
- principal diagnosis (as a three-digit code)
- type/nature of main surgical requirement.

The average length of stay for these groups is then calculated on the basis of a national '80% pool'. An expected LOS is then assigned to each patient according to the group of which he or she forms part. The expected LOS does not apply to patients who die during hospital treatment, patients whose LOS is 100 days or more and patients for whom no comparable data can be derived from the 80% pool. The mean expected LOS of a given category of patients is the average of the expected LOS figures applying to all patients in that category.

With modern hardware and software, it is possible to make a much more detailed case mix correction, comparable to that now applied to the HSMR, whereby all case mix variables which can affect LOS are taken into consideration.

Improved cut-off point of unexpectedly long LOS

At present, the indicator uses a standard cut-off point of a '50% longer than expected LOS'. This threshold should also be subject to review and adjustment. It may be appropriate to apply a variable limit depending on the precise patient group concerned. In a patient group whose treatment is subject to strict protocols, an LOS only 20% longer than expected might suggest complications. In a patient group subject to greater variation in treatment options, the deviation may have to exceed 100% before being seen as an indication of any shortcomings.

Reduction of LOS must not detract from the quality of care

This thesis demonstrates that it is perfectly possible to reduce hospital LOS while also enhancing the quality of care. However, there are limits. If the pressure to reduce LOS yet further is extremely high, there could be a temptation to discharge patients too soon. Although we have found no persuading evidence in the literature, an excessive desire for efficiency could well result in hospital admissions which are so short they cannot be regarded as forming part of 'responsible' care. Further research is required to examine if and where this is the case.

Development of indicator for unplanned readmissions

As stated above in Figure 1, the Netherlands does not yet have a general outcome indicator for 'unplanned readmissions'. Other countries have been working on developing such an indicator for some time¹⁴⁻¹⁹. If we are to gain a more complete picture of patient safety in hospitals, it is important that this indicator is developed on the basis of the Dutch hospital data registration systems.

How to achieve a more coherent indicator model

Further research should determine whether the indicator model shown in Figure 1 can provide adequate support in the external supervision of hospital care and its outcomes. Research should also ask at what level these data can be used for supervision. Should this level be the hospital, the ward, the patient group, or combinations of these? On one hand it is preferable to use a simple model, but on the other we know that hospitals are large organisations in which the quality of care varies between departments²².

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Summary

This thesis is about reducing the length of stay in hospital and asks the question whether this reduction can be carried out while at the same time improving the quality and safety of care.

Hospitals in the Netherlands differ substantially in terms of LOS, even when corrected for case mix. This variation in LOS may be due to three underlying aspects of care:

1. First, there may be differences between hospitals in their specific health care approach. Physicians may differ in their opinion about the best way to treat certain patient groups. For example, LOS can be influenced by the moment anti-biotic treatment is switched from intravenous to oral administration.
2. Second, there may be variation in the quality or service level of the care, like different waiting times for diagnostic tests or interventions, or differences in the quality or frequency of communication between doctors, nurses and the patient's family. Sub-optimal communication may cause misunderstandings about treatment and discharge, which may cause a prolonged LOS.
3. Third, there may be variation in the safety of care. Unsafe care may lead to complications and complications often lead to an extended LOS.

Hospitals want to reduce the number of hospital days for several reasons and the challenge is to do this while simultaneously improving the quality and safety of hospital care.

In **Chapter 2** we assessed the development of and variation in lengths of stay in Dutch hospitals and determined the potential reduction in hospital days if all Dutch hospitals would have an average length of stay equal to that of benchmark hospitals. For each hospital, the average length of stay was adjusted for differences in type of admission (clinical or day-care admission) and case mix (age, diagnosis and procedure). We calculated the number of hospital days that theoretically could be saved by (i) counting unnecessary clinical admissions as day cases whenever possible, and (ii) treating all remaining clinical patients with a length of stay equal to the benchmark (15th percentile length of stay hospital). A 14% reduction of hospital days could be attained. This percentage varied substantially across medical specialties. Extrapolating the potential reduction to all Dutch hospitals yielded a total savings of 1.8 million hospital days (2006). The average length of stay in Dutch hospitals if all hospitals were able to treat their patients as the 15th percentile hospital would be 6 days and the number of day cases would increase by 13%.

Hospitals are motivated to reduce LOS, but how do they do so in practice? **Chapter 3** presents a bottom up approach to developing interventions to shorten lengths of stay. Between 1999 and 2009 we applied the approach in 21 Dutch clinical wards in

12 hospitals. We present the complete inventory of all interventions. We organised, on the hospital ward level, structured meetings with the staff in order to first identify barriers to reduce the length of stay and then later to link them to interventions. The key components of the approach were a benchmark with the fifteenth percentile and the use of a matrix to collect the measures. The matrix consists 'horizontally'-that is over a period of time- of the three main phases of clinical care: admission, stay and discharge. 'Vertically' -that is involving different participants at any one moment- we partitioned the matrix to consider the degree to which the lengths of stay could be shortened by the medical specialists and nurses themselves or by involving other actors. The matrix includes about fifty different interventions which have been introduced, not only with a view to reducing LOS, but also in order to improve the overall quality of care. Most measures are similar or identical to those described in published research.

Chapter 4 investigates the correlation between length of stay (LOS) and patient satisfaction on the level of hospital wards. The underlying hypothesis is that good quality of care leads both to shorter LOS and to patients that are more satisfied. We used standardised LOS and standardised patient satisfaction data from 188 Dutch hospital wards (internal medicine, cardiology, pulmonology, neurology, general surgery, orthopaedic surgery and obstetrics & gynaecology) in the period 2003-2010. We found no evidence that hospital wards with a relatively short mean LOS had higher, or lower, patient satisfaction than hospital wards with a relatively long LOS. The first conclusion to be drawn is that the reduced LOS has not yet become 'too short', at least from the patient's own perspective. Second, there is no evidence to support the hypothesis that shorter LOS and high patient satisfaction are both the product of good quality of care.

In **Chapter 5** we present a new outcome indicator 'Percentage of patients with an unexpectedly long LOS (UL-LOS). It can be used in addition to the Hospital Standardised Mortality Ratios as an indicator of risk of unsafe care. The indicator is based on the assumption that complications often prolong the patient's stay in hospital. The indicator makes use of standardised length of stay data and a prolonged length of stay of more than 50%. We used the indicator separately for three strata of hospitals: general hospitals, tertiary teaching hospitals and university medical centres. The UL-LOS indicator showed considerable variability between the Dutch hospitals: from 8.0 to 21.4 percent in 2010. The university medical centres had a relatively high score on this indicator compared with the tertiary teaching hospitals and general hospitals. The stability of the indicator over time was quite high and the indicator had a significant positive correlation with the HSMR. The Pearson

correlation between UL-LOS and HSMR was 0.53. This means that in general, hospitals with more patients with an unexpectedly long length of stay were also the hospitals with higher standardised mortality. The first results of the new indicator are promising. The strengths of the indicator are the variations between hospitals, the relatively small confidence intervals and the stability over time.

Patient record reviewing is useful to identify opportunities for improving patient safety. It is, however, time-consuming. In **Chapter 6** we investigate whether a priori selection of patient records using the UL-LOS indicator leads to more records with adverse events compared to a random selection of patient records. We looked for AEs in records of patients with colorectal cancer. Within this group, we compared the number of AEs found in records of patients with a UL-LOS with records of patients who did not have a UL-LOS.

In the records of patients with colorectal cancer and a UL-LOS, 51% of records contained one or more AEs compared to 9% in the reference group of non-UL-LOS patients. By using the UL-LOS indicator to select records within the colorectal cancer patient group, we selected 66% of the records, and found 91% of all AEs in these records. A priori selection of patient records using the UL-LOS indicator appears to be a powerful selection method which could be an effective way for healthcare professionals to identify opportunities to improve patient safety in their day-to-day work.

In **Chapter 7** the main findings of this thesis, some methodological issues and an examination of the implications of the findings for policy, external supervision and future research are discussed. The results confirm that efforts to reduce LOS can effectively be combined with efforts to improve the safety and quality of care. The variation in LOS includes an efficiency component, a quality component and a safety component. In order to reduce LOS, hospitals must ensure that the care process is structured so as to avoid unnecessary waiting time. In addition, there must be good communication between care providers, and between the professionals and the patient. It is essential to ensure that care is provided in a safe and responsible manner, and that it is of the highest possible quality. This will promote patient recovery, reducing the risk of avoidable complications which would necessitate a longer LOS.

The UL-LOS indicator can be used as an indicator of risk of unsafe care. However, it is important to avoid assessing this indicator in isolation. The indicator must be analysed in a cohesive set together with an indicator for unplanned readmissions and an indicator for mortality, since a degree of substitution between these three

undesirable outcomes of care is possible. As yet, no indicator of unplanned readmissions is in general use. Such an indicator should be developed. Efforts to do so form an important item on the research agenda for safety in health care.

This thesis demonstrates that it is perfectly possible to reduce hospital LOS while also enhancing the quality of care. However, there are limits. If the pressure to reduce LOS yet further is extremely high, there could be a temptation to discharge patients too soon. Although we have found no persuading evidence in the literature, an excessive desire for efficiency could well result in hospital admissions which are so short they cannot be regarded as forming part of 'responsible' care. Further research is required to examine if and where this is the case.

Samenvatting en discussie

Samenvatting

Dit proefschrift gaat over opnameduurverkorting in ziekenhuizen met als centrale vraag of dit te realiseren is met gelijktijdige verbetering van de kwaliteit en veiligheid van de zorg. De gemiddelde opnameduur in Nederlandse ziekenhuizen varieert aanzienlijk, zelfs wanneer gecorrigeerd is voor verschillen in de patiëntenmix. Aan de variatie kunnen de volgende mechanismen ten grondslag liggen:

1. Ziekenhuizen variëren in de behandelwijze van patiënten. Zo kan bijvoorbeeld het ene ziekenhuis bij eenzelfde patiënt eerder van intraveneuze op orale antibiotica overstappen dan het andere ziekenhuis.
2. Er is variatie in de kwaliteit of het serviceniveau van de zorg die ziekenhuizen aanbieden. In het ene ziekenhuis moeten patiënten bijvoorbeeld langer wachten voor onderzoek, of de samenwerking en communicatie tussen zorgverleners is in het ene ziekenhuis beter dan in het andere ziekenhuis.
3. Er kan variatie zijn in de veiligheid van de aangeboden zorg. Onveilige zorg leidt eerder tot complicaties en complicaties leiden al snel tot een (soms aanzienlijke) verlenging van de opnameduur.

Doordat ziekenhuismanagers verwachten veel financieel voordeel te kunnen behalen met opnameduurverkorting, zeker in het nieuwe zorgstelsel, is ‘werken aan verkorting van de opnameduur’ een uiterst relevant doel voor ziekenhuismanagers. De uitdaging is om een verkorting van de opnameduur te combineren met het verbeteren van de kwaliteit en veiligheid van de zorg: “Better care, lower costs*”.

Hoofdstuk 2 behandelt de variatie in de opnameduur tussen ziekenhuizen op specialismenniveau. Rekening houdend met de leeftijdsklassen en diagnose- en operatiegroepen van de opgenomen patiënten is berekend hoeveel opnamedagen Nederlandse ziekenhuizen kunnen verminderen als zij zo efficiënt zouden werken als de benchmark van het 15e percentiel ziekenhuis. Dat wil zeggen dat alle ziekenhuizen per specialisme een opnameduur weten te realiseren korter of gelijk aan de 15% ziekenhuizen met de kortste opnameduur. De variatie tussen Nederlandse ziekenhuizen in aantal opnamedagen blijkt aanzienlijk, ook na correctie voor patiëntenmix. Als alle ziekenhuizen hun opnameduur per afdeling zouden terugbrengen naar het niveau van de benchmark, zou dat in totaal 1,8 miljoen opnamedagen schelen (2006).

* Deze naam is in de VS gegeven aan het grootschalige ‘partnership for patients-project’, waarbij gewerkt wordt aan verbetering van de kwaliteit, veiligheid en betaalbaarheid van de zorg. Zie www.healthcare.gov/compare/partnership-for-patients.

Hoofdstuk 3 gaat in op de vraag welke maatregelen medisch specialisten en verpleegkundigen nemen om de opnameduur in hun ziekenhuis te verkorten. Verder is geanalyseerd hoe deze maatregelen ‘uit de praktijk’ overeenkomen met maatregelen die in de literatuur beschreven zijn. In dit hoofdstuk wordt een overzicht gepresenteerd van de maatregelen bij 21 maatschappen die hier actief aan hebben gewerkt. Voor de inventarisatie hiervan is een matrix ontworpen die ‘horizontaal’ bestaat uit de belangrijkste fasen van het zorgproces: opname, verblijf en ontslag. ‘Verticaal’ is de matrix ingedeeld naar de mate waarin de opnameduur verkort kan worden door acties die de betreffende medisch specialisten en verpleegkundigen zelf in de hand hebben, of waar ze anderen bij nodig hebben, binnen of buiten het eigen ziekenhuis. De zorgprofessionals blijken voor veel maatregelen te kiezen die niet alleen het aantal opnamedagen verminderen, maar bovendien de kwaliteit van de zorg verhogen. Het gaat in totaal om zo’n 50 maatregelen die grotendeels overeen blijken te komen met maatregelen die in de literatuur beschreven zijn als opnameduurverkortend.

In **hoofdstuk 4** wordt onderzoek beschreven naar de samenhang op afdelingsniveau tussen de gemiddelde opnameduur en de patiënttevredenheid. De onderliggende hypothese hierbij is dat als een afdeling goede kwaliteit van zorg levert dit zowel leidt tot een kortere opnameduur als tot tevreden patiënten. Patiënten blijken even tevreden over ziekenhuizen met een korte gemiddelde opnameduur als over ziekenhuizen met een lange gemiddelde opnameduur. Dit betekent ten eerste dat de opnameduurverkorting nog niet is ‘doorgeschoten’ naar ‘te kort’ wat betreft de tevredenheid van de gemiddelde patiënt. Het betekent verder dat er geen ondersteuning gevonden is voor de hypothese dat zowel korte opnameduur als hoge patiënttevredenheid goede kwaliteit van zorg als oorzaak hebben.

De hoofdstukken 5 en 6 behandelen een uitkomstindicator die gebruik maakt van opnameduurgegevens: het percentage patiënten met onverwacht lange opnameduur. De inspectie voor de gezondheidszorg heeft deze indicator opgenomen in de basisset veiligheidsindicatoren ziekenhuizen. In **hoofdstuk 5** zijn de eerste uitkomsten van deze indicator geanalyseerd en is de correlatie met de Hospital Standardised Mortality Ratio (HSMR) onderzocht. De nieuwe indicator is gebaseerd op de veronderstelling dat complicaties vaak leiden tot een verlengde opnameduur. Als een ziekenhuis een hoger percentage patiënten heeft met een onverwacht lange opnameduur dan landelijk gemiddeld, dan kan dat duiden op verminderde kwaliteit of veiligheid van de zorg. De indicator laat duidelijke variatie tussen ziekenhuizen zien en heeft als voordeel dat door het grote aantal waarnemingen de

betrouwbaarheidsintervallen relatief klein zijn. Verder is de indicator stabiel door de tijd.

Dossieronderzoek is een belangrijke methode om gestructureerd onderzoek te doen naar zorggerelateerde schade en hierop verbeteracties te starten. Het is echter zeer tijdrovend.

Hoofdstuk 6 beschrijft een onderzoek waarbij we geanalyseerd hebben of een voorselectie van dossiers aan de hand van de indicator ‘percentage patiënten met onverwacht lange opnameduur’ leidt tot het vinden van meer zorggerelateerde schade ten opzichte van een random selectie van patiëntendossiers. Hiervoor is gekeken naar het voorkomen van zorggerelateerde schade bij patiënten met een colorectaal carcinoom. De mate waarin zorggerelateerde schade gevonden werd is vergeleken tussen dossiers van patiënten met een onverwacht lange opnameduur en dossiers van patiënten zonder onverwacht lange opnameduur. Bij de eerste groep bevatte 51% van de dossiers één of meer zorggerelateerde schade, en bij de controlegroep 9%. De indicator blijkt hiermee een adequaat instrument te zijn voor het voorselecteren van medische dossiers voor dossieronderzoek. Door alleen te kijken naar dossiers die met de indicator geselecteerd waren werd een groot percentage van de onbedoelde schade gevonden. Dit maakt het dossieronderzoek beduidend efficiënter.

Dit proefschrift laat zien dat het reduceren van opnamedagen goed samen kan gaan met het verbeteren van de kwaliteit en veiligheid van de zorg. De variatie in opnameduur heeft een efficiency component, een kwaliteitscomponent en een veiligheidscomponent. Om de opnameduur te verkorten zullen ziekenhuizen moeten zorgen dat het zorgproces optimaal is ingericht. Dat betekent vooral het voorkomen van onnodige wachttijden gedurende de behandeling en een goede samenwerking en communicatie tussen zorgverleners onderling en tussen zorgverleners en patiënt. Daarnaast moet bewerkstelligd worden dat de zorg kwalitatief goed en veilig gegeven wordt zodat het herstel optimaal verloopt en geen vermijdbare complicaties optreden die juist een langere opnameduur tot gevolg hebben.

Discussie

Deze discussie start met een aantal methodologische kanttekeningen die van algemene aard zijn. De vijf uitgevoerde studies hebben verder ieder eigen specifieke methodologische kanttekeningen die in de betreffende hoofdstukken beschreven zijn. De discussie gaat vervolgens in op de consequenties voor beleid en het extern toezicht op de zorgpraktijk. Als afsluiting volgt een onderzoeksagenda.

Methodologische kanttekeningen

De berekening van de verwachte opnameduur houdt alleen rekening met leeftijd, hoofddiagnose en operatie van de patiënt

In dit proefschrift is veelvuldig gebruik gemaakt van het kengetal ‘verwachte opnameduur’, dat bij de Landelijke Medische Registratie (LMR) ieder jaar volgens dezelfde systematiek berekend wordt en als variabele toegevoegd wordt aan elke opname. Dit kengetal houdt rekening met de leeftijdsklasse van de patiënt en de combinatie van hoofddiagnose en operatie. Het kengetal is enkele decennia geleden ontwikkeld, en sindsdien is de berekeningsmethode in de LMR niet meer aangepast. Uiteraard zijn de kengetallen wel ieder jaar opnieuw berekend op basis van de nieuwe landelijke gegevens. Naast de leeftijd, hoofddiagnose en operatie kunnen meer zaken van invloed zijn op de opnameduur van de patiënt, zoals bijvoorbeeld de reeds bij opname aanwezige comorbiditeit. Het feit dat de verwachte opnameduur alleen rekening houdt met de leeftijd, hoofddiagnose en operatie van de patiënt, is een beperking van de studie.

Overleden patiënten en opnamen van 100 dagen en langer worden bij de berekening van de verwachte opnameduur buiten beschouwing gelaten

De verwachte opnameduur wordt in de LMR niet berekend voor patiënten die gedurende de opnameperiode overleden zijn of voor patiënten die 100 dagen of langer in het ziekenhuizen verbleven. Bij deze patiënten wordt de verwachte opnameduur gelijkgesteld aan de werkelijke opnameduur. Dit kan in sommige gevallen tot onderschatting van aantallen leiden, bijvoorbeeld een onderschatting van het aantal opnamedagen dat bezuinigd kan worden als alle ziekenhuizen hun verhouding tussen werkelijke en verwachte opnameduur terugbrengen tot de verhouding van het 15^e percentiel ziekenhuis. Bij de indicator ‘Percentage patiënten met onverwacht lange opnameduur’ zijn de patiënten met een opnameduur van 100 dagen en langer overigens wel meegeteld, ook al is er geen verwachte opnameduur voor deze patiënten berekend.

Heropnamen zijn niet geanalyseerd

Het proefschrift gaat in op de verkorting van de opnameduur in ziekenhuizen zonder naar heropnamen te kijken terwijl een 'te korte' opnameduur ongeplande heropnamen kan veroorzaken. In de LMR is de kwaliteit van het gegeven of een opname een heropname betrof onder de maat waardoor hiervan geen gebruik is gemaakt. Heropnamen kunnen alleen op verantwoorde wijze bestudeerd worden door waarschijnlijkheidskoppelingen te maken binnen de LMR, waarmee het databestand van episode naar longitudinaal wordt getransformeerd. Deze exercitie is hier niet gedaan.

Consequenties voor het beleid en het extern toezicht op de zorgpraktijk

Werken aan kwaliteit en veiligheid van de zorg

Dit proefschrift laat zien dat ziekenhuizen die het aantal klinische opnamedagen willen terugdringen, vooral moeten werken aan verbetering van het zorgproces. Optimale inrichting van het zorgproces heeft als kenmerken dat patiënten niet onnodig lang hoeven te wachten tussen opeenvolgende stappen in het zorgproces, professionals adequaat met elkaar samenwerken en helder communiceren en dat de aansluiting naar vervolgvoorzieningen tijdig en goed geregeld is. Bovendien is het van groot belang om complicaties zoveel mogelijk te voorkomen, want deze leiden bijna automatisch tot extra opnamedagen. **Werken aan verkorting van de opnameduur betekent dus vooral werken aan verbetering van de kwaliteit en veiligheid van de zorg.**

Opnameduurverkorting en kostenreductie

Algemeen wordt aangenomen dat opnameduurverkorting ook kostenreductie betekent. Hier moeten wel enkele kanttekeningen bij geplaatst worden. Ten eerste worden bij reductie van de opnameduur vaak dagen voorkomen waarop de patiënt op een vervolgstap wacht, bijvoorbeeld op onderzoek. De kosten van deze dagen zijn waarschijnlijk lager dan de arbeidsintensievere dagen waarop de patiënt een bepaalde behandeling onderging. Als er wachtdagen worden geschrapt neemt de gemiddelde medische en verpleegkundige intensiteit per dag toe, hetgeen betekent dat de personeelsbesparing niet recht evenredig zal zijn aan de vermindering van opnamedagen. Bij het kwalitatief beter en veiliger maken van de zorg geldt ook dat de kostenbesparing niet recht evenredig zal zijn aan de besparing in opnamedagen. Het zou bijvoorbeeld nodig kunnen zijn om hiervoor investeringen te doen in kostbare medische of installatietechnische aanpassingen. Tot slot kan vaak opnameduurverkorting gerealiseerd worden door het regelen van een betere doorstroming naar vervolgvoorzieningen: dit kan kostenbesparing betekenen in het ziekenhuis, maar tegelijkertijd ook verplaatsing van kosten naar de vervolgvoorzieningen.

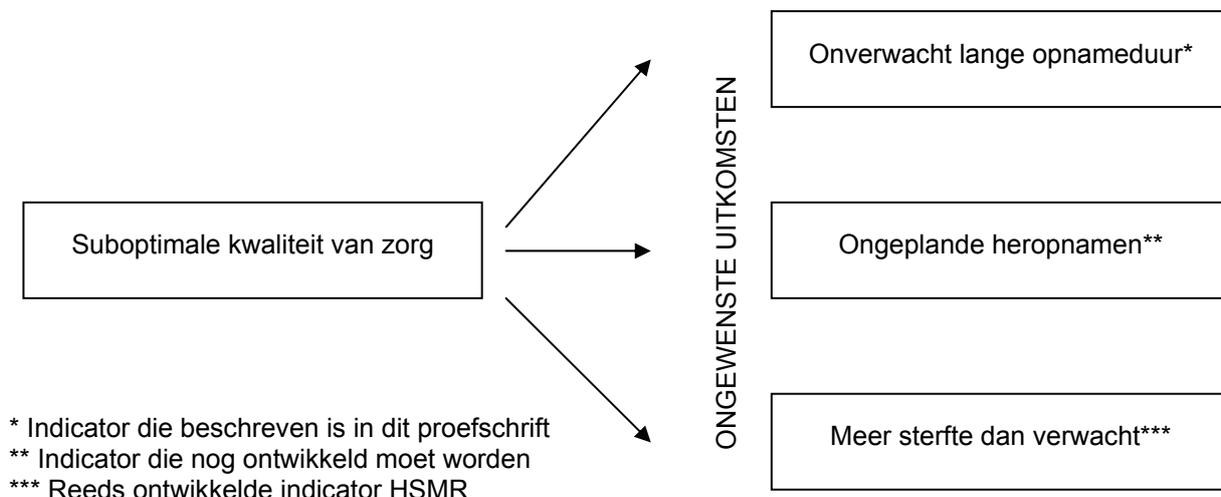
Indicatoren in samenhang bekijken

In Nederland is vanaf 2006 gewerkt aan de ontwikkeling van de HSMR, een indicator gebaseerd op sterfte in het ziekenhuis. Deze indicator heeft in de afgelopen jaren regelmatig tot uiteenlopende inhoudelijke discussies geleid die enerzijds de kracht van de HSMR benadrukken, maar anderzijds wijzen op het risico op verkeerde interpretaties.¹⁻⁶ Hoe dan ook, een indicator die alleen gebaseerd is op ziekenhuissterfte, toont - als het om het in beeld brengen van complicaties gaat - in feite slechts 'het topje van de ijsberg' van complicaties. De meeste complicaties leiden niet tot sterfte, maar tot andere vormen van schade en derhalve ook tot verlenging van de opnameduur. Welke potentie heeft de indicator 'percentage patiënten met een onverwacht lange opnameduur' in het zichtbaar maken van het totaal aan complicaties? Dit proefschrift laat zien dat de indicator gebaseerd is op de patiënten die onverwacht lang in het ziekenhuis hebben gelegen en dat bij deze populatie meer vermijdbare schade (adverse events) gevonden wordt dan gemiddeld. De indicator omvat dus de complicaties die tot een substantieel verlengde opnameduur leiden. De in het ziekenhuis overleden patiënten worden hierin niet meegenomen. De indicator moet daarmee gezien worden als een aanvulling op de HSMR: hij kijkt niet naar het topje van de ijsberg (de sterfte als complicatie), maar naar het bredere deel dat daaronder schuil gaat.

Echter, ook bij deze indicator wordt toch nog een belangrijk deel van het totaal gemist, namelijk die complicaties die zich pas manifesteren als de patiënt weer thuis of in een vervolgvoorziening is.

Figuur 1 geeft een samenhangend indicatormodel weer voor de drie mogelijk negatieve uitkomsten van klinische ziekenhuiszorg: langer dan verwachte opnameduur, ongeplande heropnamen en meer sterfte dan verwacht. De inspectie voor de gezondheidszorg zou dit indicatormodel kunnen toepassen in het externe toezicht. Voorwaarde voor het hanteren van dit indicatormodel in het externe toezicht is dat gewerkt wordt aan de permanente (door)ontwikkeling van deze drie indicatoren. Ze zijn in principe alle drie samen te stellen op basis van de al bestaande algemene ziekenhuisregistraties, waardoor er geen extra administratieve lasten veroorzaakt worden.

Figuur 1. Samenhangende uitkomstindicatoren voor suboptimale kwaliteit van klinische zorg



Het is belangrijk om deze indicatoren niet geïsoleerd te beoordelen maar in samenhang, omdat er substitutie tussen deze uitkomsten kan optreden. Als slechte kwaliteit uitmondt in sterfte, dan zal deze patiënt niet opduiken in indicatoren die iets zeggen over ongeplande heropnamen of onverwacht lange opnameduren. En omgekeerd geldt hetzelfde voor de andere twee ongewenste uitkomsten van zorg. Voor de uitkomstmaat ongeplande heropnamen is nog geen algemene indicator in gebruik. Deze moet nog ontwikkeld worden en vormt een belangrijk onderdeel van de onderzoeksagenda op het gebied van zorgveiligheid. In het buitenland is hier al ruim ervaring mee opgedaan.⁷⁻¹²

Het belang van een kwalitatief goede medische registratie

De huidige kwaliteit van de medische registratie in een deel van de Nederlandse ziekenhuizen vormt een belemmering voor het goed meten van kwaliteit van zorg. Correctie voor de patiëntenmix is essentieel, en dat kan onvoldoende plaatsvinden vanwege diverse onvolkomenheden in de ziekenhuisregistraties.

Nederland heeft vele jaren in de riant positie verkeerd van het hebben van een goedlopende LMR met de vrijwillige deelname van alle algemene en academische ziekenhuizen. De grondlegger Dick Hoogendoorn, huisarts te Olst-Wijhe, startte in 1959 in vier ziekenhuizen in Zwolle en Deventer met de registratie van medische en administratieve gegevens. Geheel op vrijwillige basis sloten zich steeds meer ziekenhuizen aan en in 1963 werd de Stichting Medische Registratie (SMR) opgericht die de registratie verder uitbouwde tot de Landelijke Medische Registratie. De registratie liep decennia lang als een geoliede machine en de betrouwbaarheid van de opgenomen data was goed tot zeer goed.¹³ Dit was mede te danken aan het feit

dat medische registratie en financiële registratie twee geheel gescheiden processen waren. De LMR kon zich richten op het vastleggen van wat medisch gezien relevant was, zonder dat dit financiële consequenties had. Bij de komst van de verplichte DBC-registratie bleek echter dat het -vanwege de administratieve lasten die daarmee gemoeid waren- buitengewoon moeilijk was om de (vrijwillige) LMR met dezelfde kwaliteit in de lucht te houden. In 2005 stopte een deel van de ziekenhuizen met de LMR en een deel besloot om met verminderde inzet van met name medisch codeurs deel te blijven nemen. Inmiddels wordt het belang van een betrouwbare medische registratie in de meeste ziekenhuizen onderkend vanwege internationale verplichtingen en de wens tot monitoren van de kwaliteit van de zorg. Met name de introductie van de HSMR heeft hier een grote rol in gespeeld. Een verminderde registratiekwaliteit bleek namelijk meestal tot voor het ziekenhuis ongunstige HSMR-cijfers te leiden. Als een ziekenhuis bijvoorbeeld de nevendiaagnosen van patiënten onvoldoende registreert, dan leidt dat tot een relatief te hoge HSMR doordat onvoldoende rekening wordt gehouden met de verzwarende omstandigheden van patiënten. De deelnamegraad en kwaliteit van de LMR is de afgelopen jaren weer gestegen en er wordt geïnvesteerd om de (verouderde) LMR aan te passen aan de nieuwe eisen. De vernieuwde registratie gaat Landelijke Basisregistratie Ziekenhuiszorg (LBZ) heten.

De betrouwbaarheid van indicatoren zoals de HSMR en de onverwacht lange opnameduur is in zeer grote mate afhankelijk van de kwaliteit van de vastgelegde gegevens. Ook de definities zijn daarbij van groot belang. Vooral wanneer met de registratie ook financiële doeleinden worden nagestreefd, moet voorkomen worden dat definities enkel gericht worden op deze financiële doeleinden en de registratie daarmee afwijkt van de medische feiten. Zo viel de financiële definitie van een eerste polikliniekconsult niet samen met de medische definitie hiervan. Als een patiënt namelijk langer dan één jaar onder behandeling staat, kan er misschien financieel wel weer een eerste consult gerekend worden, maar medisch gezien betreft het gewoon een vervolgsconsult. Voor de nieuwe LBZ is voorgesteld om de definitie van de hoofddiagnose aan te passen¹⁴. In de LMR was de hoofddiagnose de diagnose die achteraf beschouwd wordt als de oorzaak van de opname in het ziekenhuis. In de nieuwe LBZ zou dat dan de diagnose worden die achteraf beschouwd het meeste verantwoordelijk wordt geacht voor het grootste gebruik van middelen. Dat is een stap in de verkeerde richting. Met deze definitie is het veel moeilijker om de kwaliteit van de geleverde zorg in beeld te brengen. Er valt immers geen onderscheid te maken tussen aandoeningen waarmee de patiënt naar het ziekenhuis komt, en aandoeningen die de patiënt gedurende de behandeling in het ziekenhuis oploopt, mogelijk als gevolg van iatrogene schade. Dit zou een

achteruitgang betekenen in de mogelijkheden tot het in beeld brengen van de kwaliteit van de geleverde zorg.

Onderzoeksagenda

Verbetering van de correctie voor patiëntenmix

Zoals reeds bij de methodologische kanttekeningen aangegeven zou de correctie voor patiëntenmix bij de indicator ‘percentage patiënten met onverwacht lange opnameduur’ verder verbeterd moeten worden om een betrouwbaarder signaal af te geven over de kwaliteit en veiligheid van de zorg. Naast het feit dat hiervoor een kwalitatief goede medische registratie nodig is, zou ook de methodiek van de correctie verbeterd kunnen worden.

De correctie voor patiëntenmix wordt uitgevoerd aan de hand van het kengetal ‘verwachte opnameduur’ dat standaard voor iedere klinisch opgenomen patiënt berekend wordt. De berekeningswijze van dit kengetal is al decennialang ongewijzigd en stamt nog uit de tijd van de eerste computers die vaak extreem lange verwerkingstijden hadden. De berekeningswijze is hierop afgestemd. Er wordt een aantal patiëntengroepen samengesteld op basis van een drietal criteria, te weten:

- leeftijdsgroep;
- hoofddiagnose (op 3-cijferig codeniveau) en
- groep/soort van belangrijkste operatie.

Van deze groepen worden uit de landelijke 80%-pool de gemiddelde opnameduren berekend.

Elke individuele patiënt krijgt vervolgens de verwachte opnameduur toegekend van de groep waar hij bij hoort.

In een aantal gevallen wordt hierop een uitzondering gemaakt:

- als de patiënt is overleden;
- als de opnameduur 100 dagen of meer is geweest en
- als er geen gegevens van overeenkomstige patiënten in de 80%-pool aanwezig zijn.

De gemiddelde verwachte opnameduur van een bepaalde categorie patiënten is het gemiddelde van de toegekende verwachte opnameduren van de patiënten in die categorie.

Met de huidige hardware en software is een veel geavanceerdere wijze van correctie voor patiëntenmix mogelijk, vergelijkbaar met de wijze waarop de HSMR berekend wordt. Daarin kunnen namelijk alle beschikbare variabelen die een significante invloed hebben op de opnameduur betrokken worden.

Verfijning grenswaarde langer dan verwachte opnameduur

Ook de uniforme grens van '50% langer dan verwacht' die bij de indicator 'patiënten met een onverwacht lange opnameduur' aangehouden wordt, zou heroverwogen en gedifferentieerd kunnen worden. Waarschijnlijk is het beter de grens variabel te maken, afhankelijk van de patiëntengroep die het betreft. Bij de ene patiëntengroep die sterk geprotocolleerd wordt behandeld, duidt 20% langer dan verwacht opgenomen zijn mogelijk al op complicaties; bij de andere patiëntengroep moet het percentage misschien wel boven de 100% liggen omdat daar de richtlijnen meer variatie in behandeling toestaan.

Ontwikkeling indicator ongeplande heropnamen

Zoals eerder aangegeven bij figuur 1 is voor de uitkomstmaat ongeplande heropnamen in Nederland nog geen algemene indicator in gebruik. Internationaal heeft de ontwikkeling van een dergelijke indicator al enige tijd ruim aandacht.⁷⁻¹² Voor het verkrijgen van een completer zicht op de patiëntveiligheid in ziekenhuizen is het van belang dat deze indicator ook op basis van Nederlandse ziekenhuisregistraties ontwikkeld gaat worden.

Mogelijkheden voor een samenhangend indicatormodel

Toekomstig onderzoek zou moeten uitwijzen of het indicatormodel zoals gepresenteerd in figuur 1, een geschikt model is voor extern toezicht op de uitkomsten van de klinische zorg in ziekenhuizen. Onderwerp van onderzoek zou daarbij ook moeten zijn op welk niveau deze gegevens in het toezicht gebruikt kunnen worden: ziekenhuis, specialisme, patiëntengroep, of combinaties hiervan. Tegenover de eenvoud van een model op totaal ziekenhuisniveau staat het gegeven dat ziekenhuizen grote organisaties zijn waarbinnen variatie bestaat tussen afdelingen in de kwaliteit van zorg.¹⁵

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Daarnaast was dit onderzoek niet mogelijk geweest zonder de verpleegduurverkortingsprojecten in vele ziekenhuizen. In 1998 deed zich de eerste gelegenheid voor in het toenmalige Drechtsteden Ziekenhuis te Dordrecht. Daarna volgden vele andere ziekenhuizen waarvoor ik verpleegduuranalyses maakte of waar ik verpleegduurverkortingstrajecten begeleidde. De samenwerking met de raden van bestuur, stafmedewerkers, medisch specialisten en verpleegkundigen heb ik altijd zeer op prijs gesteld.

Bij mijn onderzoek heb ik gebruik gemaakt van de Landelijke Medische Registratie. Het beheer van deze registratie wordt gedaan door Dutch Hospital Data (DHD) in opdracht van de Nederlandse Vereniging van Ziekenhuizen (NVZ) en de Nederlandse Federatie van Universitair Medische Centra (NFU). Ik wil deze organisaties danken voor de toestemming om voor mijn onderzoek gebruik te maken van deze ziekenhuisdata.

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About the author

Ine Borghans was born on July 1st, 1962 in Geleen the Netherlands, the eldest daughter of Harrie Borghans and Mia Weijers. In 1974 she started her secondary education at the Sint Michiel Comprehensive School in Geleen gaining an Atheneum B diploma in 1980. That same year she began reading Health Care Sciences at Maastricht University, where, in 1984, she obtained a master's degree specialising in Policy and Management of Health Care. After graduating, she started working at the Stichting Medische Registratie (SMR), the Foundation for Medical Registration, which soon after became the Informatiecentrum voor de Gezondheidszorg (SIG), the Health Care Information Centre. Her research and consultancy work mainly concerned hospital care and, to a lesser degree, nursing home care. In 2000 the SIG merged with the Nationaal Ziekenhuisinstituut (NZI), the National Hospital Institute to form Prismant. As a senior managing consultant, she led projects in Dutch hospitals mostly concerning quality and safety topics. From 1998 till 2010 she worked as an advisor to many hospitals in reducing length of stay. From 2006 onwards she was project leader for Prismant's work in quantifying and delivering the Standardised Mortality Ratios (SMRs) in the Dutch hospitals and in supporting them to use the SMRs to improve the quality and safety of care. Since April 2010, she has been working as a co-ordinating special advisor to the Dutch Health Care Inspectorate. She co-ordinates the risk analyses used by the Inspectorate in the supervision of health care providers. As part of her research she has, since November 2007, attended the Scientific Centre for Care and Welfare at Tilburg University, Tranzo. Since 2011 she has attended the Scientific Institute for Quality of Healthcare (IQ healthcare) at Radboud University Nijmegen Medical Centre.

Ine is married to Wim Matser and they have two daughters, Tessa (1991) and Jolien (1995).

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Stellingen behorende bij het proefschrift

**Reducing hospital length of stay
by improving quality and safety of care?**

Ine Borghans

1. Ziekenhuizen die streven naar verkorting van de opnameduur zullen vooral moeten werken aan verbetering van de kwaliteit en veiligheid van het zorgproces. *(dit proefschrift)*
2. De veiligheid van de klinische zorg in Nederlandse ziekenhuizen zou gemeten kunnen worden aan de hand van een samenhangend indicatormodel van drie negatieve uitkomsten van zorg: onverwacht lange opnameduur, onverwachte sterfte en onverwachte heropname. *(dit proefschrift)*
3. Het maatschappelijk belang van het terugbrengen van de opnameduur naar een haalbaar niveau is enorm: de 1,8 miljoen bespaarde verpleegdagen betekenen immers een vermindering van 5000 bezette bedden. *(dit proefschrift)*
4. Bij projecten ter verkorting van de opnameduur in ziekenhuizen is een actieve participatie van de zorgprofessionals een voorwaarde voor succes. Zij blijken goed in staat om te inventariseren welke kwaliteits- en veiligheidsverhogende maatregelen nodig zijn. *(dit proefschrift)*
5. Het corrigeren voor nevendiaagnosen bij een patiëntenpopulatie, moet bij uitkomstindicatoren alleen plaatsvinden voor die nevendiaagnosen die de patiënten reeds bij opname hadden en niet voor nevendiaagnosen die gedurende de opnameperiode ontstaan. Anders dreigen belangrijke complicaties 'weggecorrigeerd' te worden.
6. In een deel van de Nederlandse ziekenhuizen vormt de huidige kwaliteit van de medische registratie een belemmering voor het goed meten van de kwaliteit van de zorg.
7. Kwaliteitsindicatoren zullen bij zorgprofessionals nooit erg populair zijn. Afgezien van de administratieve lasten die ermee gemoeid zijn, is men ofwel van mening dat onvoldoende rekening wordt gehouden met een specifieke patiëntenmix ofwel men ervaart -als ze juist wel voldoende rekening hiermee houden- de indicatoren als erg bedreigend.
8. Bij de zoektocht naar voorspellende indicatoren voor veiligheid valt te leren van de kolenmijnbouw. Om te weten of een mijn veilig was, namen mijnwerkers een kanarie mee. Viel de kanarie van zijn stokje dan waren ze gewaarschuwd en maakten ze dat ze wegkwamen. Slechts één indicator, low-tech, zeer effectief en eenvoudig en eenduidig te interpreteren.
9. Het niet volgen van voorschriften -wat een groot risico is voor de veiligheid van de gezondheidszorg- zit diep geworteld in de Nederlandse cultuur. Nederlanders leren immers van jongs af aan dat een rood stoplicht een signaal is om alleen maar even met fietsen te stoppen als er een agent in de buurt is.
10. Het is rampzaliger als een schilder zijn doekje vergeet dan zijn verf (vrij naar: Harrie Borghans 'Schilderen met hoofdletters').