Consecutive cycles of hospital accreditation: Persistent low compliance associated with higher mortality and longer length of stay

ANNE METTE FALSTIE-JENSEN1, SØREN BIE BOGH2, and SØREN PAAKSE JOHNSEN3

1Department of Clinical Epidemiology, Aarhus University Hospital, Olof Palms Allé 43-45, DK-8200 Aarhus N, Denmark, 2Institute of Regional Health Research, University of Southern Denmark and Centre for Quality, Region of Southern Denmark, P.V. Tuxenvej 5, DK-5500 Middelfart, Denmark, and 3Department of medicine, Aalborg University, Niels Jernes Vej 10, DK-9220 Aalborg Øst, Denmark

Address reprint requests to: Anne Mette Falstie-Jensen, Department of Clinical Epidemiology, Aarhus University Hospital, Olof Palms Allé 43-45, DK-8200 Aarhus N, Denmark. Tel: +45 871 68212; Fax: +45 871 67215; E-mail: amfj@clin.au.dk

Editorial Decision 9 January 2018; Accepted 1 March 2018

Abstract

Objective: To examine the association between compliance with consecutive cycles of accreditation and patient-related outcomes.

Design: A Danish nationwide population-based study from 2012 to 2015.

Setting: In-patients admitted with one of the 80 diagnoses at public, non-psychiatric hospitals.

Participants: In-patients admitted with one of 80 primary diagnoses which accounted for 80% of all deaths occurring within 30 days after admission.

Intervention: Admission to a hospital with high (n = 125 485 in-patients) or low compliance (n = 152 074 in-patients) in both cycles of accreditation by the Danish Healthcare Quality Programme.

Main outcome measures: A 30-day mortality, length of stay (LOS) and all-cause acute readmission. We computed adjusted odds ratios (OR) and hazard ratios (HR) using logistic and Cox Proportional Hazard regression including adjustment for six potential patient-related confounders.

Results: The 30-day mortality risk for in-patients admitted at high compliant hospitals was 3.95% (95% confidence interval (CI): 3.84–4.06) and 4.39% (95% CI: 4.29–4.49) at low compliant hospitals. In-patients admitted at low compliant hospitals had a substantially higher risk of dying within 30 days after admission (adjusted OR: 1.26 (95% CI: 1.11–1.43) and a longer LOS (adjusted HR of discharge: 0.89 (95% CI: 0.82–0.95) than in-patients at high compliant hospitals. No difference was seen for acute readmission (adjusted HR: 0.98 (95% CI: 0.90–1.06)). Focusing on the second cycle alone, in-patients at partially accredited hospitals had a higher 30-day mortality risk and longer LOS than admissions at fully accredited hospitals (30-day: adjusted OR: 1.12 (95% CI: 1.02–1.24) and LOS: adjusted HR: 0.91 (95% CI: 0.84–0.98)).

Conclusion: Persistent low compliance with the DDKM (in Danish: Den Danske Kvalitetsmodel) accreditation was associated with higher 30-day mortality and longer LOS.

Key words: hospital accreditation, quality improvement, external evaluation, mortality, length of stay, readmission, patient-related outcomes
Introduction

Accreditation is an ongoing activity undertaken by hospitals as a way of improving performance using a systematic framework that focuses on administrative and clinical structures as well as processes [1]. The main goal is to become resilient in order to provide safe and high-quality patient care [2]. Accreditation has a long tradition in healthcare; however, it remains uncertain if accreditation has a direct impact on patient care [3–7]. Still, accumulating evidence supports the beneficial effect of accreditation on patient care [8–16].

Healthcare organisations, which take on accreditation, undergo on-site surveys in intervals of 3–4 years to ensure persistent compliance with the programmes including a constant focus on quality improvement. Despite the use of repeated cycles of accreditation through decades, the existing scientific literature includes very little information on the effect of undergoing repeated cycles of accreditation [14, 17–20]. A study by Pomey et al. has reported that hospitals invest heavily to conform to the first cycle of accreditation and obtain the greatest benefits in the subsequent three cycles; however, this was not supported by the use of patient-related data [21]. Thus, there is lack of studies on the effectiveness of consecutive cycles of accreditation in particular in relation to patient-related outcomes.

In Denmark, the Danish Healthcare Quality Programme (in Danish: Den Danske Kvalitetsmodel (DDKM)) performed two cycles of hospital accreditation between 2009 and 2015. Previous studies on the first accreditation cycle have linked high compliance with the accreditation programme with a lower 30-day mortality and shorter length of stay (LOS) along with an improvement in the quality of patient care measured by process performance measures [8, 11–13]. In the current study, we examine the hypothesis that admission at hospitals with persistent low compliance in both cycles is associated with a higher 30-day mortality, longer LOS and no difference in the risk of acute readmission than admission at hospitals with high compliance in one of the cycles. In addition, we examine the association between compliance with the second cycles of accreditation alone and patient-related outcomes with the hypothesis, that admission at low compliant hospitals is associated with a higher 30-day mortality, longer LOS and no difference in the risk of acute readmission than admission at high compliant hospitals.

Methods

We conducted a nationwide population-based follow-up study among in-patients admitted to public, non-psychiatric hospitals in Denmark. All of Denmark’s 5.7 million citizens have free access to all public, tax-financed hospitals. A unique central personal registry number is assigned to all citizens at birth or immigration enabling unambiguous individual-level record linkage across all public registries [22].

Accreditation of the Danish healthcare system

Between 2009 and 2015, all Danish public hospitals were mandated to undergo accreditation by the DDKM [23]. The DDKM was a national initiative founded with the aim to improve quality of patient care and to prevent errors that caused death and lower quality of life. In June 2012, a revised version of the first programme was launched with an increase in freedom of methods to make the programme more user-friendly [24]. Yet, the extensive use of the Plan-Do-Check-Act cycle principle remained unchanged and followed the International Society of Quality in Health Care rules for developing care standards [25]. Correspondingly, with the first cycle, a team of surveyors assessed compliance on an on-site survey by means of interviewing staff, reviewing guidelines, but the time spent on observing procedures and conducting tracers was significantly increased. In addition, a new set of rating principles was introduced including a new requirement for eight predefined standards critical for patient safety, as the hospitals had to be compliant with these standards to achieve full accreditation. The principles also introduced predefined rules to increase the transparency in the allocation of level of accreditation (available at www.ikas.dk [24]).

After allocation of level of accreditation in the first proceeding, a follow-up activity was offered to hospitals not achieving full accreditation either by a return-visit or submitting additional documentation. A final level of accreditation was awarded based on the completion of the follow-up activity (final proceeding). Survey reports were fully accessible including information on level of accreditation and compliance with the standards to ensure public disclosure [24]. Equivalent with the previous study on the first cycle, we defined compliance with the second cycle of accreditation by the first proceeding, here 22 hospitals were ‘accredited with comments’ and three hospitals were ‘accredited hereby defined as partially and fully accredited hospitals, respectively. Of the 22 partially accredited hospitals, 15 hospitals had a return-visit while the remaining seven hospitals submitted additional documentation.

Compliance with consecutive accreditation was derived as a composite score of the first proceedings in the two consecutive cycles of DDKM accreditations as illustrated in Fig. 1. Hospitals that were partially accredited in both cycles were designated as ‘low compliant hospitals’ (n = 14) and hospitals fully accredited in at least one of the two cycles were designated ‘high compliant hospitals’ (n = 11 (of whom one hospital was fully accredited in both cycles)).

Study population

The Danish National Registry of Patients was used to identify all in-patients admitted with one of 80 primary diagnoses which accounted for 80% of all deaths occurring within 30 days after admission (reference [13] includes a detailed descriptions of the 80 diagnoses) [26, 27]. The registry encompasses information on dates of admission and discharge from all non-psychiatric hospitals since 1977, and healthcare providers submit the information daily. Restriction to the selected diagnoses was applied to reduce differences between the included hospitals populations to facilitate a fair comparison. We included in-patients in the hospitals’ inclusion period equivalent to a 12-month period for each hospital calculated from the first day of the on-site survey ± 6 months similar to previous publications [11–13]. Consequently, data were collected from 10 November 2012 to 30 November 2015. We only
included the in-patients' first admission in the inclusion period and in-patients' with a valid civil registration number for further analyses.

Outcomes
Patient-related outcomes were defined as 30-day mortality, LOS and acute readmission within 30 days after discharge.

The 30-day mortality included death from any cause and in any setting. In-patients were either followed from the date of admission until 30 days after admission or date of death whichever occurred first. All-cause mortality was obtained from the Danish Civil Registration System, in which vital status is registered on a daily basis for all Danish citizens.

We calculated LOS from the date of the in-patient’s first admission during the study period (index date) to date of discharge or death, whichever came first. In-patients admitted and discharged the same day were included with a LOS of half a day (0.5). If an in-patient was transferred between hospitals, the admissions were linked together and all days spent were included in the patients’ LOS.

Acute readmission encompassed all-cause acute readmission at any hospital within 30 days from the discharge date. For acute readmission, date of discharge was the entry date and follow-up ended 30 days after discharge, date of acute readmission, or death, whichever came first. Only un-planned readmissions were included, i.e. readmissions in relation to elective procedures performed were excluded.

Covariates
A number of patient-related factors were included as potential confounding variables, including age (<50 years/50–64 years/65–80 years/80+ years), gender, primary diagnosis (in three categories for underlying diseases corresponding to ICD-10 chapters), type of admission (acute/elective) and marital status (unmarried/married/divorced/widow) defined by the Danish Civil Registration System. The Charlson comorbidity index was used to assess the comorbidity burden for each patient. If the patient’s primary diagnosis was one of the 19 conditions originally included in the index, we modified the comorbidity score by not taking the condition into account when computing the score. Comorbidity was categorized into ‘no comorbidity’, low and high (0/1–2/≥3 comorbidities) [28]. In addition, we included the hospitals level of compliance with the first cycle of accreditation (fully/partially) because this could potentially affect level of compliance with the second cycle.

Statistical analysis
For the primary aim, we compared patient-related outcomes according to level of compliance with the consecutive cycles of accreditation (high/low compliance) adjusting for the hierarchical nature of data in which in-patients at one hospital are more likely treated similar relative to in-patients at another hospital.

For the secondary aim, patient-related outcomes were compared between compliance with the second cycle of accreditation (fully/partially) and subsequently by hospitals grouped according to accreditation (fully compliant, and fully and partially accredited hospitals, and by comparing the plots between in-patients admitted at high and low compliant, and fully and partially accredited hospitals, and by using the Schoenfeld-test and were not violated. All statistical tests used a significance level of 0.05 and were performed using Stata, version 12 (StataCorp. 2011. College Station, TX: StataCorp LP).

Results
The final study cohort for 30-day mortality consisted of 277 559 in-patients of whom 125 485 (45.2%) were admitted at high compliant hospitals and 152 074 (54.8%) at low compliant hospitals. Baseline characteristics of in-patients included in the analyses for 30-day mortality are summarised in Table 1. A flowchart of the inclusion of in-patients is illustrated in Fig. 2.

Compliance with two consecutive cycles of accreditation
The 30-day mortality risk for in-patients admitted at high compliant hospitals was 3.95% (95% CI: 3.84–4.06) compared with 4.39% (95% CI: 4.29–4.49) at low compliant hospitals. When adjusted for potential

Table 1 Patients characteristics for in-patients admitted at Danish hospitals by compliance with accreditation of two consecutive cycles of DDKM accreditation

<table>
<thead>
<tr>
<th>In-patients characteristics</th>
<th>Admissions at high compliant hospital (n = 125 485)</th>
<th>Admissions at low compliant hospital (n = 152 074)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;50 years</td>
<td>35 752 (28.5)</td>
<td>44 866 (29.5)</td>
</tr>
<tr>
<td>50–64 years</td>
<td>24 802 (19.8)</td>
<td>32 217 (21.2)</td>
</tr>
<tr>
<td>65–80 year</td>
<td>38 964 (31.1)</td>
<td>47 131 (31.0)</td>
</tr>
<tr>
<td>&gt;80 years</td>
<td>25 967 (20.7)</td>
<td>27 860 (18.3)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>65 754 (52.4)</td>
<td>76 961 (50.6)</td>
</tr>
<tr>
<td>Men</td>
<td>59 731 (47.6)</td>
<td>75 113 (49.4)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unmarried</td>
<td>31 788 (25.3)</td>
<td>40 270 (26.5)</td>
</tr>
<tr>
<td>Married</td>
<td>52 875 (42.1)</td>
<td>65 115 (42.8)</td>
</tr>
<tr>
<td>Divorced</td>
<td>18 562 (14.8)</td>
<td>20 860 (13.7)</td>
</tr>
<tr>
<td>Widow</td>
<td>22 260 (17.7)</td>
<td>25 829 (17.0)</td>
</tr>
<tr>
<td>Comorbidity statusa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No comorbidity</td>
<td>64 271 (51.2)</td>
<td>78 045 (51.3)</td>
</tr>
<tr>
<td>Low</td>
<td>39 190 (31.2)</td>
<td>47 733 (31.4)</td>
</tr>
<tr>
<td>High</td>
<td>22 024 (17.6)</td>
<td>26 296 (17.3)</td>
</tr>
<tr>
<td>Type of admission</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>108 754 (86.7)</td>
<td>120 672 (79.4)</td>
</tr>
<tr>
<td>Elective</td>
<td>16 731 (13.3)</td>
<td>31 402 (20.6)</td>
</tr>
<tr>
<td>Primary diagnosisb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7 223 (5.8)</td>
<td>8 062 (5.3)</td>
</tr>
<tr>
<td>2</td>
<td>60 952 (48.6)</td>
<td>76 920 (50.6)</td>
</tr>
<tr>
<td>3</td>
<td>57 310 (45.7)</td>
<td>67 092 (44.1)</td>
</tr>
</tbody>
</table>

aCategories of comorbidity were based on Charlson comorbidity index scores (IINO comorbidity = 0, low = 1 and 2, and high = ≥3).

bCategories of underlying diseases were based on chapters of the WHO’s International Classification of Diseases and Related Health Problem, 10. Revision (1 = A09, A41, A49, D63 and D64; 2 = C15–16, C18, C20, C22, C25, C34, C50, C56, C61, C64, C67, C71, C78, C79, C90, E11, E36, E87, E91, E92, E93, E95, F48, I50, I60, I61, I63, J64, J66, J70, J71, J73, J81, J82, J44, J69, J81, J90, J96, K25, K26, K55, K56, K57, K59, K62, K65, K70, K72, K92, N17, N18, N19, N30 and N39; 3 = F10, G12, R06, R09, R10, R17, R18, R31, R50, R52, S57, S60, S32, S72, Z03, Z50 and Z51).
Figure 2 Flowchart of inclusion of in-patients in the study according to admission to hospitals level of accreditation by two consecutive cycles of DDKM accreditation.
confounding factors, in-patients admitted at low compliant hospitals had a significantly higher risk of dying within 30 days after admission than in-patients at high compliant hospitals (adjusted OR: 1.26, 95% CI: 1.11–1.43). Table 2 presents all results for compliance with consecutive cycles of accreditation and the patient-related outcomes.

For the analysis of LOS, we excluded 1 449 in-patients of the in-patients identified for 30-day mortality because these patients participated in a fixed 3-week rehabilitation programme undertaken by a public hospital. Figure 2 presents the distribution of in-patients between hospitals compliance with consecutive accreditation.

The mean LOS for in-patients admitted at high compliant hospitals was 4.02 days (95% CI: 3.98–4.06) versus 4.49 days (95% CI: 4.43–4.53) at low compliant hospitals. After adjusting for patient characteristics, in-patients at low compliant hospitals have an increased mean LOS of 11% compared with in-patients at high compliant hospitals, corresponding to half a day with an (adjusted HR of hospital discharge of 0.89: 95% CI: 0.82–0.95). The estimate did not change substantially when restricting the analyses to in-patients with a LOS between 1 and 33 days (5–99 percentile) (data not shown).

Of the 276 110 in-patient included for LOS, 8 557 in-patients died during their hospital stay and further 165 in-patient had invalid readmission data and were consequently excluded from the analyses. Thus, 267 388 in-patients were included for the analyses on acute readmission. We found no evidence for a difference in acute readmission between admissions according to level of accreditation achieved in the two cycles of accreditation, as presented in Table 2. In addition, no difference was found when we restricted to in-patients with a short LOS of <3 days (data not shown).

Compliance with the second cycle of DDKM accreditation
The 30-day mortality risk for in-patients at fully accredited hospitals was 4.23% (95% CI: 4.01–4.46) and 4.19% (95% CI: 4.11–4.26) at partially accredited hospitals. In-patients admitted at partially accredited hospitals had an increased risk of dying within 30 days after admission compared with in-patients at fully accredited hospitals (adjusted OR: 1.12; 95% CI: 1.02–1.24). This result remained when comparing level of accreditation according to follow-up activity. Table 3 presents all crude and adjusted results for 30-day mortality risk, and LOS and acute readmission risk.

The mean LOS for in-patients at fully accredited hospitals was 4.03 days (95% CI: 3.95–4.10) and 4.31 days (95% CI: 4.28–4.34) at partially accredited hospitals. A longer LOS was found for in-patients admitted at partially accredited hospitals compared with admissions at fully accredited hospitals (adjusted HR of discharge: 0.91, 95% CI: 0.84–0.98). Both in-patients at partially accredited hospitals requested to submit additional documentation and having a return-visit had a longer LOS than patients at fully accredited hospitals (documentation: adjusted HR of discharge: 0.87, 95% CI: 0.79–0.96; return-visit: adjusted HR of discharge: 0.93, 95% CI: 0.87–1.00).

There was no difference in the risk of acute readmission within 30 days after discharge between fully and partially accredited hospitals (adjusted HR: 1.00, 95% CI: 0.92–1.10) or according to follow-up activity as shown in Table 3.

Discussion
Our large population-based study revealed that persistent low compliance with hospital accreditation was associated with higher 30-day mortality and longer LOS. Low compliance with the second cycle of the DDKM was also independently associated with higher 30-day mortality and longer LOS. The absolute differences in LOS were modest in both analyses. Our study, therefore, confirmed the finding from the first cycle of accreditation by the DDKM with improved 30-day mortality and LOS in favour of fully accredited hospitals [12, 13].

In 2015, the Danish Ministry of Health and Danish Regions decided to phase out the mandatory hospital accreditation in favour of a new quality improvement programme [30]. This was in-line with a massive criticism from the frontline staff whom experienced the DDKM as an overly bureaucratic and time-demanding initiative [31]. The lack of support and widespread resistance to the accreditation process, in

Table 2 Patient-related outcome and odds ratio (OR) or hazard ratio (HR) for in-patients admitted at Danish hospitals by compliance with accreditation of two consecutive cycles of DDKM accreditation

<table>
<thead>
<tr>
<th>Compliance with consecutive accreditation</th>
<th>Hospitals counts</th>
<th>In-patients counts (%)</th>
<th>30-Day mortality risk % (95% CI)</th>
<th>OR (95% CI)</th>
<th>Crude</th>
<th>Adjusted a</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-patients at high compliant hospitals</td>
<td>11</td>
<td>125 485 (45.2)</td>
<td>3.95 (3.84–4.06)</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>In-patients at low compliant hospitals</td>
<td>14</td>
<td>152 074 (54.8)</td>
<td>4.39 (4.29–4.49)</td>
<td>1.12 (1.08–1.16)</td>
<td>1.26 (1.11–1.43)</td>
<td></td>
</tr>
<tr>
<td>Length of stay</td>
<td>Hospitals counts</td>
<td>In-patients counts (%)</td>
<td>LOS mean days (95% CI)</td>
<td>HR (95% CI)</td>
<td>Crude</td>
<td>Adjusted a</td>
</tr>
<tr>
<td>In-patients at high compliant hospitals</td>
<td>11</td>
<td>124 036 (44.9)</td>
<td>4.02 (3.98–4.06)</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>In-patients at low compliant hospitals</td>
<td>14</td>
<td>152 074 (55.1)</td>
<td>4.49 (4.45–4.53)</td>
<td>0.94 (0.93–0.94)</td>
<td>0.89 (0.82–0.95)</td>
<td></td>
</tr>
<tr>
<td>Acute readmission</td>
<td>Hospitals counts</td>
<td>In-patients counts (%)</td>
<td>AR % (95% CI)</td>
<td>HR (95% CI)</td>
<td>Crude</td>
<td>Adjusted a</td>
</tr>
<tr>
<td>In-patients at high compliant hospitals</td>
<td>11</td>
<td>120 458 (45.0)</td>
<td>14.22 (14.03–14.42)</td>
<td>1.00</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>In-patients at low compliant hospitals</td>
<td>14</td>
<td>146 930 (55.0)</td>
<td>13.12 (12.95–13.29)</td>
<td>0.91 (0.90–0.93)</td>
<td>0.98 (0.90–1.06)</td>
<td></td>
</tr>
</tbody>
</table>

aAdjusted for age, gender, comorbidity, primary diagnose (three categories), type of admission and marital status, and including robust standard error at hospital level.
particular from physicians, was as an area of great concern as the physicians is a stakeholder critical for success as previously highlighted [21]. It was furthermore argued that the effect of accreditation had been reached; an argument that was not substantiated with references or presented healthcare data. This argument is not in-line with the findings by Pomey et al. whom reported that the greatest benefits are achieved in the second to fourth cycles of accreditation [21].

When DDKM was composed, the predominant perspective on quality was based on Safety I, characterised by ‘when things go wrong’ [32]. In many hospitals, the DDKM standards were implemented by converting guidelines into a number of forms/instructions, which were subsequently distributed with minimal interaction and feedback from the users. Furthermore, the persistent focus on areas for improvements and minimal focus on success seemed to demotivate the staff. Thus, the staffs’ perceptions of accreditation were to perform tasks to achieve accreditation rather than improving quality of care, which is in-line with criticism raised internationally [33]. Phasing out accreditation means that sharing knowledge between sights is no longer encouraged by surveyors and the assessment of compliance with predefined standards are discontinued which were the unique features of accreditation. Hence, the possibility to use level of compliance as a marker of high performing hospitals in future Danish studies does no longer exist.

The two cycles of accreditation were almost identical, hence, we found it reasonable to combine the results into one category to assess consecutive accreditation. However, the rating principles did differ somewhat between the cycles. Still, all hospitals were assessed on equal conditions in each cycle and, we therefore do not consider the changes to have any significance for our findings. In the second cycle of accreditation, the level of information on deficiencies and reasons for designating level of accreditation in the survey report was improved, but unfortunately not to the extent that allowed us to explore in more detail potential variation in compliance associated with types of departments or other characteristics.

Our study was observational by design and the risk of bias and confounding can therefore, not be ruled out. However, problems related to selection of patients are considered minimal because >95% of all admissions in Denmark take place at public hospitals including all emergency visits and all inhabitants have free access to healthcare. To account for potential case mix between hospitals, we restricted to the use of 80 inclusion diagnoses and were able to adjust for a large amount of covariates. Furthermore, the large sample size increased precision. However, residual and unaccounted confounding might occur, as e.g. disease severity and hospitals characteristics were not captured by the registries. Stratifying diseases according to the three categories and the 11 ICD-10 chapters did not alter the result substantially (data not shown). The lack of studies clarifying the inter- and intra-reliability of the surveyors and the assessment of compliance with predefined standards is however, considered most likely to be of non-differential nature as a number of activities were endorsed to minimise the variation [36].

Table 3 Patient-related outcome and odds ratio (OR) or hazard ratio (HR) for in-patients admitted at Danish hospitals by compliance with accreditation of the second cycles of DDKM accreditation

<table>
<thead>
<tr>
<th>Compliance according to follow-up activity</th>
<th>In-patients</th>
<th>LOS mean days (95% CI)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-patients with no follow-up (fully accredited)</td>
<td>3</td>
<td>31.014 (11.2)</td>
<td>4.23 (4.01–4.46)</td>
</tr>
<tr>
<td>In-patients submitting documentation</td>
<td>7</td>
<td>69.494 (25.0)</td>
<td>4.15 (4.01–4.30)</td>
</tr>
<tr>
<td>In-patients having a return-visit</td>
<td>15</td>
<td>177.051 (63.8)</td>
<td>4.20 (4.10–4.29)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compliance according to first proceeding</th>
<th>In-patients</th>
<th>AR % (95% CI)</th>
<th>HR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-patients at fully accredited hospitals</td>
<td>3</td>
<td>30.070 (11.2)</td>
<td>13.84 (13.45–14.23)</td>
</tr>
<tr>
<td>In-patients at partially accredited hospitals</td>
<td>22</td>
<td>237.319 (88.8)</td>
<td>13.59 (13.45–13.73)</td>
</tr>
<tr>
<td>In-patients at hospitals with no follow-up (fully accredited)</td>
<td>3</td>
<td>30.070 (11.2)</td>
<td>13.84 (13.45–14.23)</td>
</tr>
<tr>
<td>In-patients at hospitals submitting documentation</td>
<td>7</td>
<td>67.171 (25.1)</td>
<td>12.54 (12.29–12.79)</td>
</tr>
<tr>
<td>In-patients at hospitals having a return-visit</td>
<td>15</td>
<td>170.147 (63.6)</td>
<td>14.00 (13.84–14.17)</td>
</tr>
</tbody>
</table>

*Adjusted for age, gender, comorbidity, primary diagnose, type of admission, marital status and level of accreditation according to the 11 ICD-10 chapters.
A main feature of the new national quality improvement programme in Denmark is to reengage frontline staff, in particular physicians, in quality improvement work, thus the programmes contain fewer and more meaningful registration for the clinicians [21]. Eight national targets are outlined, whereupon the hospitals have the freedom to define a number of intermediate targets relevant for their organisation. Furthermore, national learning and quality teams are formed for single conditions or areas of concern (stroke, pullation and use of antibiotic) to ensure that good results and knowledge of what works best spreads out rapidly to the departments all over the country [30]. Hence, the new programme embraces several of the areas of concern related to the negative perception of accreditation in order to empower quality improvement work in the daily setting. However, the evidence of the new programmes effectiveness and cost is unclear and a plan for systematic evaluation has not been developed prior to the launch—resembling the scenario when accreditation was introduced in the Danish healthcare system.

Conclusion
Persistent low compliance during two cycles of DDKM accreditation was associated with a higher 30-day mortality and a longer LOS.

Competing interests
All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no disclosure for the submitted work; the first author was former employed by the Institute of Quality and Accreditation in Healthcare (IKAS). No other relationships or activities that could appear to have influenced the submitted work.

Funding
All authors are independent researchers without any financial interest in the results presented.

Ethics approval
The study was approved by the Danish Data Protection Agency. According to Danish law, ethical approval is not needed for registry-based studies.

Contributors
All authors designed and conceived the study; collected, analysed and interpreted the data; manuscript drafting and revision following The RECORD statement. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

Data sharing
Codebook and statistical code (in Danish) are available from the corresponding author.

References