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ORIGINAL RESEARCH

Validity of the coding for intensive care admission, mechanical ventilation, and acute dialysis in the Danish National Patient Registry: a short report

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Linea Blichert-Hansen
Malene S Nielsson
Rikke B Nielsen
Christian F Christiansen
Mette Nørgaard

Department of Clinical Epidemiology, Aarhus University Hospital, Denmark

Background: Large health care databases provide a cost-effective data source for observational research in the intensive care unit (ICU) if the coding is valid. The aim of this study was to investigate the accuracy of the recorded coding of ICU admission, mechanical ventilation, and acute dialysis in the population-based Danish National Patient Registry (DNPR).

Methods: We conducted the study in the North Denmark Region, including seven ICUs. From the DNPR we selected a total of 150 patients with an ICU admission by the following criteria: (1) 50 patients randomly selected among all patients registered with an ICU admission code, (2) 50 patients with an ICU admission code and a concomitant code for mechanical ventilation, and (3) 50 patients with an ICU admission code and a concomitant code for acute dialysis. Using the medical records as gold standard we estimated the positive predictive value (PPV) for each of the three procedure codes.

Results: We located 147 (98%) of the 150 medical records. Of these 147 patients, 141 (95.9%; 95% confidence interval [CI]: 91.8–98.3) had a confirmed ICU admission according to their medical records. Among patients, who were selected only on the coding for ICU admission, the PPV for ICU admission was 87.2% (95% CI: 75.6–94.5). For the mechanical ventilation code, the PPV was 100% (95% CI: 95.1–100). Forty-nine of 50 patients with the coding for acute dialysis received this treatment, corresponding to a PPV of 98.0% (95% CI: 91.0–99.8).

Conclusion: We found a high PPV for the coding of ICU admission and even higher PPVs for mechanical ventilation, and acute dialysis in the DNPR. The DNPR is a valuable data source for observational studies of ICU patients.

Keywords: critical care, epidemiology, intensive care unit, positive predictive values, validity

Introduction

Health care databases constitute a cost-effective way of conducting studies on intensive care unit (ICU) patients. The data are usually collected for administrative purposes, thus reducing the risk of recall bias and nonresponse bias.[1] The researchers who conduct an observational study using existing data are not able to control the data collection and the quality of the data. Therefore it is important to examine the validity of these data.

Few studies have examined the quality of coding for ICU admission in medical databases. A Canadian study used different combinations of codes to identify ICU admissions and found positive predictive values (PPV) ranging from 34% to 91%.[2] However, another recent Canadian study evaluated the accuracy of administrative data for identifying admission to adult ICUs. They found even higher PPVs ranging from 98% to 99%.[3] Additionally, a French study evaluated ICU admissions among women

Correspondence: Malene S Nielsson
Department of Clinical Epidemiology, Aarhus University Hospital, Aalborg Hospital, AHSIC, Sdr Skovvej 15, DK-9000 Aalborg, Denmark
Tel +45 9932 6905
Fax +45 9932 6914
Email mascn@rn.dk

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with severe maternal morbidity.[4] They found a PPV of 98% (95% confidence interval [CI]: 95.8–100). Still, this study was restricted to women of reproductive age with at least one code related to pregnancy, delivery, or the postpartum period.

Several studies have measured the validity of different diseases and procedure codes registered in the Danish National Patient Registry (DNPR),[5–8] but only one study examined the validity of ICU admission coding and found a PPV of 98.7% in a sample of 150 records from one hospital.[9] Few, if any, data exist on the validity of specific ICU procedure codes for interventions such as mechanical ventilation and acute dialysis. We therefore estimated the PPV of recorded coding of ICU admission, mechanical ventilation, and acute dialysis in the DNPR.

Methods

We conducted this validation study in the North Denmark Region with a population of approximately 500,000 people (corresponding to 11% of the total Danish population). Through the DNPR, we randomly selected 50 patients from each of the following categories admitted during January 1, 2005–December 31, 2010: (1) patients registered with an ICU admission (the Danish procedure codes: intensive care observation (NABE)/intensive care therapy (NABB); (2) patients registered with an ICU admission who also had a mechanical ventilation code (procedure codes: NABE/NABB + BGDA0 [mechanical ventilation]); and (3) patients registered with an ICU admission who also had an acute dialysis code (procedure codes: NABE/NABB + BJFD00 [acute hemodialysis]/BJFD02 [continous venovenous hemodialfiltration]), altogether yielding a validation cohort of 150 patients.

Since 1977, the DNPR has recorded more than 99% of all discharges from Danish hospitals. Data include the civil registration (CPR) number, dates of admission and discharge, surgical and other procedures, and one primary and up to 19 secondary discharge diagnoses classified according to the International Classification of Diseases, 8th revision until 1993 and 10th revision thereafter.[10,11] Intensive care admissions, including major treatments, have been recorded routinely since 2005.

The procedure coding for intensive care is registered each time a patient is admitted to an intensive care unit during hospitalization. The procedure codes are assigned a date corresponding to the date of ICU admission. Procedure codes for any mechanical ventilation and acute dialysis are assigned at least once per ICU admission.

All medical records were reviewed by one of the authors (LBH). All notes for the entire hospital stay from date of ICU admission and onwards were reviewed to identify ICU admission, treatment with mechanical ventilation, and acute dialysis. Medical records with uncertain information about admission and treatments were also reviewed by another author (MSN), and agreement was reached by consensus. We estimated the PPV of each of the three procedure codes as the proportion of patients registered with the specific coding in the DNPR who also received this treatment according to their medical records. All estimates are presented with 95% CIs calculated with Jeffrey's CIs.[12] Furthermore, we stratified the PPV of the coding for ICU admission by admission to either a district or a university hospital.

The statistical analyses were performed using STATA® software (version 11.2; StataCorp, College Station, TX, USA).

Table 1 PPV and 95% CI for a registered coding of ICU admission, mechanical ventilation, and acute dialysis in the DNPR

Procedure coding	n/N	PPV (95% CI)
ICU admission	41/47	87.2% (75.6–94.5)
Mechanical ventilation	50/50	100% (95.1–100)
Acute dialysis	49/50	98% (91.0–99.8)

Abbreviations: CI, confidence interval; DNPR, Danish National Patient Registry; ICU, intensive care unit; PPV, positive predictive value.

Results

We were able to locate 147 of the 150 medical records (98%). The three unavailable medical records were all patients selected from the DNPR with the coding for intensive care admission only and the patients were excluded before the analyses. The median age at admission date was 67.4 years (interquartile range [IQR], 56.7–75.4 years) and 64% were men. Of the 147 patients, 141 (95.9%; 95% CI: 91.8–98.3) had been admitted to an ICU according to their medical records.

Of the 47 patients selected solely on the coding for ICU admission in the DNPR, 41 were admitted to an ICU according to their medical records corresponding to a PPV of 87.2% (95% CI: 75.6–94.5). The PPVs of registered procedure coding are shown in Table 1.

Thirty-two patients were admitted to a university hospital, of which 29 had a confirmed admission to an ICU, yielding a PPV of 90.6% (95% CI: 77.0–97.3). Of the remaining 15 patients admitted to a district hospital, 12 had a confirmed ICU admission corresponding to a PPV of 80.0% (95% CI: 55.6–94.0). The three patients from district hospitals without a confirmed ICU admission were young patients having surgery with uncomplicated postsurgery courses. The three miscoded patients from the university hospital were hospitalized with carotid artery

surgery, stroke, and trauma, respectively. Furthermore, of the 47 patients selected from the DNPR based on the coding for ICU admission, 27 had neither a code for mechanical ventilation nor acute dialysis. Among these 27 patients, six patients had not been admitted to an ICU according to their medical records.

All 50 ICU patients registered and identified by the coding for mechanical ventilation received this treatment according to their medical records corresponding to a PPV of 100% (95% CI: 95.1–100). In addition, this corresponded to a PPV of ICU admission of 100% (95% CI: 95.1–100) in this subgroup of ICU patients.

Of the 50 ICU patients identified by the coding for acute dialysis, one did not receive this treatment, corresponding to a PPV of the coding for acute dialysis of 98% (95% CI: 91.0–99.8). The misclassified patient, however, was admitted to an ICU, making the PPV of ICU admission in this subgroup of patients 100% (95% CI: 95.1–100).

Discussion

We found that the coding for ICU admission in the DNPR had a high PPV. The coding was almost perfect for mechanical ventilation and acute dialysis.

Our PPV, however, is lower than the PPV of 98.7% (95% CI: 95.3–99.8) found by Christiansen et al in a previous Danish study.[9] This is probably because the latter study included admissions to ICUs in a single university hospital and did not include any district hospitals.

The majority of the few miscoded patients in our study were hospitalized in relation to surgery and probably coded as admitted to an ICU because of admission to the postoperative recovery room. Furthermore, we found that patients with the coding of ICU admission only had a higher likelihood of being misclassified. These potential problems should be considered when using the DNPR to identify ICU admissions.

We were unable to evaluate the proportion of ICU patients not registered in the DNPR, thereby hindering the possibility of estimating the sensitivity, specificity, and negative predictive value required in the optimal validation study.[13] If the coding in future studies is used to define ICU admission or treatments as exposure or outcome, misclassification might lead to information bias. However, in most circumstances registration will probably not depend on the other exposure or outcome under study and any bias would be towards the null leading to an underestimation of the true effect of the exposure.

In conclusion, our finding of high PPVs indicates that the coding of intensive care admission and treatment in the DNPR in a vast majority of cases corresponds to actually receiving the ICU treatment. Thus, the DNPR remains a valuable source for observational studies of ICU patients.

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Disclosure

The authors report no conflict of interest in this work.

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