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Look back for the Charlson Index did not improve risk adjustment of cancer surgical outcomes

Timothy A. Dobbins[a], Nicola Creighton[b], David C. Currow[b], Jane M. Young[c,*]

[a]*National Centre for Epidemiology and Population Health, ANU College of Medicine, Biology and Environment, The Australian National University, Building 62, Mills Road, Canberra ACT 0200, Australia*

[b]*Cancer Institute NSW, Level 9, 8 Central Avenue, Eveleigh, NSW 2015, Australia*

[c]*Sydney School of Public Health, Level 6, Lifehouse at RPAH (C39Z), University of Sydney NSW 2006, Australia*

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Abstract

Objectives: The Charlson score is a commonly used measure of comorbidity; however, there is little empirical research into the optimal implementation when studying cancer surgery outcomes using administrative data. We compared four alternative Charlson score implementations, including and excluding metastatic cancer and varying the look-back periods.

Study Design and Setting: Nine years of linked administrative data were used to identify patients undergoing surgery for cancer of the colon, rectum, or lung in New South Wales, Australia. Four binary outcomes of 30- and 365-day mortality, length of stay greater than 21 days, and emergency readmission within 28 days were compared between groups of similar hospitals. Hospital risk adjustment models were compared for alternative Charlson score implementations.

Results: Excluding metastatic cancer from the Charlson score improved model performance for short-term outcomes, but there was no implementation that was consistently optimal. Incorporating a look-back period reduced the number of patients for analysis but did not improve hospital risk adjustment.

Conclusion: Charlson scores for hospital risk adjustment of short-term outcomes of cancer surgery should be calculated excluding metastatic cancer as a separate comorbidity. We found no clear best performing implementation and found no benefit in incorporating any look-back period.

Keywords: Comorbidity; Risk adjustment; Mortality; Hospital readmission; Cancer; Administrative data

1. Introduction

Over the past two decades, there has been increasing recognition of the potential value of studies that link data from existing administrative data sets and registries for health services and outcomes research [1,2]. Data linkage studies provide a relatively inexpensive and feasible means to investigate patterns of care and determinants of health outcomes [3]. In the field of cancer, analyses of linked sets of cancer registry, death registry, and hospital administrative data have been used to investigate variations in patients' treatment and survival to identify those who are most at risk of poorer outcomes [4–6].

Analyses of linked data can also be used to provide comparative performance data about health services, hospitals, and clinicians. The importance of risk adjustment when undertaking comparative outcomes assessment is well established and requires consideration of potential confounding factors [7]. By adjusting for patient risk factors that may explain variation in outcomes, fairer and more accurate comparisons between groups are obtained [8,9].

Patient comorbidity has an important influence on health outcomes and should be included in risk adjustment models [10]. Using hospital administrative data, it is possible to calculate measures of comorbidity, such as the Charlson score, based on International Classification of Disease (ICD) diagnosis codes that are recorded within hospital admission records. To calculate the Charlson score, groups of clinical conditions are assigned a score depending on the mortality risk associated with the condition, and scores are then summed to give an overall score [11,12]. Although there are several variations in the way the comorbidities

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* Corresponding author. Tel.: +61-2-8627-1559; fax: +61-2-9515-3222.
E-mail address: jane.young@sydney.edu.au (J.M. Young).

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What is new?

Key findings

- For most surgical outcomes and cancers in this study, better risk adjustment between hospitals was obtained by excluding metastatic cancers from the calculation of the Charlson score.
- Incorporating a look-back period for the Charlson score dramatically reduced the sample size but did not improve hospital risk adjustment.
- Although the magnitude of the Charlson score differed between alternative implementations (Australian and Canadian ICD-10 coding versions; original and revised comorbidity weights), there was very little difference in hospital risk adjustment model performance.

What this adds to what was known?

- This study confirms that inclusion of a Charlson score to models containing patient and disease characteristics improved risk adjustment to compare cancer surgical outcomes between hospitals.

What is the implication and what should change now?

- For comparison of cancer surgical outcomes between hospitals, risk adjustment models should include a Charlson score derived from the index admission and should exclude metastatic cancers where stage or extent of disease is known.

are weighted and scored [13,14], the Charlson score provides a measure that is based on both the number and severity of a patient's concurrent health conditions.

Although the use of the Charlson score as a measure of comorbidity is widespread, there is little empirical research to inform how the index is optimally calculated using existing administrative data. As the comorbidities that are recorded within hospital administrative data sets are restricted to those that have a direct impact on the admission of interest, it is known that comorbid conditions are often underreported in these collections [15,16]. Data linkage enables researchers to obtain information from hospital admissions that occurred before or after a patient's index admission. This allows the inclusion of comorbidities recorded in previous admissions to be included in the calculation of the Charlson score. However, it is not clear whether this provides better risk adjustment as comorbid conditions that did not affect the index admission may be irrelevant to a patient's outcome. Furthermore, if information from additional admissions is included, the optimum period of ''look back'' is not known for cancer data linkage studies.

A further consideration specific to cancer outcome studies is whether metastatic disease should be included in the Charlson score. Solid metastatic disease is one of only two conditions that receive the highest score in the algorithm for calculating the Charlson score, and so this condition is highly influential. However, metastatic disease for people with cancer is often part of their primary condition of interest, rather than a ''comorbidity'' per se, and would not be included in the Charlson score on the grounds of face validity. Risk adjustment models that include cancer stage will already adjust for the presence of metastatic disease, thus further adjustment within the Charlson score may be superfluous.

Therefore, this study was undertaken to investigate the optimal method of calculating Charlson score for risk adjustment to enable comparison of cancer surgical outcomes between hospitals. We investigated the impact of adjusting for comorbidity while already adjusting for age and extent of disease which are known predictors of cancer outcomes [17–19]. We compared the performance of

- alternative methods for calculating the Charlson score
- the effect of including or excluding metastatic cancer as a comorbid condition and
- the effect of different look-back periods on model performance.

2. Methods

2.1. Data sources

The NSW Central Cancer Registry (CCR), a population-based registry established in 1971, receives notifications of all malignant neoplasms, in situ melanoma and carcinoma in situ breast cancer diagnosed and/or treated in NSW. Data collected in the CCR include the following: demographic details, date of diagnosis, primary site, morphology, extent of disease (summarizing the most aggressive extent of the disease based on diagnostic and therapeutic evidence within 4 months of diagnosis), and date and cause of death. Cancer cases diagnosed between January 2000 and December 2008 were available.

The Admitted Patient Data Collection (APDC) contains information on all hospital separations for all hospitals in NSW. Data collected include patient demographics and administrative information, principal and additional diagnoses, and procedures conducted for each episode of care. We used admissions with separation dates from July 2000 to June 2009.

Probabilistic data linkage was conducted by the NSW Centre for Health Record Linkage (CHeReL), and we received only anonymized data. The data linkage procedure used by the CHeReL is designed to result in fewer than 5 of 1,000 false-positive and false-negative matches. Ethics