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Cancer-specific administrative data−based comorbidity indices provided valid alternative to Charlson and National Cancer Institute Indices

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Abstract

Objective: We aimed to develop and validate administrative data−based comorbidity indices for a range of cancer types that included all relevant concomitant conditions.

Study Design and Settings: Patients diagnosed with colorectal, breast, gynecological, upper gastrointestinal, or urological cancers identified from the National Cancer Registry between July 1, 2006 and June 30, 2008 for the development cohort (n = 14,096) and July 1, 2008 to December 31, 2009 for the validation cohort (n = 11,014) were identified. A total of 50 conditions were identified using hospital discharge data before cancer diagnosis. Five site-specific indices and a combined site index were developed, with conditions weighted according to their log hazard ratios from age- and stage-adjusted Cox regression models with noncancer death as the outcome. We compared the performance of these indices (the C3 indices) with the Charlson and National Cancer Institute (NCI) comorbidity indices.

Results: The correlation between the Charlson and C3 index scores ranged between 0.61 and 0.78. The C3 index outperformed the Charlson and NCI indices for all sites combined, colorectal, and upper gastrointestinal cancer, performing similarly for urological, breast, and gynecological cancers.

Conclusion: The C3 indices provide a valid alternative to measuring comorbidity in cancer populations, in some cases providing a modest improvement over other indices. © 2014 Elsevier Inc. All rights reserved.

Keywords: Comorbidity; Multimorbidity; Cancer; Measurement; Validity; Indices

1. Introduction

Patients diagnosed with cancer frequently have other chronic medical conditions. These concomitant conditions, or comorbidity, can affect how or when a patient is diagnosed with cancer, the treatment options available or offered, and a patients' ultimate prognosis [1−13]. At an individual level, a clinician can assess the presence and impact of comorbidity in a patient diagnosed with cancer. However, at the population level, assessing comorbidity is much more difficult. The severity of a patient's comorbidity depends on the number, pattern, and severity of conditions present, and the likely impact may vary depending on the specific cancer diagnosed [4,11,14−17]. Despite these difficulties, measuring comorbidity at the population level is important, as it provides researchers, policy makers, and health service planners with the necessary tools to allow them to stratify patients into groups according to risk in the same way they do for demographic and disease factors such as age and tumor stage [16,18].

There have been many attempts to measure comorbidity in cancer patient populations [4]. The most commonly cited approach is that of Charlson et al. [19]. These investigators identified all comorbid conditions from the medical records

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What is new?

Key findings

- This study provides validated comorbidity indices for cancer populations using administrative hospitalization data. Site-specific indices did not outperform a more general cancer index. The new indices included a more extensive list of conditions, and more up-to-date and site-specific weights. They outperformed the Charlson and National Cancer Institute (NCI) indices for all sites combined and colorectal cancer, and to a lesser extent for upper gastrointestinal cancers. For other sites, the new indices performed similarly to the Charlson index.

What this adds to what was known?

- The C3 indices provide a valid alterative to the Charlson or NCI indices in cancer populations, although for many purposes any of these three measures of comorbidity will give similar results.

What is the implications and what should change now?

- Consideration of comorbidity in studies of cancer population is more important than the measure used to describe it.

of a relatively small cohort of 559 general medical patients admitted to a single hospital. They assessed the impact of each condition on 1-year mortality, and excluded any with a relative risk of less than 1.2. They developed a weighted index, with the weights being equivalent to the (rounded) adjusted relative risks for mortality for each condition, with a maximum weight of six. Subsequently, the Charlson index has been validated on data from administrative records [20–27]. The Charlson index has been used as the basis for other comorbidity indices, most notably the National Cancer Institute (NCI) comorbidity index, which uses the same conditions, but uses the regression coefficients (ie, the log of the relative risk rather than the relative risk itself) of the association of each condition with 1-year mortality to assign weights [28]. These latter investigators also argued for the importance of site-specific weights in the development of comorbidity indices for use with cancer patients.

Despite this extensive work, there has been little consideration of whether the conditions that Charlson and colleagues identified in their general medical cohort nearly 30 years ago are those that are most important for cancer patients today. The Charlson index includes some conditions that may not have an impact on survival among patients with cancer because of substantial improvements in management (eg, peptic ulcer disease), and it excludes some that do have such an impact (eg, noncerebrovascular neurological conditions and major psychiatric conditions) [19].

Comorbidity is a composite construct defined by the presence or absence of concomitant conditions. As such, theoretically, comorbidity will be best measured when as many relevant items are included as possible, and it is likely that the weighting of individual conditions will be less important than their inclusion [29]. However, a ''reduced'' comorbidity index involving a smaller number of conditions may be desirable for practical reasons.

We aimed to develop administrative data–based indices, which address some of the issues identified in previous work, to assess whether they performed better than other well-established comorbidity indices, particularly the Charlson and NCI indices. We wanted to ensure that all conditions that may be important in defining comorbidity in cancer patient populations were included. We also wanted to account for the possibility that the importance of these conditions may vary depending on the primary site of cancer, either because of different underlying prevalence rates of specific conditions or because of differential impact of individual conditions on particular cancer sites.

We used data from more than 14,000 patients diagnosed with one of the nine cancers (colon, rectal, breast, ovarian, endometrial, stomach, liver, bladder, or kidney) identified from the New Zealand cancer registry, with data identified from hospitalizations for the 5 years before diagnosis on 50 potentially concomitant conditions. We combined these into site-specific and non-site–specific indices and evaluated the performance of these against the Charlson and NCI (site-specific) indices.

2. Methods

2.1. Study population and data

The development cohort consisted of patients who had been diagnosed with colon (ICD-10 C18-19), rectal (C20), uterine (C54), ovarian (C56), liver (C22), stomach (C16), female breast (C50), kidney (C64), or bladder (C67) cancers between July 1, 2006 and June 30, 2008 (''development cohort''). To validate the indices, we obtained data from patients diagnosed with these same cancers diagnosed between July 1, 2008 and December 31, 2009 (''validation cohort''). Patients were identified from the New Zealand Cancer Registry, which is a population-based register of all primary cancers diagnosed in New Zealand excluding nonmelanoma skin cancers. Patients were excluded if they were diagnosed with carcinoma *in situ*, aged younger than 25 years at diagnosis, normally resident outside New Zealand, had a previous diagnosis with the same cancer, or diagnosed at postmortem. We collected data on the extent of disease from the Cancer Registry, using the Surveillance Epidemiology and End Results Summary Staging System and categorized the extent of disease into local, regional, distant, and unknown [30].

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