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A new simple primary care morbidity score predicted mortality and better explains between practice variations than the Charlson index

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Abstract

Objectives: Adjustment for morbidity is important to ensure fair comparison of outcomes between patient groups and health care providers. The Quality and Outcomes Framework (QOF) in UK primary care offers potential for developing a standardized morbidity score for low-risk populations.

Study Design and Setting: Retrospective cohort study of 653,780 patients aged 60 years or older registered with 375 practices in 2008 in a large primary care database (The Health Improvement Network). Half the practices were randomly selected to derive a morbidity score predicting 1-year mortality; the others assessed predictive performance.

Results: Nine chronic conditions were robust copredictors (hazard ratio = ≥1.2) of mortality independent of age and sex, producing high predictive discrimination (*c*-statistic = 0.82). An individual's QOF score explained more between practice variation in mortality than the Charlson index (46% vs. 32%). At practice level, mean QOF score was strongly correlated with practice standardized mortality ratios ($r = 0.64$), explaining more variation in practice death rates than the Charlson index.

Conclusion: A simple nine-item score derived from routine primary care recording provides a morbidity index highly predictive of mortality and between practice variation in older UK primary care populations. This has utility in research and health care outcome monitoring and can be easily implemented in other primary and ambulatory care settings.

Keywords: Comorbidity; Mortality; Primary care; Quality and Outcomes Framework; United Kingdom; Charlson Index

1. Introduction

Comorbidity is an important concept in clinical care, research, and health service outcome monitoring, and approaches to measuring morbidity levels need to be simple and standardized [1]. Morbidity scores, designed to summarize comorbidity for individual patients, by summing scores for selected diseases, are widely used in research and service monitoring to adjust for baseline differences in patient groups or service providers [2]. In primary and ambulatory care, robust adjustment for case mix is important for valid interpretation of both observational research and routine health services outcome data [3]. A range of morbidity scores have been used, of which the Charlson index is the most well known [4]. It was developed in the United States in the 1980s to predict 1-year mortality, based on a list of common chronic conditions, and has been validated in many different groups of patients worldwide [2,5−8]. It has been widely used in research with primary care data [9−11] despite it being derived from secondary care data. Implementation in primary and ambulatory care settings presents a number of challenges including agreement on appropriate code lists and quality of recording [12]. The only comorbidity score developed in ambulatory care settings is the Johns Hopkins adjusted clinical group system, which is limited by its complexity and data requirements in comparison with the Charlson Index.

The UK Quality and Outcomes Framework (QOF) was introduced into primary care in 2004 [13]. It aimed to improve chronic disease management by remunerating general practitioners for achieving clinical targets. It offers the opportunity to use routinely collected data, with standardized definitions for disease coding, to develop a simple novel morbidity score for primary care [14]. Use of QOF-based morbidity measures has a number of potential advantages, including inclusion of a range of conditions managed in primary care, such as severe mental illness and epilepsy, and better performance in low-risk community settings.

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What is new?

- Standardized measurement of morbidity is important, but few morbidity scores have been developed in primary or ambulatory care settings.
- A simple score derived from routinely recorded chronic conditions in primary care is highly predictive of 1-year mortality in an older UK population.
- It is more effective in explaining differences in mortality between practices than the established Charlson index.
- Morbidity levels also explain more interpractice variation in mortality than measures of deprivation.
- This new score offers the potential for improving risk-adjusted comparisons of performance and outcomes between primary care providers.

Specifically in the United Kingdom, it offers ease of application in nonresearch settings including national monitoring of general practice outcomes such as mortality. In this article, we describe the use of QOF data from UK primary care to create a simple morbidity score for older people and report on its effectiveness in predicting mortality, and explaining between practice variation, in comparison to the established Charlson index.

2. Methods

2.1. Data source

The Health Improvement Network (THIN) database is an established primary care database, which collects anonymized data from participating UK general practices, which use the Vision practice computer system [15]. As of 2010, it comprised 3.6 million active patients, 5.8% of the UK population. It includes a full longitudinal record of registration, consultation, diagnosis, and prescribing.

2.2. Subjects

Our analysis is based on patients aged 60 years and older included in a study of bereavement, mortality, and comorbidity in older people [16]. We included 375 practices that provided data for at least 1 year after a practice index date in 2008. This identified 653,780 patients aged 60 and older registered in the THIN database on the index date. For internal validation of our morbidity score, we divided the practices into two groups. Half the practices ($n = 188$) were randomly selected to be used as a ''training'' set, which was used to derive a ''QOF morbidity score.'' The other half ($n = 187$) were then used as a ''validation'' set to assess model performance.

2.3. Main outcome

Patients were followed for 1 calendar year. Date of death was identified through a record of death in the primary care record [17], either by a relevant deregistration flag or specific Read codes. Patients who deregistered alive from their practice were censored from the analysis on their date of deregistration.

2.4. Identifying morbidity

We identified recorded chronic disease prevalence at baseline in 2008 by using the QOF disease definitions from the UK general practice contract, which are used to determine practice payments [13]. We applied the definitions for published national disease prevalence for 15 of 18 conditions, excluding obesity, learning disability, and palliative care. As per definition, cancer was restricted to diagnoses in the last 5 years, whereas asthma, epilepsy, and hyperthyroidism all required additional recent prescription of relevant medication. We refer to these morbidities as ''Standard QOF.'' A list of the Read codes for these conditions, and their mapping to International Classification of Diseases (ICD-10), is provided in the Appendix at www.jclinepi.com.

We also investigated whether the proposed score could be improved by identifying more severe subgroups of the standard QOF conditions, so we developed an ''extended QOF'' list of conditions. Specifically we (1) identified myocardial infarction (MI) distinct from coronary heart disease (CHD), (2) separated stroke from transient ischemic attack, (3) subdivided chronic kidney disease into separate stages (3, 4, or 5), (4) restricted depression to a diagnosis in the last 12 months, and (5) subdivided cancer into metastatic and nonmetastatic. MI and stroke are separately identified in QOF for some disease indicators.

We also identified the existence at baseline of any morbidities in the Charlson index. We initially used the Read code list created by Khan et al. [9], but amended some of their inclusions. We added to their lists any codes used by QOF for the same condition, and removed any codes that we judged were erroneously included (list available from authors). For example for ''Chronic Pulmonary Disease'' we did not include ''Bronchitis unspecified'' or ''Chest infection,'' which were on the Khan list but more likely to be used for acute respiratory problems rather than chronic disease.

2.5. Prediction models of 1-year mortality

In the training set, a Cox proportional hazard model adjusting for age and sex was fitted to all conditions simultaneously. We then included conditions with a hazard ratio (HR) of 1.2 or higher as predictors for the QOF score. Following other authors [4,7], we created a weighted additive score based on the HRs (1 if HR = 1.2–1.5, 2 if HR = 1.5–2.5, 3 if HR = 2.5–3.5, 4 if HR = 3.5–4.5, 5 if HR = 4.5–6.0, and 6 if HR > 6.0), but also considered a score based on a count of the conditions only. The model