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Developing a new predictor of health expenditure: preliminary results from a primary healthcare setting

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ABSTRACT

Objectives: Risk adjustment is a widely used tool for health expenditure prediction and control. Early approaches for estimating health expenditure were based on patient demographic variables alone, whereas more recent models incorporate patient information, such as chronic medical conditions, clinical diagnoses, and self-reported health status. Many studies have investigated the health expenditure predictive capacity of single demographic, morbidity, or health-related quality of life measures, but the best models prove to be those that include them all. The aim of this study was to develop an index that combines measures of perceived health and disease severity and to compare its efficacy in predicting health expenditure with that of the measures taken individually.
Study design: This is a linked cross-sectional study.
Methods: In 2009 and 2010, the health-related quality of life questionnaire SF-36 (8 scales, two indices: Physical Component Summary [PCS] and Mental Component Summary [MCS]) was distributed to 886 patients of general practitioners in the Province of Siena, Italy. Severity of diseases was calculated for each patient using the Charlson Index (CH-I) and Cumulative Illness Rating Scale Severity Index (CIRS-SI). Siena Local Health Unit 2012 data on health expenditure were obtained for each patient. Multivariate linear regression was applied to test the performance of severity (CH-I, CIRS-SI) and perceived health (PCS and MCS) measures in predicting health expenditure. The indexes that predicted health expenditure best were then combined in a new tool, and its expenditure predictive capacity was tested.
Results: The best health expenditure predictors proved to be PCS and SI ($R^2 = 0.15$ and $R^2 = 0.17$, respectively). When combined in a new index (PCS-SI), better predictive capacity of health expenditure was obtained than with the two single measures separately ($R^2 = 0.19$).
Conclusions: A multidimensional indicator proved to be a better predictor of healthcare expenditure than single health measures.

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Introduction

The need to meet the growth of healthcare needs with available resources requires valid management tools. To improve health organization efficiency and optimize resource use, it is essential to identify the profiles of patients who can actually benefit from those resources. Risk adjustment is a widely used tool for health expenditure prediction and control. Early approaches to estimating health expenditure were based on patient demographic variables alone, whereas more recent risk adjustment models incorporate patient information, such as chronic medical conditions, clinical diagnoses, and self-reported health status.[1] In fact, many studies have demonstrated that health expenditure is best predicted by models that include demographic aspects, morbidity, and perceived health,[2–6] indicating the importance of considering both objective and subjective aspects of health. Objective aspects of health can be measured not only by traditional indicators, such as mortality or clinical/biomedical information but also by indices of morbidity or disease severity obtained either by simply counting the patient's diseases or by weighing the single diseases, for example, in terms of mortality.[7–9] Many studies have shown that these indices are good predictors of mortality for hospitalized and non-hospitalized patients and of healthcare costs.[3,5,6,8,10–12] Subjective measures, such as perceived health or health-related quality of life, describe health status from the viewpoint of patients. Owing to changes in the concept of health, non-clinical aspects, such as quality of life and perceived health, have become increasingly important and essential to consider for better healthcare delivery and optimal distribution of resources.[13,14] Numerous studies show that perceived health is related to health service use and health expenditure.[6,15–28] Assuming that morbidity and subjective measures are associated with health service use and health expenditure, we investigated the idea that a new index including objective and subjective aspects could be a better predictor of health expenditure than the single measures taken separately. Other studies have tried to build a single score including subjective and objective aspects.[29,30] Fan et al. assessed the mortality prediction performance of a comorbidity index developed combining the weight of patients' diseases with the weight of perceived health.[29] This prognostic index predicted mortality better than the single comorbidity and perceived health measures. Similar results also emerged from a study by Bayliss et al., where a subjective measure of health was incorporated in a comorbidity index derived from disease count.[30] However, studies in this field are relatively few and liable to bias. For example, in the latter two studies, the weight/count of diseases was carried out by patients themselves. This manner of obtaining information could be biased by the ability to remember that can be significantly influenced by a patient's age and education.[31] Information concerning the assessment of an individual's health status should be collected by suitably trained personnel, possibly with medical/nursing training.[32] In an endeavour to make a methodological contribution to this research and overcome some limits of previous studies, we aimed (i) to develop an easy-to-use measure that combines objective and subjective health indicators and (ii) to evaluate its health expenditure predictive capacity.

Methods

We designed a linked cross-sectional study in three phases.[33] In the first phase (conducted in the years 2009–2010), we collected health status information on a sample of general practitioners' (GPs) patients in the Province of Siena (Italy). Perceived health was measured using the SF-36 questionnaire. Objective aspects of health were assessed using the comorbidity indices Charlson Index (CH-I) and Comorbidity Illness Rating Scale (CIRS; Italian versions). To calculate the sample size, we considered a precision of ±2 in SF-36 scores estimation. As in a previous study on the same population (data not published), we obtained a mean SF-36 scores standard deviation (SD) of 24; a required number of 1100 patients ($n = z^{2*}\sigma^2/e^2$) was calculated considering a confidence level of 95% ($z = 1.96$). Estimating 50 patients per GP, we set out to recruit about 22 GPs. We conducted two-stage sampling. First, from the list of all GPs in the province (250), we extracted GPs by a sampling method according to which the probability of being selected was proportional to the number of patients. Because some GPs would decline to participate in the study, we selected a sample 20% larger than required. We then invited the selected GPs, and 20 agreed to take part in the study. Patients attending the general practices were subsequently recruited on a voluntary basis while they were waiting to see the GP. Only patients aged ≥18 years were enrolled in the study. We estimated about 50 patients for each GP, but especially in the case of a GP with less patients, we could not reach this number because although we changed the day of the week of the survey, the patients we found in the GP's waiting room were often the same. By the end of data collection, we had recruited 886 patients (80.5% of the required sample, which is considered a good level of response[34]) from 20 GPs. Medical doctors attending the University of Siena Postgraduate School of Public Health administered SF-36 questionnaires to patients at the general practices. Written informed consent was obtained from patients who accepted to be enrolled. Refusals were not recorded. At the same time, the GPs completed a form to calculate CIRS and CH-I, unaware of the information provided by patients in the interviews.

The SF-36 is a subjective measure that scores eight dimensions from 0 to 100: physical functioning (PF), role limitations due to physical problems (RP) and role limitations due to emotional problems (RE), pain (PN), general health (GH), vitality (VT), social functioning (SF) and mental health (MH). It also produces two synthetic indices: the Physical Component Summary (PCS) that by summarizing PF, RP, PN, and GH scores the physical area of health, and the Mental Component Summary (MCS) that describes the emotional/mental area by summarizing RE, VT, SF, and MH. The questionnaire is widely used and was validated in Italy on a population of about 20,000 persons.[35,36]

The Cumulative Illness Rating Scale Severity Index (CIRS-SI) requires the physician to assess the clinical and functional