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ORIGINAL ARTICLE

A population survival model for breast cancer

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Summary Breast cancer is a major health problem, and disease control depends on an effective healthcare system. A registry-based tool to monitor the quality of breast cancer care could be useful. The aim of this study was to develop a population survival model for breast cancer based on the Nottingham Prognostic Model (NPM). To this end, 1452 cases of breast cancer diagnosed in the Umbria Region, Italy, during the period 1994–1996 were studied. An extensive search for routinely available variants in prognosis and treatment was performed. In about 80% of cases complete information on factors included in the NPM was available. The Cox model was used to assess the prognostic value of study factors. Nodal stage was the most important prognostic factor. In women who did not undergo axillary dissection (17%) the risk of death was twice that in women with no affected nodes, but they received chemotherapy with the same frequency. Radiotherapy was also less frequently used in this group. Grading was a significant prognostic factor only when women over 80 were excluded. Population survival models based on data from cancer registries may provide a tool that can be used to evaluate healthcare systems and the effectiveness of interventions. The inclusion of older women in our models decreased the significance of many established prognostic factors because of the frequency of incomplete evaluation and less aggressive treatment in these patients. Not undergoing surgical axillary dissection was associated with a worse prognosis and with less aggressive treatment.

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Introduction

Randomized clinical trials are the best available methods of evaluating the efficacy of treatments or, more generally, interventions undertaken in cancer patients.[1] However, the results from clinical trials are not automatically transferred to practice, and their validity may vary depending on local conditions.[2] Thus, evaluation of the effectiveness of specific interventions in actual practice and of the performance of an oncological healthcare system is important if the quality of care and outcome for cancer patients are to be improved.

The population survival rate for cancer patients is an indicator produced by cancer registries of the overall quality of oncological care.[3] This indicator has the advantage of being calculated with standardized methods, taking account of all cases diagnosed in a population (i.e., not being subject to selection bias), and being available for many populations and periods. The main limitation of the indicator is that few explanatory variables are routinely accounted for. Thus, further study is necessary to explain the causes of survival differences when they are observed (e.g., among different geographic areas).[4]

In order to disentangle the effects of the many factors influencing survival and to identify modifiable factors, population survival models are being developed.[5] A population survival model requires collection of information on various prognostic factors. The choice of prognostic factors depends on the cancer site studied and the availability of information; that is to say that only prognostic factors routinely determined for most patients and recorded by standard methods in an accessible archive can be used.[6] Since population survival models are designed to monitor the quality of care and to select effective interventions and health organization models, they are mostly useful for frequent and 'healthcare-dependent' cancers.

Breast cancer is the most frequent cancer among girls and women in western countries, and the outcome for patients depends critically on the quality of treatment given and on a timely diagnosis.[7,8] Thus, it seems that a population survival model for breast cancer would be useful, given the social burden in terms of morbidity and mortality and the central role of the health service in disease control. A number of prognostic factors have been proposed for breast cancer, and some (e.g., disease stage, grade, and hormone receptor (HR) status) should be routinely measured.[6,9] One prognostic model for breast cancer, the Nottingham Prognostic Model (NPM), was developed in a clinical setting to produce an individual risk score, the Nottingham Prognostic Index (NPI), and it has been validated repeatedly.[9–12]In Italy, the healthcare system is broken down into Regional Health Systems, which have growing autonomy. The Umbria Region, in Central Italy, was the first Region to establish a cancer registry covering its entire population (820,000 inhabitants). In Umbria, standardized (world) incidence rates increased from 56 in 1978–1982 to 65 per 100,000 in the study period; mortality in 1994–1996 was the same as in the period 1978–1982 (about 17 per 100,000). Improved treatment is the likely explanation for the observed incidence and mortality trends in the absence of a population screening program (which has been started since 1998) and with very limited early detection activities. The overall breast cancer survival rate in Umbria is one of the highest in Italy (relative survival was 0.85 at 5 years for cases with presentation in the period 1994–1996).[13] The available data suggest that the quality of oncological care is rather good in Umbria, as in other Central Italian areas (e.g., Emilia Romagna and Tuscany).[13–15] Registration of detailed prognostic information on all breast cancer cases first seen in Umbria is ongoing (started for cases first seen in 1994), with the aim of developing a cancer registry-based tool for the evaluation of quality of care and of the efficacy of interventions (e.g., breast cancer screening for women aged 50–69 years).

The aim of the present analysis was to build up a population survival model for breast cancer based on the validated NPM. The prognostic significance and impact of incomplete prognostic evaluation and the importance of factors that are available but are not included in the NPM were also explored. More particularly, the prognostic role of not undergoing axillary dissection (incomplete prognostic evaluation) and the validity of established prognostic factors among women >80 years old were investigated.

Patients and methods

We studied the historical cohort consisting of all ($N = 1462$) cases of infiltrating female breast cancer (ICD-IX 174[16]) first diagnosed in the Umbria Region of Italy over the period 1994–1996. All cases were identified from the regional cancer registry, the Registro Tumori Umbro di Popolazione.

After reabstracting the cancer registry files, we performed an extensive search for prognostic factors in all the regional pathology archives, hospital case records and, when available, personal archives maintained by surgeons and oncologists. In addition, after the aforementioned investigation, general practitioners were contacted for informa-

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