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Breast and Prostate Cancer Productivity Costs: A Comparison of the Human Capital Approach and the Friction Cost Approach

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ABSTRACT

Objectives: Productivity costs constitute a substantial proportion of the total societal costs associated with cancer. We compared the results of applying two different analytical methods—the traditional human capital approach (HCA) and the emerging friction cost approach (FCA)—to estimate breast and prostate cancer productivity costs in Ireland in 2008. **Methods:** Data from a survey of breast and prostate cancer patients were combined with population-level survival estimates and a national wage data set to calculate costs of temporary disability (cancer-related work absence), permanent disability (workforce departure, reduced working hours), and premature mortality. **Results:** For breast cancer, productivity costs per person using the HCA were €193,425 and those per person using the FCA were €8,103; for prostate cancer, the comparable estimates were €109,154 and €8,205, respectively. The HCA generated higher costs for younger patients (breast cancer) because of greater lifetime earning potential. In contrast, the FCA resulted in higher productivity costs for older male patients (prostate cancer) commensurate with higher earning capacity over a shorter time period. Reduced working hours postcancer was a key driver of total HCA productivity costs. HCA costs were sensitive to assumptions about discount and growth rates. FCA costs were sensitive to assumptions about the friction period. **Conclusions:** The magnitude of the estimates obtained in this study illustrates the importance of including productivity costs when considering the economic impact of illness. Vastly different results emerge from the application of the HCA and the FCA, and this finding emphasizes the importance of choosing the study perspective carefully and being explicit about assumptions that underpin the methods.

Keywords: burden of illness, cancer, friction cost approach, human capital approach, productivity costs.

Introduction

Cost-of-illness studies aim to describe the economic burden of a disease on society. By providing information on this burden in monetary terms, such studies can identify key cost drivers to aid resource allocation. A holistic approach to cost estimation necessitates the capture of both direct costs and indirect costs. A recent report by the Economist Intelligence Unit [1] derived a global economic cost of US$286 billion for new cancer cases in 2009, 24% of which resulted from productivity losses. Thus, studies that fail to compute indirect costs, particularly productivity losses, may severely underestimate the true opportunity costs of a disease.

Recently, there has been increasing recognition of the impact of cancer on employment and, hence productivity. The global burden of cancer is substantial, with 12.7 million new cases diagnosed in 2008 and 7.6 million cancer deaths [2]. Breast cancer and prostate cancer account for 10.9% and 7.2% of all newly diagnosed cancer cases, respectively. Individuals diagnosed with cancer are less likely to be employed than unaffected individuals [3]. The majority of those diagnosed and who were working at the time of diagnosis have to take some time away from work, typically to undergo treatment or recover from associated side effects [4]. The period of absence ranges from a few weeks to many months [5–7]. Most will return to the workforce but may work reduced hours [8,9]. This may occur by choice, because of a reduction in a survivor's productive capacity or, by employer imposition [10–12]. A proportion never returns to the workforce because of mortality or a decision to substitute work for increased leisure time permanently.

In economic terms, cancer-related productivity losses emanate from morbidity and premature mortality costs. Traditionally, morbidity costs include short-term cancer-related work absences, in addition to permanent absences associated with workforce departure. Premature mortality costs comprise the extra loss of life directly attributed to the disease and the related reduction in potential productive capacity. Despite this relatively straightforward delineation of component parts, the appropriate method to measure and value the productivity costs associated with a disease remains an area of considerable debate [13–17].

The cancer literature to date is dominated by the use of the human capital approach (HCA) [18–23]. This approach encompasses a societal perspective and estimates an individual's contribution to society by applying labor force earnings as a measure of productivity. It assumes full employment in competitive labor markets with minimum transaction costs [24]. Firms are regarded as profit maximizers employing workers until the marginal revenue product of labor equals the wage rate. Under these conditions,

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if a person leaves the labor market, he or she will not be replaced and so an opportunity cost exists until the age of retirement. Critics argue that the neoclassical assumptions underpinning the method are unrealistic [24]. In practice, positive unemployment levels exist and the replacement of workers occurs on an ongoing basis; thus, the approach may overestimate productivity costs.

The friction cost approach (FCA), by contrast, takes an employer's perspective and attempts to measure "actual" rather than "potential" output loss, by assuming that costs relate solely to the period of time necessary to reestablish the initial production level (i.e., the friction period) and workers leaving employment are replaced by unemployed workers at an extremely low opportunity cost [25]. Critics of the FCA [15] argue that it moves away from the axioms underpinning the neoclassical theory of the firm [16]. Furthermore, it assumes that vacancies are filled by previously unemployed individuals either directly or at the end of a chain of vacancies, meaning that the calculation of costs for a single, typically short, friction period may result in underestimation [24].

The primary aim of this study was to extend the current limited evidence base by comparing the results of applying two different analytical methods—the HCA and the FCA—to quantifying the productivity costs of an illness. To illustrate this, we used the example of breast and prostate cancer in Ireland, the most common cancers in females and males, respectively. In contrast to previous productivity cost studies [19,26], we adopted a bottom-up approach based on a survey of breast and prostate cancer patients to facilitate detailed quantification of productivity loss subcomponents.

Material and Methods

This article describes one component of a larger project investigating the financial and economic impact of cancer in Ireland [4]. The current study encompassed both a societal (HCA) and an employer's (FCA) perspective, estimating lifetime productivity costs per patient with newly diagnosed primary invasive breast cancer (*International Statistical Classification of Diseases*, *10th Revision*, code C50) or prostate cancer (*International Statistical Classification of Diseases*, *10th Revision*, code C61) who were working (either employed or self-employed) at the time of diagnosis. Costs are expressed in 2008 values, and presented in euros for breast and prostate cancer separately. In the base-case analysis, future costs were discounted at 4% as recommended for Ireland [27].

Data sources

A postal questionnaire was distributed to breast and prostate cancer survivors during June to October 2008. Full details are provided elsewhere [4]. Briefly, in March 2008, a population-based sample of 1373 survivors was selected from the National Cancer Registry Ireland and invited to complete a questionnaire. Survivors were between 6 months and 2 years since diagnosis and had been treated at 1 of 17 hospitals across the country (14 mixed public/private, 3 private). Employment-focused questions included whether the individual was working at the time of diagnosis, whether he or she took time off work because of cancer, and whether this absence was of a temporary or permanent nature. We also requested hours worked on average pre- and postdiagnosis. We received 740 completed questionnaires, yielding a response rate of 54%. Of these, 358 respondents (250 with breast cancer and 108 with prostate cancer) indicated that they were in some form of employment at the time of diagnosis.

National breast and prostate cancer registration data were used to estimate premature mortality and permanent disability (PD) costs (see below). Several other national sources provided additional data. The Central Statistics Office's "National employment survey 2007" [28] supplied data on gross earnings, stratified by gender and age, while the Central Statistics Office's "Employee skills, training and job vacancies survey 2006" [29] provided job vacancy duration data. Forecasted gross domestic product growth, a proxy for labor productivity growth, was obtained from the "Recovery scenarios for Ireland: an update" published by the Economic and Social Research Institute [30].

Estimation methods

The HCA assumes that an individual produces a stream of output over a lifetime and generated labor earnings reflect productive capacity [24]. Estimation requires applying a relevant wage rate to time foregone from productive activity. We applied gross earnings stratified by age and gender to time estimates. Estimation of the FCA requires a measure of the assumed friction period, an estimate of elasticity of annual labor time versus annual labor productivity (the proportion of reduction in effective labor time resulting from an absence from work, which might be <1 because of, for example, a firm's internal labor reserves), and values for the lost production of employees. We estimated a friction period of 11.3 weeks on the basis of the average vacancy duration in 2006 (7.3 weeks), plus an additional 4 weeks to account for the lagged nature of a job advertisement following permanent absenteeism (2 weeks) and the duration necessary for the uptake of a position following a successful application (2 weeks). The second 2-week period also accounts for the training period necessary for a replacement worker. In the absence of an accurate estimate of the elasticity of annual labor time versus average labor productivity in Ireland, we assumed a base case of 1 and changed this in the sensitivity analysis (see below). Cost due to absence from work was valued by gross earnings stratified by age and gender.

Indirect cost components

Productivity costs were decomposed into four subcomponents: 1) losses arising from temporary disability (TD) due to short-term cancer-related work absences, 2) losses due to PD in the form of workforce departure, 3) losses due to PD in the form of reduced hours, and 4) losses due to premature mortality.

Temporary disability

TD estimates were based on our survey of prostate and breast cancer patients. Following the HCA, we estimated TD as time absent from work for each patient (taken as the product of the number of weeks absent from work and the average number of hours worked per week before diagnosis) multiplied by the age- and gender-adjusted gross earnings, measured before the deduction of tax, Pay Related Social Insurance, and superannuation, payable by organizations to their employees.

Friction costs due to TD were calculated similarly, but with the length of absence restricted to the friction period. Temporary absences that extended beyond this time period were capped at 11.3 weeks. Shorter absences were estimated as fractions of 11.3 weeks following Hutubessy et al. [31]. For example, an absence of 5 weeks incurred a cost of 5/11.3. Following Wieser et al. [32], we applied weights to gross foregone wages as follows: 0.8 for primary education, 1 for secondary education, and 1.2 for tertiary education.

Permanent disability: workforce departure

The percentage of PD cases was based on our patient survey. Under the HCA, workforce departure entails a productivity cost to the economy that lasts until the age of retirement (assumed 65 years of age in the Irish case). Irish wage rate growth was approximated by forecasted gross national product (GNP) growth (a proxy for productivity growth) in the economy at 2.6%. We multiplied age- and gender-adjusted gross earnings by the annual number of hours worked in the prediagnosis period to establish a base 2008