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Performance indicators evaluation of the population-based breast cancer screening programme in Northern Portugal using the European Guidelines

Maria José Bento[a,b,*], Guilherme Gonçalves[a], Ana Aguiar[c], Clara Castro[b], Vitor Veloso[c], Vítor Rodrigues[d,e]

[a] Institute of Biomedical Sciences Abel Salazar, University of Porto, Rua de Jorge Viterbo, n° 228, 4050-313 Porto, Portugal
[b] Epidemiology Unit, Portuguese Oncology Institute, Rua Dr. Antonio Bernardino de Almeida, 4200-072 Porto, Portugal
[c] Portuguese Cancer League – North Branch, Porto Estrada Circunv. 6657, 4200-000 Porto, Portugal
[d] Faculty of Medicine, University of Coimbra, Rua Larga, 3004-504 Coimbra, Portugal
[e] Portuguese Cancer League – Centre Branch, Coimbra Rua Dr. Antonio Jose Almeida 329, 2°-pt 56, 3000-045 Coimbra, Portugal

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ABSTRACT

Objective: To evaluate the first 10 years of operation of the population-based breast cancer screening programme implemented in the Northern Region of Portugal, using selected recommended standard performance indicators.
Methods: Data from women aged 50–69 screened with two-view mammography, biennially, in the period 2000–2009, were included. Main performance indicators were compared with the recommended levels of the European Guidelines.
Results: A total of 202,039 screening examinations were performed, 71,731 (35.5%) in the initial screening and 130,308 (64.5%) in the subsequent screening. Coverage rate by examination reached 74.3% of the target population, in the last period evaluated. Recall rates were 8.1% and 2.4% and cancer detection rates were 4.4/1000 and 2.9/1000 respectively, for initial and subsequent screenings. The breast cancer detection rate, expressed as a multiple of the background expected incidence was 3.1 in initial screen and 2.2 in subsequent screen. The incidence of invasive interval cancers met the desirable recommended levels both the first and second years since last screening examination, in the initial and subsequent screenings. Invasive tumours <15 mm were 50.4% and 53.8% of the invasive cancers detected in initial and subsequent screenings. Less favourable size, grading and biomarkers expression were found in interval cancers compared to screen-detected cancers.
Conclusions: Breast cancer screening programme in the Northern Region of Portugal was well accepted by the population. Most of the performance indicators were consistent with the desirable levels of the European Guidelines, which indicate an effective screening programme. Future research should verify the consistency of some of these results by using updated information from a larger population.

1. Introduction

The main objective of breast cancer screening is to reduce mortality due to the disease. That is achieved by identifying breast cancer at a stage when it is more curable and the probability of the disease being disseminated is smaller [1–4]. Because screening programmes must be operating for many years before breast cancer mortality reduction can be verified, some early surrogate measures are considered valuable indicators of future changes in mortality rates [5]. In 2006, the European Union published the 4th edition of the European Guidelines on Quality Assurance in Breast Cancer Screening and Diagnosis [6] that have been used in the evaluation of specific European programmes [7,8]. A good screening programme is a complex organisation with multiple steps encompassing the entire screening process and, to maintain a high-quality service, it requires continuous supervision and regular reporting of rigorous scientific

* Corresponding author: Institute of Biomedical Sciences Abel Salazar, University of Porto, Rua de Jorge Viterbo, n° 228, 4050-313 Porto, Portugal.
Fax: +351 225084004.
E-mail addresses: mjbento@icbas.up.pt, mjbento@ipoporto.min-saude.pt (M.J. Bento), aggoncalves@icbas.up.pt (G. Gonçalves), anateresaaguiar@netcabo.pt (A. Aguiar), clara.castro@ipoporto.min-saude.pt (C. Castro), presidente.nrnorte@ligacontracancro.pt (V. Veloso), vrodrigues@netcabo.pt (V. Rodrigues).

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studies [4,9,10]. These studies, also contribute with evidence-based knowledge on the risks and benefits of implementing breast cancer screening programmes in populations with diverse health systems and economic constraints [10].

In Portugal, the organized population-based breast cancer screening was initiated in 1990 in the Central Region, conducted by the Portuguese League Against Cancer (*Liga Portuguesa Contra o Cancro*—LPCC) a private, non-profit organization; in the Northern Region an identical programme started in October 1999 [11,12]. The programme is financed by the National Health Service (NHS). It is coordinated by the North Regional Health Administration (of the NHS) and operated by the north branch of LPCC. The organized programme coexists with opportunistic breast cancer screening; data on opportunistic screening is very limited [13].

Northern Portugal is divided into a coastal area which is predominantly urban and much industrialized, and an inland area where agriculture still plays an important role [14]. All residents in Portugal have access to health care provided by the NHS, financed mainly through taxation [15]. In 2013, approximately 98% of the population was registered at the Health Centers [16].

Since the beginning of the programme, quality assurance was considered a priority, in accordance with the European Guidelines [6]. The objective of this study was to evaluate the breast cancer screening programme during the first 10 years of operation, in the Northern Region of Portugal, using some of the standard performance indicators recommended [6].

2. Material and methods

The population-based breast cancer screening implemented from October 1999 to 2009 in the Northern Region of Portugal started in one municipality and gradually expanded to 43 municipalities (mostly rural communities) by the end of 2009. From the start of the programme, and throughout the study period, an individual invitation was sent by post mail with a pre-booked appointment to resident women aged 45–69 years.

As most Portuguese people are registered in their local Health Centers (from NHS), the lists of users enrolled in these Health Centers are very good proxies of a non-existent computerized residents database [13]. Names and addresses of women registered in the local Health Centers were provided to LPCC, who managed the individual invitation process. Additionally, to assure the invitation of the small percentage of women not registered in these lists, information on the screening programme was divulged through advertising, contacts with health professionals and community stakeholders. Mammography was offered free of charge and was performed at one of six mobile units or at one fixed facility. From the beginning screening procedures included bilateral mammography with two-view (craniocaudal, mediolateral oblique), centralized and independently read by two radiologists, with a final reading by a third independent and experienced radiologist, in case of discrepancy. Women with an abnormal screen mammography were recalled and reassessment was carried out by a multidisciplinary team (radiologist, surgeon and pathologist) at a dedicated clinical setting outside the hospital. In addition to mammography, ultrasound and fine needle aspiration cytology were performed, when necessary. Cancer treatment was established according to standardized hospital therapeutic protocols. Screen film mammography was used till mid-2007, and thereafter, computed radiography was performed in all screening units. The screening interval was 24 months.

Data collected within this programme, from the invitation process till the follow-up of cancer cases, were actively gathered and entered in a database centralized at LPCC. Information on individual women was checked for accuracy and completeness, before being introduced in the computer database. Data were organized by initial and subsequent screening; the latter includes regular and irregular screening [6]. For comparability with the European Guidelines, analysis shown here was restricted to women aged 50–69. We did not consider initial exams for women 50–55 if they had undergone testing in the programme in the ages 45–49, to avoid bias in the results. Women enrolled in 1999 were not included in this analysis due to very low figures.

Coverage rate by examination was estimated using the ratio between the number of examinations within the organized screening programme and the number of eligible women during a two-year period [6,8]. Denominator was derived from the census data provided by the office of Statistics Portugal. In the last period of the study, the methodology to individually invite women to attend screening was definitively established. The participation rate [6] was calculated as the proportion of women attending the screening among those who were invited. Coverage rate by invitation was calculated as the ratio between the number of invitations and the number of eligible women [6].

Expected incidence rate in the absence of screening for the period 2000–2009 was defined as the predicted incidence rate of invasive breast cancer based on the trends observed in 1995–1999, from the districts where cancer screening was implemented. Using the database from the population-based North Region Cancer Registry (*Registo Oncológico Regional do Norte*—RORENO), a Poisson regression model was used to calculate the breast cancer incidence for women aged 50–69 and it was estimated as 1.23/1000, with an annual percent increase of 2.1% [6,17].

Interval cancer (IC) was defined as breast cancer diagnosed in a woman who had a screening test, with/without further assessment, which was negative either before the next screening invitation or within a time period equal to a screen interval for women who have reached the upper age limit [6,18]. To evaluate interval cancers, screening data were linked to the RORENO database but their ascertainment was limited to women participating in the screening programme from 2000 to 2007 as the Cancer Registry only had complete information on breast cancer incidence till 2009. The interval cancer rate was calculated as the number of interval cancers divided by the total number of screens within a specified time. To evaluate the proportion of interval cancers related to the background (expected) incidence, the estimates were made for the years 2000–2007 (estimated rate 1.20/1000). Interval cancers were divided in two groups according to time (in months) since screening examination [6]: 0–11 and 12–23. Radiological review of last screening/assessment imaging and diagnostic mammography of the interval cancer was not performed. Information on the maximum dimension of invasive tumour and expression of biomarkers as oestrogen (ER) and progesterone (PR) receptors and human epidermal growth factor receptor 2 (HER2) were gathered from the pathology reports.

Results are given in numbers, proportions and rates. Calculated parameters are displayed by two-year periods, from 2000 to 2009. As the implementation of the programme was gradual, not all the municipalities contributed with the same number of screening rounds. In the 2000–2001 period of evaluation 8 municipalities were covered, and in the next 4 periods 19, 32, 36 and 43 municipalities were included, respectively. Performance indicators used in this evaluation were: coverage rate by examination, recall rate, cancer detection rate, positive predictive value (PPV), ratio benign/malignant, interval cancer rate, tumour maximum dimension and tumour grade, which were calculated using the recommended standard definitions [6].

3. Results

From 2000 to 2009, a total of 202,039 screening examinations were performed, 71,731 (35.5%) in the initial screening and 130,308