Journal of Cancer Policy 16 (2018) 43–48

Contents lists available at ScienceDirect

Journal of Cancer Policy

journal homepage: www.elsevier.com/locate/jcpo

Trends in mammography use in the Brazilian public healthcare system

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ARTICLE INFO

Keywords:
Breast cancer
Mammography
Early detection
Breast screening rates
BI-RADS
Brazil

ABSTRACT

Background: Although breast cancer mortality rates are declining in many developed countries, recent trends in Brazil reveal increasing mortality rates. As mammography is an important tool in the early diagnosis and improved prognosis for breast cancer, we aimed to explore recent trends of mammography in the Brazilian public healthcare system (SUS).

Methods: We extracted a range of data from the DATASUS and SISMAMA online databases for the period 2010–2013, for Brazil and all of its regions, to explore patterns and trends in mammography within SUS across Brazil.

Results: On average, over 2010–2013, 18% and 14% of SUS-dependent Brazilian women aged 50–59 and 60–69 years respectively, were given a screening mammogram. Screening and diagnostic mammograms were recorded for females outside of this age range. The South and South-East had greater rates of screening and diagnostic mammograms respectively, than other regions. Most screening and diagnostic mammograms were categorised as BI-RADS category 1 ('negative') or 2 ('benign'). There was an average annual increase in numbers of machines in use, machines available to SUS and machine usage within SUS in each region.

Conclusions: Screening mammography rates were much lower than recommended in target age groups for mammography in Brazil and both types of mammograms were recorded for women younger than usually recommended. More appropriate use of mammography and better use of resources, will likely improve the outcomes of breast cancer in Brazilian women in a country with wide socio-economic differences, as well as minimise the potential risks associated with mammography in younger women.

1. Introduction

In Brazil, there were an estimated 67,316 new cases of [1] and 13,591 deaths from [2] female breast cancer in 2012, corresponding to standardised incidence and mortality rates of 59.5 and 12.0 per 100,000 respectively [1,2]. As Brazil continues to move through the demographic transition and its ageing population grows [3], the burden of breast cancer in Brazilian women is predicted to increase over time [1].

Breast cancer incidence rates are reported to be higher in the more developed regions (South-East and South), compared to the less developed regions (North and North-East) of Brazil [4]. Although many countries in Northern and Western Europe are also experiencing increasing breast cancer incidence, mortality rates from the disease are declining [5], highlighting positive developments in its detection and treatment. In comparison, the world standardised mortality rate for breast cancer in Brazil increased from 8.61 to 12.66 per 100,000 women between 1979 and 2013 [2]. Studies exploring trends over time suggest the more developed regions are experiencing a stabilisation or decline in breast cancer mortality, whilst less developed regions are experiencing an increase [6–8].

Brazil's healthcare system has both public and private systems. Approximately 75% of the population depend solely upon the public subsector- the 'Sistema Único de Saúde' (SUS), providing free and universal health coverage to its population [3,9]. The National Institute of Cancer in Brazil (INCA), recommends screening by mammography in women aged 50–69 years at average risk of breast cancer with a maximum of 2 years between mammograms, and annual mammograms in women from 35 years if at high risk for breast cancer [10]. However, Brazil does not have a national breast screening programme and responsibility lies with local health authorities to organise and implement such programmes [11].

As breast cancer mortality rates continue to increase in Brazil, there is a need for information on screening for breast cancer in Brazilian women, particularly in those dependent upon SUS, who are most likely vulnerable to inequalities in the diagnosis and treatment of breast

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https://doi.org/10.1016/j.jcpo.2018.04.002
Received 4 December 2017; Accepted 9 April 2018
Available online 12 April 2018
2213-5383/

cancer. Therefore, this paper aims to explore recent trends and patterns in mammography among SUS-dependent women in Brazil.

2. Methods

The Informatics Department of SUS (Departmento de Informática do SUS, DATASUS) online database holds a wide range of extractable data on healthcare in Brazil [12]. From here, we went on to extract the annual number of mammograms funded by SUS from the Outpatient Information System (Sistema de Informações Ambulatoriais do SUS, SIA/SUS) [13]. Mammograms were classified by clinical indication as either 'screening' or 'diagnostic' examinations which were those conducted in women presenting without or with the signs or symptoms of breast cancer respectively. Specifically, examinations were defined as bilateral screening mammograms (Mamografia Bilateral Para Rastreamento, the examination of both breasts in one woman) or unilateral diagnostic mammograms (Mamografia) [13]. For the latter, the examination of one woman usually results in two recorded approved procedures, as one woman usually gets both breasts examined [14]. Therefore we halved the number of diagnostic mammograms for our analysis. We also extracted mammography machine and population data from DATASUS [12]. Numbers of machines in use (all public and private scanners in operation) and available to SUS (available to use by the public healthcare system) were obtained for each month of the study period and were subsequently averaged by year [15]. Population data were obtained from either census/inter-census estimates [16] or population projections for 2013 [17].

We extracted the annual number of mammograms by mammography result from the SISMAMA database [18]. Mammography results were classified using the 'Breast Imaging Reporting and Data System' (BI-RADS, categories 0–6) developed by The American College of Radiology (ACR) [19]. BI-RADS categories range from category 1- 'negative' to category 5- 'highly suggestive of malignancy' with category 0 indicating an 'incomplete' examination and category 6, a 'known biopsy-proven malignancy' [19].

Data from both databases were restricted to females, for the period 2010–2013, for Brazil and for each of its geographical regions: North, North-East, South-East, South and Mid-West. This study period was chosen as nationwide implementation of SISMAMA occurred in 2009 [20] with likely limited data entry for that year. Data for 2014 were still likely to be entering the system and data for later years were not complete at the time of analysis.

We extracted data for private health insurance coverage for women living in Brazil and its regions (Table 2) from The National Agency of Complementary Healthcare (Agência Nacional de Saúde Suplementar, ANS) website [21] by age and for each year of the study period. Data are updated quarterly and at time of analysis, only data from September of each year were available- which we used [21].

The population of women mainly dependent on SUS was estimated as the proportion of the population within each age band (10–14, 15–19, 20–29, 30–39, 40–49, 50–59, 60–69, 70–79 and ≥80 years) [16,17,21] that did not have private health insurance coverage. The total SUS- dependent population for Brazil and each region was considered as the sum of their respective SUS-dependent populations within each age band.

Crude mammography rates were calculated as the annual number of mammograms per 100,000 SUS dependent women, according to clinical indication, for Brazil and each geographical region for each year of the study period and were subsequently averaged. Age-standardized mammography rates for Brazil's regions were obtained using the 2010 Brazilian SUS-dependent female population as a standard. Rates were calculated by multiplying the crude age-specific mammography rates by the respective proportion of each age group in the standard population which were then summed for each region. We also calculated the average number and proportion of mammograms per BI-RADS category by clinical indication for the period 2010–2013 for Brazil and its geographical regions.

Table 1
Number of mammograms by type for Brazil and its regions, 2010–2013.

Diagnostic mammograms[a]

Region	2010	2011	2012	2013	CAGR[b]
Brazil	230,036.0	196,385.5	190,982.5	187,140.0	−6.6%
North	10,857.0	8,181.0	6,830.0	4,038.5	−28.1%
North-East	40,167.0	37,888.5	40,324.5	34,851.5	−4.6%
South-East	134,786.5	105,353.5	97,804.5	94,388.5	−11.2%
South	32,276.5	32,266.0	34,736.0	36,742.5	4.4%
Mid-West	11,949.0	12,696.5	11,287.5	17,119.0	12.7%

Screening mammograms

Region	2010	2011	2012	2013	CAGR[b]
Brazil	3,039,269	3,560,007	3,979,956	4,287,889	12.2%
North	67,478	81,832	107,503	124,580	22.7%
North-East	562,579	702,567	895,594	942,284	18.8%
South-East	1,569,134	1,840,372	1,987,840	2,166,180	11.3%
South	722,207	807,677	838,976	892,355	7.3%
Mid-West	117,871	127,559	150,043	162,490	11.3%

[a] Half the number of diagnostic mammograms extracted from the SIA database.
[b] CAGR = Compound annual growth rate.

For Brazil and its regions, for each year of the study period, we calculated the number of machines in use per million population of females and machines available to SUS per million SUS-dependent females. Rates of mammograms performed per machine available to SUS were calculated using the annual number of mammograms (both screening and diagnostic) and the number of SUS-available machines.

The compound annual growth rate (CAGR) over the study period was calculated using the following equation: $CAGR = [(N_f/N_i)^{1/(Yf-Yi)}]-1$ [22]

where N_f = Number in final year, N_i = Number in initial year, Y_f = Final year, Y_i = Initial year.

3. Results

Screening mammograms increased and diagnostic mammograms decreased for Brazil from 2010 to 2013 (Table 1). Age standardisation revealed screening mammography rates in the South were 3% greater than in the South-East, but over 3.5 times greater than in the North (Table 2). Diagnostic mammography rates in the South-East were 31% higher than in the South, but over 2.5 times greater than the North (Table 2).

Overall, screening and diagnostic mammography rates were highest in those aged 50–59 years. Both types of mammograms were recorded for women outside of this age range (Table 2). On average, 18% and 14% of SUS-dependent women aged 50–59 and 60–69 years respectively, were given a screening mammogram and less than 1% of 50–59 and 60–69 year old women were given a diagnostic mammogram in Brazil between 2010 and 2013. Most screening and diagnostic mammograms in each region of Brazil were classified as BI-RADS category 1 or 2 (Table 3).

The rate of machines in use and available to SUS as well as machine usage rates are shown in Table 4. All geographic regions experienced an average annual increase in all of these rates.

4. Discussion

Screening and diagnostic mammography rates were highest in 50–59 year olds, but many mammograms were recorded outside of this age range. Age standardisation highlighted regional differences, with the South and South-East having higher rates of mammograms than any other region. Most mammograms were classified as 'negative' or