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Short communication

Comparing the cost of non-metastatic breast cancer care in a low-income *vs* a high-income country: A plea for an optimal allocation of health resources in Sub-Saharan Africa

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ABSTRACT

Breast cancer incidence is rising in low-income countries, but there is limited information regarding health resource allocation for its care. We assessed the cost of care during the first three years after diagnosis in a low-income country (Mozambique; n = 162 women) and compared it with a high-income country (Portugal, n = 703 women). Local currency prices were converted to 2019 international dollars (Int$). In Mozambique, the median cost was lower than in Portugal (2888 *vs* 18,533 Int$, respectively) and did not vary across stage or tumor subtype. These findings may help improving resource allocation for breast cancer care in Sub-Saharan Africa, despite reflecting an underfunding of treatment in this setting.

1. Introduction

Globally, the number of women with breast cancer is increasing, especially in low/middle-income countries [1]. Moreover, the cost of each patient's cancer care has also been rising, due to the availability of new treatments and technologies [2]. In the European Union, breast cancer accounted for the highest cancer-related healthcare costs in 2009 [3] and limited data from developing countries show a rising cost with higher cancer stage [4]. As the case number and the costs of new treatment options for breast cancer increase globally [5], its financial burden will grow worldwide. Hence, estimating this cost is important, particularly in low/middle-income settings, where it is ill-defined, to design public policies on resource allocation.

Therefore, we assessed the cost of care of women with non-metastatic breast cancer during the first three years after diagnosis in a low-income country (Mozambique, Eastern Sub-Saharan Africa), and compared it with a high-income country (Portugal, Southern Europe).

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2. Methods

We used data from women with newly diagnosed non-metastatic breast cancer (stage I-III), enrolled in two prospective cohort studies, the Moza-BC (n = 162 participants) and the NEON-BC (n = 703) cohorts [6–8]. Briefly, the Moza-BC cohort included women diagnosed during 2015–2017 in the three largest hospitals in Mozambique (Maputo, Beira and Nampula Central Hospitals) and followed at the Maputo Central Hospital. The NEON-BC cohort enrolled women in 2012 at the Portuguese Institute of Oncology of Porto, the largest cancer-dedicated hospital in Portugal [9]. Both cohorts collected patients' baseline sociodemographic and clinico-pathological data, diagnostic procedures, and treatments received for at least three years after diagnosis. Treatment decisions were usually based on the European Society for Medical Oncology guidelines [10], though adapted to each country's resources. In both countries, chemotherapy usually consisted of a combined anthracycline-taxane based regimen. Nonetheless, there were occasional treatment interruptions/adjustments in Mozambique due to drug supply shortages. Radiotherapy, trastuzumab and aromatase inhibitors were not available at the Maputo Central Hospital, but some Mozambican patients (n = 9 [6%]) received radiotherapy outside the country.

Staging was defined by the AJCC TNM 7th edition classification [11] and tumors were classified into the classic subtype definition of hormone receptor (HR)-positive/HER2-negative, HER2-positive and triple-negative (HR-negative/HER2-negative) [12,13].

In the Portuguese cohort, healthcare costs were provided in Euros, as previously reported [7]. In Mozambique, healthcare costs were given by the Maputo Central Hospital and/or retrieved from the World Health Organization-CHOICE estimates [14].

In both cohorts, costs of care during the first three years after diagnosis were computed for each individual patient. To improve the comparability between these two countries, with different economic backgrounds and discrepancies in the cost of healthcare components, local currency prices were then converted to 2019 international dollars (Int$) using purchasing power parity exchange rates for household consumption [15]. This indicator, retrieved from the World Bank, measures the amount of local currency units required to buy the same amounts of goods and services in the domestic market as US dollars would buy in the United States.

2.1. Statistical analysis

Baseline clinico-pathological characteristics and healthcare costs were compared between the two cohorts using the chi-square test and the Wilcoxon rank-sum test, respectively. All tests were two-sided and a p-value of <0.05 was considered significant.

3. Results and discussion

Patients from Mozambique were younger and presented with a higher stage at diagnosis compared to Portuguese women (68% *vs* 15% with stage III, respectively) – Supplemental Table 1.

The median cost of care was 18,533 Int$ *vs* 2888 Int$ among Portuguese and Mozambican patients, respectively – Fig. 1. Among Portuguese women, the median cost of care rose with increasing stage (from 14,831 Int$ in stage I to 24,159 Int$ in stage III), but was stable in Mozambique. There was a great disparity in the cost of care in Portugal according to tumor subtypes, with a median value of 66,811 Int$/patient with a HER2-positive tumor, which was mostly due to the use of trastuzumab. The cost of treatment did not vary across subtypes in Mozambique, as trastuzumab is unavailable.

Regarding the proportion of resources allocated to each component of care, nearly half of Mozambican resources were used in medical tests and only 22% in systemic therapy – Fig. 2. In Portugal, systemic therapy accounted for 35%, while medical tests for 11% of the healthcare cost, with variations across subtypes. Overall, surgery had a similar "weight" in Portugal and Mozambique (17% and 18% of the total cost, respectively). Additional data regarding healthcare costs according to subtypes and stage is available in Supplemental Tables 2 and 3.

This comparison brought three major findings. First, the median cost of care is six-fold higher in Portugal compared to Mozambique, even though both countries have universal health coverage and prices were normalized by using Int$. Second, stage and subtypes led to significant cost differences in the high-income country (as expected) [4,7], but they had virtually no impact in health resource allocation in the low-income country. Third, there was a disproportionate weight of medical tests among the resources spent in Mozambique, which may be due to the high cost of reagents and other lab materials in Africa [16].

These findings reflect the difficulties in the regular assessment of tumor subtypes and the low access to radiotherapy and targeted agents in Mozambique, which impair the adequacy of care according to the patient's stage and breast tumor subtype. Ultimately, they reflect the underfunding of breast cancer care on the "treatment side" in this low-income setting. The likely cost impact of stage migration (stage III to stage IV), due to under-staging in Mozambique, is probably balanced by the limited treatment options for metastatic breast cancer, which do not meaningfully

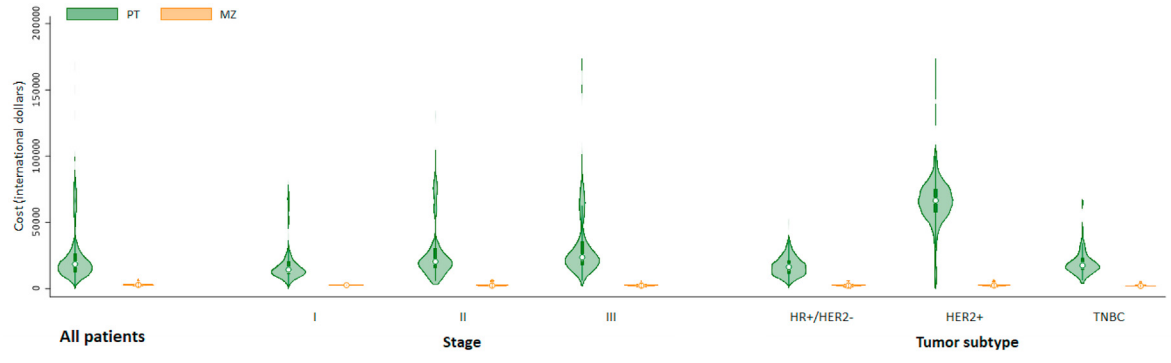
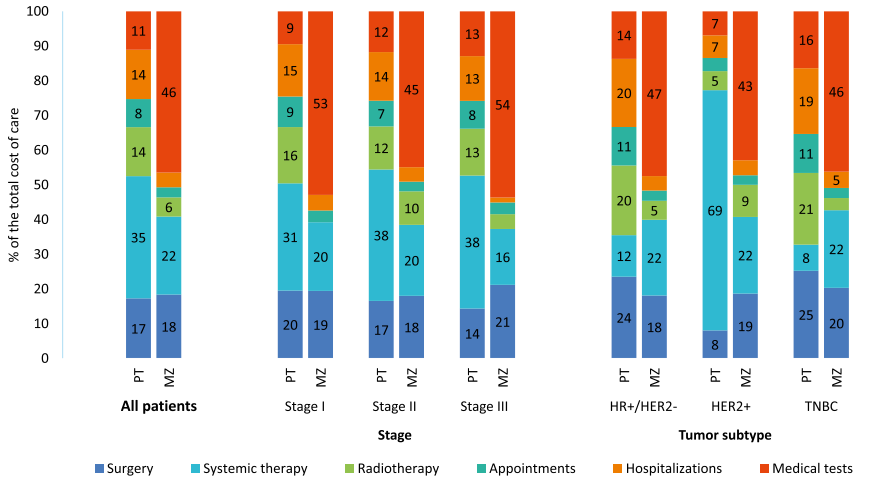


Fig. 1. Distribution of the total cost of non-metastatic breast cancer care during the first three years after diagnosis in 2019 international dollars for all patients, by stage and by tumor subtypes, among patients from Portugal (PT) and Mozambique (MZ).



"Systemic therapy" includes chemotherapy, targeted therapy, hormone therapy and day hospital use. "Medical tests" includes laboratory and pathology tests, blood transfusions, imaging and genetic testing. When the proportion of the median cost of a certain item was <5% of the overall cost, the respective label was deleted from the figure. HR: hormone receptor; TNBC: triple negative breast cancer.

Fig. 2. Proportion (%) of the total cost attributed to each component of care among all patients, by stage and by tumors subtypes, among patients from Portugal (PT) and from Mozambique (MZ).

influence the overall cost of care.

To the best of our knowledge, this is the first comprehensive assessment of health resources use and cost of care of patients with non-metastatic breast cancer in a Sub-Saharan African country. Despite the still small share of cancer in the global disease burden in Sub-Saharan Africa and the existence of competing priorities from communicable diseases (now also including COVID-19), we should keep in mind that breast cancer incidence is rapidly rising in the continent [17]. Thus, we hope that these real-world data can be used for economic evaluations of new treatment options and to improve resource allocation for breast cancer care in this region. This is especially relevant given that allocating the adequate resources for an affordable and effective treatment of non-metastatic breast cancer is key to improve the survival outcomes of these women.

Ethics Committee approval

The NEON-BC cohort study was approved by the Ethics Committee of the Portuguese Institute of Oncology of Porto (IPO-Porto; ref. CES 406/011 and CES 99/014) and by the Portuguese Data Protection Authority (ref. 9469/2012 and 8601/2014). The Moza-BC cohort study was approved by the National Health Bioethical Committee of Mozambique (ref. 226/CNBS/15). In both studies, all participants provided written informed consent.

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Data statement

The datasets generated and analysed during the current study are not publicly available given that the included patients did not specifically provide their consent for public sharing of their data. Additionally, even if possible, anonymization is partially impaired by the fact that patients in each cohort were treated in the same institution and diagnosed within a restricted period of time, with some of the groups being small. Nonetheless, data are available from the corresponding author on reasonable request.

Authors' contributions

Conceptualization: MB, AG, SP, CC, NL. Data curation: MB, AG, CC. Formal analysis: SM. Investigation and methodology: all authors. Supervision: NL. Writing – original draft: MB. Writing – review & editing: all authors.

Declaration of competing interest

MB: travel grant and speaker honorarium from Roche/GNE; all other authors: no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.breast.2021.02.010.

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