PriMera Scientific
Medicine and Public Health
Volume 6 Issue 6 June 2025
ISSN: 2833-5627

Direct non-medical costs of breast cancer treatment at the Joliot Curie Institute of Aristide Le Dantec Hospital in Dakar, Senegal

Type: Thesis
Received: May 02, 2025
Published: June 04, 2025

Citation:
Mory DIALLO., et al. "Direct non-medical costs of breast cancer treatment at the Joliot Curie Institute of Aristide Le Dantec Hospital in Dakar, Senegal". PriMera Scientific Medicine and Public Health 6.6 (2025): 12-26.

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Abstract

Introduction: In 2022, the incidence of breast cancer amounted to 2,296,840 cases worldwide, including 198,553 in Africa and 1,838 cases in Senegal. However, the direct non-medical costs of treating cancer in general are not known in Senegal. For a better allocation of resources, it is important to estimate their costs. The objective of this article is to analyze the direct non-medical costs of breast cancer treatment at the Joliot Curie Institute in Dakar.

Methods: This is a retrospective study conducted on patients diagnosed with breast cancer between January and December 2017 at the Joliot Curie Institute. A questionnaire survey and semi-structured interviews were conducted with sick people and their relatives to reconstruct the direct non-medical cost.

Results: The estimated average direct non-medical cost of breast cancer treatment at Joliot Curie Institute is 2,844,731 FCFA ($4,559.79) with a minimum of 359,650 FCFA ($576.48) and a maximum of 7,110,584 FCFA ($11,397.48) over an average duration of 31 months. In addition, the analysis of this average direct non-medical cost reveals that it is made up of 63.45% of the cost of housing; 22.48% of the cost of food and 12.27% of the cost of transportation. The reduction of sequelae related to treatment constitutes only 1.8%.

Conclusion: The direct non-medical cost of breast cancer treatment is very high in Senegal. The non-medical direct cost of the maximum treatment is 7,110,584 FCFA ($11,397.48) and the minimum is 359,650 FCFA ($576.48), i.e. an average cost of 2,844,731 FCFA ($4,559.79)[1].

Keywords: Direct non-medical costs; breast cancer; breast cancer treatment; Joliot Curie Institute; Senegal

Introduction

The incidence of cancer worldwide amounted to 19,976,499 cases in 2022 according to estimates by the International Agency for Research on Cancer. These data reveal that 22.80% of cancer cases have been diagnosed in the European continent; 49.26% in Asia; 13.25% in North America; 7.62% in Latin America; 5.75% in Africa and 1.32% in Oceania. Cancers are the second leading cause of death, accounting for nearly one in six deaths and (CIRC, 2022) 9,743,832 cases deaths in 2022 alone in the world. (CIRC, 2022).

In 2022, the incidence of breast cancer was 2 296 840 cases worldwide with 666,103 deaths. In Africa, it was estimated at 198 553 cases with 91,252 deaths. Senegal, for its part, has counted 1,838 cases with 976 deaths over the same period. (CIRC, 2022).

Mortality is quite high in Africa, certainly because of limited access to care, but also because of a delay in consultations. Indeed, it is found that 46% of people diagnosed with breast cancer in Africa in 2022 lost their lives. (CIRC, 2022).

The incidence of breast cancer is increasing in sub-Saharan Africa and early diagnosis efforts have not been very satisfactory because the public is not very familiar with the disease. Most cases of breast cancer are diagnosed late and mainly in rural areas. In sub-Saharan Africa, the challenges of accurately identifying cancer cases and counting the population at risk make it difficult to obtain data that reflect reality. The non-availability of the real incidence of cancers would not facilitate a determination of the cost of managing these diseases. An understanding of the cost elements of common diseases is a necessary step to ensure optimal use of increasingly limited health resources.(Dinah A Tetteh, 2016) (Dinah A Tetteh, 2016) (Will BP, 2000).

In most sub-Saharan African countries, cancer treatment is not covered by national health insurance programs, which forces patients to bear in addition to direct medical costs, non-medical direct costs (cost of transport, cost of housing, cost of mitigating the after-effects of treatment, etc.).

Cancer affects all levels of society (young and old, rich and poor, men, women and children). This pathology, associated with heavy treatments, causing suffering and sometimes death, leads to a loss of usefulness for sick people and their loved ones, and therefore a loss of social utility. Thus, a sick person may be forced to stop working temporarily or permanently, which has an impact on the country's production depending on the person's productivity and the state of the labour market.

In addition, all the care provided to people with cancer is very important, due to the heavy treatment, surgery, radiotherapy, chemotherapy, check-ups, etc.

In addition, in developing countries such as Senegal, health structures are very poorly distributed across the country. In general, rural areas have little health infrastructure. In Senegal, the reference health structures in the treatment of chronic diseases in general and cancers in particular are all located in large cities, particularly in Dakar. Thus, most patients are forced to travel to Dakar for treatment. Given the duration of the treatment, patients and their companions are required to reside in Dakar or to travel many trips back and forth between their localities of residence and Dakar. This leads to expenses related to transport, housing, food, etc.

The question then arises on a recurring basis as to how much is the average direct non-medical cost at the end of a sick person's treatment?

Thus, in France, the median non-direct medical cost (purchase of a wig, transport, bra for prosthesis, etc.) is estimated at €614 per patient per year (€10 -16,909). (Delphine Héquet, 2019).

The average annual non-medical direct costs per household equivalent in Germany, Spain and Greece are around €13,300, €11,100 and €7,800 respectively.

For the Netherlands and the United Kingdom, the average non-medical direct costs by age are around €10,000 and €12,200 respectively. (Hamraz Mokri, 2022).

However, to our knowledge, no study has yet attempted to estimate the direct non-medical costs of cancer care in Senegal. Given that the direct non-medical costs of cancer treatment are not known, it would be important to estimate and identify the mechanisms for sharing these costs for equitable access to care for patients.

Thus, the objective of this article is to analyze the direct non-medical costs of breast cancer treatment diagnosed at the Joliot Curie Institute of the Aristide Le Dantec Hospital in Dakar.

Faced with the multiplicity of public and private health structures potentially having an activity related to oncology, it was decided to involve only the Joliot Curie Institute, which is the reference for cancer care in Senegal. The Joliot Curie Institute of the Aristide Le Dantec Hospital is a public institute with a triple vocation: care, teaching and research.

In addition, a better knowledge of the direct non-medical costs of breast cancer treatment at the Joliot Curie Institute in Dakar could represent an important factor in the improvement of public health policy.

Methods

The research began with an exploration phase, which consisted of observation visits by attending consultations with attending doctors' consultations, chemotherapy sessions, and making appointments for patients. This phase made it possible to better contextualize the study and to understand the field. It was also used to interview oncology resource persons. These interviews with professionals were carried out in accordance with the minimum number of at least one interview per specialty. It was a question of having the widest possible range of professionals by not aiming for saturation but for complementarity of interviews.

Study population

The study targets patients diagnosed at the Joliot Curie Institute in Dakar with breast cancer between January 1 and December 31, 2017.

The following specific criteria for patient inclusion have been defined:

- Have been diagnosed with breast cancer between January and December 2017 at the Joliot Curie Institute of the Aristide Le Dantec Hospital in Dakar;
- Have a follow-up medical file with a telephone number at the Joliot Curie Institute;
- Reside in Senegal during the study period;
- Have a state of physical and mental health that the relatives consider suitable for participating in the study;
- Agree to participate in the study.

Taking these criteria into account, 50 patients were selected for the study.

The study protocol was approved by the Ethics Review Committee of the Cheikh Anta Diop University in Dakar.

Also, criteria have been defined for the choice of companions for those who have them. Must:

- Reside in the same plot or neighborhood as the patient;
- To be the person who has accompanied the patient the most to the health structure;
- Reside in Senegal during the study period;
- Be designated by the patient as the main companion;
- Agree to participate in the study.

On the basis of these criteria, we were able to have 34 companions for breast cancer.

An information sheet was provided to all participants and consent was obtained from each participant. They were administered a questionnaire to collect expenditure data in order to estimate the direct non-medical cost of breast cancer management over the entire treatment period.

Sampling technique

Interest-based sampling was used. Thus, Figure 1 below shows the approach that was taken.

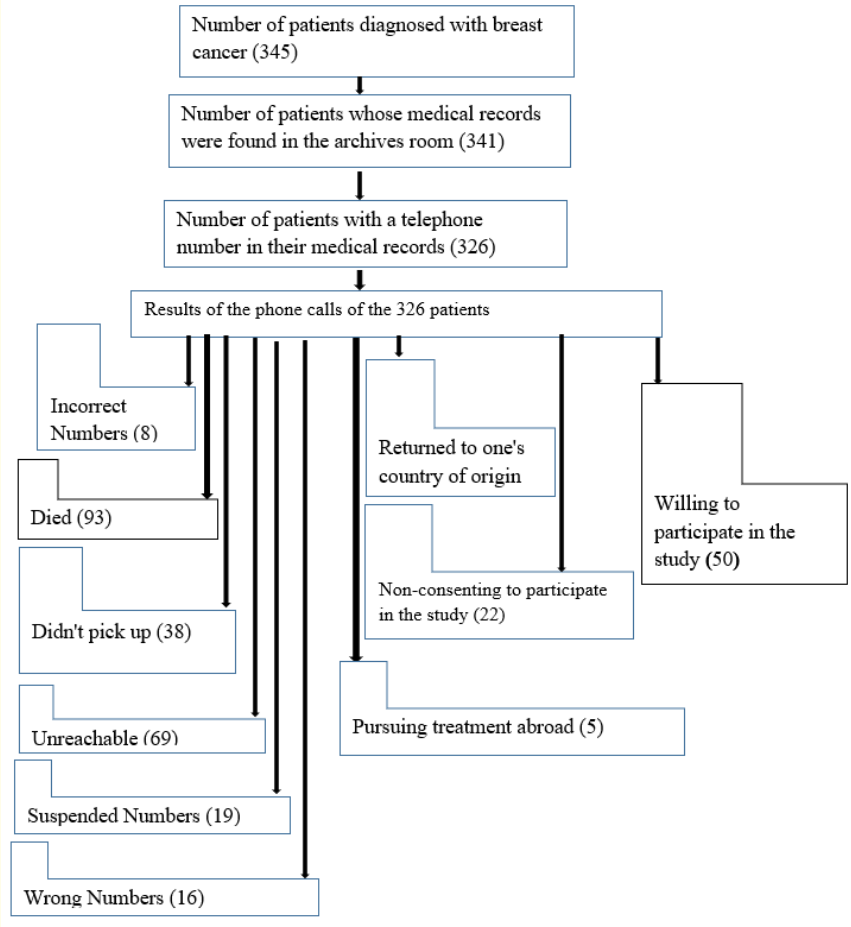

Figure 1: Sampling Process.

Thus, a total of 15.3% of patients whose medical records have a telephone number were included in the study.

Data collection

Data collection lasted 9 months. It took place between December 09, 2019 and August 29, 2020. The spread of the collection period over this period is justified for two reasons:

The first is due to the fact that some patients live outside the Dakar region. Due to the lack of resources to regularly meet patients in the regions, it was necessary to take advantage of their appointments at the Joliot Curie Institute. It is on this occasion that an appointment is made at the patient's home in Dakar for the administration of the questionnaire.

The second reason is due to the coronavirus pandemic, which has blocked patients in the regions for the entire period of the state of health emergency.

The majority of patients were interviewed at home in order to respect confidentiality. At this level, the questionnaire was administered in the presence of each patient's main caregiver in order to facilitate the reconstruction of the expenses incurred in the context of the treatment. Exceptionally, some patients have been surveyed at the Joliot Curie Institute at their request. To this end, arrangements have been made for the administration of the questionnaire in compliance with confidentiality criteria. The questionnaire was administered on paper designed with the Sphinx plus2 (V5) software.

Processing and analysis

This phase was carried out with the use of data processing and analysis software. These include Excel and SPSS[2], which respectively made it possible to analyse, calculate costs and analyse the key variables of the study. The descriptive analysis made it possible to identify the statistical parameters including the average, the minimum and the maximum. To facilitate the comparison of costs, the amounts in FCFA have been converted into US dollars with an exchange rate of 1 FCFA = 0.0017 USD as of March 16, 2025 at 1:30 p.m[3].

The following equation was used to calculate the non-medical direct cost.

$$\mathbf{CDNM = Ctr + Cn + Chb + Cml + Casq}$$

CDNM: Non-Medical Direct Cost.
Ctr: Transport Cost.
Cn: Cost of Food.
Chb: Cost of housing.
Cml: Disease-Related Housing Modification Cost.
Casq: Cost of mitigating treatment-related sequelae.

Results

Sociodemographic characteristics of the patients in the sample

Age and level of education

Of the 50 respondents, 14% declare an age between 25 and 34 years old. However, 18% of patients are aged 60 and over. The most represented age group is between 35 and 59 years old with 68%. The average age of the patients surveyed is 48 years with a minimum of 25 years and a maximum of 71 years. The following Table 1 shows the distribution of patients by age group.

Age group	*Actual*	*Percentage*
25 - 45 years old	19	38%
46 - 50 years	14	28%
51- 60 years old	10	20%
61 years and older	7	14%
Total	50	100%

Table 1: Distribution of patients by age group.

Observation of the distribution according to level of education shows that 48% of patients report having no level of education. Similarly, 30% of patients reveal that they have a primary level of education. Middle and secondary education represent 12% and 6% of respondents respectively. Only 4% of patients have the higher level of education. Thus, the following figure 2 presents the distribution of patients according to their level of education.

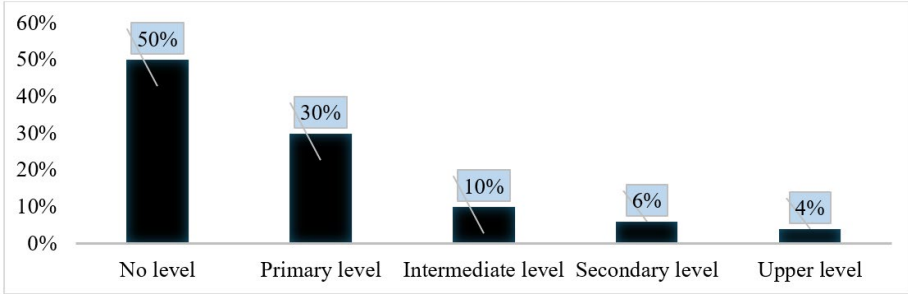

Figure 2: Distribution of patients by level of education.

Occupation and marital status

For the distribution of patients by profession, female shopkeepers represent 30% of the sample. They are followed by housewives who represent 18%. Housewives and restaurateurs each account for 10%. Seamstresses make up 8% of the sample. Other professions are also represented at 24%. They are teachers, farmers, midwives, nurses, computer scientists, students...

The distribution of patients according to marital status reveals that the majority of them are married, with 70% of the respondents. Of these brides, 58% are in a monogamous couple; 8% are in a duorange pair and 4% are in a polyrange pair. Widows make up 16%. Divorced and single women each account for 6%. Separated women make up 2% of the people surveyed.

Place of residence and income level

The distribution of the sample by place of residence reveals that most of the patients reside in the Dakar region, with 52% of the people surveyed. More specifically, these 52% are spread over the four departments: Dakar (10%), Rufisque (10%), Guédiéwaye (12%) and Pikine (20%). Patients from the Thiés region amount to 16%. Those from the Diourbel and Saint-Louis regions represent 10% and 6% respectively. The least represented regions are Kolda, Louga and Kaolack, which respectively account for 4%; 4% and 2% of the sample. A small proportion of patients come from other administrative regions of the country (Ziguinchor and Sédhiou).

Of the 50 patients surveyed, 39 answered the income question, i.e. 78% of those surveyed. Of these patients, 36% say they have an average of less than 60,000 CFA francs ($95.85) per month. Patients with an income between 60,000 and 120,000 CFA francs ($95.85 - $191.71) represent 38%. Respondents who declare an income level greater than or equal to 180,000 CFA francs ($287.60) represent 23%. The least represented income bracket is between 120,000 and 180,000 CFA francs ($191.71 - $287.60) and with 3% of the people surveyed. In addition, the following Figure 3 presents patients by their average monthly income bracket.

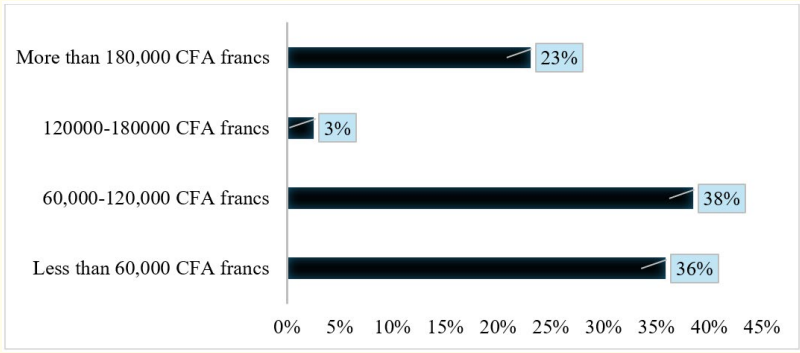

Figure 3: Distribution of patients by reported monthly income.

Type of treatment, duration of treatment and stage of the disease

The description of the treatment of the patients notes that chemotherapy and surgery predominate with 48%, followed by chemotherapy, radiotherapy and surgery with 30%. More than a quarter of the treatment protocol received by patients is done with chemotherapy, i.e. 16%. It should be noted that chemotherapy and radiotherapy, as well as surgery, do not exceed 6% of the sample. In fact, Figure 4 below summarizes the distribution of patients by type of treatment.

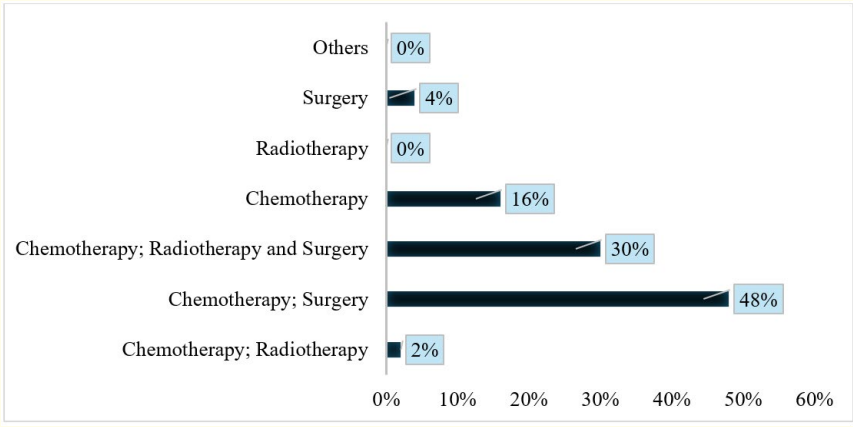

Figure 4: Distribution of patients by type of treatment.

Analysis of the duration of treatment of patients reveals that 50% have followed a treatment of 31 months or more. Patients with a treatment duration of between 23 and 30 months make up 50% of the sample. The average duration of treatment for patients is 31 months with a minimum of 23 months and a maximum of 47 months. In the medical records of the 50 patients surveyed, only 47 had information on the stage of the disease. The majority of those surveyed have stage II cancer with 62% of the sample. Stages I and III each account for 19% of respondents. We note the absence of stage IV patients in the sample.

Direct non-medical costs of breast cancer treatment at the Joliot Curie Institute in Dakar

Direct non-medical costs include the cost of housing, transportation, food, habitat development, and mitigation of treatment-related sequelae.

Cost of transportation

The cost of transportation consists of intercity transportation, transportation during chemotherapy, transportation during radiotherapy, transportation during dressing, transportation during other phases of treatment, and the average cost of transportation during the entire treatment.

Cost of intercity transport: the analysis of the means of intercity transport reveals that 62% of patients who reside outside the Dakar region have used buses. In addition, 15% used shared taxis, 7% used minibuses and 4% used 7-seater vehicles. In addition, 13% used other means of transport (plane, family car, etc.). The average cost of intercity transport is estimated at 142,022 FCFA ($235.78) with a minimum of 12,000 FCFA ($19.92) and a maximum of 375,000 FCFA ($622.56).

Cost of transport during chemotherapy: the data analysis reveals that the average cost of transport during chemotherapy is estimated at 49,516 FCFA ($82.20) with a minimum of 2,450 FCFA ($4.07) and a maximum of 168,000 FCFA ($278.9).

Cost of transport during radiotherapy: for radiotherapy-related transport, patients spent an average of 1,01,039 FCFA ($167.74) with a minimum of 10,000 FCFA ($16.60) and a maximum of 700,000 FCFA ($1,162.1).

Cost of transport during dressing: The average cost of transport for dressing patients who have undergone surgery is estimated at 16,835 FCFA ($27.95) with a minimum of 9,000 FCFA ($1.49) and a maximum of 75,000 FCFA ($124.51).

Cost of transport during the other phases of treatment: During the other phases of treatment, the average cost of transport is estimated at 39,124 FCFA ($64.95) with a minimum of 3,200 FCFA ($5.31) and a maximum of 280,000 FCFA ($464.84).

Average cost of transport during the entire treatment: The average cost of transport during the entire treatment is estimated at 348,536 FCFA ($578.62) with a minimum of 28,550 FCFA ($47.40) and a maximum of 1,598,000 FCFA ($2,652.91). Thus, the following table summarizes the minimum, average and maximum costs of transporting patients throughout the duration of the treatment.

Treatment phases	***Minimum***	***Medium***	***Maximum***
Intercity Transportation	12 000	142 022	375 000
Chemotherapy transport	2 450	49 516	168 000
Transport radiotherapy	10 000	101 039	700 000
Dressing transport	900	16 835	75 000
Transport of other phases of treatment	3 200	39 124	280 000
Transportation cost during the entire treatment	28 550	348 536	1 598 000

Table 2: Minimum, average and maximum costs of patient transport throughout the duration of treatment.

Cost of food

In this analysis, food consists mainly of breakfast in the hospital, lunch and the hygienic and dietetic diet adopted by the sick person.

Cost of breakfast in hospital: The average cost of breakfast for the duration of treatment is estimated at 395,200 FCFA ($656.09) with a minimum of 14,100 FCFA ($23.41) and a maximum of 422,084 FCFA ($700.72). However, it should be noted that this cost related to breakfast in the hospital is very underestimated. This is due to the fact that the majority of patients do not eat breakfast in the hospital. Some have breakfast at home before coming to the hospital, others wait until they get home to have breakfast. In addition, there are also patients who use the rest of the previous night's dinner as breakfast.

Cost of lunch in the hospital: usually patients wait until they get home to have lunch. However, a very small proportion of patients eat breakfast in hospital. For the few patients who eat meals in the hospital, the average cost is estimated at 6,000 FCFA ($9.96) with a

minimum of 6000 FCFA and a maximum of 6,000 FCFA.

Cost of the hygienic diet: The average cost of the hygienic diet is estimated at 238,132 FCFA ($395.33) with a minimum of 15,000 FCFA ($24.90) and a maximum of 1,350,000 FCFA ($2,241.2).

Average cost of food: The average cost of food is estimated at 639,382 FCFA ($1061.47) with a minimum of 35,100 FCFA ($58.27) and a maximum of 1,778,084 FCFA ($2,951.88) for the duration of treatment. However, it should be noted that this cost is also underestimated because it only takes into account the expenses incurred in the hospital and those related to the hygienic and dietary diet.

Analysis of the distribution of the average cost of food reveals that it consists of 99% of hospital breakfast and the hygienic diet. Lunch in the hospital represents only 1% of the average cost of food.

Cost of housing

The cost of housing is made up of the cost of renting a room or apartment, installation costs (mattress, pad, chairs, sheets, etc.) and water and electricity service costs.

The results reveal that the average cost of the lease is estimated at 1,585,000 CFA francs ($2,631.33) with a minimum of 200,000 CFA francs ($332.03) and a maximum of 2,970,000 CFA francs ($4,930.63) over an average period of 13 months. As for installation costs, the average cost of installation costs is 220,000 FCFA ($365.23) with a minimum of 90,000 FCFA ($149.41) and a maximum of 350,000 FCFA ($581.05). Thus, the average cost of housing is estimated at 1,805,000 CFA francs ($3,005.55) with a minimum of 290,000 CFA francs ($482.87) and a maximum of 3,320,000 CFA francs ($5,528.21).

Cost of mitigating treatment-related sequelae

The cost of mitigating the after-effects of the treatment is made up of expenses relating to physiotherapy sessions, shea butter and the purchase of compresses for the arm next to the breast that has undergone surgery, which very often tends to swell. Thus, the average cost of alleviating treatment-related sequelae is estimated at 51,813 CFA francs ($86.28) with a minimum of 6,000 CFA francs ($9.99) and a maximum of 414,500 CFA francs ($690.19).

Treatment-related home modification cost

It should be noted that none of the patients investigated revealed that they had incurred expenses related to the development of the habitat due to the disease. These changes are generally related to the construction or renovation of internal toilets for patients. This type of cost generally concerns patients who very often experience urinary difficulties.

Non-medical direct cost

The average direct non-medical cost consists of the cost of housing, food, accommodation related to the disease and the mitigation of treatment-related sequelae. The total non-medical direct cost is estimated at 22,437,725 CFA francs ($37,361.61) with an average of 2,844,731 CFA francs ($4,736.83); a minimum of 359,650 FCFA ($598.87) and a maximum of 7,110,584 FCFA ($11,840.01) over an average duration of 35 months of treatment.

In addition, the analysis of this average direct non-medical cost reveals that it is made up of 63.45% of the cost of housing; 22.48% of the cost of food and 12.27% of the cost of transportation. The reduction of treatment-related sequelae constitutes only 1.8%. In addition, it should be noted that this large proportion of the cost of housing in the average direct non-medical cost is a major concern for non-state actors in the fight against cancer in Senegal. Thus, whether it is the Senegalese League for the Fight against Cancer or the Soutoura Association, they have all included in their prospects the construction of a house for patients and companions who do not live in the Dakar region.

Cost Type	*Breast Cancer*		
	Minimum	*Medium*	*Maximum*
Cost of housing	290 000	1 805 000	3 320 000
Transportation Cost	28 550	348 536	1 598 000
Cost of food	35 100	639 382	1 778 084
Disease-related home development costs	0	0	0
Cost, measures, mitigation of treatment-related sequelae	6 000	51 813	414 500
Total	359 650	2 844 731	7 110 584

Table 3: Average, minimum and maximum direct non-medical costs in FCFA.

Discussion

Socio-demographic characteristics

The analysis reveals a fairly significant proportion of patients who have reached retirement age (which is 60 years old in Senegal except for a few professionals) with 14% of the sample. This proportion may have difficulty meeting the costs associated with direct non-medical costs. This category of patients could therefore go to hospital late and would be likely to use other less expensive care. The average age of patients is 48 years. This average age is higher than those of; who found 43 and 42 respectively. The study by Madiéye et al, found in another series a median age of 29.5 years. This difference in average age with that obtained in this study would be linked to the fact that Madiéye et al, had chosen to work exclusively on patients under 35 years of age. Likewise (Madiéye et al, 2016) (Sarré B, 2006)(Gupta Nidhi, 2020); (Gulia Seema, 2020); (Bapna Ajay, 2019)obtained a median age of 46 years. This median age is closer to the results of this study. The results of this study are in line with those of (Julius Gbenga Olaogun, 2020) which found an average age of 48.9 years.

(Baudouin et al, 2020) for their part, obtained an average age of 56 years, higher than that of this study. (María et al, 2015) Have showed that the group with the highest number of diagnosed breast cancer cases was women between the ages of 45 and 64 with 53.5%. These results are different from those of this study. Most of the patients in this study (68%) are between the ages of 35 and 59. They are part of the labour force and are mostly breadwinners. This difference could be linked to the fact that breast cancer is increasingly affecting the young population. In addition, it could also be explained by the fact that the young population has more access to information related to screening, diagnosis and treatment of the disease. Indeed, this category of the population is more proficient in modern communication tools (social networks). Another aspect of the literature that coincides with the results of this study is that the majority of breast cancer cases detected occur in patients under the age of 65 (Knaul Felicia Marie, 2008).

For the level of education, 52% of patients have at least the primary level of education. The secondary level represents 6% of the sample. Educational attainment may be a very important variable for cancer awareness and prevention within the family and community. Patients with a high level of education would be more likely to have access to the right information about the importance of early detection and diagnosis of the disease. They could thus serve as relays at the level of their respective families and communities. These results, which differ from those of(Julius Gbenga Olaogun, 2020); who found respectively that (Van Minh Hoang, 2017)64.6% and 58.6% of the patients in their sample who have at least a secondary level of education. (Teshale Mulatu Dibisa, 2019)obtained a majority of participants (94.5%) who were illiterate, contrary to the results of this study, which has only 48% of uneducated. found (Jacobo Gómez-Rico, 2008) 57, 9 % of women with primary education and 23.5% who completed grade nine.

A study conducted in Indonesia on the perception of breast cancer risks among high school girls concluded that most participants (69.5%) had a low level of knowledge about breast cancer. In addition, they also had a negative perception (43.2%) of breast cancer risks. The factor influencing their perception was family income (p=0.012) and knowledge about breast cancer (p=0.008). Also, a study conducted in Sweden shows that (Sri Yusnita irda Sari, 2019)Compared with women with less than 9 years of schooling, university

graduates were more likely to be diagnosed in situ. Women with higher education were more likely to be diagnosed with breast cancer in situ and had higher survival after a diagnosis of invasive breast cancer. One explanation for these findings may be that women with higher levels of education participate more in breast cancer screening than less educated women.

In contrast, a study conducted in Ghana found that University students tend to estimate their risk based on their experience with breast cancer. Students who have already been screened for breast cancer and those who intend to have a breast self-exam in the future are more likely to perceive themselves as being at risk and therefore take steps to avoid getting breast cancer. This shows that the level of education has no influence on the perception of breast cancer risk in this specific case.(Eric Osei, 2021).

Analysis of marital status reveals that brides make up 70% of the sample. These results are similar to those of ; (Hierrhum Aboubacar Bambara, 2017) (Baudouin et al, 2020)who obtained 81.25% and 85.5% of brides respectively. The results of this study differ from those of (Carlson Babila Sama, 2017) which only got 18% of the brides in its sample. found 52% of brides, a lower proportion than in this study. The results obtained by 17% of brides; 25% divorced; 58.3% who are not in a different marriage relationship with the data in this series. (Omolola Salako, 2016)(Gonzaga, 2013).

For the place of residence, 52% of patients live in the Dakar region. This is in contradiction with the results of (Kanono Thabane et al, 2021)who have found 62.8% of residents in rural areas. However The results of this study are in line with those of (Hierrhum Aboubacar Bambara, 2017); (Omolola Salako, 2016)who have respectively 87.50% and 80% of patients come from urban areas.

Direct non-medical costs of breast cancer treatment

Cancer is a major public health problem in Senegal due to the high costs of treatment. The study highlighted that the data published on this topic is rather limited and comes mainly from high-income countries, and among these are the United States and Canada.

The objective of this article is to analyze the direct non-medical costs of treatment of breast cancer diagnosed at the Joliot Curie Institute in Dakar. For a good optimization of the care pathway, the estimation of direct non-medical costs is necessary. The estimated average direct non-medical cost of breast cancer treatment is 2,844,731 FCFA ($4,559.79) with a minimum of 359,650 FCFA ($576.48) and a maximum of 7,110,584 FCFA ($11,397.48) over an average duration of 31 months.

The average direct non-medical cost is made up of 63.45% of the cost of housing, 22.48% of the cost of food and 12.27% of the cost of transport. The reduction of sequelae related to treatment constitutes only 1.8%.

The results of this study have the potential to support new research that would generate data that would be very useful in achieving an efficient allocation of resources. Similarly, the present study makes a contribution to information that can be used for the implementation of a breast self-examination awareness program that would facilitate early detection of cancer.

The total non-medical direct cost is estimated at 22,437,725 CFA francs ($37,361.61) with an average of 2,844,731 CFA francs ($4,736.83); a minimum of 359,650 FCFA ($598.87) and a maximum of 7,110,584 FCFA ($11,840.01) over an average duration of 35 months of treatment.

However, one of the limitations of this study is the fact that it was only conducted on patients who were diagnosed in a public facility (Joliot Curie Institute in Dakar), which may limit the generalization of the study's results to the entire health sector of the country.

Most of the costs were borne by households through a direct payment mechanism. Many cancer patients have experienced financial difficulties and have had to take out a loan or sell a property. This situation is similar to that of many developing countries. (Shiva Ram Khatiwoda et al, 2019).

Moreover, although social protection systems differ from country to country, the comparison of direct non-medical costs can be instructive.

Differences in direct non-medical costs per country may be due to the cost of housing, clothing, transport, etc. which are higher in some countries than in others. Differences in estimates of non-medical direct costs between countries can be explained by inter-country variation in average household size, purchasing patterns and incomes. (Hamraz Mokri et al, 2022).

According to a study conducted by the International Association of Hospitalists in Iran, patients referred to the public hospital incurred hotel costs of $380 (30.26%) of the total cost of hospitalization. In addition, the average non-medical direct cost of patients referred to the private and public hospital is $170 (1.39% of total costs) and $340 (1.29% of total costs), respectively. The highest component of the non-medical direct cost of patients who were treated at the private and public hospitals was attributed to transportation and food costs at $150 and $250, respectively. In both hospitals, travel costs accounted for the largest component of patients' total non-medical direct costs. (Abolhasan Afkar et al, 2021).

The optimization of clinical pathways could therefore contribute to cost control. In addition, the implementation of organized clinical pathways helps to improve the quality of care (Delphine Héquet et al, 2019).

Also, the non-medical direct cost of breast cancer treatment in Ghana was estimated at $150.73. (Adanu K et al, 2022).

In addition, Liao and colleagues cited by Adanu et al, 2022 estimated the average non-medical expenditure for breast cancer treatment in China at $922. Also, a similar study in Pakistan cited by Adanu et al, 2022 estimated the average non-medical direct cost to be $310.88.

Thus, Hughes et al, found an estimated non-medical direct cost of $11,154 (Hughes et al, 2012).

The average non-medical cost reported in China is about 11% of the total direct cost compared to 16% in this study. The cost of transportation (47%) makes up a significant portion of non-medical expenses, followed by food and beverage expenses (43%). Together, they make up 90% of the total non-medical direct cost, suggesting that food and transportation are essential for breast cancer patients.

These studies show that understanding the total cost of breast cancer treatment is essential, as it will inform decision-makers about the financing of breast cancer treatment.

Therefore, to ease the financial burden of breast cancer treatment, promoting early diagnosis is vital.

Direct non-medical costs are estimated at $78 million. Patients incurred average non-medical direct costs of $56 per year. The minimum and maximum values are $6 million and $262 million, respectively. Among non-medical direct costs, transportation has the highest average cost, $40, followed by meals $23 and non-prescribed supplements $34. In addition, those with complications spent more on all components of non-medical direct costs than those without complications (transportation: $36 vs. $14; meals: $18 vs. $13. (Thi Tuyet Mai Kieu et al, 2020).

The most important household expenses are food 461,623 pesos ($23,162.8) and transportation 106,546 pesos ($5,346.15), 40% of families pay an average of 445,645 pesos ($22,361.07) in rent. The largest expenses are food in 64% of families amounting to 169,796 pesos ($8,519.83); public transport in 68% of families for an amount of 39,942 pesos ($2,004.16); personal care and hygiene products in 42% of families for an amount of 35,531 pesos ($1,728.83).

Sánchez concludes that there is a need to build on public health policies and establish strategies that allow families and patients to reorganize their lifestyles. (Astrid Nathalia Páez Esteban et al, 2020).

The most significant costs were, food, housing, and transportation, affecting family dynamics as they face not only increased costs, but also decreased income.

Direct non-medical costs increased from US$50.69 million in 2007 to US$75.83 million in 2010, an increase of 49.6%. The average cost of one-way transportation per hospital visit for a patient and caregiver is $6.83. (Astrid Nathalia Páez Esteban et al, 2020).

Data on the cost of the burden of breast cancer on households are limited in Ghana. However, the non-medical direct cost of breast cancer treatment was estimated at $150.73.(Adanu K et al, 2022).

In addition, Liao and colleagues cited by Adanu et al, 2022 estimated the average non-medical expenditure for breast cancer in China at $922. Also, a similar study in Pakistan cited by Adanu et al, 2022, estimated the average non-medical direct cost to be $310.88. Hughes et al, the estimated non-medical cost is $11,154.(Hughes et al, 2012).

The average non-medical cost reported in China is about 11% of the total direct cost compared to 16% in this study. The cost of transport (47%) makes up a significant share of non-medical costs, followed by food and drink expenses (43%). Together, they make up 90% of the total non-medical cost, suggesting that food and transportation are essential for breast cancer patients.

However, methodological heterogeneity and variation in the inclusion of cost components limit the comparison of the results of our study with other countries.

The average annual non-medical direct costs per household equivalent in Germany, Spain and Greece are around €13,300 ($14,525.99), €11,100 ($12,123.2) and €7,800 ($8,519), respectively.

Differences in direct non-medical costs by country may be due to the cost of housing, clothing, transportation, etc. are higher in some countries than in others. Differences in non-medical cost estimates between countries can be explained by inter-country variation in average household size, purchasing patterns and incomes. (Hamraz Mokri et al, 2022).

The median cost of transport for these patients was €902 ($985.15) with a minimum of €15 ($16.38) and a maximum of €10,024 ($10,948.01).

The cost of transportation is $58.33 which is the highest among non-medical direct costs.

Most of the costs were borne by households through a direct payment mechanism. Many cancer patients have experienced financial hardship and have had to take out a loan or sell a property. This situation is similar to that of many developing countries. (Shiva Ram Khatiwoda et al, 2019).

The direct non-medical cost of breast cancer treatment is very high in Senegal. This is all the more so since 74% of the patients in the sample claim to have an income of less than 180,000 FCFA ($298.83) per month. Moreover, a patient testifies about the cost of living in Dakar where the treatment by referral of cancer is done by saying this: "*We are afraid of Dakar. When a sick person is referred to Dakar, he is advised not to go there because he risks spending all his money on housing and food before even starting medical treatment*".

On this the State should:

- Optimize cancer care pathways;
- Build cancer treatment centers in other regions of the country;
- Strengthen the staff intended for cancer care.

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Foot Notes

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