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Article

Access of patients with breast and lung cancer to chemotherapy treatment in public and private hospitals in the city of Buenos Aires

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Abstract

Objectives: Describe the time elapsed from the diagnosis to treatment with chemotherapy for patients with breast and lung cancer at public and private hospitals in Buenos Aires.
Design: Retrospective cohort study.
Setting: Three public and three private academic hospitals in Buenos Aires.
Participants: Patients with breast (n = 168) or lung cancer (n = 100) diagnosis treated with chemotherapy.
Main outcomes measures: Clinical and sociodemographic data were collected in a stratified sample. We used the Kaplan–Meier estimator to analyse the time elapsed and the log rank test to compare both groups
Results: For breast cancer patients, median time elapsed between diagnosis and treatment with chemotherapy was 76 days (95% CI: 64–86) in public and 60 days (95% CI: 52–65) in private hospitals (P = 0.0001). For adjuvant and neoadjuvant treatments, median time was 130 (95% CI: 109–159) versus 64 (95% CI: 56–73) days ($P < 0.0001$) and 57 days (95% CI: 49–75) versus 26 (95% CI: 16–41) days, respectively (P = 0.0002). There were no significant differences in the time from first consultation to diagnosis. In patients with lung cancer, median time from diagnosis to treatment was 71 days (95% CI: 60–83) in public hospitals and 31 days (95% CI: 24–39) in private

hospitals ($P = 0.0002$). In the metastatic setting, median time to treatment was 63 days (95% CI: 45–83) in public and 33 (95% CI: 26–44) days in private hospitals ($P = 0.005$).
Conclusions: There are significant disparity in the access to treatment with chemotherapy for patients in Buenos Aires, Argentina.

Key words: access, breast cancer, lung cancer, chemotherapy, Argentina

Introduction

Disparities in access to timely cancer care for patients constitute a significant barrier in providing quality healthcare in low and middle-income countries (LMICs) [1]. Adequate health coverage and efficient health systems are necessary factors to provide adequate access to cancer screening and prevention, timely diagnosis and treatments [2–6]. Unfavorable socioeconomic conditions such as unemployment, low education level and income are related to higher odds of cancer diagnosis in advanced stages leading to greater risk of disease recurrence and death [7–9].

Few studies have reported on the access to cancer diagnosis and treatments in Latin America, showing significant differences in delays to cancer care according to the type of health coverage [10–14]. The health system in Argentina is comprised of three main providers: the public health system, private health insurances and union-run or social security health insurance [15]. The public health system provides universal coverage including access to public hospitals and primary care facilities to all individuals free of charge, and is financed from the state or national budget. Union-run health insurance is provided by trade unions, to workers and their dependents. It is funded by a compulsory payroll contribution from the employees and employers. There are approximately 300 different trade unions with diverse health care plans in Argentina. However, some individuals and union-run insurance opt to sub-contract private health plans who might provide higher quality medical care in private hospitals to their beneficiaries [16]. In other cases, individuals with social security consult at public hospitals leading to high levels of cross-coverage between health systems [17]. The private health system is comprised of around 200 pre-paid health insurance and is purchased by individuals or companies who pay to receive care in private hospitals.

In Argentina, the National 'Compulsory Medical Plan' mandates that all cancer-related treatments must be provided without cost to insured patients by private and union-run health insurance. Patients without health insurance rely on public hospitals and the provision of drug supplies by the state for cancer care. Though the coverage for medical attention and cancer-related treatments is mandatory, timely access and the quality of cancer care can differ substantially in this segmented health care system.

The primary objective of this study was to describe and compare the time elapsed from breast and lung cancer diagnosis to treatment with chemotherapy between public and private hospitals. Secondary objectives were to describe the time elapsed from first consultation to diagnosis of breast and lung cancer, describe epidemiological and clinical characteristics of patients treated in both systems and evaluate their association with the time elapsed from diagnosis to treatment.

Methods

This is a multicenter, retrospective cohort study performed at six academic hospitals in the city of Buenos Aires. Three of these were private hospitals assisting patients with private health insurance or social security and three were public hospitals assisting patients without private insurance, covered by social security or the public health system.

Study population

Convenience sampling was performed, stratified by type of institution (public or private). Inclusion criteria were as follows: Adult patients (≥ 18 years old) with diagnosis of non-small cell lung cancer (NSCLC) or breast cancer, stages I to IV treated with chemotherapy from January 1st 2016. Chemotherapy could be delivered in the adjuvant (given after surgery for tumor removal), neoadjuvant (given before surgery) or metastatic settings (as palliative treatment) for the treatment of patients with NSCLC or breast cancer. Definitive chemoradiation (chemotherapy given concomitantly with radiation therapy) was a treatment option solely for patients with NSCLC. Patients were excluded if they were pregnant during cancer diagnosis, unable to provide informed consent or unable to answer the survey due to cognitive impairment.

The physician-consultation ratio for each institution was calculated by dividing the number of annual patient consults to the medical oncology department by the number of physicians.

Procedure and data collection: Researchers from each institution recruited the patients and obtained informed consent. All personal information was deidentified to ensure patient anonymization throughout the study course. The research team developed a survey addressing epidemiological and socio-economic factors, including education level, familial composition, income, employment, geographical localization, transportation, and health insurance. This survey was validated prior to study initiation in a cohort of 30 eligible patients, though those results were not included in the final analysis. Once the participant consented, the researcher administered the survey verbally and documented the responses in writing. Clinical data regarding tumor type, staging, dates and methods of diagnostic procedures, and type of treatments were abstracted from the medical records and captured in a clinical form. All the data was then recorded in a case report form (CRF) as well as the electronic research data capture (REDCap), following a double entry procedure [18]. This study was conducted in accordance with the Good Clinical Practice and all the previsions of the Declaration of Helsinki.

Time intervals were defined as time from first consultation to diagnosis and time from diagnosis to treatment. The date of first consultation was established as the first consultation of the patient for symptoms of breast or lung cancer, or the date of diagnostic mammography or ultrasonography for breast cancer or chest radiologic study for lung cancer. The time of diagnosis was reported as the date of a biopsy-proven pathology report. The time of treatment initiation was the date the patient started systemic treatment with chemotherapy for breast or lung cancer.

Statistical analysis

Sample sizes were estimated based on the assumptions about diagnosis-to-treatment times, according to the data obtained from the survey of local experts (real-life setting) and published studied (ideal setting). Statistical power was set at 80% and alpha level at 0.05. For the breast cancer population, mean time estimates (+/− standard deviation) of 110 days (55) and 80 days (40) were obtained, and a sample size of 65 patients per arm was calculated, totaling 130 individuals. For the lung cancer population, mean time estimates (+/− standard deviation) of 120 days (50) and 140 days (55) were obtained, resulting in sample size estimates equal to 99 patients per group, and 198 individuals overall.

Mean and standard deviation or median and interquartile range (for continuous variables) as well as frequency and percentage (for categorical variables) were used to describe the study population by health system. Kaplan Meier curves were calculated to estimate patterns in time to diagnosis and to initial treatment and groups were compared by the log rank test. Unadjusted and Bonferroni corrected *P*-values are provided for the outcomes. A Cox proportional hazard regression model was used to explore the association between type of health system and individual sociodemographic and clinical variables with the time from diagnosis to treatment with chemotherapy in each cohort. Factors shown to significantly associate in the univariate models were evaluated in a multivariate Cox regression model.

For both univariate and multivariate models, we reported the estimate hazard ratios (HR) with the 95% confidence interval (CI). Variables associated with the time elapsed from diagnosis to treatment in univariate analysis, with a *P*-value <0.1, were included in multivariate analysis. Data analyses were performed using SAS software version 9.3 (SAS Institute Inc, Cary, NC); *P*-values are two-sided, with an α level of 0.05 considered statistically significant.

Ethics

The study protocol was reviewed and approved by the ethics committee of each participating institution. All patients signed an informed consent to participate in the study, conducted in accordance with the Declaration of Helsinki

Results

Between June 2016 and September 2017, 306 patients were screened for eligibility criteria. Of these, 25 individuals did not meet the inclusion criteria. Of the 281 patients who met inclusion criteria, 13 declined to participate in the study. Among 268 patients consented and included in the study, 168 had breast cancer and 100 had lung cancer diagnosis. The survey was conducted to all the participants. Among the participating institutions, the provider-consultation ratio (number of patient consultation/physician) for public hospitals was 2198, 2414 and 2365. The provider-consultation ratio for private hospitals was 690, 1478 and 1571.

Breast cancer

A total of 168 female patients with breast cancer were included, 93 were treated in private hospitals and 75 in public hospitals. Mean age (SD) was 50.8 (13.4) in public hospitals and 52.0 (11.0) in private hospitals (Table 1). There was a higher proportion of foreign-born patients consulting in the public system compared with private hospitals (24% vs 3.3%, $P < 0.0001$). Regarding relationship status, 64.5% of patients treated at private hospitals were married or cohabiting compared to 37,3% of women in public hospitals. Patients consulting in public hospital had lower educational level and had lower family income compared to patients assisted at private hospitals. Lower levels of employment were consistently observed in patients treated at public hospitals (24% versus 69.9%, $P < 0.001$). Importantly, 10.7% of patients treated in public hospitals had to relocate closer to the hospital to receive care compared to 1.1% in private hospitals. There were no significant differences in the travel distance to public and private hospitals, when considering the patient's location at the time of cancer diagnosis and chemotherapy initiation. However, 69.3% of patients treated at public hospital used public transportation compared to 29.3% of patients in private hospitals resulting in significant longer travel times for patients treated in public hospitals. Regarding health insurance, 57% of patients treated in private hospitals had private insurance and 43% had union-run health insurance. In public hospitals, 46.7% of patients had union-run health insurance and 53.3% had no health insurance.

Patients treated in public hospitals had more advanced breast cancer stage disease compared to patients treated in private facilities, stage III in 45.3% versus 21.5% and stage IV in 13.3% versus 3.2%, respectively ($P < 0.0001$). Contrariwise, most patients treated at private hospitals presented with early stage disease, stage I in 29% vs 2.7% and stage II in 45.2% vs 33.3% ($P < 0.0001$). There was a significant difference in the rate of breast cancer diagnosis as a result of screening practice, 36.6% of cases in private and 9.3% in public hospitals. Patients treated at private hospitals had improved performance status than their counterparts in public facilities, with an Eastern Cooperative Oncology Group Performance Status (ECOG PS) score of 0 in 90.3% vs 77.3% and score I in 8.6% vs 22.7% respectively. The ECOG PS is used in oncology to quantify the functional status of patients and it ranges from 0 (fully active without restriction) to 5 (death).

Chemotherapy modalities varied significantly between systems, likely due to the differences in clinical stage at presentation. In public hospitals, 46.7% of patients received neoadjuvant therapy compared to 17.2% of individuals in private hospitals. Contrariwise, adjuvant treatment was administered to 79.6% of patients in private and 36% of patients in public hospitals. When accounting per stage, a higher proportion of patients with stage I-II disease received neoadjuvant treatment in public compared to private hospitals ($P < 0.0001$). There were no significant differences in the treatment modalities for patients with stage III disease (Supplementary Table 1).

Chemotherapy drugs were provided by private insurance or social security in 96.8% of patients in the private and 36% in public hospitals. The public health system provided the treatment to 36% of patients treated in the public and 1.1% in the private hospitals. In 28% of patients treated in public hospitals and 2.2% in private hospitals, chemotherapy drugs were provided by the institutional pharmacies as remaining unused drugs from other patient's treatments. There were no differences in the use of high cost drugs (trastuzumab, pertuzumab or bevacizumab) between systems, 17.2% in private and 18.7% in public hospitals.

Median time elapsed from diagnosis to treatment was significantly prolonged in public compared to private hospitals, 76 days (95% CI: 64–86) vs 60 days (95% CI: 52–65) ($P = 0.0001$) (Table 2). After performing subgroup analysis, according to treatment modality, the difference in time from diagnosis to treatment was maintained in the neoadjuvant and adjuvant setting between systems (Fig. 1). In the neoadjuvant setting, median time from diagnosis

Table 1 Socio-economic, educational and clinical characteristics of patients with breast cancer treated at public and private hospitals. (Page 8).

Characteristic	Variable	Private hospitals ($n = 93$)	Public hospitals ($n = 75$)	P
Age [Mean (SD]		52.0 (11.0)	50.8 (13.4)	0.5153
Nationality	Argentina	90 (96.7%)	57 (76.0%)	<0.0001
	Other	3 (3.3%)	18 (24.0%)	
Civil status	Married/cohabiting	60 (64.5%)	28 (37.3%)	0.0005
	Single	33 (35.5%)	47 (62.7%)	
Education	Incomplete primary education or inferior	2 (2.2%)	7 (9.3%)	<0.0001
	Complete primary / Incomplete secondary education	11 (11.8%)	29 (38.7%)	
	Complete secondary / incomplete tertiary education	22 (23.7%)	31 (41.3%)	
	Complete tertiary education	58 (62.4%)	8 (10.7%)	
Family Income [Median (Q1–Q3)]		2166,6 US dollars (1333.3–3333.3)	666.6 US dollars (500–1000)	< 0.0001
Employment status	Employed	65 (69.9%)	18 (24.0%)	<0.0001
	Unemployed	10 (10.8%)	33 (44.0%)	
	Retired	18 (19.4%)	21 (28.0%)	
	Pensioner	0 (0.0%)	3 (4.0%)	
Transportation to Hospital	Public	25 (26.9%)	52 (69.3%)	<0.0001
	Private	67 (72.0%)	22 (29.3%)	
	Walking	1 (1.1%)	1 (1.3%)	
Travel time to the hospital (min) [Median (Q1–Q3)]		40.0 (25.0–60.0)	50.0 (30.0–90.0)	0.0028
Travel Distance (km) [Median (Q1–Q3)]		11.0 (6.0–19.0)	13.0 (5.1–30.0)	0.3418
Housing relocation for treatment		1 (1.1%)	8 (10.7%)	0.0061
Health insurance	Private insurance	53 (57.0%)	0 (0.0%)	<0.0001
	Union-run health insurance	40 (43.0%)	35 (46.7%)	
	None	0 (0.0%)	40 (53.3%)	
Breast Cancer stage (AJCC 7th edition)	I	27 (29.0%)	2 (2.7%)	<0.0001
	II	42 (45.2%)	25 (33.3%)	
	III	20 (21.5%)	34 (45.3%)	
	IV	3 (3.2%)	10 (13.3%)	
	Relapse after definitive treatment	1 (1.1%)	4 (5.3%)	
Breast cancer detection by screening		34 (36,6%)	7 (9,3%)	0.0003
Performance status (ECOG)	0	84 (90.3%)	58 (77.3%)	0.0280
	1	8 (8.6%)	17 (22.7%)	
	2	1 (1.1%)	0 (0.0%)	
Treatment modality	Neoadjuvant	16 (17.2%)	35 (46.7%)	<0.0001
	Adjuvant	74 (79.6%)	27 (36.0%)	
	Palliative	3 (3.2%)	13 (17.3%)	
High cost drugs		16 (17.2%)	14 (18.7%)	0.8414
Chemotherapy drug provider	Health insurance	90 (96.8%)	27 (36.0%)	<0.0001
	Provided by the State	1 (1.1%)	27 (36.0%)	
	Hospital Pharmacy (unused medication)	2 (2.2%)	21 (28.0%)	

to treatment was 57 days (95% CI: 49–75) in public and 26 days (95% CI: 16–41) in private hospitals ($P = 0.0002$). Median time from diagnosis to adjuvant treatment was 130 days (95% CI: 109–159) in public and 64 days (95% CI: 56–73) in private hospitals ($P < 0.0001$). In the adjuvant setting, this difference was due to prolonged times from diagnosis to surgery, 50 days (95% CI: 36–67) in public and 18 days (95% CI: 16–26) in private hospitals ($P = 0.0013$), as well as from surgery to chemotherapy, 83.5 (95% CI: 70–98) and 48 days (95% CI: 40–59) respectively ($P < 0.0001$). Importantly, there were no significant differences between the time elapsed from the first consultation to diagnosis between both groups, median time for public hospitals of 43 days (95% CI: 30–57) and 35 days (95% CI: 31–41) in private hospitals ($P = 0.1769$).

The variables that were associated with the time from diagnosis to chemotherapy treatment in the univariate analysis were the type of health insurance ($P = 0.001$), the type of hospital ($P = 0.0002$), number of inhabitants in a household ($P = 0.0013$), the travel distance to the hospital ($P = 0.0815$), age at diagnosis ($P = 0.0035$), whether the patient was the main source of family income ($P = 0.0056$) and employment status ($P = 0.0175$). In multivariate analysis, treatment in a private hospital was associated with a shorter time elapse between diagnosis and treatment (HR 2.978, $P < 0.001$). Age was borderline statistically significantly associated with time to treatment (HR 0.984, $P = 0.0234$).

Lung cancer

A total of 100 patients with NSCLC were included, 59 in private and 41 in public hospitals. Mean age (SD) was 63.8 years (10.1) in public and 64.1 years (10.0) in private hospitals (Table 3). There was a higher proportion of men with lung cancer treated in both systems. There were no significant differences in relationship nor

Table 2 Primary Outcome: times from diagnosis to treatment with chemotherapy for patients with breast cancer and lung cancer diagnosis in private and public hospitals. Secondary outcome: time from first consultation to cancer diagnosis. (Pages 10 and 12).

Interval time	Private hospitals		Public hospitals		*P**	Bonferroni adjusted *P**
	n	*Days, median (95% CI)*	*n*	*Days, median (95% CI)*		
Breast cancer cohort						
Diagnosis to chemotherapy (global)	93	60 (52–65)	75	76 (64–86)	0.0001	0.0006
Diagnosis to neoadjuvant treatment	16	26 (16–41)	35	57 (49–75)	0.0002	0.0012
Diagnosis to adjuvant treatment	74	64 (56–73)	27	130 (109–159)	<0.0001	0.0006
Diagnosis to surgery	74	18 (16–26)	27	50 (36–67)	0.0013	0.0076
Surgery to chemotherapy	74	48 (40–59)	27	83.5 (70–98)	<0.0001	0.0006
First consultation to diagnosis	93	35 (31–41)	75	43 (30–57)	0.1769	1.0000
Lung cancer cohort						
Diagnosis to chemotherapy (global)	59	31 (24–39)	41	71 (60–83)	0.0002	0.0008
Diagnosis to chemotherapy treatment in metastatic disease	33	33 (26–44)	30	63 (45–83)	0.005	0.0200
Diagnosis to neoadjuvant, adjuvant or chemoradiation therapy	26	22 (14–37)	11	83 (64–99)	0.0091	0.0364
First consultation to diagnosis	59	48 (33–61)	41	86 (69–116)	0.0014	0.0056

smoking status between patients treated at public and private hospitals. Patients treated in public hospitals had significantly lower levels of education ($P < 0.0001$), rates of employment ($P = 0.0074$) and family income ($P < 0.0001$) compared to patients treated in private hospitals. Patients treated in public hospitals had to travel significantly longer distances to reach the hospital ($P = 0.0255$) which resulted in prolonged travel times compared to patients treated in private hospitals ($p = 0.0007$). With respect to health insurance, 41.5% of patients treated in public hospitals had no health insurance and 56.1% had union-run insurance. In private hospitals, 62.7% of patients had private insurance and 37.3% had union-run health insurance.

Most patients in both groups presented with advance disease at diagnosis: metastatic disease (stage IV) in 73.2% in the public and 59.3% in the private hospitals and locally advanced disease (stage III) in 17.1% and 30.5% of patients, respectively. Only 9.8% of patients in the public and 10.2% in private hospitals presented with stage I or II disease. Lung adenocarcinoma was the predominant histological subtype of NSCLC in both groups, 83.1% in private and 61% in public hospitals. There was a higher proportion of squamous cell carcinoma histology in public hospitals, 31.7% vs 13.6% ($p = 0.03$).

Chemotherapy was mostly administered in the context of metastatic (stage IV) disease in both groups. There was a higher proportion of chemoradiation therapy in private hospitals, 32.2% vs 12.2% ($P = 0.03$). Adjuvant treatment was administered to 11.9% of patients in private and 9.8% in public hospitals. There were no significant differences in performance status between the groups, with 88.1% in the private and 85.3% in the public group having ECOG scores 1–2. Chemotherapy drugs were provided by private insurance or social security in 96.6% of patients treated at private hospitals. In patients treated in public hospitals, treatment drugs were provided by union-run health insurance in 42.5% of the cases and the public health system in 35%. A total of 22.5% of patients received chemotherapy drugs provided by the hospital pharmacies as remaining unused drugs in public hospitals compared to 3.4% in private institutions.

Time elapsed from diagnosis to chemotherapy treatment was significantly higher in public hospitals, median time of 71 days (95% CI: 60–83) in public compared to 31 days (95% CI: 24–39) in private hospitals ($P = 0.0002$) (Table 2). In a subgroup analysis by treatment modality this difference was maintained for patients treated in the metastatic setting, with a median time of 63 days (95% CI: 45–83) and 33 days (95% CI: 26–44) respectively ($P = 0.005$) (Fig. 2). For patients treated with neoadjuvant, adjuvant or chemoradiation therapy, median time from diagnosis to treatment was 83 days (95% CI: 64–99) in the public hospitals and 22 days (95% CI: 14–37) in private hospitals ($P = 0.0091$). Median time from first consultation to diagnosis was 86 days (95% CI: 69–116) in public and 48 days (95% CI: 33–61) in private hospitals ($P = 0.0014$).

We performed multivariate analysis to study the association of variables inherent to the health system and to patients with lung cancer, with the time elapsed from diagnosis to chemotherapy treatment. Significant variables in univariate analysis were: type of hospital ($P = 0.0003$), type of transportation ($P = 0.0005$), type of health insurance ($P = 0.022$), employment ($P = 0.0284$), education level ($P = 0.0732$) and histological type ($P = 0.087$). In multivariate analysis, attention in a private hospital [HR 1.99 (95% CI: 1.27–3.11)] and private transportation [HR 2.12 (95% CI: 1.35–3.32)] were significantly associated with shorter times from diagnosis to chemotherapy treatment. As the point of analysis is the time, a positive hazard ratio reflects that it is more likely to have shorter treatment delays in a private hospital with respect to public hospitals.

Discussion

Timely access to cancer diagnosis and treatment is a key factor to guarantee high quality medical care for patients. Health coverage is a fundamental determinant of access to medical attention, but these two concepts differ substantially. The Argentinean National Cancer Institute (INC) reported from a nationwide registry, with data mainly aggregated from public hospitals, the time elapsed from first consultation to diagnosis and from diagnosis to treatment for multiple cancer types [19]. The current study provides further information regarding the access to cancer diagnosis and treatment between the private and public health system in our country.

In this study, we described inequities in timely access to treatments with chemotherapy for patients with breast and lung cancer between the public and private health systems in the city of Buenos Aires, Argentina. We observed a two-fold time difference in the initiation of adjuvant and neoadjuvant treatments in public compared to

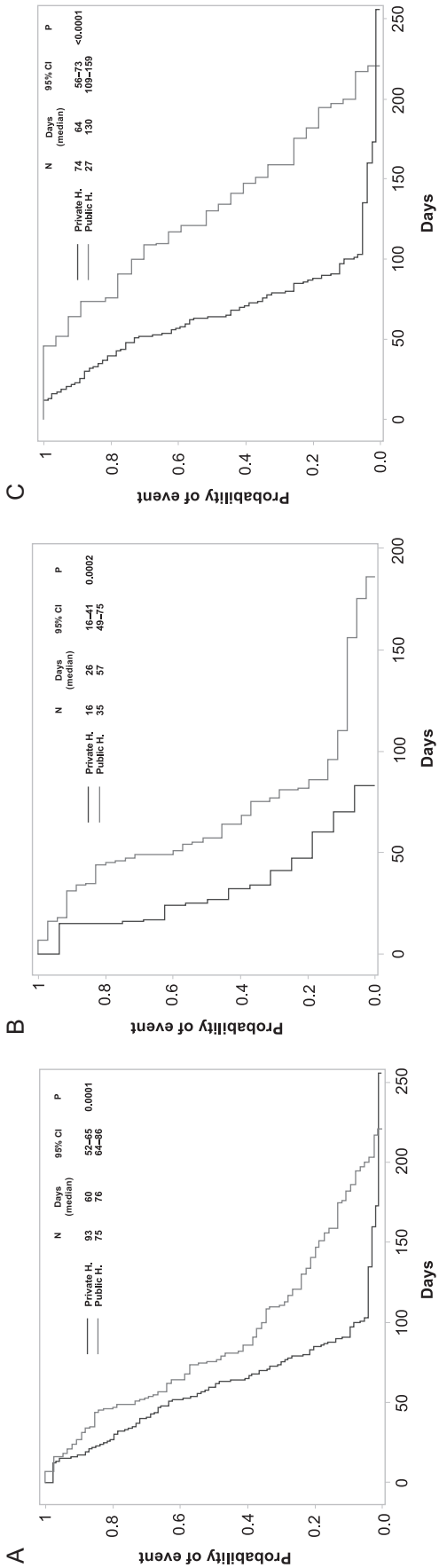

Figure 1 Kaplan–Meier curves in the cohort of patients with breast cancer for: **(A)** Time from diagnosis to treatment with chemotherapy, **(B)** time from diagnosis to neoadjuvant treatment, **(C)** time from diagnosis to adjuvant treatment. (Page 10).

private hospitals in patients with breast cancer. In the adjuvant setting, this difference was comprised of prolonged delays in time from diagnosis to surgery and from surgery to chemotherapy. Importantly, the time from first consultation to diagnosis was similar between public and private hospitals, highlighting that timely breast cancer diagnosis by core biopsy is achieved in both systems. Mosunjac *et al.*, report similar findings in Atlanta, USA. In their study, the time elapsed from diagnosis to surgery (47 versus 33 days) and adjuvant chemotherapy (25 versus 18 days) were longer in public compared to private hospitals, without differences in time from first consultation to diagnosis [20]. In the study reported here, patients consulting in public hospitals presented with more advanced disease stage and lower rates of diagnosis by breast cancer screening. Similar results were reported in Brazil, where patients treated in public hospitals had significantly higher clinical stage at diagnosis, lower rates of chemotherapy use and longer delays to treatment compared to patients in private hospitals [21]. Women with lower income and educational levels achieve lower rates of breast cancer screening, which has been associated with disease presentation in more advanced stages [22].

In the lung cancer cohort, we observed a two-fold difference in time to chemotherapy for patients with metastatic disease and a nearly four-fold difference in the median time to treatment for patients receiving neoadjuvant, adjuvant or chemoradiation therapy. Similarly, disparities in the time to lung cancer treatment have been reported in high-income countries, associated with the type of health insurance and healthcare facility [23]. The time elapsed from first consultation to lung cancer diagnosis was also significantly prolonged in patients treated at public hospitals compared to private institutions.

Compared to patients with breast cancer, where diagnosis by ultrasound guided biopsies of the breast is less complex and more widely available, patients with lung cancer most often present with a variety of symptoms, frequently requiring hospitalization. Lung cancer diagnosis requires invasive procedures like endoscopy, surgical or CT-guided biopsies and multiple staging studies [24, 25]. This could account for the differences observed in the time intervals from first consultation to diagnosis between private and public hospitals in our study, where the access to imaging studies and invasive diagnostic procedures vary significantly. The symptomatic onset and complexity in diagnosing lung cancer, often requiring the input of highly specialized medical professionals, could also explain why patients are required to travel longer distances to consult in specialized academic public hospitals, while those diagnosed with breast cancer may receive adequate care closer to their home.

The retrospective cohort design of the study allowed for an accurate assessment of multiple social, demographic, educational and economic factors related to the individuals and their families. These factors differed significantly between patients treated in private and public hospitals in Buenos Aires. Socioeconomic factors like education, income and employment are known to influence the access to breast and lung cancer diagnosis and treatment [26–28]. Patients seeking treatment in public hospitals had lower educational level, lower employment rates and family income compared to patients in the private system. These factors are likely contributing to the delays in cancer treatment for patients attending public hospitals, but in the present study, the analysis of socioeconomic factors on the time to treatment was limited by the sample size. Population based studies from broader registries could potentially identify patients at higher risk of experiencing delays in medical attention in the future.

Table 3 Socio-economic, educational and clinical characteristics of patients with lung cancer treated at public and private hospitals. (Page 11).

Characteristic	Variable	H. Private ($n = 59$)	H. Public ($n = 41$)	*P*
Age [Mean (SD)]		64.1 (10.0)	63.8 (10.1)	0.8793
Sex	Male	35 (59.3%)	26 (63.4%)	0.6798
	Female	24 (40.7%)	15 (36.6%)	
Nationality	Argentina	59 (100%)	34 (82.9%)	0.0014
	Other	0 (0.0%)	7 (17.1%)	
Civil status	Married/cohabiting	17 (28.8%)	21 (51.2%)	0.0232
	Single	42 (71.2%)	20 (48.8%)	
Smoking status	Current	7 (11.9%)	5 (12.2%)	0.6974
	Former	46 (78.0%)	34 (82.9%)	
	Non-smoker	6 (10.2%)	2 (4.9%)	
Education	Incomplete Primary education or inferior	0 (0.0%)	3 (7.3%)	<0.0001
	Complete primary / Incomplete secondary education	4 (6.8%)	23 (56.1%)	
	Complete secondary / incomplete tertiary education	17 (28.8%)	9 (22.0%)	
	Complete tertiary education	38 (64.4%)	6 (14.6%)	
Family Income [Median (Q1–Q3)]		2666.6 US Dollars (1733,3 – 4000)	1000 US Dollars (666.6 – 1333.3)	<0.0001
Employment status	Employed	32 (54.2%)	11 (26.8%)	0.0074
	Unemployed	5 (8.5%)	11 (26.8%)	
	Retired	22 (37.3%)	19 (46.4%)	
Distance (km) [Median (Q1–Q3)]		10 (6–14.8)	20 (5.8–35)	0.0255
Housing relocation for treatment	Yes	2 (3.4%)	4 (9.8%)	0.224
Transportation to Hospital	Public	8 (13.6%)	24 (58.5%)	<0.0001
	Private	50 (84.7%)	15 (36.6%)	
	Walking	1 (1.7%)	2 (4.9%)	
Travel time to the hospital (min) [Median (Q1–Q3)]		30 (20–40)	60 (30–90)	0.0007
Health insurance	Private Insurance	37 (62.7%)	1 (2.4%)	<0.0001
	Union-run health insurance	22 (37.3%)	23 (56.1%)	
	None	0 (0.0%)	17 (41.5%)	
Lung Cancer stage (AJCC 7th edition)	I/II	6 (10.2%)	4 (9.8%)	0.2916
	III	18 (30.5%)	7 (17.1%)	
	IV or relapsed	35 (59.3%)	30 (73.2%)	
Histology	Adenocarcinoma	49/ 59 (83.1%)	25/ 41 (61.0%)	0.0369
	Squamous Cell Carcinoma	8/ 59 (13.6%)	13/ 41 (31.7%)	
	Other	2/ 59 (3.4%)	3/ 41 (7.3%)	
Treatment modality	Neoadjuvant	0 (0.0%)	2 (4.9%)	0.0329
	Adjuvant	7 (11.9%)	4 (9.8%)	
	Chemoradiotherapy	19 (32.2%)	5 (12.2%)	
	Palliative	33 (55.9%)	30 (73.2%)	
Performance Status (ECOG)	1	31 (52.5%)	12 (29.3%)	0.6854
	2	21 (35.6%)	23 (56%)	
	3	7 (11.9%)	6 (14.6%)	
Chemotherapy drug provider	Health insurance	57 (96.6%)	17/ 40 (42.5%)	<0.0001
	Provided by the State	0 (0.0%)	14/ 40 (35.0%)	
	Hospital Pharmacy (unused medication)	2 (3.4%)	9/ 40 (22.5%)	

Further research is also needed to identify barriers leading to health system delays. In this study, the type of hospital (public/private) was independently associated with delays to chemotherapy treatment initiation in a multivariate analysis. We hypothesize that multiple factors can contribute to the delays in cancer diagnosis and treatment observed in public hospitals. There is a higher physician-consultation ratio in public hospitals that can translate into prolonged waiting times for outpatient consultations. In addition, there are important differences in the management, infrastructure and technological resources between public and private hospitals that likely contribute to the observed disparities [29]. The private health system counts with higher number of diagnostic imaging apparel, rapid access to diagnostic testing and surgical therapeutic interventions. Time to drug approvals and dispensing is usually more eficient in the private health system compared to state oncology drug banks, influencing timely access to treatments.

This is the first study, to our knowledge, to describe disparities in cancer care access between public and private health systems in Argentina. Disparities in cancer access can vary significantly by geographical localization. The present study included only patients treated at academic hospitals from the city of Buenos Aires and therefor, cannot be generalized to other regions of the country.

Identifying disparities in the access of patients to cancer diagnosis and treatment can guide future interventions to design health

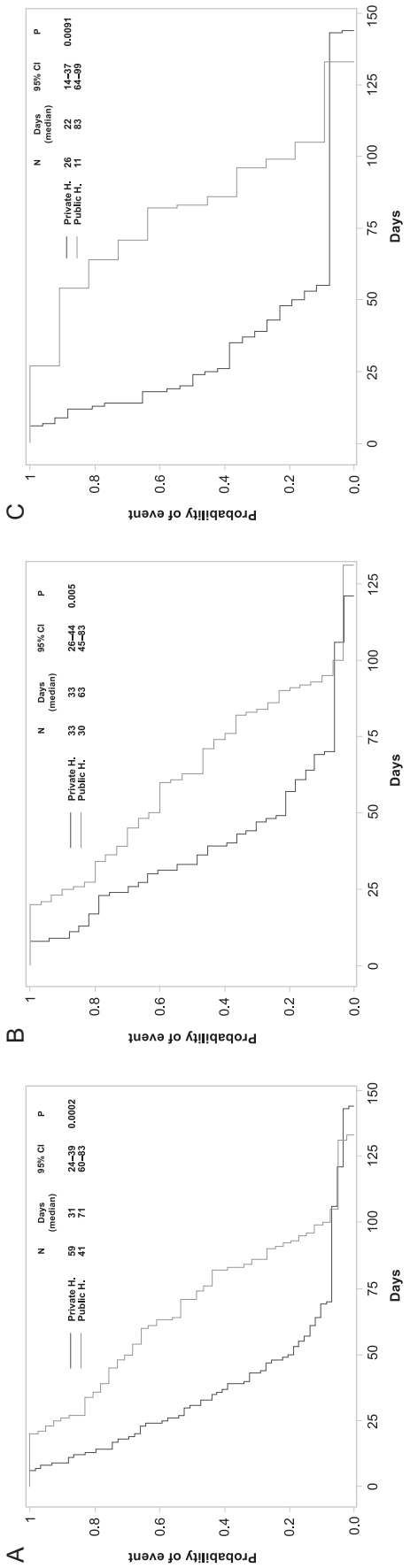

Figure 2 Kaplan–Meier curves in the cohort of patients with lung cancer for: (**A**) Time from diagnosis to treatment with chemotherapy, (**B**) Time from diagnosis to treatment of metastatic disease, (**C**) Time from diagnosis to neoadjuvant, adjuvant and chemoradiation treatment. (Page 12).

policies aiming to improve the quality of health systems and assist populations at risk of delayed cancer care.

Supplementary material

Supplementary material is available at *International Journal for Quality in Health Care* online.

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