

Cost-effectiveness analysis with real-world data reusing brazilian health system databases: a case study in breast cancer

INTRODUCTION

Metastatic HER2-positive breast cancer remains a major challenge for the Brazilian public health system (SUS). The incorporation of monoclonal antibodies such as trastuzumab and pertuzumab has significantly improved clinical outcomes, particularly through dual HER2 blockade.

OBJECTIVE

To evaluate the cost-effectiveness of pertuzumab in patients with HER2-positive metastatic breast cancer within SUS, compared to standard chemotherapy, using real-world data.

METHODS

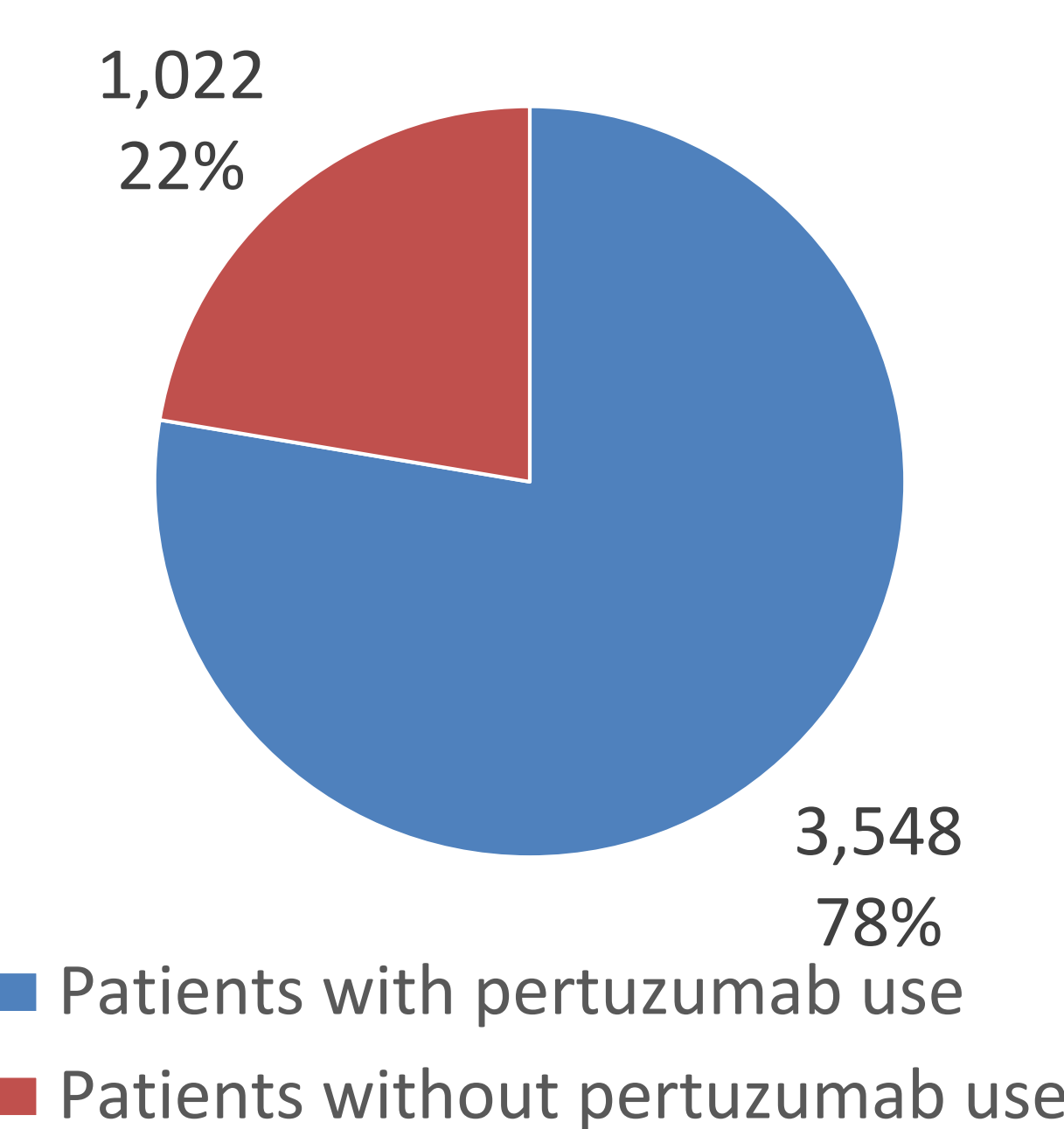
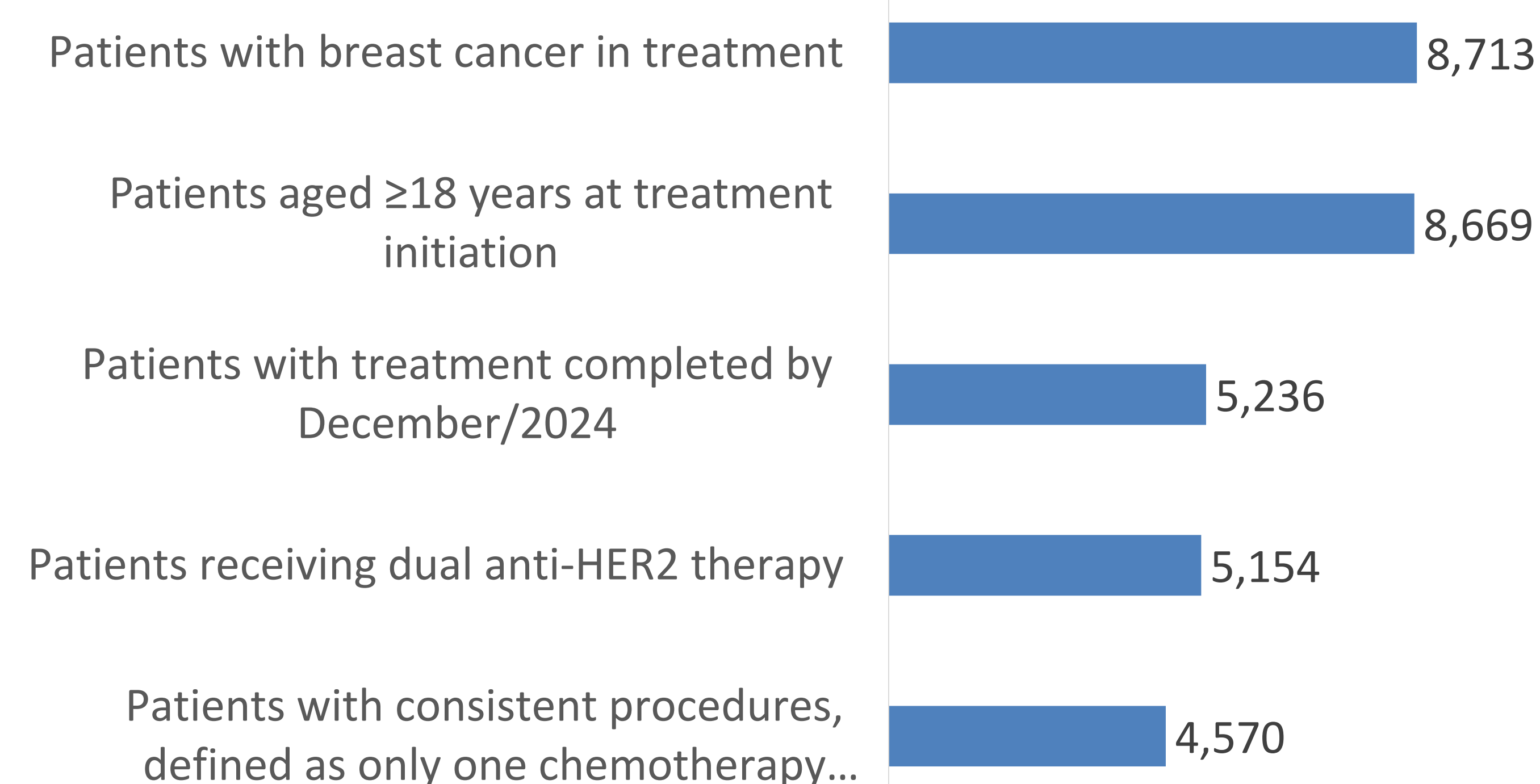
Retrospective observational study using secondary administrative data from Health System (SUS), applying a RWE approach in breast cancer patients

Data sources (integrated national databases): Outpatient: chemotherapy, radiotherapy, diagnostics
Records with zero financial value excluded (proxy for non-performance)

Inpatient database: hospitalizations related to breast cancer

Mortality database: deaths with ICD-10 C50 (breast cancer)

Patient selection:



Data linkage: deterministic record linkage methods applied **SIA(outpatient) /SUS ↔ SIH (inpatient)/SUS:**
Variables: sex, ZIP code, race/color, date of birth, municipality, date of care, facility, ICD-10
6–7 variable combinations; **174 matching iterations.**
Only unique matches retained
SIM ↔ patient journey data:
Variables: sex, race/color, date of birth, municipality (care/residence), facility, date (care/death)
7 combinations; **7 matching iterations** Only unique matches retained

Costs of chemotherapy, radiotherapy, hospitalization, consultations, and exams were extracted for each patient on a monthly basis, covering the period the patient remained in the database. A microsimulation model, using individual patient-level data, was built to estimate the average cost and life-years gained along each treatment path. Censored patients had their survival calculated based on the general population's survival, adjusted for their age. Patients were filtered by place of care, staging at diagnosis, and presence of prior treatment to verify the heterogeneity of (ICER) across these subgroups.

Variable	Category	Total (n = 3548)	Pertuzumab (n = 3548)	Chemotherapy (n = 3548)	valor-p
Initial Age	Mean (DP)	53.6 ± 12.3	53.6 ± 12.4	53.7 ± 12.1	0,737
	40 - 59, n (%)	2.858 (80.6)	1.949 (54.9)	2.006 (56.5)	0,435
	60 - 79, n (%)	1.743 (49.1)	1.023 (28.8)	1.011 (28.5)	
	20 - 39, n (%)	908 (25.6)	498 (14.0)	460 (13.0)	
	>= 80, n (%)	146 (4.1)	78 (2.2)	71 (2.0)	
Residence Region	0 - 19, n (%)	0 (0.0)	0 (0.0)	0 (0.0)	
	SE, n (%)	2.246 (63.3)	1.286 (36.2)	1.478 (41.7)	< 0,001
	NE, n (%)	1.510 (42.6)	995 (28.0)	718 (20.2)	
	S, n (%)	956 (26.9)	483 (13.6)	557 (15.7)	
	MW, n (%)	843 (23.8)	516 (14.5)	371 (10.5)	
Staging at first treatment	N, n (%)	662 (18.7)	268 (7.6)	424 (12.0)	
	advanced, n (%)	3.412 (96.2)	2.971 (83.7)	2.748 (77.5)	< 0,001
	initial, n (%)	1.055 (29.7)	507 (14.3)	649 (18.3)	
	in situ, n (%)	217 (6.1)	70 (2.0)	151 (4.3)	

RESULTS

The results shown in Table 1 present the mean costs and effectiveness per patient over a 73-year time horizon, considering that censored patients followed the general population survival curve according to age. A scenario analysis was performed (Table 2) in which the mortality of censored patients was influenced by treatment. In this case, the Hazard Ratio for disease-specific mortality was calculated separately for the Chemotherapy and Pertuzumab arms.

The survival curve was extracted for all patients recorded as deceased (non-censored) in the database within the Pertuzumab arm. Subsequently, the overall survival curve for these patients was estimated according to IBGE life tables, taking into account their baseline age in the model. The two curves were compared by calculating a Hazard Ratio between them in order to demonstrate the impact of having breast cancer and receiving Pertuzumab treatment on overall survival relative to a general population of the same age. The same procedure was performed for the Chemotherapy arm. Pertuzumab HR was 2,61 an Chemotherapy HR was 5,16. The Brazilian Willingness to pay threshold is US\$21,000/life years

Table 1 – Base case Results

Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER
Chemotherapies	13,479.18		10.04		
Pertuzumab	41,215.20	27,736.02	11.51	1.46	18,955.25

Table 2 – Scenario Results

Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER
Chemotherapies	13,479.18		7.34		
Pertuzumab	41,215.20	27,736.02	9.85	2.51	11,028.88

In **Table 3**, is presented on the side, the results of the population subgroup analysis

CONCLUSION:

The study showed the cost-effectiveness of Pertuzumab within the Brazilian Public Health System (SUS) using real-world data, that is, the amount of resources invested to increase patients' life expectancy by one additional year. The results showed that the values were within the willingness-to-pay threshold adopted by SUS. However, the subgroup analysis demonstrated that the efficiency of the medication use is heterogeneous, particularly across geographic regions and disease staging.

Table 3 – Subgroup Results

Strategy	Cost(U\$)	Staging in situ		Incr Eff	ICER(U\$)	Pacientes
		Incr Cost	Eff			
Pertuzumab	11.265,85		12,67			151
Chemotherapies	38.107,21	26.841	12,69	0,01	2.144.014	70
Staging Advanced						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Pertuzumab	31.563,80		11,5			2.971
Chemotherapies	4.411,60	27.152	9,59	1,92	14.158	1.793
Staging Initial						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Pertuzumab	13.979,45		10,55			649
Quimioterapia	42.954,90	28.975	11,35	0,8	36.287	507
Region Mid-West						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Chemotherapies	10.268,44		9,07			371
Pertuzumab	41.937,60	31.669	11,85	2,78	11.377	516
Region Northeast						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Chemotherapies	12.251,62		9,97			718
Pertuzumab	38.827,76	26.576	11,97	2	13.279	995
Region Southeast						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Chemotherapies	13.408,21		9,65			1.478
Pertuzumab	41.554,00	28.146	11,2	1,55	18.151	1.286
Region South						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Chemotherapies	12.719,64		9,57			557
Pertuzumab	41.923,12	29.203	10,66	1,09	26.833	483
Region North						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Chemotherapies	19.612,50		13,03			424
Pertuzumab	45.786,50	26.174	12,14	-0,89	Dominated	268
Without previous tratment						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Chemotherapies	14.295,68		10,61			1792
Pertuzumab	41.256,35	26.961	11,6	0,99	27.153	1.590
With previous tratment						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Chemotherapies	12.691,62		9,5			1756
Pertuzumab	41.181,78	28.490	11,43	1,93	14.750	1.958
Initial Age < 40						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Quimioterapia	14.053,79		11,58			460
Pertuzumab	44.199,09	30.145	13,43	1,85	16.263	498
Initial Age 40-49						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Quimioterapia	15.207,63		11,35			834
Pertuzumab	43.800,11	28.592	12,82	1,46	19.550	853
Initial Age 50-64						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Quimioterapia	13.880,31		10,01			1.597
Pertuzumab	41.224,02	27.344	11,61	1,6	17.107	1.532
Initial Age 65 -74						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Chemotherapies	10.351,74		8,16			478
Pertuzumab	37.802,91	27.451	8,74	0,58	47.245	480
Initial Age >74						
Strategy	Cost	Incr Cost	Eff	Incr Eff	ICER	Pacientes
Chemotherapies	8.721,92		5,27			179
Pertuzumab	30.044,82	21.323	6,57	1,3	16.389	185

