

Analysis of the Variation of Costs in Available Anti-Cancer Drugs in the Indian Market

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Patil *et al.*: Cost Variation among Anti-Cancer Drugs

Physicians often face challenges in prescribing the most economical anti-cancer drugs due to a lack of comprehensive, up-to-date comparative information on drug costs. To analyze the variation in cost percentage among various brands of anti-cancer drugs available in the Indian market, this study is designed. For analysis of the costs of the anti-cancer drugs a Pharma Sahi Daam from March 2021 to September 2021 was used to collect study data. For every drug calculation was done to find the difference between the maximum and minimum costs. Similarly, it also done for cost ratio and variation of cost percentage. Among anti-cancer drugs, drug with highest cost is Bevacizumab 400 mg injection; 117625 and drug with lowest cost is temozolomide 20 mg, 100 mg, 250 mg capsule; 0.25. Among anti-cancer drugs cost ratio is highest for temozolomide (20 mg/100 mg/250 mg Capsule; 8407.192 and cost ratio is lowest for Bleomycin 15 IU injection; 1.002. Among anti-cancer drugs cost variation is highest for Temozolomide 20 mg/100 mg/250 mg capsule; 840619.2 and cost variation is lowest for Fulvestrant 250 mg injection; 40.3318. This study shows among anti-cancer drugs there is a high variation in prices, cost ratio and cost variation. Study may helpful for understanding price variation among anti-cancer drugs. It may useful to doctors to get knowledge regarding the variations of cost among drugs to choose prices which will be cheap to patient.

Key words: Cancer, anti-cancer drugs, pharma Sahi Daam, cost variation, cost ratio

Cancer, or malignancy, is characterized by the abnormal growth of cells. Breast, lung, skin, prostate, colon cancers and lymphoma are most common cancer affecting humans among more than 100 types of cancers. Cancer is typically treated with radiation, chemotherapy, and surgery^[1].

In 2022, lung cancer emerged as the most diagnosed cancer globally, accounting for nearly 2.5 million new cases, which represented about 12.4 % of all cancers worldwide. This was followed by breast cancer (11.6 %), colorectal cancer (9.6 %), prostate cancer (7.3 %), and stomach cancer (4.9 %). Tragically, lung cancer was also the leading cause of cancer-related deaths, with an estimated 1.8 million deaths, making up 18.7 % of all cancer deaths. Colorectal cancer (9.3 %), liver cancer (7.8 %), breast cancer (6.9 %), and stomach cancer (6.8 %) were the other leading causes of cancer death. Lung cancer was the most frequent cancer and cause of death in men, while breast cancer held that distinction in women^[2].

Causes of death due to cancer includes use of tobacco (about 22 %) and deficiency of physical activity, obesity, excessive alcohol drinking, poor diet (about 10 %)^[3-5]. Other factors such as exposure to ionizing radiation, certain infections and environmental pollutants are also responsible^[6].

Very low fruits and vegetables intakes rises risk of some cancers. Obesity and alcohol intake increase the risk of some cancer^[7].

Cancer may manifest through a range of signs and symptoms, which frequently vary based on the specific type of cancer and its anatomical location within the body. Common symptoms may consist of unusual bleeding, unexplained weight loss, a

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persistent cough, and alterations in bowel habits^[8].

The most common cancers vary by gender. In women, the cancers most diagnosed include breast, colorectal, lung, and cervical cancers, while in men, the most prevalent types are lung, prostate, colorectal, and stomach cancers^[9].

In 2015, cancer was a significant global health issue, with approximately 90.5 million people diagnosed with the disease^[10]. It accounted for around 8.8 million deaths, representing about 15.7 % of all deaths that year^[11].

Expenditure on drug by the cancer patients substantially growing and cost of an anti-cancer medicines are more than other drugs categories^[12].

In developed countries, the presence of comprehensive medical insurance often helps mitigate the costs of anti-cancer drugs, making them more accessible to patients. In numerous developing nations, such as India, the medical insurance system remains in a state of development. This can lead to challenges in affordability and access to necessary treatments, resulting in disparities in cancer care^[13].

Physicians often face challenges in prescribing the most economical anti-cancer drugs due to a lack of comprehensive, up-to-date comparative information on drug costs.

To analyse the variation in cost percentage among various brands of anti-cancer drugs available in the Indian market, this study is designed.

MATERIALS AND METHODS

Study was conducted in the Department of Pharmacology after the approval from the Institutional Research Committee (IRC) and from the Independent Ethics Committee (IEC). For analysis of the costs of the anti-cancer drugs a Pharma Sahi Daam from March 2021 to September 2021 was used to collect study data.

Pharma Sahi Daam is an online platform designed to help consumers in India easily access information about the prices of medicines, compare their prices across different pharmacies and provides information about the ceiling prices for essential medicines as set by the National Pharmaceutical Pricing Authority (NPPA).

A variety of anti-cancer drugs were chosen, ensuring representation from different classes of medications. Specific strengths and dosage forms (tablets, capsules, injections) were selected for each drug to

standardize the comparison. The costs of each brand were documented in a table format. Only strips or injections containing the same quantity of tablets, capsules, or injections were included to maintain consistency. The cost per unit (capsule, tablet, or injection) for each brand was calculated in Indian Rupees (INR) using a calculator. The cost of one capsule, tablet, or injection was compared across different brands for the same drug, strength and dosage form produced by various manufacturers.

For every drug calculation was done to find difference between the maximum and minimum costs. Similarly, it also done for cost ratio and variation of cost percentage^[14].

Formula used for price variation calculation;

Percentages price variation = $\frac{\text{Price of the most expensive brand} - \text{Price of the least expensive brand}}{\text{Price of the least expensive brand}} \times 100$

The cost ratio was calculated by taking cost of most expensive brand and dividing it by cost of least expensive brand for the same drug, strength, and dosage form. This ratio reflects the extent to which the most expensive brand exceeds the cost of the least expensive brand^[15].

Inclusion criteria: Same strength from different manufacturers; identical strength and quantity in tablet strips and Fixed-Dose Combinations (FDCs) with more than two drugs.

Exclusion criteria: A single pharmaceutical company that manufactured drug; different pharmaceutical companies manufactured drug in different strengths and no information related to cost for drugs.

Statistical analysis:

Findings of the study were analysed using Microsoft Word 2016 and Excel 2016. The results were presented in both absolute figures and percentages, and calculations were made for the percentage variation of costs and the cost ratio. Data is illustrated through the use of tables and charts.

RESULTS AND DISCUSSION

A total of 19 different classes of anti-cancer drugs were selected for the study. This variety ensures a comprehensive analysis of pricing across a broad spectrum of treatment options, reflecting the complexity and diversity of cancer therapies available in market.

Among the alkylating agents, drug with highest cost is

a Bendamustine (100 mg injection; 11 000) and drug with lowest cost is temozolomide (20 mg/100 mg/250 mg capsule; 0.25).

Cost ratio is highest for temozolomide (20 mg/100 mg/250 mg capsule; 8407.192) and lowest for Melphalan (2 mg/5 mg tablet; 1.0528).

Cost variation is highest for Temozolomide (20 mg/100 mg/250 mg Capsule; 840 619.2) and lowest for Melphalan (2 mg/5 mg tablet; 5.2873).

Among the platinum coordination complexes, drug with highest cost is oxaliplatin (100 mg infusion; 10419.4) and drug with lowest cost is cisplatin (50 mg infusion 50 ml infusion; 297.62).

Cost ratio is highest for oxaliplatin (100 mg infusion; 6.6055) and lowest for cisplatin (50 mg infusion 50 ml infusion; 1.2912).

Cost variation is highest for oxaliplatin (100 mg infusion; 560.5510) and lowest for cisplatin (50 mg infusion 50 ml infusion; 29.1243).

Among antimetabolites, drug with highest cost is pemetrexed (500 mg injection; 81026) and drug with lowest cost is 6-mercaptopurine (50 mg tablet; 5).

Cost ratio is highest for pemetrexed (500 mg injection; 33.1739) and lowest for methotrexate (20 mg tablet; 1.1150).

Cost variation is highest for pemetrexed (500 mg injection; 3217.3931) and lowest for Methotrexate (20 mg tablet; 11.5021).

Among the microtubule damaging agents, drug with highest cost is paclitaxel (300 mg infusion; 19 825.57) and drug with lowest cost is vincristine (1 mg/ml injection; 50.3).

Cost ratio is highest for docetaxel (20 mg injection; 11.2) and lowest for vincristine (1 mg/ml injection; 1.0842).

Cost variation is highest for docetaxel (20 mg injection; 1,020) and lowest for vincristine (1 mg/ml injection; 8.4294).

Among the topoisomerase-2 inhibitor, drug with highest cost is etoposide (100 mg injection; 196.47) and drug with lowest cost is etoposide (100 mg injection; 136). Cost variation of etoposide for 100 mg injection is 44.4632.

Among the topoisomerase-1 inhibitor, drug with highest cost is irinotecan (100 mg injection; 4,095) and drug with lowest cost is irinotecan (100 mg injection;

517.82).

Cost ratio is highest for irinotecan (100 mg injection; 7.9081) and lowest for irinotecan (40 mg injection; 2.7301).

Cost variation is highest for irinotecan (100 mg injection; 690.8153) and lowest for irinotecan (40 mg injection; 173.0162).

Among antibiotics, drug with highest cost is doxorubicin (2 mg/ml 1 ml) injection; 49 427) and drug with lowest cost is doxorubicin (10 mg plain injection; 79).

Cost ratio is highest for doxorubicin (10 mg liposomal injection; 17.4914) and lowest for bleomycin (15 IU injection; 1.0023).

Cost variation is highest for doxorubicin 10 mg liposomal injection; 1649.1465) and lowest for bleomycin (15 IU injection; 0.2316).

Among the Break Point Cluster-Abelson Tyrosine Kinase (BCR-ABL) tyrosine kinase inhibitors, drug with highest cost is dasatinib (50 mg tablet; 2761.3333) and drug with lowest cost is imatinib (100 mg Tablet; 29.513).

Cost ratio is highest for dasatinib (50 mg tablet; 53.5315) and lowest for dasatinib (20 mg tablet; 1.0636).

Cost variation is highest for Dasatinib (50 mg tablet; 5253.1536) and lowest for Dasatinib (20 mg tablet; 6.3659).

Among the Epidermal Growth Factor (Human Epidermal Growth Factor Receptor) (EGF (HER)) receptor inhibitors, drug with highest cost is Trastuzumab (440 mg/50 ml injection; 64 052) and drug with lowest cost is Gefitinib (250 mg tablet; 80.507).

Cost ratio is highest for erlotinib (150 mg tablet; 8.7229) and lowest for lapatinib (250 mg tablet; 1.9061).

Cost variation is highest for erlotinib (150 mg tablet; 772.2972) and lowest for lapatinib (250 mg tablet; 90.6191).

Among angiogenesis inhibitors, drug with highest cost is bevacizumab (400 mg injection; 117,625) and drug with lowest cost is sorafenib (200 mg tablet; 47.5873).

Cost ratio is highest for bevacizumab (100 mg injection; 4.3257) and lowest for sorafenib (200 mg tablet; 1.6460).

Cost variation is highest for bevacizumab (100 mg injection; 332.5754) and lowest for Sorafenib (200 mg Tablet; 64.6096) as shown in fig. 1.

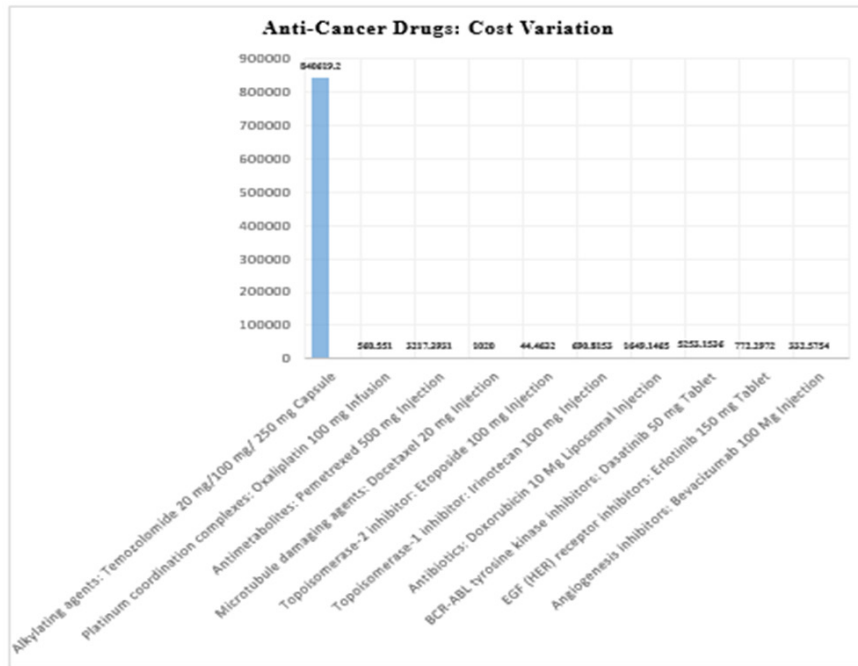


Fig. 1: Maximum cost variation among anti-cancer drugs

Among the proteasome inhibitors, drug with highest cost is of bortezomib (3.5 mg injection; 54,350) and drug with lowest cost is of bortezomib (2 mg injection; 2,150).

Cost ratio is highest for the bortezomib (2 mg injection; 6.0134) and lowest for the bortezomib (3.5 mg injection; 3.2351).

Cost variation is highest for the bortezomib (2 mg injection; 501.3413) and lowest for the bortezomib 3.5 mg injection; 223.5119).

Among Cluster of Differentiation 20 (CD20) inhibitors, drug with highest cost is rituximab (10 mg/ml injection; 42 350.56) and drug with lowest cost is rituximab (100 mg injection; 6368).

Cost ratio is highest for rituximab (10 mg/ml injection; 3.4497) and lowest for rituximab (100 mg injection; 1.4865).

Cost variation is highest for rituximab (10 mg/ml injection; 244.9796) and lowest for rituximab (100 mg injection; 48.6534).

Among Selective Estrogen Receptor Modulators (SERMs), drug with highest cost is Fulvestrant (250 mg injection; 28 200) and drug with lowest cost is tamoxifen (20 mg tablet; 2.655).

Cost ratio is highest for Fulvestrant (250 mg injection; 1.4033) and lowest for Fulvestrant (250 mg prefilled syringe; 1.1774).

Cost variation is highest for Fulvestrant (250 mg injection; 40.3318) and lowest for Fulvestrant (250 mg prefilled syringe; 17.7419).

Among the aromatase inhibitors, drug with highest cost is exemestane (25 mg tablet; 81) and drug with lowest cost is Letrozole (2.5 mg tablet; 6.3).

Cost ratio is highest for letrozole (2.5 mg tablet; 6.9876) and lowest for letrozole (2.5 mg Capsule; 1.3651).

Cost variation is highest for letrozole (2.5 mg tablet; 598.7619) and lowest for letrozole (2.5 mg capsule; 36.5152).

Among antiandrogens, drug with highest cost is Bicalutamide (50 mg tablet; 57.06) and drug with lowest cost is Flutamide (250 mg Tablet; 10.7).

Cost ratio is highest for Bicalutamide (50 mg tablet; 2.6915) and lowest for Flutamide (250 mg tablet; 1.3246).

Cost variation is highest for Bicalutamide (50 mg tablet; 169.1509) and lowest for Flutamide (250 mg Tablet; 32.4672).

Among 5 alpha-reductase inhibitors, drug with highest cost is Dutasteride (0.5 mg capsule; 26 (two drugs with same price)) and drug with lowest cost is Finasteride (1 mg tablet; 4).

Cost ratio is highest for Dutasteride (0.5 mg Tablet; 1.9191 (two drugs with same price)) and lowest for Dutasteride (0.5 mg capsule; 1.0637 (two drugs with

same price)).

Cost variation is highest for Dutasteride (0.5 mg tablet; 91.9191 (two drugs with same price)) and lowest for Dutasteride (0.5 mg capsule; 6.3742 (two drugs with same price)).

Among Gonadotropin Releasing Hormone (GnRH) analogues, drug with highest cost is Leuprorelin (Leuprolide) (22.5 mg injection; 22,650) and drug with lowest cost is Leuprorelin (Leuprolide) (1 mg injection; 145).

Cost ratio is highest for Cetrorelix (0.25 mg injection; 4.0368) and lowest for Goserelin (3.6 mg injection; 1.1379).

Cost variation is highest for Cetrorelix (0.25 mg injection; 303.6846) and lowest for Goserelin (3.6 mg injection; 13.7967).

Among somatostatin analogues, drug with highest cost

is Octreotide (10 mg injection; 51 113.75) and drug with lowest cost is Octreotide (50 mg injection; 235.5).

Cost ratio is highest for Octreotide (10 mg injection; 5.3696) and lowest for Octreotide (100 mg injection; 1.4123).

Cost variation is highest for Octreotide (10 mg injection; 436.9627) and lowest for Octreotide (100 mg injection; 41.2393).

Among miscellaneous, drug with highest cost is arsenic trioxide (1 mg injection; 606.37) and drug with lowest cost is hydroxyurea (500 mg capsule; 6.4).

Cost ratio is highest for Hydroxyurea (500 mg capsule; 2.3031) and lowest for arsenic trioxide (1 mg injection; 1.4686).

Cost variation is highest for hydroxyurea (500 mg capsule; 130.3125) and lowest for arsenic trioxide (1 mg injection; 46.8670) (Table 1 and fig. 2).

TABLE 1: A TOTAL OF 19 DIFFERENT CLASSES OF ANTI-CANCER DRUGS WERE SELECTED FOR THE STUDY

Drug	Strength	Dosage form	Cost variation
Maximum cost variation among anti-cancer drugs			
Alkylating agents			
Temozolomide	20 mg/100 mg/250 mg	Capsule	840619
Platinum coordination complexes			
Oxaliplatin	100 mg	Infusion	560.551
Antimetabolites			
Pemetrexed	500 mg	Injection	3217.39
Microtubule damaging agents			
Docetaxel	20 mg	Injection	1020
Topoisomerase-2 inhibitor			
Etoposide	100 mg	Injection	44.4632
Topoisomerase-1 inhibitor			
Irinotecan	100 mg	Injection	690.815
Antibiotics			
Doxorubicin	10 Mg	Liposomal Injection	1649.15
BCR-ABL tyrosine kinase inhibitors			
Dasatinib	50 mg	Tablet	5253.15
EGF (HER) receptor inhibitors			
Erlotinib	150 mg	Tablet	772.297
Angiogenesis inhibitors			
Bevacizumab	100 mg	Injection	332.575
Proteasome inhibitors			
Bortezomib	2 mg	Injection	501.341

CD20 inhibitors			
Rituximab	10 mg/ml	Injection	244.98
SERMs			
Fulvestrant	250 mg	Injection	40.3318
Aromatase inhibitors			
Letrozole	2.5 mg	Tablet	598.762
Antiandrogens			
Bicalutamide	50 mg	Tablet	169.151
5 α -reductase inhibitors			
Dutasteride	0.5 mg	Tablet	91.9191
GnRH analogues			
Cetrorelix	0.25 mg	Injection	303.685
Somatostatin analogues			
Octreotide	10 mg	Injection	436.963
Miscellaneous			
Hydroxyurea	500 mg	Capsule	130.313

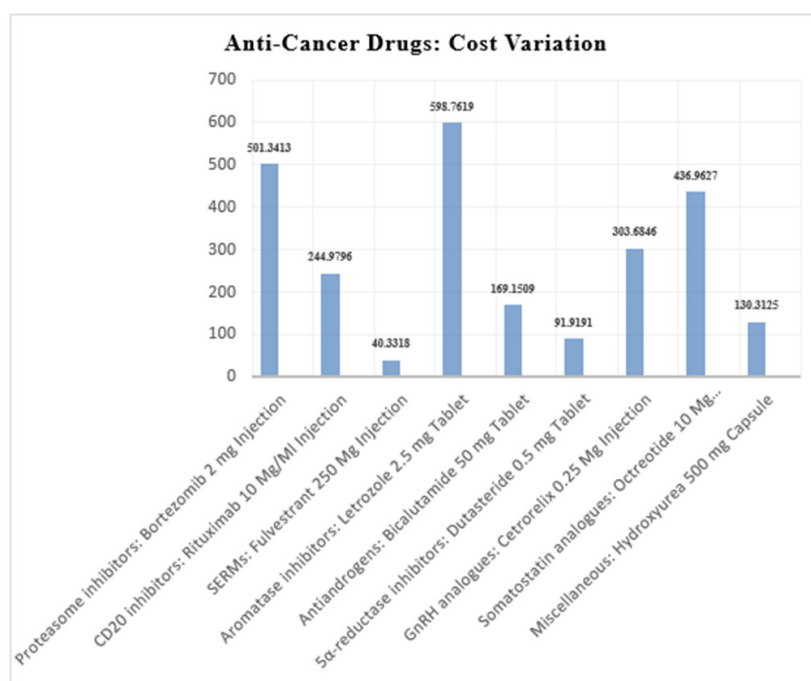


Fig. 2: Maximum cost variation among anti-cancer drugs

Among the anti-cancer drugs temozolomide 20 mg/100 mg/250 mg capsule; 840 619.2 shows highest cost variation.

Cancer indeed involves uncontrolled growth of the cells, which can infiltrate adjacent tissues and spread to various regions of the body through the bloodstream or the lymphatic system^[3,16].

Malignant progression typically involves several key steps from initiation, promotion to progression forming a detectable mass to outright cancer^[17].

Cancer treatment is tailored to each individual based on various factors, including cancer grade, type, location, stage and also age and health status of patient. Common treatment modalities include chemotherapy, radiation therapy and surgery.

The cost of anti-cancer drugs is a significant barrier to access and treatment in resource-poor countries like India^[18].

NPPA plays a crucial role in regulating drug prices in India and based on essentiality decide the ceiling

price. Manufacturing pharmaceutical companies set their prices below or equal to the ceiling price as per ceiling price given in Drugs Prices Control Order (DPCO)^[19]. Anti-cancer drugs included under DPCO are Cisplatin, Carboplatin, Oxaliplatin, Methotrexate, 6-mercaptopurine, Azathioprine, 5-Fluorouracil, Cytosine Arabinoside, Capecitabine, Gemcitabine, Vincristine, Vinblastine, Cyclophosphamide, Chlorambucil, Melphalan, Dacarbazine, Temozolomide, Procarbazine, Hydroxyurea, L-Asparaginase, Arsenic trioxide, Imatinib, Gefitinib, Trastuzumab, Bortezomib, Rituximab, BCG, Prednisolone, Dexamethasone, Tamoxifen, Paclitaxel, Docetaxel, Etoposide, Actinomycin D, Doxorubicin, Daunorubicin, Bleomycins, Letrozole and Bicalutamide.

Cancer is common and is major causes of morbidity and mortality in India as well as whole world was the reason for choosing this study. There is a limited amount of research comparing the costs of different brands of anti-cancer drugs. This lack of studies can pose challenges for healthcare providers and patients seeking affordable treatment options. For collection and analysis of study data Pharma Sahi Daam from March 2021 to September 2021 was chosen.

Among alkylating agents, drug with highest cost is Bendamustine (100 mg injection; 11,000) and drug with lowest cost is temozolomide (20 mg/100 mg/ 250 mg capsule; 0.25). Cost ratio is highest for temozolomide (20 mg/100 mg/ 250 mg capsule; 8,407.192) and lowest for melphalan (2 mg/5 mg tablet; 1.0528). Cost variation is highest for temozolomide (20 mg/100 mg/ 250 mg capsule; 840,619.2) and lowest for melphalan (2 mg/5 mg tablet; 5.2873).

Among platinum coordination complexes, drug with highest cost is oxaliplatin (100 mg Infusion; 10,419.4) and drug with lowest cost is Cisplatin (50 mg infusion 50 ml infusion; 297.62). Cost ratio is highest for Oxaliplatin (100 mg infusion; 6.6055) and lowest for cisplatin (50 mg infusion 50 ml infusion; 1.2912). Cost variation is highest for oxaliplatin (100 mg infusion; 560.5510) and lowest for Cisplatin (50 mg infusion 50 ml infusion; 29.1243).

Among Antimetabolites, drug with highest cost is pemetrexed (500 mg injection; 81 026) and drug with lowest cost is 6-mercaptopurine (50 mg tablet; 5). Cost ratio is highest for pemetrexed (500 mg injection; 33.1739) and lowest for methotrexate (20 mg tablet; 1.1150). Cost variation is highest for pemetrexed (500 mg injection; 3217.3931) and lowest for methotrexate (20 mg tablet; 11.5021).

Among microtubule damaging agents, drug with highest cost is paclitaxel (300 mg infusion; 19,825.57 and drug with lowest cost is Vincristine (1 mg/ml injection; 50.3). Cost ratio is highest for Docetaxel (20 mg injection; 11.2) and lowest for vincristine (1 mg/ml injection; 1.0842). Cost variation is highest for docetaxel (20 mg injection; 1,020) and lowest for vincristine (1 mg/ml injection; 8.4294).

Among topoisomerase-2 inhibitor, drug with highest cost is etoposide (100 mg injection; 196.47) and drug with lowest cost is etoposide (100 mg injection; 136). Cost ratio of etoposide for 100 mg injection is 1.4446. Cost variation of etoposide for 100 mg injection is 44.4632.

Among Topoisomerase-1 inhibitor, drug with highest cost is irinotecan (100 mg injection; 4,095) and drug with lowest cost is irinotecan (100 mg injection; 517.82). Cost ratio is highest for irinotecan (100 mg injection; 7.9081) and lowest for irinotecan (40 mg injection; 2.7301). Cost variation is highest for irinotecan (100 mg injection; 690.8153) and lowest for irinotecan (40 mg injection; 173.0162).

Among Antibiotics, drug with highest cost is Doxorubicin (2 mg/ml 1 ml) injection; 49,427) and drug with lowest cost is Doxorubicin (10 mg Plain Injection; 79). Cost ratio is highest for Doxorubicin (10 mg Liposomal Injection; 17.4914) and lowest for Bleomycin (15 IU injection; 1.0023). Cost variation is highest for Doxorubicin 10 mg liposomal injection; 1649.1465) and lowest for Bleomycin (15 IU injection; 0.2316).

Among the BCR-ABL tyrosine kinase inhibitors, drug with highest cost is Dasatinib (50 mg tablet; 2761.3333) and drug with lowest cost is Imatinib (100 mg tablet; 29.513). Cost ratio is highest for Dasatinib (50 mg tablet; 53.5315) and lowest for Dasatinib (20 mg tablet; 1.0636). Cost variation is highest for Dasatinib (50 mg tablet; 5253.1536) and lowest for Dasatinib (20 mg tablet; 6.3659).

Among EGF (HER) receptor inhibitors, drug with highest cost is Trastuzumab (440 mg/50 ml injection; 64 052) and drug with lowest cost is Gefitinib (250 mg tablet; 80.507). Cost ratio is highest for erlotinib (150 mg tablet; 8.7229) and lowest for lapatinib (250 mg tablet; 1.9061). Cost variation is highest for erlotinib (150 mg tablet; 772.2972) and lowest for Lapatinib (250 mg tablet; 90.6191).

Among Angiogenesis inhibitors, drug with highest cost is Bevacizumab (400 mg injection; 117 625) and

drug with lowest cost is Sorafenib (200 mg tablet; 47.5873). Cost ratio is highest for Bevacizumab (100 mg injection; 4.3257) and lowest for Sorafenib (200 mg tablet; 1.6460). Cost variation is highest for Bevacizumab (100 mg injection; 332.5754) and lowest for Sorafenib (200 mg tablet; 64.6096) (fig. 1).

Among Proteasome inhibitors, drug with highest cost is the Bortezomib (3.5 mg injection; 54 350) and drug with lowest cost is the Bortezomib (2 mg injection; 2150). Cost ratio is highest for the Bortezomib (2 mg Injection; 6.0134) and lowest for the Bortezomib (3.5 mg injection; 3.2351). Cost variation is highest for the Bortezomib (2 mg injection; 501.3413) and lowest for the Bortezomib 3.5 mg injection; 223.5119).

Among CD20 inhibitors, drug with highest cost is Rituximab (10 mg/ml injection; 42 350.56) and drug with lowest cost is Rituximab (100 mg injection; 6,368). Cost ratio is highest for Rituximab (10 mg/ml injection; 3.4497) and lowest for Rituximab (100 mg injection; 1.4865). Cost variation is highest for rituximab (10 mg/ml injection; 244.9796) and lowest for Rituximab (100 mg injection; 48.6534).

Among SERMs, drug with highest cost is Fulvestrant (250 mg injection; 28 200) and drug with lowest cost is Tamoxifen (20 mg tablet; 2.655). Cost ratio is highest for Fulvestrant (250 mg injection; 1.4033) and lowest for Fulvestrant (250 mg prefilled syringe; 1.1774). Cost variation is highest for Fulvestrant (250 mg injection; 40.3318) and lowest for Fulvestrant (250 mg prefilled syringe; 17.7419).

Among Aromatase inhibitors, drug with highest cost is Exemestane (25 mg tablet; 81) and drug with lowest cost is the Letrozole (2.5 mg tablet; 6.3). Cost ratio is highest for the Letrozole (2.5 mg tablet; 6.9876) and lowest for the letrozole (2.5 mg capsule; 1.3651). Cost variation is highest for the letrozole (2.5 mg tablet; 598.7619) and lowest for the letrozole (2.5 mg capsule; 36.5152).

Among Antiandrogens, drug with highest cost is Bicalutamide (50 mg tablet; 57.06) and drug with lowest cost is Flutamide (250 mg tablet; 10.7). Cost ratio is highest for Bicalutamide (50 mg Tablet; 2.6915) and lowest for Flutamide (250 mg tablet; 1.3246). Cost variation is highest for Bicalutamide (50 mg tablet; 169.1509) and lowest for Flutamide (250 mg tablet; 32.4672).

Among 5 α -reductase inhibitors, drug with highest cost is Dutasteride (0.5 mg capsule; 26 [two drugs with same price]) and drug with lowest cost is Finasteride (1 mg

tablet; 4). Cost ratio is highest for Dutasteride (0.5 mg tablet; 1.9191 (two drugs with same price)) and lowest for Dutasteride (0.5 mg capsule; 1.0637 (two drugs with same price)). Cost variation is highest for Dutasteride (0.5 mg tablet; 91.9191 (two drugs with same price)) and lowest for Dutasteride (0.5 mg Capsule; 6.3742 (two drugs with same price)).

Among GnRH analogues, drug with highest cost is Leuprorelin (Leuprolide) (22.5 mg injection; 22,650) and drug with lowest cost is Leuprorelin (Leuprolide) (1 mg injection; 145). Cost ratio is highest for Cetrorelix (0.25 mg injection; 4.0368) and lowest for Goserelin (3.6 mg injection; 1.1379). Cost variation is highest for Cetrorelix (0.25 mg injection; 303.6846) and lowest for Goserelin (3.6 mg injection; 13.7967).

Among Somatostatin analogues, drug with highest cost is Octreotide (10 mg injection; 51 113.75) and drug with lowest cost is Octreotide (50 mg injection; 235.5). Cost ratio is highest for Octreotide (10 mg injection; 5.3696) and lowest for Octreotide (100 mg injection; 1.4123). Cost variation is highest for Octreotide (10 mg injection; 436.9627) and lowest for Octreotide (100 mg injection; 41.2393).

Among Miscellaneous, drug with highest cost is arsenic trioxide (1 mg injection; 606.37) and drug with lowest cost is hydroxyurea (500 mg capsule; 6.4). Cost ratio is highest for Hydroxyurea (500 mg capsule; 2.3031) and lowest for arsenic trioxide (1 mg injection; 1.4686). Cost variation is highest for hydroxyurea (500 mg capsule; 130.3125) and lowest for arsenic trioxide (1 mg injection; 46.8670) (fig. 2).

Among anti-cancer drugs, drug with highest cost is Bevacizumab 400 mg injection; 117 625 and drug with lowest cost is Temozolomide 20 mg/100 mg/250 mg Capsule; 0.25.

Among anti-cancer drugs cost ratio is highest for temozolomide 20 mg/100 mg/250 mg Capsule; 8407.192 and lowest for Bleomycin 15 IU injection; 1.0023.

Among anti-cancer drugs cost variation is highest for Temozolomide 20 mg/100 mg/250 mg Capsule; 840 619.2 and lowest for Fulvestrant 250 mg injection; 40.3318.

This study shows high-cost variation among anti-cancer drugs. Competition between pharmaceutical companies may be responsible for cost variation. Pharmacists are supposed to prioritize patient care and follow clinicians' prescriptions. For high profit few times pharmacist

substitutes a more expensive brand ignoring the brand prescribed by clinician^[20].

In favour of gifts from pharmaceutical companies doctors prescribe costliest branded drugs. Lack of information of drug costs making difficult for clinicians to prescribe the most economical drugs. Prescribing generic medications when appropriate can help reduce costs for patients and improve access to necessary treatments. Clinicians should prioritize patient welfare and base their decisions on evidence rather than external influences from pharmaceutical companies. Promoting generics also encourages competition and can lead to lower overall healthcare costs. Doctors must be aware of cost variation of drugs. When medications are affordable, patients are more likely to adhere to their treatment plans, which is crucial for managing conditions like cancer. Improved compliance can lead to better health outcomes, as patients can consistently take their prescribed medications without financial stress. Access to effective, low-cost treatments plays a significant role in controlling diseases and enhancing overall patient well-being.

Many patients worry that generic cheap drugs may not be as effective as brand-name drugs and will not cure their disease. Generics must meet the same regulatory standards for safety, efficacy, and quality as their brand-name counterparts. Still is it not proved that brand with highest cost is more effective than brand with the lowest cost^[21].

Government intervention can play a crucial role in making medications more affordable and accessible. Few strategies that could help such as price regulation, promoting generics and transparency in pricing.

Doctors should consider prescribing affordable options, like generics, whenever appropriate and discuss the benefits with patients. Pharmacists play a vital role in ensuring patients receive the prescribed medications, and they should be transparent about costs and alternatives. Patients advocate for themselves, ask questions, and express concerns about medication costs. Regulatory Authorities should actively regulate drug prices and promote policies that enhance access to affordable medications. It is a collaborative effort. When everyone works together, it can lead to better health outcomes and a more equitable healthcare system. Hospital can make their drug formulary of cheaper drugs and insist clinician to prescribe cheaper drugs.

Findings from the study done by Kolasani *et al.*^[18] shows high variation in the costs of the various anti-

cancer drugs such as among hormonal drugs flutamide (250 mg; tablet) showed the highest price variation (714.24 %).

Sandeep Kumar Adwal and Ruchi Baghel study reveals high variations in the costs of anti-cancer drugs like an alkylating agent carboplatin 150 mg injection (1100 %) shows highest cost variation and anti-metabolite cytarabine 500 mg injection (6.56 %) shows lowest cost variation^[22].

A study focused on price variations among anti-cancer drugs could provide valuable insights. In few ways it could be beneficial. Doctors can use the data to make more cost-effective prescribing decisions, ensuring that patients receive the best treatment options within their budget. Understanding price variations can help clinicians educate patients about their options, empowering them to make informed choices. Identifying lower-cost alternatives can enhance access to necessary treatments, potentially improving compliance and outcomes. The findings could also inform policy discussions aimed at reducing drug costs, encouraging the development of more affordable treatment options. By highlighting price differences, the study can advocate for greater transparency in drug pricing, benefiting patients and healthcare providers alike. Overall, this kind of research is essential for promoting equity and effectiveness in cancer care.

Limitation of our study are only Pharma Sahi Daam was used and very few references. More such studies required to explore the cost variation of anti-cancer drugs. It's time to know why high cost variation and how to tackle it. In new medical education curriculum Pharmacoeconomic need to be included for understanding cost of drugs.

Study was conducted in the Department of Pharmacology after the approval from the IRC and from the IEC. For analysis of the costs of the anti-cancer drugs a Pharma Sahi Daam from March 2021 to September 2021 was used to collect study data.

A variety of anti-cancer drugs were chosen, ensuring representation from different classes of medications. Specific strengths and dosage forms (tablets, capsules, injections) were selected for each drug to standardize the comparison. The costs of each brand were documented in a table format. Only strips or injections containing the same quantity of tablets, capsules, or injections were included to maintain consistency. The cost per unit (capsule, tablet, or injection) for each brand was calculated in Indian Rupees (INR) using a

calculator. The cost of one capsule, tablet, or injection was compared across different brands for the same drug, strength and dosage form produced by various manufacturers.

The findings of this study that there is significant variation in the prices of anti-cancer drugs, as well as in their cost ratios and overall cost variations.

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