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ORIGINAL RESEARCH

Access to anti-cancer drugs in India: is there a need to revise reimbursement policies?

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ABSTRACT

Background: The aim of this study was to examine the access of Indian cancer patients to optimum cancer care under selected government schemes by reviewing reimbursement schemes for cancer care in India.

Methods: All cancer care reimbursement schemes in India were identified and three highly utilized schemes (VAS, RAS, CMCHS) were selected. Quality of breast, colorectal, lung, head & neck, and gastric cancer care was reviewed with respect to NCCN guidelines. Direct medical costs and shortage of budget in reimbursed amounts were calculated for each listed chemotherapy regimen.

Results: Medical oncology practice following the schemes' formularies is inferior to recommendations by the NCCN guidelines. Innovative treatment (targeted therapies) like trastuzumab, pertuzumab (breast), bevacizumab, cetuximab, panitumumab (colorectal), erlotinib, gefitinib, crizotinib, and nivolumab (lung) are either not reimbursed (VAS, CMCHS) or partially reimbursed (RAS). Average shortage of budget was found to be 43% (breast), 55% (colorectal), 74% (lung), 7% (head & neck), and 51% (gastric cancer).

Conclusions: Policy makers should consider addition of newer treatments, exclusion of sub-optimal treatments, increments in per patient budget and optimization of supportive care, which may contribute to improvements in survival and quality of life for Indian cancer patients.

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Cancer; chemotherapy; cost; reimbursement; India

1. Introduction

Cancer is becoming one of the most important causes of morbidity and mortality in India, with 1 million new cancer cases each year [1]. Besides an aging population, which is a well-known attributable factor to cancer in developed nations, local use of tobacco and human papilloma virus infections are contributing to increasing cancer morbidity in India [2,3]. Among the most prevalent cancer types in both sexes are breast, head and neck, cervix, lung, colorectal, and gastric cancer together accounting for 62% of all cancer cases in 2012. With late stage diagnosis and suboptimal cancer treatment causing poor survival, cancer mortality in India was around 555,000 in 2010 [1,4].

India's health-care system is a mix of public and private players. The public health-care system is almost entirely free but often of poor quality in comparison with the private health system, which is highly expensive and appears to vary in quality. Specialty cancer care hospitals do exist in the public health-care system of India, such as TMH in Mumbai and AIIMS in Delhi, both known to deliver high quality care. In general, there is limited data available on the overall quality of care. In terms of pharmaceutical price controlling, India is still

struggling to find the right balance between regulating drug prices under its Drug Price Control Order (DPCO) to maintain access to medicines for the common man and the freedom that should be provided to the globally competitive Indian domestic pharmaceutical industry [5]. The latest updated DPCO notified in May 2013, regulates the pricing of 348 essential medicines listed on the National List of Essential Medicines.

As outlined in the WHO World Health Report, every health system should strive toward universal health coverage, offering cost-effective health care for everyone whilst protecting against catastrophic health expenditure [6]. India's per capita public health-care expenditure is still among the lowest in the world, with a high burden of health-care expenditure on individual households as a result [7]. Over 75% of cancer expenditures in India are out-of-pocket payments, affecting welfare and education for patients and their families [8]. The implications of a cancer diagnosis on the patient's family members has been studied by Mahal and colleagues, whom demonstrated that out-of-pocket expenditures from cancer-affected households on in-patient care was equivalent to 36–44% of annual household expenditures of non-affected households with a similar social-economic status [9]. In addition, cancer-affected

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Supplemental data for this article can be accessed [here](#).

households had significantly higher rates of borrowing and asset sales for financing health care. A solution to mitigate this financial risk is through the provision of health-care insurance, either via private insurance companies funded by the employer or employee, or via funds and schemes fully financed by the government. Quite a few initiatives have been launched recently but influenced by decentralized state-based politics, health-care schemes are scattered and not uniformly implemented across India. Besides, these schemes are mainly designed to accommodate for patients who are living below the poverty line (BPL), based on state-level BPL census. As with every insurance policy, the challenge is to find the optimal ratio between health outcomes and (pharmaceutical) reimbursement policy within each scheme.

Over time, a broad range of clinical studies has provided the evidence to create internationally recognized cancer guidelines, such as the National Comprehensive Cancer Network (NCCN), American Society of Clinical Oncology (ASCO), and the European Society of Medical Oncology (ESMO) to guide practicing oncologists, including surgical oncologists, radiation oncologists, and medical oncologists. In India, institutes such as Tata Memorial Centre and the Indian Council of Medical Research provide guidelines for the treatment of cancers; however, these guidelines are not being updated as frequently as for example the NCCN guidelines and not all major cancer types in India are covered yet [10]. Currently, the India Cancer Grid, with support from the Tata Trust, is working to develop India-specific guidelines for all major cancer types. Clinical practice in India continues to be largely based on international guidelines because of the high-quality evidence and appraisal by clinical experts, although the developing countries are poorly represented in the expert panels who formulate international guidelines, as explained by Mahantshetty and colleagues in the context of cervical cancer [11]. The majority of innovative therapies listed in the guidelines are currently available in India; however, with limited available resources, out-of-pocket payments need to occur for the expensive treatments, which is a major limitation for the application of the NCCN guidelines to the Indian cancer patient population.

The aim of this study is to investigate the health-care insurance government schemes available for cancer patients in India and to show patient access to optimal anti-cancer chemotherapy treatment under selected government schemes by comparing them among each other and with NCCN clinical practice guidelines for selected cancers. The focus of this analysis is upon chemotherapy only; it does not address reimbursement for other modalities of anti-cancer treatment, such as surgery and radiotherapy, nor does it address reimbursement of cancer diagnostics as part of molecular pathology.

2. Methods

Health-care reimbursement schemes for cancer care in India were identified using PubMed and the publicly available search engine Google using the keywords 'healthcare schemes', 'India', 'cancer', 'reimbursement', 'government schemes'. The results were validated with the financial administrator responsible for

the billing of health-care resource use to different reimbursement schemes, from one of the hospitals in Mysuru, Karnataka state. In total, 17 schemes and funds were identified and screened for eligibility criteria, reimbursement policies, and procedures. Exclusion criteria were employment-related schemes ($n = 8$), absence of detailed formularies (i.e. reimbursement per request most commonly performed within funds) ($n = 5$), and not targeted toward the population living in BPL ($n = 1$). Three schemes were selected for further exploration of their strengths and weaknesses [12–14].

Permitted chemotherapy regimens and other medical anti-cancer treatment and the maximum amount reimbursed per cycle were reviewed for five cancer types (breast, colorectal, lung, head & neck, and gastric) in India. To maintain the balance between male and female cancers types whilst focusing on the most prevalent cancers, cervix cancer was excluded and lung cancer was added to the reviewed cancer types. Direct medical costs per chemotherapy cycle were calculated for permitted chemotherapy regimens including required pre-medications and other supportive care as advised by the NCCN guidelines version 2, 2015. A detailed list comprising of all chemotherapy regimens, the drugs they consist of, the dose per individual drug, and the number of days the regimen is administered is given in S1 Supplementary Tables 1–5. Also, the calculated costs per cycle (price $\times$ dosage $\times$ number of days) of cancer treatments and the concomitant premedication and supportive care are listed in the S1 Supplementary tables. An average body surface area of 1.7 (length: 160 cm, weight: 65 kg) was used to calculate required dosages [15]. Drug prices were used as per provided by the website of the CIMS Drug Information System on 30 September 2015 [16]. CIMS is the Indian chapter of the Monthly Index of Medical Specialties Asia, an online medical drug directory that contains clinical and price information about branded and generic drugs in several Asian countries including Australia, Singapore, and India. The exchange rate of Indian rupee to US dollar on 30 September 2015 was 1USD = 65.7084 INR [17]. Assuming that only half the time oncologists specifically prescribe the original innovator's brand while substantial differences in prices exist, both innovator and generic prices were taken into consideration by calculating the average price (weighted 50%/50%) of the innovator drug and its generic competitor. Reflecting clinical practice, generic brands from trustworthy manufacturers were chosen, based on their reputation of high quality and competitive pricing. No consultation or drug administration costs are charged to patients treated within the schemes by the hospital. For each permitted regimen, the calculated direct medical cost was compared with the actual amount reimbursed.

When the calculated direct medical cost was higher than the reimbursed amount, shortage of budget was calculated as the difference between maximal reimbursed amount per cycle and total treatment cost per cycle as a percentage of total treatment cost per cycle:

$$\text{Shortage of budget (SoB)} = \left(1 - \frac{\text{maximal reimbursed amount per cycle}}{\text{total treatment costs per cycle}} \right) \times 100\%$$

Based on the individual percentages of SoB for each treatment and scheme, the average shortage of budget per cancer type was calculated:

$$\text{Average SoB per cancer type} = \frac{\text{SoB (treatment A, scheme 1)} + \text{SoB (treatment B, scheme 1)} + \text{SoB (treatment A, scheme 2)} + \dots}{n (\text{SoB})}$$

Finally, a comparison was made between the treatment offered by the schemes and the recommended optimal cancer treatment as outlined in international cancer guidelines. The NCCN guidelines were identified as the leading cancer guidelines among Indian oncologists and therefore used for comparison. A sensitivity analysis was performed assuming a 10% increase and decrease of calculated costs, based on the limited pharmaceutical price ranges in India. Besides, a scenario analysis was performed assuming the prescription and use of generics only. Based on our review, areas of improvement were identified under each scheme.

3. Results

An overview of the characteristics of the reviewed schemes Vajpayee Arogyashree Scheme (VAS), Rajiv Aarogyasri Scheme (RAS), and Chief Minister Comprehensive Health Scheme (CMCHS) is provided in Table 1. The eligibility criteria for enrolment in all three schemes are solely based on a family income below the poverty line. Once a patient is enrolled in the scheme, he or she can be treated with the oncology medicines listed on the formulary. There is no clinical eligibility criteria specified per listed chemotherapy item other than the oncologist's expert opinion.

The results of the cross-examination of VAS, RAS, and CMCHS comparing the type of cancer care provided among the schemes, the associated costs, and the reimbursed amount for the selected cancer types in India are listed in Tables 2 and 3. More details on the regimens are given in the Supplementary appendix S1.

Overall, there is inconsistency in the selection of reimbursed treatments among the three schemes for all cancer types except for breast cancer. RAS and CMCHS do not provide funding for any head & neck cancer treatment, although the three treatments provided under VAS are funded for other types of cancer like cervical, ovarian, and esophageal cancer. Across all schemes and cancer types, the reimbursed amount is not sufficient to cover the total costs associated with the regimens in 34 out of 51 treatments. The average shortage of budget (excluding sufficiently reimbursed treatments) per cancer type is 43% (breast), 55% (colorectal), 74% (lung), 7% (head & neck), and 51% (gastric cancer). The largest shortages of budget for individual treatments across all cancer types and schemes were for gefitinib (87%), CAPEIRI (89%), and capecitabine + bevacizumab (96%). The differences between schemes in reimbursed amounts range from 3% to 67% with a maximal difference of 67% between VAS and RAS in XELOX treatment reimbursement for colorectal cancer.

Table 1. Geographical reach, eligibility criteria, and maximal reimbursement sum for different health insurance schemes.

Scheme	Geographical reach	Eligibility	Max reimbursement sum
VAS	Karnataka	Below Poverty Line (BPL) families	INR.150,000 (US\$ 2283) on a family floater basis per year plus INR 50,000 (US\$ 761) through buffer
RAS	Andhra Pradesh	BPL families	INR.150,000 (US\$ 2283) on a family floater basis per year plus INR 50,000 (US\$ 761) through buffer
CMCHS	Tamil Nadu	Annual family income less than INR 72,000 (US\$ 1096)	INR. 100,000 (US\$ 1522) on a family floater basis per year

VAS: Vajpayee Arogyashree Scheme; RAS: Rajiv Aarogyasri Scheme; CMCHS: Chief Minister Comprehensive Health Scheme; BLP: Below Poverty Line.

Table 2. Accepted regimens for breast and colorectal cancer care, total costs, and reimbursed amounts for three different schemes.

Accepted therapeutic regimens	Total treatment costs per cycle (Base case, US\$)	Total treatment costs per cycle (SA, generics use only, US\$)	Maximal reimbursed amount per cycle (US\$)		
			VAS	RAS	CMCHS
Breast cancer					
AC	58.04	57.46	45.66	54.79	54.79
CMF	12.07	11.17	22.83	30.44	30.44
FAC	58.79	58.20	47.18	54.79	56.61
Paclitaxel	167.81	114.21	144.58	106.53	173.49
Docetaxel	422.20	362.22	NA	152.04	NA
Tamoxifen	1.28	1.23	1.29	7.61	1.52
Anastrozole*	68.91	24.27	12.71	18.26	15.22
Letrozole*	66.21	17.50	12.71	18.26	15.22
Colorectal					
FOLFOX4	185.47	139.09	152.19	175.02	182.63
XELOX	498.89	397.73	60.88	182.47	73.05
CAPEIRI	1,047.00	527.97	NA	117.34	NA
Monthly 5FU	3.25	3.23	60.88	79.14	22.83
Capecitabine	209.01	185.36	NA	106.38	NA
Capecitabine + bevacizumab	2,873.82	2,850.17	NA	117.34	NA

* For tamoxifen, anastrozole, and letrozole, costs/reimbursed amounts are given per month. NA: treatment not available under scheme; AC: Adriamycin, Cyclophosphamide; CMF: Cyclophosphamide, Methotrexate, 5-Fluoro-Uracil (5-FU); FAC: 5-FU, Adriamycin, Cyclophosphamide; FOLFOX: Oxaliplatin, Leucovorin, 5-FU; XELOX: Oxaliplatin, Capecitabine; CAPEIRI: Irinotecan, Capecitabine; SA: scenario analysis.

Table 3. Accepted regimens for lung, head & neck, and gastric cancer care, total costs, and reimbursed amounts for three different schemes.

Accepted therapeutic regimens	Total treatment costs per cycle (Base case, US\$)	Total treatment costs per cycle (SA, generics use only, US\$)	Maximal reimbursed amount per cycle (US\$)		
			VAS	RAS	CMCHS
Lung					
Cisplatin + etoposide	86.84	75.98	106.53	106.53	127.84
Cisplatin + pemetrexed	1,460.03	632.67	NA	304.22	NA
Paclitaxel + carboplatin	373.48	260.51	NA	152.04	127.84
Erlotinib*	1,170.22	474.94	NA	228.28	NA
Gefitinib*	842.83	145.91	NA	107.75	NA
Head & Neck cancer					
Cisplatin	33.22	29.71	30.44	NA	NA
Paclitaxel + carboplatin	165.19	121.48	159.80	NA	NA
Cisplatin + 5-FU	83.64	67.78	76.09	NA	NA
Gastric cancer					
Mc Donald	18.46	18.44	76.09	76.09	91.31
ECF	115.37	95.89	NA	182.63	NA
EOX	571.29	370.23	NA	228.13	NA
DCF	466.04	401.79	NA	273.79	NA

*For erlotinib and gefitinib, costs/reimbursed amounts are given per month; NA: treatment not available under scheme; 5-FU: 5-Fluoro-Uracil; ECF: Epirubicin, Cisplatin, 5-FU; EOX: Epirubicin, Oxaliplatin, Capecitabine; DCF: Docetaxel, Cisplatin, 5-FU; SA: scenario analysis.

When reviewing treatment compliance with respect to NCCN guidelines for breast cancer, the CMF chemotherapy regimen is outdated but remains its position in the formularies. Limited reimbursement of docetaxel is of concern for patients with metastatic disease as minimum options are available for advanced breast cancer. Biologicals like trastuzumab, ado-trastuzumab, pertuzumab, and lapatinib, all monoclonal antibodies that inhibit tumor cell growth and cell proliferation, are not reimbursed for the eligible patients with human epidermal growth factor receptor (HER2) positive breast cancer under any of the selected schemes. As patients with breast cancer are at risk for developing bone metastases, zoledronic acid and denosumab to prevent or treat bone metastasis are advised by NCCN, but not reimbursed by the schemes. The limited coverage of the aromatase inhibitors anastrozole and letrozole, which block the production of estrogen that tumor cells need for their growth, impairs medication adherence over time for the eligible patients [18].

As for colorectal cancer, the chemotherapy regimen FOLFIRI (5-FU, leucovorin, and irinotecan) is lacking in the formulary of all schemes. Epidermal growth factor receptor (EGFR) inhibitors like cetuximab and panitumumab, monoclonal antibody therapies against tumor cell growth, are not reimbursed under any of the schemes. Only patients whom do not have mutations (wild type) in oncogenes called RAS are eligible for EGFR inhibitor treatment as RAS mutation is predictive of a very poor response to EGFR inhibitors. Patients who have mutations in RAS genes are eligible for bevacizumab monotherapy treatment that inhibits vascular growth toward the tumor, which is also not reimbursed under all schemes [19].

There are two types of lung cancer: squamous cell carcinoma and non-squamous cell carcinoma. Patients with squamous cell carcinoma of lung are treated according guidelines with cisplatin and etoposide regimen under all three schemes in contrast to patients with non-squamous cell carcinoma for whom pemetrexed-based therapy is only available under one of the schemes. Gefitinib and erlotinib, both EGFR inhibitors that are effective in carcinomas with mutated and overactive EGFR, are only reimbursed by RAS. None of the schemes provide coverage for drugs like bevacizumab, cetuximab,

crizotinib, and nivolumab, all targeted therapies against tumor cell growth, which are very essential drugs as per NCCN guidelines. Patients with non-squamous cell carcinoma who have an aberrant ALK oncogene are eligible for crizotinib. Nivolumab is a novel anti-cancer drug that stimulates the immune system to clear the cancer [20].

For patients with head and neck cancer, none of the schemes provide reimbursement for cetuximab, which is essential for locally advanced squamous cell carcinoma. Secondly, DCF (docetaxel, cyclophosphamide, and fluorouracil) regimen, which is recommended neo-adjuvant therapy for head & neck carcinoma where the tumor is unresectable, is not provided. Patients with nasopharyngeal carcinoma can be benefited with gemcitabine-cisplatin regimen, which is not included in the formulary of VAS [21].

NCCN does not recommend use of McDonald's regimen for gastric cancer currently as it is outdated now due to availability of better alternatives. Patients with HER2 overexpressing inoperable advanced gastric carcinoma should be treated with trastuzumab-based therapy as per NCCN guidelines; however, trastuzumab is not reimbursed by any of the schemes. Ramucirumab, a monoclonal antibody against tumor growth, is drug of choice as per NCCN guidelines for advanced gastric cancer or adenocarcinoma of gastroesophageal junction where the intent to treat is palliative. However, ramucirumab is also not reimbursed by any of the schemes in India [22].

The sensitivity analysis shows that when costs decrease, the number of insufficiently funded regimens also decreases from 34 to 25 out of 51 regimens (Table 4). However, the average shortage of budget of the 25 treatments, that were still insufficiently funded, increased by 11% from 48% to 59%, as more expensive treatments remained insufficiently funded. This shows that with decreased costs, only 41% of the actual costs is reimbursed for half of the anti-cancer treatments under the schemes.

Assuming that 50% of the time, innovator drugs are prescribed/dispensed and that the other 50% of the time, generics are prescribed/dispensed, the average price difference between innovator drugs and generics for antineoplastic medicines, hormonal therapy, and targeted therapies was found to be 38%, 47%, and 83%, respectively. The scenario analysis

Table 4. Sensitivity analyses.

Cancer type	Base case	Total costs –10%	Total costs +10%	Generics use only
Total number of insufficiently funded regimens	34/51	25/51	36/51	26/51
Breast	15/22	11/22	17/22	13/22
CRC	9/12	7/12	9/12	6/12
Lung	5/8	5/8	5/8	5/8
Head & Neck	3/3	0/3	3/3	0/3
Gastric	2/6	2/6	2/6	2/6
Average SoB for insufficiently funded regimens	48%	59%	50%	39%
Breast	43%	51%	43%	21%
CRC	55%	66%	59%	73%
Lung	74%	71%	77%	44%
Head & Neck	7%	NA	15%	NA
Gastric	51%	45%	55%	35%

All tables included in the present manuscript are original and have not been published previously.

(Table 4) demonstrated that when only the cost of generic drugs were taken into account, 26 out of 51 regimens would be insufficiently funded, but the average shortage of budget would decrease from 48% to 39%.

4. Discussion

In India, health insurance largely comprises of government-funded schemes [23]. In 2012, 30% of the total population in India was living in BPL, making them eligible for funding of health-care expenses through one of the government's BPL schemes [9]. However, the limited coverage of the available government schemes and their ability to protect patients of lower economic background for catastrophic health-care expenditure have been questioned in recent studies [24,25].

In general, the regimens that are paid for by the schemes have been used by oncologists for decades and are sometimes even obsolete according to the international guidelines, for instance the McDonald's regimen for the treatment of gastric cancer [22]. They comprise of chemotherapy agents that have lost their patents years ago and have affordable prices, and exclude innovative cancer medicines. These outcomes are in line with cancer treatments in other low- to middle-income countries (LMIC), all sharing the skepticism related to the scarcity of funds [26]. Even developed nations are nowadays facing health resource constraints, although they are able to cover a much broader range of cancer therapies in their national health plans. Overall, the RAS scheme provides the highest number of treatment options for patients, although none seems to be available for head & neck cancer. When compared with the WHO essential medicines list, treatments like carboplatin, docetaxel, oxaliplatin, capecitabine, irinotecan, and trastuzumab are not sufficiently or not at all reimbursed by the schemes although they are on the essential medicines list [27]. This shows that there is a huge need for additional and clinically evident treatment options to reduce the disparity in the burden of cancer deaths between poor countries like India with low survival rates versus improved survival in developed countries [28].

The Indian National Sample Survey 2015 (Consumption of Social Goods: Health) [29] reports a total average medical expenditure for cancer treatment per hospitalized case of INR 24,526 (US\$ 373) and INR 78,050 (US\$ 1188) for the public and private facilities, respectively. In comparison with the

reimbursed amounts ranging from INR 85 (US\$1.29) for tamoxifen under VAS up to INR 20,000 (US\$304) for cisplatin and pemetrexed under RAS, the average medical expenditure appears to be in line with our findings of insufficient funding, although one should be cautious drawing conclusions as our calculations only evaluate chemotherapy coverage of selected cancers. The schemes also extend their subsidized cancer care support through other modalities like cancer surgery and radiation therapy for which they provide additional funding. Obviously, the type of cancer care modality provided is based on the requirements of the individual patient.

When it comes to innovative treatments, prices rise exponentially up to INR 188,834 (US\$2874) for the combination treatment of capecitabine and bevacizumab for colorectal cancer, far exceeding the highest amount paid by the schemes. Innovative cancer treatments are mostly targeted therapies that have shown to be effective in a group of patients with (over) expression of certain proteins or aberrant genes, which can be detected by biomarker tests [30]. The fact that no genetic or protein expression testing is reimbursed by any of the schemes implies that the concept of biomarker testing after diagnosis is not widely spread across the country although much research on biomarkers has been done. Despite the fact that 25% of Indian breast cancer patients have HER-2 positive disease, trastuzumab is not funded by any of the schemes [31]. The same applies for cetuximab and panitumumab, despite approximately 45% of Indian colorectal cancer patients having wild-type RAS genes [32,33]. Lung cancer patients do not get sufficient funding for gefitinib or erlotinib and no funds are available for crizotinib, although 23–33% have an EGFR mutation and 3% have an aberrant form of ALK [34,35]. Further research is needed to investigate whether these expensive medicines and the genetic testing that is required prior to the treatment would be cost-effective in India, as a LMIC. This also applies to tests used to screen for cancers, as India still does not have any organized national cancer screening programs that would help to diagnose cancer patients at an earlier stage and improve their survival outcomes [8].

On the other hand, in 17 out of 51 regimens, the reimbursement of the schemes exceeded the estimated costs. Potential justifications for this could be that (1) the calculated costs were underestimated by the assumptions that were

made regarding average body surface area, (2) the fact that spillage was not accounted for in the estimated costs, or (3) discrepancies in clinical practice of premedication and/or supportive care provided alongside the chemotherapy regimen.

Adequate premedication and supportive care is a crucial aspect in quality cancer care and meant to prevent or treat the adverse events related to chemotherapy regimens. The patients from BPL families who are treated within the schemes are usually vulnerable because of the conditions they live in and the types of jobs they do. To maintain a reasonable quality of life during cancer treatment, it is important to offer supportive care prior to and after completion of the chemotherapy regimen. Firstly, patients need premedication to mitigate the nausea and vomiting (anti-emetics) caused by the chemotherapy [36]. Even though the cost of supportive care in most circumstances is minimal compared to the costs of chemotherapy agents, limited approved budget per cycle does not allow use of quality anti-emetics like NK-1 receptor antagonists (aprepitant) as the approved amount per cycle is hardly sufficient enough to cover chemotherapy costs. Secondly, patients with low blood counts are vulnerable for infections and need preventive treatment with granulocyte-colony stimulating factors (G-CSFs) to increase their white blood cell count and intravenous antibiotics to prevent them for bacterial infections [37]. On paper, there is reimbursement for G-CSF's by the schemes; however, in practice it turns out to be impossible to receive funding due to many additional formalities resulting in the host hospital usually bearing the cost of managing febrile neutropenia. Other important elements in supportive care are pain management, maintenance of healthy nutritional status, and prevention of bone metastasis, all requiring additional funds [37].

Based on our findings, opportunities exist to strengthen the reimbursement policies for cancer care schemes in India. In the present analysis, the NCCN guidelines have been used as a reference point, though other cancer guidelines such as ASCO or ESMO are available as well. Obviously, some differences between these guidelines exist potentially related to country/regional differences, differences in health systems, and specific opinions of stakeholders and key opinion leaders involved. Of course, alignment of various guidelines is increasingly achieved with respect to standardized embedding in evidence-based medicine, design of guideline formats, and transparency of opinions and interests of specialists involved. Although one should be cautious with linking increased coverage with improved health outcomes, it would be reasonable to assume that with the inclusion of several innovative oncology treatments, the life expectancy and quality of life of cancer patients would change for the better. As budget restrictions inevitably will remain a challenge over the next decades, we would like to emphasize the need for a more centralized health-care system in India. In that way, payers and suppliers will be better equipped to negotiate list prices and reimbursement fees and potentially introduce value-based contracting or risk-

sharing agreements, resulting in a higher number of treatment options for cancer patients. The recent introduction of the central health-care scheme Badan Pelaksana Jaminan Sosial in Indonesia provides the evidence that it can be done, if the government of India is committed to do so.

4.1. Study limitations

The fact that the authors had no access to prescribing data showing the actual balance between the use of innovator and generic medicines was the main limitation of our analysis. Although we included the outcome of the analysis when only generic medicines would be used, we believe that our assumption of 50% innovator drug prescription reflects the situation in Indian hospitals. Nevertheless, it is obvious that in a country like India, it would be best practice for oncologists to weigh the pros and cons for generic versus innovator treatment carefully as budgets are restricted. Another limitation is the lack of high quality, regularly updated Indian cancer guidelines over a broad range of cancer types, which resulted in the use of the NCCN guidelines in this analysis. Some of the treatments advised by the NCCN guidelines might be questionable for the Indian cancer population because of the high costs involved with the treatment.

5. Conclusions

Our research shows that there is inequality in access to cancer care among patients treated under the examined schemes in India. Innovative treatments are either not available or only partially reimbursed and large shortages between reimbursed amount and actual treatment cost exist. This finding is obviously not new, as even developed countries sometimes fail to adequately reimburse novel anti-cancer therapies in their state-sponsored health-care plans. When a patient insists on good quality cancer care, out-of-pocket payments need to be made, negatively affecting both the patient and the patient's family. In compliance with the WHO goal to provide financial protection from the costs of ill health to those most in need, the government must increase the total budget spend on health care. We would strongly advise policymakers to review the schemes and, depending on cost-effectiveness and budget-impact, make adjustments in reimbursed amounts and regimens of the selected regimens, targeted therapies, and supportive care. Improving the quality of cancer care will ascertain cancer patients of a better clinical outlook and ultimately decrease cancer mortality in India.

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