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Original Research Article

Evaluating the landscape of PD-L1 testing and treatment approaches in gastrointestinal and lung cancer: a questionnaire-based study among Indian oncologists

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ABSTRACT

Background: Lung and gastrointestinal (GI) cancers together account for a major proportion of India's cancer burden, with most cases diagnosed at advanced stages. Despite the proven efficacy of immune checkpoint inhibitors (ICIs), access and biomarker-guided implementation remain limited. This study assessed the current landscape of PD-L1 testing and immunotherapy (IO) practices among Indian oncologists treating patients with lung and GI malignancies.
Methods: A cross-sectional, questionnaire-based survey was conducted among 63 practicing oncologists across India from February 2025 to April 2025. The 23-item questionnaire collected information on PD-L1 testing practices, immuno-oncology (IO) usage, and barriers to adoption. Data were analyzed using descriptive statistics.
Results: Most respondents (73.02%) had over 10 years of clinical experience. PD-L1 testing was most frequent in non-small cell lung cancer (NSCLC) and less consistent in GI malignancies. Immunotherapy use was highest in NSCLC (44.44% common use in first-line) and hepatocellular carcinoma (36.51%), but infrequent in colorectal and biliary tract cancers. High PD-L1 expression guided IO use in most cases, while actionable mutations and performance status also influenced treatment choice. Cost was the predominant barrier, with 56-70% of patients deferring IO due to financial constraints. Key unmet needs included affordable access to IO (95.24%), predictive biomarkers (58.73%), and India-specific clinical guidelines (57.14%). Experienced oncologists were more likely to consider IO re-challenge after progression (p=0.03).
Conclusions: PD-L1 testing and IO adoption remain inconsistent across India, primarily due to cost, infrastructure, and limitations in biomarker availability. Strategic measures such as subsidized access, standardized testing, and context-adapted guidelines are essential to advance equitable precision immunotherapy in Indian oncology practice.

Keywords: PD-L1 testing, Immunotherapy, Lung cancer, Gastrointestinal malignancies, Biomarker testing

INTRODUCTION

Lung cancer and gastrointestinal (GI) malignancies together represent a significant proportion of the oncologic disease burden in India, consistently ranking among the foremost contributors to cancer-related morbidity and mortality.[1] National estimates reported 1.46 million new cancer cases in 2022, a figure projected to rise to 1.57 million by 2025, highlighting the escalating public health challenge.[2] The clinical impact is further magnified by the predominance of advanced-stage presentation, with 80–90% of patients diagnosed at a point where curative therapeutic options are limited.[1,3] This late-stage detection contributes to India's disproportionately high mortality-to-incidence ratio of 64.2%, the highest among the world's ten most cancer-burdened nations.[4]

Lung cancer is the second most common malignancy among Indian men, with 74,763 new cases reported in 2024 and a crude incidence of 10.3 per 100,000, and the

burden is projected to rise to 81,219 cases by 2025.[1-3] Esophageal cancer ranks sixth for both incidence (4.9%) and mortality (5.9%), with 52,396 new cases in 2018, predominantly squamous cell carcinoma affecting the mid-esophagus.[5,6] Other gastrointestinal cancers, including hepatocellular carcinoma (HCC), colorectal cancer (CRC), and biliary tract cancer (BTC), and colorectal cancer incidence by 20% over the same period, totaling 64,863 new cases and 38,367 deaths in 2022.[7-9]

Conventional treatments for advanced cancers have been limited by modest efficacy, high toxicity, and resistance, highlighting the need for more effective therapies.[10] Immune checkpoint inhibitors (IO) have emerged as a transformative approach, reactivating the immune system to achieve improved response rates, durable clinical benefits, and a better safety profile compared with traditional modalities.[11] In resectable NSCLC, neoadjuvant chemoimmunotherapy followed by surgical resection has emerged as a transformative treatment paradigm, demonstrating superior pathological complete response rates and improved event-free survival in pivotal phase III trials, including KEYNOTE-671, CheckMate-77T, AEGEAN, and RATIONALE-315.[12-15] For unresectable stage III NSCLC PACIFIC trial, concurrent chemoradiation followed by consolidation therapy with durvalumab within 42 days of completion has become the standard of care, converting a previously palliative approach into one with curative potential for select patients.[16,17]

In advanced NSCLC lacking actionable mutations, first-line immunotherapy-based regimens - including pembrolizumab, tislelizumab or nivolumab combinations are increasingly employed, guided by PD-L1 expression, performance status, and patient-specific factors, reflecting the growing adoption of precision medicine approaches.[18] Immunotherapy has also transformed the management of gastrointestinal malignancies.[19] The ATTRACTION-3 trial demonstrated superior outcomes with nivolumab over conventional chemotherapy in the second-line setting, while pembrolizumab combined with chemotherapy is now established as first-line therapy for both esophageal and gastroesophageal junction cancers.[20] Similarly, CheckMate-649 and ATTRACTION-4 support nivolumab plus chemotherapy as first-line treatment in PD-L1–positive, HER2-negative gastric and gastroesophageal junction cancers. Tislelizumab has also gained approval for esophageal squamous cell carcinoma (ESCC) (RATIONALE-306/302) and gastric/gastroesophageal junction (GEJ) adenocarcinoma (RATIONALE-305), shaping current guideline-recommended first-line options. Collectively, these pivotal studies have shaped guideline-recommended first-line therapeutic strategies for eligible patients.[21-25]

Across multiple gastrointestinal malignancies, immunotherapy combinations have emerged as transformative first-line treatments, with landmark trials demonstrating superior survival outcomes in hepatocellular carcinoma (IMbrave150, HIMALAYA), biliary tract cancer (TOPAZ-1, KEYNOTE-966), and microsatellite instability-high colorectal cancer (CheckMate-8HW), establishing immunotherapy as a cornerstone of precision oncology in solid tumors.[26-31] PD-1/PD-L1 inhibitors have become central to immunotherapy across multiple tumor types. PD-L1 expression is a key biomarker for guiding immunotherapy and is routinely assessed by immunohistochemistry (IHC). Validated antibody clones such as 22C3, 28-8, SP142, and SP263 are FDA-approved to direct the clinical use of pembrolizumab, nivolumab, Tislelizumab and atezolizumab, respectively. Scoring is typically performed using the tumor proportion score (TPS) or combined positive score (CPS), or the emerging tumor area positivity (TAP) score depending on the tumor type and therapeutic context.[32-34] Though these methods are clinically validated, variability in assay platforms, antibody clones, scoring algorithms, and interpretation can limit standardization. Although higher PD-L1 expression generally predicts better response to ICIs, patients with low or negative PD-L1 can still derive clinical benefit, highlighting the need for complementary biomarkers such as tumor mutational burden and microsatellite instability to optimize patient selection.[35]

Despite the transformative impact of IOs in lung, esophageal, and gastric cancers, access in India remains limited, with fewer than 3% of eligible patients receiving therapy due to high costs, socioeconomic disparities, and geographic barriers. Biomarker testing is also inconsistent, with PD-L1 assessed in only 40.7% and tumor mutational burden in 3.3% of patients, while financial constraints lead to treatment discontinuation in 17.6% despite ongoing clinical responses in half of these cases.[36] These challenges emphasize the need to examine real-world use of PD-1 inhibitors, the uptake of biomarker testing, and the practical obstacles clinicians encounter in delivering these therapies. This study seeks to evaluate current PD-L1 testing and immunotherapy practices among Indian oncologists, identify gaps in laboratory and clinical implementation, and explore barriers to accessing personalized immunotherapy, with the aim of informing targeted educational programs, and improving precision oncology care across India. While PD-L1 expression serves as the primary predictive biomarker for immune checkpoint inhibitor selection, it has inherent limitations as a perfect predictor due to its spatial and temporal heterogeneity within tumors, variability in assay methodologies and cutoff thresholds, and the paradoxical phenomenon where PD-L1-negative patients may still respond to immunotherapy while some PD-L1-high patients may not benefit.[37]

METHODS

Study design and setting

A quantitative, cross-sectional, questionnaire-based open survey was conducted to evaluate the landscape of PD-L1

testing and treatment practices among Indian oncologists managing gastrointestinal and lung cancers from February 2025 to April 2025. The study was designed and reported in accordance with the checklist for reporting results of internet E-surveys (CHERRIES) guidelines to ensure transparency, clarity, and methodological rigor in cross-sectional research.[38]

Participant selection

The survey included practicing medical oncologists from public and private healthcare settings across India who were actively involved in diagnosing, testing, or making treatment decisions for patients with gastrointestinal or lung cancers and who provided informed consent. Participants were excluded if they were not directly engaged in managing these cancers, were residents, postgraduate trainees, or non-clinical researchers, or if their responses were incomplete or duplicated based on matching credentials or email IDs.

Sample size and recruitment

Participants were recruited using a convenience sampling technique to ensure representation across geographic regions (North, South, East, and West) and practice types (academic tertiary care centers as well as private practices). Invitations were disseminated through professional networks, institutional mailing lists, and oncology associations. A total of 63 oncologists completed the survey.

Sample size consideration

Given the exploratory objective of mapping real-world practices, no formal sample size calculation was mandated. However, the achieved sample size was considered adequate for descriptive analysis in this focused survey.

Questionnaire design and validation

A structured questionnaire comprising 23 items was specifically developed for this study. The tool included multiple-choice questions, with limited open-ended fields for free-text comments. Domains covered included respondent demographics and practice setting, patterns of PD-L1 testing (tumor types, methodologies, timing, and reporting), thresholds and interpretation of PD-L1 positivity, impact of PD-L1 results on treatment selection (first line and subsequent lines) and perceived barriers to routine PD-L1 testing and treatment uptake. The draft questionnaire was reviewed for content validity by a panel of five senior oncologists. Feedback was incorporated to improve clarity and coverage.

Data collection procedures

The final questisonnaire was implemented in English on an online platform (SurveyMonkey®). Invitations containing the survey link were sent via personalized emails and professional messaging groups (e.g., WhatsApp groups of oncologists). The first page included study details and an electronic informed consent statement. Only participants providing consent could proceed to the questionnaire. To improve participation, two reminder notifications were sent to non-responders at one-week intervals. Data collection was conducted over a 3-month period, from 01 February 2025 to 30 April 2025.

Statistical analysis

The primary objective of this study was to describe real-world practice patterns of ICI use in India and to identify existing gaps and barriers in their implementation. This descriptive, observational study focused on documenting usage patterns rather than testing hypotheses or comparing groups; therefore, no interventions, randomization, comparative arms, or statistical significance testing were required. Survey responses were exported to Microsoft Excel (Microsoft Corp., Redmond, WA) for analysis. Data cleaning was performed to exclude incomplete entries. Descriptive statistics were used to summarize findings. Categorical variables (e.g., proportion of oncologists using PD-L1 testing in each cancer type) were expressed as frequencies and percentages, while continuous variables (e.g., years in practice) were summarized as medians. Results were primarily reported as percentages for clarity. Graphical visualizations (bar charts, column charts, and pie charts) were generated to highlight key outcomes. Pearson's Chi-square analyses were conducted to determine whether clinical experience or geographic region influenced practice patterns and perceptions. Data analysis was performed using statistical package for the social sciences (SPSS), version 23.0. A p value of <0.05 was considered statistically significant.

RESULTS

A total of 63 oncologists completed the survey. Most respondents had substantial clinical experience, with the majority, 23 (36.51%), reporting 11-15 years and more than 15 years of practice each. The sociodemographic characteristics are summarized in Table 1.

Table 1: Sociodemographic characteristics.

Years of experience	N (%)
<5	2 (3.17)
5–10	15 (23.81)
11–15	23 (36.51)
>15	23 (36.51)

PD-L1 expression distribution

Table 2 shows that the reported proportion of patients with high PD-L1 expression varied by cancer type, with NSCLC showing a mean proportion of 21%, while gastrointestinal cancers generally showed intermediate

expression levels. In contrast, SCLC and HCC were characterized by a higher proportion of PD-L1–negative tumors.

Respondents reported several challenges in PD-L1 testing which has been summarized in Figure 1.

Immunotherapy usage in PD-L1 expression distribution of different cancer types

Immunotherapy uptake was highest among patients with high PD-L1 expression, moderate in those with intermediate expression, and infrequent in PD-L1–negative/low groups. Detailed distributions are presented in Table 3. These data indicate that immunotherapy use is preferentially targeted to patients with high PD-L1 expression, is modestly used in intermediate expression groups, and is rarely administered to patients with negative/low PD-L1 expression across various cancer types.

The highest proportion of respondents 21 (33.33%) reported that 56–70% of their patients deferred immunotherapy due to cost. This was followed by 12 (19.05%) oncologists indicating 71–85% deferrals and 11 (17.46%) each reporting 25–40% and 41–55% deferrals. A smaller fraction, 7 (11.11%), observed deferrals in more than 85% of patients, while only 1 (1.59%) noted fewer than 25% of patients declining therapy.

The majority, 47 (74.6%) of respondents reported that the presence of other actionable mutations/biomarkers was the most important factor guiding their choice of treatment in PD-L1 expressing tumors. ECOG performance status was considered important by 6 (9.52%) of respondents, while 2 (3.17%) emphasized the patient's age and comorbidities. Additionally, 8 (12.70%) mentioned other factors, including clinical stage, presence of actionable mutations, PD-L1 score, cost–benefit considerations, treatment cost, and financial or logistical constraints for consideration in the selection of treatment. The stages of cancer at which immunotherapy is typically initiated among respondents are depicted in Figure 2.

The preferred practice of using immunotherapy in resectable NSCLC cases was highest for the perioperative setting (27, 42.86%), followed by the neoadjuvant setting (24, 38.10%). The adjuvant setting was preferred by 9 (14.29%) respondents, while only 3 (4.76%) respondents reported that they were not using IO for resectable NSCLC. The use of IO monotherapy in eligible squamous NSCLC cases with PD-L1 ≥50% varied considerably. Overall, about two-thirds of oncologists reported using IO monotherapy in at least a quarter of their squamous NSCLC patients with high PD-L1 expression.

Table 4 shows that IO use was most common in first-line NSCLC, with the majority of oncologists prescribed it commonly (28, 44.44%) or sometimes (15, 23.81%). In ESCC, first-line use was most often reported as 'sometimes' (24, 38.10%), while in GC/GEJ, IO was mainly prescribed 'sometimes' (20, 31.75%) or 'rarely'. For HCC, first-line IO use was higher, with 23 (36.51%) reporting common and 15 (23.81%) very common use, whereas second-line use was mostly rare or very rare. In contrast, IO prescription in CRC and BTC was largely infrequent, with most respondents indicating that it was used rarely or very rarely. Overall, IO adoption was highest in first-line NSCLC and HCC but remained low in gastrointestinal cancers.

Table 2: PD-L1 expression distribution of various types of cancers.

Type of cancer	Average proportions of patients (%)		
	High PD-L1 expression	Intermediate PD-L1 expression	Negative/low PD-L1 expression
NSCLC	21	31	42
SCLC	11	15	45
ESCC	14	22	47
Esophageal adenocarcinoma (EAC)	13	22	50
GC/GEJC	13	22	50
HCC	9	14	47
CRC	7	14	48
BTC	10	16	50

Table 3: IO usage in PD-L1 expression of various types of cancers.

Type of cancer	Average proportions of patients (%)		
	High PD-L1 expression	Intermediate PD-L1 expression	Negative/low PD-L1 expression
NSCLC	42	31	17
SCLC	28	26	17
ESCC	29	23	11
EAC	29	23	8
GC/GEJC	28	23	9

Continued.

Type of cancer	Average proportions of patients (%)		
	High PD-L1 expression	Intermediate PD-L1 expression	Negative/low PD-L1 expression
HCC	31	24	21
CRC	24	17	6
BTC	30	21	17

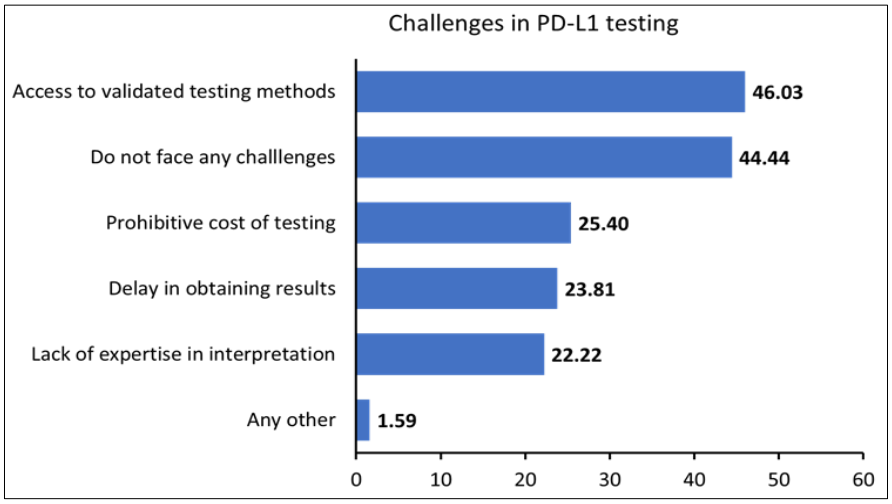

Figure 1: Challenges in PD-L1 testing.

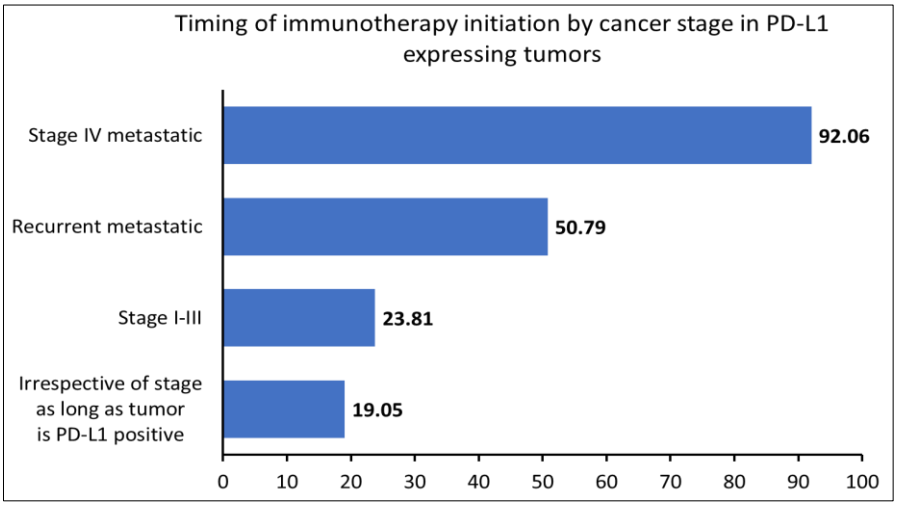

Figure 2: Stages of cancer at which immunotherapy is typically initiated among respondents.

Table 4: Frequency of IO prescription for different cancer types.

Tumor type and treatment	N (%)				
	Very rare (<10%)	Rare (10–25%)	Sometimes (25–50%)	Common (50–75%)	Very common (>75%)
First-line NSCLC	2 (3.17)	6 (9.52)	15 (23.81)	28 (44.44)	12 (19.05)
Second-line NSCLC	1 (1.59)	8 (12.70)	28 (44.44)	18 (28.57)	8 (12.70)
First-line ESCC	9 (14.29)	10 (15.87)	24 (38.10)	11 (17.46)	9 (14.29)
Second-line ESCC	11 (17.46)	9 (14.29)	24 (38.10)	15 (23.81)	4 (6.35)
First-line GC/GEJ	9 (14.29)	17 (26.98)	16 (25.40)	14 (22.22)	7 (11.11)
Second-line GC/GEJ	10 (15.87)	18 (28.57)	20 (31.75)	11 (17.46)	4 (6.35)
First-line HCC	4 (6.35)	12 (19.05)	9 (14.29)	23 (36.51)	15 (23.81)
Second-line HCC	19 (30.16)	13 (20.63)	15 (23.81)	13 (20.63)	3 (4.76)
First-line CRC	25 (39.68)	13 (20.63)	10 (15.87)	8 (12.70)	7 (11.11)

Continued.

Tumor type and treatment	N (%)				
	Very rare (<10%)	Rare (10–25%)	Sometimes (25–50%)	Common (50–75%)	Very common (>75%)
Second-line CRC	29 (46.03)	12 (19.05)	13 (20.63)	6 (9.52)	3 (4.76)
First-line BTC	5 (7.94)	18 (28.57)	12 (19.05)	17 (26.98)	11 (17.46)
Second-line BTC	17 (26.98)	19 (30.16)	17 (26.98)	7 (11.11)	3 (4.76)

Re-challenging patients with immunotherapy after prior discontinuation was generally uncommon. The majority of oncologists, 26 (41.27%), reported doing so very rarely (<10%), while 19 (30.16%) described it as rare (10–25%).

When asked about scenarios for IO re-challenge, the most common response was early discontinuation of previous IO despite response (37, 58.73%), followed by progression after completing the first course (31, 49.21%) and resumption after resolution of immune-related adverse events (irAEs) (27, 42.86%). Other frequently cited scenarios included patients with significant partial or complete responses during initial IO and all patients who were affordable and had no other treatment options.

Tolerability-related discontinuation of immunotherapy was reported infrequently. The majority of respondents, 32 (50.79%), indicated that discontinuation was a rare event (10–25% of cases), while 21 (33.33%) reported it as very rare (<10%). Only 10 (15.87%) described it as occurring sometimes (25–50%). None of the respondents reported it as a common (>50%) occurrence.

The most frequently cited unmet need in the management of PD-L1 positive cancers in India was access to cost-effective immunotherapy (60, 95.24%). This was followed by the need for predictive biomarkers of treatment response (37, 58.73%) and guidelines tailored to the Indian population (36, 57.14%). Additionally, respondents highlighted the lack of comparative clinical evidence, and the need for improved PD-L1 testing infrastructure as other unmet needs.

In response to the question on improving the current PD-L1 treatment landscape in India, most respondents suggested subsidies for immunotherapy (32, 50.79%), followed by improving access to testing and drugs (19, 30.16%). Increased awareness and training for oncologists, as well as the expansion of clinical trials, were each reported by 6 (9.52%) respondents.

Test for associations

PD-L1 testing challenges, including limited access to validated methods (p=0.53), prohibitive costs (p=0.37), delays in reporting (p=0.83), and interpretation expertise (p=0.70) showed no significant association with years of practice, indicating that these barriers are universally felt across the oncology community regardless of seniority. Similarly, the stage at which immunotherapy is initiated appeared uniform, with the vast majority of oncologists (91.2%) prioritizing Stage IV metastatic disease irrespective of their experience level (p=0.70). However, a distinct, statistically significant divergence was observed in re-challenge strategies: more experienced oncologists were significantly more likely to consider re-treating patients who had completed an initial course of immunotherapy and subsequently progressed (p=0.03). While early discontinuation despite ongoing response was the most common re-challenge scenario overall (58.7%), it did not vary by experience (p=0.64). Furthermore, geographic location did not significantly associate with either treatment initiation practices or reported testing hurdles, and no experience-dependent pattern was found in the frequency of prescribing monotherapy for PD-L1 ≥50% squamous NSCLC (p=0.70), suggesting that clinical decision-making in these domains is largely consistent nationwide.

DISCUSSION

This cross-sectional questionnaire-based study offers an in-depth exploration of PD-L1 testing and immunotherapy utilization among Indian oncologists managing gastrointestinal and lung malignancies. PD-L1 expression demonstrates considerable heterogeneity across tumor types. NSCLC generally exhibits the highest rates of high PD-L1 expression, while gastrointestinal malignancies show more variable positivity. Global meta-analyses report PD-L1 positivity in NSCLC ranging from 14–76% at a TPS ≥1% and 5–44% at TPS ≥50%, with pooled estimates of 58% and 27%, respectively.[39] Geographic differences further influence expression patterns, with studies from Asia and South America reporting relatively lower rates of high PD-L1 expression.[40,41] For gastrointestinal malignancies, PD-L1 positivity is highly variable, with reported rates ranging from 22–85%. Variability in PD-L1 scoring systems and cut-off thresholds affects classification of expression, yet even tumors with low or negative PD-L1 such as small cell lung, hepatocellular, and colorectal cancers may still benefit from checkpoint inhibitors, particularly in combination regimens.[40]

Access to validated testing methods emerged as the most frequently reported challenge, followed by cost, delayed results, and limited interpretive expertise. These barriers mirror international experiences, where variability in assay validation, specimen processing, and interpretation practices highlight persistent infrastructure and standardization, 44.44% of respondents reported no challenges, suggesting successful testing in well-equipped tertiary centers. This bimodal distribution reflects heterogeneous healthcare infrastructure in India, consistent with patterns observed in middle-income

countries where resource availability is unevenly distributed.[42-44]

Immunotherapy use is largely guided by PD-L1 expression, particularly in NSCLC, where high levels favor checkpoint inhibitor therapy. Patients with intermediate or low PD-L1 may still benefit, especially with combination regimens or when tumors have high mutational burden, microsatellite instability, or an inflamed microenvironment. Treatment decisions also consider actionable genomic alterations, including EGFR, ALK, ROS1, BRAF, KRAS, and HER2 mutations, alongside clinical factors such as performance status and comorbidities, reflecting the complexity of precision oncology and the need for individualized therapy.[45,46] Indeed, 74.6% of respondents indicated that actionable mutations or other biomarkers primarily influenced treatment selection, illustrating the complexity of modern precision oncology approaches.

Financial constraints emerged as a major barrier, with a substantial proportion of respondents reporting high rates of treatment deferral due to cost. These findings are consistent with prior Indian data, which indicate that fewer than 2% of patients are able to afford prescribed immunotherapy, highlighting the significant challenges in treatment accessibility.[44,47] In India, per-patient annual costs for standard regimens (₹68–85 lakh) far exceed median household income, illustrating the catastrophic financial impact and highlights systemic inequities in access.[48]

First-line NSCLC remains the most well-established setting for immunotherapy, with many clinicians routinely incorporating these agents into practice. In India, IOs such as pembrolizumab, nivolumab, durvalumab, tislelizumab and atezolizumab are approved for the management of lung cancer. Additionally, perioperative use of checkpoint inhibitors, including pembrolizumab, nivolumab, tislelizumab, and durvalumab, is increasingly adopted, reflecting their benefits in both neoadjuvant and adjuvant settings.[13,18,48,49] For PD-L1 ≥50% squamous NSCLC, monotherapy utilization varied, with approximately two-thirds of oncologists using it in at least 25% of eligible cases. However, first-line chemoimmunotherapy appears to offer superior outcomes, with a median overall survival of 22.6 versus 14.2 months compared with monotherapy and a 26% reduction in the risk of death (HR 0.74; 95% CI 0.54–1.00), highlighting the potential benefit of combination therapy in this population.[50]

Treatment duration was typically 6–12 months, although many patients continued therapy beyond one year. Emerging real-world evidence indicates that extending treatment to 18–24 months may offer survival benefits; however, prolonged therapy also increases the risk of irAEs and adds to the financial burden. The CheckMate-153 trial showed that extending therapy beyond 1 year improves progression-free survival but increases irAEs (48% versus 26%) and poses higher economic burdens in resource-limited settings.[51]

Immunotherapy use in gastrointestinal cancers remains cautious, with adoption shaped by evolving evidence and recent approvals. In our real-world analysis, only 36.5% of HCPs reported first-line immunotherapy use in HCC, contrasting with pivotal trials such as IMbrave150 and HIMALAYA, which established immunotherapy-based combinations as the preferred first-line standard. This gap underscores differences between trial-defined standards and routine practice, driven by cost, and access limitations.[26,52] Most patients received therapy for 6–12 months, reflecting careful uptake. In colorectal cancer, use was rare in microsatellite stable disease, with benefit mainly in the ~5% MSI-H/dMMR population. The recent FDA approval of nivolumab–ipilimumab for first-line MSI-H/dMMR colorectal cancer (CheckMate-8HW), may expand future utilization.[53] Similarly, in China, pembrolizumab was approved for first-line treatment of MSI-H/dMMR colorectal cancer following the KEYNOTE-859 trial, and envafolimab received approval after a pivotal phase II study, reflecting the growing adoption of PD-1/PD-L1–targeted therapies in the region.[54,55]

Immunotherapy re-challenge was uncommon in our cohort, though it was generally considered in select scenarios such as prior response, completion of therapy, or resolution of immune-related toxicity. Evidence from meta-analyses and NSCLC-specific studies indicates that re-challenge can provide meaningful survival benefit with lower severe toxicity rates, supporting the cautious yet evidence-based approach observed in our findings.[56,57] Discontinuation due to tolerability was relatively infrequent, with 50.79% reporting it as rare (10–25%) and 33.33% as very rare (<10%). These low rates reflect both manageable toxicity profiles and careful patient selection. Notably, patients discontinuing therapy due to adverse events often maintain durable responses, with long-term (24 months) clinical benefit observed in real-world studies.[58] Immune- related adverse events (irAEs) are a major consideration in the management of NSCLC and GC, requiring vigilant monitoring and multidisciplinary care.

In advanced NSCLC, clinically meaningful irAEs occur in approximately 37% of patients receiving PD-1/PD-L1 inhibitors, with (27.6%) pneumonitis, (21.2%) dermatitis, and (14,1%) colitis among the most frequent serious events.[59] Affordability (91%) emerged as the most critical barrier, with most patients unable to access PD-L1–guided treatment due to financial constraints.[44] Beyond cost, major barriers included the lack of robust predictive biomarkers beyond PD-L1, limited applicability of global guidelines without India-specific adaptation, gaps in local evidence, and inadequate PD-L1 testing infrastructure, underscoring the need for stronger biomarker development, context-specific guidelines, and quality assurance systems.

Collectively, these insights highlight the urgent need for multifaceted strategies including financial subsidies, biomarker development, regionally tailored guidelines, and strengthened laboratory infrastructure to advance equitable access to precision immunotherapy in India. A key strength of this survey lies in its Pan-Indian scope, incorporating perspectives from oncologists across academic and private practice settings. However, certain limitations should be acknowledged: the modest sample size, use of convenience sampling, and reliance on self-reported data may introduce bias and limit generalizability. Additionally, the survey did not assess patient-level outcomes, which constrains the ability to directly correlate clinician perspectives with real-world clinical impact.

CONCLUSION

Our findings bring out key shortcomings in PD-L1 testing and the delivery of immunotherapy in India. Variability in assay results, a tendency to prioritize treatment in high expressors, and the overwhelming impact of treatment costs - leading to deferral in nearly two-thirds of eligible patients remain major barriers. Gaps in testing infrastructure, the absence of predictive biomarkers beyond PD-L1, and the lack of context-specific guidelines point to the need for practical solutions. Targeted measures such as subsidized access, investment in biomarker development, and robust quality assurance for PD-L1 testing will be critical to ensure wider and more equitable access to precision immuno-oncology across India.

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