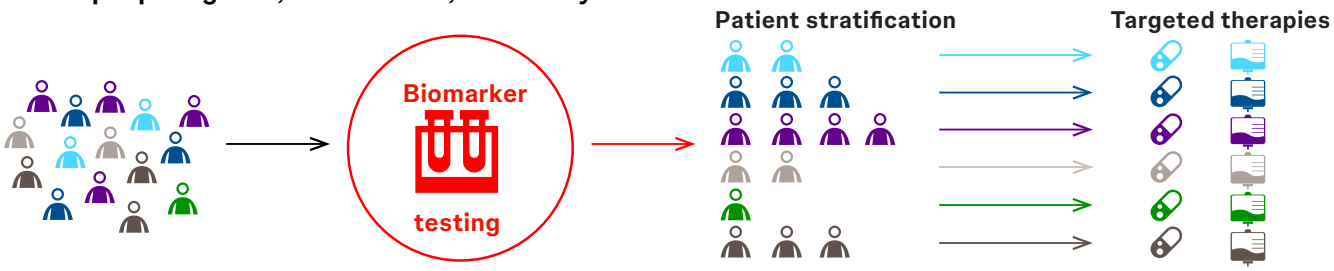
Unlocking Economic and Clinical Outcome Advantages: The Impact of NGS Testing

Biomarker Testing Is the Gateway to Targeted Therapies in Precision Medicine

Precision medicine is an innovative approach to **tailoring disease prevention and treatment** that takes into account **differences in people's genes, environment, and lifestyles.**[1]



Test Selection Is Critical When Identifying Genomic Alterations

Next-generation sequencing (NGS)

A **high-throughput** DNA and RNA sequencing method enabling **comprehensive analysis** through **tissue or liquid biopsy**, facilitating upfront testing for both common and rare actionable genetic alterations[2,3]

Targeted sequencing
Tests specific genes and coding regions with known disease relevance for focused analysis[2]

Whole genome sequencing
Investigate the whole genome to discover novel and unknown genomic variants for target diseases[2]

Whole exome sequencing
Sequences exons only, capturing protein-coding regions of the genome[2]

Polymerase chain reaction (PCR)

Tests for single or a cluster of actionable genetic alterations at a time[4]

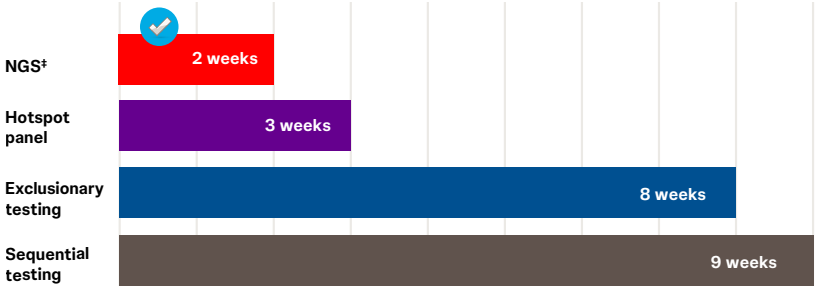
Exclusionary testing
Starts with testing the most common mutation. If result is negative, follow-up with sequential testing

Sequential testing
Perform a sequence of single-gene tests, based on clinical guideline recommendations, until a positive result is observed

Hotspot panel
Simultaneously tests for common mutations, based on clinical guideline recommendations

NGS Is Associated With the Fastest Targeted Therapy Initiation: An Example in NSCLC

Estimated Mean Time to Initiation of Appropriate Targeted Therapy for mNSCLC in US-Based Study[4*†]:



The decision tree model included a US population of adult patients with mNSCLC insured through Medicare or commercial health insurance who had unknown genomic status and were not yet undergoing active treatment.[4]

Decreased turnaround time by[5*]

2.8 weeks

NGS: 2 weeks vs Sequential testing: 4.8 weeks

A decision analytic model considered patients who were newly diagnosed with mNSCLC who were eligible for genomic testing.[5]

*Study limitations included model inputs/assumptions based on expert opinion, reimbursed amount based on publicly available CMS information or commercial claims, and model inclusion of testing costs (not therapy costs or benefits).[4,5] †Other study limitations were inclusion of all first-line mNSCLC (not specific subgroups), DNA- or RNA-based NGS (not combined testing), results not generalizable to countries other than US, and liquid biopsy option for NGS (not PCR).[4] ‡For NGS testing, patients received broad spectrum biomarker panel using either tissue or liquid biopsy that simultaneously tested for all alterations included in clinical guideline recommendations at the time of model development (*EGFR, ALK, ROS1, BRAF, KRAS, MET, HER2, RET, NTRK1*).[4]

CMS, Centers for Medicare and Medicaid Services; mNSCLC, metastatic non-small cell lung cancer; NSCLC, non-small cell lung cancer; US, United States.

1. US Food and Drug Administration. Precision medicine. Updated September 27, 2018. Accessed November 30, 2023. https://www.fda.gov/medical-devices/in-vitro-diagnostics/precision-medicine 2. Pei XM, et al. *Cells*. 2023;12(3):493. 3. Kemper M, et al. *Cancers (Basel)*. 2023;15(5):1430. 4. Vanderpoel J, et al. *J Med Econ*. 2022;25(1):457-468. 5. Pennell NA, et al. *JCO Precis Oncol*. 2019;3:1-9.

Johnson&Johnson

NGS Testing May Provide Health Economic Benefits*

NGS may be considered more **cost-effective** than alternative testing approaches, as it reduces the need for retesting and repeat biopsies[1]

Based on an economic model study in the US[1†]:

NGS consistently yielded lower testing costs than PCR strategies

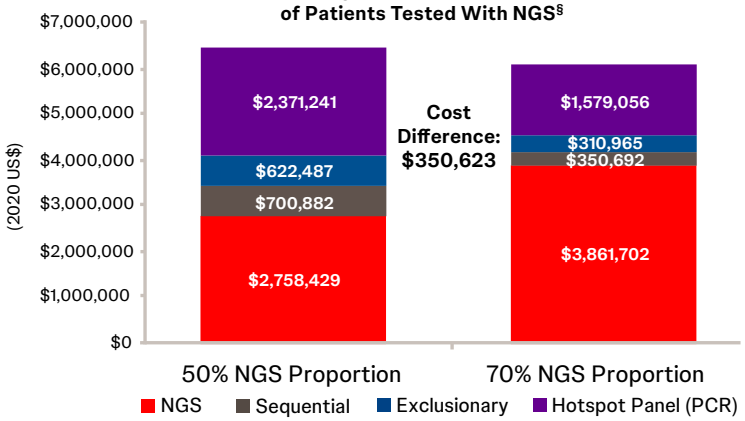
Cost of Testing per Strategy

	NGS	Sequential	Exclusionary	Hotspot Panel
Total cost of testing per patient	**$4,932**	$6,263	$5,563	$7,066
Medical/ diagnostic costs per patient‡	**$1,175**	$1,733	$1,630	$1,158
Gene testing cost per patient	**$3,757**	$4,531	$3,933	$5,908

The decision tree model included a US population of adult patients with mNSCLC insured through Medicare or commercial health insurance who had unknown genomic status and were not yet undergoing active treatment. Based on a hypothetical cohort of 1,000,000 members consisting of 250,000 members covered by Medicare and 750,000 members covered by a commercial insurance plan, 1,119 patients were estimated to have mNSCLC and be eligible for genetic testing.[1]

Increased NGS testing led to cost savings for payers

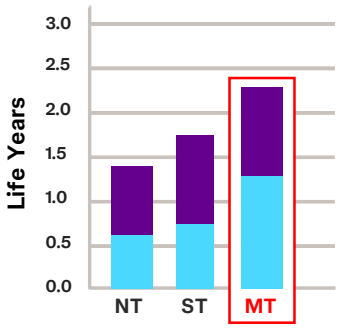
Total Budget Impact for 50% vs 70% of Patients Tested With NGS§



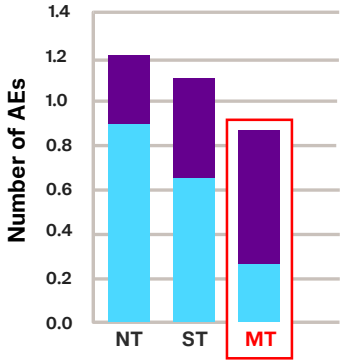
NGS Correlated With Improvements in Survival and Clinical Outcomes*

In advanced NSCLC, more NGS testing correlates with **improved survival rates, increased life years, a prolonged progression-free disease phase, and fewer treatment-related AEs[2¶]**

Estimated Life Years per Patient in US#**



Estimated Number of TRAEs per Patient Over 5-Years in US**



NT = No Testing ST = Sequential Testing MT = Multigene Testing (NGS)
Progression-Free Phase Progressed Phase

A health economic model considered 3 different scenarios for upfront biomarker testing and ensuing first-line systemic therapy in advanced NSCLC. This study included data from pivotal clinical trials and country-specific prevalence of mutations and gene expression in NSCLC and information on test accuracy.[2]

Survival Rates#**

	No Testing	Sequential (Testing (Singleplex PCR & IHC))	Multigene Testing (IHC, NGS)
	Chemo	Chemo (−) / Targeted therapy (+)	Immuno (chemo) therapy (+) / Targeted therapy (+)
1-year survival rate[2#]**			
US	51%	62%	**73%**
Brazil	51%	62%	**73%**
Germany	51%	60%	**71%**
China	51%	68%	**80%**
5-year survival rate[2#]**			
US	2%	6%	**15%**
Brazil	2%	6%	**14%**
Germany	2%	5%	**13%**
China	2%	7%	**19%**

Summary: Potential Cost Implications of NGS Testing in NSCLC Care

Lowest total testing cost[1]

Lower healthcare cost[3]

Savings for payers[1]

*Studies were based on NSCLC.[1,2] †Study limitations included model inputs/assumptions based on expert opinion or published data, inclusion of all first-line mNSCLC (not specific subgroups), reimbursed amount based on publicly available CMS information or commercial claims, DNA- or RNA-based NGS (not combined testing), results not generalizable to countries other than US, liquid biopsy option for NGS (not PCR), and model inclusion of testing costs (not therapy costs or benefits).[1] ‡Costs include rebiopsy, outpatient visits, specialist visits, and PD-L1 testing costs.[1] §Assumed 25% of members had Medicare coverage and 75% of members had commercial coverage.[1] Total cost of testing for genomic alterations associated with next-generation sequencing versus polymerase chain reaction testing strategies among patients with metastatic non-small cell lung cancer, Vanderpoel et al., *Journal of Medical Economics*, 30 March 2022, reprinted by permission of the publisher Informa UK Limited trading as Taylor & Francis Ltd, http://www.tandfonline.com ¶Study limitations included less than 5 years of follow-up (leading to underestimation of the true size of survival outcomes), survival data from different clinical trials with heterogenous patient populations, and assumption that all patients are tested and receive appropriate treatment accordingly (may not reflect clinical practice).[2] #Survival was measured as both the number of life years after treatments start (separated in model into years spent progression-free and in progression after first-line therapy) and the absolute survival rate as the proportion of patients alive after a certain number of years.[2] **Adapted with permission of *Frontiers in Medicine*, A global analysis of the value of precision medicine in oncology – The case of non-small cell lung cancer, Hofmarcher et al., 2023; permission conveyed through Copyright Clearance Center, Inc. http://creativecommons.org/licenses/by/4.0/

AE, adverse event; CMS, Centers for Medicare and Medicaid Services; IHC, immunohistochemistry; mNSCLC, metastatic non-small cell lung cancer; NGS, next-generation sequencing; NSCLC, non-small cell lung cancer; PCR, polymerase chain reaction; PD-L1, programmed death-ligand 1; TRAE, treatment-related adverse event; US, United States.

1. Vanderpoel J, et al. *J Med Econ*. 2022;25(1):457-468. 2. Hofmarcher T, et al. *Front Med (Lausanne)*. 2023;10:1119506. 3. Pruneri G, et al. *Pharmacoecon Open*. 2021;5(2):285-298. 4. Pennell NA, et al. *JCO Precis Oncol*. 2019;3:1-9.

Johnson&Johnson