IN-HOUSE VERSUS SEND-OUT NGS TESTING FOR METASTATIC NON-SMALL CELL LUNG CANCER: A BUDGET-IMPACT ANALYSIS

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Objectives

- Next generation sequencing (NGS) is used to identify genetic markers of disease, making it important for personalized cancer treatment.
- NGS testing can occur in external laboratories (send-out) or in the hospital (in-house).
- We analyzed the impact on hospital budgets of increasing in-house NGS for metastatic non-small cell lung cancer (mNSCLC).

Methods

- A cohort-level, decision-tree model (**Figure 1**) feeding into a Markov model (**Figure 2**) was used to compare two hospital pathways:
  - Only send-out
  - Mixed in-house (75%) and send-out (25%)

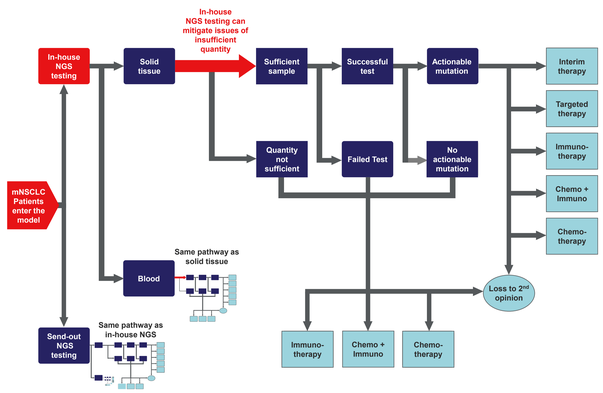

Figure 1 Decision tree modeling movement of patients through standardized testing pathway until therapy decision. The arrows describe the movement of individuals between the different states.

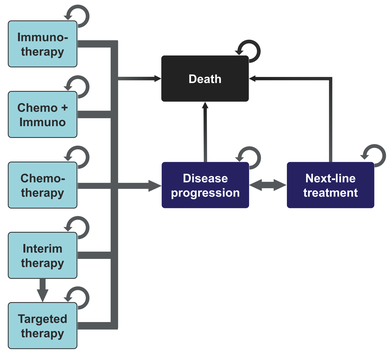

Figure 2 Markov model for disease progression from initiation of therapy until death. The arrows describe the movement of individuals within and between the different states.

- A time horizon of five years was considered from the perspective of a US hospital.
- Costs are in 2021 USD, including costs of NGS capital acquisition associated with the hospital payer.
- The model inputs were derived from a retrospective analysis of real-world data of newly diagnosed stage IV mNSCLC cases and all others from peer-reviewed articles and expert opinions.[1]

(**Table 1**)

Table 1 A selection of key model inputs

Parameter	Value
Cost of in-house NGS testing, per test	$600*
Cost of send-out NGS testing, per test	$300*‡
Cost of single-gene testing per test	$141[2]
Acquisition cost of in-house NGS	$200,000**
Reimbursement for in-house NGS testing, per test	$580[3]
Revenue per hospital visit	$124[4]
Send-out turnaround time, days	10.3-27.8[5.1]
In-house turnaround time, days	3[5,6]

*List price of laboratories, ‡ $3,000 per send-out test with 10% of invoices funded by the hospital ($300), **Expert opinion

Results

- For a hospital with 500 mNSCLC cases per year, the model estimated increases in overall testing costs as well as revenue with the use of the mixed approach.
- Compared to send-out, the mixed approach resulted in $710,060 of increased testing costs and $1,732,506 of increased revenue over the five-year time horizon.
- The return on investment was $1,022,446 (95% credible Interval: $787,903; 1,252,846) with a positive break-even point after 15 (95% credible Interval: 14; 17) months of investment.
- Different combinations of mNSCLC cases per year and proportions of in-house NGS implementation result in different break-even points. (**Figure 3**)
- More cases per year would require a lower rate of in-house NGS adoption to reach the break-even point and vice versa (**Figure 3**)
- The one-way sensitivity analysis showed that the proportion of send-out NGS testing and the proportion of patients on targeted therapy had the greatest impact on the return on investment.

A

Proportion of in-house NGS \ Number of patients per year	50	100	150	200	300	400	600	800
5%	-$190,156	-$180,312	-$170,468	-$160,624	-$140,936	-$121,248	-$81,872	-$42,496
10%	-$182,127	-$164,255	-$146,382	-$128,510	-$92,764	-$57,019	$14,471	$85,962
15%	-$174,099	-$148,198	-$122,296	-$96,395	-$44,593	$7,210	$110,815	$214,420
20%	-$166,070	-$132,140	-$98,210	-$64,281	$3,579	$71,439	$207,158	$342,877
40%	-$133,956	-$67,911	-$1,867	$64,177	$196,266	$328,355	$592,532	$856,709
60%	-$101,841	-$3,682	$94,476	$192,635	$388,953	$585,270	$977,905	$1,370,541
80%	-$69,727	$60,547	$190,820	$321,093	$581,640	$842,186	$1,363,279	$1,884,372
100%	-$37,612	$124,775	$287,163	$449,551	$774,326	$1,099,102	$1,748,653	$2,398,204

B

Proportion of in-house NGS \ Number of patients per year	50	100	150	200	300	400	600	800
5%	>60	>60	>60	>60	>60	>60	>60	>60
10%	>60	>60	>60	>60	>60	>60	>60	49
15%	>60	>60	>60	>60	>60	>60	45	36
20%	>60	>60	>60	>60	>60	51	37	29
40%	>60	>60	>60	52	37	29	21	17
60%	>60	>60	47	37	27	21	16	12
80%	>60	52	38	30	21	17	12	10
100%	>60	43	31	25	18	14	10	8

Figure 3 Scenario analysis **A** Return on investment after five years. **B** Payback period (months), dark grey: scenario does not break even withn five year time horizon.

CONCLUSION

- **An in-house NGS system reduces the testing turnaround time, and increases the number of mNSCLC patients on targeted therapy.**
- **Hospitals with >100 mNSCLC cases per year are expected to find in-house NGS profitable within 5 years.**

- The mixed approach reduced the mean test turnaround time by 9.86 (9.21; 10.49) days and led to a +3.38 (2.31; 4.05) %-points increase in patients on targeted therapies (**Figure 4**).

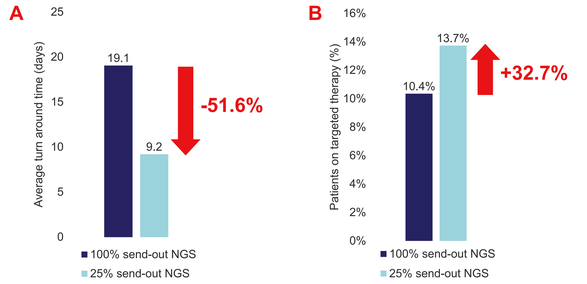

Figure 4 Effects of a mixed approach **A** Average turn-around time in days **B** Patients on targeted therapy as a percentage of all patients

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