Economic Impact of Concurrent Tissue and Circulating Tumor DNA Molecular Profiling In Advanced Breast Cancer Patients

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INTRODUCTION

The use of molecularly-directed targeted therapies has become a vital tool in treating advanced breast cancer patients. While solid tumor testing is standard of care for biomarker detection, the use of circulating tumor DNA (ctDNA), a noninvasive technology for molecular profiling is becoming more common. Concurrent testing, or the use of simultaneous solid tissue and ctDNA testing, has the potential to increase detection of actionable findings, as well as reduce adverse events from repeat biopsies compared to solid tissue testing alone. A large real-world study of patients tested concurrently identified an additional 20% of patients with advanced breast cancer with actionable findings which were missed by tissue-based testing alone. We use these data to assess the economic impact of concurrent testing compared to tissue-only testing in a simulation of patients with advanced Breast Cancer in the United States.

SUMMARY

Concurrent tissue and liquid-based NGS testing in advanced breast cancer identifies a higher proportion of patients with actionable variants and reduces the number of repeated biopsies performed than tissue testing.

These incremental costs of concurrent testing are higher than solid tumor testing, but less than the additional costs of a liquid biopsy test.

Future analyses will include the impact of increased matched therapy due to increased identification of actionable variants, decreased toxicities and improved survival in concurrently tested patients compared to patients tested with tissue testing alone.

METHODS

A microsimulation compared concurrent testing to solid tumor testing alone in patients with advanced breast cancer. We simulated 1,000 patients 10,000 times. Model entry occurred at progression on first line therapy, while model exit occurred at the start of second line therapy, after receipt of all genetic test results.

Frequency of actionable biomarkers (BRCA1, BRCA2, ERBB2, ESR1, PIK3CA, and MSI) detected by testing modality were derived from a real-world data study of patients tested concurrently.

Other model inputs, including detection rates of testing modalities, rates of rebiopsy due to inadequate tissue, and rates of adverse events were derived from literature.

Total costs modeled included cost of NGS, biopsy costs, and management of adverse events due to biopsies. We assumed the cost of solid tumor and the cost of liquid biopsy were each $2,900.

The primary economic endpoint measured was the total cost per patient, while the primary clinical endpoints included percentage of patients with actionable variants identified, total biopsies performed per cohort, and serious biopsy events avoided per cohort.

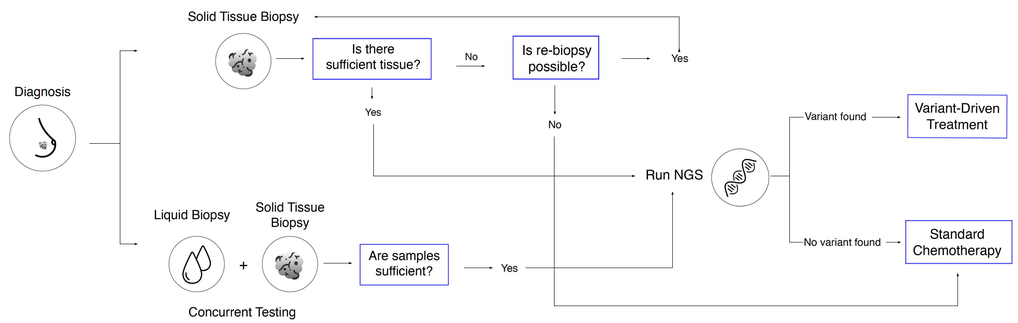
Base case input parameters

Genetic Variant	Patient Population	Detected by Tissue	Detected by Liquid
None	0.47	-	-
ESR1	0.18	0.81	0.91
PIK3CA	0.37	0.96	0.83
ERBB2	0.07	0.89	0.69
BRCA2	0.03	0.65	0.88
BRCA1	0.02	0.80	0.87

Intervention	Cost
Tissue Biopsy	$1,042.99
Blood Draw	$8.83
Tissue Sequencing	$2,900.00
Liquid Sequencing	$2,900.00
Concurrent Sequencing	$5,800.00
Management of Biopsy Adverse Event	$23,436.02

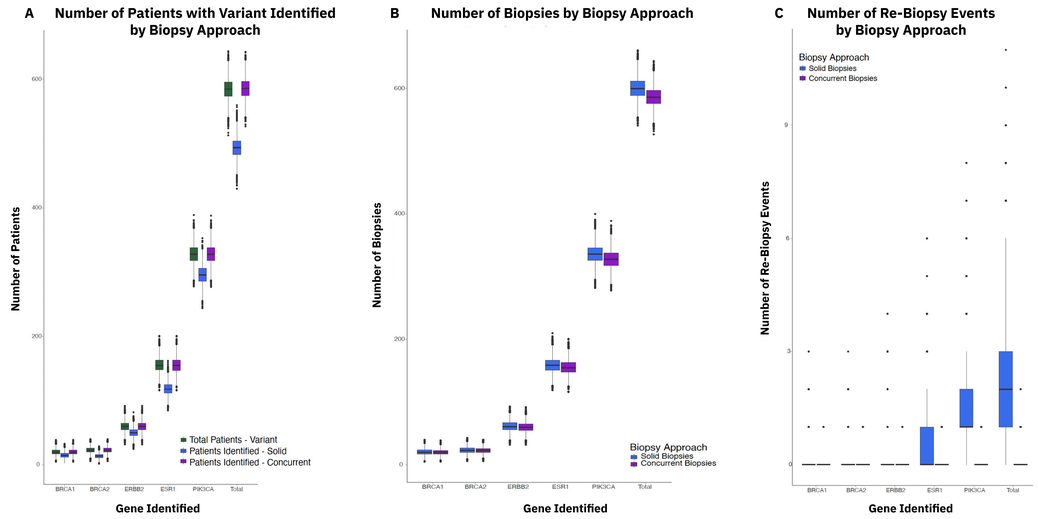
Biopsy Event	Probability
Quantity not sufficient, first biopsy	0.08
Patient able to be re-biopsied	0.3
Patient experiences re-biopsy adverse event	0.18
Quantity not sufficient, second biopsy	0.15
Quantity not sufficient, liquid	0.01

Liquid biopsy provides results to more patients because it can capture variants even when there is insufficient tissue



RESULTS

Clinical Outcomes



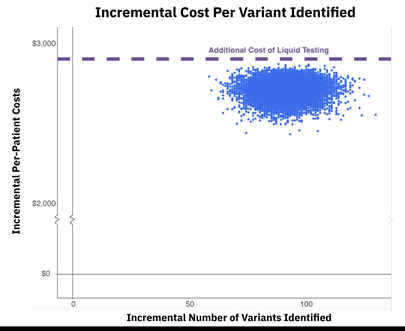
Clinical Outcomes

A. For every genetic variant tested, **concurrent biopsy** identified more patients than **solid biopsy** alone

B. **Concurrent biopsy** typically resulted in the need for fewer biopsies to identify variants than **solid biopsy** alone

C. For higher frequency genetic variants, **solid biopsy** alone resulted in re-biopsy events more frequently than **concurrent biopsy**

Economic Outcomes



	Solid Testing	Concurrent Testing	Incremental Difference
Average Number of Variants Detected	494	586	92
Average Per Patient Cost of Variant Detection	$4,138.80	$6,853.78	$2,714.98
Average Number of Biopsies	1024	1000	-24
Average Number of Rebiopsy-related events	4	0	-4

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