Economic Impact of Earlier Detection and Therapeutic Management of Leptomeningeal Metastases Using CNSide: A Cost-of-Care Analysis

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Background

- Leptomeningeal Metastases (LM) occurs in ~5-20% of patients with solid tumors; most commonly from breast, lung, and melanoma[1,2]
- LM drives high cost and poor outcomes, often recognized late, leading to intensive use of inpatient, outpatient, and palliative services[3,4]
- Diagnostic delay/uncertainty prolongs time to CNS-active therapy and increases preventable spend (e.g., unplanned admissions, repeat imaging)
- Claims bundling masks LM-specific spend, hindering cost attribution, forecasting, and value assessment of new diagnostics

Objectives

- To estimate late-stage (stage IV) LM costs, including drug therapy, imaging, hospitalizations, and palliative care
- To evaluate the economic and clinical impact of CNSide, a novel cerebrospinal fluid (CSF) assay platform enabling earlier, definitive LM tumor cell detection, quantification, characterization, and real-time response monitoring

Methods

- A Hypothetical cost-of-care model was developed using literature, real-world data, and claims databases to estimate direct and indirect medical costs associated with late-stage LM diagnosis[5-8]
- Sensitivity analyses tested standard pathway (MRI and repeated cytology; empiric therapy) vs. a CNSide-enabled pathway (earlier definitive diagnosis, targeted therapy, quantitative monitoring)
- Key Assumptions: Adults with suspected/confirmed stage IV LM (breast, NSCLC, melanoma); 6-month life expectancy (range 4–8); 1 drug, 1 cycle/month. CNSide improves sensitivity, enables earlier diagnosis, and reduces repeat LPs/MRIs and inpatient days
- Cost ranges were applied to address bundling (LM vs. primary cancer)

Platform

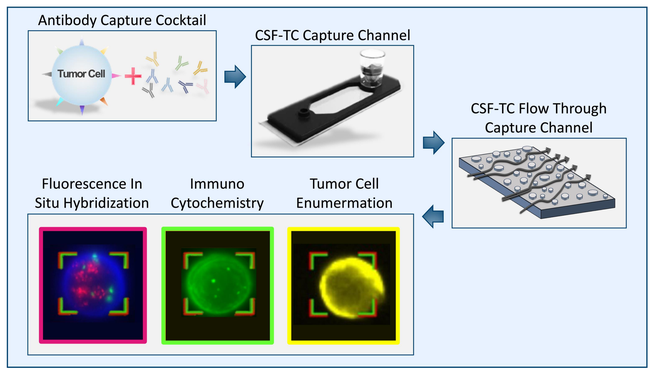

Figure 1. CNSide CSF Tumor Cell (CSF-TC) Capture Platform

The CNSide workflow captures CSF-TCs from CSF using a 10-antibody cocktail, then traps them in a microfluidic device enabling quantitative tumor cell enumeration (TCE) and further analyses with fluorescence in situ hybridization (FISH) and immunocytochemistry (ICC)

Results

Take Home #1: Earlier, definitive diagnosis and better monitoring most strongly influence time on therapy; regimen choice has the biggest impact on cost

- Base-case average monthly LM cost ≈ $119,500 over 6 months (Table 1). One-way sensitivity analysis varied single parameters to assess impact on net monthly cost (Figure 2).
- Largest Cost Drivers
  1) Drug cost per cycle:
     - Range tested: $7,000–$15,000
     - Δ vs. base: –$18,000 to +$30,000 (max swing $30,000, ±16–26%)
  2) Treatment duration (active cycles)
     - Range tested: 4–8 cycles
     - Δ vs. base: –$21,000 to +$21,000 (max swing $21,000, ±18%)

Parameter	Monthly Cost / Units
Base fixed	$61,000
Drug cost per cycle	$11,000
Hospital cost per event	$20,000
Expected hospital events	1.6
Imaging cost	$2,500
Palliative cost	$12,500
Administrative cost per cycle	$550
Monthly Total:	$119,550
Life Expectancy (months):	6
6 Month Total:	$717,300

Table 1. Cost-of-Care Model for Late-Stage (Stage IV) LM Diagnosis

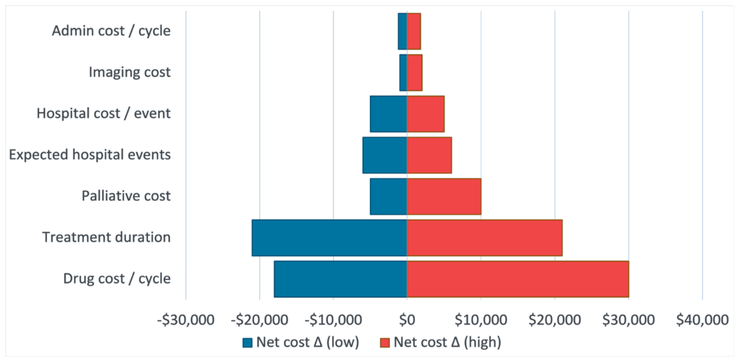

Figure 2. One-Way Sensitivity Analysis: CNSide's impact on monthly LM management costs

Results

Take-Home #2: Even with costlier targeted therapy, earlier LM confirmation plus optimized management is cost-reducing; the extent depends most on drug cost/cycle and treatment duration

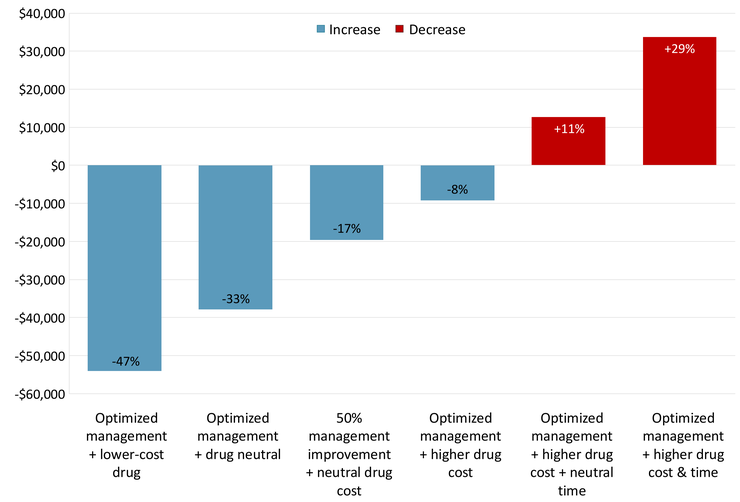

Figure 3. Multi-Way Scenario Analysis: Impact of CNSide-enabled earlier LM detection and optimized management on Monthly LM management costs

Conclusions

- By enabling earlier LM confirmation and optimized, quantitatively monitored management, CNSide can plausibly reduce monthly LM-related costs by ~33-47%
- Overall spend is ultimately governed by regimen composition, including drug selection and combination strategies
- These findings underscore the need for integrating advanced diagnostic technologies to address the economic and clinical burden of LM

References

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