Estimated cost of anti-cancer therapy directed by comprehensive genomic profiling in a single-center study

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BACKGROUND

Accumulating evidence supports the clinical benefit of targeted therapies matched to cancer patients based on genomic alterations.[1,2,3] Comprehensive genomic profiling (CGP), which detects all classes of alterations (base pair substitutions, copy number, insertions/deletions, and rearrangements), can match patients with available and investigational therapies.[4] This study estimated anti-cancer drug costs and overall survival (OS) for matched versus unmatched therapy.

METHODS

Costs were estimated for patients with complete data (N=188/500) from a prospective, nonrandomized, phase I oncology center study of patients with diverse refractory cancers who underwent CGP, with FoundationOne®, and were treated with matched or unmatched therapy.[5] Average time to treatment failure (TTF) and average observed OS were assessed during the observation period. Patient-specific drug and administration costs were imputed for the first regimen after CGP based on a representative drug from relevant drug classes, unit costs (wholesale average cost[6]), and TTF.

RESULTS

A total of 500 patients were enrolled of whom 339 received molecular profiling, 322 of whom had at least one alteration detected, and 188 received a subsequent treatment with either matched (N=122/188, 65%) or unmatched (N=66/188, 35%) therapy.[5] Patient characteristics are described in Table 1. Most patients (N=130) had received at least three lines of therapy before undergoing CGP in the phase I study. The median number of molecular alterations per person was four (unmatched therapy) to five (matched therapy). Combination therapy was used for 71% of matched and 53% of unmatched patients.

Table 1. Patient characteristics

	MATCHED THERAPY (N=122)	UNMATCHED THERAPY (N=66)
AGE (N, %)[5]		
≤60 years	67 (55)	36 (55)
>60 years	55 (45)	30 (45)
SEX (N, %)[5]		
Women	80 (66)	42 (64)
Men	42 (34)	24 (36)
ECOG PERFORMANCE STATUS (N=170; N, %)[5]		
0	24 (21)	10 (19)
≥1	92 (79)	44 (81)
TUMOR TYPE (N, %)		
Lung	5 (4.1)	1 (1.5)
Breast	22 (18.0)	9 (13.6)
Uterine	7 (5.7)	3 (4.5)
Head and Neck	8 (6.6)	4 (6.1)
Colorectal	7 (5.7)	4 (6.1)
Ovarian	24 (19.7)	9 (13.6)
Other[a]	49 (40.2)	36 (54.5)
Melanoma	3 (2.5)	3 (4.5)
Sarcoma	17 (13.9)	7 (10.6)
Neuroendocrine	5 (4.1)	1 (1.5)
Renal	8 (6.6)	5 (7.6)
TIME TO TREATMENT FAILURE ON PRIOR THERAPY, MONTHS (N=140; median, range)[5]	2.6 (0.5–19.7)	3.0 (0.4–96.0)
LINE OF THERAPY FOR STUDY CGP (N, %)		
1	11 (9.0)	1 (1.5)
2	8 (6.6)	5 (7.6)
3	22 (18.0)	11 (16.7)
≥4	81 (66.4)	49 (74.2)
NUMBER OF MOLECULAR ALTERATIONS PER PERSON (median, range)[5]	5 (1–14)	4 (1–11)
TREATED WITH COMBINATION THERAPY (N, %)	87 (71.3)	35 (53.0)

ECOG = Eastern Cooperative Oncology Group
[a] Selected tumor types, presented here, are from among those grouped as other.

Patients on matched (N=122) versus unmatched (N=66) therapy had, on average, longer time on treatment (+1.5 months), longer observed OS (+2.4 months), and higher anti-cancer drug costs (+$38,000) (all p<0.01) (Table 2).

Those undergoing CGP in earlier lines of therapy (1–3, N=58 vs. 4+, N=130) had numerically larger incremental increases in average times on treatment (+1.9 vs. +1.2 months) and observed OS (+2.5 vs. +2.1 months), and numerically lower incremental drug costs (+$27,000 vs. +$43,000), with matched versus unmatched therapy (Table 2).

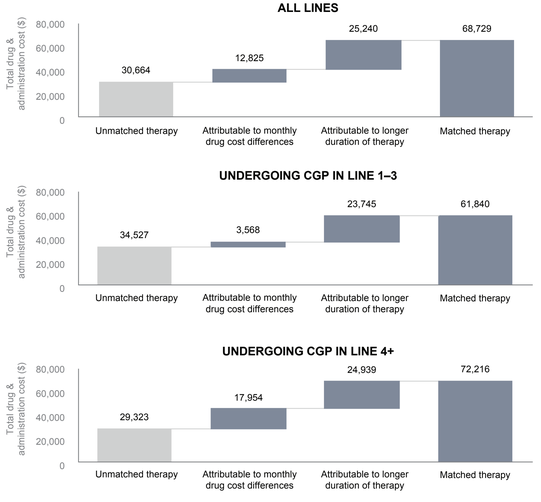
Table 2. Clinical and economic outcomes for matched and unmatched therapy

	MATCHED THERAPY	UNMATCHED THERAPY	Δ[b]	P-VALUE[c]
ALL PATIENTS				
Sample size (N)	122	66		
OS (months)	8.2	5.9	2.4	0.002
TTF (months)	3.9	2.4	1.5	0.002
Cost ($)[a]	68,729	30,664	38,065	0.003
UNDERGOING CGP IN LINE 1–3				
Sample size (N)	41	17		
OS (months)	9.5	7.0	2.5	0.112
TTF (months)	4.5	2.6	1.9	0.051
Cost ($)[a]	61,840	34,527	27,313	0.296
UNDERGOING CGP IN LINE 4+				
Sample size (N)	81	49		
OS (months)	7.5	5.5	2.1	0.013
TTF (months)	3.6	2.4	1.2	0.024
Cost ($)[a]	72,216	29,323	42,893	0.003

OS = overall survival; TTF = time to treatment failure.
[a] Mean drug and administration cost calculated based on per patient time on treatment.
[b] All calculated differences were rounded to one decimal place.
[c] All differences were evaluated for statistical significance using t-tests.

The majority of increased drug treatment costs were attributable to longer duration of therapy associated with extended TTF (66%) as opposed to higher monthly drug costs (33%) (Figure 1).

Figure 1: Comparison of total drug treatment costs between matched and unmatched therapy



CONCLUSIONS

For patients treated in a Phase I clinic, matched versus unmatched therapy was associated with longer treatment duration, increased survival, and manageable incremental costs. Despite frequent use of combination therapy, most of the increased costs of matched therapy were due to longer duration of therapy rather than higher monthly drug costs. Benefits of matching were numerically greater in earlier- versus later-lines, consistent with the value of earlier-line use of comprehensive genomic profiling to guide treatment.

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