Precision Medicine: Estimated Clinical and Economic Outcomes of Using a Predictive and Prognostic Biomarker to Avoid Ineffective Therapies in Advanced Non-Small Cell Lung Cancer

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INTRODUCTION

The VeriStrat® test is intended to help guide treatment decisions for patients with advanced non-small-cell lung cancer (NSCLC) without an EGFR-sensitizing mutation. VeriStrat (VS) blood-based proteomic testing measures chronic activation of complex proteomic pathways. It classifies patients into two categories, VSGood and VSPoor. Extensive clinical data demonstrates that patients classified as VSGood have a favorable prognosis and benefit from receiving active treatment whereas patients classified as VSPoor have a more aggressive cancer and less favorable prognosis, and exhibit no significant response to EGFR-TKIs.[1-3]

PURPOSE

The purpose of this study is to assess the clinical and cost utility of the VeriStrat test in lung cancer patients. Specifically, the study evaluates the impact of the VeriStrat test on treatment recommendations, estimated clinical outcomes and lifelong health costs of integrating a serum-based proteomic test in the care of advanced non-small cell lung cancer (NSCLC) patients.

METHODS

The analysis evaluated the effect of proteomic testing for patients with advanced NSCLC without detected EGFR mutations. We estimated the impact of changes in treatment decisions following VeriStrat testing on the lifetime health costs, survival outcomes and quality adjusted life years (QALY) of patients.

To this end, we compared two scenarios. 1. treatment of patients without VeriStrat testing and 2. treatment of patients with VeriStrat testing.

Table 1. Model inputs

Data Type	Source
Response to active treatments or best supportive care (BSC)	Multi-arm randomized phase III studies: PROSE, BR.21 (Bucher method)[2-4]
Test characteristics	Published clinical trials[1-3]
Cost of proteomic testing	2016 List price
Cost of treatments	Price: Micromedex RED Book, number of cycles: Kantar health
Cost of surveillance	Medicare physician fee schedule
Cost of BSC	Medicare hospice cap
Costs of treating adverse events	Physician fee schedule and studies
Utility and disutility	Published studies
Clinical management decisions	Decision impact study
Fixed parameters: age at testing (65), time horizon (3 years), annual discount rate (3%)	

Treatment patterns with and without the VeriStrat test were based on a clinical utility study that collected physician treatment plans both before and after receiving a VS results. [5] Treatments without VS were based on the actual pre-test treatment decisions of physicians who ordered VS between 2012 and 2016. Treatment with VS was based on the post-test treatment decisions of the same group. For each scenario, we derived survival and adverse event outcomes from published clinical trials using placebo as a proxy for best supportive care. All costs in this analysis were based on 2016 fee schedule or inflated to 2016 USD using the consumer price index for medical care. Health utility scores quantifying patient experience on a scale of 1 (perfect health) to 0 (death) obtained form published studies were used to weigh quality of life.

RESULTS

Table 2. Base case cost-effectiveness of using VeriStrat to guide shared-treatment decision making

	No VeriStrat	VeriStrat	Difference
Treatment use			
Chemotherapy	9.4%	29.5%	20.0%
EGFR TKI's	90.0%	60.8%	-29.2%
Best supportive care	0.6%	9.7%	9.1%
Health outcomes			
Overall survival, years	0.851	0.906	0.055
QALYs	0.519	0.560	0.040
Costs			
Testing	$0	$3,480	$3,480
Surveillance	$1,368	$1,394	$26
Drug and administration	$32,653	$26,261	-$6,392
Best supportive care	$87	$1,506	$1,419
Management of adverse events	$369	$786	$417
Total	$34,477	$33,427	-$1,050
Incremental costs			
ICER ($/LY)			-$19,204
ICER ($/QALY)			-$26,131

In the base case, the use of proteomic testing reduced the use of active treatment by 9.1% and changed the choice of active treatment in an additional 20% of patients. This resulted in improvements in overall survival of 0.7 months and of 0.5 quality adjusted months per patients. VS testing decreased drug acquisition costs by $6,392. When including the cost of treating adverse events (AE's), increased cost of surveillance (due to increased life expectancy) as well as the cost of testing, VS testing resulted in a net savings of $1,050 per patient. The incremental cost-effectiveness ratio of using proteomic testing was a cost savings of $26,131 per quality adjusted life year

For patients with test results of VSPoor, the impact of VeriStrat testing was more pronounced leading to a cost-savings of $10,414 per patient. For patients with test results of VSPoor, there was a net 24% shift from active treatment to best supportive care. Within those choosing active treatments, an additional 55% of patients had changes in treatment decisions to select more effective therapies given test results. The estimated impact on survival outcomes of using VeriStrat to guide treatment selection for patients with a test result of VSPoor was an improvement in survival of 1.9 months per patient or a 138% improvement. For patients with a test result of VSPoor, the incremental cost effectiveness was a savings of -$91,398/QALY

Table 3. Incremental costs and outcomes, VeriStrat Poor patients

	Incremental Quality adjusted life years	Incremental costs	ICER (S/QALY)
VeriStrat Poor subgroup	0.114	$-10,414.49	-$91,398

Figure 1. Impact of the VeriStrat test on shared treatment decision in patients with test results of VSPoor
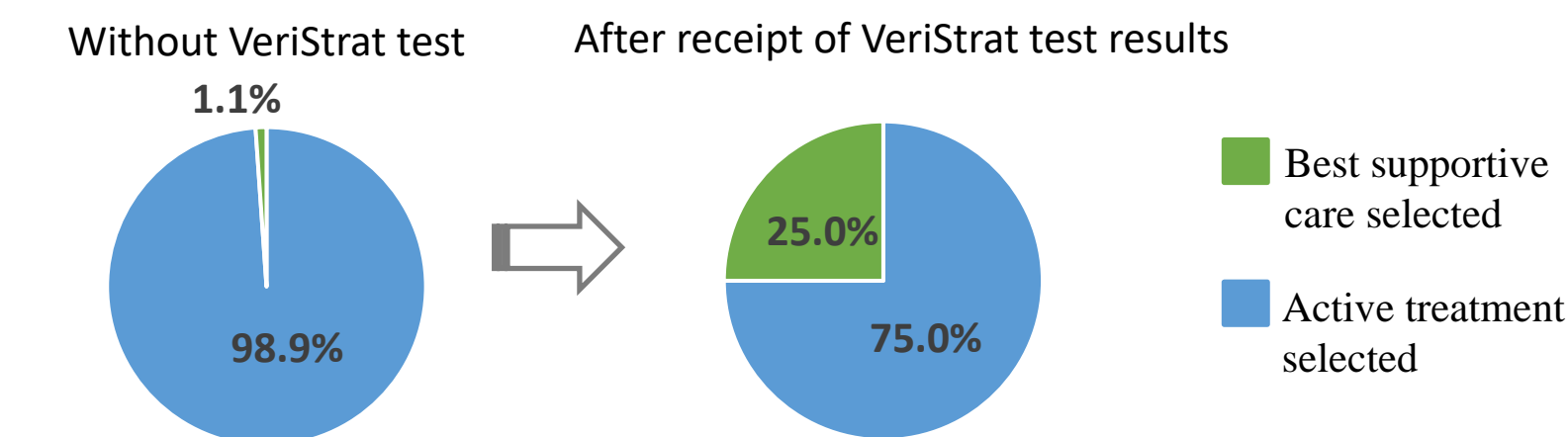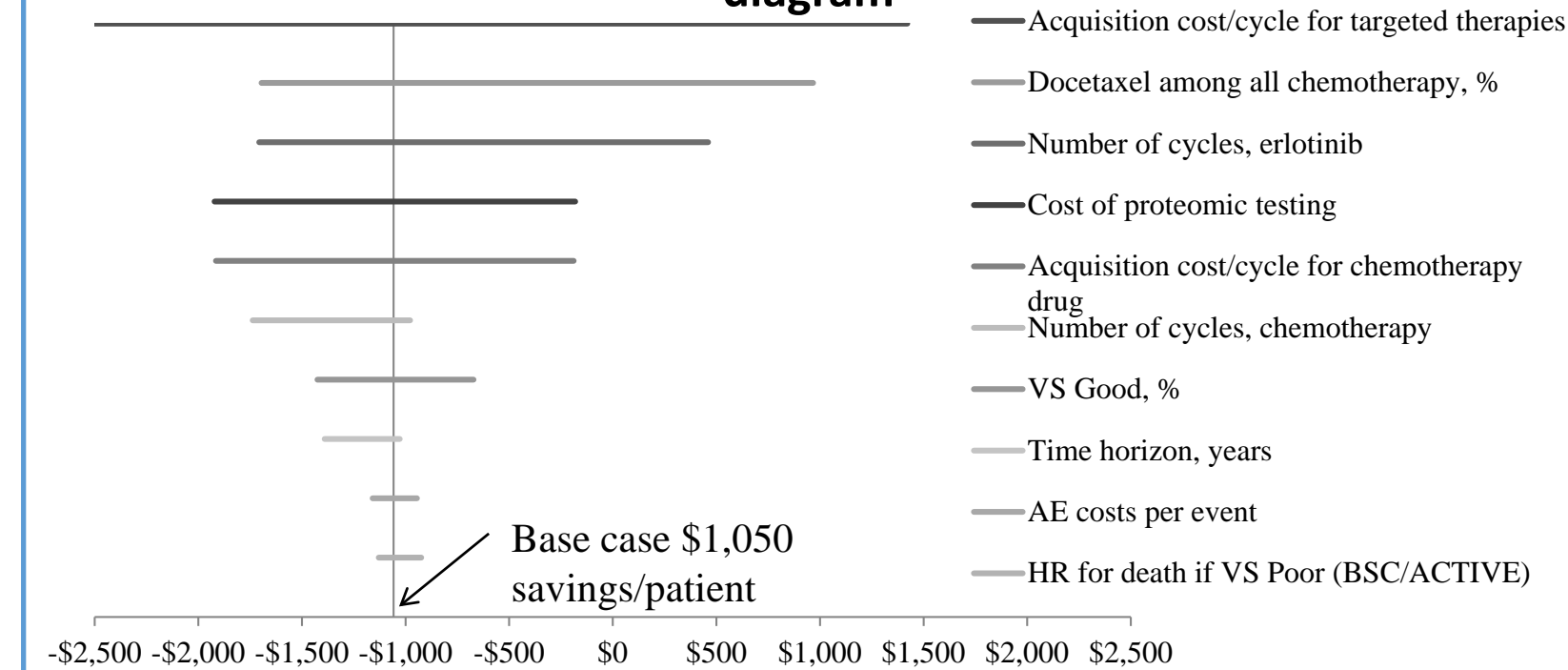

Figure 2. Base case one-way sensitivity analysis, tornado diagram

DISCUSSION

VeriStrat results help to inform shared decision making between physicians and patients and facilitate conversations about prognosis and next steps in treatment. Informed management of patients at end of life is crucial to avoid overtreatment and properly time best supportive care. Overtreatment is tied to poor outcomes and decreased quality of life for patients as well as increased anxiety for patients and their families. On the other hand, treatment focused on best supportive care or palliative care has been demonstrated to improve or maintain quality of treatment for patients with advanced cancers.[6-7] Understanding prognosis and the aggressiveness of a patient's cancer is central to end of life planning and treatment decision making. As this cost-effectiveness analysis demonstrates, in patients with advanced NSCLC, the VeriStrat test changes patient and physician treatment decisions. The result is a reduction in overtreatment in patients for whom active treatments would have been largely ineffective in increasing overall survival as well as the optimization of treatment when active treatment is decided upon (shifting away from targeted therapies towards single agent chemotherapies). The optimized treatment decisions result in large cost savings as well as improved QALY outcomes.

CONCLUSION

Utilizing VeriStrat results decreases the costs of treatment while improving outcomes compared to making treatment decisions without advanced diagnostic testing. In patients with advanced NSCLC, VeriStrat informs prognosis and can facilitate conversations about best supportive care. VeriStrat is cost savings with a total cost savings of $1,039 per patient and improvements in survival of 0.7 months by guiding patients and physicians to more efficient treatments for a net QALY impact of -$25,856/QALY. In patients with test results of VSPoor, the impact of VS is magnified with cost savings of over $10,000 per patient while still improving outcomes.

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