

# Improving cancer care through modern portfolio theory

By Kevin B Knopf, MD, MPH

We struggle daily to improve cancer care – to improve our therapeutic outcomes in cancer – as individual physicians and as researchers. We work collectively to disseminate information and collaborate, and there are welcome calls for open data sharing to accelerate progress.<sup>1</sup> We enroll patients on clinical trials, or we work in a basic science lab to discover mechanisms of carcinogenesis and potential therapeutic targets. We discuss “n of 1” trials and the “paradigm shift of precision oncology,” and we are optimistic about the future of cancer care.

Leaving the world of biology and clinical trials for a minute, we also can apply economic theory in our never-ending quest to improve cancer outcomes. One area of interest may be modern portfolio theory (MPT), which the economist Harry Markowitz introduced in an essay in 1952 and later won the Nobel Prize for his work.

MPT is complex, but it states that one’s expected rate of financial return depends on how assets are allocated. There is even discussion of an “efficient frontier”: an optimal way to allocate assets for a given system. We can apply MPT to how we think about allocating economic assets in cancer care – with the goal of maximizing return for all cancer patients – by following the principal of distributive justice.<sup>2</sup>

At least 71 billionaires live in the San Francisco Bay Area, where I live, but 14,000 children (13%) in the area live below the poverty line.<sup>3</sup> When there is a range of asset allocations in health care, results can vary not on the basis of the underlying disease state or the quality of the provider, but on access to care. As an example, most pediatric cancers are curable, yet a recent retrospective analysis of data in the SEER-Medicare registry showed that mortality within 1 month of diagnosis of childhood cancer related in part to socioeconomic factors – those patients with a lower socioeconomic status (which correlates with being an ethnic minority in the United States) were more likely to die within a month of diagnosis of their cancer than were patients with a higher socioeconomic status.<sup>3</sup> Here is where MPT can transform the cancer outcomes

landscape at no additional investment in basic science or costly precision medicine<sup>5</sup>: by triaging these patients according to their disease state rather than their ability to pay, they could be administered curative chemotherapy, placed on the appropriate clinical trial, and be cured of their cancer like other children of higher socioeconomic status.

My colleagues and I observed a similar trend when we looked at treatment of diffuse large-cell non-Hodgkin lymphoma in Medicare recipients.<sup>6</sup> Although the cure rate is as high as 60%-80% with the use of CHOP (cyclophosphamide, doxorubicin, vincristine, prednisolone) or R (rituxin)-CHOP chemotherapy, we found that many patients had received suboptimal chemotherapy. Upon closer examination, we found that there were variations in care by socio-

economic status even in a single-payer system. Thus aspects of cultural literacy and additional efforts for triage need to be developed, but again, application of MPT could be instrumental in improving cancer cure rates by reducing disparities in care by allocating assets to solve access-to-care issues, and curing these patients of their non-Hodgkin lymphoma.

A physician at a Bay Area health care system notes that the open slots in his schedule are triaged by his employer by the patient’s ability to pay – well-insured patients are seen within a few days, but there are very few slots for Medicaid patients, who have to wait weeks or longer to be seen. During this time, their malignancies have time to grow, and potentially metastasize. This may provide suboptimal outcomes for some patients in his community.

We solved this problem at a local hospital where all patients were on Medicaid or uninsured. We triaged patients according to severity of illness, with patients with rapidly growing cancers, particularly curable ones, were brought in as soon as possible and patients with stable benign hematologic conditions seen on a less urgent basis. A social worker and I saw patients together. She would find them resources such as transportation, food, copay assistance to help them through their treatment, and I would



optimize their cancer care clinically. On a small scale, this application of MPT (or asset allocation) worked quite well. Perhaps it can be reproduced on a much larger scale. Return on investment relates largely to how you allocate

your assets. What's nice about these applications of MPT is that the return on investment – increasing the cure rate of cancer - is quite large for just a minimal change in asset allocation.

## References

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