Table 1. Probability of Running Out of Stock Based on Number of Units Owned

Type of Surgery	Units					
	1	2	3	4	5	6
Open	0.899	0.815	0.701	0.570	0.435	0.308
Laparoscopic	0.561	0.377	0.226	0.118	0.0543	0.0217

Type of Surgery	Units				
	7	8	9	10	11
Open	0.2000	0.118	0.0631	0.0302	0.0129
Laparoscopic	0.00766				

Corresponding author: Faye A. Queresby, MD, MBA, FRCS(C), Princess Margaret Hospital, University Health Network, Department of Surgical Oncology, Room 3 130, 610 University Ave, Toronto, Ontario, Canada M5G 2M9; e-mail: faye.quereshy@utoronto.ca.

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Reduction in Chemotherapy Mixing Errors Using Six Sigma: Illinois CancerCare Experience

By Bridgette Heard, MBA, Laura Miller, BSN, and Pankaj Kumar, MD
Illinois CancerCare, Peoria, IL

Purpose: Chemotherapy mixing errors (CTMRs), although rare, have serious consequences. Illinois CancerCare is a large practice with multiple satellite offices. The goal of this study was to reduce the number of CTMRs using Six Sigma methods.

Patients and Methods: A Six Sigma team consisting of five participants (registered nurses and pharmacy technicians [PTs]) was formed. The team had 10 hours of Six Sigma training in the DMAIC (ie, Define, Measure, Analyze, Improve, Control) process. Measurement of errors started from the time the CT order was verified by the PT to the time of CT administration by the nurse. Data collection included retrospective error tracking software, system audits, and staff surveys.

Results: Root causes of CTMRs included inadequate knowledge of CT mixing protocol, inconsistencies in checking methods, and frequent changes in staffing of clinics. Initial CTMRs ($n = 33,259$) constituted 0.050%, with 77% of these errors affecting patients. The action plan included checklists, education, and competency testing. The postimplementation error rate ($n = 33,376$, annualized) over a 3-month period was reduced to 0.019%, with only 15% of errors affecting patients. Initial Sigma was calculated at 4.2; this process resulted in the improvement of Sigma to 5.2, representing a 100-fold reduction. Financial analysis demonstrated a reduction in annualized loss of revenue (administration charges and drug wastage) from \$11,537.95 (Medicare Average Sales Price) before the start of the project to \$1,262.40.

Conclusion: The Six Sigma process is a powerful technique in the reduction of CTMRs.

Corresponding author: Pankaj Kumar, MD, Illinois CancerCare, 8940 N. Wood Sage Rd, Peoria, IL 61615; e-mail: pkumar@ohaci.com.

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Drug-Addicted Oncology Practice: The Drug Test

By Neil M. Barth, MD, and Beau Donegan, MBA
Oncology Services Management, Newport Beach, CA

Purpose: The buy-and-bill model of pharmaceuticals has been an economic reality for medical oncology practices for more than 30 years. Infusion services, once just a supportive service, grew exponentially in most practices between 1991 and 2000, to the point at which revenue from these services created a high, which made all things possible, including care of underinsured or uninsured patients. This altered state was further enhanced in the early part of this past decade when the introduction of high-

cost chemotherapeutics and biologic agents created the euphoria of big business and a true dollar distortion for even the smallest oncology practice.

Results: In 2005, government and payer intervention forced average wholesale price to average sales price conversion to reduce the drug effect. Concurrently, payer scrutiny of utilization and medical necessity with further dose reductions, equating to margins, led many practices to experience painful drug withdrawal symptoms. Despite the enormous financial risk for unreimbursed expense and acknowledged spiraling decline of drug margins of greater than 30% since 2002, the seductive possibility of a financial fix keeps the practices hooked.

Conclusion: Many practices will make poor financial choices and will gamble with their financial health by consuming precious resources to support the habit. We propose the drug test: Run your practice financials without drugs. Can you cover the total practice expense without drugs? If not, determine your level of dependency on the drug margin, and adjust your service lines and salaries accordingly. We issue the following warning: Drug dependencies may be hazardous to the financial health of your organization.

Corresponding author: Neil M. Barth, MD, Senior Physician Executive, Oncology Services Management, 20162 SW Birch St, Ste 300, Newport Beach, CA 92660; e-mail: neilbarthmd@yahoo.com.

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Wise Investment? Modeling Industry Profitability and Risk of Targeted Chemotherapy for Incurable Solid Cancers

By Henry J. Conter, MD, BSc, and Quincy S.C. Chu, MD

The University of Texas MD Anderson Cancer Center, Houston, TX; and University of Alberta, Edmonton, Alberta, Canada

Purpose: Pharmaceutical development involves substantial financial risk. This risk, rising development costs, and the promotion of continued research and development have been cited as major drivers in the progressive increase in drug prices. Currently, cost-effective analyses are being used to determine the value of treatment. However, cost-effective analyses practically function as a threshold for value and do not directly address the rationale for drug prices. We set out to create a functional model for industry price decisions and clarify the minimum acceptable profitability of new drugs.

Methods: Assuming that industry should only invest in profitable ventures, we employed a linear cost-volume-profit breakeven analysis to equate initial capital investment and risk and post-drug-approval profits, where drug development represents the bulk of investment. A Markov decision analysis model was also used to define the relationships between investment events risk. A systematic literature search was performed to determine event probabilities, clinical trial costs, and total expenses as inputs into the model. Disease-specific inputs, current market size across regions, and lengths of treatment for cancer types were also included.

Results: With development of single novel chemotherapies costing from \$802 to \$1,042 million (2002 US dollars), pharmaceutical profits should range from \$4.3 to \$5.2 billion, with an expected rate of return on investment of 11% annually. However, diversification across cancer types for chemotherapy can reduce the minimum required profit to less than \$3 billion. For optimal diversification, industry should study four tumor types per drug; however, nonprofit organizations could tolerate eight parallel development tracks to minimize the risk of development failure. Assuming that pharmaceutical companies hold exclusive rights for drug sales for only 5 years after market approval, the minimum required profit per drug per month per patient ranges from \$294 for end-stage lung cancer to \$3,231 for end-stage renal cell carcinoma.

Conclusion: Pharmaceutical development in oncology is costly, with substantial risk, but is also highly profitable. Minimum acceptable profits per drug per month of treatment per patient vary with prevalence of disease, but they should be less than \$5,000 per month of treatment in the developed world. Minimum acceptable profits may be lower for treatments with additional efficacy in the earlier stages of a tumor type. However, this type of event could not be statistically modeled.

Corresponding author: Henry J. Conter, MD, BSc, The University of Texas MD Anderson Cancer Center, Hematology/Oncology, 8380 El Mundo St, Ste 505, Houston, TX 77954; e-mail: hconter@gmail.com.

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