Appendix 5.6.2
Examples of Common Cost Models

Product value to payers is strictly defined by the costs and benefits associated with the technology. Some of the various economic models that can be used to construct compelling payer value propositions are described below.

Cost Analysis
Cost analysis can be the strongest and most persuasive type of modeling to payers and administrators. It compares the money spent on competing treatments over time. If a new treatment that is safe and effective (superior or at least non-inferior) to alternative treatments can be shown to produce overall costs savings, then this may be sufficient by itself to warrant positive reimbursement decisions without the need to perform more extensive modeling.

Example: Radical retropubic prostatectomy (RRP) is the most common therapy for patients with prostate cancer. Laparoscopic (LRP) and robot-assisted (RAP) prostatectomies have recently been introduced as minimally invasive alternatives to RRP. A study published in the *Journal of Urology* in 2004, attempted to quantify the cost and benefits of LRP and RAP compared to RRP.[1] The calculations involved both labor costs and supply costs for all three procedures, as well as the cost of purchasing and maintaining the *da Vinci*® robot from Intuitive Surgical Systems for RRP (see 5.1 IP Strategy for a description of Intuitive Surgical). Because the cost of the robot had to be spread over multiple procedures over multiple years, the analysis had to make assumptions on the number of procedures per year and the number of years. The results from the analysis are summarized in the table below. This information demonstrates that while RAP reduces total operating room costs and hospital room and board compared to both RRP and LRP, the added cost of equipment and the robot cost (which is in addition to the equipment) make it significantly more costly than RRP. The analysis assumed a purchase price for the robot of $1.2 million, annual maintenance cost of $100,000, 300 cases per year with a 7- year period of analysis. The following table presents costs per case.

Table 5.6.2-1 – A per case cost comparison.

Cost Component (per case in $)	**RRP ($)**	**LRP($)**	**RAP ($)**	
			With Robot Purchase Cost	**Without Robot Purchase Cost**
Total	5,554	6,041	7,280	6,709
Operating room	2,428	2,876	2,204	2,204
Standard equipment	75	533	1,705	1,705
Surgeon fees	1,594	1,688	1,688	1,688
Hospital room and board	988	514	474	474
Fluids and	150	78	72	72

medications				
Robot cost per case (purchase and maintenance)			857	286

Cost-Effectiveness Model

In a **cost effectiveness model**, cost is expressed per unit of meaningful efficacy, usually used comparatively across interventions.

Example: Initial hospital costs for DES are $2,881 higher than BMS. Over the first year, follow-up costs for DES are lower by $2,571 primarily because revascularization events drop from 28.4 percent in the BMS group to 13.3 percent in the DES group. Therefore, over the first year the incremental cost of DES is $309 per patient but the revascularization rate is 15.1 percent lower. The incremental cost per revascularization avoided is $309/0.151 = $2,046.[2]

Cost-Utility Analysis

In cost-utility models, a cost is assigned for quality of life and years lived, based on clinical outcomes measures related to quality of life and/or disability and mortality. Quality of life indexes and disability-adjusted life indexes are multiplied by the number of years gained. Costs are then expressed as a ratio. This model is often used by national health systems as the standard for evaluating reimbursement outside the U.S. The threshold for allowing certain treatments is a dollar value per quality adjusted life year (QALY) or disability adjusted life year (DALY).

Example: Eight randomized trials evaluated the value of using ICDs for primary prevention (see the InnerPulse story in chapter 2.3 Stakeholder Analysis of the *Biodesign* text). The studies showed that life expectancy increased by as much as 4.14 years (depending on the study) while costs increased by more than $100,000 in some instances (all these relative to an increase in life span by 10 years, but with a quality of life ratio of 0.4—a quality of life ratio equal to 1 is perfect health and 0 is death). In one specific study (SCD-HeFT), the cost increase related to ICD was $71,000 and the life expectancy increase was 1.40 years.[3] Assuming a quality of life of 0.75, this translates into a QALY increase of 0.75 x 1.40 = 1.05 and incremental cost per quality adjusted life year of $71,000 / 1.05 = $67,619.

Budget Impact Models

Budget impact models look at the cost and treatable population within the health plan, as well as the expected annual cost to the plan of covering the device. The results are normally evaluated in terms of per-member, per-month costs. Often, a cost-effectiveness model and a budget impact model will be combined.

Example: A health plan has 50,000 members. The annual incidence of patients who expect to be treated by a new device is 0.1 percent. The total reimbursement for the device is $500 per patient. Therefore, the total budget impact of the device on the health plan is $25,000 per year, which equates to approximately $0.04 per member per month.

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[1] Lotan et al., "The New Economics of Radical Prostatectomy," *Journal of Urology*, 2004, pp. 1431-1435.
[2] Cohen et al., "Cost Effectiveness of Sirolimus-Eluting Stents for the Treatment of Complex Coronary Stenosis," *Circulation*, 2004, pp. 508-514.
[3] Sanders et al., "Cost-Effectiveness of Implantable Cardioverter-Defibrillators, *New England Journal of Medicine*, 2004, pp. 1471-1480.

