

A Quality-Adjusted Price Index for Colorectal Cancer Drugs

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- Medical technology has been identified as the main driver of the increase in healthcare cost
- More effective, but more expensive treatments are introduced
- What is the value of innovation?
- Are prices rising or falling after accounting for quality?

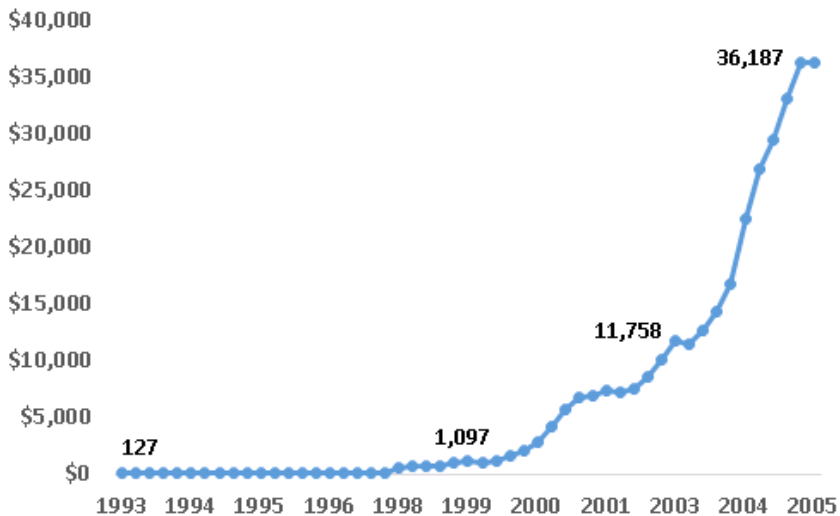


Figure 1: Price of Drug Regimens Weighted by Market Shares, 1993-2005

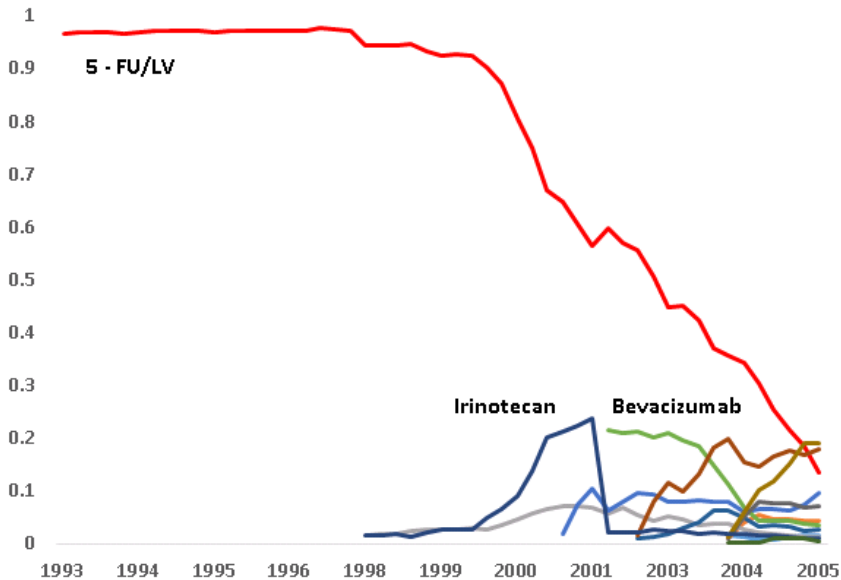


Figure 2: Market Shares of 12 Largest Regimens, 1993-2005

What we do

- Estimate price indices for colorectal cancer treatments, using several models from the discrete choice literature
 - Hedonic price regression
 - Logit model
 - Random coefficients
 - Pure characteristics
- Use data on market shares, attributes of regimens, and prices to physicians across the United States

Colorectal Cancer

- About 140,000 new cases diagnosed per year in the United States. About 50,000 deaths per year in the U.S.
- Chemotherapy represents a large percentage of the total treatment costs. Innovation has occurred mostly in chemotherapy.
- 5 new drugs launched in the U.S. between 1995 and 2004. Drug prices and spending increased substantially.
- Consistent information on efficacy and side effects of each drug based on phase 3 clinical trials.
- Most chemotherapy drugs are infused to the patient at the physician's office
- Physicians take ownership of oncology drugs

Prices

- IMS 1993-2005
- Transaction amount actually paid by provider types, and quantities purchased in each quarter
- Calculate average price per milligram of active ingredient of each drug

Regimen Market Shares

- SEER: claims-based market share by regimen by quarter for Medicare patients 1993-2002
- IntrisiQ: market share by regimen by quarter based on a dose administration system in oncologists' practices for 2002-2005
- Construct adjustment factor to link the two datasets

Regimen-Specific Dose Per Patient

- National Comprehensive Cancer Network: typical quantity of each drug used in each regimen for a representative patient

Drug Attributes

- Overall survival rates, time to progression of cancer, tumor response rates, and side effects experienced by Phase 3 trial patients, as reported in package inserts

Outside Option

- Off-label drugs or those with less than 1% market share

Attributes of Regimens in Sample

Regimen	Launch Year	Price (2005)	Survival Months	Efficacy Measures	
				Response Rate	Time to Progression
5-FU + Leucovorin	1991	75	12.5	20.8	4.7
Irinotecan (Second Line)	1996	23,478	9.5	15.0	4.2
Irinotecan + 5-FU/LV	1996	20,124	15.6	35.4	6.7
Capecitabine	2001	9,223	13.1	21.0	4.4
Ironetecan + capecitabine	2001	21,385	15.6	35.4	6.7
Oxaliplatin + 5-FU/LV	2002	25,426	19.4	46.1	9.1
Cetuximab (Second Line)	2004	53,859	N/A	10.8	1.5
Cetuximab + irinotecan (Second Line)	2004	73,519	6.1	22.9	4.1
Bevacizumab + oxaliplatin + 5-FU/LV	2004	76,636	23.2	41.0	9.9
Bevacizumab + oxaliplatin + capecitabine	2004	57,541	23.2	41.0	9.9
Bevacizumab + irinotecan + 5-FU/LV	2004	46,991	20.3	45.0	10.6

Notes: All attribute information is based on results of patients in Phase 3 Clinical Trials. Median survival is given in months. Time to progression is measured as the mean number of months for a tumor to advance to a more severe stage. Side Effects are measured as percentage of patients who experienced a grade 3 or 4 side effect of the given variety.

Attributes of Regimens in Sample

Regimen	Launch Year	Price (2005)	Abdominal Pain	Side Effects Measures			
				Diarrhea	Nausea	Vomiting	Neutropenia
5-FU + Leucovorin	1991	75	5.5	10.4	4.8	4.4	33.7
Irinotecan (Second Line)	1996	23,478	16.0	31.0	17.0	12.0	26.0
Irinotecan + 5-FU/LV	1996	20,124	5.3	24.0	11.9	8.0	39.5
Capecitabine	2001	9,223	9.5	15.0	4.0	4.5	3.0
Ironetecan + capecitabine	2001	21,385	5.3	24.0	11.9	8.0	39.5
Oxaliplatin + 5-FU/LV	2002	25,426	6.0	15.4	4.4	5.5	38.8
Cetuximab (Second Line)	2004	53,859	14.0	2.0	2.0	6.0	5.0
Cetuximab + irinotecan (Second Line)	2004	73,519	8.0	22.0	6.0	7.0	5.0
Bevacizumab + oxaliplatin + 5-FU/LV	2004	76,636	8.0	23.1	7.9	8.6	12.2
Bevacizumab + oxaliplatin + capecitabine	2004	57,541	8.0	23.1	7.9	19.0	12.0
Bevacizumab + irinotecan + 5-FU/LV	2004	46,991	8.0	34.0	1.0	1.0	21.0

Notes: All attribute information is based on results of patients in Phase 3 Clinical Trials. Median survival is given in months. Time to progression is measured as the mean number of months for a tumor to advance to a more severe stage. Side Effects are measured as percentage of patients who experienced a grade 3 or 4 side effect of the given variety.

- Hedonic price regression
 - Reduced form projection of prices on characteristics space
 - Price index obtained from differences in time dummies
- Discrete Choice Models
 - Estimate structure (preferences)
 - Instruments to control for endogeneity of prices
 - Logit: Simple, taste for products makes utility grow as number of products grow
 - BLP: Heterogeneity in preference parameters, taste for products
 - Pure Characteristics: Heterogeneity in preference parameters, no taste for products
 - Price index obtained from compensating variation

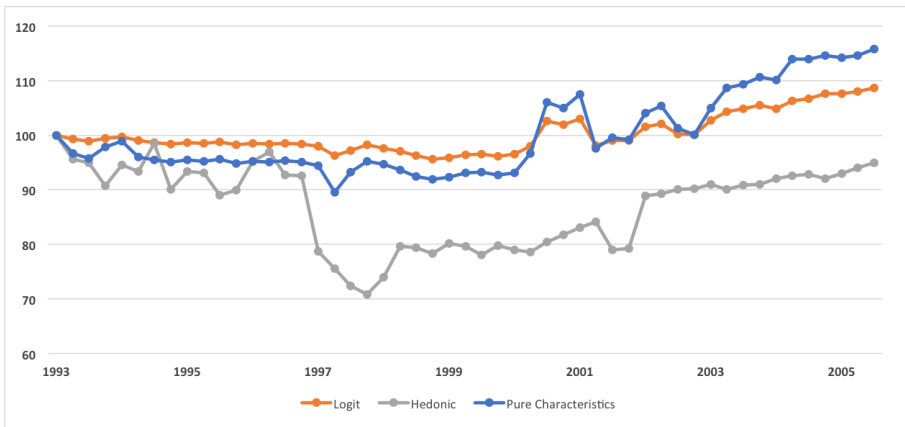


Figure 3: Quality Adjusted Price Indices, 1993-2005

- Naive price index greatly overstates the cost of colorectal cancer treatments.
- Adjusting for quality, prices have either declined or risen more modestly
 - Hedonic: prices decreased 5%
 - Logit model: prices increased 8%
 - Pure char model: prices increased 16%
- Important to take into account the value of innovation