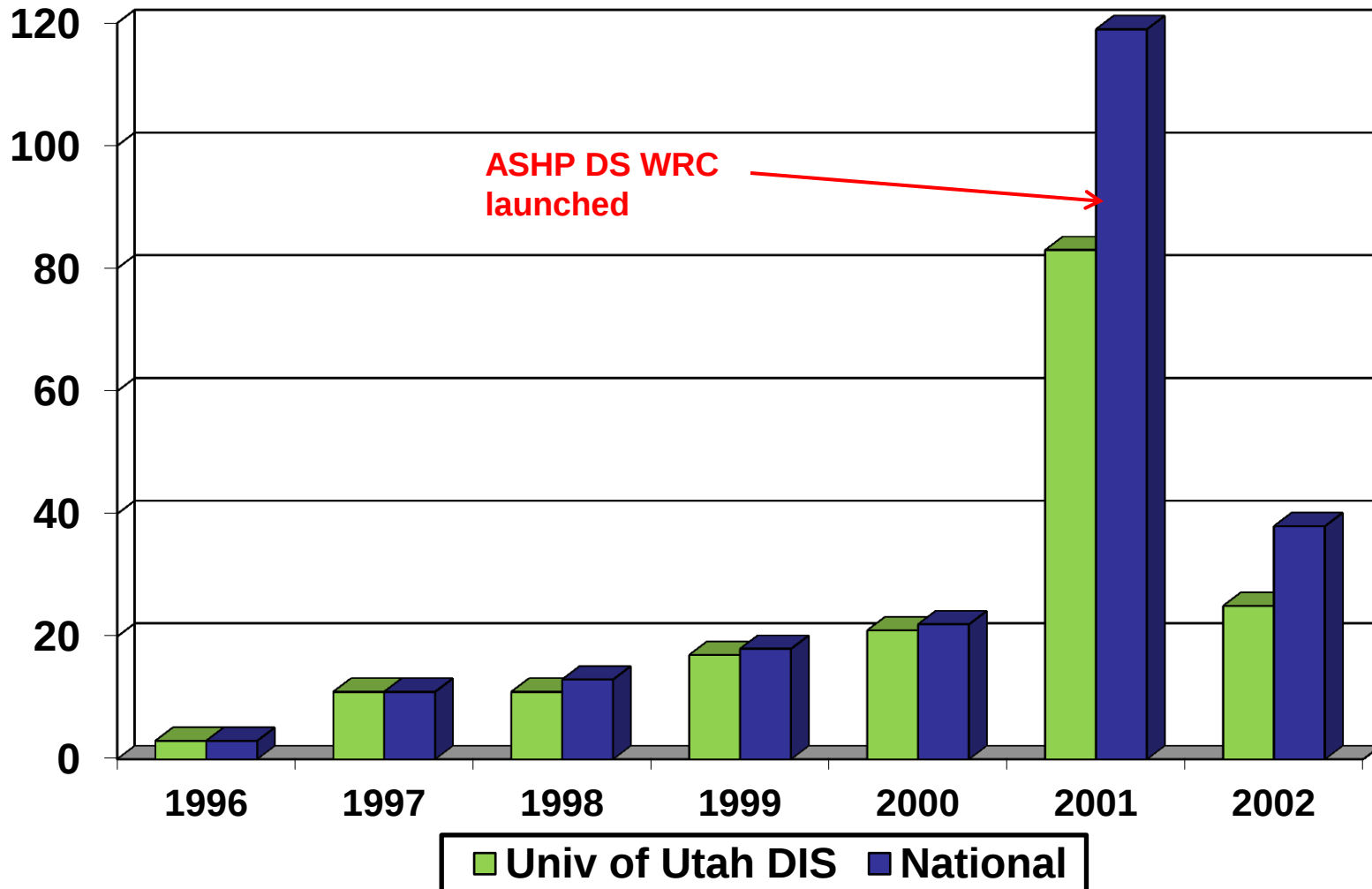


The Oncology Drug Shortage

A Crisis in Care

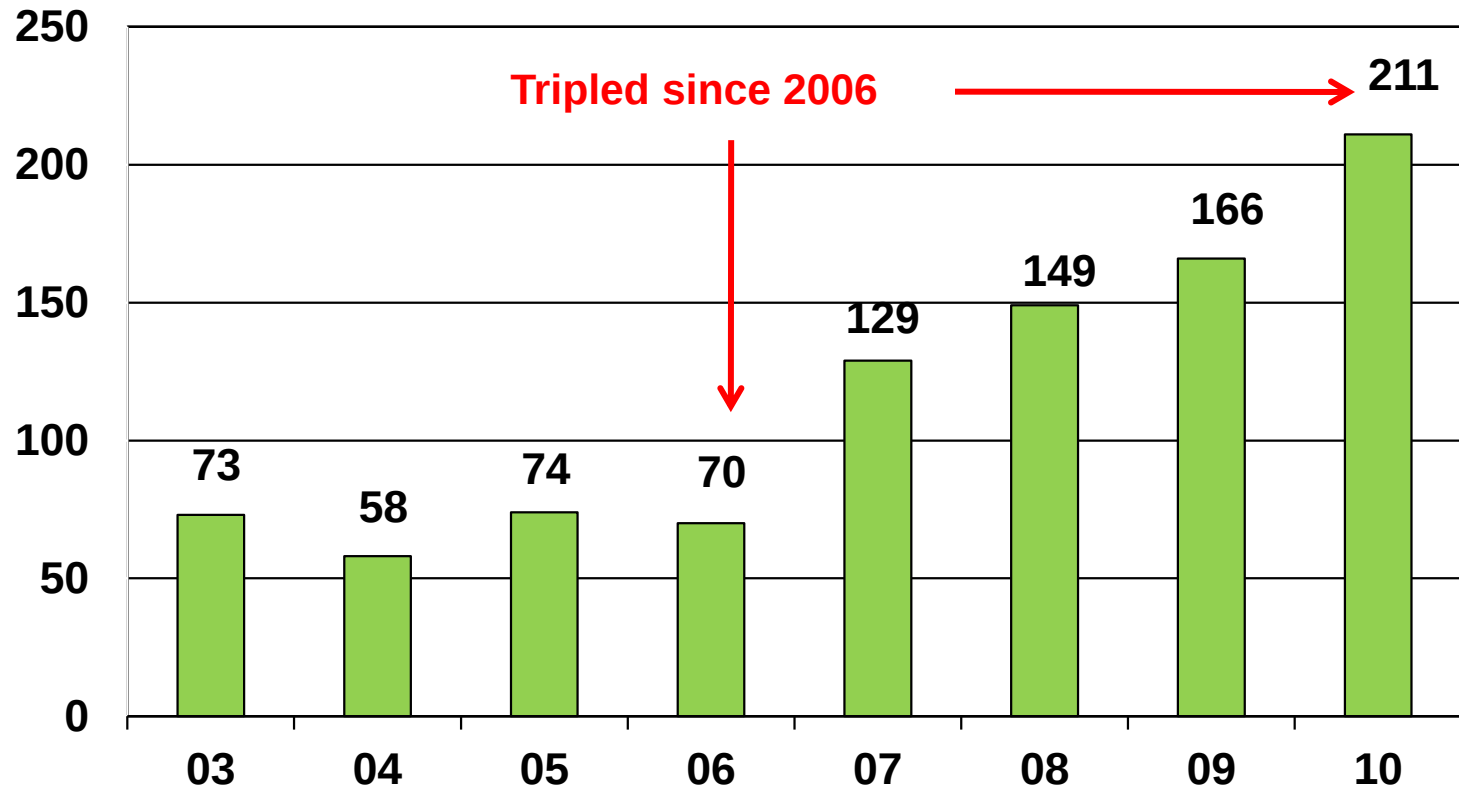
Michael Link, MD

Historical Drug Shortage Data



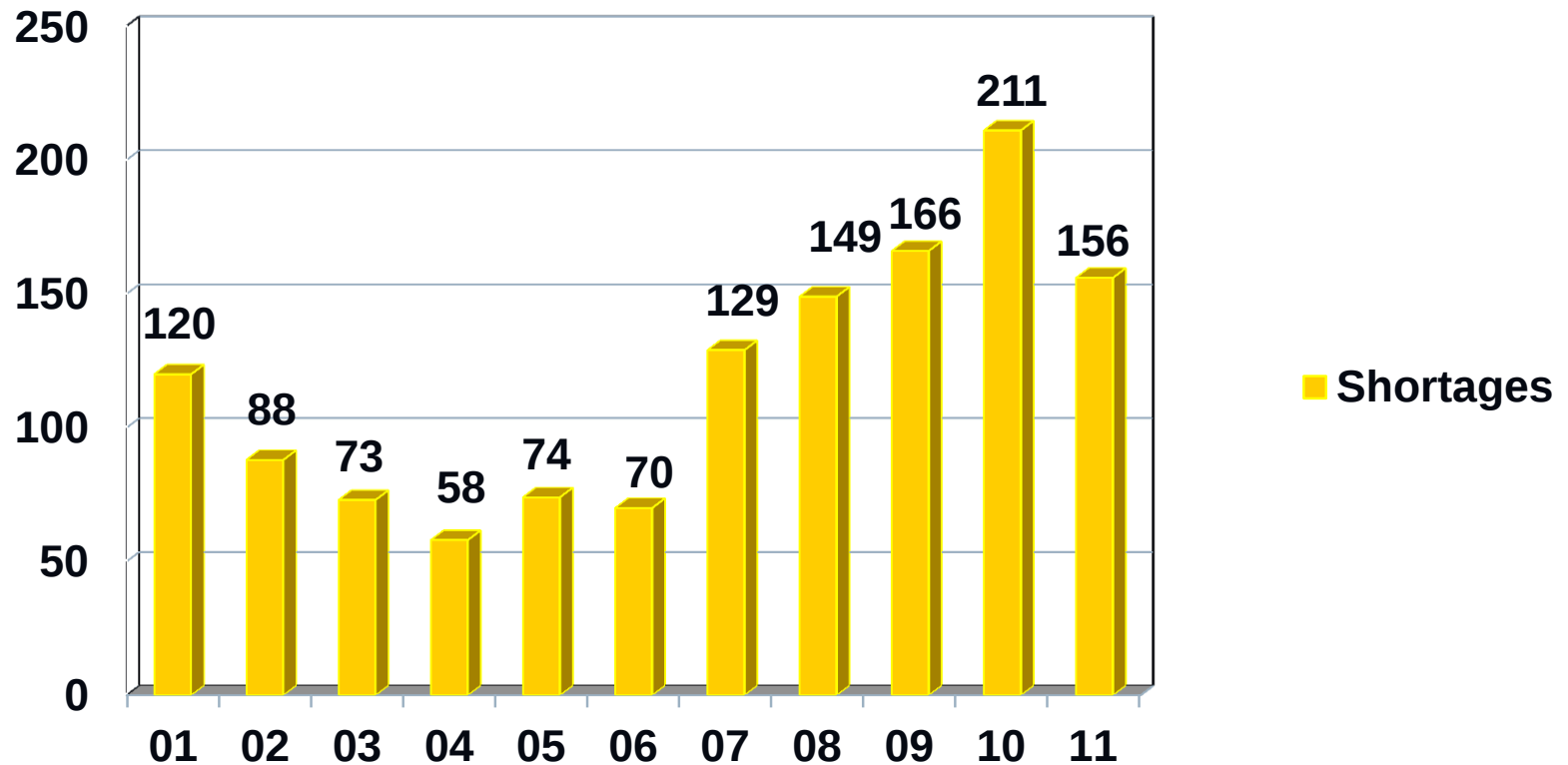
Annual New Drug Shortages

January 2001 to December 31, 2010



National Drug Shortages

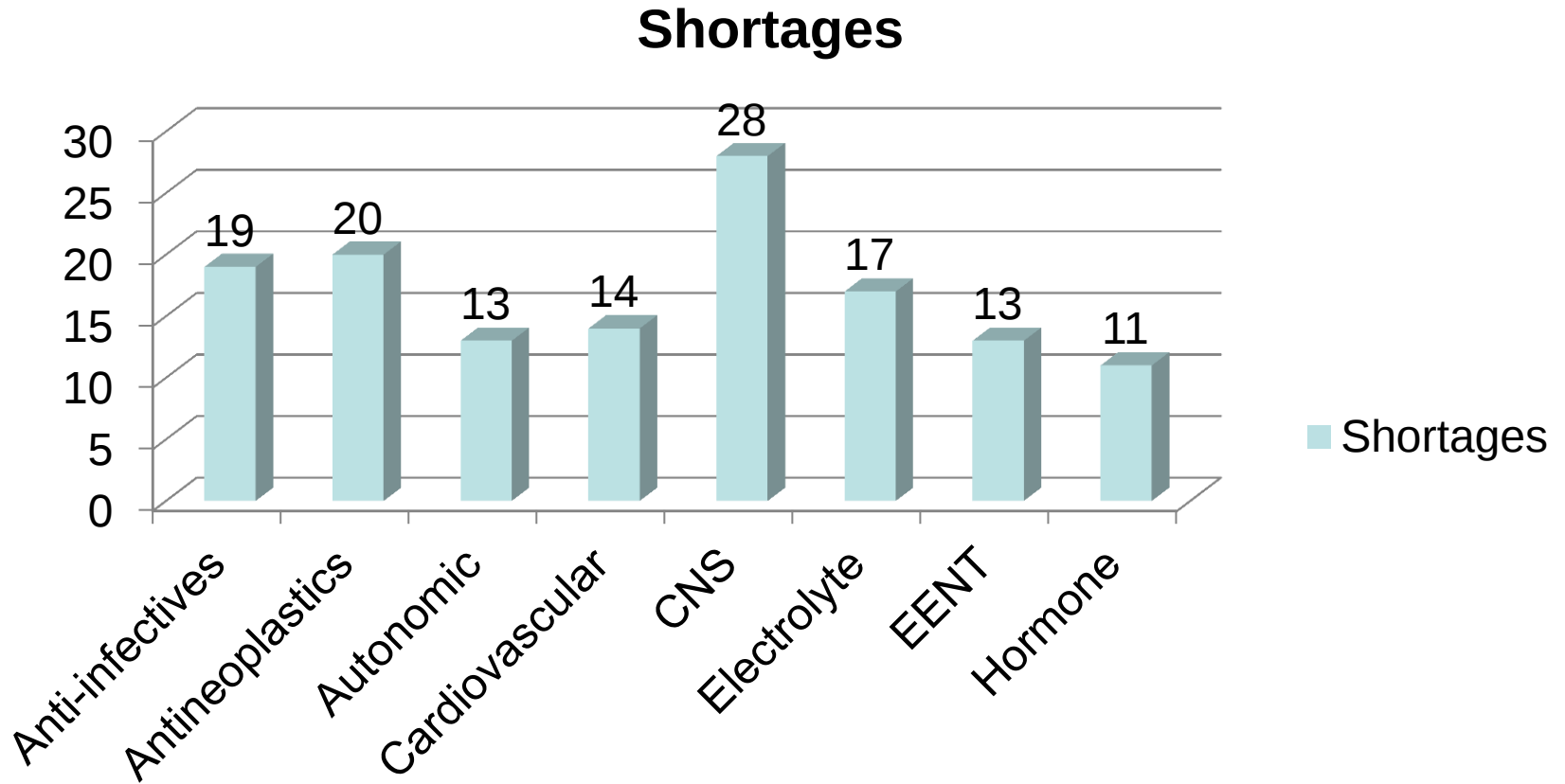
January 2001 to June 20, 2011



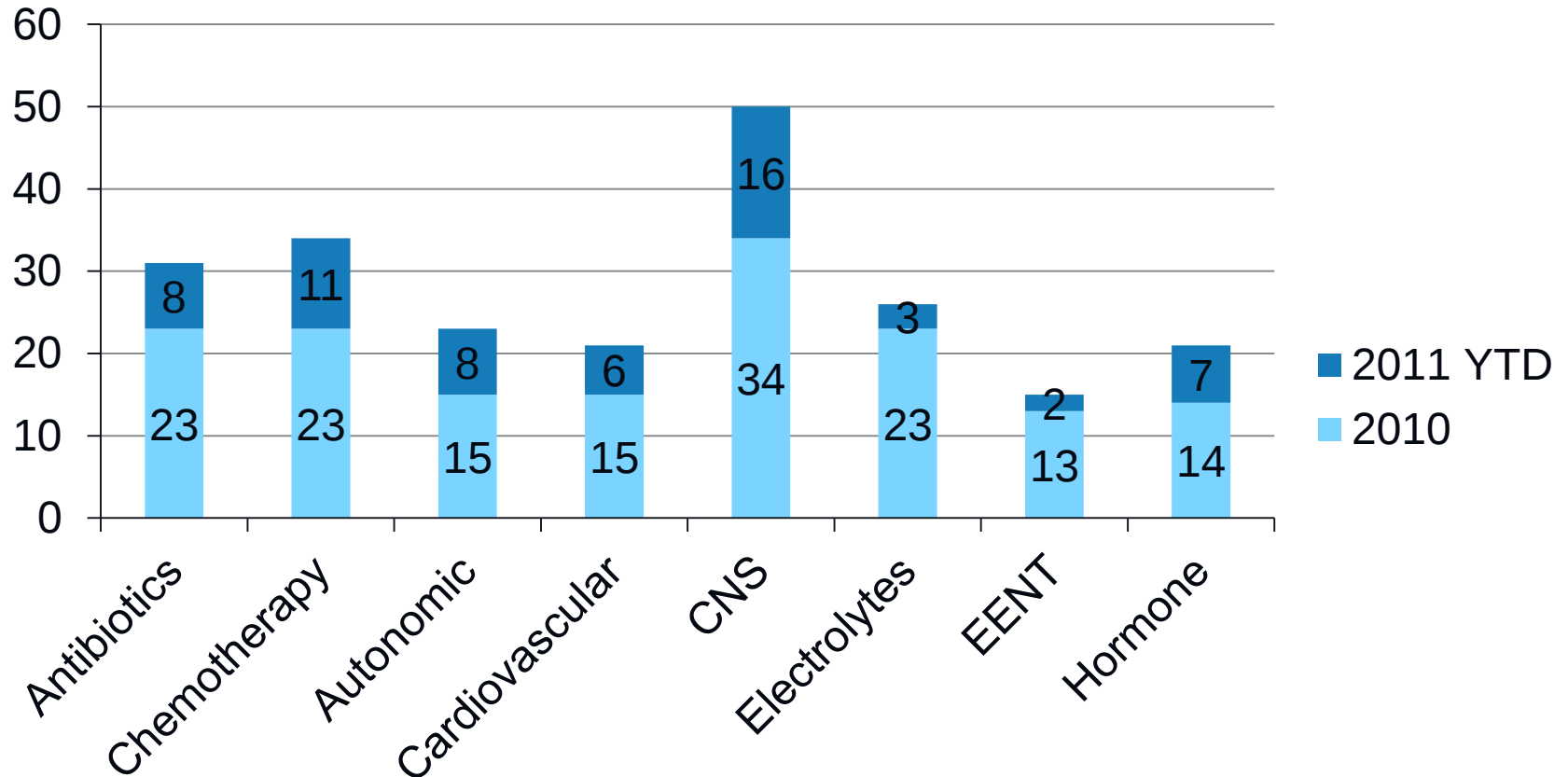
Note: Each column represents the # of new shortages identified during that year

Source: University of Utah Drug Information Service

Shortages by Drug Class > 10 Shortages in 2010



Shortages by Drug Class



Comparing drug shortage trends

Then and now...

- 1996 - 2003
 - Average # of drugs tracked: 60/year
- 2003 – 2011
 - Average # of drugs tracked: 150/year

Crisis

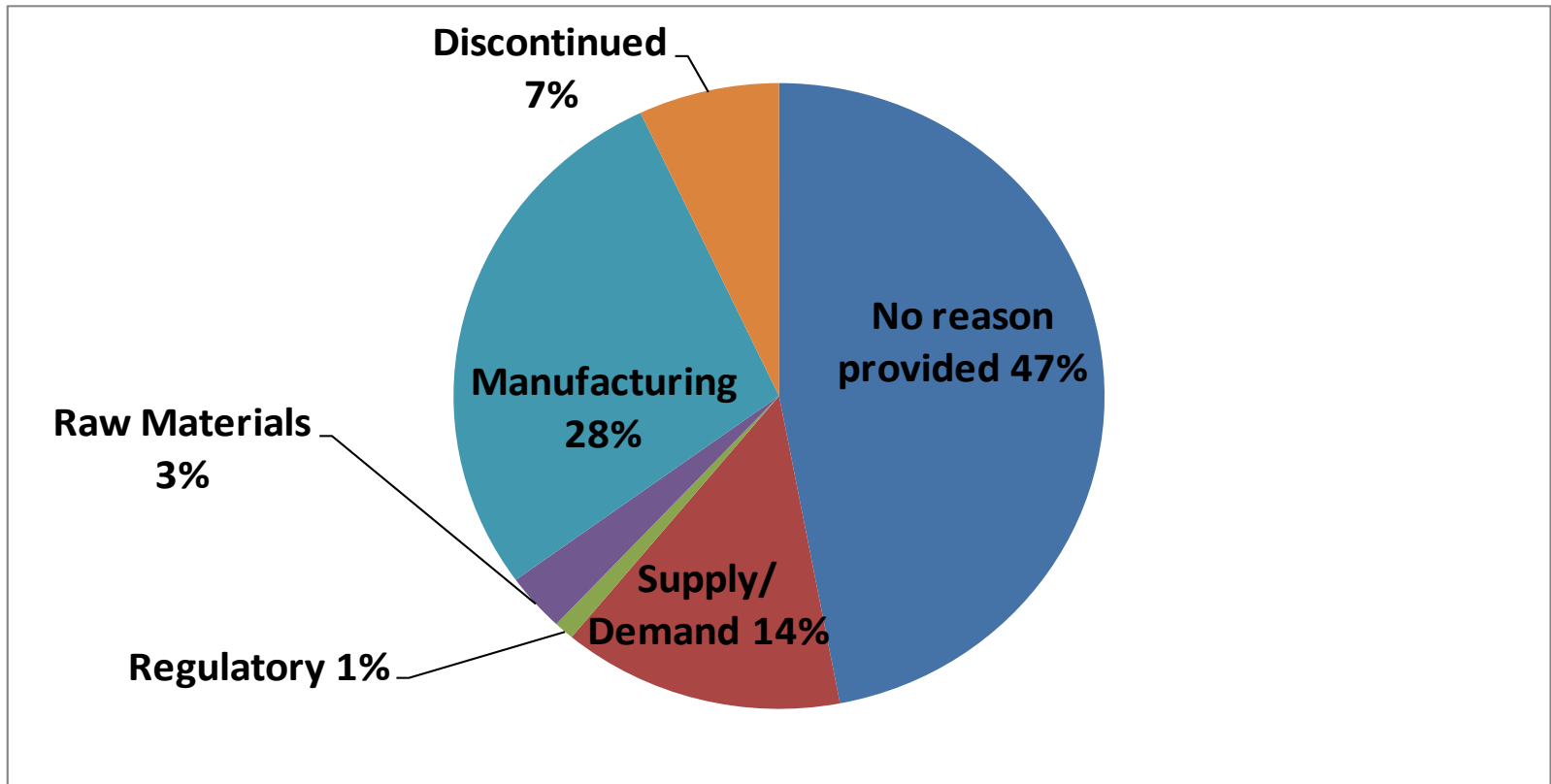
- Current pace is for >300 for 2011
 - Q1 2010 = 49 shortages vs. Q1 2011= 89
 - Jan 1, 2011 through June 20, 2011 = 156
- Particularly concerning for oncology: 77% of 2010 shortages were of sterile injectables
- Chemotherapy drug shortages
 - 23 in 2010 and 11 so far in 2011 (Q1)
 - No alternatives to these drugs for most indications
- Manufacturing issues are not resolving

Causes of the Drug Shortage

- Manufacturing difficulties/compliance issues
- Corporate decisions/discontinuations
- Market concentration/limited capacity
- Raw materials/API shortage
- Changes in clinical practice
- Emergency situations
- Hospital/pharmacy-based issues

*Source: FDA November 2010

Causes of Drug Shortages 2010



Source: University of Utah DIS

Shortages of Sterile Injectables: Marketing/Business Causes

For older sterile injectable products

- Fewer firms making these products
- Not enough capacity
- Complex manufacturing process
- Generally not economically attractive; not enough financial return to justify corrective action when problem occurs
- Resources directed to more profitable products

When one firm has problems or discontinues, a shortage almost always occurs.

Oncology Drugs in Short Supply

DRUG

APPLICATION

Bleomycin

Lymphoma, testis

Busulfan

Bone marrow transplantation

Cisplatin

Testis, ovary, lung, sarcoma

Cytarabine

Leukemia, lymphoma

Daunomycin

Leukemia, lymphoma

Doxorubicin

Leukemia, lymphoma, breast,
sarcoma

Etoposide

Leukemia, sarcoma, testis, lung

Leucovorin

Bowel, sarcoma. lymphoma

Mechlorethamine

Lymphoma

Methotrexate

Leukemia, lymphoma

Taxol

Breast, lung

Thiotepa

Bone marrow transplantation

Vincristine

Many cancers

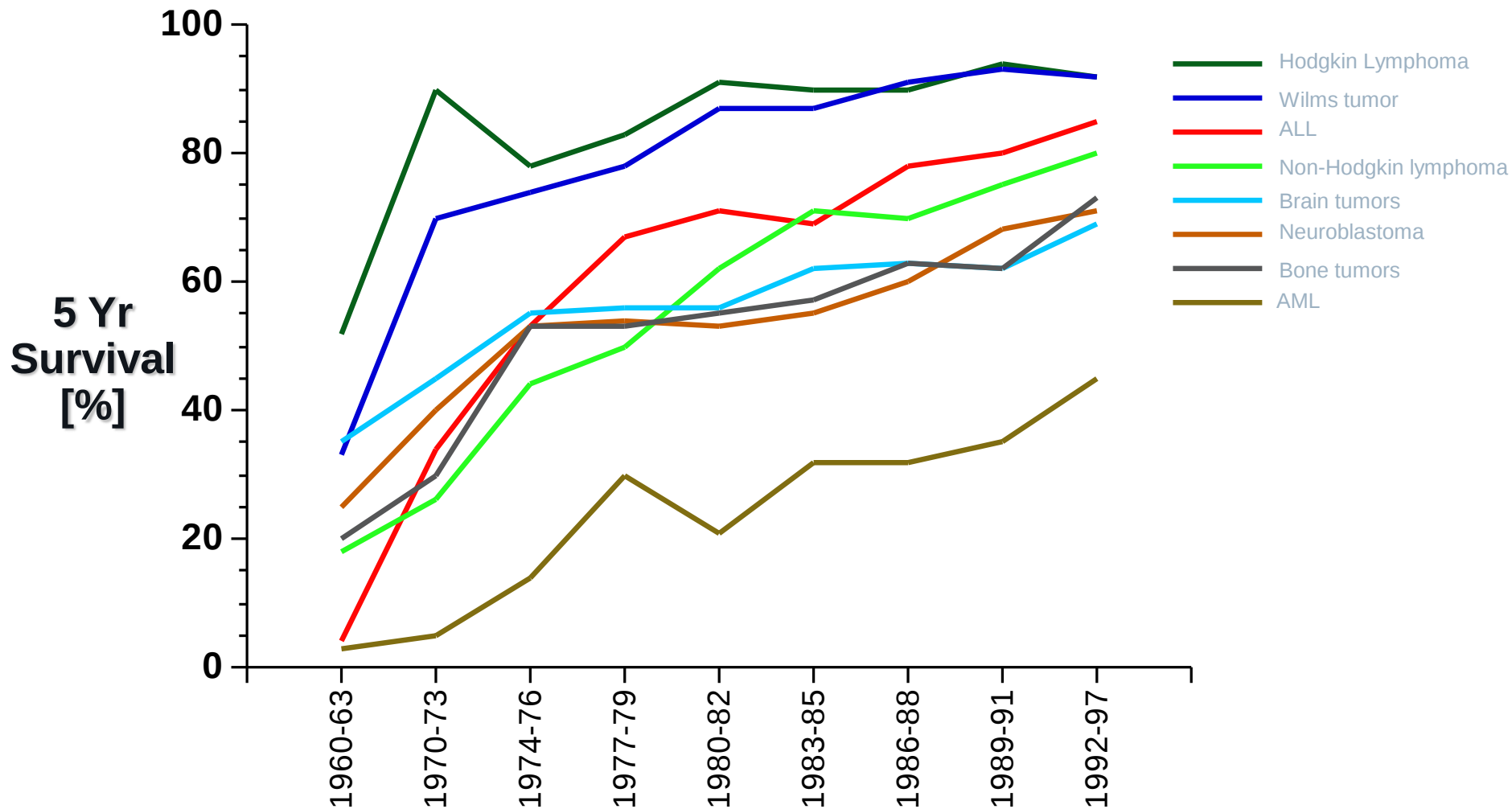
Consequences of Cancer Drug Shortage

- Treatment delays—never a good idea
- Substitution treatments
 - Less effective therapies
 - Sometimes no effective work-around available
- Increased patient anxiety
- Time and expense of finding drug supply
- Adverse effect on ongoing clinical trials
- Price markup and increase costs of care

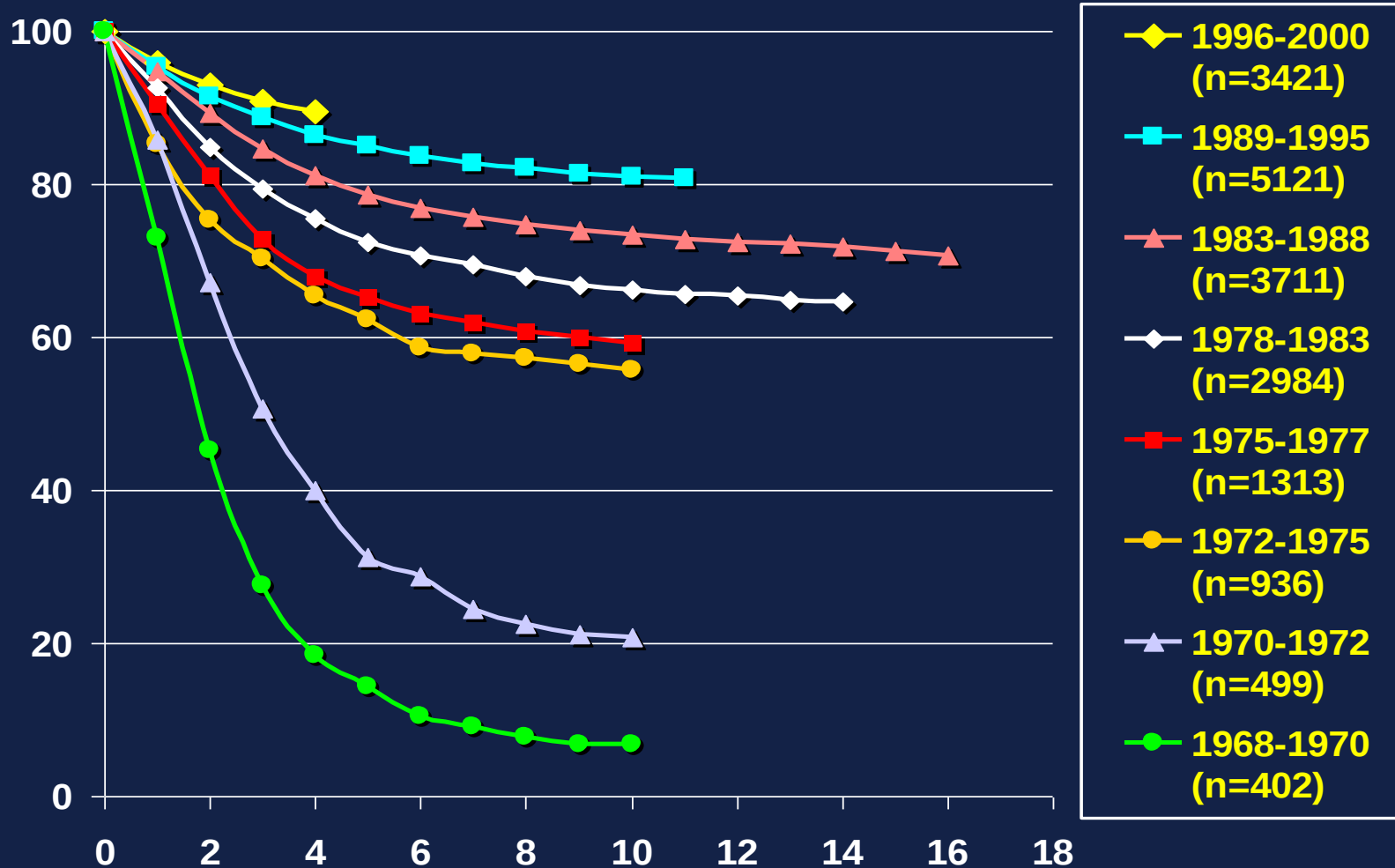
Consequences of Cancer Drug Shortage

- Unavailability of Potentially Curative Therapy
 - Leukemia
 - Hodgkin disease
 - Non-Hodgkin lymphoma
 - Testis cancer
 - Sarcomas of bone and soft tissue
 - Multiple childhood cancers

Survival Trends in Common Pediatric Cancers



Improvement in Outcome Over Time: Results of COG Studies of ALL



Consequences of Cancer Drug Shortage—Childhood Leukemia

- Acute Lymphoblastic Leukemia (ALL)
 - Most common childhood cancer
 - 5000 cases annually in the USA
 - Currently ~ 85-90% are cured
- Curative therapy for ALL

Vincristine*

Prednisone (pills)

Asparaginase

Daunomycin*

Mercaptopurine (pills)

Cyclophosphamide

Cytarabine*

Methotrexate* + leucovorin*

*In short supply

Consequences of Cancer Drug Shortage—Bone Tumors

- Osteosarcoma
 - Most common bone tumor in children and adolescents
 - Currently 65% can be cured with surgery + chemotherapy
 - <10% cured with surgery but without chemotherapy
- Curative therapy for osteosarcoma

Surgery

Doxorubicin*

Cisplatin*

High dose methotrexate* + leucovorin*

*In short supply