Cancer: Approval, ownership, market structure, and placement on WHO Model Essential Medicines List, for 100 new molecular entities (NMEs) on the NCI alpha list of cancer drugs and vaccines

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Table of Contents

Introduction and Summary

This research note presents data on the approval, ownership, market structure and placement on the WHO Model Lists of Essential Medicines new molecular entities (NMEs) approved by the U.S. Food and Drug Administration (FDA) for the treatment of cancer. The examined products, which include both drugs and vaccines, are those included in the U.S. National Cancer Institute (NCI) "alpha list" of cancer drugs.[1] The July 2011 version of the alpha list includes 100 unique molecular entities, as well as a number of new formulations or combinations and chemotherapeutic regimens. Our analysis focuses on the 100 unique molecular entities.

Each of the products was approved by the FDA through one of two mechanisms. For pharmaceutical drugs, products are registered under a New Drug Application (NDA). For biologic products, registration is through a Biologic License Application (BLA).

1 See: http://www.cancer.gov/cancertopics/druginfo/alphalist

Among our findings are the following:

1. The role of biologic products has increased

1.1 Of the 100 drugs and vaccines, 79 were registered under New Drug Applications (NDA) and 21 were registered under Biologic License Applications (BLA).

1.2 From January 1, 2000 to July 2011, 15 of 52 products were biologics, or 29 percent of the total.

1.3 For the 48 products registered before 2000, 6 of 48 were biologic, or 12.5 percent of the total.

2. Registrations have increased, and most cancer drugs are relatively new

2.1 Despite an overall decline in the registration of NME products in recent years, there has been a sharp rate of increase in the registration of NME products for the treatment of cancer.

2.2 In the 38 years from 1952 to 1989, there were only 21 NME on the NCI list, an average of . 55 per year.

2.3 In the ten year period of 1990 to 1999, the list contains 27 NME cancer products - an average of 2.7 per year.

2.4 In the ten year period of 2000 to 2009, 45 NME cancer products were registered - an average of 4.5 per year.

2.5 For 2010 through the July of 2011, 7 NME products were registered, an average of 4.4 per year.

2.6 More than half (52 of 100) of all cancer NME products were first registered after January 1, 2000.

3. Most drugs are only available from a single supplier

3.1 66 of the 100 products are only available to one FDA approved supplier or a joint venture managing the same brand name[2], suggesting strong barriers to entry due to intellectual property rights and other factors.

3.2 45 of 79 pharmaceutical drugs (57 percent) do not have competitive suppliers.

3.3 21 of 21 biologic products (100 percent) do not have competitive suppliers.

3.4 For products registered between January 1 2000, and July 2011, 51 of 52 products (98 percent) do not have competitive suppliers.

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2 Genentech, now owned by Roche (BLA 103705) and Idec, now owned by Biogen (BLA 103737), both have FDA approval to market rituximab, under the brand Rituxan,. Roche markets the drug, but shares profits with Biogen. Oct 21, 2010, Thomas Gryta, Biogen, Roche Alter Pact For Rituxan, Follow-Up Drugs, Dow Jones.

4. Ownership is concentrated in six countries, and among thirteen companies

4.1 28 companies own or control the sale of the 66 drugs that do not have competitive suppliers.

4.2 13 companies control more than one cancer monopoly, including:

- GlaxoSmithKline (9), Amgen (5), Novartis (5)
- 4 each for Sanofi, Bristol Myers Squibb, Celgene and Roche
- 3 each for Eisai, Merck, Astrazeneca and Eli Lilly, and
- 2 each for Pfizer and Cephalon

4.3 In terms of nationality, just six countries host the companies that own and control cancer products sold as a monopoly.

4.4 One half (33 of the 66) monopoly products are controlled by firms located in the United States.

4.5 Of the remaining 33 monopoly products 12 are controlled by UK firms, 11 by firms in Switzerland, 5 by firms in Japan, 4 by firms in France and 1 by a firm in Germany.

5. The WHO Model Essential Medicines List excludes all new cancer drugs

5.1 The March 2011, 17th Edition of the WHO Model Essential Medicines List[3] (EML) includes zero products from the NCI alpha list of cancer drugs on its "core" list of the minimum medicine needs for a basic health-care system.

5.2 The 17th Edition of the WHO Model EML includes 20 products from the NCI alpha list on its "complementary" list of "essential medicines for priority diseases."

5.3 For the 2011 WHO Model EML complementary list, the newest product that is also on the NCI alpha list was registered 15 years ago, in 1996.

5.4 The newest cancer product on the 2002 version of the complementary WHO Model EML was first registered 19 years earlier, in 1983.

Methodology

As noted in the introduction, this research note presents data on the approval, ownership and market structure of new molecular entities (NMEs) approved by the U.S. Food and Drug Administration (FDA) for the treatment of cancer.

There are many different products used to treat cancer, including chemotherapeutic drugs, such as alkylating agents, antimetabolites, anthracyclines, plant alkaloids, topoisomeraseinhibitors, monoclonal antibodies, tyrosine kinase inhibitors and other antitumour agents, as well as a variety of vaccines and products to facilitate cancer treatment and care, including those involving related illnesses or palliative care. The full range of products has been narrowed to those drugs and vaccines included in the U.S. National Cancer Institute (NCI) "alpha list" of cancer drugs. The NCI list is presented on a web page

3 See: http://www.who.int/medicines/publications/essentialmedicines/en/

to provide the public more information about cancer drugs.[4] The July 2011 version of the alpha list includes 100 unique molecular entities, as well as a number of new formulations or combinations and chemotherapeutic regimens. The NCI contains duplicate entries for both generic and name brand listings, and gives chemotherapeutic regimens. Our analysis focuses on the 100 unique molecular entities.

For the 100 products, we used the Drugs@FDA and the FDA Orange Book databases to identify whether the drug was a New Drug Application (NDA) or Biological License Application (BLA), the original FDA application number, approval date, brand name and applicant, the chemical type (all were New Molecular Entities), the review classification, and the number of competitors selling the product in July 2011. All drugs were traced to the first registration on the market, including those cases where the original applicant no longer sells the product.

For every product for which there is no competition among suppliers, we have identified the owner of the firm or joint venture that owns and controls the marketing of the product in the United States, and the host country for each firm.

We also compared the NCI Alpha list of cancer drugs to the WHO List of Essential Medicines[5] (17th ed, March 2011 and 12th ed, April 2002) to determine the amount of overlap between the WHO "core" and "complementary" lists (see the WHO definitions below).

The FDA Selected FDA definitions for NME, Biological Product and Drug are as follows:

New Molecular Entity (NME)

A New Molecular Entity is an active ingredient that has never before been marketed in the United States in any form.

Biological Product

Biological products include a wide range of products such as vaccines, blood and blood components, allergenics, somatic cells, gene therapy, tissues, and recombinant therapeutic proteins. Biologics can be composed of sugars, proteins, or nucleic acids or complex combinations of these substances, or may be living entities such as cells and tissues. Biologics are isolated from a variety of natural sources — human, animal, or microorganism — and may be produced by biotechnology methods and other cutting-edge technologies. Gene-based and cellular biologics, for example, often are at the forefront of biomedical research, and may be used to treat a variety of medical conditions for which no other treatments are available.

In general, the term "drugs" includes therapeutic biological products.

Drug

A drug is defined as:

4 See footnote 1.

5 http://www.who.int/medicines/publications/essentialmedicines/en/

- A substance recognized by an official pharmacopoeia or formulary.
- A substance intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease.
- A substance (other than food) intended to affect the structure or any function of the body.
- A substance intended for use as a component of of a medicine but not a device or a component, part or accessory of a device.

Biological products are included within this definition and are generally covered by the same laws and regulations, but differences exist regarding their manufacturing processes (chemical process versus biological process.)

Results

Registration

The drugs and vaccines on the NCI alpha list of cancer drugs entered the market between 1952 and July 2011. All were first registered for cancer as new molecular entity pharmaceutical or biologic products. New molecular entities (NME) are drugs that have no active form that has been previously approved by the FDA. Of these more than half (52 percent) have entered the market since 2000, and 79 percent have entered the market since 1990.

Between 1952 to 1989 only 21 new cancer drugs entered the market according to the NCI list. During this time about 5 new drugs were released each decade. The 1990s saw a dramatic increase in the approval of new drugs with the number of drugs approved in the previous four decades more than doubling (27 new drugs). In the decade of 2000 to 2009, 45 new cancer drugs were registered -- 45 percent of all the drugs on the NCI alpha list.

Of the 100 drugs, 79 are regulated under New Drug Applications (NDA) and 21 under Biologic License Applications BLA). Of the NDAs 62 had Priority Review status, and 15 had Standard Review status. Two NDAs (Pazopanib and Bleomycin) had no listing for review track status.

Competition and ownership

Of the 100 products, 66 were only available from a single firm or joint venture. Of the five products with the largest number of suppliers (irinitecan, anastrozole, letrozole, epirubicin and carboplatin, respectively), all were released between 1989 and 1999.

Among the older cancer drugs, chlorambucil, procarbazine and etoposide phosphate (1957, 1969 and 1983, respectively) were available from a single supplier.

Since 2000 only one of 52 products (oxaliplatin) is available from more than one competitor.

In total, 28 companies hold the 66 drugs with monopolies. Companies with the most monopolies are GlaxoSmithKline (9), Amgen (5) and Novartis (5). Sanofi, Bristol Myers Squibb, Celgene and Roche each hold 4. Eisai, Merck, Astrazeneca and Eli Lilly each hold 3. Pfizer and Cephalon each hold 2. Thus, 13 of the 28 companies hold monopolies on more than one drug, representing 51 of the 66 drugs.

In terms of corporate national headquarters 33 of the 66 drugs controlled by monopolies are located in the United States, 12 in the United Kingdom, 11 in Switzerland, 5 in Japan, 4 in France and 1 Germany. Of those companies with more than one monopoly on a cancer drugs 23 are controlled by US companies (Amgen, Bristol Myers Squibb, Celgene, Cephalon, Eli Lilly, Merck and Pfizer), 12 by UK companies (Glaxosmithkline and Astrazeneca), 9 by Swiss companies (Novartis and Roche), 4 by French companies (Sanofi) and 3 by Japanese companies (Eisai).

WHO List of Essential Medicines

Since 1977, the World Health Organization has published and periodically revised a Model List of Essential Medicines. The WHO model list is an effort to identify the "essential medicines . . . that satisfy the priority health care needs of the population."[6] The WHO says the medicines on the list "are selected with due regard to disease prevalence, evidence on efficacy and safety, and comparative cost-effectiveness." In a 2003 article in the *Lancet*, the development of the list was described as "a peaceful revolution in international public health that "helped to establish the principle that some medicines were more useful than others."[7] Over the years there have been significant controversies over the list, in part because of its influence in determining reimbursements and placement in procurement schedules in many developing countries. Among the controversies are those associated with higher priced drugs under patent. Laing, Waning, Gray, Ford and 't Hoen note that "differences exist between the WHO model EML and national EMLs since countries face varying challenges relating to costs, drug effectiveness, morbidity patterns, and rationality of prescribing," and that "ensuring equitable access" to such drugs requires dealing with intellectual property issues. At one point, life saving treatments for HIV drugs were left off the list, because they were not "cost effective."

The list is presented in two parts, a "core" and a "complementary list" which are defined as follows:

Core List

The list of minimum medicine needs for a basic health-care system, listing the most efficacious, safe and cost-effective medicines for priority conditions. Priority conditions are selected on the basis of current and estimated future public health relevance, and potential for safe and cost effective treatment.

Complementary List

Essential medicines for priority diseases, for which specialized diagnostic or monitoring facilities, and/or specialist medical care, and/or specialist training are needed. In case of doubt medicines may also be listed as complementary on the basis of consistent higher costs or less attractive cost effectiveness in a variety of settings.

6 http://www.who.int/medicines/services/essmedicines_def/en/index.html

7 Laing R, Waning B, Gray A, Ford N, 't Hoen E., 25 years of the WHO essential medicines lists: progress and challenges. *Lancet*. 2003 May 17;361(9370):1723-9.

In March 2011, the WHO published the 17th edition of the list. None of the products on the NCI alpha list of cancer drugs are on the "core" WHO Model Essential Medicines List.

Twenty of the 100 products are on the WHO Model Essential Medicines "complementary list." The products on the complementary list received FDA approval between 1953 to 1996. The newest registration is 15 years old.

The 2002 WHO Model EML was similarly restrictive as regards newer cancer products, in that the most recent drug was first registered 19 years earlier, in 1983.

Since 2006, KEI has twice asked the WHO to revise the model essential medicines list, to address the paucity of newer patented medicines, when it was possible to overcome patent barriers and obtain those medicines at generic prices.

On December 1, 2006, the Consumer Project on Technology wrote to Dr. Margaret Chan, then the Director General Elect of the WHO. The letter said:

> We recognize that the current WHO Essential Medicines List (EDL) is designed to avoid high priced (less cost effective) patented medicines, that some national laws that reference the EDL create obligations for public outlays, and that these outlays may not be justified at the higher prices for patented medicines. The WHO could easily address this problem by creating a category within the EDL for medicines that are essential "if available at generic prices," an option that is clearly relevant for many developing countries.
>
> We therefore propose a review of the policies and considerations that shape the WHO Essential Medicines List, to examine how the list should address medicines that are current under patent but could be manufactured or imported at generic prices.

On March 2, 2007, KEI sent a letter to the WHO Expert Committee on the Selection and Use of Essential Medicines, asking again that the list be modified to create a category of products that would be essential, "if available at generic prices." The suggestion was rejected, without comment by the committee.[8]

The continued absence of new cancer drugs on the WHO Model Essential Medicines List is evidence that the WHO needs to more explicitly deal with intellectual property issues, if the policy objective of access to medicine for all is to be pursued.

8 KEI March 2, 2007 letter to WHO on the Model Essential Medicines List. http://keionline.org/content/view/196/1

Appendix on Cancer

Cancer is the leading cause of death globally. In 2008, it was estimated that 13 percent of all deaths, or 7.6 million deaths, were caused by cancer.[9] In the United States 1 out of every 4 deaths is attributable to cancer.[10] Cancer affects developed and developing nations alike. At least 70 percent of cancer deaths occur in low- to middle-income countries.10 According to the WHO, deaths from cancer will increase to over 11 million by 2030.[11]

The most common forms of cancer are lung, breast, colorectal, stomach and prostate.12 For men the most frequent forms of cancer are lung, prostate, colorectal, stomach and liver. For women the most frequent forms of cancer are breast, colorectal, cervicouterine, lung and stomach.[12]

The costs of cancer treatment are staggering. In 2008, it was estimated that the overall annual costs of cancer in the United States was USD $228.1 billion. Broken down, this equates to $93.2 billion in direct medical costs (total of all health expenditures), $18.8 billion in costs of lost productivity due to illness, and $116.1 billion in costs of lost productivity due to premature death.[13] In 2010, the cost of treatment alone was estimated to be $124.57 billion. By 2020, the costs of treatment alone are projected to range between $158 billion and $207 billion. Globally, economic loss alone is estimated to cost $895 billion annually.[14]

KEI has a number of papers on innovation and access to cancer drugs at http://keionline.org/cancer. In writing about income related disparities in outcomes for cancer patients, KEI notes:[15]

> It is not surprising that incomes matter when it comes to outcomes for cancer patients, and some of the reasons for these disparities are well known, such as the unequal access to diagnostics, care and new drugs. The challenge for the public health community is to implement policy changes that will reduce these disparities, including not only strengthening of health systems in lower income countries, but also supporting access to newer patented inventions for diagnostics, treatment and care, and implementing new paradigms to finance and encourage research that focus on diagnostics, treatments and care that are useful in resource poor settings.

9 Globocan 2008, http://globocan.iarc.fr/factsheets/populations/factsheet.asp?uno=900
10 American Cancer Society 2009, http://www.cancer.org/cancer/cancerbasics/economic-impact-of-cancer
11 WHO, http://www.who.int/mediacentre/factsheets/fs297/en/
12 Globocan 2008
13 American Cancer Society 2009
14 American Cancer Society (2010), The Global Economic Impact of Cancer.
15 KEI Research Note 2010:5, Differences in ratio of deaths to new cases for 6 cancer types in 14 WHO regions, with reference to income of region, December 23, 2010, http://www.keionline.org/node/1044. See also: Cancer: Annual deaths compared to new cases in 2004, for 16 types of cancer and 4 World Bank income groups, December 21, 2010. http://www.keionline.org/node/1039.

Appendix: New Molecular Entity drugs and vaccines on the NCI Alpha List of cancer drugs

	International Nonproprietary Names of products on NCI's Alpha List of cancer drugs	Type	App No	Originator brand name	Originator company	Current Parent	CC	Year 1st approval	Sellers	17th WHO model essential medicines list, March 2011	12th WHO model essential medicines list, April 2002
1	Abiraterone Acetate	NDA	202379	Zytiga	Centocor Ortho	Johnson and Johnson	US	2011	1		
2	Vandetanib	NDA	22405	Vandetanib	IPR PHARMS INC	AstraZeneca	UK	2011	1		
3	Ipilimumab	BLA	125377	Yervoy	Bristol Myers Squibb	Bristol Myers Squibb	US	2011	1		
4	Eribulin Mesylate	NDA	201532	Halaven	Eisai	Eisai	JP	2010	1		
5	Cabazitaxel	NDA	201023	Jevtana Kit	Sanofi Aventis US	Sanofi	FR	2010	1		
6	Denosumab	BLA	125320	Prolia (Xgeva)	Amgen	Amgen	US	2010	1		
7	Sipuleucel-T	BLA	125197	Provenge	Dendreon Corporation	Dendreon	US	2010	1		
8	Romidepsin	NDA	22393	Istodax	Celgene	Celgene	US	2009	1		
9	Ofatumumab	BLA	125326	Arzerra	Glaxo Group	GlaxoSmithKline	UK	2009	1		
10	Pazopanib Hydrochloride	NDA	22465	Votrient	GlaxoSmithKline	GlaxoSmithKline	UK	2009	1		
11	Recombinant HPV Bivalent Vaccine	BLA	125259	Ceravix	GlaxoSmithKline Biologicals	GlaxoSmithKline	UK	2009	1		
12	Pralatrexate	NDA	22468	Folotyn	Allos	Allos (US)	US	2009	1		
13	Everolimus	NDA	22334	Afinitor	Novartis	Novartis	CH	2009	1		
14	Degarelix	NDA	22201	Firmagon	Ferring	Ferring	CH	2008	1		
15	Plerixafor	NDA	22311	Mozobil	Genzyme	Sanofi	FR	2008	1		
16	Eltrombopag Olamine	NDA	22291	Promacta	Glaxosmithkline	GlaxoSmithKline	UK	2008	1		
17	Romiplostim	BLA	125268	Nplate	Amgen	Amgen	US	2008	1		
18	Bendamustine Hydrochloride	NDA	22249	Treanda	Cephalon	Cephalon	US	2008	1		
19	Nilotinib	NDA	22068	Tasigna	Novartis	Novartis	CH	2007	1		
20	Ixabepilone	NDA	22065	Ixempra	Bristol Myers Squibb	Bristol Myers Squibb	US	2007	1		
21	Temsirolimus	NDA	22088	Torisel	Wyeth Pharms Inc	GlaxoSmithKline	UK	2007	1		
22	Lapatinib Ditosylate	NDA	22059	Tykerb	Smithkline Beecham	GlaxoSmithKline	UK	2007	1		
23	Vorinostat	NDA	21991	Zolinza	Merck	Merck	US	2006	1		
24	Panitumumab	BLA	125147	Vectibix	Amgen	Amgen	US	2006	1		
25	Dasatinib	NDA	21986	Sprycel	Bristol Myers Squibb	Bristol Myers Squibb	US	2006	1		

	International Nonproprietary Names of products on NCI's Alpha List of cancer drugs	Type	App No	Originator brand name	Originator company	Current Parent	CC	Year 1st approval	Sellers	17th WHO model essential medicines list, March 2011	12th WHO model essential medicines list, April 2002
26	Recombinant HPV Quadrivalent Vaccine	BLA	125126	Gardasil	Merck	Merck	US	2006	1		
27	Decitabine	NDA	21790	Dacogen	Eisai	Eisai	JP	2006	1		
28	Sunitinib Malate	NDA	21938	Sutent	CPPI CV	Pfizer	US	2006	1		
29	Lenalidomide	NDA	21880	Revlimid	Celgene	Celgene	US	2005	1		
30	Sorafenib Tosylate	NDA	21923	Nexavar	Bayer	Bayer	DE	2005	1		
31	Nelarabine	NDA	21877	Arranon	Smithkline Beecham	GlaxoSmithKline	UK	2005	1		
32	Clofarabine	NDA	21673	Clolar	Genzyme	Sanofi	FR	2004	1		
33	Palifermin	BLA	125103	Kepivance	Amgen	Amgen	US	2004	1		
34	Erlotinib Hydrochloride	NDA	21743	Tarceva	OSI Pharms	Astellas	JP	2004	1		
35	Azacitidine	NDA	50794	Vidaza	Celgene	Celgene	US	2004	1		
36	Bevacizumab	BLA	125085	Avastin	Genentech	Roche	CH	2004	1		
37	Cetuximab	BLA	125084	Erbitux	Imclone	Eli Lilly	US	2004	1		
38	Pemetrexed Disodium	NDA	21462	Alimta	Lilly	Eli Lilly	US	2004	1		
39	Palonosetron Hydrochloride	NDA	21372	Aloxi	Helsinn	Helsinn	CH	2003	1		
40	Tositumomab (I 131 Iodine Tositumomab)	BLA	125011	Bexxar	Smithkline	GlaxoSmithKline	UK	2003	1		
41	Bortezomib	NDA	21602	Velcade	Millennium	Takeda	JP	2003	1		
42	Gefitinib	NDA	21399	Iressa	Astrazeneca	AstraZeneca	UK	2003	1		
43	Aprepitant	NDA	21549	Emend	Merck	Merck	US	2003	1		
44	Oxaliplatin	NDA	21492	Eloxatin	Sanofi Aventis	Sanofi	FR	2002	8		
45	Rasburicase	BLA	103946	Elitek	Sanofi Synthelabo	Sanofi	FR	2002	1		
46	Fulvestrant	NDA	21344	Faslodex	Astrazeneca	AstraZeneca	UK	2002	1		
47	Ibritumomab Tiuxetan	BLA	125019	Zevalin	Spectrum	Spectrum	US	2002	1		
48	Zoledronic Acid (aka zoledronate)	NDA	21223	Zometa	Novartis	Novartis	CH	2001	1		
49	Imatinib Mesylate	NDA	21335	Gleevec	Novartis	Novartis	CH	2001	1		
50	Alemtuzumab	BLA	103948	Campth	Ilex	Ilex	US	2001	1		
51	Arsenic Trioxide	NDA	21248	Trisenox	Cephalon	Cephalon	US	2000	1		
52	Gemtuzumab Ozogamicin	NDA	21174	Mylotarg	Wyeth Pharms Inc	Pfizer	US	2000	1		
53	Bexarotene	NDA	21055	Taragretin	Eisai	Eisai	JP	1999	1		
54	Aminolevulinic Acid	NDA	20965	Levulan	DUSA	DUSA	US	1999	1		

	International Nonproprietary Names of products on NCI's Alpha List of cancer drugs	Type	App No	Originator brand name	Originator company	Current Parent	CC	Year 1st approval	Sellers	17th WHO model essential medicines list, March 2011	12th WHO model essential medicines list, April 2002
55	Exemestane	NDA	20753	Aromasin	Pharmacia and Upjohn	Pfizer	US	1999	2		
56	Epirubicin Hydrochloride	NDA	50778	Ellence	Pfizer	Pfizer	US	1999	14		
57	Temozolomide	NDA	21029	Temodar	Schering	Bayer	DE	1999	2		
58	Denileukin Diftitox	BLA	103767	Ontak	Seragen	Ligand	US	1999	1		
59	Trastuzumab	BLA	103792	Herceptin	Genetech	Roche	CH	1998	1		
60	Thalidomide	NDA	20785	Thalomid	Celgene	Celgene	US	1998	1		
61	Capecitabine	NDA	20896	Xeloda	Hoffmann La Roche	Roche	CH	1998	1		
62	Talc	NDA	20587	Sclerosol	Bryan	Bryan	US	1997	2		
63	Raloxifene Hydrochloride	NDA	20815	Evista	Lily	Eli Lilly	US	1997	1		
64	Rituximab	BLA	103705	Rituxan	Genetech	Roche	CH	1997	1		
65	Letrozole	NDA	20726	Femara	Novartis	Novartis	CH	1997	14		
66	Toremifene	NDA	20497	Fareston	GTX Inc	GTX	US	1997	1		
67	Imiquimod	NDA	20723	Aldara	Graceway	Graceway	US	1997	6		
68	Irinotecan Hydrochloride	NDA	20571	Camptosar	Pfizer	Pfizer	US	1996	17		
69	Topotecan Hydrochloride	NDA	20671	Hycamtin	GlaxoSmithKline	GlaxoSmithKline	UK	1996	10		
70	Gemcitabine Hydrochloride	NDA	20509	Gemzar	Lily	Eli Lilly	US	1996	11		
71	Docetaxel	NDA	20449	Taxotere	Sanofi Aventis	Sanofi	FR	1996	5	Comp	
72	Anastrozole	NDA	20541	Arimidex	Astrazenica	AstraZeneca	UK	1995	16		
73	Dexrazoxane Hydrochloride	NDA	20212	Zinecard	Pharmacia and Upjohn	Pfizer	US	1995	3		
74	Vinorelbine Tartrate	NDA	20388	Navelbine	Pierre Fabre	Pierre Fabre	FR	1994	8		
75	Pegaspargase	BLA	103411	Oncaspar	Enzon	Enzon	US	1994	1		
76	Paclitaxel	NDA	20262	Taxol	Bristol Myers Squibb	Bristol Myers Squibb	US	1992	9	Comp	
77	Aldesleukin	BLA	103293	Proleukin	Chiron	Novartis	CH	1992	1		
78	Fludarabine Phosphate	NDA	20038	Fludara	Genzyme	Sanofi	FR	1991	8		
79	Filgrastim	BLA	103353	Neupogen	Amgen	Amgen	US	1991	1		
80	Carboplatin	NDA	19880	Paraplatin	Bristol Myers Squibb	Bristol Myers Squibb	US	1989	13	Comp	
81	Ifosfamide	NDA	19763	Ifex	Baxter Healthcare	Baxter	US	1988	4	Comp	
82	Mesna	NDA	19884	Mesnex	Baxter Healthcare	Baxter	US	1988	5	Comp	
83	Leuprolide Acetate	NDA	19010	Lupron	Abbott Labs	Abbott	US	1985	5		

	International Nonproprietary Names of products on NCI's Alpha List of cancer drugs	Type	App No	Originator brand name	Originator company	Current Parent	CC	Year 1st approval	Sellers	17th WHO model essential medicines list, March 2011	12th WHO model essential medicines list, April 2002
84	Etoposide Phosphate	NDA	18768	VePesid	Bristol Myers Squibb	Bristol Myers Squibb	US	1983	1	Comp	Comp
85	Daunorubicin Hydrochloride	NDA	50484	Cerubidine	Wyeth Ayerst	Pfizer	US	1979	3	Comp	Comp
86	Cisplatin	NDA	18057	Platinol	Bristol Myers	Bristol Myers Squibb	US	1978	4		Comp
87	Tamoxifen Citrate	NDA	17970	Nolvadex	Astazeneca	AstraZeneca	UK	1977	4	Comp	Comp
88	Dacarbazine	NDA	17575	DTIC-DOME	Bayer Healthcare	Bayer	DE	1975	5	Comp	Comp
89	Doxorubicin Hydrochloride	NDA	50467	Adriamycin RDF	Pharmacia and Upjohn	Pfizer	US	1974	5	Comp	Comp
90	Bleomycin	NDA	50443	Bleomycin	Bristol Myers Squibb	Bristol Myers Squibb	US	1973	5	Comp	Comp
91	Procarbazine Hydrochloride	NDA	16785	Matulane	Sigma Tau	Sigma Tau	US	1969	1	Comp	Comp
92	Cytarabine	NDA	16793	Cytarabine	Teva Parenteral	Teva	IL	1969	5	Comp	Comp
93	Vinblastine Sulfate	NDA	12665	Velban	Lilly	Eli Lilly	US	1965	2	Comp	Comp
94	Vincristine Sulfate	NDA	14103	Oncovin	Lilly	Eli Lilly	US	1963	2	Comp	Comp
95	Fluorouracil	NDA	12209	Fluorouracil	Valeant	Valeant	CA	1962	10	Comp	Comp
96	Cyclophosphamide	NDA	12141	Cytoxan	Baxter Healthcare	Baxter	US	1959	2	Comp	Comp
97	Chlorambucil	NDA	10669	Leukeran	Smithkline	GlaxoSmithKline	UK	1957	1	Comp	Comp
98	Prednisone	NDA	9766	Meticorten	Schering	Bayer	DE	1955	7	Comp	Comp
99	Methotrexate	NDA	8085	Methotrexate sodium	DAVA	DAVA	US	1953	10	Comp	Comp
100	Leucovorin Calcium	NDA	8107	Leucovorin calcium	Hospira	Hospira	US	1952	7		