

June 2016

Global Oncology Trend Report

A Review of 2015 and Outlook to 2020



Introduction

The surge of innovation in cancer treatments is catching the attention of health system stakeholders and participants around the world. Providers and patients have more choices – and face more complexity - in treatment options, including the possibility of dramatic increases in progression free and overall survival. Payers are also noticing the impact on drug budgets of longer treatment duration and increased numbers of patients receiving treatment. The focus on oncology will continue over at least the next five years, driven by unmet needs that remain high, a bulging pipeline of oncology drugs in clinical development, and limited availability in most countries of drugs that are already approved and launched elsewhere.

In this report, we share our updated perspective on some of the trends we have observed in 2015, including new treatment options, availability of cancer treatments, costs of oncology therapeutics and supportive care drugs, distribution of cancer drugs, and some dynamics that are specific to the U.S.

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Contents

- 02 Executive summary
- 07 New treatment options
- 14 Availability of cancer treatments
- 20 Costs
- 28 Distribution of cancer drugs
- 31 U.S. oncology trends

- 38 Notes on Sources
- 39 Appendix
- 40 Authors
- 41 About the Institute

Executive summary

The oncology landscape is evolving rapidly, as scientific advances bring treatment options to an expanded number of patients and redefine cancer as a large number of narrowly defined diseases. Most health systems are struggling to adapt and embrace this evolution, in particular the regulatory systems, diagnostic and treatment infrastructure, and financing mechanisms that are required to meet the needs of populations. Over the past five years, 70 new oncology treatments have been launched and are being used to treat over 20 different tumor types. However, most of these drugs are not yet available in most countries, and even when they are registered, they may not be reimbursed. The total cost of cancer therapeutics and medicines used in supportive care – measured at the ex-manufacturer price level before the application of rebates or other price concessions – reached \$107 billion in 2015, representing an increase in constant dollars of 11.5% over the prior year. Not surprisingly, payers are seeking assurance of the value that results from their expenditure on these drugs and the associated services required for their appropriate use. This tension can be expected to intensify over the next five years as a strong pipeline of clinically distinctive therapies reaches a growing number of patients around the world.

New treatment options

New treatment options have become available in the past five years, and the surge of innovation is expected to continue due to a robust pipeline of drugs in clinical development by a large and diverse group of pharmaceutical companies.

- Over 20 tumor types are being treated with one or more of the 70 new cancer treatments that have been launched over the past five years (see Chart 1).
- The impact of these new medicines on patient care is exemplified by the case of the two PD-1 immuno-oncology drugs, whose rapid uptake reflect their remarkable clinical profile and successive expansion of indications (see Chart 2).
- The pipeline of oncology drugs in clinical development has expanded by more than 60% over the past decade, with almost 90% of the focus on targeted agents (see Chart 3).
- This high level of activity is illustrated in the case of non-small cell lung cancer and melanoma, where more than 120 clinical development projects are underway, with different mechanisms and combinations (see Charts 4 and 5).

- A large and diverse set of more than 500 companies are currently actively pursuing oncology drug development around the world. Collectively they are pursuing almost 600 indications, most commonly for non-small cell lung cancer, breast, prostate, ovarian and colorectal cancers (see Chart 6).
- Over 300 companies with cancer drugs in clinical development are entirely focused in oncology, and have between one and seven candidates in development. The ten largest oncology companies – measured by their current sales of existing cancer drugs – collectively have 130 molecules in their late stage pipelines, representing from 20% to 60% of their total research activity (see Chart 7).

Availability of cancer treatments

While the time taken for new cancer treatments to receive regulatory approval is shortening in the U.S., only six countries have more than half of the recently launched drugs available for patients and even less are reimbursed under public insurance programs.

- The median time from patent filing in the U.S. to approval for the oncology drugs approved in 2015 was 9.5 years, down from 10.25 years in 2013. A series of initiatives including the FDA Breakthrough Therapy designation introduced in 2012 may be contributing to this reduction. Over the past three years, three molecules were approved within four years of patent registration (see Chart 8).
- The availability of new cancer treatments varies widely around the world, and is dependent on manufacturers filing for registration in each country as well as the complexity and duration of each regulatory process. Of the 49 oncology New Active Substances analyzed that were initially launched during the 2010-2014 period, fewer than half were available by the end of 2015 to patients in all but 6 countries – the U.S., Germany, the U.K., Italy, France and Canada (see Chart 9).
- Individual countries vary in the availability of each of the six categories of new cancer treatments. The targeted immunotherapies are available in most developed countries, but none of the emerging markets outside of the European Union have yet registered these treatments (see Chart 10a and 10b).
- Even when available through the regulatory review process, not all cancer drugs are accessible to patients due to lack of reimbursement under public insurance programs. Of the drugs approved in 2014 and 2015 by a selection of developed countries, only the U.S., France and Scotland have more than half included on reimbursement lists at the end of 2015. In some cases, reimbursement may be forthcoming for specific indications, depending on health technology assessments or other processes used by the country (see Chart 11).

- The U.S. leads developed countries in the volume use of newer targeted treatments, with about one-third of the volume of targeted oral or injectable/infusion therapies coming from drugs launched in the past five years. In the EU5 and Japan, this share fell below 25% (see Chart 12).

Costs of oncology therapeutics and supportive care drugs

Costs of oncology therapeutics and supportive care drugs grew to reach \$107 billion globally in 2015, an increase of 11.5% over 2014 (on a constant dollar basis) and up from \$84 billion in 2010, as measured at invoice price levels. These costs are expected to reach \$150 billion globally by 2020.

- The total cost of oncology therapeutics and supportive care drugs rose from \$90 billion in 2011 to \$107 billion in 2015, measured at invoice price levels. Annual growth rates – at constant exchange rates – accelerated during this period. Of this total, \$84 billion of the total cost is for therapeutic oncologics, which increased 14.2% over 2014 (see Chart 13).
- The U.S. accounts for 46% of the global total market for therapeutics, up from 39% in 2011, due in part to a strengthening U.S. Dollar over this time period and more rapid adoption of newer therapies. The EU5 and Japan registered constant dollar compound annual growth rates of 5.3% and 5.4% respectively over the past five years, compared to 7.4% for the U.S. The pharmerging markets, comprising 13% of the global total in 2015, increased their medicine costs annually by 15% on average over the past five years (see Chart 14).
- Oncology drug costs relative to total drug costs range from 2.5% in the case of India to almost 16% in the case of Germany and France. In the U.S., cancer drugs account for 11.5% of total drug costs in 2015, up from 10.5% in 2011 (see Chart 15).
- Treatment costs for new therapies remain high, ranging from \$6,000 - \$13,000 per treatment month in the U.S. Clinical benefits – measured in incremental progression-free or overall survival – are significant for many of the most recent launches, although real world evidence of patient benefits – including quality of life and side effects – is not systematically gathered and reported, leaving cost and value assessments complex and inconsistently analyzed (see Chart 16).
- Over the past five years, the cost of oncology medicines in the U.S. increased by \$15.9 billion, or 72% over the 2010 level. Over \$9 billion of total growth came from the adoption of new therapies introduced since 2010 and a similar amount is due to increased volume and price of existing branded drugs. Almost \$5 billion was saved during the past five years when the loss of patent exclusivity for some older brands resulted in lower use of the brand and switching to generics (see Chart 17).

- In countries other than the U.S., the increase in costs over the five year period was \$13.8 billion at constant exchange rates, or almost 50% over 2010. The uptake of new therapies contributed \$8.4 to the total increase. Greater use of existing brands, offset by a small reduction in their prices, contributed a similar amount to the growth (see Chart 18).
- Pricing concessions by manufacturers – including mandatory and negotiated rebates, discounts, patient cost offsets – are reducing manufacturer-realized net sales. In the U.S., net price growth on existing branded oncology drugs is estimated to have averaged 4.8% in 2015, versus 6.4% invoice price growth. In Europe, a range of discounts and other mechanisms also exist, resulting in lower realized prices by manufacturers (see Chart 19).
- Annual growth globally in the cost of oncology drugs is expected in the 7.5 – 10.5% range through 2020, and will exceed \$150 billion. Wider usage of new products – especially immunotherapies – will drive much of this growth, and will be partially offset by reduced use of some existing treatments with inferior clinical outcomes. Payers are also expected to tighten their negotiation stance with manufacturers in an effort to limit growth in this part of their healthcare budgets (see Chart 20).

Distribution of cancer drugs

The distribution of cancer drugs through hospitals or retail and specialty pharmacies varies widely across health systems, and is shifting due to reimbursement changes and expanded use of oral formulations, especially for targeted therapies.

- The mix of spending on oncology drugs between hospitals and retail channels varies widely across countries reflecting differences in healthcare practice, reimbursement and mix of formulations. In some European markets including Italy, Spain and the UK, costs have shifted to hospital channels over the past five years while in Canada, France and the U.S., costs have increased more rapidly in retail channels (see Chart 21).
- Almost 40% of the total cost of targeted therapies in the U.S. are now for oral formulations, up from 26% in 2010. This reflects a shift in the mix of new therapies towards those that can be taken by patients orally and remove the need for injection or infusion in a physician's office or hospital outpatient facility (see Chart 22).
- In the U.S., over one-third of cancer drug costs is for medicines dispensed by retail pharmacies, up from 25% ten years ago, which means a growing share of the costs are covered by pharmacy benefits under insurance plans, including Medicare Part D (see Chart 23).

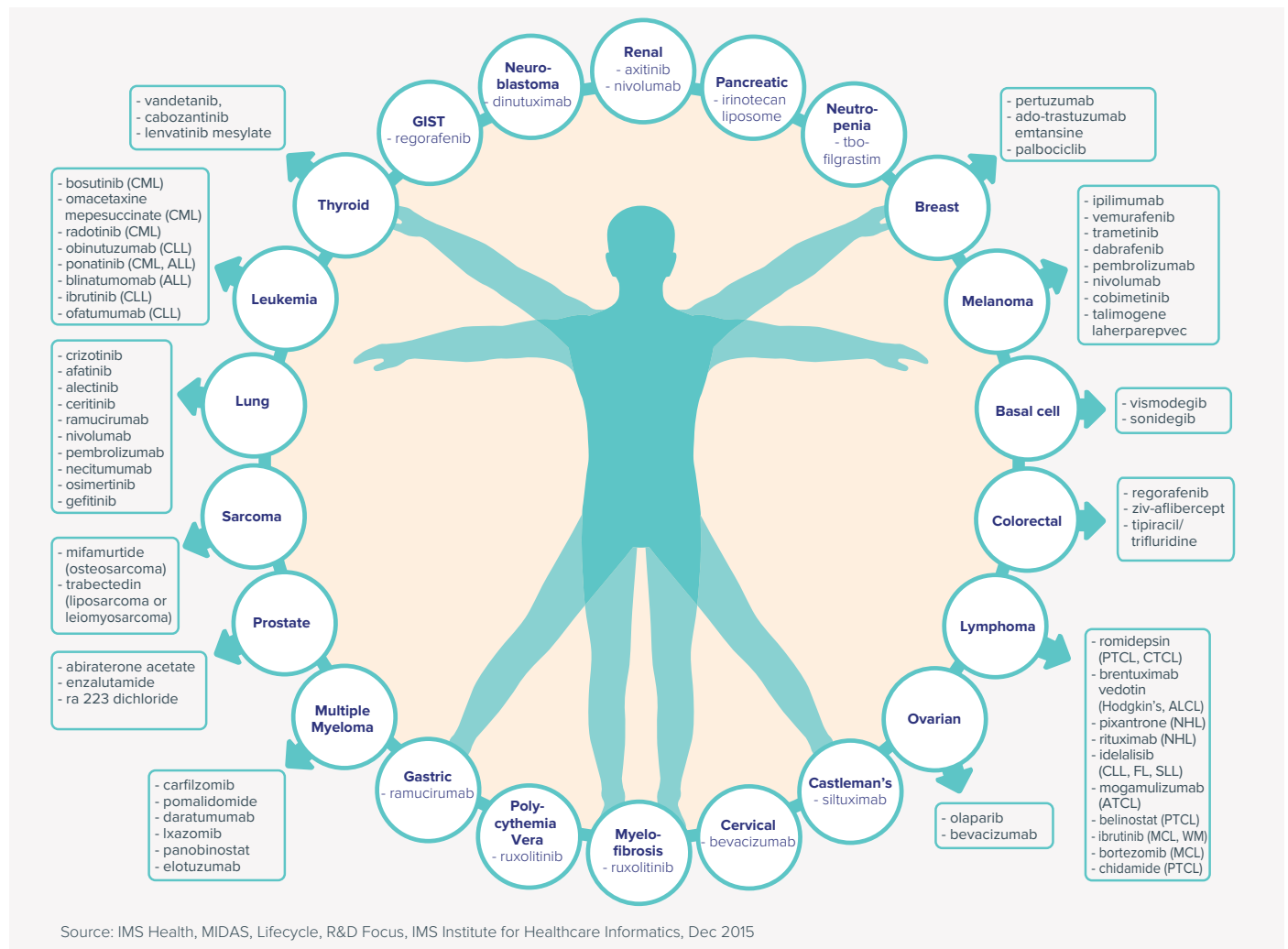
U.S. oncology trends

In the U.S., key trends in oncology include the shift toward integrated delivery systems, rising average total treatment costs, and higher patient cost responsibility.

- Delivery of cancer treatment is shifting toward integrated delivery systems. Only 17% of oncologists are in independent practices, unaffiliated with some type of integrated delivery network or corporate parent, down from 28% in 2010 (see Chart 24).
- State-level variation is wide, with 14 states having fewer than 10% of their oncologists in independent practices, and 6 states having more than 30%. This reflects variation in the role and presence of integrated systems across the country (see Chart 25).
- Ownership of medical groups is shifting with many being acquired and integrated into larger hospital systems. The percentage of all medical groups that are independent has fallen from 56% to 43% over the past five years (see Chart 26).
- Average total treatment costs for patients in commercial insurance plans that were in active treatment for cancer reached \$58,097 in 2014, an increase of 19% over 2013. Over half of total costs are for outpatient services and the average combined cost of all drugs used by each patient represents 28% of the total cost of care (see Chart 27).
- Average costs for administering cancer drugs are typically at least twice as much when treatment is received in hospital outpatient settings rather than in physician offices. This also results in higher patient cost responsibility (see Chart 28).
- Patient responsibility for total treatment costs are rising, though partially offset by coupons and other forms of assistance. Patients with commercial insurance who were treated in 2014 with cancer drugs received by injection or infusion were responsible for over \$7,000 of costs on average for the year. This compares to about \$3,000 for patients receiving only oral medicines (see Chart 29).
- Some type of coupon or patient cost offset was used for over 25% of retail prescriptions for cancer drugs filled by patients with commercial insurance, up from 5% in 2011 and reflecting efforts by manufacturers to reduce patient out-of-pocket costs. The average cost offset has averaged about \$750 per prescription over the past five years (see Chart 30).

Over twenty tumor types are being treated with new medicines that have been launched in the past five years

Chart 1: New Active Substance Launches 2011–2015 by Indication



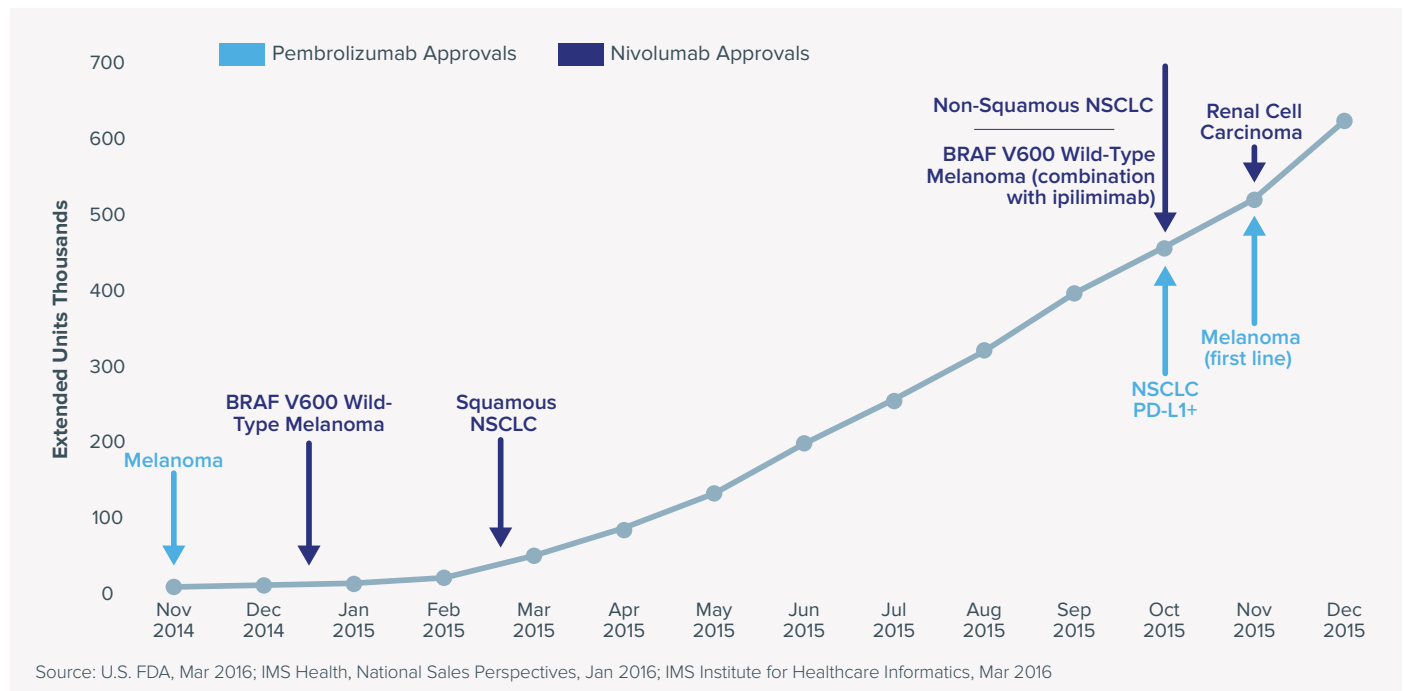
- From 2011 to 2015, 70 new oncology treatments have been launched for over 20 uses.
- As of 2015, half of the New Active Substances (NAS) are available in 20 or more countries and 12 NAS are available in only a single country with 9 of them in the U.S.
- Many of these new agents are being researched further and will likely be approved for subsequent indications, providing therapeutic options to additional patients.

Chart notes:

Includes initial and subsequent indications. Excludes supportive care.

Rapid uptake of new immuno-oncology drugs reflects their remarkable clinical profile and expansion of indications

Chart 2: Immuno-Oncology PD-1 Inhibitor Uptake in the U.S.



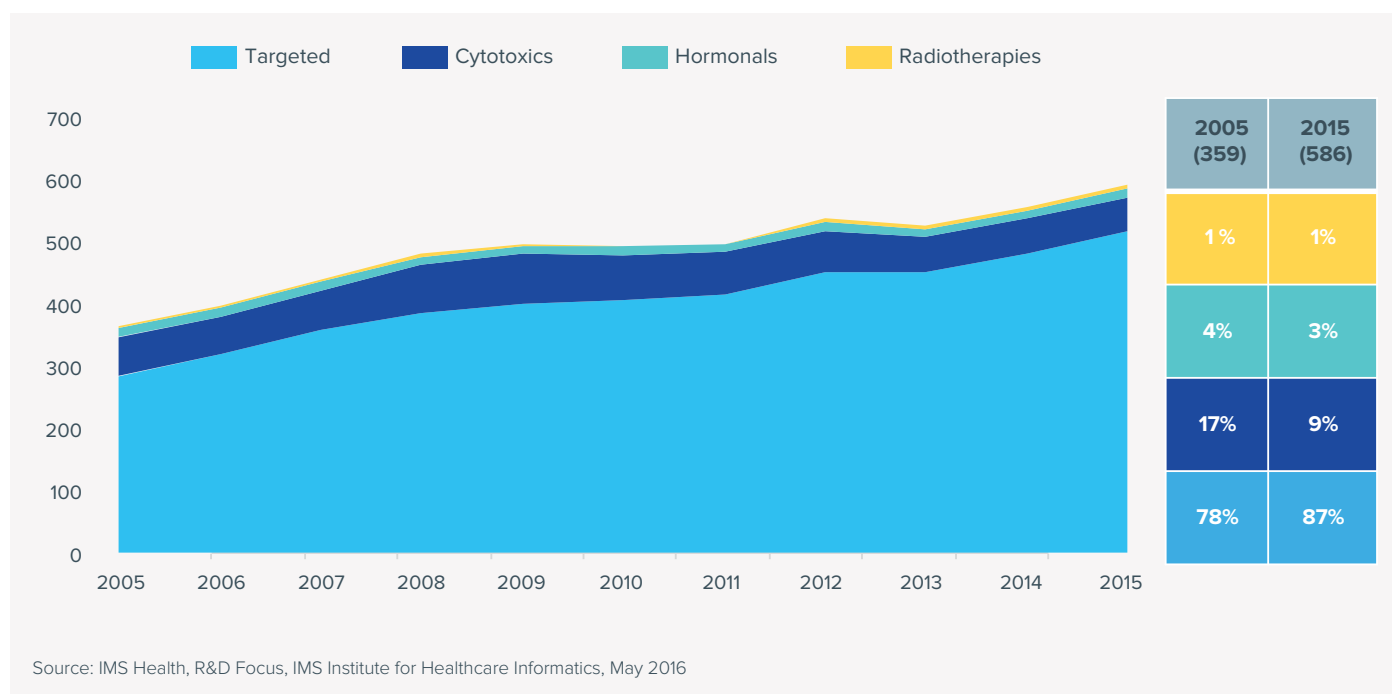
- The first of many highly anticipated immuno-oncology market was launched at the end of 2014 with two treatments for melanoma entering the oncology market (pembrolizumab in September, and nivolumab in December).
- Over 135 clinical trials for additional indications across 30 tumor types exist between the two currently approved PD-1 inhibitors.
- The promising PD-L1 inhibitor atezolizumab has ongoing Phase III trials in the pipeline for bladder cancer, breast cancer, non-small cell lung cancer and renal cell cancer.
- Other immunotherapies in the late stage pipeline include durvalumab, which has a Breakthrough Therapy designation for PD-L1+ bladder cancer, and avelumab, which has a Breakthrough Therapy designation for the rare Merkel Cell carcinoma.

Chart notes:

PD-1 is an abbreviation for the programmed cell death protein 1; BRAF is a gene that makes a protein called B-Raf; NSCLC refers to non-small cell lung cancer. All indications are for metastatic disease and second line or lower treatment sequence unless otherwise indicated. Months represent three month rolling average.

The pipeline of oncology drugs in clinical development has expanded by 63% over the past ten years

Chart 3: Growth of the Late Phase Oncology Pipeline, 2005–2015



Source: IMS Health, R&D Focus, IMS Institute for Healthcare Informatics, May 2016

- Oncology research and development activity remains concentrated on targeted therapies, which make up 87% of the late phase pipeline today.
- Targeted therapies include small molecule protein kinase inhibitors, biologic monoclonal antibodies, and a range of new mechanisms that can identify or block the cell processes that cause cancer cells to multiply.
- Particular focus is being placed on targeted therapies that use gene marker tests to indicate a greater likelihood of tumor response, or amplify the patient’s own immune response to target the cancer.
- The late phase oncology pipe includes 270 biologic therapies, including 16 gene therapies, 86 new monoclonal antibodies (mAbs), and 15 biosimilars of existing mAbs.
- The late phase pipeline also includes 74 potential vaccines for a wide variety of tumor types.
- Immunotherapies are one of the fastest growing areas within oncology R&D, and will undoubtedly make up a larger portion of the pipeline in 2020.

Chart notes:

Includes oncology products in active research at the end of December each year. Products are included if they are a new molecule, combination, or delivery system which is being investigated separately from any prior research or regulatory filings. Products are included based on the most advanced research stage for any indication in any geography and include phases II to registration. Additional indications for marketed products or indications less advanced than the lead research indication are not included.

The NSCLC pipeline includes over 76 new therapeutic options across multiple modes of action

Chart 4: Key In-Market and Investigational Agents for NSCLC



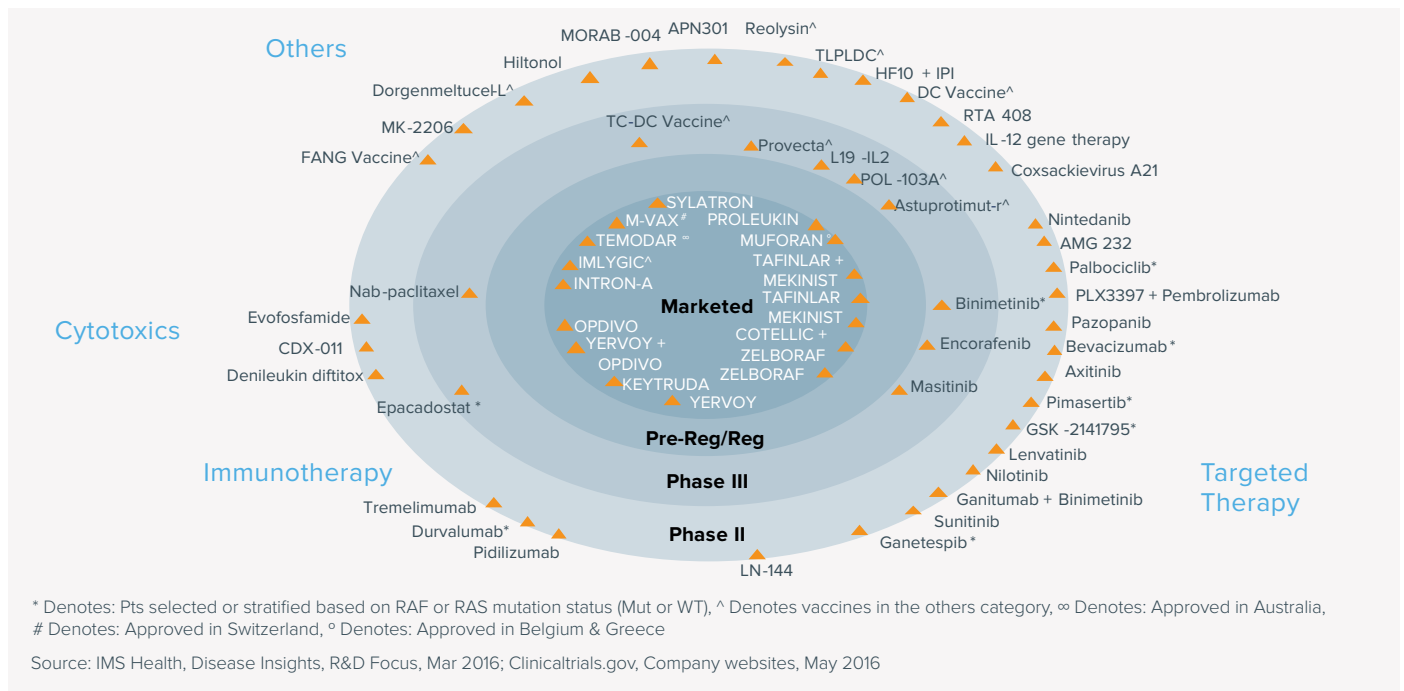
- Patients diagnosed with non-small cell lung cancer (NSCLC) now benefit from a wide range of targeted treatment options.
- Targeting mechanisms include specific gene mutations or biomarkers such as ALK, EGFR in tumor cells or less specific targeting of chemicals to interrupt cell processes, such as angiogenesis (blood vessel growth), and hormone receptors to slow or reverse tumor growth.
- More recently immunotherapies have become available which are understood offer significant clinical benefits over other treatment options by marshalling a patient's own immune system to target and attack tumor cells.

Chart notes:

The chart includes marketed and emerging therapies in NSCLC as of May 2016. Development status for each molecule was validated by company websites and secondary domain. The highest phase of development was selected. Count excludes marketed products.

Treatment options for melanoma continue to evolve and expand with over 44 new treatments in late phase trials

Chart 5: Key In-Market and Investigational Agents for Melanoma



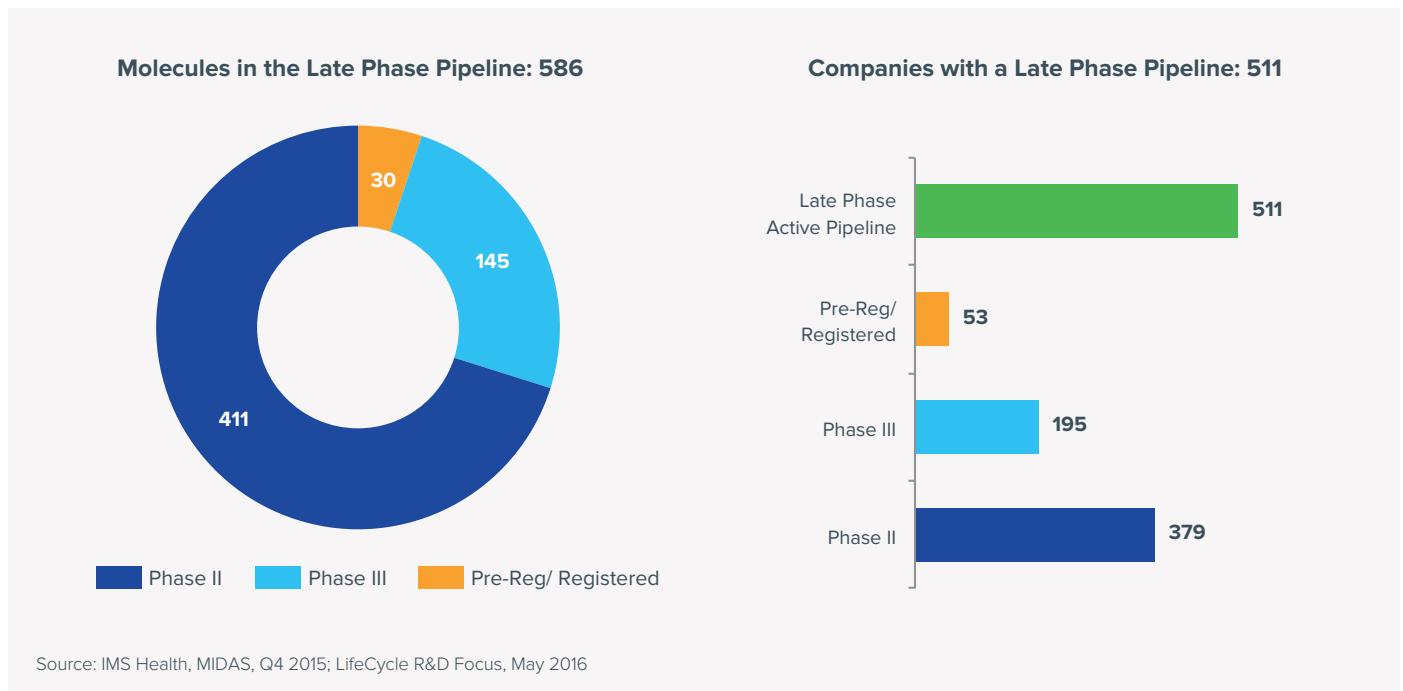
- For decades, the lack of effective drug therapies for patients with metastatic melanomas led healthcare professionals to focus mainly on skin cancer prevention and proactive excision of growths.
- Currently marketed melanoma medicines include immuno- and other targeted therapies as well as treatments for specific sub-populations.
- The presence of a biomarker, such as a BRAF mutation, can influence a patient’s therapeutic options.
- The newest immunotherapy drugs use the PD1, PDL1 and CLTA-4 mechanisms to help the patient’s immune system attack cancer cells.
- Unlike older targeted therapies which are not as effective when used together, the new immunotherapies appear to work well as part of a combination regimen.
- After the most recently approved group of treatments, there is likely to be a gap of several years until the next group of melanoma treatments become available.

Chart notes:

The chart includes marketed and emerging therapies in NSCLC as of May 2016. Development status for each molecule was validated by company websites and secondary domain. The highest phase of development was selected.

The global R&D pipeline for oncology remains robust with 586 late phase therapies being developed by 511 companies

Chart 6: The Global Late Phase Oncology Pipeline in 2015



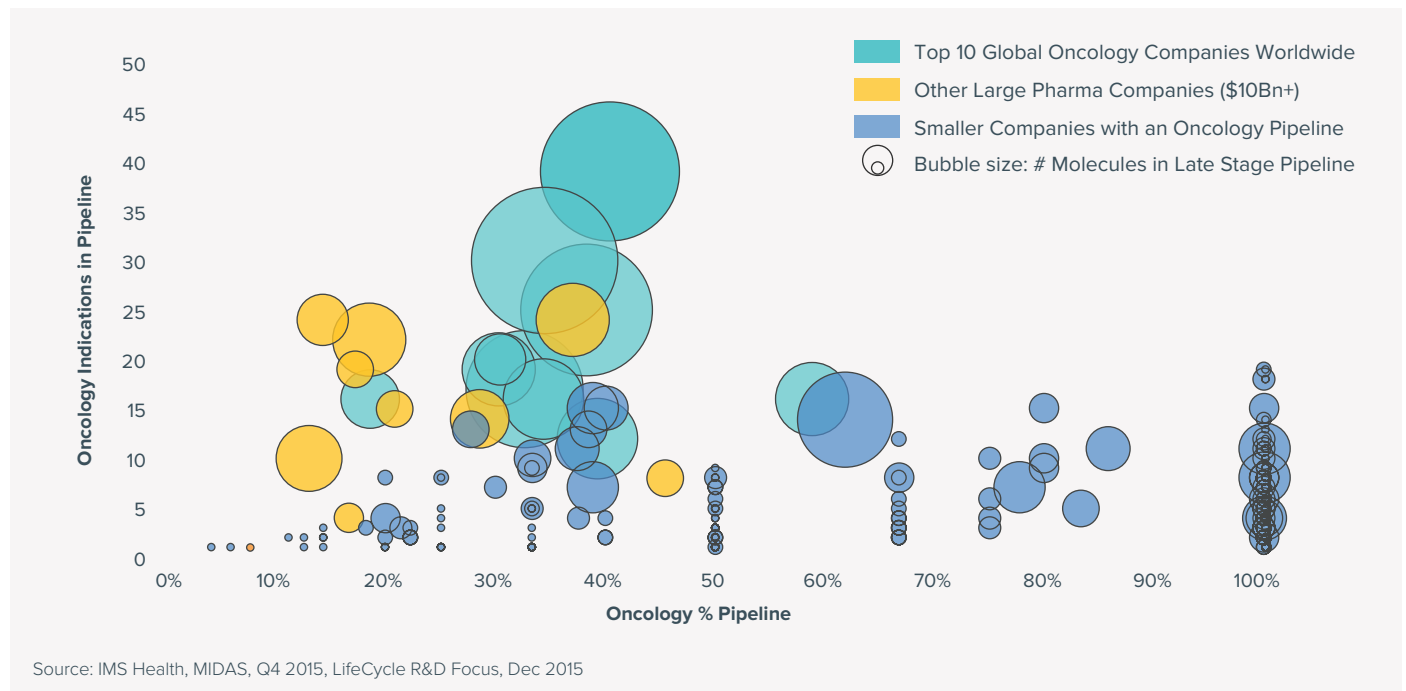
- Nineteen of the top 20 global pharmaceutical companies have an active late phase oncology pipeline.
- One-third of companies with late phase oncology pipelines have more than one late phase cancer medicine in development.
- Thirty-four companies have five or more molecules in their late stage pipelines.
- Three-quarters of the companies with a late phase cancer therapy pipeline have no presence in the global oncology market today.
- Forty-two percent of late phase therapies are being developed as collaborations between multiple companies. Only 15% of these companies have previously brought a cancer treatment to market, while 7% have marketed medicines in other therapy areas.
- The average late stage pipeline candidate is being tested in three indications, but several are being tested in as many as 18 tumor types.
- Non-small cell lung, breast, prostate, ovarian, and colorectal cancers are the most popular drug targets in the late stage pipeline.

Chart notes:

Active late stage pipeline defined as molecules that have reached Phase II or above but are not yet marketed. Molecule and company counts are unique. Where more than one company is actively involved in development of a single molecule, both collaborating companies are reflected in the count, however the molecule is counted once.

A diverse set of companies are actively engaged in oncology R&D, including most leading global companies and many newcomers

Chart 7: Companies with Active Late Phase Oncology Pipelines



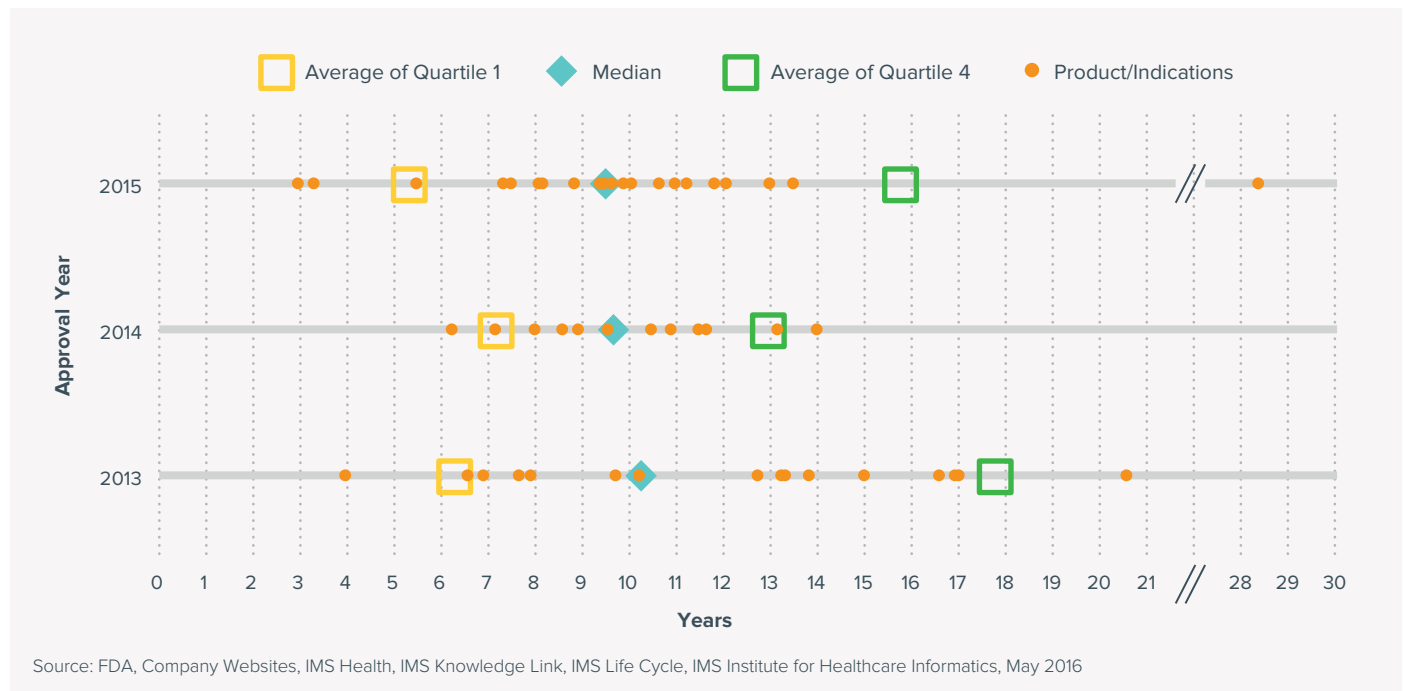
- Therapies in the late phase pipeline are being developed by companies of all sizes, including both new and established companies with narrow and broadly focused R&D priorities.
- The 130 cancer therapies currently being developed by the ten largest oncology companies represent only 19% to 59% of their respective late phase pipelines.
- Other large companies are developing an average of 6 cancer medicines and 55% to 92% of their late phase therapies target other diseases.
- Over 300 companies have R&D pipelines exclusively focused on oncology, with between one and seven late phase therapies aimed at fighting cancer.
- Cancer therapies make up 49% of the collective R&D activity underway in the labs of these 511 companies.

Chart notes:

Late phase pipeline is defined as active programs in Phase II through Registered.

The median time from patent filing to approval for oncology drugs approved in 2015 was 9.5 years, down from 10.25 years in 2013

Chart 8: Time from Patent Filing to Approval in the U.S.



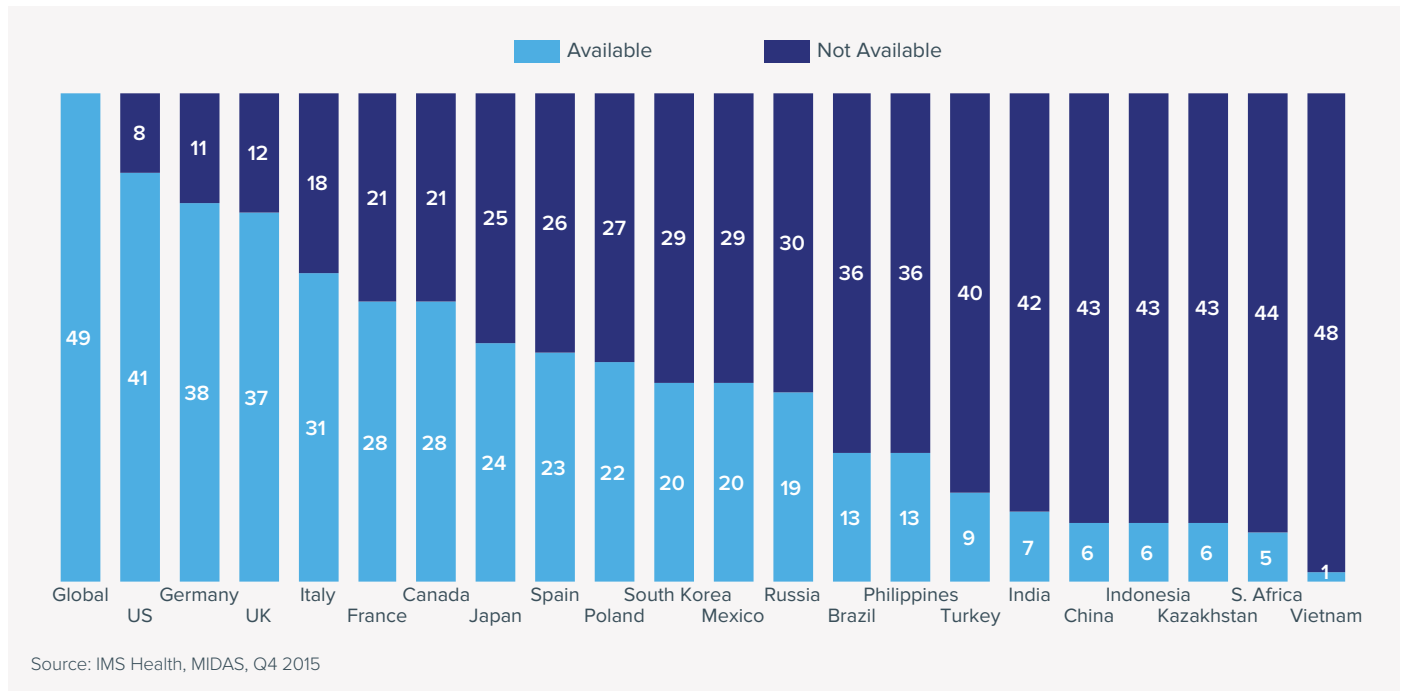
- Since the introduction of the FDA Breakthrough Therapy designation in 2012, the median time from patent filing to FDA approval has dropped from 10.25 years to 9.5 years, primarily through “pulling forward” late stage drugs and approving them sooner.
- The last three years have seen three medicines approved within 4 years of original patent filing including dabrafenib for melanoma with patent filed in May 2009 and approved by the FDA in May of 2013.
- Two treatments (osimertinib for non small cell lung cancer; ixazomib for multiple myeloma) were first patented in 2012 and were approved just 36 and 40 months later respectively in 2015.
- Of the 48 approvals analyzed, 21 had a breakthrough designation granted, 14 prior to filing with the FDA and 7 during FDA review or after approval.

Chart notes:

First patent filing for the molecule, and specific indication FDA approval are used in the analysis, and some products are included multiple times for the separate approvals they received. CDER used a number of regulatory methods to expedite the development and approval of novel drugs in 2015. These involved: Fast Track, Breakthrough, Priority Review, and Accelerated Approval.

Patients in only 6 countries had access to at least half of the 49 new oncology medicines launched 2010-2014

Chart 9: 2015 Availability of Oncology Medicines Launched 2010-2014



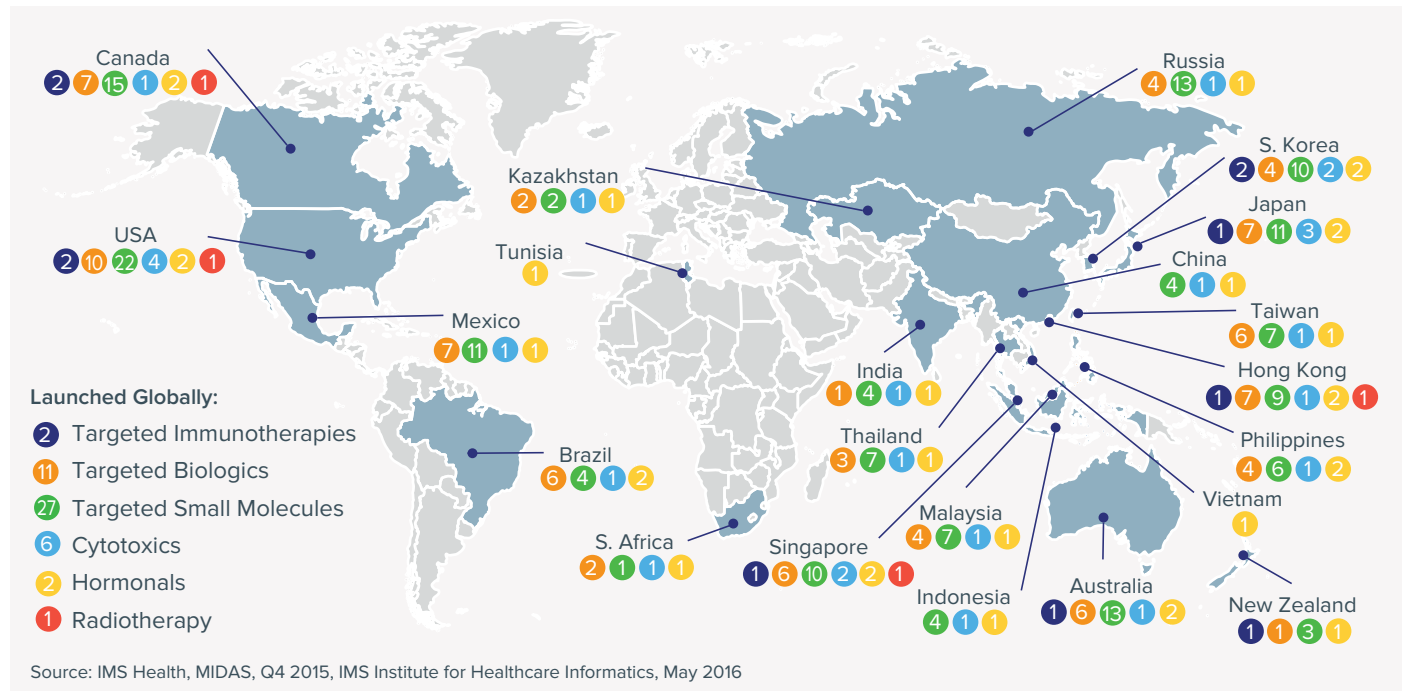
- Forty-nine new cancer medicines were launched between 2010 and 2014.
- Patients gained access to as many as 41 of these new medicines in the United States, and as few as one in Vietnam and Tunisia.
- Forty-seven of the new cancer medicines launched in at least one developed country, while only 34 launched in at least one pharmerging country.
- Only 25 of the 49 new cancer medicines analyzed are currently available in 20 or more countries.
- Seventeen of the 49 new cancer medicines analyzed are currently available in 10 or fewer countries.

Chart notes:

Includes innovative medicines, often referred to as New Active Substances or New Chemical Entities, first launched globally between 2010 and 2014. Availability is based on sales in audited markets, regardless of reimbursement rates. Supportive care medicines are not included.

The availability of new oncologic treatments, especially the newer targeted therapies, varies widely by country and region

Chart 10a: 2015 Availability of New Oncology Medicines Launched 2010–2014



- Targeted therapies represent 82% of all oncology NAS launched between 2010–2014.
- Just over half (55%) of the new targeted therapies are available in pharmerging countries.
- Targeted small molecules had the greatest number of NAS launched (27) and radiotherapy the fewest (1).
- New oncology medicines launched since 2010 include 11 biologic medicines and two immunotherapies.

Chart notes:

New active substances (NAS) defined as innovative medicines first launched globally between 2010 and 2014. Availability is based on sales in audited markets, regardless of reimbursement rates. Supportive care medicines are not included.

New oncology medicines become available in Western European countries sooner than in the smaller markets of Eastern Europe

Chart 10b: 2015 Availability of Oncology Medicines Launched 2010–2014 within the EU and Eastern Europe



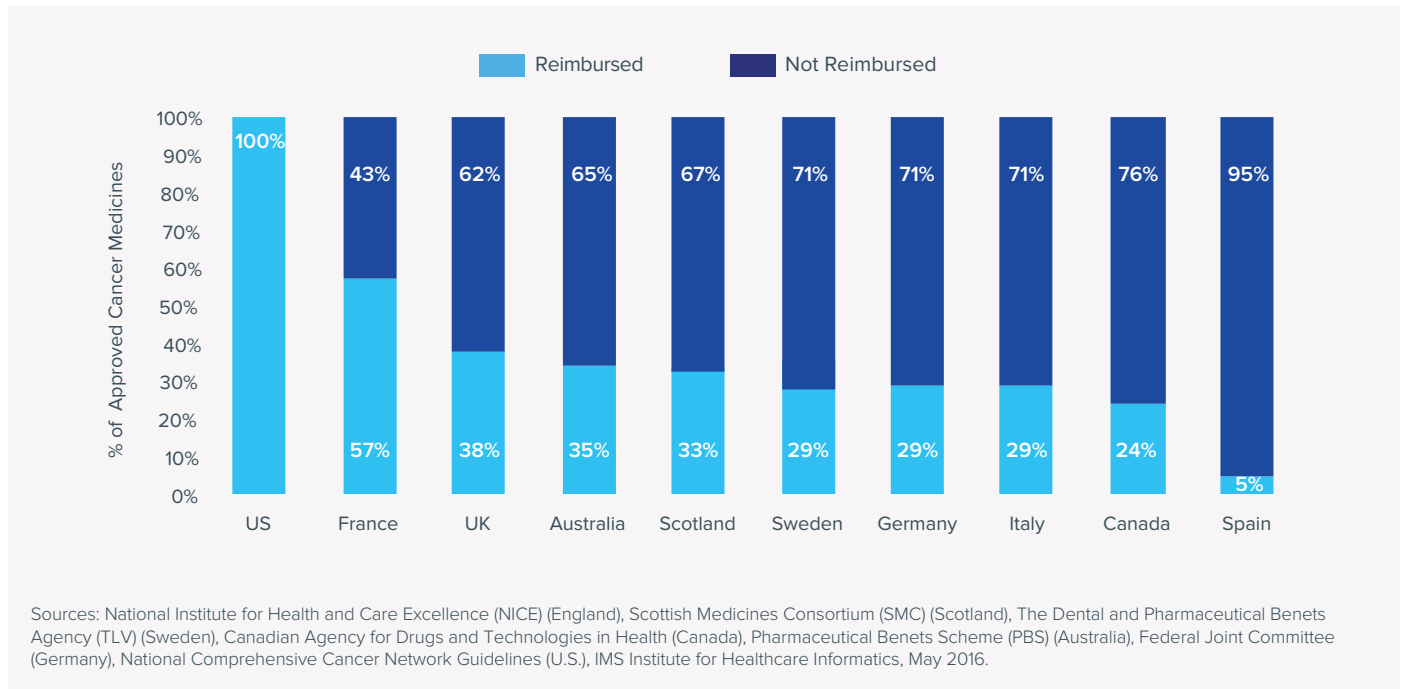
- By the end of 2015, 78% of the new oncology medicines launched between 2010 and 2014 were available within the greater EU.
- Patients in six European countries gained access to NAS within all 6 therapy categories. Over half of them were within the EU.
- Only one-third of the former Eastern Bloc countries have access to at least one of the new targeted immunotherapies.
- Patients in all EU and Eastern European countries have access to some new targeted biologics, targeted small molecules, and hormonal therapies.

Chart notes:

New active substances (NAS) defined as innovative medicines first launched globally between 2010 and 2014. Availability is based on sales in audited markets, regardless of reimbursement rates. Supportive care medicines are not included.

Even when commercially available, not all cancer drugs are reimbursed under public insurance programs

Chart 11: Reimbursement Status of Cancer Medicines Approved in 2014 and 2015



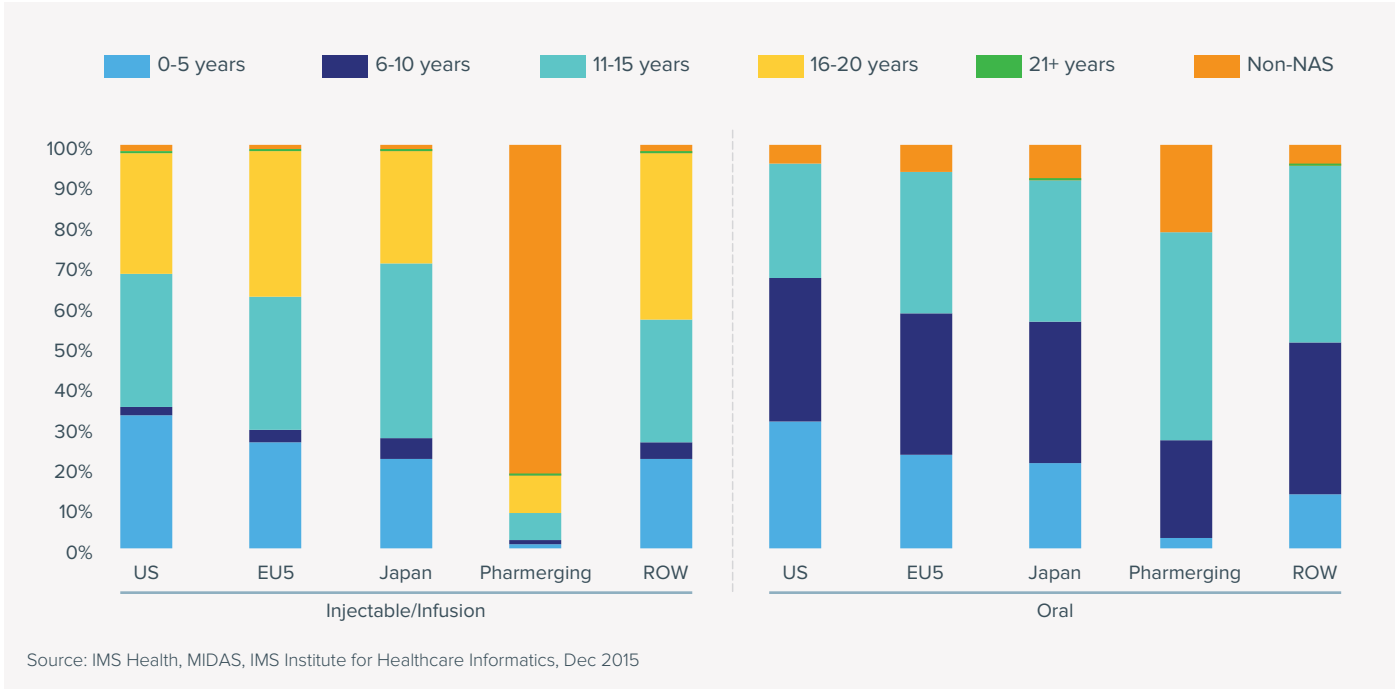
- Access to new cancer drugs is not universal even in developed countries, where national health systems’ priorities may result in declining to reimburse some products.
- Countries employing a formal cost-effectiveness methodology based upon cost per quality life year gained are much less likely to reimburse new cancer medicines than countries using other assessment approaches.
- The categorization of not-reimbursed does not mean that there is no patient access to these medicines and there may be non-standard means for obtaining access to new medicines through special funds and submission of applications for approval outside of standard guidelines.

Chart notes:

Reimbursement determined by review of drugs approved in each country for 2014 and 2015. Drugs for which reimbursement data was not available or reimbursement application was withdrawn or discontinued are considered ‘Not Reimbursed’. In the U.S., if a medicine appears on payer preferred drug lists, the medicine was considered “reimbursed”, however, the payer may have requirements that must be met to qualify for reimbursement.

The U.S. leads developed markets in the wide and early adoption of newer targeted treatments

Chart 12: Targeted Oncologics Share of Volume by Global NAS Age

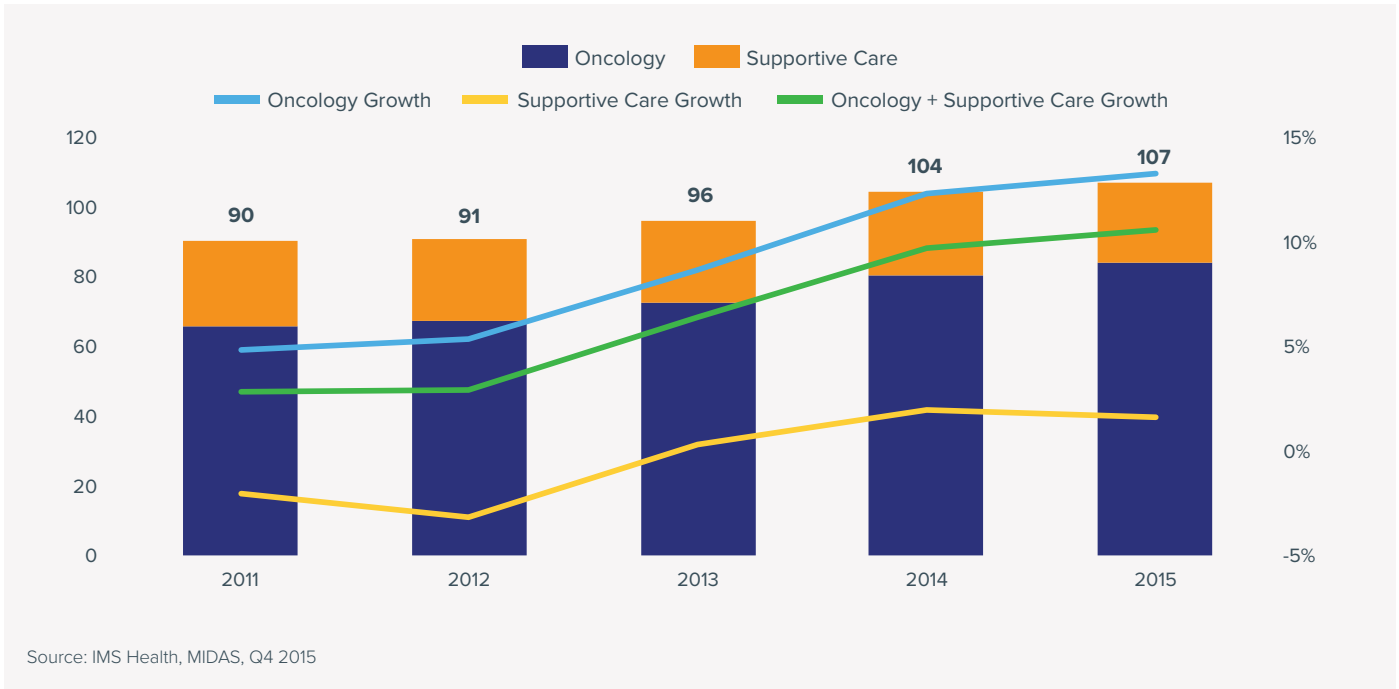


- New targeted oncologics medicines introduced globally in the last five years represent nearly one-third of the volumes used in the U.S. compared to 23–26% in the top five European countries, and 21–22% in Japan.
- Oral forms of targeted oncologics introduced in the past 10 years account for 67% of U.S. oral cancer volumes compared to 58% in EU5 and 56% in Japan.
- In the U.S., EU5 and Japan, over 90% of oral treatments currently used were introduced since 2000, representing a near complete replacement of the treatment arsenal over that time.
- Over 30% of injectable treatment volumes in major developed markets are for older treatments.

Chart notes:
Targeted oncology therapies, segmented by the share of volumes in standard units. New active substances (NAS) categorized by year of first global launch. Incomplete coverage of relevant distribution channels in Pharmerging and Rest of World geographies may understate the level of adoption of newer cancer treatments.

Global costs of oncology therapeutics and supportive care medicines increased 11.5% in 2015 to \$107 billion

Chart 13: Global Oncology and Supportive Care Costs US\$BN



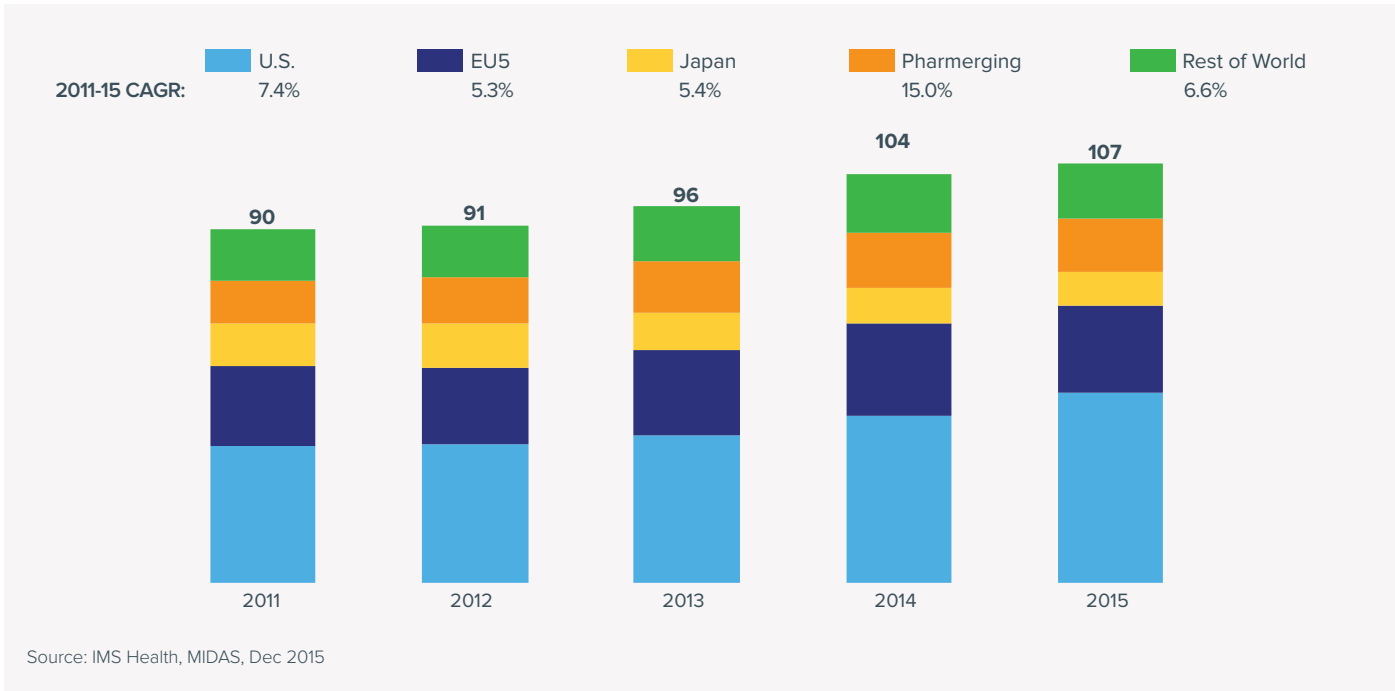
- The cost of therapeutic oncology medicines increased at a compound annual growth rate of 9.8% since 2010, while the cost of supportive care treatments increased only 0.7%.
- In 2015, the cost of therapeutic oncology treatments increased 14.2% to \$83.7Bn.
- Costs of supportive care therapies increased 2.6% to \$22.9Bn in 2015.
- The total global cost of cancer medicines rose at a compound annual growth rate of 7.4% in the past five years, which is slightly slower than the 8.3% growth recorded between 2005 and 2010.

Chart notes:

Spending in US Dollars with variable exchange rates. Growth in US Dollars with constant exchange rates. Therapeutic oncology is defined as L1 antineoplastics, L2 cytostatic hormone therapies, V3C radio pharmaceuticals, denosumab, lenalidomide, pomalidomide, and aldesleukin. Supportive care includes anti-emetics, erythropoietins, hematopoietic growth factors, select interferons, bisphosphonates, and cancer detox medicines.

The U.S. accounts for 46% of total global oncology costs, up from 39% in 2011

Chart 14: Global Oncology and Supportive Care Costs US\$BN

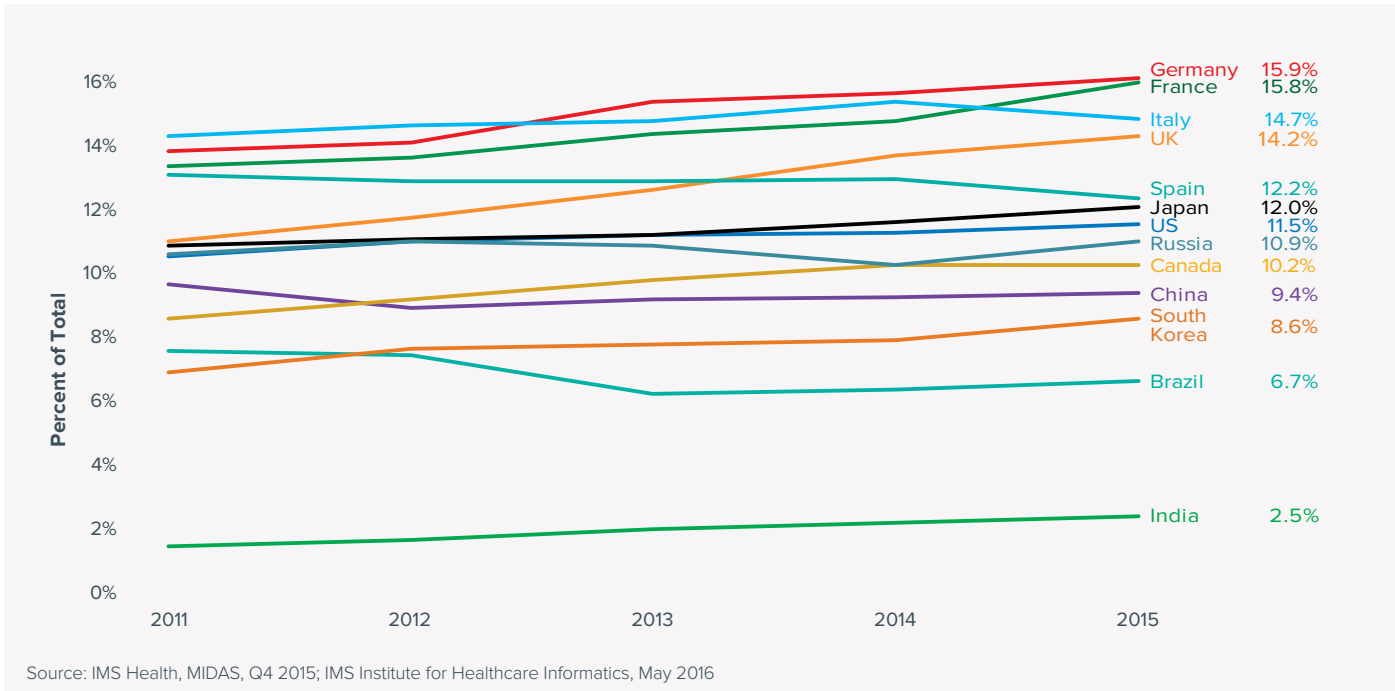


- Nearly half (46%) of the growth in global oncology costs between 2011 and 2015 can be attributed to higher cost growth in the U.S. and the strengthening of the U.S. dollar over the time period.
- In the U.S., non-discounted costs of cancer and supportive care medicines increased from 2.0 percent in 2011 to 13.9 percent in 2015, at constant exchange rates.
- Costs in pharmerging markets increased 15.0% annually since 2010.
- In Japan, the second largest developed market, costs rose at a compound annual growth rate of 5.4% to \$8.8Bn.
- Costs in the five largest markets in Europe – France, Germany, Italy, Spain and the United Kingdom – rose 5.3% annually.
- The rest of the world accounted for 13.0% of total oncology costs in 2015 and 6.6% of the increase in costs between 2011 and 2015.

Chart notes:
Includes supportive care. Costs in US Dollars with variable exchange rates. Growth in US Dollars with constant exchange rates.

Oncology drug costs, as a proportion of overall drug cost, remain higher in the EU5 and Japan than in the U.S.

Chart 15: Oncology Cost as a Share of Total Pharmaceutical Costs



- The U.S. derives 11.5% of its total drug costs from oncology, up from 10.5% in 2011.
- In developed countries, between 8.6% and 15.9% of the total drug bill is spent on oncology and supportive care medicines.
- Oncology accounts for a smaller portion of total medicines costs in pharmerging countries, where between 2.5% and 11.5% of total drug cost is for cancer treatments.
- The countries with the highest portion of total costs allocated to cancer medicines are Austria, the Netherlands, Taiwan, Hong Kong, and Singapore.
- While Germany spends the most on cancer medicines, proportionally, of the nine developed countries, the oncology bill is rising the fastest in the United Kingdom.
- Spain is the only developed country in which oncology costs have fallen in proportion to total medicines costs in the last five years.
- Mexico and South Africa are the only pharmerging countries in which oncology costs have fallen in proportion to total medicines costs in the last five years.

Chart notes:
Includes supportive care. Costs and growth in US Dollars with constant exchange rates.

Newly launched cancer drugs are bringing survival benefits to patients at monthly treatment costs of \$6,000-\$13,000

Chart 16: Profiles of New Cancer Medicines

Product	Indication	Clinical Data			Monthly Treatment cost*
		PFS: Median Months (95% CI)	OS: Median Month (95% CI)	Comments	
Cobimetinib (Cotellic) + vemurafenib	Advanced melanoma with a BRAF V600E or V600K mutation	12.3 (9.5, 13.4) versus 7.2 (5.6,7.5)	not estimable (20.7, NE 95% CI) versus 17.0 (15.0, NE)	Trial was versus Placebo + Vemurafenib	\$6,000 to \$6,500
Daratumumab (Darzalex)	Refractory multiple myeloma	3.7 months (2.8, 4.6)	not estimatable 17.5 months (13.7, NE)	Trial was among patients refractory to 3 plus line of therapy	\$13,000 to \$14,000
Necitumumab (Portrazza) + gemcitabine + cisplatin	Metastatic squamous non-small cell lung cancer	5.7 (5.6, 6.0) versus 5.5 (4.8, 5.6)	11.5 (10.4, 12.6) versus 9.9 (8.9, 11.1)	Trial was versus gemcitabine + cisplatin	\$11,000 to \$12,000
Nivolumab (Opdivo)	Unresectable (cannot be removed by surgery) or metastatic (advanced) melanoma	5.1 (3.5, 10.8) versus 2.2 (2.1, 2.4)	Not Reached versus 10.8 (9.3, 12.1)	Trial 5 versus Dacarbazine	\$6,000 to \$13,000
Nivolumab (Opdivo)	Advanced (metastatic) squamous non-small cell lung cancer (NSCLC)	NA	9.2 (7.3, 13.3) versus 6.0 (5.1, 7.3)	Trial 2 versus Docetaxel	\$6,000 to \$13,000
Nivolumab (Opdivo)	Advanced (metastatic) non-small cell lung cancer	2.3 versus 4.2	12.2 (9.7, 15.0) versus 9.4 (8.0, 10.7)	Trial 3 versus Docetaxel	\$6,000 to \$13,000
Nivolumab (Opdivo)	Advanced renal cell carcinoma	NA	25.0 (21.7, NE) versus 19.6 (17.6, 23.1)	Trial 6 versus Everolimus	\$6,000 to \$13,000
Olaparib (Lynparza)	Advanced ovarian cancer associated with defective BRCA gene	NA	NA	Median duration of response (95% CI) – 7.9 (5.6, 9.6)	\$12,000 to \$13,000
Palbociclib (Ibrance) + letrozole	ER-positive, HER2-negative advanced breast cancer	20.2 (13.8, 27.5) versus 10.2 (5.7, 12.6)	NA	Study 1: IBRANCE plus Letrozole	\$10,000 to \$10,500
Pembrolizumab (Keytruda)	Advanced or unresectable melanoma	4.1 (2.9, 6.9) for Keytruda every 3 wks versus 5.5 (3.4, 6.9) for Keytruda every 2 wks versus 2.8 (2.8, 2.9) for Ipi	NA	Ipilimumab-Naive Melanoma (Trial 6)	\$6,000 to \$13,000
Pembrolizumab (Keytruda)	Advanced (metastatic) non-small cell lung cancer (NSCLC)	all patients: 3.9 versus 4.0 PD-L1 >50%: 5.0 versus 4.1	all patients: 10.4 versus 8.5 PD-L1 >50%: 14.9 versus 8.2	Trial 10 versus docetaxel	\$6,000 to \$13,000

Source: Company product inserts, PubMed.gov, May 2016; IMS Health, MIDAS Disease Insights., IMS Institute for Healthcare Informatics, May 2016

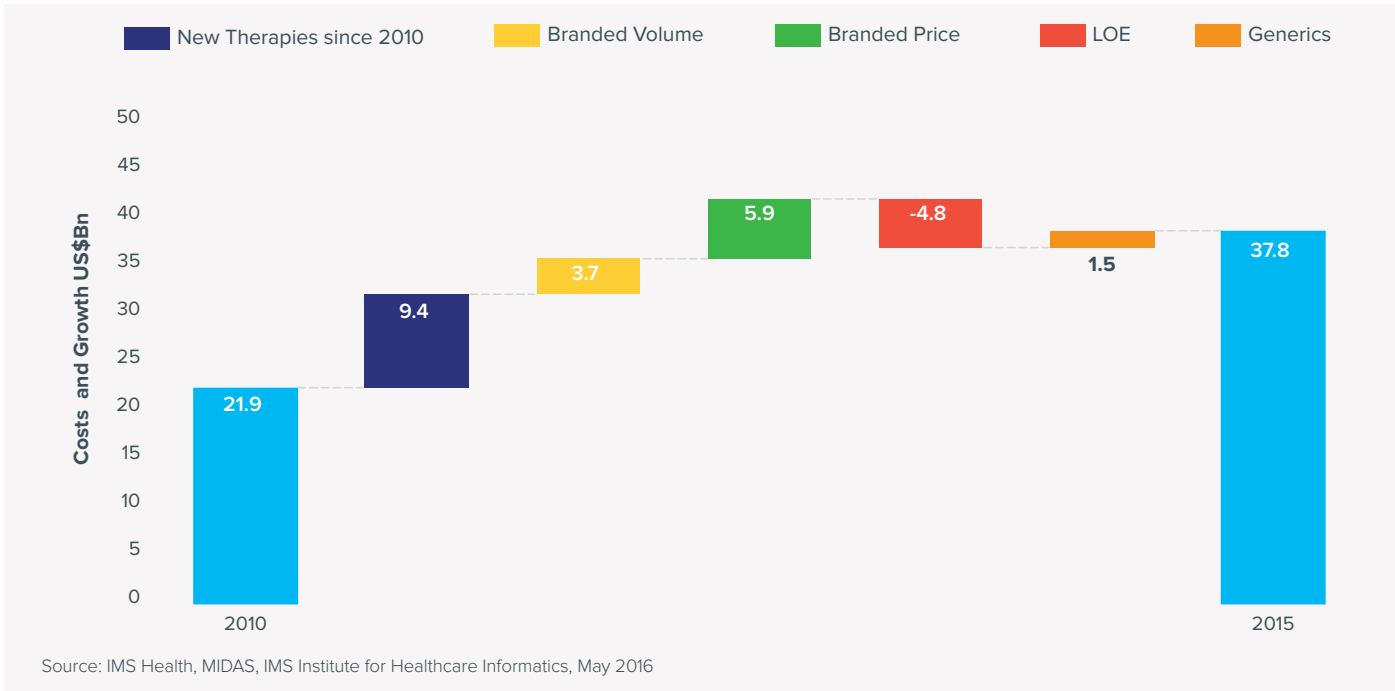
- The monthly treatment cost for new cancer treatments average about \$8,000 to \$12,000 per month.
- Clinical benefits – measured in incremental progression-free or overall survival – are significant for many of the most recent launches.

Chart notes:

* Monthly treatment cost for new agent approved. NA – Not applicable. Monthly treatment costs based on typical dose range, duration, and patient weight. OS = Overall Survival. PFS = Progression Free Survival.

U.S. cost of oncology medicines has increased in the past five years by 73%, primarily driven by new medicines

Chart 17: U.S. Oncology Market Growth

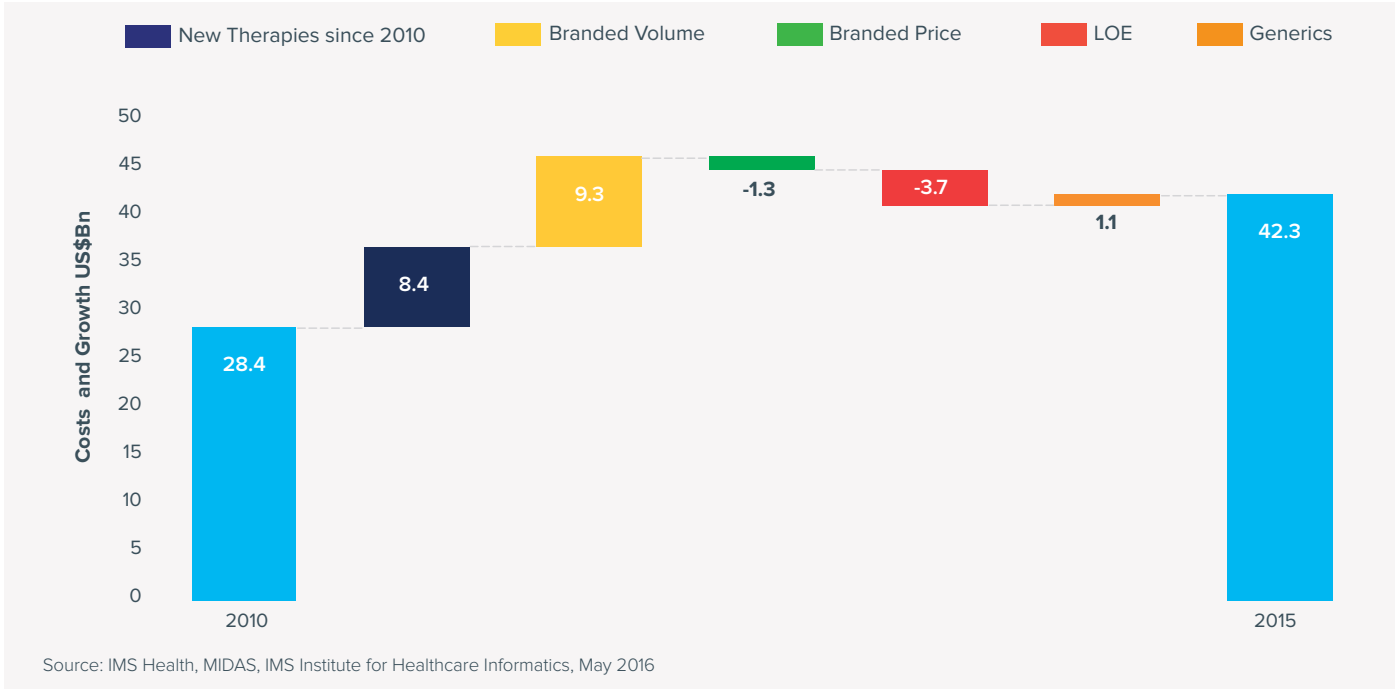


- The total cost of oncology medicines rose \$15.9Bn to \$37.8Bn in the U.S. between 2010 and 2015.
- Sixty percent of the growth in U.S. oncology costs in the last five years can be attributed to the uptake of innovative medicines launched since 2010.
- The costs for older protected brands increased \$9.6Bn, due to both wider usage and increasing prices.
- The loss of patent exclusivity for some older brands contributed to \$4.8Bn in lower brand costs.
- The \$1.5Bn increase in generic costs equates to only 10% of oncology cost growth between 2010 and 2015.
- Price concessions from manufacturers in the form of discounts and rebates, are known to offset 1-2 percentage points of the 4-7% average invoice price growth in the U.S.

Chart notes:
Oncology excluding supportive care. LOE = Loss of Exclusivity.

Outside of the U.S., the uptake of new therapies and more widespread use of older medicines is driving oncology cost growth

Chart 18: Ex-U.S. Oncology Market Growth

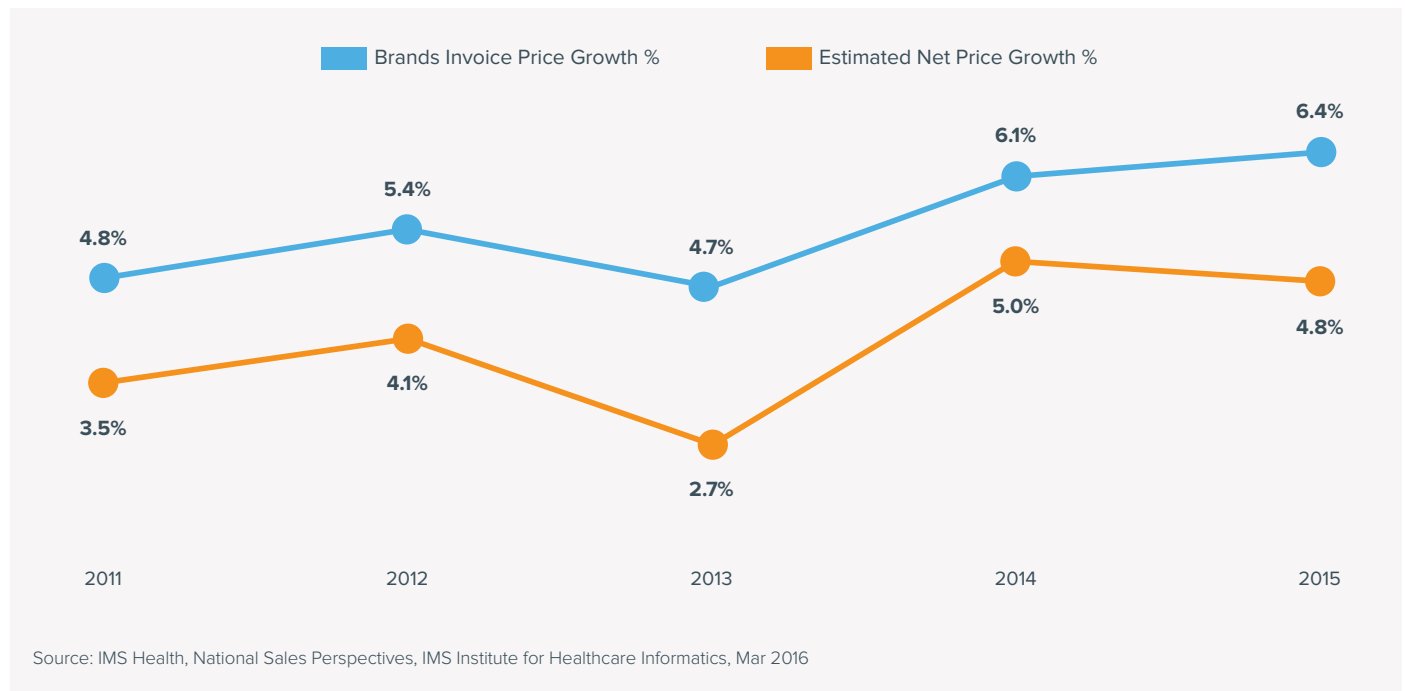


- Outside the U.S., oncology costs increased \$13.8Bn to \$42.3Bn between 2010 and 2015.
- The uptake of new brands resulted in \$8.4Bn in increased costs in other countries.
- Greater use of older brands – due to increasing numbers of patients receiving treatment as well as lengthening treatment durations – led to \$9.3Bn in cost growth in the past five years.
- Prices declined on average for older protected brands outside the U.S. and contributed to \$1.3Bn of lower brand costs over five years.
- Loss of exclusivity for brands resulted in \$3.7Bn in lower costs of cancer medicines outside the U.S.

Chart notes:
 Oncology excluding supportive care. Rest of World includes 41 audited countries for which brand/generic segmentation and patent information is available. US Dollars with constant exchange rates. LOE = Loss of Exclusivity.

Pricing concessions by manufacturers – including mandatory and negotiated rebates, discounts, and patient cost offsets – are reducing manufacturer-realized net price growth

Chart 19: Invoice and Net Price Growth of Protected Oncology Brands – U.S.



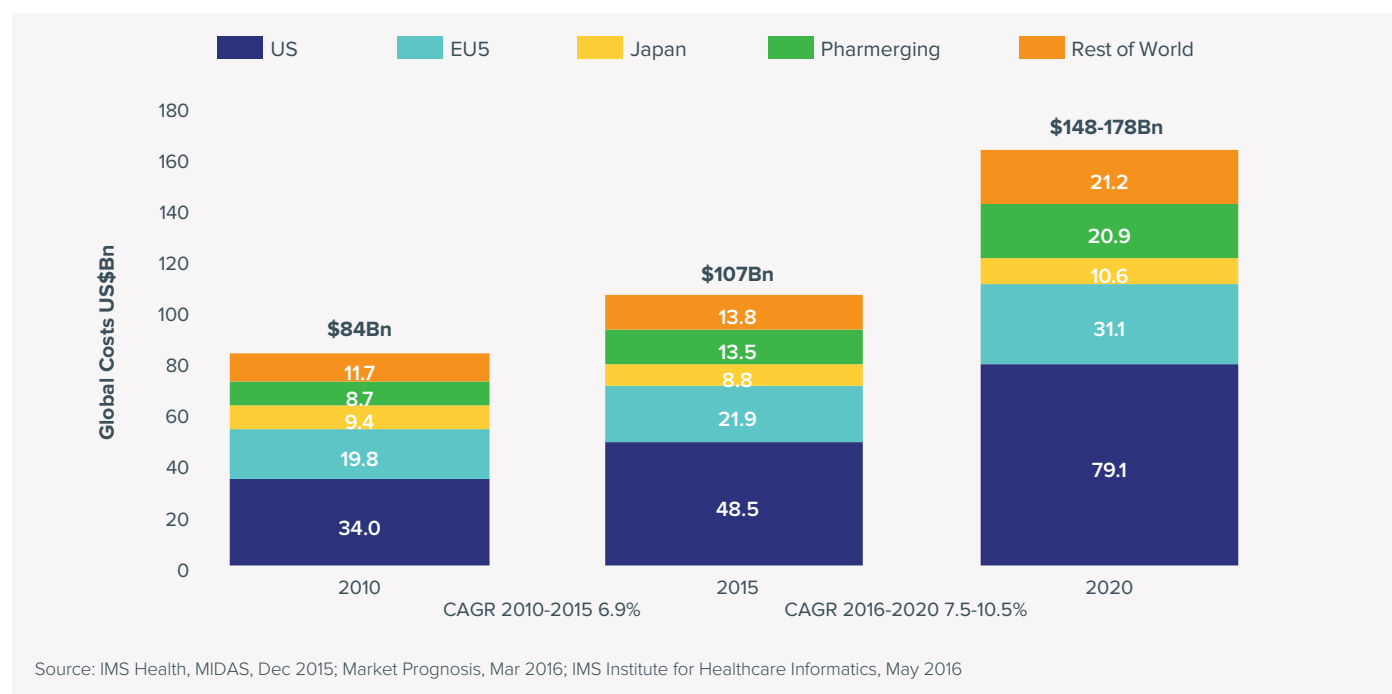
- In the U.S., net price growth on existing branded oncology drugs is estimated to have averaged 4.8% in 2015 as opposed to 6.4% invoice price growth in 2015.
- Insurers ability to negotiate lower prices is the key driver of lower net prices and lower net price growth for cancer products.
- Cancer medicines are subject to different types of off-invoice discounts, rebates and price concessions based on how the medicines are reimbursed or administered to patients.
- An increasing number of cancer medicines are oral formulations, provided to patients via pharmacies or mail-order and often reimbursed through pharmacy benefit claims, and reimbursed through specialty pharmacy benefits.
- Insurers are often less able to negotiate lower rates on specific medicines which are infused due to the way medical claims are reimbursed for the service including the drug rather than the drug alone.
- In other countries, a wide range of discounts and other various mechanisms result in lower realized prices by manufacturers.

Chart notes:

Invoice values are IMS Health reported values from wholesaler transactions measured at trade/invoice prices and exclude off-invoice discounts and rebates that reduce net revenue received by manufacturers. Net values denote company recognized revenue after discounts, rebates and other price concessions. Results are based on a comparative analysis of company reported net sales and IMS Health audited sales and prices at product level for branded products. Growth rates are calculated over same cohort of products in the prior year.

Oncology cost growth is expected in the 7.5% to 10.5% range annually through 2020, when global oncology costs will exceed \$150 billion

Chart 20: Global Oncology Costs and Growth, 2010–2020



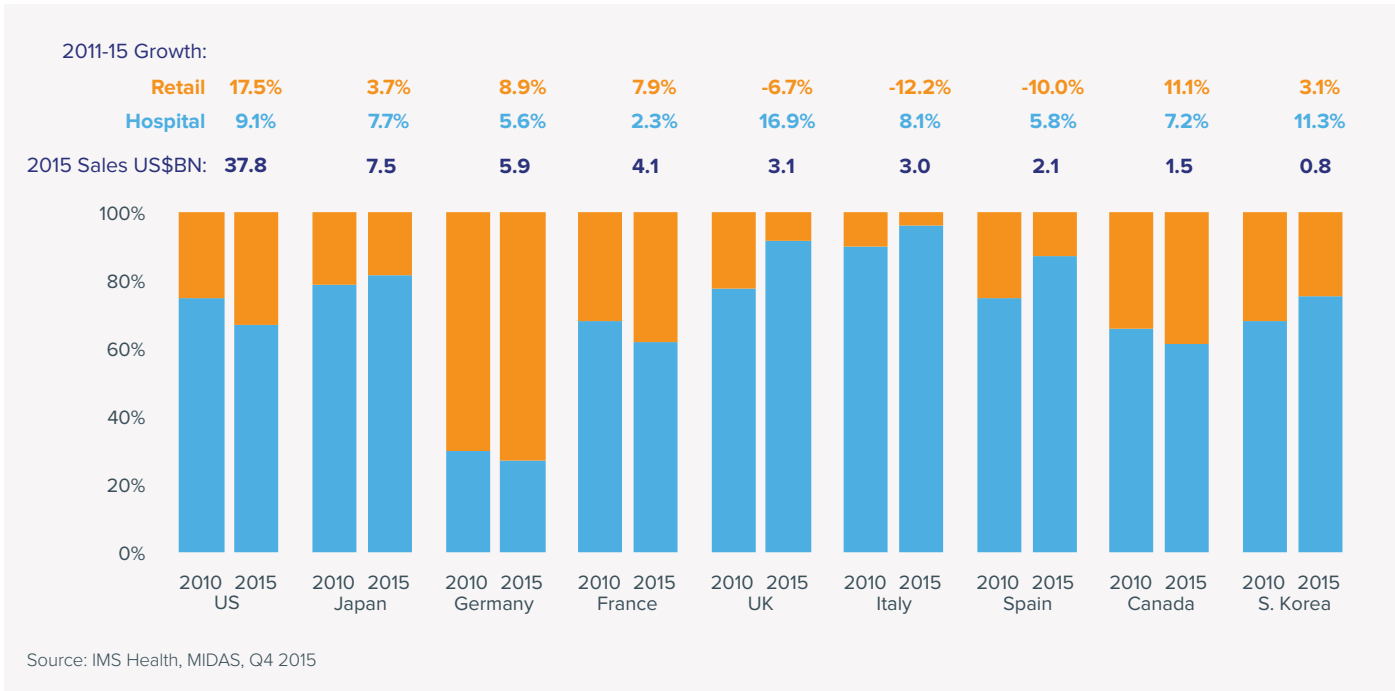
- Higher costs will be driven by the wider usage of new products, especially immunotherapies, in developed markets such as the U.S. and the five major European countries.
- Newer therapies with survival benefits will also bring longer therapy durations.
- Patient not currently candidates for cancer therapy may be able to take advantage of new options and lines of therapy.
- The use of newer treatments will be offset by lower usage of existing treatments, some of which are already off patent and available as generic medicines.
- Patent expiries and biosimilar competition will contribute to lower costs but will be offset by increased prevalence, diagnosis rates and treatment rates.
- Since 2013, growth in EU5 has rebounded driven by new medicines and this continued wave of innovation is expected to lift growth to 2020.

Chart notes:

Includes supportive care. Costs in US\$ with variable exchange rates. Growth in US Dollars with constant exchange rates.

The mix of costs for oncology drugs between hospitals and retail pharmacies varies widely between countries

Chart 21: Global Oncology Spending and Growth by Sector in Developed Markets

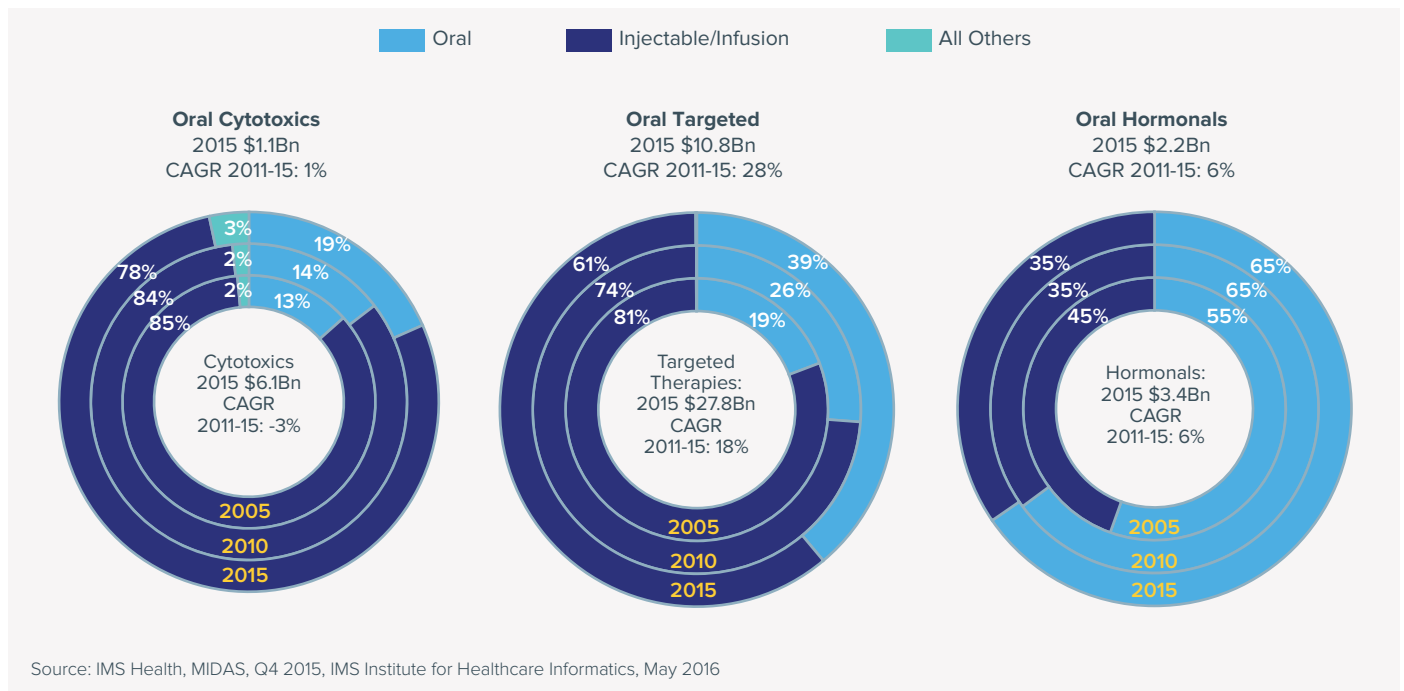


- In most developed markets, the majority of oncology costs are incurred in hospitals.
- Germany is an exception, with 73% of oncology costs from retail compared to 28% in other developed markets.
- In the United States, oncology costs are shifting to the retail sector, the source of 33% of oncology costs in 2015 compared to 25% in 2010.
- In the nine developed markets, retail oncology costs rose at a 11.7% compound annual growth rate since 2010 while hospital costs rose only 8.5%.
- Retail cost growth outpaces hospital cost growth in the United States, Germany, France, and Canada.
- Hospital cost growth outpaces retail cost growth in Japan, the United Kingdom, Italy, Spain, and South Korea.

Chart notes:
 Costs in US dollars with variable exchange rates. Market shares and growth in US dollars with constant exchange rates.
 Supportive care not included.

Oral therapies are becoming increasingly common in cancer treatment, and make up a larger portion of costs than five years ago

Chart 22: U.S. Market Share of Spending in US\$ by Formulation and Oncology Segment



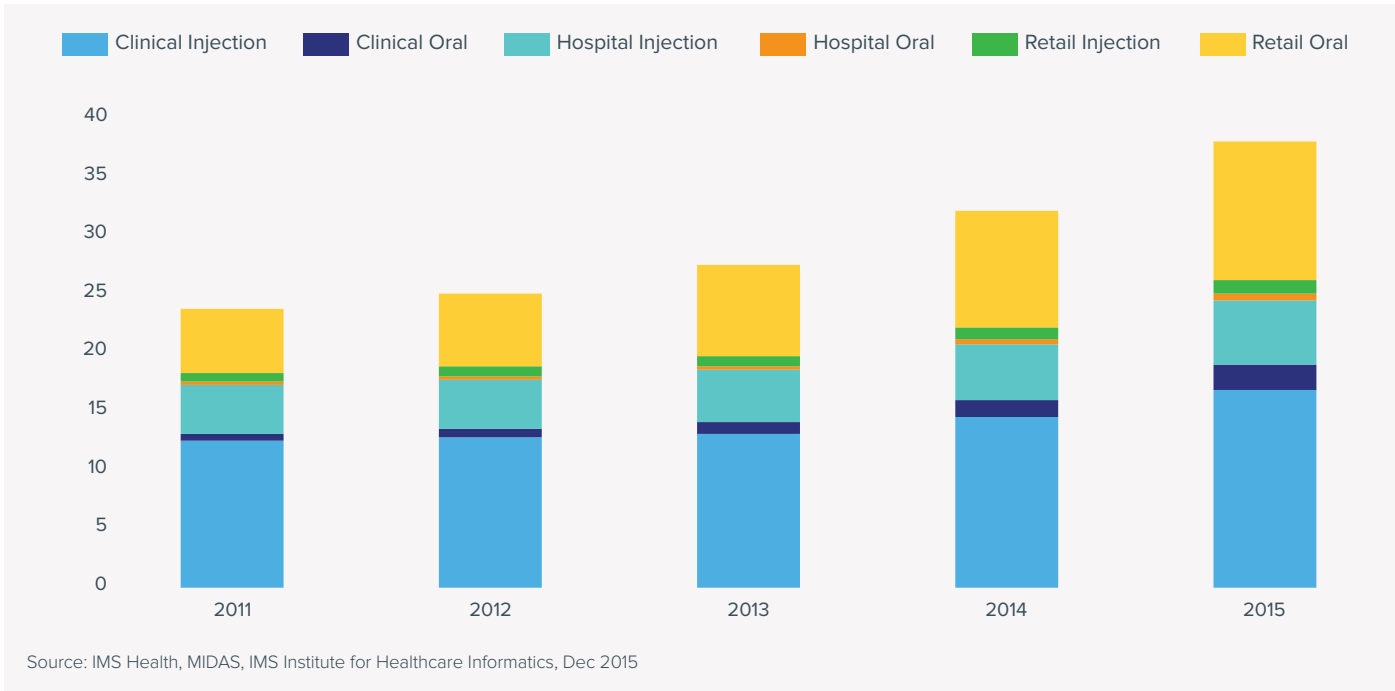
- Oral forms of targeted oncologics represent 39% of the \$27.8Bn spent in the U.S. in 2015, up from 19% in 2005 and 26% in 2010.
- Targeted therapies have contributed the most to overall oncologic growth, with the segment growing by 18% CAGR from 2011-15, even as oral treatments share of spending has risen from 26% to 39%.
- Cytotoxic treatment spending declined by an average 3% over the past five years while oral treatment share of spending increased by five share points.
- Hormonal treatments historically focused more on oral formulations, often as maintenance therapy following breast cancer or prostate cancer treatment for hormonally activated tumors.
- Newer hormonal medicines, particularly for prostate cancer have contributed to increasing spend for orals, offsetting patent expiries which had contributed to reduced oral hormonal treatment spending between 2005-15, slowing overall hormonal treatment growth to 6% CAGR 2011-15.

Chart notes:

Ex-manufacturer level sales reported in MIDAS are approximately 3.5% lower than invoice level sales reported locally in the IMS Health National Sales Perspectives™.

In the U.S., more than one-third of costs are from medicines available at retail pharmacies, up from 25% ten years ago

Chart 23: U.S. Oncology Spending by Form and Dispensing Location, US\$Bn

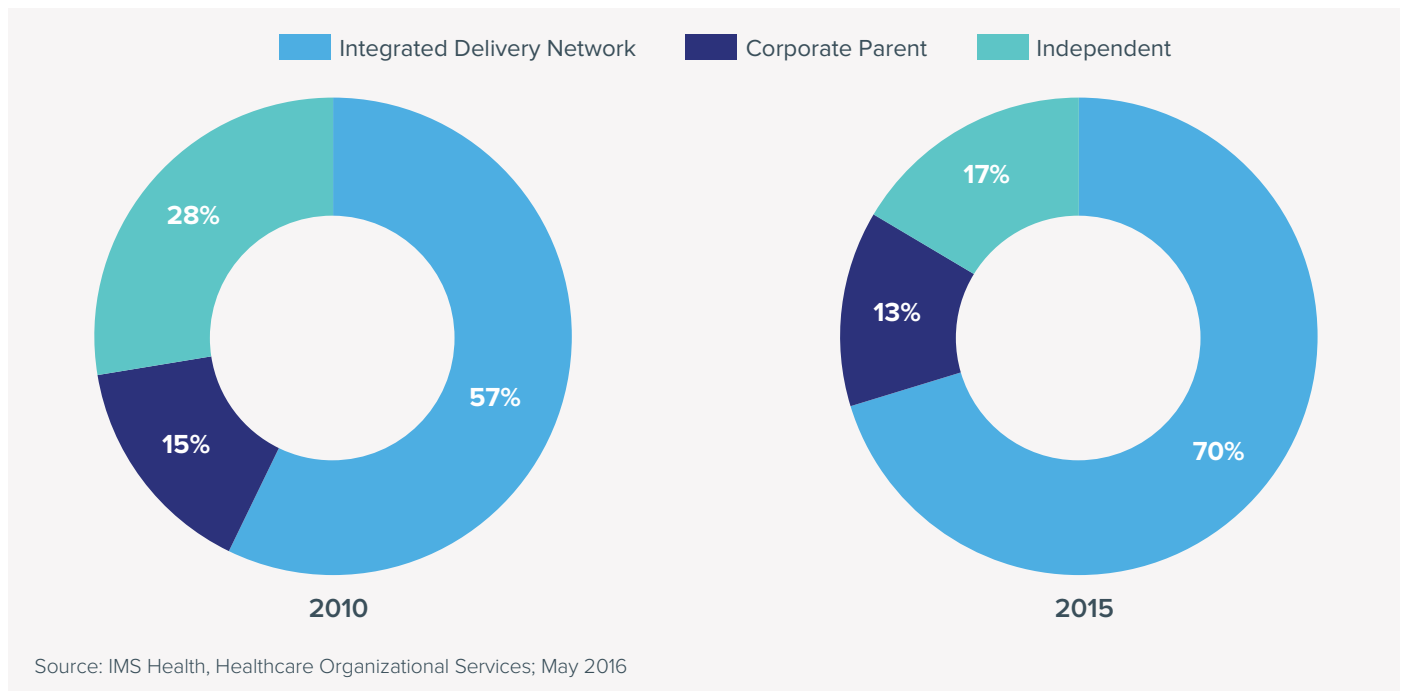


- Oral forms, able to be dispensed through pharmacies or mail order, have significantly contributed to oncology cost growth over the past decade.
- Commercial insurance and Medicare both distinguish and manage pharmacy and medical benefits separately which largely correlates to the form and location that medicines are provided to patients.
- Retail, including mail order pharmacies, provide oral cancer treatments to patients.
- Injectable forms are most often administered to patients in a clinic or a hospital, and are primarily reimbursed through a patient’s medical benefit.
- Oral medicines now represent 38% of U.S. oncology costs, up from 23% ten years ago.
- Oral medicines account for 49% of the cost growth over the past decade, 38% from oral medicines in retail.

Chart notes:
 Clinical administration of oncology treatments includes both stand-alone cancer clinics, infusion centers and office-based oncologists who administer treatments in their offices. Retail injection reflects the relatively rare but increasing practice, termed “white-bagging”, where patients purchasing their chemotherapy agents directly and provide them to their physician for administration. Injection includes infused therapies.

The delivery of cancer care is shifting to integrated delivery systems

Chart 24: U.S. Oncology Provider Affiliations by Delivery System Type



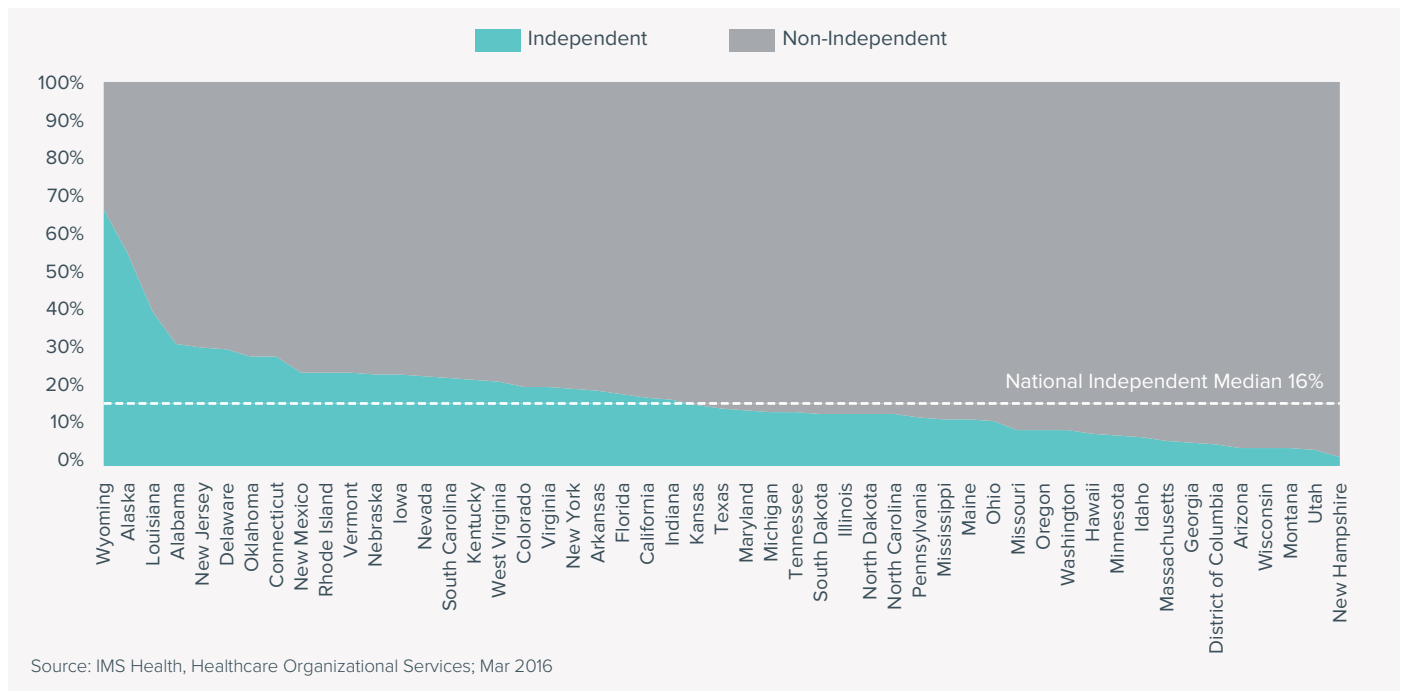
- Only 17% of oncologists are in independent practices, unaffiliated with some type of integrated delivery network or corporate parent, down from 28% in 2010.
- Over 83% of oncologists are part of an Integrated Delivery Network (IDN) or a system with a corporate parent and are more likely to follow pathways for cancer treatments rather than independent standards of care.
- This shift is indicative of the gradual integration, consolidation and increasing maturity of healthcare systems .
- The specifics around delivery of care and integrated healthcare system trends varies significantly by geography within the U.S.

Chart notes:

IDNs are defined as a healthcare system or network that includes at least one acute care hospital. A Corporate Parent is defined as a healthcare system or network that does not include an acute care hospital. An Independent is a facility that is not part of a broader healthcare system. Oncology provider defined as a specialty type of hematology or oncology. Includes all facility affiliations for each time period.

State-level variation is wide in the role and presence of integrated delivery systems

Chart 25: Oncology Provider Affiliations by State



- Across the United States, between 33% and 98% of oncologists are affiliated with with some type of corporate parent or an IDN.
- Fourteen states have fewer than 10% of oncologists in independent practices while six states have over 30% of oncologists in independent practices.
- In Arizona, Wisconsin, Montana, Utah and New Hampshire, over 95% of oncologists are affiliated with a corporate parent or an IDN.
- Wyoming and Alaska have the highest percent of independent oncologists at over 50%.

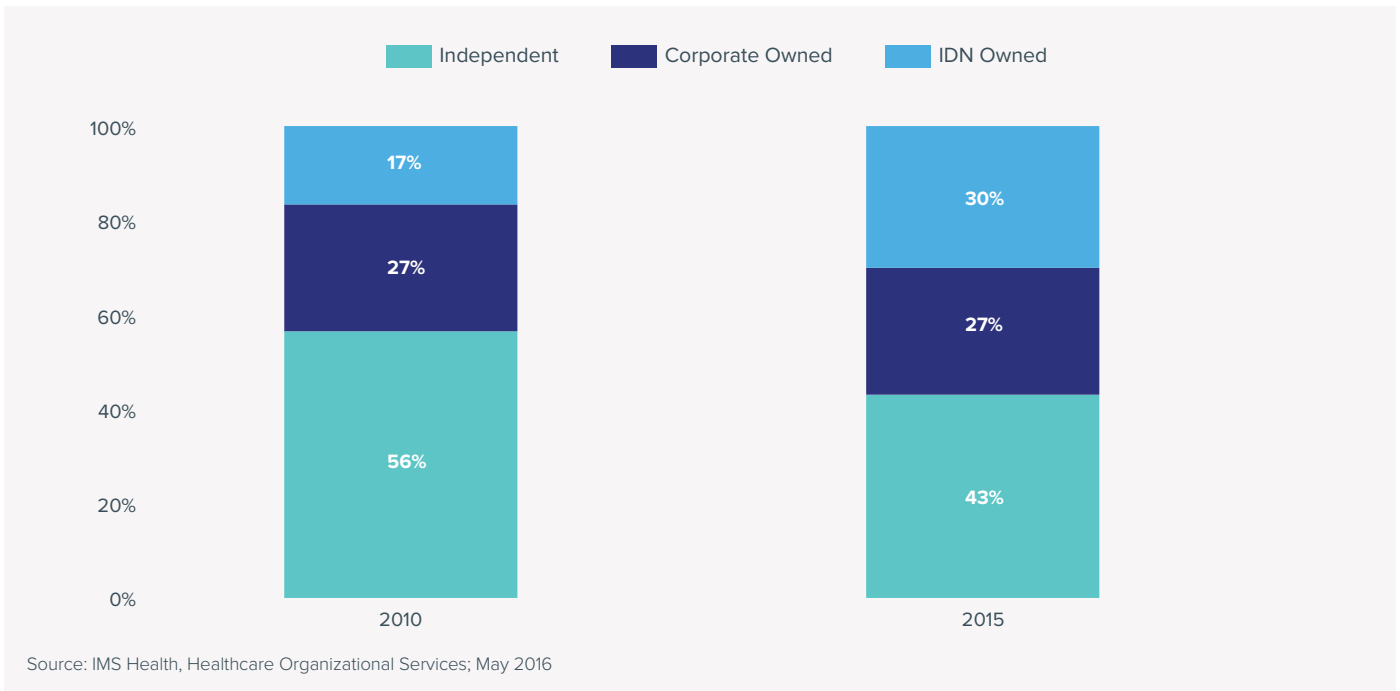
Chart notes:

The term integrated system includes both IDN and Corporate Parent affiliations. IDNs are defined as a healthcare system or network that includes at least one acute care hospital. A Corporate Parent is defined as a healthcare system or network that does not include an acute care hospital. An Independent is a facility that is not part of a broader healthcare system. Oncology provider defined as a specialty type of hematology oncology or oncology. Includes all facility affiliations for each time period.



Ownership of medical groups is shifting as many are being acquired and integrated into larger hospital systems

Chart 26: Oncology Medical Group Ownership Trends



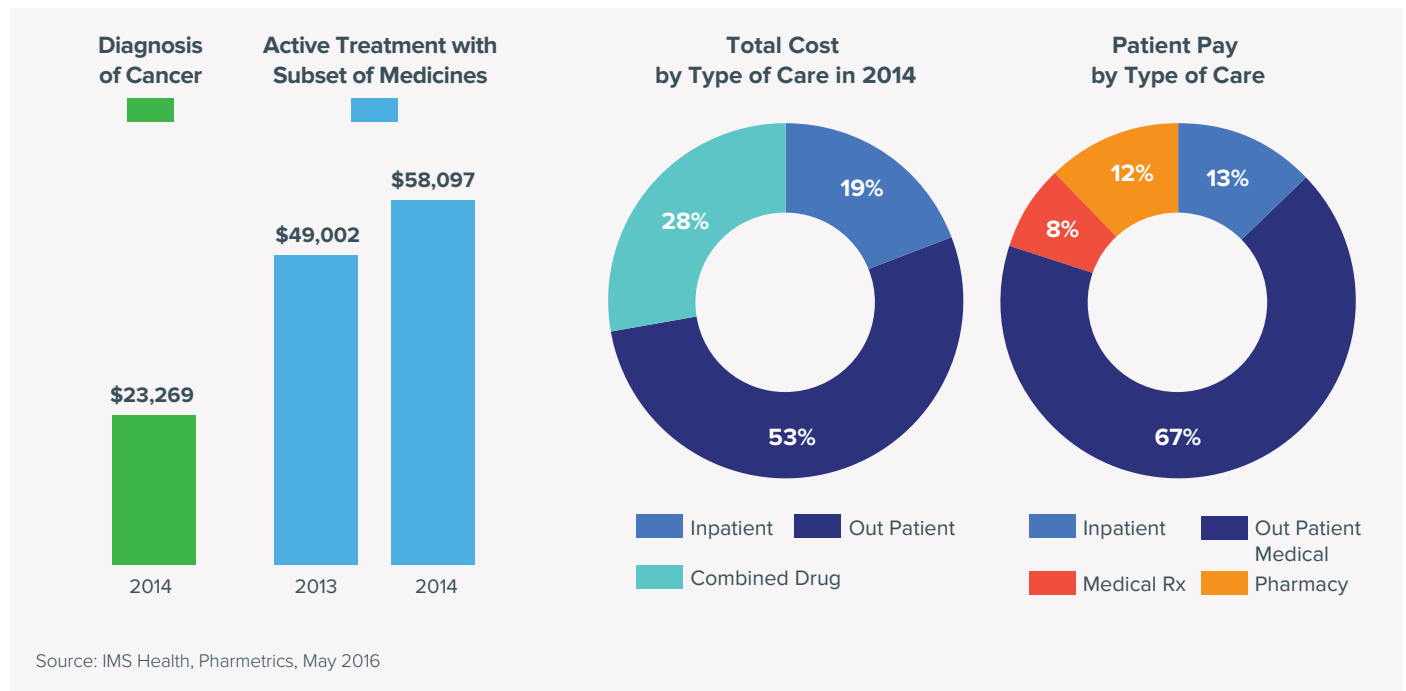
- The amount of medical groups owned as part of an IDN grew from 17% in 2010 to 30% in 2015.
- As oncology medical groups are acquired by healthcare systems, higher reimbursed costs may be charged for the administration of cancer drugs as they become considered hospital outpatient facilities.

Chart notes:

IDNs are defined as a healthcare system or network that includes at least one acute care hospital. A Corporate Parent is defined as a healthcare system or network that does not include an acute care hospital. An Independent is a facility that is not part of a broader healthcare system. Oncology provider defined as a specialty type of hematology oncology or oncology. Includes all facility affiliations for each time period.

Average annual total treatment costs for patients that were in active treatment for cancer reached \$58,097 in 2014, an increase of 19% over 2013

Chart 27: Breakdown of Average Annual Treatment Costs



- For patients in active treatment with a subset of medications, their average annual total cost for care grew to \$58,097 in 2014, up 19% from 2013.
- The average combined cost of all drugs used by patients with a cancer diagnosis represents 28% of the total cost of care.
- Outpatient costs represent 53% of the total cost of care.
- On average, payers cover 90% of the cost of care for oncology patients while patients are responsible for 10% of the cost.
- Out of the total annual patient cost responsibility, 20% is for prescriptions – 8% for medical and 12% for pharmacy prescriptions.
- Outpatient medical services represent the highest percent of patient cost responsibility at 67%.

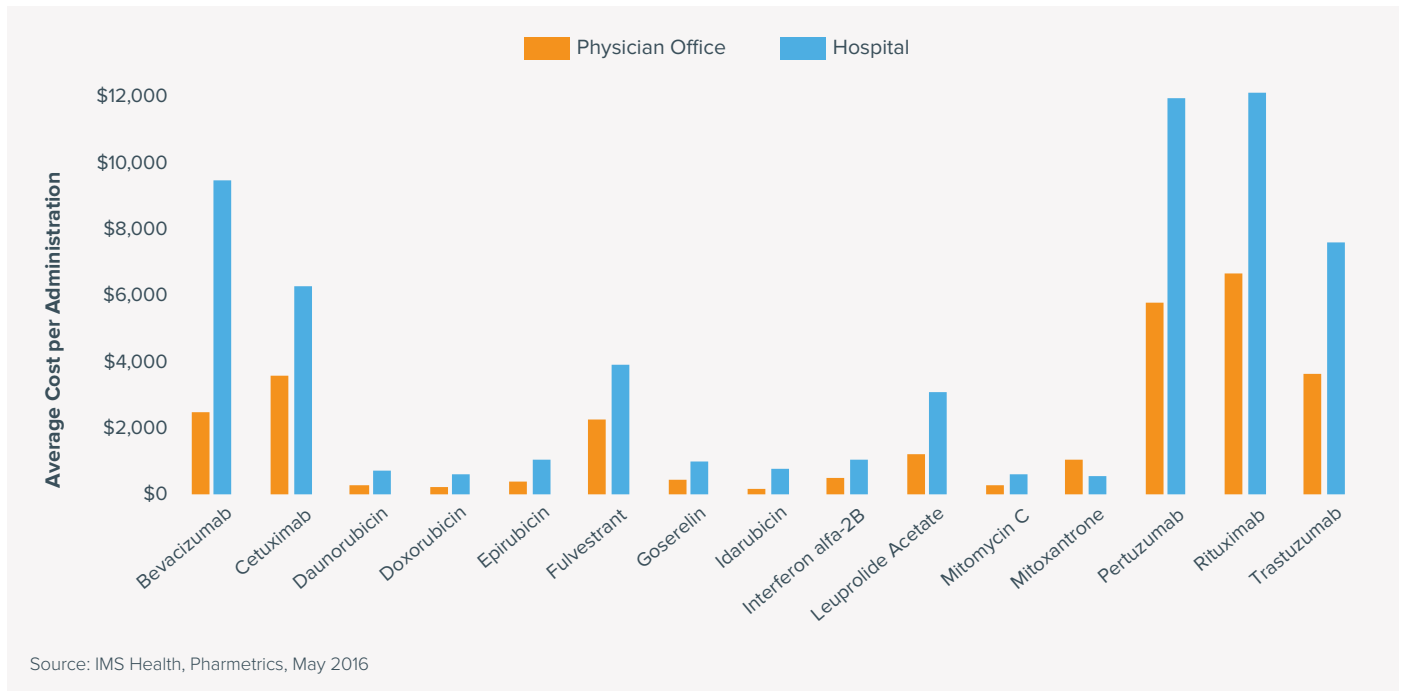
Chart notes:

Average total treatment costs for patients diagnosed with cancer includes all patients regardless of active use of medicines and is for patients in commercial insurance plans. Average yearly out-of-pocket costs derived based on the difference between allowed and paid amounts and considered to be the patient's responsibility. Costs include inpatient, outpatient and pharmacy costs. Average total treatment cost determined by a subset of patients that were actively in treatment during the time period and taking a subset of medicines that represent 60% of all products.



Drug administration costs are typically much higher in hospital facilities than in physician offices

Chart 28: Hospital and Physician Outpatient Costs

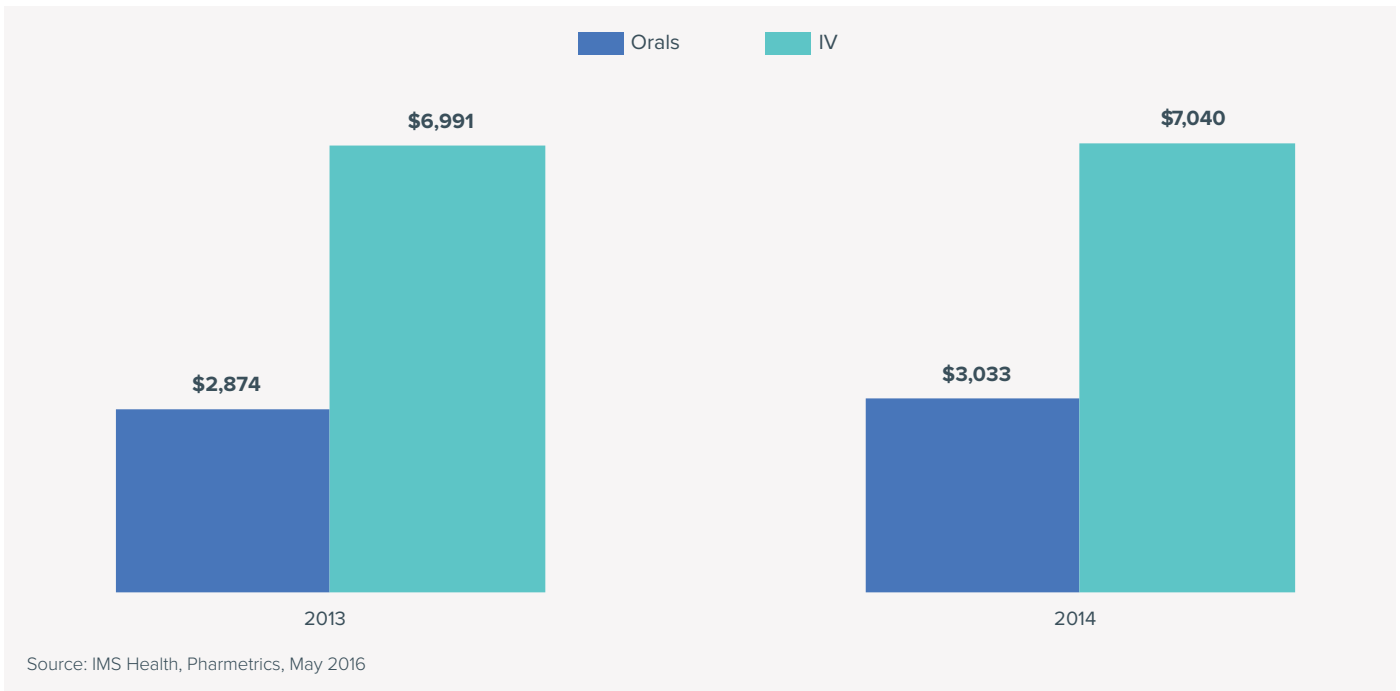


- Average costs for administering cancer drugs are typically twice as much when treatment is received in hospital outpatient settings rather than in physician offices.
- Higher reimbursement levels are in part associated with higher costs incurred by hospitals related to their delivery of care.



Patient responsibility for cost in the U.S. is rising, though partially offset by coupons and other forms of assistance

Chart 29: Average Annual Patient Responsibility for Total Care by Medicine Type



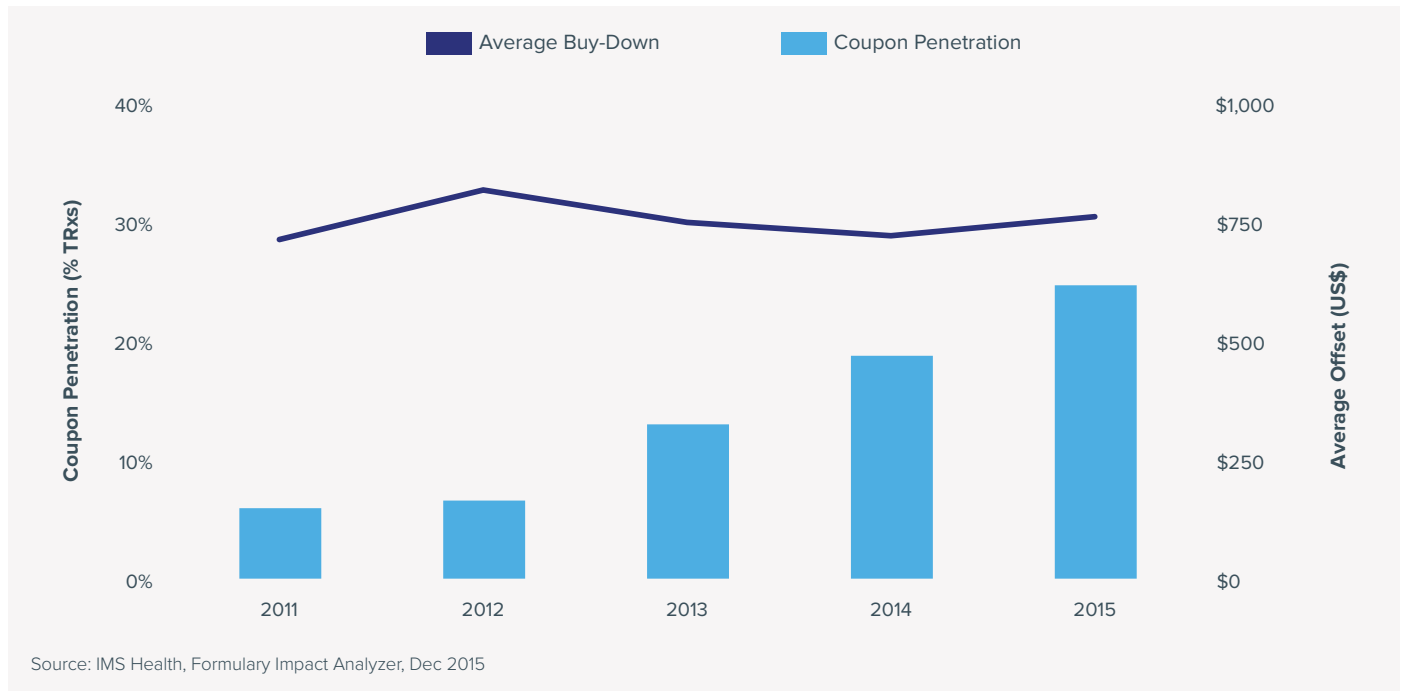
- Patients with commercial insurance who were treated in 2014 with injection or infusion cancer drugs were responsible for over \$7,000 in costs on average.
- Those patients receiving only oral medicines were responsible for an average of over \$3,000 in costs.

Chart notes:

Average yearly out-of-pocket costs derived based on the difference between allowed and paid amounts and considered to be the patient's responsibility. Costs include inpatient, outpatient and pharmacy costs. Based on a subset of patients that were actively in treatment during time period and taking a subset of medicines representing 60% of all products.

Growing use of coupons helps offset patient out-of-pocket costs

Chart 30: Coupon Penetration and Average Offset of Patient Savings Programs in Oral Oncology



- Some type of coupon or patient cost offset was used in over 25% of retail prescriptions for cancer drugs filled by patients with commercial insurance, up from 5% in 2011.
- The increased use of coupons reflects efforts by manufacturers to reduce patient out-of-pocket costs.
- The average cost offset has averaged about \$750 per prescription over the past five years.

Chart notes:

Sample is limited to oral oncology products (capsules and tablets) available through retail and specialty pharmacies. Coupon penetration is calculated as the percent of commercial claims for which an identified coupon is used as either a primary or secondary payer. Average offset is a simple average across brands where a coupon is the secondary payer. IMS Health believes that patient savings programs may be more prevalent than is reflected in the data due to specialty pharmacy sample coverage.

Notes on Sources

IMS MIDAS™ is a unique platform for assessing worldwide healthcare markets. It integrates IMS Health's national audits into a globally consistent view of the pharmaceutical market, tracking virtually every product in hundreds of therapeutic classes and provides estimated product volumes, trends and market share through retail and non-retail channels.

IMS National Sales Perspectives (NSP)™ measures spending within the U.S. pharmaceutical market by pharmacies, clinics, hospitals and other healthcare providers. NSP reports 100% coverage of the retail and non-retail channels for national pharmaceutical sales at actual transaction prices.

PharMetrics Plus™ is a closed-source de-identified longitudinal patient database that captures a patient plan experience through his/her pharmacy, medical provider, and hospital. Patient membership eligibility is accounted for within the source which ensures complete longitudinal activity per patient. PharMetrics Plus captures health activities from a membership of approximately 60Mn lives per year. PharMetrics Plus integrates IMS Health's legacy PharMetrics data with Blue Health Intelligence participating plan claims data.

IMS Healthcare Organization Services (HCOS)™ is an organizational and affiliation reference for hospitals, long-term care and alternate care sites, medical group practices, outpatient surgery centers, diagnostic imaging centers, and home health agencies and the doctors associated with them. Organization data can be aligned and integrated with IMS Health's professional, prescription and/or medicine spending data. HCOS includes single ownership relationships and multiple purchasing, distribution, academic and alliance relationships.

IMS LifeCycle™ R&D Focus™ is a global database for evaluating the market for medicines, covering more than 31,000 drugs in R&D and over 8,900 drugs in active development worldwide. It includes information about the commercial, scientific and clinical features of the products, analyst predictions of future performance, and reference information on their regulatory stage globally.

IMS Disease Insights provides in-depth country level analysis of nine diseases: Alzheimer's, Asthma, Diabetes, COPD, Parkinson's, Melanoma, Stroke Prevention in Atrial Fibrillation, Prostate Cancer and Rheumatoid Arthritis. The offering produces a total of 81 country-specific disease analyses. Disease Insights includes an overview of each disease and available treatment options along with a detailed view of the market and a forecast for approximately 640,000 facilities.

IMS Formulary Impact Analyzer (FIA) provides insight into what impact popular utilization-control measures enforced by managed care organizations and their impact on prescription volumes and patient behavior. Formulary measures include tiered co-pay benefit designs and prior authorization. FIA offers visibility to claims rejected or switched at the pharmacy for reasons such as nonpreferred prescriptions, contraindications as well as refilled too soon. FIA sources include national and regional chains, independent pharmacies and a switch house providing a comprehensive view of retailers and across geographies.

Appendix

New Active Substances Launch and Indication Approvals 2011–2015

Medicines

Basal cell

1. vismodegib
2. sonidegib

Breast

1. pertuzumab,
2. ado-trastuzumab
emtansine
3. palbociclib

Castleman's Disease

1. siltuximab

Cervical

1. bevacizumab

Colorectal

1. regorafenib
2. ziv-aflibercept
3. tipiracil/trifluridine

Gastric

1. ramucirumab

GIST

1. regorafenib

Leukemia

1. bosutinib (CML)
2. omacetaxine
mepesuccinate (CML)

3. radotinib (CML)

4. obinutuzumab (CLL)
5. ponatinib (CML,ALL)
6. blinatumomab (ALL)
7. ibrutinib (CLL)
8. ofatumumab (CLL)

Lung

1. crizotinib
2. afatinib
3. alectinib
4. ceritinib
5. ramucirumab
6. nivolumab
7. pembrolizumab
8. necitumumab
9. osimertinib
10. gefitinib

Lymphoma

1. romidepsin (PTCL,CTCL)
2. brentuximab vedotin
(Hodgkin's ALCL)
3. pixantrone (NHL)
4. rituximab (NHL)
5. idelalisib (CLL, FL, SLL)
6. chidamide (PTCL)
7. mogamulizumab (ATCL)
8. belinostat (PTCL)
9. ibrutinib (MCL, WM)
10. bortezomib (MCL)

Melanoma

1. ipilimumab
2. vemurafenib
3. trametinib
4. dabrafenib
5. pembrolizumab
6. nivolumab
7. talimogene
laherparepvec
8. cobimetinib

Multiple Myeloma

1. carfilzomib
2. pomalidomide
3. daratumumab
4. Ixazomib
5. panobinostat
6. elotuzumab

Myelofibrosis

1. ruxolitinib

Neuroblastoma

1. dinutuximab

Neutropenia

1. tbo-filgrastim

Ovarian

1. olaparib
2. bevacizumab

Pancreatic

1. irinotecan liposome

Polycythemia vera

1. ruxolitinib

Prostate

1. abiraterone acetate
2. enzalutamide
3. ra 223 dichloride

Renal

1. axitinib
2. nivolumab

Sarcoma

1. mifamurtide
(osteo-)
2. trabectedin
(lipo- or leiomyo-)

Thyroid

1. vandetanib
2. cabozantinib
3. lenvatinib mesylate

Appendix notes:

Includes initial and subsequent indications. Excludes supportive care.

Authors



Murray Aitken

Executive Director, IMS Institute for Healthcare Informatics

Murray Aitken is Executive Director, IMS Institute for Healthcare Informatics, which provides policy setters and decision makers in the global health sector with objective insights into healthcare dynamics. He assumed this role in January 2011. Murray previously was Senior Vice President, Healthcare Insight, leading IMS Health’s thought leadership initiatives worldwide. Before that, he served as Senior Vice President, Corporate Strategy, from 2004 to 2007. Murray joined IMS Health in 2001 with responsibility for developing the company’s consulting and services businesses. Prior to IMS Health, Murray had a 14-year career with McKinsey & Company, where he was a leader in the Pharmaceutical and Medical Products practice from 1997 to 2001. Murray writes and speaks regularly on the challenges facing the healthcare industry. He is editor of Health IQ, a publication focused on the value of information in advancing evidence-based healthcare, and also serves on the editorial advisory board of Pharmaceutical Executive. Murray holds a Master of Commerce degree from the University of Auckland in New Zealand, and received an M.B.A. degree with distinction from Harvard University.



Michael Kleinrock

Research Director, IMS Institute for Healthcare Informatics

Michael serves as Research Director for the IMS Institute, setting the research agenda for the Institute, leading the development of reports and projects focused on the current and future role of biopharmaceuticals in healthcare in the U.S. and globally. He joined IMS Health in 1999 and has held roles in consulting, service and marketing and assumed his current role in 2011. Michael holds a B.A. in History and Political Science from the University of Essex, Colchester, U.K. and an M.A. in Journalism and Radio Production from Goldsmiths College, University of London, U.K.

About the Institute

The IMS Institute for Healthcare Informatics leverages collaborative relationships in the public and private sectors to strengthen the vital role of information in advancing healthcare globally. Its mission is to provide key policy setters and decision makers in the global health sector with unique and transformational insights into healthcare dynamics derived from granular analysis of information.

Fulfilling an essential need within healthcare, the Institute delivers objective, relevant insights and research that accelerate understanding and innovation critical to sound decision making and improved patient care. With access to IMS Health's extensive global data assets and analytics, the Institute works in tandem with a broad set of healthcare stakeholders, including government agencies, academic institutions, the life sciences industry and payers, to drive a research agenda dedicated to addressing today's healthcare challenges.

By collaborating on research of common interest, it builds on a long-standing and extensive tradition of using IMS Health information and expertise to support the advancement of evidence-based healthcare around the world.

Research Agenda

The research agenda for the Institute centers on five areas considered vital to the advancement of healthcare globally:

The effective use of information by healthcare stakeholders globally to improve health outcomes, reduce costs and increase access to available treatments.

Optimizing the performance of medical care through better understanding of disease causes, treatment consequences and measures to improve quality and cost of healthcare delivered to patients.

Understanding the future global role for biopharmaceuticals, the dynamics that shape the market and implications for manufacturers, public and private payers, providers, patients, pharmacists and distributors.

Researching the role of innovation in health system products, processes and delivery systems, and the business and policy systems that drive innovation.

Informing and advancing the healthcare agendas in developing nations through information and analysis.

Guiding Principles

The Institute operates from a set of Guiding Principles:

The advancement of healthcare globally is a vital, continuous process.

Timely, high-quality and relevant information is critical to sound healthcare decision making.

Insights gained from information and analysis should be made widely available to healthcare stakeholders.

Effective use of information is often complex, requiring unique knowledge and expertise.

The ongoing innovation and reform in all aspects of healthcare require a dynamic approach to understanding the entire healthcare system.

Personal health information is confidential and patient privacy must be protected.

The private sector has a valuable role to play in collaborating with the public sector related to the use of healthcare data.

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