

# Comparing the Approval and Coverage Decisions of New Oncology Drugs in the United States and Other Selected Countries

Yuting Zhang, PhD; Hana Chantel Hueser; and Inmaculada Hernandez, PharmD, PhD

## ABSTRACT

**BACKGROUND:** Global pharmaceutical sales for anticancer drugs were \$74.4 billion in 2014, ranking first for drugs by therapeutic class. Countries may differ substantially in the approval and coverage decisions for anticancer drugs.

**OBJECTIVE:** To compare the approval and coverage decisions for new anticancer drugs between the United States and 4 other countries: the United Kingdom, France, Australia, and Canada.

**METHODS:** We identified all new anticancer drug indications approved by the FDA between January 1, 2009, and December 31, 2013. For each country, we reviewed the organizations, processes, criteria, and special considerations used to make approval and coverage decisions for the drug indications approved. We further quantified and compared the variations across the 5 countries in the approval and coverage decisions as of June 30, 2014, for new anticancer drug indications.

**RESULTS:** Of 45 anticancer drug indications approved in the United States between January 1, 2009, and December 31, 2013, 67% (30) were approved by the European Medicines Agency, and 53% (24) were approved in Canada and Australia before December 31, 2013. The U.S. Medicare program covered all 45 drug indications, and as of June 30, 2014, the United Kingdom covered 87% (26) of those approved in Europe—58% (26) of the drug indications covered by Medicare. France, Canada, and Australia covered 42% (19), 29% (13), and 24% (11) of the drug indications covered by Medicare, respectively.

**CONCLUSIONS:** Approval and reimbursement decisions vary substantially by country. The United States had the fewest access restrictions, and Australia was the most restrictive of the 5 countries that were examined.

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## What this study adds

- This study updates the previous country comparisons to cover the years 2009-2013 and expands the comparisons to France and Canada.
- Among the 5 countries reviewed, the United States had the fewest access restrictions, and Australia had the most restrictions.
- Countries using cost-effectiveness analyses explicitly are more restrictive in their coverage decisions.

Cancer is among the leading causes of morbidity and mortality worldwide. In 2012 alone, there were 14 million new cancer cases worldwide, 8.2 million cancer-related deaths, and 32.6 million people living with cancer.<sup>1</sup> Cancer treatment is costly. Anticancer drugs are estimated to account for 12% of total direct cancer care costs and 5% of total drug costs worldwide.<sup>2</sup> In 2014, global pharmaceutical sales for anticancer drugs were \$74.4 billion, ranking first in global sales for drugs by therapeutic class.<sup>3</sup>

Scientific understanding of cancer is growing rapidly and has led to a surge in new development of anticancer drugs. Approval and reimbursement decisions may vary substantially by country. Many national health care systems use strategies to rationally allocate scarce health care resources.<sup>4</sup> For instance, the United Kingdom bases its coverage decisions on health technology assessments that include a cost-effectiveness analysis, that is, a drug is covered if it is below a prespecified cost per quality-adjusted life-year (QALY). However, restricting access to anticancer drugs is highly controversial because of the lack of therapeutic alternatives for some types of cancer.

In this study, we compared the approval and coverage decisions for new anticancer drugs between the United States and 4 other countries: the United Kingdom, France, Australia, and Canada. These 4 countries were chosen because, compared with the United States, they accomplish better health outcomes—commonly measured by life expectancy, infant mortality, and percentage of population with multiple chronic conditions—with less than or about half of the total health care expenditures per capita in the United States.<sup>5</sup> All 5 countries rely on a market economy and share similar political systems. France, the United Kingdom, and Australia often rank at the top based on measures such as efficiency and equity, but each has its unique way for allocating health care resources.<sup>5,6</sup>

## What is already known about this subject

- Previous studies have shown that 42% of anticancer drugs approved in the United States from 2004 to 2008 were approved in the United Kingdom, and 35% of anticancer drugs approved in the United States from 2000 to 2009 were approved in Australia.
- The U.S. Medicare program covers anticancer drugs through its Part B and Part D components: Oncologic drugs that need to be administered by physicians are generally covered by Part B with a fixed 20% coinsurance, and oral anticancer drugs are covered under Medicare Part D with varying coinsurance depending on plan formularies and benefit structures.
- Australia, Canada, and the United Kingdom use cost-effectiveness analyses explicitly, and France considers costs implicitly in its coverage decisions.

Canada was also chosen for its geographic proximity to the United States. We reviewed the organizations, processes, criteria, and special considerations used by these countries to make approval and coverage decisions for new anticancer drug indications that were approved by the U.S. Food and Drug Administration (FDA) between January 1, 2009, and December 31, 2013. We further quantified and compared the variations across the 5 countries of the approval and coverage decisions for these new anticancer drug indications before June 30, 2014.

### An Overview of the International Comparison of Anticancer Drug Approval and Coverage

**United States.** In the United States, the FDA's Center for Drug Evaluation and Research evaluates the safety and efficacy of new medications and makes decisions about whether a new drug should enter the U.S. market on the basis of safety, quality, and efficacy.<sup>7</sup> Cost is not a criterion used for approving a new drug. For anticancer drugs, the FDA Office of Hematology and Oncology Drug Products facilitates the rapid review of promising new cancer therapies.

Once a new drug is approved by the FDA, public and private insurance programs separately evaluate the coverage decisions for their own covered patients. There are 3 main publicly funded insurance programs: Medicare covers the elderly and disabled; Medicaid covers the poor; and the Department of Veterans Affairs covers veterans. Medicare covers anticancer drugs through its Part B and Part D programs. Oncologic drugs that need to be administered by physicians are generally covered by Part B, with a fixed 20% coinsurance after a deductible, and the law requires Medicare Part B to cover any drug used in an "anticancer chemotherapeutic regimen," as long as the use is "for a medically accepted indication," which includes off-label use—an indication not approved by the FDA but accepted by physicians as medically beneficial treatment.<sup>8</sup> Oral anticancer drugs, which patients can obtain from a pharmacy, are covered under Medicare Part D, with varying coinsurance depending on plan formularies and benefit structures. For veterans, anticancer drugs are covered, as long as the drug is used for an approved indication. For individuals with commercial insurance covering prescription drugs, each insurance plan maintains a formulary, which is a list that indicates what prescription drugs are covered by the plan and the rate of copayments or coinsurance for the drugs.

**United Kingdom.** During the study period, the United Kingdom was a member of the European Union, where the European Medicines Agency (EMA) appraises the safety and efficacy of new medications and supervises their entrance to and duration on the market in the European Union. The EMA applies its centralized procedure to determine which medications are approved to enter the market in all European Union member countries.

For the United Kingdom specifically, the National Institute for Clinical Excellence (NICE) assesses the technologies referred by the U.K. Department of Health and issues coverage recommendations to the U.K. National Health Service (NHS).<sup>11</sup> NICE recommendations are based on drug efficacy, safety, and cost-effectiveness. NICE cost-effectiveness coverage threshold for cancer drugs is £50,000 (U.S. \$74,500) per QALY, which is £12,000 (U.S. \$17,880) per QALY higher than for the rest of the drug classes set at £38,000 (U.S. \$56,620) per QALY.<sup>12</sup> In addition, the Cancer Drugs Fund provides £200 million (U.S. \$298 million) each year to cover anticancer drugs not covered by the NHS, and some pharmaceutical companies have negotiated patient access schemes with the NHS for drugs not recommended by NICE.<sup>13</sup> These risk-sharing contracts allow patients to have access to some drugs not covered otherwise.<sup>14</sup> Almost half of the drugs with currently approved patient access schemes are anticancer drugs.<sup>15</sup>

**France.** After a drug is approved by the EMA to enter the European market, the French Agency for the Safety of Medicines and Health Products must approve all medications for use in France.<sup>16</sup>

The Transparency Committee of the High Authority of Health recommends the coverage of new drugs on the market in France. The committee appraises the severity of the drug's cancer indication; its effectiveness; its safety profile; whether it is intended to prevent, cure, or relieve symptoms; and how it compares to other drugs on the market.<sup>17</sup> The National Union of Health Insurance Funds uses the determinations of the Transparency Committee, as well as the severity of the indication, to define the rate of permissible reimbursement benefits and fixed rate support care for the drug. Orphan drugs seen as irreplaceable and lifesaving receive 100% reimbursement, and this applies to many of the available cancer drugs on the List of Long-Term Afflictions.<sup>18</sup>

**Australia.** The Australian Therapeutic Goods Administration approves new drugs to enter the Australian market. The approval decision is based on the efficacy, cost-effectiveness, and safety of a drug.<sup>19,20</sup>

The Pharmaceutical Benefits Advisory Committee is responsible for the coverage decisions in Australia after a drug is approved.<sup>21</sup> A coverage decision is based on the efficacy, cost-effectiveness, and safety of the drug as compared with other treatments currently covered for the same indication. There is no stated cost-effectiveness threshold, but the regularly implied level is AUD \$50,000 (U.S. \$39,000) per QALY.<sup>22</sup> The only exception to this pathway for coverage is for orphan drugs, whose coverage is usually rejected by the Pharmaceutical Benefits Advisory Committee based on cost-effectiveness and is reconsidered under the Life Saving Drugs Program. Under this program, orphan drugs for rare and life-threatening forms of cancer are covered for eligible patients.

**Canada.** Health Canada's drug review process begins with its Therapeutic Products Directorate, a board of scientists that assesses the quality, safety, and efficacy of a drug and decides whether the benefits outweigh the risks of allowing the drug to enter and continue to be on the market.<sup>23</sup>

The Canadian Agency for Drugs and Technologies in Health runs a Common Drug Review to rate the clinical and cost effectiveness of drugs for the purpose of recommending drugs to be covered by the provinces, but each province can make its own decision.<sup>24</sup> The pan-Canadian Oncology Drug Review evaluates oncology drugs based on clinical evidence and cost-effectiveness, recommends funding decisions, and includes suggested dosage and place in therapy.<sup>25</sup> Then, the provinces make their respective coverage decisions independently on the basis of the information provided by the pan-Canadian Oncology Drug Review.

## Methods

### Identification of FDA-Approved New Oncology Drugs

We identified new drugs approved by the FDA for the treatment of any cancer between January 1, 2009, and December 31, 2013, using the FDA (<http://www.fda.gov/>) and CenterWatch (<http://www.centerwatch.com/>) websites (Table 1). Previous researchers have shown that new drugs are approved more quickly in the United States, compared with European countries, so using the list of new drugs approved by the FDA provided the most updated list of new drugs.<sup>26,27</sup> Our sample included active ingredients approved for new cancer indications between January 1, 2009, and December 31, 2013. Pharmaceutical agents used to treat any chemotherapy-induced side effects or cancer-related pains were excluded. The final list included 41 unique drugs that were approved for 45 drug indications related to cancer. We also stratified the analyses by each drug's route of administration: oral or injectable.

### Identification of Approval Data for New Anticancer Drugs

The following websites were checked to obtain approval dates between January 1, 2009, and December 31, 2013: EMA (<http://www.ema.europa.eu/ema/>) for the United Kingdom and France; the French Agency for the Safety of Medicines and Health Products for France (<http://agence-prd.ansm.sante.fr/php/ecodex/index.php>); the Australian Therapeutic Goods Administration (<http://www.tga.gov.au/>) for Australia; and the Drug Product Database on the Health Canada website (<http://webprod5.hc-sc.gc.ca/dpd-bdpp/index-eng.jsp>) for Canada.

### Identification of Coverage Decision Data of New Anticancer Drugs

Between March and June 2014, we checked the following websites to collect coverage information for all approved drug indications in each country. We reviewed the British National Formulary websites to identify whether approved

drugs were covered by the NHS.<sup>28</sup> For drug coverage in France, we reviewed the Public Database of Medications and the Technical Agency for Hospital Information (Agence Technique de l'Information sur l'Hospitalisation).<sup>29,30</sup> We searched the Pharmaceutical Benefits Advisory Committee's website to determine whether a drug was covered in Australia.<sup>31</sup> The pan-Canadian Oncology Drug Review database was used to identify coverage data for the drugs approved in Canada.<sup>32</sup> Because all the study drugs were approved and covered by Medicare in the United States, we used Medicare as a benchmark to compare with the other countries. We calculated the percentages of approved U.S. drugs that were approved, approved and covered, and approved but not covered in other countries. If a drug was approved before December 31, 2013, in other countries, it was defined as approved; if a drug was covered at the time of collecting these data, it was defined as covered.

## Results

Before December 31, 2013, 67% (30) of those 45 drug indications were approved by the EMA and therefore available (but possibly not covered) in the United Kingdom, and France approved all 30 EMA-approved drug indications. In Canada and Australia, 53% (24) of the drug indications were approved.

All these drug indications were covered by Medicare, with 23 covered in Medicare Part B and 22 covered in Medicare Part D. Figure 1 summarizes the percentage of drugs covered by Medicare that were approved and covered by other countries as of June 30, 2014, showing the total as well as stratifying by route of administration. The NHS covered 87% (26) of the 30 drugs approved in the United Kingdom, or 58% (26) of the 45 drug indications covered by Medicare. France covered 63% of the 30 drug indications approved in France, equivalent to 42% (19) of what Medicare covered, followed by Canada with 29% (13) and Australia with 24% (11) of what Medicare covered.

After stratifying by route of administration, we found that the coverage of oral anticancer drugs is less restrictive than the coverage of injections in all non-U.S. countries. Specifically, the United Kingdom covered 71% (17) of all oral anticancer drug-indications in our list, but only 43% (9) of the injectable anticancer drug-indications"

## Discussion

We compared the approval and coverage decisions in 5 developed countries for 45 new cancer drug indications that were approved by the FDA between January 1, 2009, and December 31, 2013. Medicare covered all 45 drug indications approved. The list of 5 countries in order from the most restrictive to the least restrictive is Australia, Canada, France, the United Kingdom, and the United States.

Mason et al. (2010) compared the coverage decisions in the United States and the United Kingdom for 46 anticancer drugs

## Comparing the Approval and Coverage Decisions of New Oncology Drugs in the United States and Other Selected Countries

**TABLE 1** List of New Oncology Drugs Approved by the FDA, January 1, 2009-December 31, 2013

Brand Name	Active Ingredient	Indication	Route of Administration	Approval Dates				Coverage			
				FDA	EMA	Canada	Australia	United Kingdom	France	Canada	Australia
Abraxane	Paclitaxel protein-bound particles	Non-small cell lung cancer	Injectable	October 2012	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Adcetris	Brentuximab vedotin	Hodgkin lymphoma and anaplastic large cell lymphoma	Injectable	August 2011	October 2012	February 2013	December 2013	Yes	Yes	Yes	No
Afinitor	Everolimus	Renal cell carcinoma	Oral	March 2009	August 2009	Not Approved	August 2009	Yes	Yes	NA	Yes
Afinitor	Everolimus	Advanced pancreatic neuroendocrine tumors	Oral	May 2011	September 2011	August 2011	July 2012	Yes	Yes	Yes	Yes
Afinitor	Everolimus	Hormone receptor-positive, HER2-negative breast cancer	Oral	July 2012	July 2012	January 2013	February 2013	Yes	Yes	Yes	Yes
Arzerra	Ofatumumab	Chronic lymphocytic leukemia	Injectable	October 2009	April 2010	August 2012	Not Approved	Yes	No	No	NA
Avastin	Bevacizumab	Renal cell carcinoma	Injectable	July 2009	January 2008	Not Approved	Not Approved	Yes	No	NA	NA
Bosulif	Bosutinib	Ph+ chronic myelogenous leukemia	Oral	September 2012	March 2013	Not Approved	Not Approved	Yes	Yes	NA	NA
Cometriq	Cabozantinib	Metastatic medullary thyroid cancer	Oral	November 2012	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Erivedge	Vismodegib	Basal cell carcinoma	Oral	January 2012	July 2013	August 2013	May 2013	Yes	Yes	Yes	No
Erwinaze	Asparaginase Erwinia chrysanthemi	Acute lymphoblastic leukemia	Injectable	November 2011	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Folotyn	Pralatrexate	Peripheral T-cell lymphoma	Injectable	September 2009	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Gazyva	Obinutuzumab	Previously untreated chronic lymphocytic leukemia	Injectable	October 2013	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Gilotrif	Afatinib	Metastatic non-small cell lung cancer with EGFR mutations	Oral	July 2013	September 2013	Not Approved	November 2013	No	Yes	NA	No
Halaven	Eribulin mesylate	Metastatic breast cancer	Injectable	November 2010	March 2011	March 2012	August 2012	Yes	Yes	Yes	No
Herceptin	Trastuzumab	Gastric cancer	Injectable	October 2010	January 2010	August 2010	September 2010	Yes	Yes	No	Yes
Iclusig	Ponatinib	Chronic myeloid leukemia and Philadelphia chromosome positive acute lymphoblastic leukemia	Oral	December 2012	July 2013	Not Approved	Not Approved	Yes	No	NA	NA
Imbruvica	Ibrutinib	Mantle cell lymphoma	Oral	November 2013	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Inlyta	Axitinib	Advanced renal cell carcinoma	Oral	January 2012	September 2012	August 2012	July 2012	Yes	Yes	Yes	No
Istodax	Romidepsin	Cutaneous T-cell lymphoma	Injectable	November 2009	Not Approved	Not Approved	August 2013	NA	NA	NA	No
Jevtana	Cabazitaxel	Prostate cancer	Injectable	June 2010	March 2011	August 2011	December 2011	Yes	Yes	No	Yes
Kadcyla	Ado-trastuzumab	HER2-positive metastatic breast cancer	Injectable	February 2013	November 2013	October 2013	September 2013	No	Yes	Yes	No

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## Comparing the Approval and Coverage Decisions of New Oncology Drugs in the United States and Other Selected Countries

**TABLE 1** List of New Oncology Drugs Approved by the FDA, January 1, 2009–December 31, 2013 (continued)

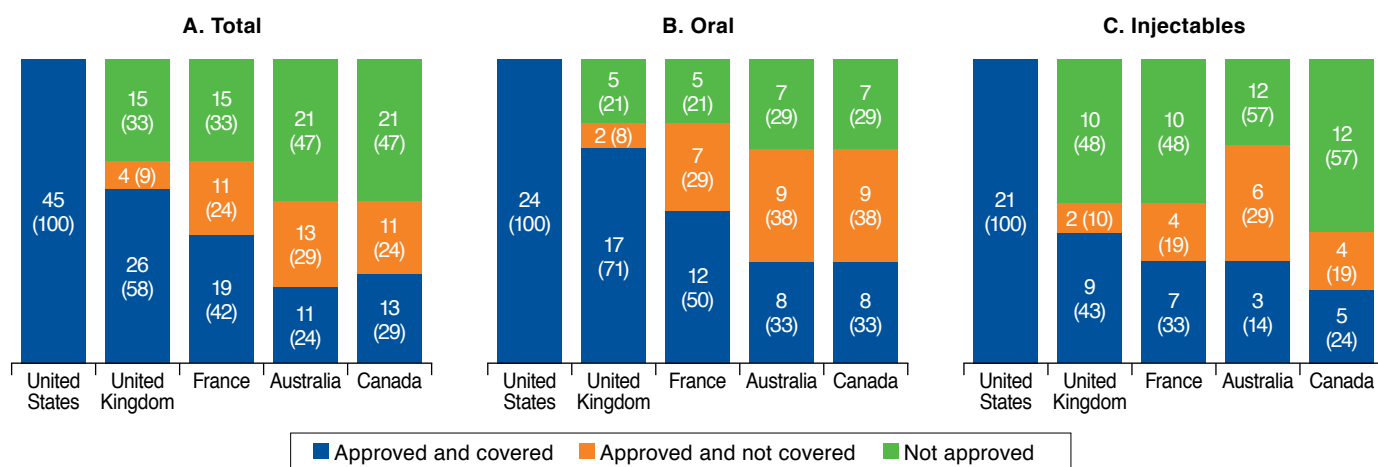
Brand Name	Active Ingredient	Indication	Route of Administration	Approval Dates				Coverage			
				FDA	EMA	Canada	Australia	United Kingdom	France	Canada	Australia
Kyprolis	Carfilzomib	Multiple myeloma	Injectable	July 2012	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Marchiqibo	Vincristine	Ph-acute lymphoblastic leukemia	Injectable	August 2012	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Mekinist	Trametinib	Unresectable or metastatic melanoma with BRAF V600E or V600K mutations	Oral	May 2013	Not Approved	August 2013	Not Approved	NA	NA	No	NA
Perjeta	Pertuzumab	HER2+ metastatic breast cancer	Injectable	June 2012	March 2013	May 2013	May 2013	Yes	Yes	Yes	No
Pomalyst	Pomalidomide	Relapsed and refractory multiple myeloma	Oral	February 2013	August 2013	Not Approved	Not Approved	Yes	No	NA	NA
Provenge	Sipuleucel-T	Hormone refractory prostate cancer	Injectable	May 2010	September 2013	Not Approved	Not Approved	No	No	NA	NA
Revlimid	Lenalidomide	Mantle cell lymphoma	Oral	June 2013	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Stivarga	Regorafenib	Metastatic colorectal cancer	Oral	September 2012	September 2013	April 2013	November 2013	Yes	No	No	No
Stivarga	Regorafenib	Gastrointestinal stromal tumor	Oral	February 2013	Not Approved	April 2013	Not Approved	NA	NA	No	NA
Sutent	Sunitinib	Pancreatic neuroendocrine tumors	Oral	May 2011	December 2010	Not Approved	March 2011	Yes	Yes	NA	Yes
Sylatron	Peginterferon alfa-2b	Melanoma	Injectable	April 2011	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Synribo	Omacetaxine	Chronic or accelerated phase chronic myeloid leukemia	Injectable	October 2012	Not Approved	Not Approved	Not Approved	NA	NA	NA	NA
Tafinlar	Dabrafenib	Unresectable or metastatic melanoma with BRAF V600E mutation	Oral	May 2013	September 2013	August 2013	August 2013	No	No	No	Yes
Vandetanib	Vandetanib	Thyroid cancer	Oral	April 2011	February 2012	February 2012	January 2013	Yes	Yes	No	No
Votrient	Pazopanib	Renal cell carcinoma	Oral	October 2009	June 2010	August 2010	June 2010	Yes	No	Yes	Yes
Votrient	Pazopanib	Soft tissue sarcoma	Oral	April 2012	August 2012	August 2010	May 2011	Yes	No	No	Yes
Xalkori	Crizotinib	ALK+ non-small cell lung cancer	Oral	August 2011	October 2012	May 2012	September 2013	Yes	Yes	No	No
Xgeva	Denosumab	Giant cell tumor of bone	Injectable	June 2013	Not Approved	June 2011	Not Approved	NA	NA	No	NA
Xtandi	Enzalutamide	Metastatic castration-resistant prostate cancer	Oral	August 2012	June 2013	June 2013	Not Approved	Yes	No	Yes	NA
Yervoy	Ipilimumab	Metastatic melanoma	Injectable	March 2011	July 2011	March 2012	June 2011	Yes	No	Yes	Yes
Zaltrap	Ziv-aflibercept	Metastatic colorectal cancer	Injectable	August 2012	February 2013	Not Approved	April 2013	Yes	Yes	NA	No
Zelboraf	Vemurafenib	BRAFm+ melanoma	Oral	August 2011	February 2012	March 2012	May 2012	Yes	Yes	Yes	No
Zytiga	Abiraterone	Prostate cancer	Oral	May 2011	September 2011	July 2011	March 2012	Yes	Yes	Yes	Yes

Sources: The FDA and CenterWatch websites were used to identify drugs approved by the FDA for the treatment of any cancer between the dates shown above (<http://www.fda.gov/>; <http://www.centerwatch.com/>).

Notes: The date December 31, 2013, was used as the end point for approval decisions, and June 30, 2014, was used as the end point for coverage decisions in non-U.S. countries. NA denotes not applicable because these drugs were not approved in other countries, so they were not covered.

EMA = European Medicines Agency; FDA = U.S. Food and Drug Administration.



**FIGURE 1** Comparison of Approval and Coverage Decisions in Other Countries as Percentages of Drugs That Were Approved in the United States and Covered by Medicare, by Route of Drug Administration

Sources: For the United Kingdom, we reviewed the National Institute for Health and Care Excellence (<https://www.nice.org.uk/>) and the British National Formulary (<https://www.bnf.org/>) websites; for France, we reviewed the Public Database of Medications in France (<http://base-donnees-publique.medicaments.gouv.fr/index.php>); for Australia, we searched the Pharmaceutical Benefits Advisory Committee's webpage (<http://www.pbs.gov.au/info/industry/listing/participants/pbac>); and for Canada, we searched the pan-Canadian Oncology Drug Review database (<https://www.cadth.ca/pcodr>). All data were collected between March and June 2014. Further information on the algorithms used to identify coverage is available upon request.

Note: Results are expressed as n (%).

approved by the FDA from 2004 through 2008.<sup>10</sup> In our study, we updated the list of anticancer drugs approved between 2009 and 2013 and found that the proportion of covered medications increased from 42% as reported by Mason et al. to 58%. Wilson et al. (2011) compared the cancer drug coverage decisions of the United States and Australia for 34 drugs approved by the FDA between 2000 and 2009, and they found that 35% of the drugs approved by the FDA were approved and covered in Australia.<sup>33</sup> During our study period, we found that the proportion of covered medications decreased from 35% to 24%.

Of the 5 countries we reviewed, Australia, Canada, and the United Kingdom used cost-effectiveness analyses explicitly in their coverage decisions. France considered cost implicitly and did not compare health gains against an explicit and rigid cost-effectiveness threshold. Use of cost-effectiveness in coverage decisions was relatively limited in the United States, as compared with the other 4 countries. Medicare has used cost-effectiveness analysis to inform its coverage decisions for preventive care services, but it does not and is unlikely that it will use explicit and rigid cost-effectiveness thresholds in coverage decisions for treatments, as in the United Kingdom.<sup>34</sup> Nevertheless, allowing the flexible use of cost-effectiveness analysis to guide some reimbursement policies may be beneficial, especially for conditions with multiple treatment options and existing rigorous comparative effectiveness evidence. For example, there can be flexibilities in different thresholds for different

subgroups, different conditions, how well patients respond to the treatment, and patient life expectancy.<sup>35</sup> In fact, under the U.S. Affordable Care Act, the payment and integrated delivery models incentivize high-value cancer care, ranging from preventive screening, to value-based treatment, and to palliative care to end-of-life patients. For example, in the Medicare program, accountable care organization providers have incentives to use low-cost and high-value oncology care to manage their patients' health.<sup>36</sup>

### Limitations

There are several limitations in this study. First, the results on the comparative coverage of anticancer drugs in 5 countries are not generalizable to other therapeutic classes. Coverage of anticancer drugs is likely to differ from other therapeutic classes because cancer is often a life-threatening illness. Second, we did not evaluate when manufacturers actually submitted the approval requests to the approval agencies of the different countries. If manufacturers did not submit to the EMA during the study period, we would not have been able to observe those approval dates. However, previous researchers have shown that manufacturers often submitted to the FDA and the EMA around the same time and submitted to Australian and Canadian agencies within 3 months after submission to the FDA.<sup>37</sup> Third, we only reported whether a drug was covered in a specific country during our study period and did not report

actual coverage dates because countries do not routinely report these dates. Finally, we did not compare cancer outcomes across countries.

## Conclusions

Of 45 anticancer drug indications approved in the United States between January 1, 2009, and December 31, 2013, 67% (30) were approved by the EMA, and 53% (24) were approved in Canada and Australia before December 31, 2013. As of June 30, 2014, in the United States, Medicare covered all 45 drug indications, while the United Kingdom, France, Canada, and Australia covered 58% (26), 42% (19), 29% (13), and 24% (11) of that number, respectively.

## Authors

YUTING ZHANG, PhD, Department of Health Policy and Management, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, Pennsylvania; HANA CHANTEL HUESER, Department of Biological Sciences, Dietrich School of Arts and Sciences, University of Pittsburgh, Pittsburgh, Pennsylvania; and INMACULADA HERNANDEZ, PharmD, PhD, Department of Pharmacy and Therapeutics, School of Pharmacy, University of Pittsburgh, Pittsburgh, Pennsylvania.

AUTHOR CORRESPONDENCE: Yuting Zhang, PhD, Department of Health Policy and Management, University of Pittsburgh, 130 De Soto St., Crabtree Hall A664, Pittsburgh, PA 15261. Tel.: 412.383.5340; E-mail: ytzhang@pitt.edu.

## DISCLOSURES

No outside funding supported this study, and the authors report no conflicts of interest.

Study concept and design were contributed primarily by Zhang, along with Hernandez and Hueser. All authors participated in data collection, and data interpretation was performed by Zhang and Hernandez, along with Hueser. The manuscript was written and revised by Zhang and Hernandez, along with Hueser.

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