Evaluating the Need for an Orphan Drug Act in India by comparing it with the US Orphan Drug Act of 1983

by

Dhiren V. Aaytee

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Abstract

The enactment of The Orphan Drug Act on January 4, 1983, triggered the development of orphan drugs that are used to treat rare diseases prevalent in the US. It provided multiple incentives to the pharmaceutical industry to develop these orphan drugs and make them profitable. In India, the health-care industry is still developing, and there is a negligible market for orphan drugs. The unavailability of orphan drugs to all economic classes of the public has negatively affected the health condition of many Indians. An analysis was performed using the generic name of FDA-approved orphan drugs and compared their availability in India. Results showed that though a good number of drugs were available in India, overall no incentives were provided to the pharmaceutical industries. Thus, there is need for a law similar to the US orphan drug act in India to make the orphan drugs accessible and affordable to those with rare diseases.

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Introduction

Health issues are widespread and one of the major concerns in current society is rare diseases. Rare diseases are often progressive, chronic, leading to disability and even death because of no proper treatment (Wastfelt, Fadeel, & Henter, 2006). The US Congress has defined rare disease as "one that affects less than 200,000 people in United states, or one that affects more than 200,000 in United states and for which there is no reasonable expectation that the cost of developing and making available in the United States a drug for such disease or condition will be recovered from sales in the US of such drug" (Rogoyski, 2006). The European Union (EU) defines rare diseases as "a disease with prevalence of five or less cases per 10,000" (Wastfelt, Fadeel, & Henter, 2006). About 6,000 to 7,000 rare diseases have been identified throughout the world, of which only 500 have known therapies (Hiranjith, 2016).

Rare diseases range from being pathogenic to genetic (hereditary), physiological, or deficiency-related. These diseases were neglected due to the low occurrence and poor awareness which made the pharmaceutical companies less interested in developing rare disease drugs, also known as "orphan drugs (Sharma et al., 2010). EURORDIS in 2008, initiated a program to increase awareness of rare diseases throughout the world. US joined this program in 2009 (Rarediseaseday, n.d.) Every year the last day of February is considered as "Rare Disease Day" (Rarediseaseday, n.d.)

The most time consuming and expensive period of developing a new drug is Clinical trials (DiMasi, Hansen, & Grabowski, 2003). At present, it is estimated that $350 - $850 million USD are invested to bring a drug from its discovery into the market (Matthew, 2013). Drugs for common diseases have a large market (owing to the vast population being affected by the

disease). As a result, it is profitable for pharmaceutical companies to conduct research and development activities in such therapeutic areas (Vernon, Golec, & Dimasi, 2010).

Many initiatives were taken by various countries to attract pharmaceutical innovators for their investment in orphan drug development, such as the enactment of the Orphan Drug Act in 1983 by the U.S Congress, followed by a similar law in Japan in 1985, Australia in 1997 and by the European Union in the year 2000 (Lavandeira, 2002).

The U.S. Orphan Drug Act

Prior to 1983, very few orphan drugs were available in the market as the pharmaceutical companies were not willing to invest due to the small population and little or no incentives. The Congress passed, "The US Orphan Drug Act" on January 4, 1983 to conduct studies on rare diseases and encourage orphan drug development (Sharma et al., 2010).

The orphan drug act supported and encouraged companies to treat the patients with rare diseases. It provides fee waivers and incentive plans that help the companies recover their production costs, as the patient population is small and the investment is high; but, more importantly, it saves lives of those patients (Tiwari, 2014). The law provided benefits such as 7 years of marketing exclusivity for an approved orphan drug to the sponsor, a tax credit of 50% on the investment made on conducting clinical trials and federal grants to test new diagnostic procedures. In addition to the above mentioned benefits pharmaceutical companies get regulatory fee waivers which are generally charged to review the new drug application (NDA).

There have been multiple amendments to the Orphan Drug Act since it was signed into a law in 1983. There was an amendment made to the original law in 1984 which provided federal grants to pharmaceutical companies and research organizations to assess the orphan-designated

drugs for their safety and efficacy. In 1992, the FDA created a process to hasten the approval procedures with the help of surrogate points. This was very helpful in the case of orphan drugs, which are needed for serious diseases (Coles & Cloyd, 2012). In 1997, the FDA Modernization Act, exempted pharmaceutical companies from paying the New Drug Application (NDA) user fee for the review of orphan drug application.

This law was one of a kind and a benchmark for success. Many other countries incorporated similar rules and regulations which helped the orphan drug market to develop and help the rare disease patients. The FDA Office of Orphan Product Development (OOPD) was established for evaluation and development of new drugs, biologics devices or medicinal foods which help treat rare diseases. It also evaluates clinical data, designates orphan drug status and awards grants for research (Tiwari, 2014).

Between 1983 and 2000, an estimated 3095 drugs were given an orphan drug designation; out of these, 476 have been given approval for marketing and correspond to treatment of an estimated 14 million patients annually. In 2012 alone, 13 orphan drugs were approved for treating rare diseases in US (Tiwari, 2014).

Clinical studies in rare diseases

Clinical trials are critical for any drug to come into the market, but in the case of rare disease, carrying out clinical trials becomes even more difficult because of the very small population of patients and the complexity of the condition.

Advances in technology and science help in the innovation of new treatments for rare diseases. Owing to the proper implementation of the orphan drug act there has been tremendous advancement in the number of orphan drugs available in the U.S. market. The two key funding

sources of research are the U.S. government and the private investment companies who fund large scale clinical trials. Between 1985 and 1995, a study conducted by Shulman and Monocchia examined 121 orphan drug approvals which were used for 102 rare diseases. The average time taken for a new drug from the initial application of investigational new drug to submission of the new drug application is 8 years (Kesselheim, 2010). Though there have been many hurdles like the small population and not understanding the causes of the underlying rare disease, there has been a remarkable growth in the treatment of orphan diseases with innovative new drugs.

Challenges faced by orphan drugs.

The biggest challenge with orphan drugs is controlling its development cost (Azie, 2012). Pharmaceutical companies and investors are generally not interested in funding for basic rare disease research because of the small population and the marginal profits. Choosing the primary end point to test the novel orphan drug along with issues with assessing safety data in clinical trials for orphan drugs are some of the challenges faced by orphan drugs (Cassino, 2013).

Growth of Orphan drugs

Ever since the orphan drug act (ODA) came into place in 1983, the number of orphan drugs coming into market has been increasing every year which ultimately is helping the rare disease patients. Before the act, only 10 orphan drugs came to market some of which are calcitrol (Rocaltrol, Caligex), for the treatment of hypocalcemia in dialysis patients (1978); metoclopramide (Reglan), a gastric smooth-muscle relaxant for the treatment of gastroparesis (1979); and alprostadil (Prostin VR), for treating neonates with congenital heart defects before surgery (1981) (Hyde, 2010).

Large Pharmaceutical companies such as Abbott, Merck, Bayer, Pfizer, Roche and GlaxoSmithKline are coming forward to research and help in the growth of orphan drugs (Hyde, 2010). The rate at which orphan drugs are approved has also been accelerated owing to the faster approval process.

Orphan Diseases in India

India, one of the most populated countries in the world, faces numerous healthcare challenges. Rare disease patients in India need access to orphan disease treatments and information about the symptoms and precautions for the rare diseases. Every country has its own specifications to define a rare or orphan disease, with reference to that country's population, resources, and other factors. Similar to many other developing countries, India falls behind in setting a standard definition for rare/orphan disease. After considering the population of India, which is about 1.2 billion, there have been recommendations to define a disease as rare or orphan if it affects only 1 person in 5000 (Sharma, 2010). Orphan diseases are mostly inherited or due to genetic mutations. Rare diseases in India are not as rare as they are in other countries like the US or Europe. This may be due to the lack of treatment available for many chronic diseases. It is estimated that about 70 million people in India suffer from rare diseases, compared to 30 million and 29 million in the United States and Europe, respectively. About 6000 to 8000 rare diseases have been identified in India, and most of them are genetic in nature (Reddy, Pramodkumar, Reddy, & Sirisha, 2014). Some of the diseases, such as the Madras Motor Neuron Disease and the Kyasanur Forest Diseases, are found only in India (Kumari et al., 2013). Rare diseases also include autoimmune disease, rare inherited cancers, infectious diseases, and congenital malfunctions.

Attempts have been made to obtain the "probable" numbers for rare disease in affected South Asian countries based on their officially reported population census of 2011 or later and the data was derived based on the estimation of prevalence of rare diseases globally (Navaneetham, 2013; Table 1). Similarly, a state-wise estimate of rare disease was also derived for India (Table 2).

Table 1. *Rare Disease Populations in Select South Asian Countries*

Countries in South Asia	**Rare Diseases and Disorders Population**
Afghanistan	1,530,006
Bangladesh	9,151,081
Bhutan	44,099
India	72,611,605
Maldives	19,037
Nepal	1,589,670
Pakistan	10,999,800
Sri Lanka	1,216,656

Data from (Navaneetham, 2013).

Table 2. *Rare Diseases Populations in Indian States*

States (India)	**Rare Diseases and Disorders Population**
Andhra Pradesh	5,079,932
Arunachal Pradesh	82,957
Assam	1,870156
Bihar	6,228.278
Chattisgarh	1,532,412
Goa	87,463
Gujarat	3,623,018
Haryana	1,521,185
Himachal Pradesh	411,391
Jammu Kashmir	752,936
Jharkhand	1,977,974
Karnataka	3,667,842
Kerala	2,003,261
Madhya Pradesh	4,355,854
Maharashtra	6,742,378
Manipur	163,305
Meghalaya	177,840

States (India)	Rare Diseases and Disorders Population
Mizoram	65,461
Nagaland	118,836
Orissa	2,516,841
Punjab	1,662,254
Rajasthan	4,117,261
Sikkim	36,461
Tamil Nadu	4,328,337
Tripura	220,262
Uttar Pradesh	11,974,891
Uttarkhand	607,005
West Bengal	5,480,864

Data from (Navaneetham, 2013).

Healthcare System in India

The framework of public health has been changing in India and has seen numerous obstacles in its endeavor to influence the lives of the general population of this nation. Wasteful usage and a lack of monetary assets result in disparities in wellbeing. The reasons for the wellbeing disparities lie in the social, monetary, and political systems that prompt social stratification as based on income, training, occupation, sex, and race or ethnicity.

Issues.

Because India is a country with a multicultural and multilingual population, it is difficult to inform the people about advancements in science, technology, and medicine. People living in underdeveloped areas and villages lack even basic healthcare facilities, and of these, women and children are the ones who suffer the most (Bhavik & Arijeet, 2015). The healthcare system in India fails to reach these core areas where people remain unaware of the new advanced treatments available to them. Information about rare diseases is still minimal in the rural areas, villages, and even some cities. The curriculum of doctors, nurses, and other healthcare professionals lacks exposure to molecular biology, medical biology, genetics, and rare disorders.

Encouragement provided by the government of India is also inadequate (Bhavik & Arijeet, 2015).

Very few nonprofit organizations have come forward to address the issues and the need to help patients with rare diseases. One such organization, which is run by volunteers, is the Organization for Rare Diseases India (ORDI).

Challenges faced by Indians with rare diseases.

The major challenge faced by the patients suffering with rare diseases in India is that the treatments are not available which leaves them with no option but to import the drugs some of which costs as high as $ 400,000 annually (Tapan, 2012).

Intellectual property rights in India.

With advances in technology and science, India developed its own research and development (R&D) industry which helped Indian pharmaceutical companies manufacture many drugs. Intellectual Property laws are created by Trade Related Intellectual Property Rights (TRIPS) governed by World Trade Organization (WTO) which are recognized internationally like patents, copyrights, trademarks, geographical indicators and protection of undisclosed information (Ghai, 2010). As the number of pharmaceutical companies started increasing, the competition became high and the need for intellectual property rights (IPR) became a necessity. It took some time for the authorities in India to realize the long-term benefits of IPR (Bhavik & Arijeet, 2015).

Eventually, in 1970, the government of India announced the Patents Act, which granted a company exclusive rights to manufacture and sell a drug and all the benefits and profits would be the company's only. India is exporter of many drugs, so it's important not only to follow the

standards of the India but it should also abide the standards of the country to which it is exporting (Vishwanath, n.d.).

Before 2005, India's patent protection was limited to only the process of manufacturing and not the drug itself but after the change in the policy India allowed foreign companies to manufacture their drugs in India (Wei, n.d.).

Organization for Rare Diseases India (ORDI)

To point out the threats and the desperate need to take action against the increasing demands of orphan drugs, a group of people from various departments of science, technology, and management joined together and formed the ORDI. This organization has been incorporating guidelines from the U.S. FDA and European Union (EU) and paving the way to form many such similar rare-disease foundations. Their main goal is to provide easy access to orphan drugs and make them affordable. Collecting epidemiologic data, catalyzing research, and supporting the creation of registries and biorepositories are the primary areas of concentration (ORDI, 2014).

Indian Organizations Dedicated to Specific Rare Diseases

Many foundations and organizations are devoted solely to the welfare of people suffering from rare diseases in India (Rajasimha et al., 2014). Some of them are listed in Table 3.

Table 3 *Rare Disease Organizations in India*

	Rare Disease Organizations in India
1	Alzheimers and Related Disorders Society of India (ARDSI)
2	Birth Defects Registry of India
3	Down syndrome Federation India
4	Fragile X Society
5	Genetic Alliance
6	Hemophilia Federation
7	Indian RETT Syndrome Foundation
8	Muscular Dystrophy Foundation of India
9	Muskaan (for the intellectually disabled)
10	National Thalassemica Welfare Society

	Rare Disease Organizations in India
11	Pompe Foundation
12	Rare Diseases India
13	Retina India
14	Sjogren India
15	Thalassemics India

Data from (Rajasimha et al., 2014).

All of these organizations and foundations have a common goal; the betterment of rare-disease patients. ORDI has played a key role in engaging the stakeholders in India and raising general public awareness about rare diseases. It has been the driving force for many rare-disease-specific organizations to achieve their goal and ultimately benefit patients (Rajasimha et al., 2014).

Stakeholders

Stakeholders are people or organizations which directly or indirectly contribute and are affected by the rare diseases. Following are some of the stakeholders (from Rajasimha et al., 2014).

Diseased patients and their families: They are considered as the most important stakeholders, as they are the ones who are directly affected by rare diseases. Patients are the primary topic of many discussions and debates related to new legislations and laws.

Physicians and Healthcare Suppliers: Doctors, nurses and other healthcare practitioners are considered as frontline healthcare workers. They provide treatment to the patients directly and are responsible for offering efficient care.

Researchers and Scientists: Researchers and scientists in India play an important role in getting orphan drugs that are not available in India. They study patient population, their genetics, and their medical history, thus transforming research discoveries into diagnostic tests and treatments.

Pharmaceutical and Biotechnology Manufacturers: The pharmaceutical and biotechnology industries in India lack legislation similar to the US Orphan Drug Act, hampering the indigenous development of rare-disease drugs. Manufacturers face many obstacles, as research and development takes high investments but the returns are low. This is one of the main reasons why pharmaceutical and biotech companies do not want to invest for such a small market where there is no profit, but then it raises ethical concerns.

Indian Government: The health initiatives for rare diseases will not be successful unless they are supported by the Government of India. The Indian government lacks funding opportunities for the biotechnology and pharmaceutical industries to promote advanced research in creating new diagnostic procedures and therapeutics.

A Prospective Orphan Drug Act in India

India has an immense potential to develop and/or manufacture medicines, therapeutics, vaccines, nanotechnology, and stem cell research. In the last decade itself, India has developed exponentially in advanced research and world-class infrastructure (Navaneetham, 2013). Surgeries and diagnostic machines that were previously unavailable are now easily available in all multi-specialty hospitals.

Clinical trials are important to conduct to determine the safety and efficacy of any new drug before it is sold in the market. India has been the site of choice for many cancer, diabetes, and CNS studies. The Indian government has a critical role to play in spreading knowledge about rare diseases and developing health insurance schemes, grants, benefits, and many such monetary incentives that help both patients and pharmaceutical companies. The US Orphan Drug Act of 1983 set a standard that many countries could incorporate in order to help improve the

orphan drug market in their own countries. Europe, China, and Australia are some of the countries that have taken inspiration from the US and set up their own incentive plans and funding schemes.

Purpose of Study

The purpose of this study is to compare the availability of orphan drugs in United States to those in Indian pharmaceutical market and to see if any obvious factors may have led to any differential availability.

Research Methodology

FDA's "Drugs@FDA" website was searched for Orphan Drug Designation and Approvals (USFDA, 2015). The list extracted was based on FDA approvals for orphan drugs from January 4, 1983, which is the date when Orphan Drug Act was passed until June 2015. Each of the FDA-approved orphan drugs was then cross-referenced to the database of Medindia (Medindia, A-Z Drug Information) which is one of the leading provider of healthcare information about the drugs in India to determine how many of them were available in the Indian pharmaceutical market. If Indian trade names were found for the US products' generic names, they were considered available in India. These orphan drugs were then sorted by body systems affected by the disease treated and a Chi-Square Test was done for each body system to see if there any body system is significantly different than expected based on the overall availability of orphan drugs in India vs. the US.

Further analysis of the available drugs was conducted by examining the likely most expensive drug type, monoclonal antibodies (MABs). Differences between the countries' orphan drugs was examined by comparing overall availability, availability by body system effected, and availability of MAB's.

Results

From 1983 through June, 2015, the U.S. FDA approved a total of 380 orphan drugs. The Appendix lists the generic names of the FDA-approved orphan drugs and their availability in India. Out of the 380, 198 (52%) of orphan drugs approved by the FDA before June 2015 were available in India's pharmaceutical market.

The 380 orphan drugs marketed in the USA and the 198 available in India were categorized into 16 body systems. See Table4.

Table 4. *Number of Orphan Drugs Available in Each Body System in the US and India*

	Body System	USA	India
1	Blood and Lymphatic system disorder	97	53
2	Cardiovascular disease	5	2
3	Endocrine system disorder	35	16
4	Gallbladder disease	3	1
5	Gastrointestinal disorder	6	4
6	Genetic disorder	21	9
7	Immune system disorder	29	13
8	Infectious disease	35	24
9	Musculoskeletal system disorder	23	16
10	Ophthalmic disorders	11	9
11	Nervous system disorder	40	27
12	Pulmonary system disorder	12	4
13	Renal system disorder	26	9
14	Reproductive system disease	8	6
15	Respiratory system disorder	10	4
16	Skin and subcutaneous tissue disease	19	9

Classification by body system was determined by the disease state of the first orphan indication.

Results from Chi-Square test of each body system show that p-values of all the body systems are greater than 0.05 which means that they are not significantly different than expected. See Table 5.

Table 5. *Results from Chi-Square Test of Each Body System in the US and India*

Body System	Country	Observed	Expected	p-value
Blood and Lymphatic system disorder	India	51	50.69896194	0.958414943
	USA	97	97.30103806	
Cardiovascular disease	India	2	2.397923875	0.751301662
	USA	5	4.602076125	
Endocrine system disorder	India	16	17.47058824	0.664346698
	USA	35	33.52941176	
Gallbladder disease	India	1	1.370242215	0.696473606
	USA	3	2.629757785	
Gastrointestinal disorder	India	4	3.425605536	0.701906124
	USA	6	6.574394464	
Genetic disorder	India	9	10.27681661	0.623274614
	USA	21	19.72318339	
Immune system disorder	India	12	14.38754325	0.494867311
	USA	29	27.61245675	
Infectious disease	India	24	20.21107266	0.298606502
	USA	35	38.78892734	
Musculoskeletal system disorder	India	14	12.67474048	0.646165225
	USA	23	24.32525952	
Ophthalmic disorders	India	9	6.851211073	0.311313338
	USA	11	13.14878893	
Nervous system disorder	India	27	22.95155709	0.297315633
	USA	40	44.04844291	
Pulmonary system disorder	India	4	5.480968858	0.435290677
	USA	12	10.51903114	
Renal system disorder	India	7	11.30449827	0.114346996
	USA	26	21.69550173	
Reproductive system disease	India	5	4.453287197	0.749336152
	USA	8	8.546712803	
Respiratory system disorder	India	4	4.795847751	0.654010674
	USA	10	9.204152249	
Skin and subcutaneous tissue disease	India	9	9.591695502	0.813723113
	USA	19	18.4083045	

Chi-Square test results showing the p-values of each body system.

Of the total 380 US orphan drugs, 22 drugs were found to be monoclonal antibodies, only 3 of which were found to be available in India. (Table 6).

Table 6. *US Monoclonal Antibody Orphan Drugs and Their Availability in India*

	Orphan drugs- Generic names (Monoclonal Antibodies)	Available in India
1	Adalimumab	NO
2	Alemtuzumab	NO
3	Basiliximab	NO
4	Bevacizumab	NO
5	Brentuximab vedotin	NO
6	Canakinumab	NO
7	Cetuximab	NO
8	DaclizumabO	NO
9	Denosumab	NO
10	Eculizumab	NO
11	Gemtuzumab zogamicin	NO
12	Ibritumomab tiuxetan	NO
13	Infliximab	YES
14	Ipilimumab	NO
15	Obinutuzumab	NO
16	Ofatumumab	NO
17	Raxibacumab	NO
18	Rituximab	YES
19	Satumomab pendetide	NO
20	Tocilizumab	NO
21	Tositumomab and idodine I 131 tositumomab	NO
22	Trastuzumab	YES

Monoclonal Antibodies were identified as those generic names which ended in “mab”.

Discussion

Only 198 (52%) out of the 380 FDA-approved orphan drugs are available in India. Results from Chi-Square test of each body system show that p-values of all the body systems are greater than 0.05 which means that they was no significant difference than expected. This means that there was no correlation between the availability of orphan drugs in India to the body systems.

Results based on the number of orphan drugs which come under the category monoclonal antibodies show that only 3 out of 22 MAB orphan drugs were available in India. Monoclonal antibodies are one the most expensive form of drugs which are used for the treatment of cancers and auto immune diseases. Infliximab is used for reducing signs and symptoms and inducing and maintaining clinical remission in pediatric patients 6 years of age and older with moderately to severely active ulcerative colitis who have had an inadequate response to conventional therapy; Rituximab is used in combination with glucocorticoids for the treatment of patients with Wegener's Granulomatosis (WG) and Microscopic Polyangiitis (MPA) and Trastuzumab for patients with HER2 overexpressing metastatic gastric or gastroesophageal junction adenocarcinoma, who have not received prior treatment for metastatic disease. These three orphan drugs are still under patent protection: until 9/23/2018 for Infliximab, 4/19/2018 for Rituximab and 10/20/2017 for Trastuzumab.

Finally, the prices of the Monoclonal Antibodies (MAB) which were available in India was verified. Remicade (generic name-Infliximab) is one of the three monoclonal antibodies available in India which was introduced in India by Ranbaxy (one of the largest pharmaceutical company in India) under the trade name of Infimab™ after a licensing partnership with Epirus (A US Biopharmaceutical company). The drug was at priced at Rs.41039 per vial as found in

database of Medindia (Medindia, A-Z Drug Information) which is very expensive for patients in India. Similarly, Herceptin (Trastuzumab) was sold in India by Biocon, a biotechnological company under the trade name of Canmab after getting licensing permission from Roche. This drug treatment would costs Rs.712,500 or $11,600 which is unaffordable for a common man (Kresge & Gokhale, 2014). Two of these drugs are also available for non-orphan indications. Infliximab is used for treating rheumatoid arthritis and Trastuzumab for treating HER2-overexpressing metastatic breast cancer.

Drug development costs in India are much lower when compared to other countries like USA. This could potentially be the reason why international pharmaceutical companies collaborate with Indian pharmaceutical companies to expand their orphan drug market by developing their generic forms. The price of the drug can be much lower than its original trade form in USA but this cost is still high for a population living below poverty line.

Though India is rapidly moving forward in the research and technology sector, it seems as if very little effort is being put into surveying the rare diseases and developing drugs to combat them. India needs to shift its focus from developing generic forms to actually understanding the rare disease population and getting in-license from other international pharmaceutical companies for the orphan drugs which are already developed and market them in India. Developing the orphan drugs within the country would benefit both, the patients with accessible and affordable treatment and the pharmaceutical companies where it can share the benefits with the international companies.

The presence of an orphan drug act in India would potentially have advantages like Indian Pharmaceutical companies coming forward to manufacture orphan drugs in India which would lead to affordable orphan drugs, easy access to the newer treatments, benefit plans for the

innovators would attract international pharmaceutical companies to market their orphan drugs in India. The Indian government has a major role to play in laying incentive plans to attract International pharmaceutical market.

The Organization for Rare Disease India (ORDI) is taking active steps in teaming up with the Indian Pharmaceutical Association, the Organization of Pharmaceutical Producers of India (OPPI), and other pharmaceutical groups to assess the rare disease market in India and propose to the government of India the passage of a law identical to the Orphan Drug Act in the US (ORDI, 2014).

Conclusion

While half of orphan drugs which are available in the US are also available in India, only a small number of monoclonal antibodies are available. Indian pharmaceutical companies need to understand the current status of patient population suffering from autoimmune rare diseases and come up with products to treat patients in India. But without the guarantee of grants, fee waivers, exclusivity, or other commercial benefits, the probability of success of an Indian orphan drug industry is small.

The government of India needs to come up with a plan for orphan drug regulations and take the necessary steps to meet the Indian orphan drug demand. A proper regulatory framework and incentive plans for orphan drugs would provide a push to the Indian pharmaceutical companies to come forward and develop, market orphan drugs at affordable price.

Ultimately, this would relieve the rare-disease patients and their families and make them realize that even their lives are important.

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APPENDIX

U.S. FDA-Approved Orphan Drugs by Generic name, Approved Between January 4, 1983 and June 2015 and their availability in India. See text for sources.

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
1	Hemin	NO	Genetic disorder
2	Chenodiol	NO	Gallbladder disease
3	Cromolyn sodium 4% ophthalmic solution	NO	Ophthalmic disorders
4	Pentamidine isethionate	NO	Infectious disease
5	Naltrexone HCl	YES	Nervous system disorder
6	Potassium citrate	YES	Renal system disorder
7	Somatropin	YES	Endocrine system disorder
8	Somatrem for injection	NO	Endocrine system disorder
9	Monooctanoin	NO	Gallbladder disease
10	Trientine HCl	NO	Genetic disorder
11	Levocarnitine	NO	Renal system disorder
12	Digoxin immune FAB (Ovine)	NO	Blood and Lymphatic system disorder
13	Urofollitropin	YES	Endocrine system disorder
14	Calcitonin-human for injection	YES	Endocrine system disorder
15	Clofazimine	YES	Infectious disease
16	Tranexamic acid	YES	Blood and Lymphatic system disorder
17	Somatropin for injection	YES	Endocrine system disorder
18	Zidovudine	YES	Infectious disease
19	Etidronate disodium	YES	Musculoskeletal system disorder
20	Pentastarch	NO	Blood and Lymphatic system disorder
21	Alpha1-proteinase inhibitor (human)	NO	Skin and subcutaneous tissue disease
22	Mitoxantrone HCl	NO	Blood and Lymphatic system disorder
23	Benzoate and phenylacetate	NO	Renal system disorder
24	Teriparatide	YES	Musculoskeletal system disorder
25	Methotrexate sodium	NO	Immune system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
26	Tiopronin	NO	Renal system disorder
27	Leucovorin	YES	Renal system disorder
28	Interferon alfa-2a (recombinant)	NO	Infectious disease
29	Interferon alfa-2b (recombinant)	NO	Infectious disease
30	Metronidazole (topical)	YES	Skin and subcutaneous tissue disease
31	Ethanolamine oleate	NO	Blood and Lymphatic system disorder
32	Ifosfamide	YES	Reproductive system disease
33	Mesna	NO	Renal system disorder
34	Mefloquine HCL	YES	Infectious disease
35	Rifampin	YES	Infectious disease
36	Epoetin alfa	YES	Blood and Lymphatic system disorder
37	Selegiline HCl	YES	Nervous system disorder
38	Pentamidine isethionate	NO	Infectious disease
39	Ganciclovir sodium	NO	Immune system disorder
40	Gonadorelin acetate	NO	Endocrine system disorder
41	Antithrombin III (human)	NO	Blood and Lymphatic system disorder
42	Cromolyn sodium	NO	Immune system disorder
43	Botulinum toxin type A	NO	Immune system disorder
44	Pegademase bovine	NO	Immune system disorder
45	Colfosceril palmitate, Cetyl alcohol, Tyloxapol	NO	Respiratory system disorder
46	Colfosceril palmitate, Cetyl alcohol, Tyloxapol	NO	Respiratory system disorder
47	Idarubicin HCl for injection	YES	Blood and Lymphatic system disorder
48	Citric acid, glucono-delta-lactone and magnesium carbonate	NO	Renal system disorder
49	Eflornithine HCl	NO	Nervous system disorder
50	Calcium acetate	NO	Renal system disorder
51	Interferon gamma 1-b	NO	Immune system disorder
52	Altretamine	YES	Reproductive system disease
53	Epoetin alfa	YES	Blood and Lymphatic system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
54	Coagulation Factor IX (human)	YES	Blood and Lymphatic system disorder
55	Gallium nitrate injection	NO	Blood and Lymphatic system disorder
56	Succimer	NO	Blood and Lymphatic system disorder
57	Sargramostim	YES	Blood and Lymphatic system disorder
58	Alglucerase injection	NO	Genetic disorder
59	Fludarabine phosphate	YES	Blood and Lymphatic system disorder
60	Beractant	NO	Respiratory system disorder
61	Morphine sulfate concentrate (preservative free)	NO	Nervous system disorder
62	Pentostatin for injection	NO	Musculoskeletal system disorder
63	Leucovorin	YES	Renal system disorder
64	Histrelin acetate	NO	Nervous system disorder
65	Liothyronine sodium injection	YES	Endocrine system disorder
66	Nafarelin acetate	YES	Endocrine system disorder
67	Aldesleukin	NO	Skin and subcutaneous tissue disease
68	Zalcitabine	YES	Immune system disorder
69	Baclofen	YES	Musculoskeletal system disorder
70	Teniposide	NO	Blood and Lymphatic system disorder
71	Halofantrine	YES	Infectious disease
72	Coagulation factor IX	YES	Blood and Lymphatic system disorder
73	Sotalol HCl	YES	Cardiovascular disease
74	Melphalan	YES	Skin and subcutaneous tissue disease
75	Atovaquone	YES	Infectious disease
76	Dronabinol	YES	Gastrointestinal disorder
77	Rifabutin	YES	Infectious disease
78	Satumomab pendetide	NO	Reproductive system disease
79	Antihemophilic factor (recombinant)	NO	Blood and Lymphatic system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
80	Cladribine	YES	Blood and Lymphatic system disorder
81	Leuprolide acetate	YES	Endocrine system disorder
82	Levomethadyl acetate hydrochloride	NO	Endocrine system disorder
83	Interferon beta-1b	YES	Nervous system disorder
84	Felbamate	YES	Nervous system disorder
85	Megestrol acetate	YES	Gastrointestinal disorder
86	Lodoxamide tromethamine	YES	Ophthalmic disorders
87	Trimetrexate glucuronate	NO	Pulmonary system disorder
88	Immune globulin intravenous, human	YES	Immune system disorder
89	Aprotinin	YES	Blood and Lymphatic system disorder
90	Dornase alfa	YES	Respiratory system disorder
91	Pegaspargase	YES	Blood and Lymphatic system disorder
92	Desmopressin acetate	YES	Blood and Lymphatic system disorder
93	Pilocarpine	YES	Ophthalmic disorders
94	Iobenguane I 131	YES	Endocrine system disorder
95	Imiglucerase	YES	Genetic disorder
96	Rifampin, isoniazid, pyrazinamide	YES	Infectious disease
97	Filgrastim	YES	Immune system disorder
98	Aminosalicylic acid	YES	Infectious disease
99	Sulfadiazine	NO	Infectious disease
100	Cysteamine	NO	Genetic disorder
101	Filgrastim	YES	Blood and Lymphatic system disorder
102	Rho (D) immune globulin intravenous (human)	YES	Immune system disorder
103	Dexrazoxane	NO	Cardiovascular disease
104	Amiodarone HCl	YES	Cardiovascular disease
105	Sargramostim	YES	Blood and Lymphatic system disorder
106	Epoprostenol	YES	Blood and Lymphatic system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
107	Interferon alfa-2a	YES	Blood and Lymphatic system disorder
108	Tretinoin	YES	Blood and Lymphatic system disorder
109	Amifostine	YES	Renal system disorder
110	Riluzole	YES	Nervous system disorder
111	Porfimer sodium	YES	Pulmonary system disorder
112	Respiratory syncytial virus immune globulin (Human)	YES	Infectious disease
113	Bleomycin sulfate	YES	Pulmonary system disorder
114	Daunorubicin citrate liposome injection	YES	Infectious disease
115	Sodium phenylbutyrate	NO	Renal system disorder
116	Interferon beta-1a	YES	Nervous system disorder
117	Allopurinol sodium	YES	Musculoskeletal system disorder
118	Ofloxacin	YES	Ophthalmic disorders
119	Corticorelin ovine triflutate	NO	Endocrine system disorder
120	Albendazole	YES	Infectious disease
121	Fosphenytoin	YES	Nervous system disorder
122	Midodrine HCl	YES	Blood and Lymphatic system disorder
123	Polifeprosan 20 with Carmustine	YES	Nervous system disorder
124	Pentosan polysulfate sodium	YES	Infectious disease
125	Buffered intrathecal electrolyte/dextrose injection	YES	Blood and Lymphatic system disorder
126	Clonidine	YES	Nervous system disorder
127	Amphotericin B lipid complex	YES	Infectious disease
128	Betaine	NO	Genetic disorder
129	Mitoxantrone	YES	Endocrine system disorder
130	Glatiramer acetate	YES	Nervous system disorder
131	Zinc acetate	YES	Genetic disorder
132	Coagulation Factor IX (recombinant)	NO	Blood and Lymphatic system disorder
133	Anagrelide	YES	Blood and Lymphatic system disorder
134	Toremifene	NO	Endocrine system disorder
135	Diazepam viscous solution for rectal administration	YES	Nervous system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
136	Paclitaxel	YES	Infectious disease
137	Liposomal amphotericin B	YES	Skin and subcutaneous tissue disease
138	Sermorelin acetate	NO	Endocrine system disorder
139	Oprelvekin	NO	Blood and Lymphatic system disorder
140	Rituximab	YES	Blood and Lymphatic system disorder
141	Fomepizole	YES	Ophthalmic disorders
142	Daclizumab	NO	Renal system disorder
143	Ursodiol	YES	Gallbladder disease
144	Tobramycin for inhalation	YES	Genetic disorder
145	Sterile talc powder	YES	Pulmonary system disorder
146	Pilocarpine HCl	YES	Ophthalmic disorders
147	Hydroxyurea	YES	Blood and Lymphatic system disorder
148	Lepirudin	YES	Blood and Lymphatic system disorder
149	Filgrastim	YES	Blood and Lymphatic system disorder
150	Sacrosidase	NO	Gastrointestinal disorder
151	Basiliximab	NO	Renal system disorder
152	Mafenide acetate solution	NO	Infectious disease
153	Rifapentine	NO	Pulmonary system disorder
154	Surface active extract of saline lavage of bovine lungs	NO	Respiratory system disorder
155	Thalidomide	YES	Skin and subcutaneous tissue disease
156	Infliximab	YES	Immune system disorder
157	Lamotrigine	YES	Nervous system disorder
158	Valrubicin	NO	Renal system disorder
159	Octreotide	YES	Endocrine system disorder
160	Thyrotropin alpha	NO	Endocrine system disorder
161	Cytomegalovirus immune globulin (human)	YES	Immune system disorder
162	Modafinil	YES	Nervous system disorder
163	Atovaquone	NO	Infectious disease

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
164	Alitretinoin	NO	Skin and subcutaneous tissue disease
165	Busulfan	YES	Blood and Lymphatic system disorder
166	Denileukin diftitox	NO	Immune system disorder
167	Lidocaine patch 5%	YES	Nervous system disorder
168	Coagulation factorVIIa (recombinant)	YES	Blood and Lymphatic system disorder
169	Cytarabine liposomal	YES	Nervous system disorder
170	Antihemophilic factor/von Willebrand factor complex (human), dried, pasteurized	NO	Blood and Lymphatic system disorder
171	Etanercept	YES	Musculoskeletal system disorder
172	Doxorubicin liposome	YES	Reproductive system disease
173	Temozolomide	YES	Nervous system disorder
174	Epirubicin	YES	Reproductive system disease
175	Caffeine	YES	Respiratory system disorder
176	Exemestane	YES	Reproductive system disease
177	Pulmonary surfactant replacement, porcine	NO	Respiratory system disorder
178	Nitric oxide	NO	Blood and Lymphatic system disorder
179	Bexarotene	YES	Blood and Lymphatic system disorder
180	Interferon gamma-1b	YES	Musculoskeletal system disorder
181	Antihemophilic factor (recombinant)	YES	Blood and Lymphatic system disorder
182	Epoprostenol	YES	Blood and Lymphatic system disorder
183	Gemtuzumab zogamicin	NO	Musculoskeletal system disorder
184	Follitropin alfa, recombinant	YES	Endocrine system disorder
185	Arsenic trioxide	YES	Blood and Lymphatic system disorder
186	Antivenin, crotalidae polyvalent immune Fab (ovine)	NO	Immune system disorder
187	Botulinum toxin type B	NO	Nervous system disorder
188	Botulinum toxin type A	YES	Nervous system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
189	Alemtuzumab	NO	Blood and Lymphatic system disorder
190	Imatinib	YES	Blood and Lymphatic system disorder
191	Zoledronate	YES	Blood and Lymphatic system disorder
192	Topiramate	YES	Nervous system disorder
193	Bosentan	YES	Blood and Lymphatic system disorder
194	Nitisinone	NO	Endocrine system disorder
195	Ibritumomab tiuxetan	NO	Blood and Lymphatic system disorder
196	Synthetic porcine secretin	NO	Endocrine system disorder
197	Treprostinil	YES	Blood and Lymphatic system disorder
198	Rasburicase	NO	Blood and Lymphatic system disorder
199	Oxybate	NO	Nervous system disorder
200	Buprenorphine hydrochloride	YES	Nervous system disorder
201	Buprenorphine in combination with naloxone	YES	Nervous system disorder
202	Nitazoxanide	YES	Infectious disease
203	Icodextrin 7.5% with Electrolytes Peritoneal Dialysis Solution	NO	Renal system disorder
204	Polifeprosan 20 with carmustine	NO	Nervous system disorder
205	Pegvisomant	NO	Endocrine system disorder
206	Ceramide trihexosidase/alpha-galactosidase A	NO	Genetic disorder
207	laronidase	YES	Genetic disorder
208	Bortezomib	YES	Blood and Lymphatic system disorder
209	Tositumomab and iodine I 131 tositumomab	NO	Blood and Lymphatic system disorder
210	Ribavirin	YES	Infectious disease
211	Miglustat	YES	Genetic disorder
212	Porfimer	NO	Blood and Lymphatic system disorder
213	Iron(III)-hexacyanoferrate(II)	NO	Blood and Lymphatic system disorder
214	Botulism immune globulin	NO	Infectious disease

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
215	Acetylcysteine	YES	Nervous system disorder
216	Pemetrexed disodium	YES	Skin and subcutaneous tissue disease
217	Cinacalcet	YES	Endocrine system disorder
218	Apomorphine HCl	YES	Nervous system disorder
219	Tinidazole	YES	Infectious disease
220	Azacitidine	YES	Blood and Lymphatic system disorder
221	Glutamine	YES	Endocrine system disorder
222	Diethylene triamine pentaacetic acid (DTPA)	NO	Renal system disorder
223	Multi-vitiam infusion without vitamin K	NO	Blood and Lymphatic system disorder
224	Recombinant human luteinizing hormone	NO	Endocrine system disorder
225	Clofarabine	NO	Blood and Lymphatic system disorder
226	Iloprost inhalation solution	NO	Pulmonary system disorder
227	Potassium Iodide Oral Solution	NO	Endocrine system disorder
228	Benzoate/phenylacetate	NO	Renal system disorder
229	Vaccinia Immune Globulin (Human) Intravenous	NO	Immune system disorder
230	Fluocinolone	YES	Ophthalmic disorders
231	N-acetylgalactosamine-4-sulfatase, recombinant human	NO	Musculoskeletal system disorder
232	Meloxicam	YES	Musculoskeletal system disorder
233	Quinine Sulfate	YES	Infectious disease
234	Mecasermin	NO	Endocrine system disorder
235	Nelarabine	NO	Blood and Lymphatic system disorder
236	Deferasirox	YES	Blood and Lymphatic system disorder
237	Sorafenib	YES	Renal system disorder
238	lenalidomide	YES	Skin and subcutaneous tissue disease
239	Cetuximab	NO	Renal system disorder
240	Tacrolimus	YES	Immune system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
241	Ibuprofen lysine	YES	Musculoskeletal system disorder
242	Recombinant human acid alpha-glucosidase	NO	Nervous system disorder
243	Decitabine	YES	Blood and Lymphatic system disorder
244	Dasatinib	YES	Blood and Lymphatic system disorder
245	Idursulfase	YES	Endocrine system disorder
246	Biocarbonate infusate	NO	Renal system disorder
247	Vorinostat	NO	Blood and Lymphatic system disorder
248	Bortezomib	YES	Skin and subcutaneous tissue disease
249	Hydroxocobalamin	YES	Respiratory system disorder
250	Balsalazide disodium	YES	Gastrointestinal disorder
251	Antihemophilic factor (human)	NO	Blood and Lymphatic system disorder
252	Eculizumab	NO	Blood and Lymphatic system disorder
253	Protein C concentrate	YES	Blood and Lymphatic system disorder
254	Hepatitis B immune globulin (human)	NO	Immune system disorder
255	Temsirolimus	YES	Renal system disorder
256	Ambrisentan	NO	Pulmonary system disorder
257	Lanreotide	NO	Endocrine system disorder
258	Dexrazoxane	NO	Cardiovascular disease
259	Raloxifene	YES	Musculoskeletal system disorder
260	Nilotinib	YES	Blood and Lymphatic system disorder
261	Sapropterin	NO	Nervous system disorder
262	Thyrotropin alfa	NO	Endocrine system disorder
263	Adalimumab	NO	Musculoskeletal system disorder
264	Rilonacept	YES	Immune system disorder
265	Levoleucovorin	NO	Musculoskeletal system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
266	Bendamustine hydrochloride	YES	Blood and Lymphatic system disorder
267	Tetrabenazine	YES	Musculoskeletal system disorder
268	Romiplostim	YES	Blood and Lymphatic system disorder
269	Immune Globulin (Human)	NO	Immune system disorder
270	Iobenguane I 123	NO	Nervous system disorder
271	C1 Esterase inhibitor (human)	YES	Immune system disorder
272	Rufinamide	YES	Nervous system disorder
273	Eltrombopag	NO	Blood and Lymphatic system disorder
274	Plerixafor	YES	Blood and Lymphatic system disorder
275	Fludarabine phosphate oral tablets	YES	Blood and Lymphatic system disorder
276	Human fibrinogen concentrate, pasteurized	NO	Blood and Lymphatic system disorder
277	Recombinant human antithrombin	NO	Blood and Lymphatic system disorder
278	Trypan blue	YES	Ophthalmic disorders
279	Artemether/lumefantrine	YES	Infectious disease
280	Bevacizumab	NO	Reproductive system disease
281	Tadalafil	YES	Blood and Lymphatic system disorder
282	Canakinumab	NO	Musculoskeletal system disorder
283	Sotalol (IV)	NO	Cardiovascular disease
284	Colchicine	YES	Genetic disorder
285	Treprostinil (inhalational)	NO	Blood and Lymphatic system disorder
286	Vigabatrin	YES	Musculoskeletal system disorder
287	Ganciclovir	YES	Infectious disease
288	Pralatrexate	NO	Immune system disorder
289	Ofatumumab	NO	Blood and Lymphatic system disorder
290	Romidepsin	YES	Blood and Lymphatic system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
291	Capsaicin	YES	Nervous system disorder
292	Ecallantide	NO	Skin and subcutaneous tissue disease
293	Human plasma coagulation Factor VIII and human plasma von Willebrand Factor	NO	Blood and Lymphatic system disorder
294	Dalfampridine	NO	Nervous system disorder
295	Collagenase clostridium histolyticum	YES	Musculoskeletal system disorder
296	Aztreonam	YES	Respiratory system disorder
297	Velaglucerase-alfa	YES	Genetic disorder
298	Carglumic acid	NO	Blood and Lymphatic system disorder
299	Tenofovir	YES	Infectious disease
300	Rifaximin	YES	Infectious disease
301	Glycopyrrolate	YES	Nervous system disorder
302	Pegloticase	NO	Musculoskeletal system disorder
303	Dexamethasone intravitreal implant	NO	Ophthalmic disorders
304	Repository corticotropin or adrenocorticotropic hormone	YES	Musculoskeletal system disorder
305	Trastuzumab	YES	Gastrointestinal disorder
306	Everolimus	YES	Immune system disorder
307	Sodium nitrite and sodium thiosulfate	NO	Respiratory system disorder
308	Gabapentin	YES	Nervous system disorder
309	Hydroxyprogesterone caproate	NO	Endocrine system disorder
310	Factor XIII concentrate (human)	NO	Blood and Lymphatic system disorder
311	Ipilimumab	NO	Immune system disorder
312	Peginterferon alfa-2b	YES	Infectious disease
313	Vandetanib	YES	Endocrine system disorder
314	Belatacept	NO	Renal system disorder
315	Coccidioidin SD Skin Test Antigen	NO	Skin and subcutaneous tissue disease
316	Centruroides immune F(ab)2	NO	Immune system disorder
317	Vemurafenib	YES	Skin and subcutaneous tissue disease

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
318	Brentuximab vedotin	NO	Blood and Lymphatic system disorder
319	Icatibant	NO	Blood and Lymphatic system disorder
320	Crizotinib	NO	Pulmonary system disorder
321	Deferiprone	YES	Blood and Lymphatic system disorder
322	Clobazam	YES	Nervous system disorder
323	Ruxolitinib phosphate	YES	Musculoskeletal system disorder
324	Erwinia L-asparaginase	NO	Blood and Lymphatic system disorder
325	Glucarpidase	NO	Renal system disorder
326	Ivacaftor	NO	Genetic disorder
327	Mitomycin-C	YES	Ophthalmic disorders
328	Mifepristone	YES	Endocrine system disorder
329	Pazopanib	YES	Renal system disorder
330	Taliglucerase alfa	YES	Genetic disorder
331	Difluprednate	YES	Ophthalmic disorders
332	Immune globulin infusion (human)	YES	Immune system disorder
333	Carfilzomib	YES	Skin and subcutaneous tissue disease
334	Vincristine sulfate liposome injection	YES	Blood and Lymphatic system disorder
335	Technetium Tc99m sulfur colloid injection, lyophilized	NO	Skin and subcutaneous tissue disease
336	Bosutinib	NO	Blood and Lymphatic system disorder
337	Cysteamine hydrochloride	NO	Genetic disorder
338	Omacetaxine mepesuccinate	NO	Blood and Lymphatic system disorder
339	Cabozantinib	NO	Endocrine system disorder
340	Pasireotide	NO	Endocrine system disorder
341	Raxibacumab	NO	Infectious disease
342	Ponatinib	NO	Blood and Lymphatic system disorder
343	Varicella Zoster Immune Globulin (Human)	NO	Immune system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
344	Anakinra	NO	Musculoskeletal system disorder
345	Lomitapide	NO	Genetic disorder
346	Teduglutide [rDNA origin]	NO	Gastrointestinal disorder
347	Bedaquiline; (1R,2S) 6-bromo-alpha-[2-(dimethylamino)ethyl]-2-methoxy-alpha-(1-naphthyl)-beta-phenyl-3-quinolineethanol	NO	Infectious disease
348	Mipomersen	NO	Genetic disorder
349	Glycerol phenylbutyrate	NO	Renal system disorder
350	Pomalidomide	NO	Blood and Lymphatic system disorder
351	Regorafenib	NO	Renal system disorder
352	Immune globulin intraveous (human)	NO	Immune system disorder
353	Botulism antitoxin heptavalent (A, B, C, D, E, F, G) (Equine)	NO	Nervous system disorder
354	Tocilizumab	NO	Immune system disorder
355	Prothrombin complex concentrate (human)	NO	Blood and Lymphatic system disorder
356	Cysteamine enteric coated	NO	Genetic disorder
357	Nimodipine	YES	Blood and Lymphatic system disorder
358	Japanese encephalitis vaccine, inactivated, adsorbed	NO	Infectious disease
359	Trametinib	NO	Skin and subcutaneous tissue disease
360	Dabrafenib	NO	Skin and subcutaneous tissue disease
361	Denosumab	NO	Musculoskeletal system disorder
362	Afatinib	NO	Pulmonary system disorder
363	Enalapril maleate (powder for oral solution)	NO	Blood and Lymphatic system disorder
364	Meclorethamine	NO	Skin and subcutaneous tissue disease
365	Paclitaxel protein-bound particles	NO	Reproductive system disease
366	Riociguat	NO	Pulmonary system disorder
367	Macitentan	NO	Pulmonary system disorder
368	Obinutuzumab	NO	Blood and Lymphatic system disorder
369	Ibrutinib	NO	Blood and Lymphatic system disorder

	U.S. FDA-Approved Orphan Drugs - Generic Names	Available in India	Body System
370	Anti-inhibitor coagulant complex	NO	Blood and Lymphatic system disorder
371	Coagulation factor XIII A-subunit (recombinant)	NO	Blood and Lymphatic system disorder
372	Trametinib and Dabrafenib	NO	Skin and subcutaneous tissue disease
373	Tasimelteon	NO	Nervous system disorder
374	Elosulfase alfa	NO	Genetic disorder
375	Droxidopa	NO	Nervous system disorder
376	Metreleptin	NO	Endocrine system disorder
377	Deferasirox	YES	Blood and Lymphatic system disorder
378	Gefitinib	YES	Pulmonary system disorder
379	Lumacaftor/ivacaftor	YES	Genetic disorder
380	Technetium Tc 99m tilmanocept	YES	Immune system disorder