India's Emergence As A Global Biopharmaceutical Player: Aligning CDSCO Guidelines With International Standards For Health Equity


Kirti Rajput, Kamla Pathak*

Department of Pharmaceutics, Faculty of Pharmacy, Uttar Pradesh University of Medical Sciences, Saifai, Etawah 206130, Uttar Pradesh

Email: kamlapathak5@gmail.com

Abstract

The world of pharmaceuticals is in a state of transformation as biologics - complex drugs derived from living organisms, become increasingly significant for chronic and severe diseases. Despite their transformative impact on patient lives, their exorbitant prices restrict their access. However, a major "patent cliff" from 2022 to 2032, with almost 300 drug patents expiring each year, has set impetus for rapid growth of the biosimilar market. This article explores the changing regulatory landscape of USFDA, EMA, CDSCO and other nations. At the same time, India is gradually escalating the ladder from being a local manufacturer to global player by adopting 2025 guidelines in line with WHO standards, enabling availability of biopharmaceuticals for low- and middle-income nations. This article also discusses the opportunities and challenges in the global uptake of biosimilars. Conclusively, a holistic approach, blending scientific excellence with equity, is needed to ensure access to life-saving drugs for all patients worldwide.

Keywords: Biologics, biosimilars, patent cliff, USFDA, EMA, CDSCO

1. Introduction

Biologics is a rapidly evolving industry in the pharmaceutical sector that utilizes biotechnological methods involving live systems and tissues to produce sophisticated medications. The introduction of biologics around ten years ago revolutionized the way chronic

and potentially fatal diseases like psoriasis, ulcerative colitis, juvenile idiopathic arthritis and rheumatoid arthritis were treated (1, 2). As per FDA, a biosimilar is a biological product significantly similar to an existing FDA-approved reference product (RP), assuring no clinically significant differences (3). Likewise, the EMA (European Medicines Agency) defines a biosimilar as a therapeutic agent potentially similar to another biological therapeutic agent already commercialized in the European Union (4). The description of biosimilar as per CDSCO is a biological product similar in terms of quality, efficacy and safety to a pre-approved Reference Biological product (5). Biologics necessitate advanced production techniques to guarantee uniform product quality, safety, and efficacy throughout their lives (6).

Biosimilars, which are less expensive substitutes, have set foot in the market as original biologics are losing their exclusivity. A biological product designed to closely resemble an already-approved "reference" biologic is called a biosimilar (7, 8). In order to ensure that patients receive the same therapeutic benefit without the need for unnecessary clinical testing, regulatory organizations such as the FDA and EMA increasingly rely on sophisticated analytical technologies to verify that the biosimilar's molecular structure and function match the original.

According to research by Drug Patent Watch, almost 300 drug patents in various categories will expire annually during the patent cliff period of 2022–2032, a list of more than 300 US patents that will expire in 2020–2030. This pattern will persist until 2036. According to an estimate, twenty-four significant blockbuster patents will expire between 2020 and 2030. As a result, megasellers like Humira (adalimumab) will no longer have exclusivity in the US starting in 2023. In 2019, Humira biosimilars were introduced in Europe, which has already caused the brand's scale to deteriorate (9).

As of 2025, the growing frequency of chronic diseases, patent expirations, and the growing need for reasonably priced biologics are all contributing factors to the worldwide biosimilar market's rapid expansion. The market is valued at more than 28 billion USD in 2024 and is expected to increase annually at a robust rate to surpass 120 billion USD by 2033. While Europe, which holds more than half of the global market, continues its stewardship via strong replacement policies, regulatory frameworks, and clinical acceptance, the United States is anticipated to generate significant savings through increased FDA approvals and greater use

(10). The recently approved biosimilars (2024-2026) are listed in Table 1.

Table 1. Currently approved biosimilars in different regulatory authorities (11-13)

Regulatory Authority	Reference product	Approved Biosimilar	Year
USFDA	Eylea®(Aflibercept)	Eydenzelt	2025
	Prolia / Xgeva (Denosumab)	Boncresa /Oziltus, Osvyrti /Jubereq, Enoby / Xtrenbo, Aukelso /Bosaya	
	Lucentis (Ranibizumab))	Nufymco	2025
	Stelara® (Ustekinumab)	Starjemza	
	Actemra® (Tocilizumab)	Tyenne® Avtozma®	
	Perjeta (Pertuzumab)	Poherdy	
	Prolia (Denosumab)	Ponlimsi	2026
	Neupogen (Filgrastim)	Filkri	
Europe	Stelara	Uzpruvo, Fymskina	2024
	Prolia®/Xgeva	Stoboclo, Osenvelt	2025
	Eylea	Eydenzelt	
	ROACTEMRA	Avtozma	
Japan	Stelera	Ustekinumab BS	
	Ranmark	Denosumab Biosimilar	
	Simponi	Golimumab Biosimilar 1	
	Eylea	Aflibercept Biosimilar 2	
	Xolair	Omalizumab BS	2026
	Actemra	Tocilizumab BS	

2. Regulatory Landscape

Biosimilar development is a laborious process that encompasses clinical trials, analytical, functional, and nonclinical evaluations. The selection of an appropriate reference medicine, which must denote similarity in quality, efficacy and safety via a stepwise method, is a critical challenge in this process. In this phase, functional analytical investigations are essential because they evaluate the structural and functional characteristics of biosimilars in comparison to their reference products. Rather than separately proving the biosimilar's safety and efficacy, these studies seek to confirm its similarity. There are still disagreements over things like immunogenicity, interchangeability, and nomenclature even though our understanding of biosimilars has grown. To guarantee that quality, safety, and efficacy criteria are upheld, regulators and developers must work together to maximize the benefits of biosimilars (14). The regulatory guidelines for biosimilars in the US, EU and India will be scrutinized in the preceding text.

2.1 USFDA Regulations

The US biosimilar regulatory journey has progressed from the initial Biologics Price Competition and Innovation Act (BPCIA) under section 351k of the Public Health Service Act (PHSA) of 2009 where the first approval occurred in 2015 with figrastim-sndz Zarxio® (15,16) to a revolutionary "analytical first" approach in 2025. This historic decision officially exempted the default requirement for comparative efficacy and safety clinical trials, as long as residual doubts are resolved by definitive analytical similarity, functional characterization, pharmacokinetic (PK) profiles and immunogenicity data. This shift is reflected in the approval of the first interchangeable biosimilar Wezlana (ustekinumab) to Stelara, and the first applications for monoclonal antibodies without efficacy trials (17,18).

With this totality-of-evidence, risk-based assessment, even interchangeability can be approved without mandatory switching studies if the analytical and PK data are decisive. This led to market explosion in 2015 with 18 biosimilars approved referencing 10 compounds across a wide range of therapeutic areas - such as denosumab, ophthalmology (aflibercept), immunology (tocilizumab) and diabetes (insulin aspart) - driving the number of active development programs in the FDA's Biosimilar Biological Product Development (BPD) program to 135 (18).

2.2 EMA Regulations

In 2004, the EU established the first biosimilar approval system in history, making it a global leader in biosimilar regulation (19). The EMA has constructed a comprehensive regulatory landscape for biosimilars, with three key overarching guidelines that cover the general principles, questions of quality, and the pre-clinical and clinical requirements for biotechnology products (proteins). This core guidance is now evolving towards a more product-specific and clinical-based approach, with recent concept papers focusing on optimising development strategies for efficiency and specificity. To enhance specificity, the EMA has a detailed product-specific list of guidelines for various therapies, including recombinant erythropoietins, granulocyte-colony stimulating factors (G-CSF), low-molecular-weight heparins, somatropin and various insulins.

Additionally, complex biologics, including monoclonal antibodies, follicle-stimulating hormones, and various interferons (alpha and beta), have specific non-clinical and clinical requirements in place to demonstrate their biosimilarity. These rules are complemented with an array of cross-functional guidelines that cover key technical challenges, such as immunogenicity (of therapeutic proteins and monoclonal antibodies), pharmacokinetics, and product comparability for manufacturing changes. These guidelines collectively constitute a

high scientific standard to ensure that biosimilars are equivalent in safety and efficacy to their biological reference therapeutic agents (20, 21).

2.3 CDSCO Regulations

The guidelines for biosimilars (Similar biologics) regulatory requirements for marketing in India were published by CDSCO in 2012 in alliance with the Department of Biotechnology to discourse the regulatory framework for biosimilars in India. The framework was revised in 2016 with focus on the scientific principles involved and the incremental approach to be solicited during the corroboration of similarity between a biosimilar and its reference biological product (22).

Due to their complexity, generally, regulations on clinical trials for biosimilars are far more rigorous in comparison to the generics. Additionally, biosimilars are also monitored for manufacturing, clinical trials and import thereof. These regulations warrant testing of biosimilars in the pre-clinical phase and clinical trials for efficacy and safety (10). However, the Indian regulatory framework has come under scan for being unclear, especially when it comes to implementation. The challenges in Indian context are depicted in Fig. 1. The guidelines on biosimilars are thorough, but they are still only recommendations rather than legally binding regulations, allowing for interpretation and legal conflicts. As a result, neither the government regulatory authority nor the business houses can be held accountable for not following the regulatory guidelines. Furthermore, the current biosimilar regulations should be neatly written, which gives innovators the opportunity to cast doubt on the introduction of new biosimilars (23).

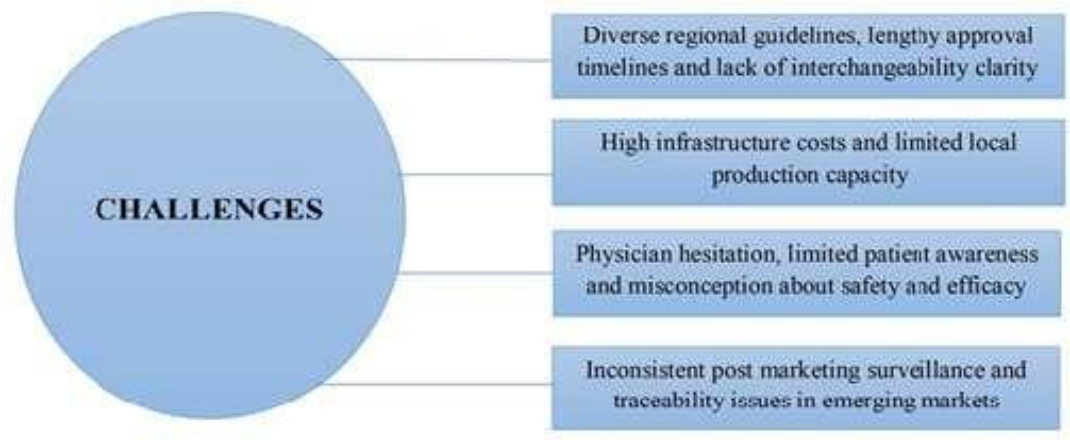

Figure 1. Challenges in global biosimilar adoption

India's 2025 biosimilar guidelines elevate the country from a domestic producer to a proactive global player in biopharmaceutical access, especially for low- and middle-income countries (LMICs). Through harmonisation of the CDSCO guidelines with the WHO's TRS 1043

guidelines, India opens the door to WHO prequalification and streamlines the integration of its biosimilars into international procurement agencies such as UNICEF, GAVI and the Global Fund. Beyond production, India is set to lead the region in capacity building through twinning and South-South exchanges, while also unlocking innovation in biobetters and AI-based manufacturing. Figure 2 presents the opportunities available in the near future. In conclusion, through its diplomatic convenings in the G20 and BRICS, India is bringing together scientific rigour and health equity to become the primary policy maker and supplier of biologics (24).

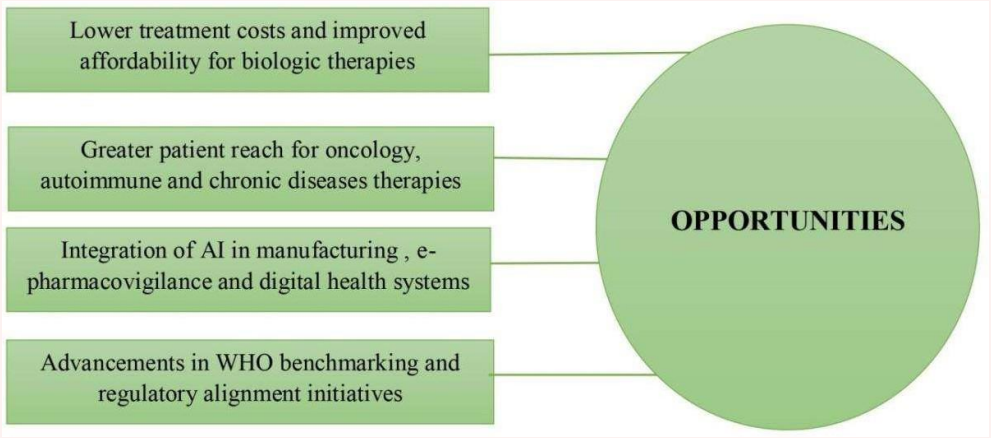

Figure 2. Key opportunities in global biosimilar adoption

A comparison of the biosimilar regulatory framework of developed countries namely US, EU and Japan followed by the examination of the regulatory guidelines in developing countries like India, Brazil and South Africa are depicted in Table 2.

Table 2. Current regulatory landscape of biosimilars (25-33).

Aspects	USFDA	Europe	India	Japan	Brazil	South Africa
Regulatory timeline	351(k)BPCI Act	Art.10(4), Dir.2002/83/EC	Guidelines on Similar Biologics (2020)	PMDA Biosimilar guidelines	RDC 55/2010- RDC 875/2024	Biosimilar guidelines (2019)
Reference Product (RP)	A single FDA-approved RP. A foreign comparator with sufficient scientific support, and bridging data is permissible	Preferably EU - authorized RP is required. Any non-EU comparator is allowed after analytical bridging only	India- licensed RP is preferred. Any foreign RP that is ICH accorded is acceptable with bridging data	Japan approved RP is preferred; Any other RP is allowed if justified	Brazil approved RP; foreign RP allowed if justified	SAHPRA-registered RP; foreign RP allowed
Bridging requirement	When a foreign comparator is employed, a three-way PK bridging study might not be necessary. If sufficient scientific rationale is demonstrated, biosimilar developers can depend on the results evidenced by a non-US licensed comparator without further bridging studies.	Analytical bridging is primary requirement but PK bridging may also be required	Bridging is required when foreign RP is used. Both analytical and comparative PK/PD data is needed	Case by case bridging determination can be affected. Global comparability data may be accepted	Analytical bridging is typically sufficient. Additional PK/clinical data may be requested case by case if desirable	Analytical bridging is usually adequate. Additional information is needed on an individual basis.
Non-clinical requirements	*Focus is on in vitro* studies. In vivo studies are done if needed	*In vitro* data is dominant	*In vitro* + limited *in vivo*	*In vitro* is dominant	May be waived off depending on the totality of evidence	May be waived off depending on scientific justification

Clinical PK/PD requirements	Comparative PK mandatory; PD when relevant	Comparative PK mandatory; PD when applicable	Comparative PK/PD generally required	Comparative PK mandatory; PD when relevant	PK/PD may suffice	Comparative PK/PD generally required
Interchangeability	An "interchangeable" biosimilar status may be granted by the FDA if additional switching studies evidence no risk in terms of safety or diminished efficacy as compared to the RP.	EU-approved biosimilars are interchangeable with their RP. Individual member states oversee the substitution at the pharmacy level.	No formal interchangeability designation recognized.	No separate interchangeability designation recognized. Switching is decided by prescriber	No formal interchangeability designation recognized.	SAHPRA permits interchangeability between biosimilars that have been demonstrated to be equivalent to the same RP as well as between a biosimilar and its RP. The prescribing physician should decide whether to switch.
Pharmacovigilance	Post-marketing surveillance and a risk management plan are necessary. The framework should be same as originators	Post-marketing surveillance and a risk management plan are essential within a framework similar to originators.	Post-marketing surveillance and a risk management plan are essential within a framework similar to originators.	Same pharmacovigilance requirements as originators	Risk management plan is required in a similar framework as the originators	Risk management plan needed in a similar framework as originators

Naming	International Nonproprietary name (INN)+ 4 -letter suffix	Same INN; brand and batch tracing	Same INN + brand name	Same INN + biosimilar identifier	Same INN	Same INN

3. Recommendations for clinical practice and global regulatory alignment

The project ICH M18 titled as "Framework for determining the utility of comparative efficacy studies in biosimilar development programs" has moved past the approval stage in early 2026, and is currently working on developing the guideline. The guideline's objective is to offer a standardized scientific method for comparative efficacy studies of biosimilar development programs. ICH M18 aims to improve coherence with international regulatory decision-making while supplementing a principled "tailored approach" outlined in the WHO 2022 guidelines. The world's regulatory bodies will remove duplication, standardize the burden of proof, and enable states to rely on common scientific judgments if they adopt the ICH M18 standards.

All things considered, these advancements could speed up access to more reasonably priced biologic medications worldwide and reduce the time and expense of developing new products. Adoption of biosimilars is nevertheless hampered by complicated international patent and legal frameworks, despite regulatory advancements. A fully open-access, centralized digital platform that exclusively compiles data on patent expiration dates, exclusivity periods, litigation status, and regulatory pathways could facilitate prompt and assured clinical adoption. A cross section of ongoing clinical trials on biosimilars is enlisted in Table 3. Education and trust among clinicians is another major issue. Education programs include interactive clinical case discussions, real-world evidence sharing, and authorized online instruction may boost confidence. Particularly in low- and middle-income contexts, additional policy measures including incentives, prescription monitoring, and patient feedback can promote optimal use. Last but not least, enhancing international post-marketing immunogenicity monitoring through cooperative data-sharing networks will guarantee biosimilars' long-term safety, trust, and equitable access (33).

Table 3. Ongoing Clinical Trials on Biosimilars in 2025-26 (33)

Name of Biosimilars	Clinical Trial No.	Company/ Sponsor	Start date	Indication
Trastuzumab biosimilars and Pertuzumab biosimilars plus XELOX	NCT07108127	Peking Union Medical College Hospital, China	2025-06-20	HER2-positive rectal cancer
Ocrelizumab	NCT06847724	Sandoz, USA	2025-06-10	Relapsing multiple sclerosis

Ipilimumab Biosimilar HLX13 vs. YERVOY®	NCT07176650	Shanghai Henlius Biotech, USA	2025-11-25	Hepatocellular carcinoma
Ustekinumab	NCT06997055	Celltrion HealthCare, France	2025-03-17	Crohn's disease
Aflibercept (MY-1701P)	NCT07235527	Saglik Bilimleri Universitesi, Turkey	2025-11-20	Age related macular degeneration
Bevacizumab	NCT06860490	Fudan University, China	2025-03-18	Advanced hepatocellular carcinoma.
Rituximab	NCT06890884	Merck Sharp & Dohme LLC, USA	2025-04-11	Lymphoma
Ranibizumab	NCT07520045	Osijek University Hospital, Croatia	2026-03-12	Diabetic Retinopathy
Sintilimab combined with bevacizumab biosimilar	NCT07324824	Sun Yat-sen University, China	2026-01-14	Hepatic Carcinoma
SCD411	NCT07501052	Sam Chun Dang Pharm. Co. Ltd., USA	2026-05-08	AMD, RVO, DME, or Diabetic Retinopathy (DR)

4. Conclusion

The advent of biosimilars represents a game-changing opportunity to reduce healthcare expenditure and enhance access to biologic medicines globally, but it cannot be achieved through science alone. To guarantee safety and sustainability over time, the global community needs to focus on regulatory alignment, including the establishment of a global safety data platform to monitor real-world data and immunogenicity. Overcoming the global health divide between developed and emerging markets is vital to health equity, and demands international collaboration in surveillance and capacity development. In both the short and long term, the benefits of biosimilars can only be fully harnessed by a comprehensive approach that includes evidence-based education for medical professionals alongside harmonised regulatory pathways to ensure all patients can benefit from these life-saving therapies, wherever they live.

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ONCOLOGY
NEUKINE
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BASALOGONE