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Supplementary information

The rise of China's pharmaceutical industry from 2015–2024: a decade of innovation

In the format provided by the authors and unedited

Data sources and analysis
This study conducted a cross-sectional analysis using a comprehensive data compiled from various sources to assess the development of China's innovative pharmaceutical industry from 2015 to 2024. The primary data was sourced from the Pharmcube database, which integrated information from several specialized databases.

Innovative product pipeline data was sourced from Pharmcube's NextPharma®, PharmaGO® and TrialCube® databases, which aggregated information from China's Registration and Information Disclosure Platform for Drug Clinical Studies, the Chinese Clinical Trial Register (ChiCTR), ClinicalTrials.gov, scientific conferences, press releases, published reports and investor presentations and other sources.

Capital investment data was obtained from Pharmcube's InvestGO® databases, incorporating corporate registration records from China's National Enterprise Credit System, verified PR announcements and executive interviews. Financing events were categorized by round, including seed, angel, pre-A, series A, pre-B, series B, pre-C, series C, pre-D, series D, pre-IPO and strategic financing before IPO, excluding IPOs, follow-on offerings and mergers/acquisitions. Financing amount reflected only those events with publicly available funding figures, as not all events disclose financial details. Limitations include slower updates in some corporate registry records, which may lead to incomplete disclosures, as well as the potential omission of data from companies that choose not to disclose certain information.

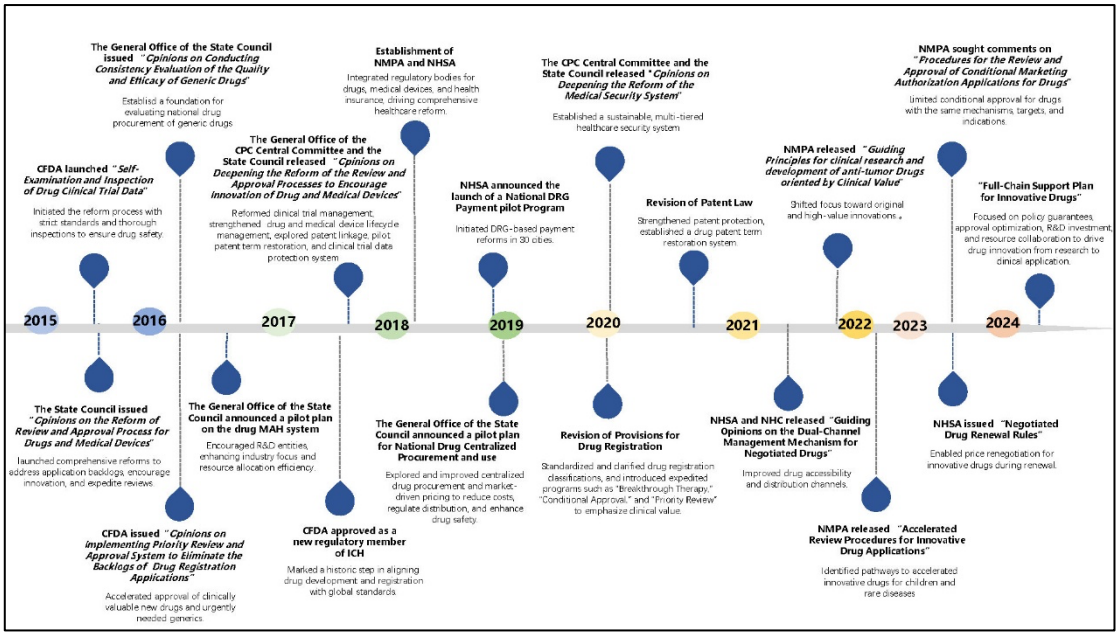
Out-licensing agreements data were sourced from Pharmcube's NextPharma® database, which gathered information from company websites, annual reports, press releases, academic conferences and journal articles. These various sources of information provided a comprehensive view of licensing trends based on license-out deals in China. The data covers both innovative therapeutic assets and enabling technology platforms, such as drug discovery engines, biomanufacturing systems, advanced delivery technologies and other proprietary methodologies supporting end-to-end drug development. However, the data may miss undisclosed or confidential agreements and may be biased toward larger companies, potentially overlooking smaller firms or private deals.

Definition of innovative drugs
In this study, "innovative drugs" are defined as new active substances, including new molecular entities (NMEs), new therapeutic biological products, new active ingredients such as optical isomers, esters or other derivatives of approved active moieties and new combination of active moieties or biological products, where the components may be either previously approved or not yet approved. Preventive vaccines, generic drugs, biosimilars, traditional Chinese medicines (TCMs), salts of approved active moieties and new dosage forms, new formulations or new administration routes of approved active moieties are explicitly excluded.

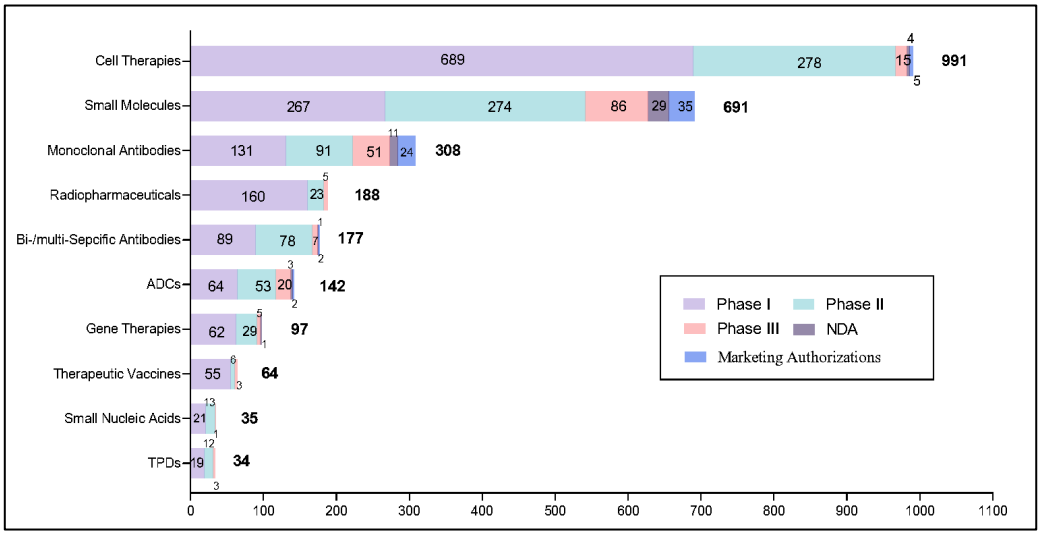
The China's approval innovative product data includes drugs that received their first approvals in mainland China between January 2015 and December 2024. This data also includes drugs that were approved abroad but received their first approval in mainland China during this period.

The first global approval innovative product data includes drugs that received global first approvals between January 2015 and December 2024. A total of 918 candidates received global first approvals during this period.

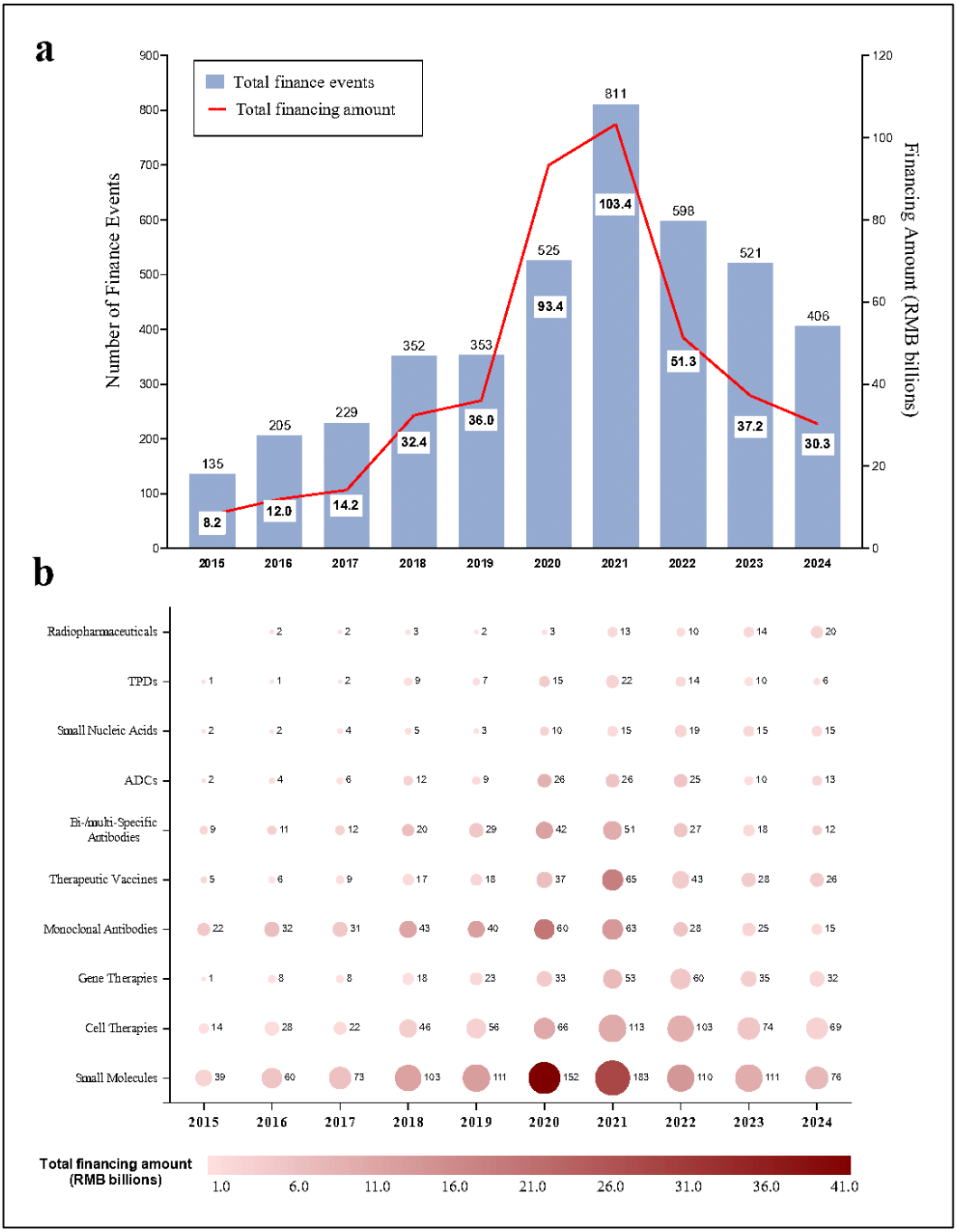
The China's innovative product pipelines data includes innovative drug candidates that initiated first-in-human studies between January 2015 and December 2024. During this period, a total of 4,382 innovative drug candidates developed by Chinese companies initiated first-in-human studies worldwide. As of 31 December 2024, 3,575 drug candidates remain in active development, with pipeline activity tracked up to this date. Investigator-initiated trials (IITs) were also included in the analysis. The development status of a drug candidate was determined by the highest clinical phase reached as of 31 December 2024, considering both IITs and sponsor-initiated trials. Clinical phases ranged from Phase I to marketing authorization. Phase I/II trials were categorized as Phase II and Phase II/III trials were categorized as Phase III. If the IIT phase was marked as "Not available (NA)," it was considered Phase I.



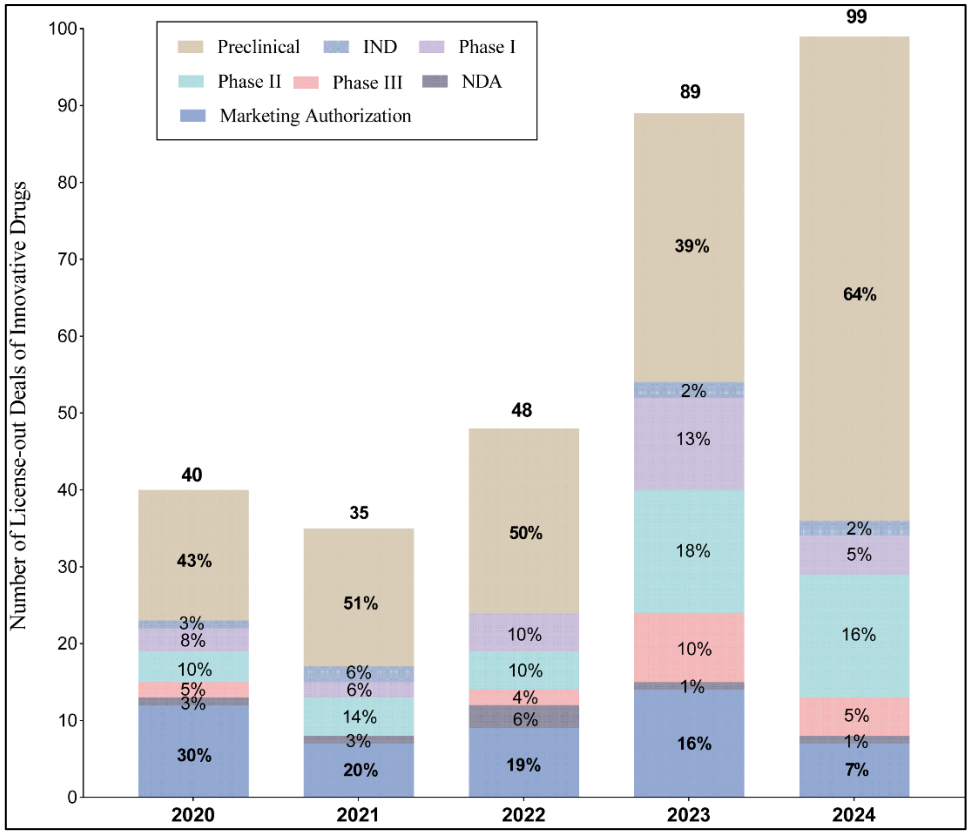
Supplementary Fig. 1 | Major policy reforms affecting China's pharmaceutical industry (2015-2024). The selected policies were chosen for their significant impact on areas such as drug innovation, market access, pricing and reimbursement. Key reforms include streamlining the review and approval process, measures to encourage the development of innovative drugs, controlling costs through the National Drug Centralized Procurement Program and enhancing market access through negotiations for inclusion in the National Reimbursement Drug List (NRDL). CFDA: China Food and Drug Administration; CPC, Communist Party of China; ICH, International Conference on Harmonisation; MAH, marketing authorization holder; NMPA: National Medical Products Administration. NHSA: National Healthcare Security Administration; NHC: National Health Commission; DRG: Diagnosis-Related Groups.



Supplementary Fig. 2 | Representative innovative drug pipeline of Chinese companies by drug type and development status (2015-2024). This panel characterizes innovative drugs or drug candidates from mainland China-based companies initiating first-in-human trials worldwide between 2015 and 2024, with pipeline activity tracked through 31 December 2024. Drugs are categorized into 10 representative drug types: cell therapies, small molecules, monoclonal antibodies, radiopharmaceuticals, bi-/multi-specific antibodies, antibody-drug conjugates (ADCs), gene therapies, therapeutic vaccines, small nucleic acids, targeted protein degraders (TPDs). Each drug type is further classified based on the highest global development status as of 31 December 2024, with Phase I/II trials counted as Phase II and Phase II/III trials counted as Phase III.



Supplementary Fig. 3 | Primary market financing dynamics for innovative drug development companies in mainland China (2015-2024). a | Annual distribution of total financing events and amount. **b |** Representative therapeutic pipeline distribution by financing activity. Finance events include all financing rounds prior to an initial public offering (IPO) and were compiled from press releases and corporate registration records from China's National Enterprise Credit System, with financing amounts reflecting the total funds raised per event. Bubble size represents event frequency, while color intensity (darker red) corresponds to high total capital raised. If a single financing event involved multiple therapeutic pipelines, it was counted separately for each pipeline. The average financing disclosure rate was 54.6%, based on events with publicly available financial data. ADC, antibody-drug conjugates; TPD, targeted protein degradation.



Supplementary Fig. 4 | Out-licensing deals of innovative drugs from China by development status at the time of licensing (2020–2024). The deals are categorized by the development status of the drugs, including preclinical, IND, Phase I, Phase II, Phase III, NDA and marketing authorization stages. Deals involving multiple drugs are counted multiple times. Phase I/II is counted as Phase II and Phase II/III is counted as Phase III.

Supplementary Table 1 | Overseas approvals of Chinese-origin innovative drugs

No.	Product name	Developers	Product type	Target	Therapeutic area	Date first approved in US	Date first approved in Europe	Date first approved in Japan	Date first approved in other regions
1	Zanubrutinib	BeiGene, Co., Ltd	Small molecule	Bruton's tyrosine kinase (BTK)	Oncology	Nov. 14, 2019	Nov. 22, 2021	Dec. 27, 2024	Feb. 1, 2021 (United Arab Emirates)
2	Levoamlodipine	CSPC Pharmaceutical Group Co., Ltd	Small molecule	L-type calcium channel	Cardiovascular	Dec. 19, 2019			
3	Albuvirtide	Frontier Biotechnologies Inc.	Polypeptide	Envelope glycoprotein gp41	Infection				Mar. 18, 2021 (Ecuador)
4	Chidamide	Shenzhen Chipscreen Biosciences Co., Ltd	Small molecule	Histone deacetylase (HDAC)	Oncology			Jun. 23, 2021	
5	Ciltacaptagene autoleucel	Nanjing Legend Biotech Co., Ltd	Cell therapy	B-cell maturation antigen (BCMA)	Oncology	Feb. 28, 2022	May 25, 2022	Sep. 26, 2022	
6	Benvitimod	Beijing Wenfeng Tianji Pharmaceuticals Co., Ltd	Small molecule	Aryl hydrocarbon receptor (AhR)	Immunology	May 23, 2022		Jun. 25, 2024	
7	TPN171	Vigonvita Life Sciences Co., Ltd.	Small molecule	Phosphodiesterase 5 (PDE5)	Urinary				Sep. 1, 2022 (Uzbekistan)
8	Tislelizumab	BeiGene, Co., Ltd	Monoclonal antibody	Programmed cell death 1 (PD1)	Oncology	Mar. 13, 2024	Sep. 15, 2023		May 30, 2024 (Australia)
9	Toripalimab	Top Alliance Biosciences	Monoclonal antibody	Programmed cell death 1 (PD1)	Oncology	Oct. 27, 2023	Sep. 19, 2024		
10	Fruquintinib	HUTCHMED, Ltd	Small molecule	Vascular endothelial growth factor receptor (VEGFR)	Oncology	Nov. 8, 2023	Jun. 20, 2024	Sep. 24, 2024	
11	Efbemalenograstim alfa	Evive Biotech, Ltd	Recombinant protein	Granulocyte colony-stimulating factor (G-CSF)	Oncology	Nov. 11, 2023	Mar. 21, 2024		
12	Serplulimab	Shanghai Henlius Biotech, Inc.	Monoclonal antibody	Programmed cell death 1 (PD1)	Oncology				Dec. 28, 2023 (Indonesia)
13	Recombinant human serum albumin	Tonghua Anrate Biopharmaceuticals Co., Ltd	Blood product	Albumin (ALB)	Other				Apr. 8, 2024 (Russia)
14	Conbercept	Chengdu Kanghong Pharmaceutical Co., Ltd	Recombinant protein	Vascular endothelial growth factor receptor (VEGFR)	Ophthalmology				Jun. 19, 2024 (Burma)
15	Glumetinib	Shanghai Institute of Materia Medica Chinese Academy of Sciences	Small molecule	Hepatocyte growth factor receptor (HGFR, c-Met)	Oncology			Jun. 24, 2024	
16	Sugemalimab	CStone Pharmaceuticals	Monoclonal antibody	Programmed death-ligand 1 (PDL1)	Oncology		Jul. 26, 2024		
17	Recombinant M. Tuberculosis ESAT6-CFP10 immunogen	Chongqing Zhifei Biological Products Co., Ltd	Recombinant protein	Mycobacterium tuberculosis (M.tb)	Infection				Oct. 17, 2024 (Indonesia)
18	Ensartinib	Betta Pharmaceuticals Co., Ltd	Small molecule	Anaplastic lymphoma kinase (ALK)	Oncology	Dec. 18, 2024			