China Anti-tumor and Autoimmune Disease Drug Market Study

Independent Market Research Report

Confidential For

劲方医药 GENFLEET

Date : 2025.9.11

For and on behalf of
Frost & Sullivan (Beijing) Inc., Shanghai Branch Co.

Name: Terry Tse
Title: Consulting Director

Frost & Sullivan
Sep 2025

Table of Contents

Primary Laws and Regulations in the Pharmaceutical Industry

Drug Management

Release Date	Issuing Authority	Policies	Comments
Aug, 2019	Standing Committee of the National People's Congress	*Drug Administration Law of the People's Republic of China (2019)* 《中华人民共和国药品管理法》（2019 年）	China's Basic Law on drug management stipulates the research, production, use and supervision of drugs in China, improves the implementation of the drug marketing authorization holder system (MAH), and strengthens the management of the full life cycle of drugs.
Mar, 2019	The State Council	*Implementation Regulations of the Drug Administration Law of the People's Republic of China (Revised in 2019)* 《中华人民共和国药品管理法实施条例》（2019 年）	In accordance with the Drug Administration Law, the administration and supervision of drug production and distribution enterprises and drugs shall be further clarified.
Jul, 2020	NMPA, National Health Commission	*Pharmacopoeia of the People's Republic of China (2020 edition)* 《中华人民共和国药典》（2020 年版）	Legal technical standards to be followed in drug development, production (import), distribution, use, supervision and administration.

Source: Government Website, Frost & Sullivan Analysis

Primary Laws and Regulations in the Pharmaceutical Industry

Drug Registration

Release Date	Issuing Authority	Policies	Comments
Jan, 2020	State Administration for Market Regulation	*Measures for the Administration of Drug Registration* 《药品注册管理办法》	The important operational regulations of China's drug research and development and registration management mainly stipulate drug clinical trials, marketing authorization and marketing approval, drug verification and registration and inspection
Jul, 2019	NMPA(CFDA)	*Announcement of the State Food and Drug Administration on Matters related to Further Improving Drug Related Review, Approval and Supervision* 《国家药监局关于进一步完善药品关联审评审批和监管工作有关事宜的公告》	The relevant matters related to the review, approval and supervision of raw materials, pharmaceutical excipients, packaging materials and containers in direct contact with drugs (referred to as original and auxiliary packages) and drug preparations are clarified
May, 2018	NMPA, National Health Commission	*Announcement on Optimizing Matters Related to the Review and Approval of Drug Registration* 《关于优化药品注册审评审批有关事宜的公告》	The working mechanism for drug priority review and approval has been further implemented, and the approval procedures for clinical trials have been simplified and accelerated
Nov, 2017	NMPA	*Acceptance of adjustment of drug registration* *Announcement of Work* 《关于调整药品注册受理工作的公告》	The drug registration applications that were previously accepted by the provincial food and drug administration and reviewed and approved by the State Food and Drug Administration are adjusted to the centralized acceptance by the State Food and Drug Administration (CFDA)

Source: Government Website, Frost & Sullivan Analysis

Primary Laws and Regulations in the Pharmaceutical Industry

Drug Registration

Release Date	Issuing Authority	Policies	Comments
Nov, 2017	NMPA(CFDA)	*Acceptance of Drug registration Notice of review guidelines (trial)* 《关于发布药品注册受理审查指南（试行）的通告》	The guidelines for the examination of drug registration acceptance are formulated in accordance with the Announcement on Adjusting the Acceptance of Drug Registration (No. 134 of 2017)
Nov,2017	NMPA(CFDA)	*Announcement of the State Administration of China on Adjusting the Review and Approval of Raw materials, Pharmaceutical excipients and Pharmaceutical Packaging Materials* 《总局关于调整原料药、药用辅料和药包材审评审批事项的公告》	Drug supervision and administration departments at all levels will no longer accept applications for the registration of raw materials, pharmaceutical excipients and pharmaceutical packaging materials separately, and will be reviewed together after the application for registration of related drug preparations is submitted
Oct,2017	General Office of the CPC Central Committee, The State Council	*Opinions on Deepening the Reform of the Review and Approval System to Encourage Innovation of Pharmaceutical Medical Devices* 《关于深化审评审批制度改革鼓励药品医疗器械创新的意见》	Promote the structural adjustment and technological innovation of the pharmaceutical and medical device industry, and put forward guidance on reforming clinical trial management, accelerating listing review and approval, promoting drug innovation and generic drug development, strengthening the full life cycle management of pharmaceutical and medical devices, and improving technical support capabilities
Aug, 2017	NMPA(CFDA)	*Notice on Matters related to Promoting the Pilot Work of the Drug Marketing Authorization Holder System* 《关于推进药品上市许可持有人制度试点工作有关事项的通知》	Further implement the legal responsibilities of drug marketing authorization holders, clarify the quality management system in entrusted production and the responsibility system of the whole chain of production and sales, and the regulatory cohesion, responsibility division and responsibility landing of cross-regional drug regulatory agencies

Source: Government Website, Frost & Sullivan Analysis

Primary Laws and Regulations in the Pharmaceutical Industry

Drug Registration

Release Date	Issuing Authority	Policies	Comments
Jul, 2017	NMPA(CFDA)	*Quality Management Practice for Non-Clinical Drug Studies* 《药物非临床研究质量管理规范》	It provides for non-clinical safety evaluation studies of drugs for application for drug registration, including activities related to non-clinical safety evaluation studies of drugs and other pre-clinical related research activities of drugs for registration purposes
May,2016	The State Council	*Notice of The General Office of the State Council on Issuing and Distributing the Pilot Program of the Holder System of Drug Marketing Authorization ((2016) No. 41)* 《国务院办公厅关于印发药品上市许可持有人制度试点方案的通知》（国办发〔2016]41 号）	Further clarify the application conditions, legal obligations and responsibilities, application procedures and scope of pilot drugs for drug registration applicants and drug marketing authorization holders
Mar,2016	NMPA(CFDA)	Announcement of the General Administration on the Release of the Work Plan for the Reform of the Registration Classification of Chemical Drugs (No. 51 of 2016) 《总局关于发布化学药品注册分类改革工作方案的公告（2016 年第 51 号）》	In order to encourage the creation of new drugs, strictly review and approval, improve drug quality, and promote industrial upgrading, the classification of chemical drugs registration is adjusted

Source: Government Website, Frost & Sullivan Analysis

Primary Laws and Regulations in the Pharmaceutical Industry

Drug Manufacturing

Release Date	Issuing Authority	Policies	Comments
Mar,2020	NMPA	*Announcement of the State Food and Drug Administration on the Implementation of the Newly revised "Measures for the Supervision and Administration of Drug Production"* 《国家药监局关于实施新修订<药品生产监督管理办法>有关事项的公告》	Implement the production license of drug manufacturers and the quality supervision and inspection of the production process
Jan,2020	State Administration for Market Regulation	*Measures for the Supervision and Administration of Drug Production* 《药品生产监督管理办法》	Comprehensively standardize the production license of drug manufacturers and the quality supervision and inspection of the production process
Mar,2019	The State Council	*Implementation Regulations of the Drug Administration Law of the People's Republic of China (Revised in 2019)* 《中华人民共和国药品管理法实施条例（2019 年修订）》	The establishment of a drug manufacturing enterprise shall be subject to the approval of the drug regulatory department of the province, autonomous region or municipality directly under the Central Government where the enterprise is located and shall be issued a Drug Manufacturing License. To be responsible for the safety, effectiveness and quality control of drugs during the whole process of drug development, production, distribution and use in accordance with law
Jan,2011	Former Ministry of Health	*Good Practice for Quality Control of Pharmaceutical Manufacturing (revised in 2010)* 《药品生产质量管理规范》（2010 年修订）	Standardize the basic requirements of drug production management and quality control, and systematically standardize the quality requirements of drug production from the aspects of drug production personnel arrangement, plant and facilities, and production equipment

Source: Government Website, Frost & Sullivan Analysis

Primary Laws and Regulations in the Pharmaceutical Industry

Drug Export

Release Date	Issuing Authority	Policies	Comments
Jul,2008	CFDA	*Notice on the Management of the Catalog for Some Exported Drugs and Medical Device Products and Production Projects* 《关于对部分出口药品和医疗器械生产实施目 录管理的通告》	Management of the Catalog for Some Exported Drugs and Medical Device Product Production Projects

Source: Government Website, Frost & Sullivan Analysis

Regulatory Authorities in China Pharmaceutical Industry

Authorities	Main Responsibilities	Nature
National Medical Products Administration 国家药品监督管理局	Drafting laws and regulations on drug supervision and management, formulating policies and plans, formulating departmental regulations, promoting the establishment of a direct reporting system for major information on drugs, and organizing the implementation and supervision of inspection. Responsible for drug registration, organizing the formulation and publication of the national pharmacopoeia and other drug standards, classification and management system, and supervising its implementation. Responsible for the development of drug supervision and management of the inspection system and organize the implementation of the organization to investigate and deal with major violations. Responsible for the construction of emergency response system for drug safety affairs; guiding local drug supervision and management work.	The main national regulatory agency responsible for administering the registration of drugs, medical devices, and cosmetics.
National Health Commission of the People's Republic of China 国家卫生健康委员会	Promoting medical and health system reform. Formulating strategic objectives, plans and policies for health reform and development, drafting relevant laws and regulations, formulating rules and regulations on health, food safety, medicines and medical devices, and relevant standards and technical specifications in accordance with the law. Establishing the national essential drug system and organizing its implementation, as well as organizing the formulation of the drug code and the national essential drug catalog. Organizing the formulation of national drug policies. Formulating policies and measures for the procurement, distribution and use of national essential medicines, and putting forward proposals on national pricing policies for essential medicines.	The main national governing body responsible for public health and family planning.

Source: Government Website, Frost & Sullivan Analysis

Industry Regulatory System

China's Drug Registration Process (1/2)

- Drug registration refers to the review process conducted by the national drug regulatory authorities based on the application submitted by the applicant for drug registration. The review assesses the safety, efficacy, quality control, and other aspects of the drug intended for sale. It also determines whether to approve the application. According to the "Administrative Measures for Drug Registration" regulations, the process applies to the clinical trial approval, drug manufacturing, drug import, and drug inspection and supervision in China, and follows the guidelines set by the "Administrative Measures for Drug Registration."
- According to the "Administrative Measures for Drug Registration," drug registration applications include new drug applications, generic drug applications, imported drug applications, supplementary applications, and re-registration applications.

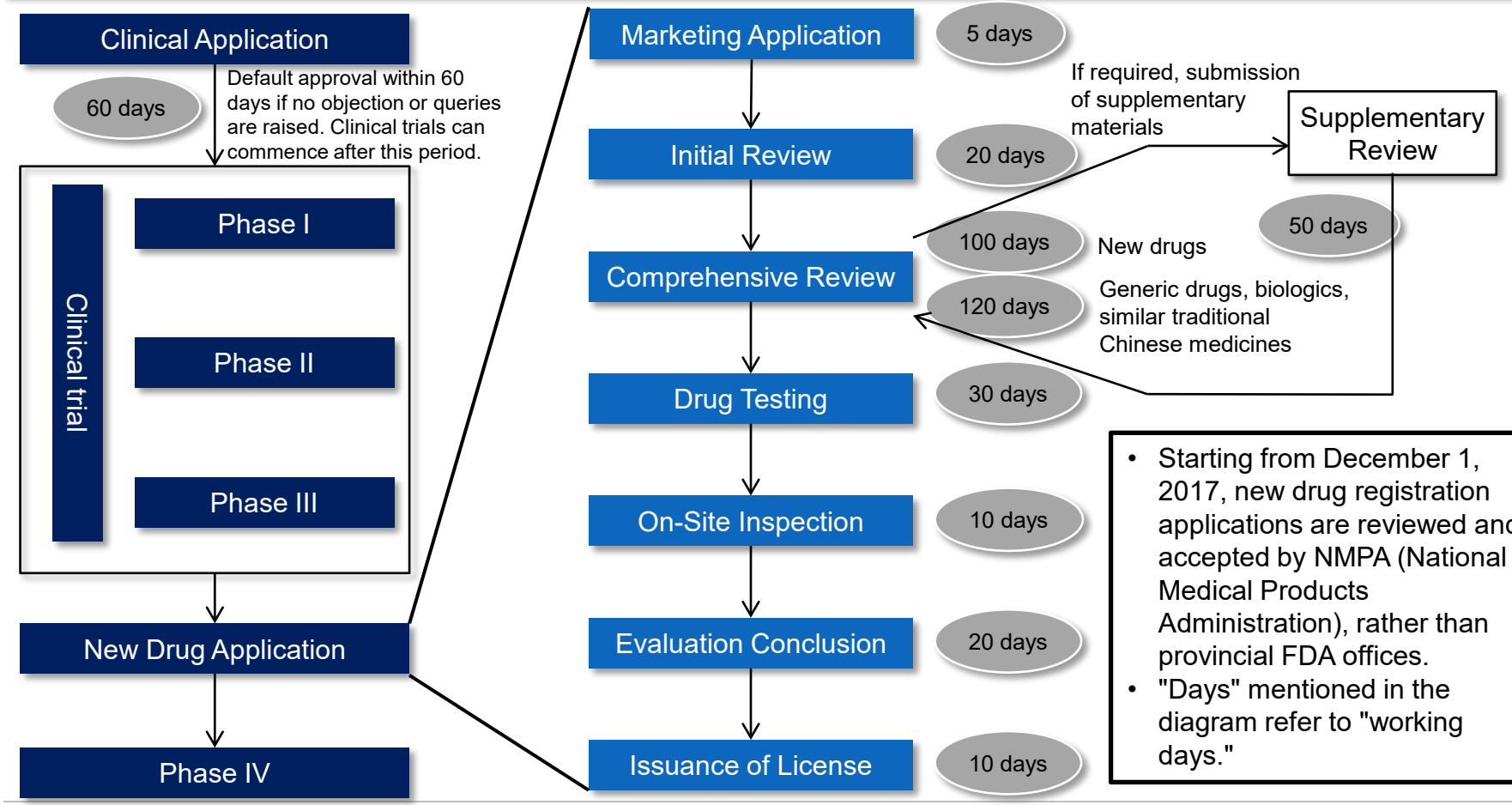
Application Type	Definition
New Drug Application	Applications for drugs that have not yet been marketed in China. This includes applications for changes to the dosage form, route of administration, or new indications of marketed drugs, which must be submitted according to new drug application procedures.
Generic Drug Application	Applications for generic drugs that have already been approved by the national drug regulatory authority, except for biological products, which must follow the new drug application procedures.
Imported Drug Application	Applications for drugs produced outside China and intended for sale within China.
Supplementary Application	Applications for modifications or cancellations of original approval items or application content, submitted after the approval of new drugs, generic drugs, or imported drugs.
Re-registration Application	Applications for the continued production or import of a drug after the expiration of the drug approval certificate's validity period.

Source: Government Website, Frost & Sullivan Analysis

Industry Regulatory System

China's Drug Registration Process (2/2)

- The drug registration application and approval process is divided into two stages: clinical trial applications and marketing applications. For new drug development, the drug regulatory department supervises the process according to the regulations, ensuring accurate submission of research methods, quality indicators, pharmacological and toxicological test results, and relevant documents and samples. After the regulatory department approves or does not raise objections to the application, the clinical trial can proceed. Once clinical trials are completed, the application for marketing and registration can begin, and upon approval, the drug regulatory department will issue a new drug certificate.



- Starting from December 1, 2017, new drug registration applications are reviewed and accepted by NMPA (National Medical Products Administration), rather than provincial FDA offices.
- "Days" mentioned in the diagram refer to "working days."

Source: Government Website, Frost & Sullivan Analysis

Favorable Policies for Innovative Drugs in China

Case Study: Clinical Value-Oriented Guidelines for the Clinical Development of Antitumor Drugs

- In Nov 2021, CDE released Clinical Value-Oriented Guidelines for the Clinical Development of Antitumor Drugs（《以临床价值为导向的抗肿瘤药物临床研发指导原则》）, the guidelines focused on clinical R&D of antitumor drugs, promote standardization of relevant industry. The release of the policy has impact on many pharmaceutical enterprises, but especially benefits companies with pipelines aligned with the guideline in the long run.

Date	Agency	Policy	Comments
15th Nov 2021	Center for Drug Evaluation, NMPA (CDE) 国家药品监督管理局药品评审中心	CDE released Clinical Value-Oriented Guidelines for the Clinical Development of Antitumor Drugs 《以临床价值为导向的抗肿瘤药物临床研发指导原则》	After the issuance of the guidelines, it turns the industry standards into regulatory documents, further driving the standardization of the clinical research and development of anti-tumor drugs industry.

Key policy contents

- The overarching goal of new drug development should be to provide patients with better treatment options.
- Randomized controlled studies should try to provide participants with the best treatment or drug in clinical practice, and should not select less safe and effective treatments or drugs for sake of improving clinical trial success and trial efficiency.

- When a drug is selected as the positive control, it should responds and represents the best medication situation of the target indication patients.
- When planning to choose a placebo or BSC as control group, there must have no standard treatment for this indication in the clinic. When exist, BSC should be preferred as control rather than placebo.

impact analysis

- With the promulgation of the guideline, the is expected that the stakeholders will act accordingly to get aligned with the policy.

To companies: Biotechnology and biopharmaceutical companies that has clinical trials designed in accordance with the guideline will gain more competitiveness in a long run. This will encourage the other market players to emphasize more on innovation rather than simply focusing on the speed and number of doing clinical trials.

To investors: The investors will re-evaluate the value of the biotechnology companies that they would like to invest, with focus being put more on the companies that is outstanding in innovation. Investment will flow more to these companies, bringing them more support for further innovation.

Positive for first-in-class or drugs with novel modality: Innovation in drug R&D is highly encouraged. Generic drugs and biosimilars should be cautiously chosen when founding the company and developing drugs.

Source: Government Website, Frost & Sullivan Analysis

Favorable Policies/ Regulations

Review of Clinical Trial and New Drug Application

Release Date	Issuing Authority	Policies	Comments
May, 2018	NMPA	*Notice for Optimizing the Examination, Assessment and Approval of Drug Registration* *《关于优化药品注册审评审批有关事宜的公告》*	In order to improve the efficiency of review and approval of innovative drugs as well as simplify the procedure: • The review and approval for rare diseases that seriously endanger life with no effective treatment could be sped up through communication system between CDE and applicants. • The clinical data obtained overseas with no ethnic difference could directly apply for drug launch registration.
Jul, 2018	NMPA	*Technical Guidelines for Accepting Data from Overseas Clinical Trials of Drugs* *《接受药品境外临床试验数据的技术指导原则》*	• In order to encourage the synchronous drug R&D both domestic and abroad, the acceptable overseas clinical trials data are clarified. • The overseas R&D of generic drug with complete and assessable bioequivalence data can also be used for registration applications.
Jul, 2018	NMPA	*Announcement on Adjusting the Examination and Approval Procedure of Drug Clinical Trials* *《关于调整药物临床试验审评审批程序的公告》*	• Drug clinical trial filing system: The drug clinical trial can be carried out according to the submitted scheme if the applicant fails to receive the negative or doubtful opinions from CDE within 60 days from the accepted and payment date of the application.
Oct, 2018	NMPA	*Announcement on the urgent clinical need for approval of new drugs abroad* *《关于临床急需境外新药审评审批相关事宜的公告（2018年第79号）》*	Establish a special channel for review and approval of overseas innovative drugs that are urgently needed, which has launched in the US, the EU or Japan in the past 10 years but not in China, meeting one of the following circumstances: • Drugs for the treatment of rare diseases • Drugs for serious life-threatening diseases without effective treatment • Drugs have obvious clinical advantages for serious life-threatening diseases. The innovative drugs from abroad can be declared for manufacturing directly without domestic clinical data after demonstration of no ethnic difference.

Source: Government Website, Frost & Sullivan Analysis

Favorable Policies/ Regulations

Review of Clinical Trial and New Drug Application

Release Date	Issuing Authority	Policies	Comments
Sep, 2019	NHC, NHSA, NMPA	*Notice for the Publication of the Health China_ Implementation Plan for Cancer Prevention (2019-2022 edition)* *《关于印发健康中国行动——癌症防治实施方案（2019—2022年）的通知》*	• Establish a comprehensive clinical evaluation system for anticancer drugs. • Speed up the approval of new anticancer drugs at home and abroad.
Nov, 2019	NMPA	*Notice on Soliciting Opinions on the Working Procedures of Breakthrough Therapeutics and the Priority Review and Approval Process* *《关于突破性治疗药物工作程序和优先审评审批工作程序征求意见的通知》*	• Encourage research and innovation, and accelerate the development of drugs with significant clinical advantages. • For innovative drugs or improved new drugs that are used to prevent or treat severely life-threatening diseases, and that have no effective prevention measures or have sufficient evidence to show obvious clinical advantages compared with existing therapies, they can apply for Breakthrough Treatment Drugs. • Breakthrough Treatment Drugs can be reviewed and approved first.
Jan, 2020	State Administration for Market Regulation	*Drug Registration Management Measures* *《药品注册管理办法》*	• Optimize the review and approval workflow. • Establish four accelerated channels for breakthrough therapeutic drugs, conditional approval, priority review and approval, and special approval to clarify the review time limit and improve the efficiency of drug registration and the expectation of the registration time limit.
Jul, 2020	NMPA	*Working Procedures for Review of Breakthrough Therapeutics (Trial)* *《突破性治疗药物审评工作程序（试行）》*	• To encourage research and innovation, and accelerate the development of drugs with significant clinical advantages. • For innovative drugs or improved new drugs that are used to prevent or treat severely life-threatening diseases, and that have no effective prevention measures or have sufficient evidence to show obvious clinical advantages compared with existing therapies, they can apply for Breakthrough Treatment Drugs.

Source: Government Website, Frost & Sullivan Analysis

Favorable Policies/ Regulations

Review of Clinical Trial and New Drug Application

Release Date	Issuing Authority	Policies	Comments
Nov, 2020	NMPA	*Technical Guidelines for Conditional Approval of Drugs for Marketing (Trial)《药品附条件批准上市技术指导原则（试行）》*	• Conditional approval refers to the situation that the existing clinical research data has not met all the requirements of conventional new drug registration, but it shows curative effects and clinical values can be predicted based on surrogate endpoints, intermediate clinical endpoints or early clinical trials.
Dec, 2020	CDE	*Technical Guidelines for Communication on Clinical Aspects of Pre-application Marketing Authorization for Antineoplastic Drugs Supporting Marketing in Single-Arm Trials《单臂试验支持上市的抗肿瘤药上市许可申请前临床方面沟通交流技术指导原则》*	• On the basis of communication with the regulator prior to entering the pivotal trial and reaching a consensus on the key indicators and requirements in the trial, the applicant may use the results of the single-arm trial to support the marketing. • The guideline also stipulates the information that the applicant should prepare before applying for the communication exchange, and provides reminders on the core issues to be discussed in the communication exchange meeting, which mainly include the trial population, efficacy, safety, dynamic submission/supplementary information, confirmatory trial and other six aspects in total.
Dec, 2020	CDE	*Technical Guidelines for Communication and Exchange of Clinical Aspects of Single-Arm Trials to Support the Entry of Registered Innovative Antitumor Drugs into Pivotal Trials《单臂试验支持注册的抗肿瘤创新药进入关键试验前临床方面沟通交流技术指导原则》*	• In principle, single-arm trials are applicable to single-drug therapies with outstanding efficacy in the context of refractory diseases that are severely life-threatening and for which standard treatments are lacking; the focus will be on assessing whether the efficacy has the potential to significantly outperform existing therapies and warrants the use of a single-arm trial to accelerate development. • The guideline also stipulates the information to be prepared by the applicant before applying for the communication, and provides hints on the core issues to be discussed in the communication meeting, which mainly include seven aspects, including preliminary safety data, dosage selection, applicability of single-arm trials, design of pivotal trial protocols, IRC charter, expected marketing conditions and other issues.

Source: Government Website, Frost & Sullivan Analysis

Favorable Policies/ Regulations

Review of Clinical Trial and New Drug Application

Release Date	Issuing Authority	Policies	Comments
June,2022	CDE	*Technical Guidelines on the Applicability of Single-Arm Clinical Trials for Use in Support of Antineoplastic Drug Marketing Applications (Draft for Comment)《单臂临床试验用于支持抗肿瘤药上市申请的适用性技术指导原则》（征求意见稿）*	• The limitations, applicability, requirements for confirmatory clinical trials and other concerns of single-arm clinical trials were elaborated in detail, and it was clearly pointed out that single-arm clinical trials are generally applicable to the study population with no effective therapeutic choices, clear mechanism of action of the test drug, clear data on efficacy of external controls for the indications, outstanding effectiveness of the test drug, controllable safety risks and rare tumors. • Moreover, it emphasized that the above conditions for the applicability of single-arm clinical trials are not sufficient conditions for the adoption of a single-arm study design for pivotal clinical trials, i.e., it is not necessarily acceptable for SAT to be used as a pivotal clinical trial in support of a market launch if the above conditions are met. Whether SAT is ultimately accepted as a pivotal study in support of marketing application should be based on the combination of the potential benefit-to-risk ratio of the test drug in the target population and whether the mechanism of the disease and the drug and the results of the SAT can form a chain of evidence, so that the results of the SAT will be sufficient to predict/confirm the effectiveness of the drug and so on, to jointly determine the reasonableness of the use of SAT as a pivotal study.
July, 2023	NMPA	*Provisions of Drug Standards《药品标准管理办法》*	• Further standardize and strengthen the management of drug standards, ensure the safety, efficacy and controllable quality of drugs, and promote the high-quality development of drugs.

Source: Government Website, Frost & Sullivan Analysis

Favorable Policies/ Regulations

Review of Innovation Encouragement

Release Date	Issuing Authority	Policies	Comments
Jan, 2018	State council	*Reform of Review and Approval System for Drugs and Medical Devices to Encourage Innovation (the Opinion)* *《关于深化审评审批制度改革鼓励药品医疗器械创新的意见》*	• Promote the integration of drug registration technical standards with international standards. • Accelerate the drug examination and approval process. • Strengthening the management for drug life cycle.
Mar, 2018	NMPA	*Guidance for Pharmaceutical Research in Phase III Clinical Trials of Innovative Drugs (Chemicals)* *《创新药(化学药) III期临床试验药学研究信息指南》*	• Encourage R&D of new and innovative drugs. • Accelerate establishment of the standard system of technical guidelines for R&D and examination and approval process of innovative pharmaceuticals. • Improve the quality and efficiency new R&D review.
May, 2018	NMPA	*Announcement on Optimizing Review and Approval of Registration of Medical Products Issued* *《关于优化药品注册审评审批有关事宜的公告》*	• For medical products for prevention and treatment of seriously life-threatening diseases without any effective treatment and rare diseases, clinical trial data obtained from overseas can be submitted to apply for the registration if there is no racial difference. • Drug testing is required based on product safety risk control • File review procedure in re-registration of imported drugs is canceled to simplify the registration process.
Aug, 2019	NMPA	*Pharmaceutical Administration Law of the People's Republic of China* *《中华人民共和国药品管理法》*	• It is the second major systematic and structural amendment to the Pharmaceutical Administration Law since its first promulgation in 1984. • Focus on supporting clinical value-oriented drug innovations which have significant effects on human disease. Encourage the development of new medicines with new treatment mechanism on severely life-threatening diseases, rare diseases and children's diseases. • Establish related laws of clinical trial acquiescence system, clinical trial institution filing management system, priority review and approval system, conditional approval system, etc. • Established a listing authorization system to encourage innovation.
Oct, 2020	The National People's Congress	*Decision on Amending the "Patent Law of the People's Republic of China* *《关于修改〈中华人民共和国专利法〉的决定》*	• To encourage pharmaceutical innovation while giving innovators due intellectual property protection. • Add the related content of compensation for drug patent term and early settlement mechanism of drug patent dispute.

Source: Government Website, Frost & Sullivan Analysis

Medical Reimbursement Policy

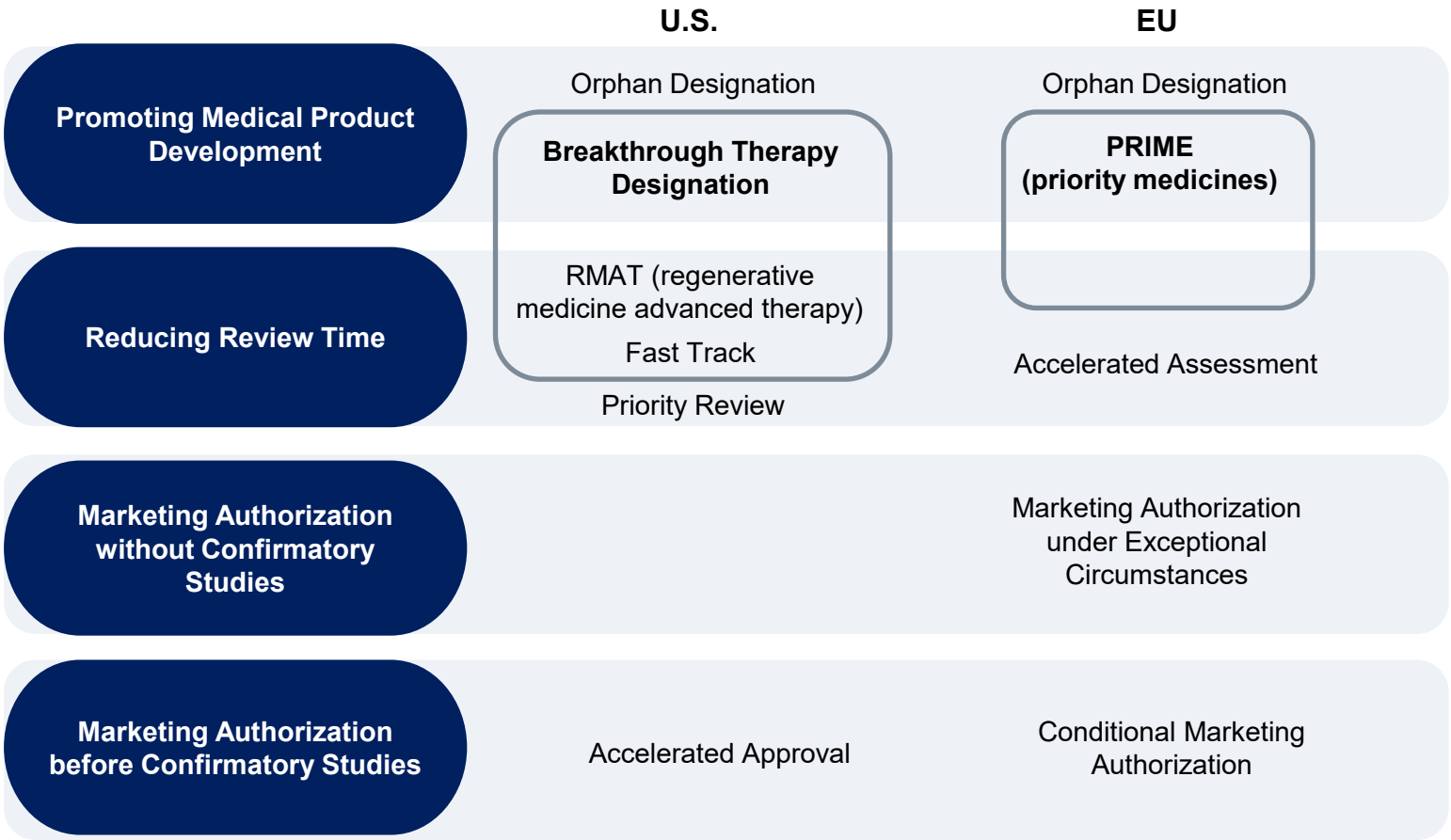
Release Date	Issuing Authority	Policies	Comments
Jul, 2018	NHC, MoHRSS, MoF	*Notice for Improving Basic Medical Insurance for Urban and Rural Residents in 2018* *《关于做好2018年城乡居民基本医疗保险工作的通知》*	• In 2018, the standard of financial subsidy and individual payment of medical insurance for urban and rural residents was raised simultaneously.
Oct, 2018	National Healthcare Security Administration	*The inclusion of 17 drugs in the national basic medical insurance, industrial injury insurance and maternity insurance category B* *《关于将17种药品纳入国家基本医疗保险、工伤保险和生育保险药品目录乙类范围的通知》*	• China has included 17 more cancer drugs in its national basic medical insurance program, among 44 selected cancer drugs for negotiations on lowering their prices and inclusion in the list of drugs eligible for reimbursement through the medical insurance program.
Nov, 2019	MoHRSS	*Notice for the inclusion of 2019-Negotiations-Drugs in List B of the National Basic Medical Insurance, Industrial Injury Insurance and Birth Insurance Catalogue* *《关于将2019年谈判药品纳入国家基本医疗保险、工伤保险和生育保险药品目录乙类范围的通知》*	• Included 97 successful negotiations drugs (70 new drugs + 27 renewal drugs).
Dec, 2020	National Healthcare Security Administration	*Catalog for National Basic Medical Insurance, Work-related Injury Insurance and Maternity Insurance, 2020* *《国家基本医疗保险、工伤保险和生育保险药品目录(2020年)》*	• There are 2,800 drugs in the list, involving 1,264 western drugs and 1,315 traditional Chinese drugs. There are also 892 kinds of Chinese herbal medicine. • This catalog adjustment is the first attempt to negotiate a price reduction for the drugs in the catalog.
Dec, 2021	National Healthcare Security Administration	*Catalog for National Basic Medical Insurance, Work-related Injury Insurance and Maternity Insurance, 2021* *《国家基本医疗保险、工伤保险和生育保险药品目录(2021年)》*	• There are 2,860 drugs in the list, involving 1,486 western drugs and 1,374 traditional Chinese drugs. There are still 892 kinds of Chinese herbal medicine. • 74 new drugs were added to the catalog and 11 drugs were removed from the catalog. The newly-added drugs accurately complement the medication needs of tumors, chronic diseases, anti-infections, rare diseases, women and children.

Source: Government Website, Frost & Sullivan Analysis

Overview of Expedited Regulatory Review for Innovative Therapies

U.S., EU

- Several expedited regulatory review projects for innovative therapies have been developed in the U.S. and the EU.
- Each regulatory agency has elaborated an original regulatory framework and adopted the regulatory projects developed by the other regulatory agencies. For example, the FDA first developed the breakthrough therapy designation, and then EMA introduced the PRIME.



Note: The encircled items mean that those items satisfy all the included features mentioned on the left.

Source: Frost & Sullivan Analysis

Overview of Special Designation for Innovative Therapies

EU's PRIME, FDA's Breakthrough Therapy

- In the U.S. and EU, special designations are in place to promote the early application and expediate the development of innovative therapies.

	PRIME (EU-EMA)	Breakthrough Therapy (U.S.-FDA)
Qualifying Criteria and Eligibility	• Demonstrate potential to address unmet medical needs based on early clinical data; May offer a major therapeutic advantage over existing treatments, or benefit patients without treatment options.	• Treat a serious or life-threatening disease or condition and provide preliminary clinical evidence indicating a potential for substantial improvement over existing therapies on one or more clinically significant endpoints.
Engagement with Regulators	• Intense guidance, including early and ongoing scientific advice on the development plan, with involvement of multiple stakeholders • Early appointment of CHMP/CAT Rapporteur • Initial kick-off meeting • Assign a dedicated contact point	• Increased communication and guidance from FDA during development and review • Cross-disciplinary project lead assigned to the FDA review team • Increased involvement of senior managers and experienced review staff
Regulatory Response Time to Request	• 40 days from the start of procedure	• Within 60 days of receipt of the request
Review Timeline Implications	• If confirmation of eligibility for accelerated assessment, then the evaluation for market authorization application takes up to 150 days (versus 210 days for standard products)	• Could be eligible for priority review (i.e. 8 months) if supported by clinical data at the time of submission • To date, all approvals with breakthrough therapy designation have received priority review

Source: Frost & Sullivan Analysis

Overview of Healthcare Insurance System in the U.S.

- The U.S. healthcare system does not provide universal coverage and can be defined as a mixed system, where publicly financed government health coverage coexists with privately financed market coverage. The majority of health insurance in the U.S. is covered by commercial providers.

Public Medical Insurance	**Medicaid**	• Medicaid is a medical and healthcare program for low-income groups. • Targeted at low-income parents, the elderly, children, and people with disabilities. • Jointly funded by the U.S. federal government and the state governments. • The CMS center supervises the implementation of the projects in each state.
	Medicare	• Established in accordance with the Social Security Amendment in 1965, which is operated by the U.S. federal government. • It serves the elderly over the age of 65 or persons with disability or end-stage renal disease who meet certain conditions and are under the age of 65.
	CHIP(Children 's Health Insurance Program)	• Determined by the Balanced Budget Act of 1997, which provided health insurance for children from low- and middle-income families in the US in the form of federal funding provided by the federal government. • The targets are those children whose family income is less than twice the federal poverty line and who have not participated in other private insurance.
Commercial Medical Insurance		• Commercial insurance providers are private insurance companies that contract with businesses or individuals to help cover healthcare costs according to criteria set forth in a formal health plan. Private health insurance plans typically require that the company or the individual receiving coverage pay a predetermined deductible or a monthly premium before benefits take effect. • Unlike heavy reliance on public medical insurance in China, commercial medical insurance contributes the majority of the healthcare services payment in U.S.. Types of commercial medical insurance includes: 1. **Preferred provider organizations (PPOs):** PPOs operate off a list of preferred healthcare providers that patients can choose from for their coverage. Patients save the most money on their healthcare plans by selecting the preferred providers affiliated with a PPO. 2. **Health maintenance organizations (HMOs):** HMOs are groups of physicians, medical facilities, and healthcare services that work to keep patients under the care of providers within their network. Healthcare providers in HMOs coordinate a patient's healthcare decisions and suggest a suitable hospital for urgent care. 3. **Point-of-service Plans:** Point-of-service plans form a hybrid between PPOs and HMOs. As with HMOs, point-of-service plans allow you to select physicians and services from within a dedicated network of providers.

Source: Frost & Sullivan Analysis

Overview of Healthcare Insurance System in the EU

- Overall, although the medical insurance systems of members in the European Union, differ in specific operation system, funding source, etc., they have managed to achieve comprehensive health care coverage and provide equal access to a high volume of advanced medical services. There are 3 predominant systems of healthcare finance in the European Union.
- Germany's healthcare insurance system is recognized to be one of the best, and the categories of it are listed below.

Countries	Predominant System of Finance	Main Supplementary System of Finance
Finland, Greece, Ireland, Italy, Sweden, Spain, United Kingdom	Public: taxation	Private voluntary insurance, direct payments
Denmark, Portugal	Public: taxation	Direct payments
Austria, Belgium, France, Germany, Luxembourg	Public: compulsory social insurance	Private voluntary insurance, direct payments, public taxation
Netherlands	Mixed compulsory social insurance and private voluntary insurance	Public taxation, direct payments

German Medical Insurance System

Public Medical Insurance

- The statutory social insurance system covers over 90% of the German population, unless their income exceeds €64,350 per year in 2021.
- Workers below a certain income threshold are required to take out statutory health insurance, the unemployed are entirely covered by the State.
- The insurance system covers outpatient/inpatient service, certain rehabilitation treatment and medicine pay. It is not dependent on an individual's health condition, but a percentage of salaried income under €64,350.

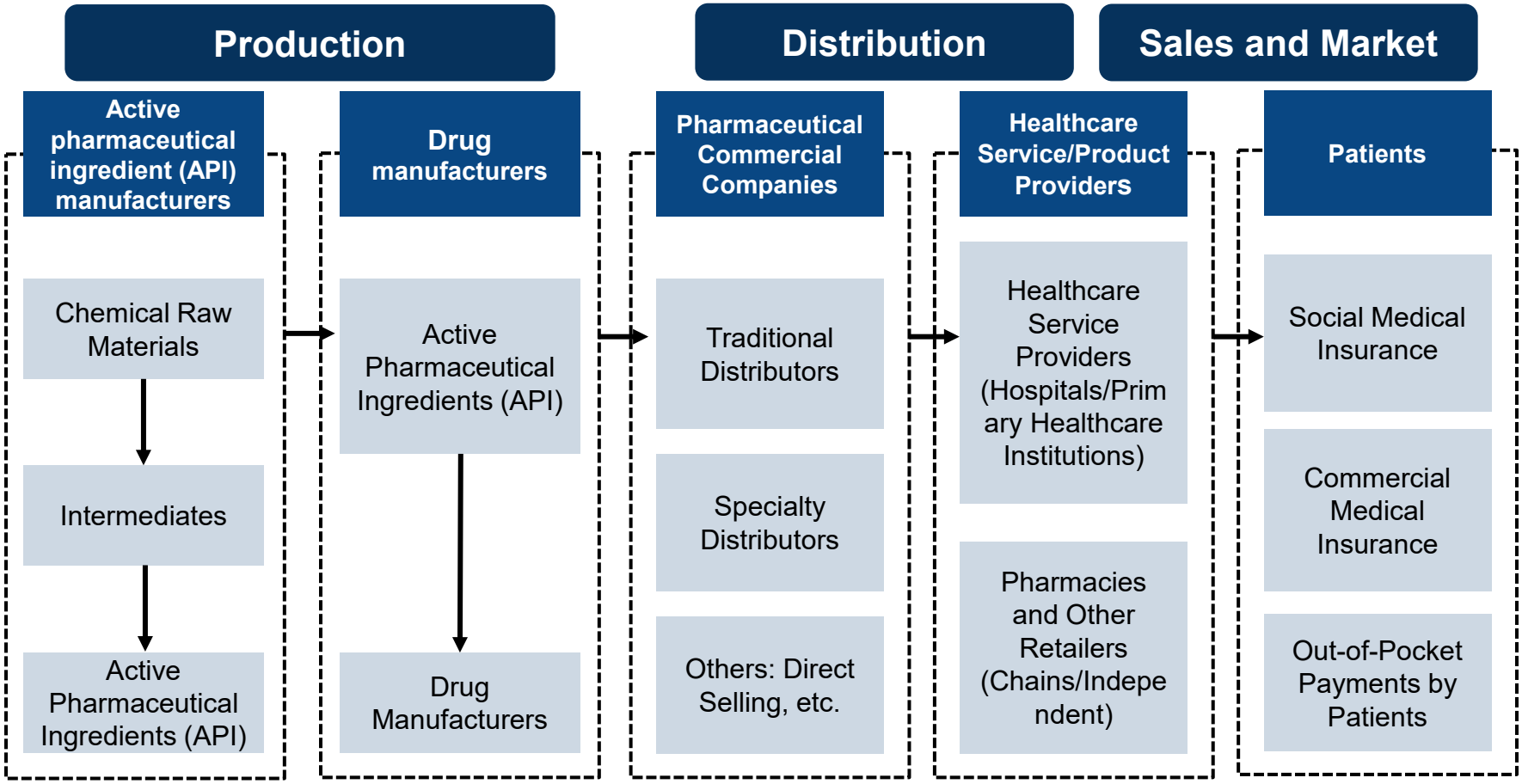
Commercial Medical Insurance

- High income earners (over €64,350 per year) are privately insured with private insurance companies.
- In the private system, the premium is based on an individual agreement between the insurance company and the insured person defining the set of covered services and the percentage of coverage.

Source: Frost & Sullivan Analysis

Analysis of Pharmaceutical Industry Chain

- The pharmaceutical industry is an important component of the national economy. In the pharmaceutical industry, raw material suppliers and drug manufacturers are positioned upstream in the industry chain, providing production services. Commercial companies offer drug distribution and logistics services to the pharmaceutical sector, while the downstream of the industry consists of sales terminals, including hospitals, pharmacies, and patients.



Source: Frost & Sullivan Analysis

Common Research and Development Models for Innovative Pharmaceutical Companies

- The development models of innovative pharmaceutical companies generally fall into three categories: Independent Research, License-In/Out, and Collaborative Development. These three models are suitable for different types of companies and each has its advantages and disadvantages.
- There are differences in the characteristics of the License-In/Out model at different stages. When License-In/Out is performed in the preclinical stage, the drug has not yet entered human trials, and at this time the risk is higher, but there is also more room for future gains. License-In/Out at the clinical stage is supported by certain clinical data, and the negotiation basis is more solid for the licensee.

	Independent Research	License-In / License-Out	Collaborative Development
Overview	Independent research refers to the enterprise conducting its own drug development, including drug design and core production processes, with independent intellectual property rights.	License-In is a model where a product is introduced into the company, with the core elements being "product introduction" and "product licensing.“, to obtain the commercial rights for the product’s research, production, and sales in a specific country or region. License-Out model is where a company that owns its own patents or technologies licenses them to other companies to develop, produce and sell them globally.	Collaborative development is a model where two parties jointly carry out drug research and development, with both parties providing all or part of the funds, technology, and equipment needed. According to the agreement, both parties cooperate in the operation of the drug development project.
Advantages	• High return on products • Complete intellectual property rights	License-In: • Rich product line • Quick market entry • Possession of complete intellectual property rights License-Out: • Reduce R&D costs and time • Diversify risk • Leverage partner expertise and resources	• Strategic alliances foster biological technology industrialization • Cost savings, improved efficiency, and increased success rates
Disadvantages	• Longer development cycle • Requires significant upfront capital investment • Higher risks during the development process • Complex management system	License-In: • Requires sufficient capital and strong purchasing power • The company must have academic ability or sales ability in the corresponding field • Certain independent research capabilities are needed to bring the licensed-in product to clinical trials and market License-Out: • Difficulty in operating the model • Constrained by the probability of drug development and limited equity in the drug under the license-out model	• If any problems arise, both parties must share responsibilities and risks • Potential for conflicts or disagreements, necessitating a consideration of possible termination of collaboration

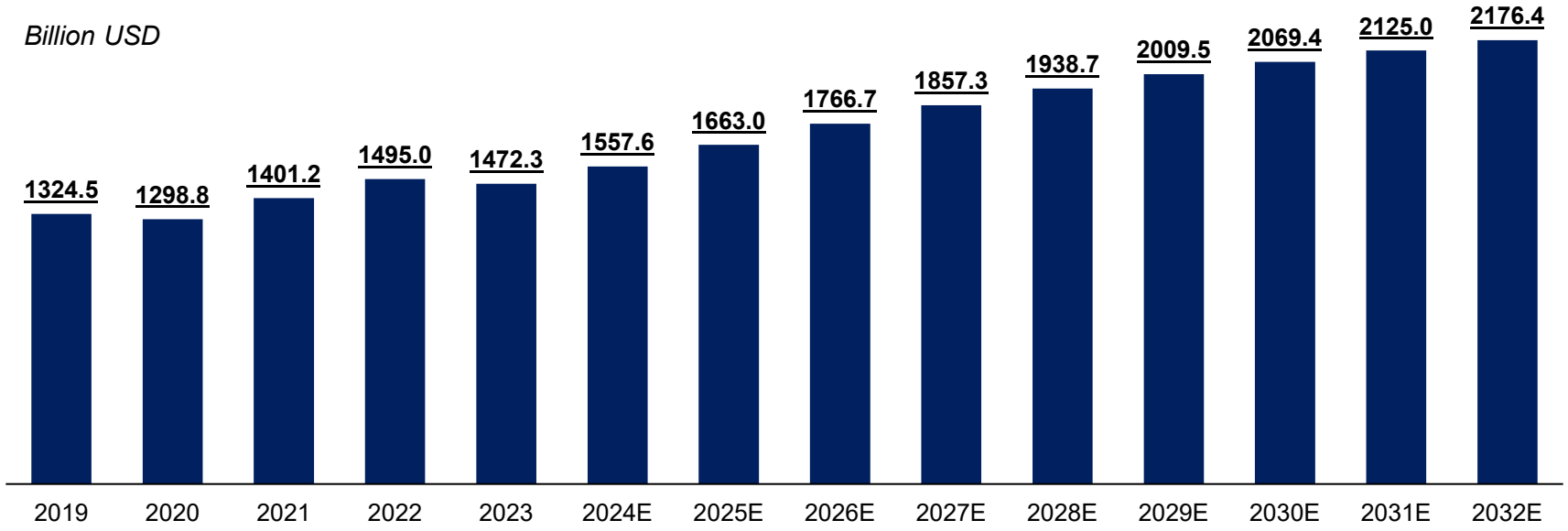
Source: Public Information, Frost & Sullivan Analysis

Global Pharmaceutical Market, 2019-2032E

- Global pharmaceutical market size continues to grow, rising from 1,324,5 billion USD in 2019 to 1472.3 billion USD in 2023.The global pharmaceutical market size is expected to grow at a CAGR of 4.4% between 2023 and 2032, increasing to 2176.4 billion USD by 2032.

Global Pharmaceutical Market, 2019-2032E

	CAGR
2019-2023	2.7%
2023-2032E	4.4%



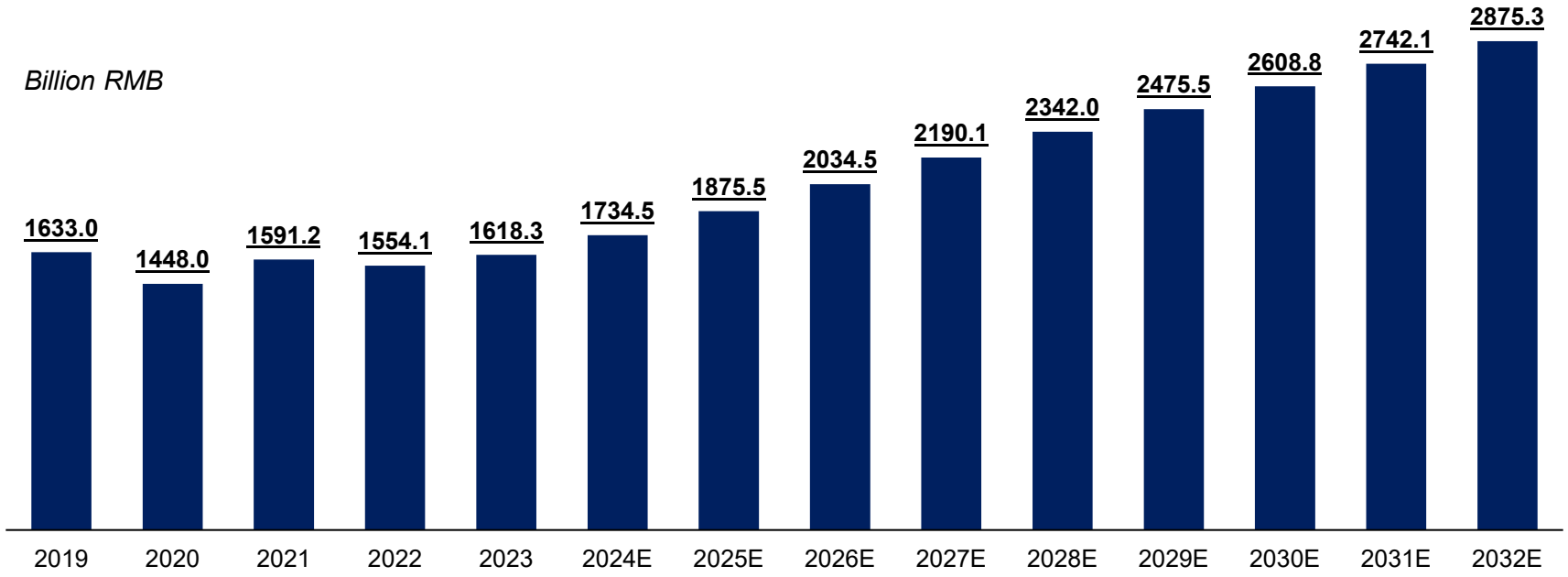
Source: Frost & Sullivan Analysis

China Pharmaceutical Market, 2019-2032E

- China pharmaceutical market size decreases slightly from 1,633.0 billion RMB in 2019 to 1618.3 billion RMB in 2023. China pharmaceutical market size is expected to grow at a CAGR of 6.6% between 2023 and 2032, increasing to 2,875.3 billion RMB by 2032.

China Pharmaceutical Market, 2019-2032E

	CAGR
2019-2023	-0.2%
2023-2032E	6.6%



Source: Frost & Sullivan Analysis

Table of Contents

Comparison of Different Therapeutic Modalities

Characteristics	Cellular Therapy Products	Biologic Targeted Drugs	Small Molecule Targeted Drugs	Chemotherapy
Safety	• By specifically targeting tumor cell antigens, CAR-T therapy minimizes off-target effects and side effects. • It may trigger an immune response.	• Specific antigen recognition reduces off-target side effects. • It may trigger an immune response.	• Small molecule drugs are more likely to produce off-target effects, leading to greater side effects. • Low immunogenicity.	• Whole body cytotoxicity: Chemothera circulates throughout patients' body a damage both cancerous and healthy cells, causing off-target effects and reducing patients' quality of life. • Immune Suppression: High-dose chemotherapy can deplete effector immune cells, leading to immunosuppression and increased susceptibility to infections.
Effectiveness	• Long-term Efficacy: Cellular immunotherapy enhances immune memory and can remain active in patients for weeks to months, extending response duration and reducing tumor recurrence. • Cellular therapy has shown efficacy in hematological malignancies but faces obstacles in solid tumors.	• Longer half-life: Most antibody drugs are typically administered via intravenous injection every 1-2 weeks. • Multi-target: Biologics can be designed to target multiple target proteins simultaneously, enhancing therapeutic efficacy.	• Drugs with a shorter half-life generally need to be taken daily. • Small molecules offer high oral bioavailability, easy vascular penetration, and broad distribution in tumor tissues.	• Chemotherapies directly damage the nucleus of cancer cells when they div • Drug Resistance: Cancer cells gradua generate resistance to almost all chemotherapeutic drugs via a variety mechanisms and pathways.
Production	• The production of cellular products typically includes complicated steps including cell collection, genetic engineering, cell culture, and formulation. • Maintaining drug activity throughout the production process also leads to higher production costs.	• This process involves various steps from cell culture to final product filling and requires precise control to ensure product quality and safety throughout the manufacturing process.	• The production process has fewer steps and is quicker than that of biologics, and it is less sensitive to storage conditions, making storage and transport easier.	• Chemotherapeutic agents are typicall small molecules or cytotoxic drugs produced through chemical synthesis
Price	• The cost is relatively high, with approved products in China exceeding 1 million RMB per dose.	• Annual treatment costs range from hundreds of thousands to over a million RMB, depending on the drug and cancer type.	• Annual treatment costs vary by drug and cancer type, ranging from tens to hundreds of thousands of RMB.	• Cost varies by drug and dosage, but chemotherapy is generally more affordable than targeted therapy.
Head-to-head clinical trial versus BIC)	• Mostly head-to-head trial versus standard-of-care(SOC)	• i.e. Trial HARMONi-2 (AkesoBio): Ivonescimab (anti-PD-1/VEGF) vs pembrolizumab (KEYTRUDA) as first-line treatment in patients with PD-L1-positive aNSCLC	• i.e. Trial ALPINE (BeiGene): zanubrutinib vs ibrutinib in previously treated patients with R/R CLL or SLL who received at least 1 prior systemic therapy	• /

Source: Frost & Sullivan Analysis

Development Path of Cancer Treatment

- Cancer treatment has gone through a long process of development in history, and it will continue to evolve over time with the innovative and hard work of scientists around the world.
- Today, major treatments include surgery, radiotherapy, chemotherapy, targeted therapy, and immunotherapy.

Milestones in Cancer Treatment

Surgery
1881, first successful surgery performed for stomach cancer

- ***Surgery*** is a procedure in which a surgeon removes cancer from patient's body.
- Surgery works best for solid tumors that are contained in one area. It is not used for leukemia or for cancers that have spread. Surgery may be performed before or after other forms of treatment.
- In addition to removal of the primary tumor, surgery is often necessary for staging.

Radiotherapy
1903, first successful use of radiation to cure skin cancer

- ***Radiotherapy*** is a cancer treatment that uses high doses of radiation to kill cancer cells and shrink tumors.
- Radiotherapy can be used to treat many types of cancer including solid tumors and leukemia. And in many cases, patients receive radiotherapy with other cancer treatments, such as surgery and chemotherapy.
- Radiation not only kills or slows the growth of cancer cells, it can also affect nearby healthy cells, which will cause side effects.

Chemotherapy
1949, FDA approved first chemotherapy drug - nitrogen mustard - for the treatment of Hodgkin lymphoma

- ***Chemotherapy*** is a cancer treatment that uses chemical substances, especially one or more anti-cancer drugs to stop or slow the growth of cancer cells.
- Chemotherapy can be used to treat many types of cancer alone or in combination with other treatments.
- Chemotherapy also causes side effects such as mouth sores, nausea, and hair loss.
- Typical chemotherapeutic drugs include alkylating agents, antimetabolites, anti-tumor antibiotics and etc..

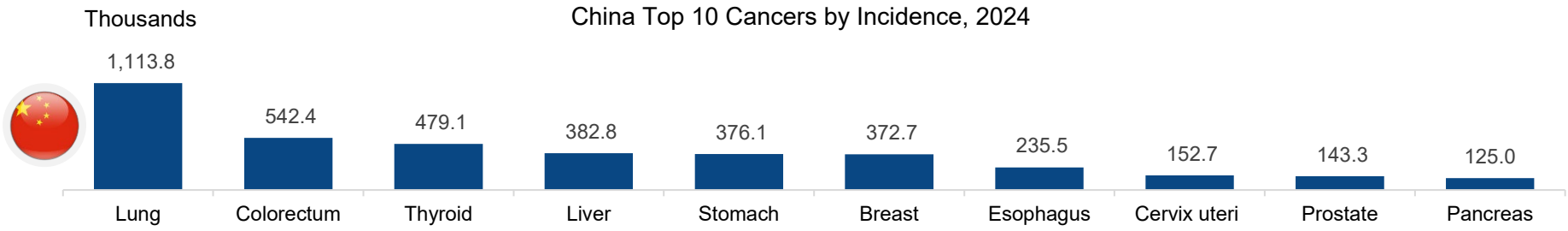
Targeted Therapy and Immunotherapy
1997, FDA approved the first molecularly targeted cancer drug, rituximab. In 2011, FDA approved the first checkpoint inhibitor, Ipilimumab.

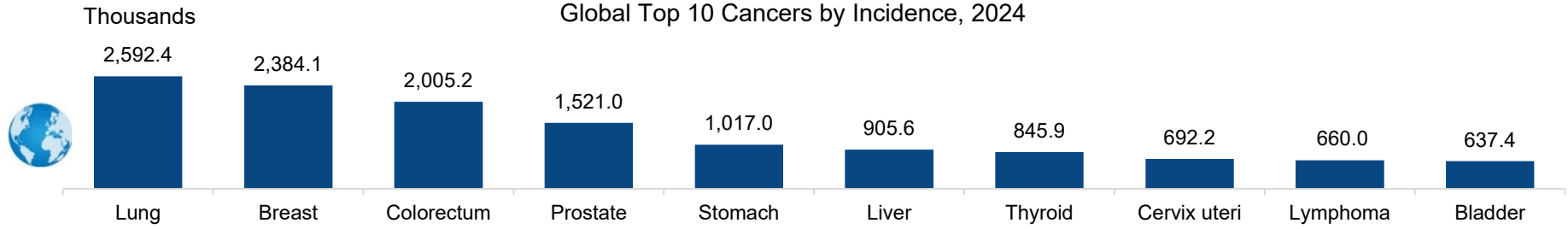
- ***Targeted therapies*** act on specific targets that are associated with cancer growth, thus they do less harm to normal cells. Most targeted therapies are either small-molecule drugs or antibodies. ADC drugs combined them and maximized their advantages. The small molecule drugs will release cytotoxicity after being accurately located by the antibody which significantly improves the drug performance.
- ***Immunotherapy*** induces the patient's own immune system to fight cancer. Immunotherapy includes cytokines, monoclonal antibodies, checkpoint inhibitors, adoptive T-cell therapy and cancer vaccines.

Source: Literature research, Frost & Sullivan Analysis

China and Global Top 10 Cancers by Incidence, 2024

- The top 5 cancers by incidence in China are lung cancer, colorectal cancer, thyroid cancer, liver cancer and stomach cancer. While the global top 5 cancer are lung cancer, breast cancer, colorectal cancer, prostate cancer and stomach cancer.
- The incidence rates of colorectal, liver, stomach and esophagus cancers in the Chinese population are relatively high, and the main reasons are related to unhealthy diet, obesity, alcohol consumption and other lifestyle problems.





Note: Head and neck cancer is a collective term for cancers that occur in various parts of the head and neck, so it is not included in the ranking of single cancer incidence.

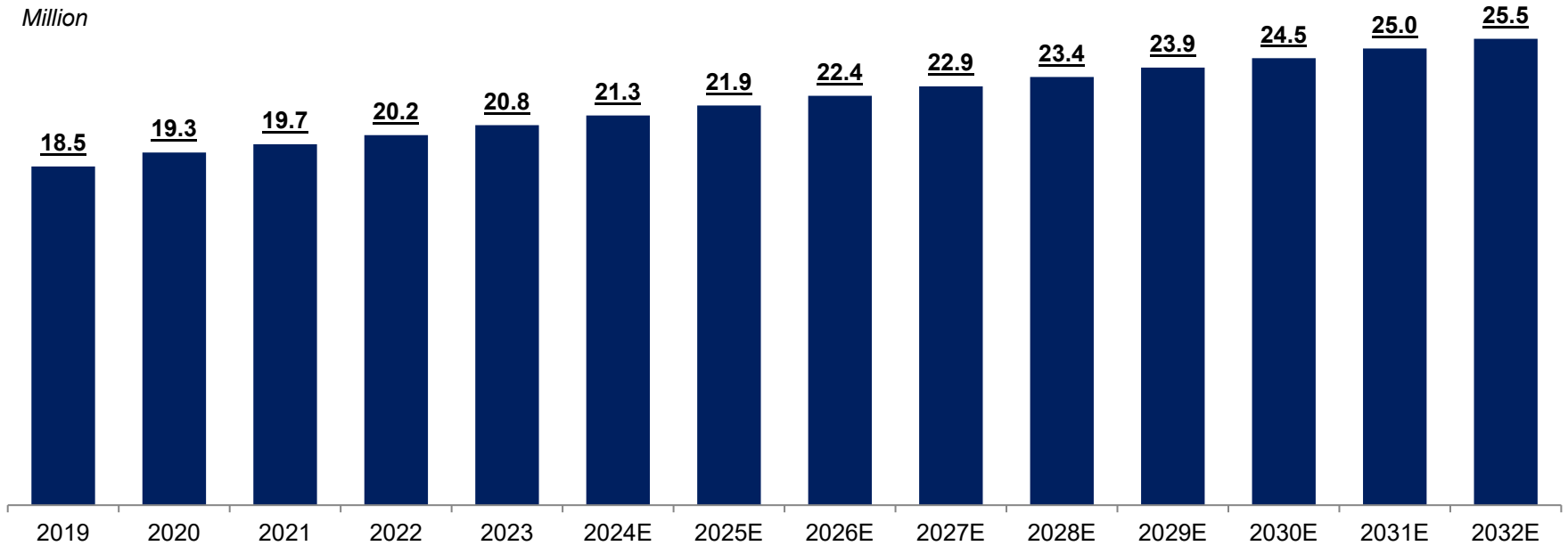
Source: Globocan, IARC, NCCR, Frost & Sullivan analysis

Incidence of Total Cancer Globally, 2019-2032E

- There were 20.8 million new cancer cases globally in 2023. It is expected to continue increasing to 25.5 million by 2032, reflecting a CAGR of 2.3% from 2023 to 2032.

Incidence of Total Cancer Globally, 2019-2032E

Period	CAGR
2019-2023	2.9%
2023-2032E	2.3%



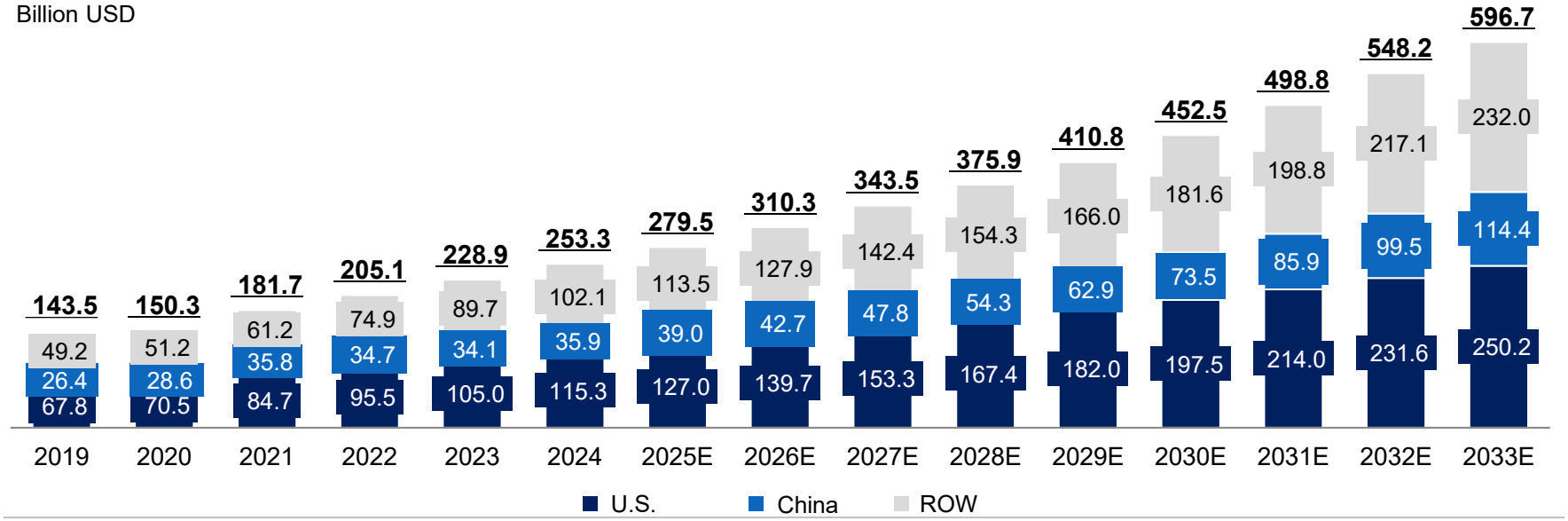
Source: Frost & Sullivan Analysis

Global Oncology Drug Market, 2019-2033E

- From 2019 to 2024, global oncology market expanded from USD 143.5 billion to USD 253.3 billion, representing a CAGR of 12.0% during this period. Global oncology market is expected to reach USD 596.7 billion by 2033, representing a CAGR of 10.0% from 2024 to 2033.
- The U.S. oncology market has grown from USD 67.8 billion in 2019 to USD 115.3 billion in 2024, with a CAGR of 11.2%. It is expected to reach USD 250.2 billion in 2033, with a CAGR of 9.0%.
- Oncology drug market in China has grown from USD 26.4 billion in 2019 to USD 35.9 billion in 2024, representing a CAGR of 6.3%. The Chinese oncology market is anticipated to continue to grow to USD 114.4 billion, with a CAGR of 13.7% from 2024 to 2033.

Global Oncology Drug Market, 2019-2033E

Period	CAGR			
	U.S.	China	ROW	Global
2019-2024	11.2%	6.3%	15.7%	12.0%
2024-2033E	9.0%	13.7%	9.5%	10.0%



Source: Frost & Sullivan Analysis

Growth Drivers and Future Trends of Oncology Drugs Market

Unmet Clinical Needs	• In 2023, the global cancer incidence reached 20.8 million cases, which can be attributed to various factors such as an aging population, environmental pollution, and the prevalence of unhealthy lifestyle choices including smoking, physical inactivity and high-calorie diets. As a result, the number of cancer patients worldwide is expected to increase, leading to a corresponding expansion of the oncology drug market.
Emerging Innovative Therapies	• Innovative therapies such as ADCs and targeted inhibitors are emerging treatment modalities for certain types of cancers. These therapies have made significant clinical progress with the increasing understanding of tumorigenesis mechanism and the use of evolving techniques to formulate such innovative therapies. • In recent years, an increasing number of innovative cancer therapies have been approved globally. It is expected that more innovative drugs with better efficacy and/or less adverse effects than currently available therapies will continue to emerge.
Targeted Therapies	• Targeted therapy is an approach to diagnose and treat cancer that leverages information of an individual's genotypes and associated factors. Statistics show that over 85% of the oncology market is now centered around targeted therapies. Targeted therapy enables physicians to formulate personalized and effective treatment options by incorporating cancer DNA (such as oncogenes) analysis into tailored cancer therapies with enhanced treatment outcomes.
General Support Care	• Supportive care services focus on supportive therapy that helps relieve pain, distress and other symptoms that can accompany serious illness. Substantial needs have developed around support care. For instance, around 30% of cancer-related deaths are associated with cachexia, symptoms not only impact patient tolerability to treatment but also significantly deteriorate their quality of life. Developing treatments for chronic diseases-induced symptoms is crucial for prolonging patient survival, improving quality of life, and saving medical costs.

Source: Frost & Sullivan Analysis

Growth Drivers and Future Trends of Oncology Drugs Market

Expanding Combination Therapy

- Combining different therapies, such as small molecule inhibitors with immunotherapy, has the potential of increasing the efficacy of cancer treatment and represents a promising direction for the development of oncology drugs.

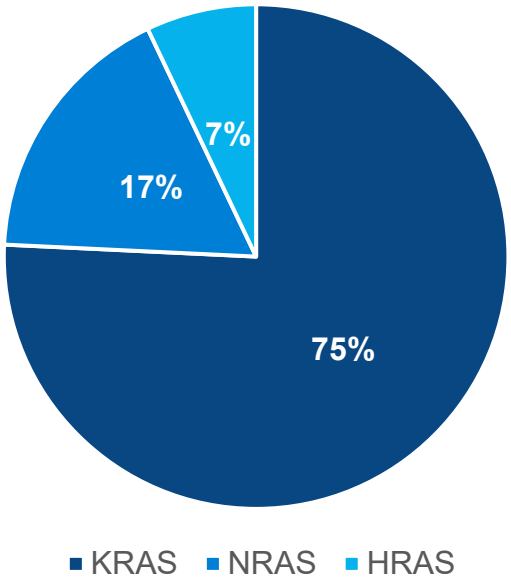
Source: Frost & Sullivan Analysis

Table of Contents

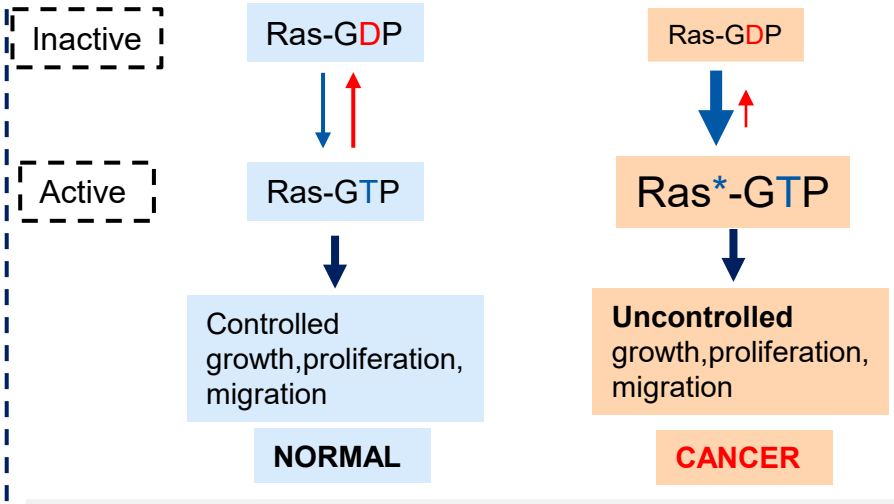
Overview of RAS Signalling Pathway

- RAS proteins are frequently mutated proto-oncogenes in human cancers, which are encoded by three commonly expressed genes: HRAS, KRAS, and NRAS. Three RAS oncogene mutations are present in approximately 30% of all human cancers, and they drive tumor growth and metastasis through aberrant activation of RAS-mediated signaling.

Percentage Distribution of RAS Isoforms Contributing to Cancer



Normal vs. Mutated RAS Function in Cell Growth and Cancer

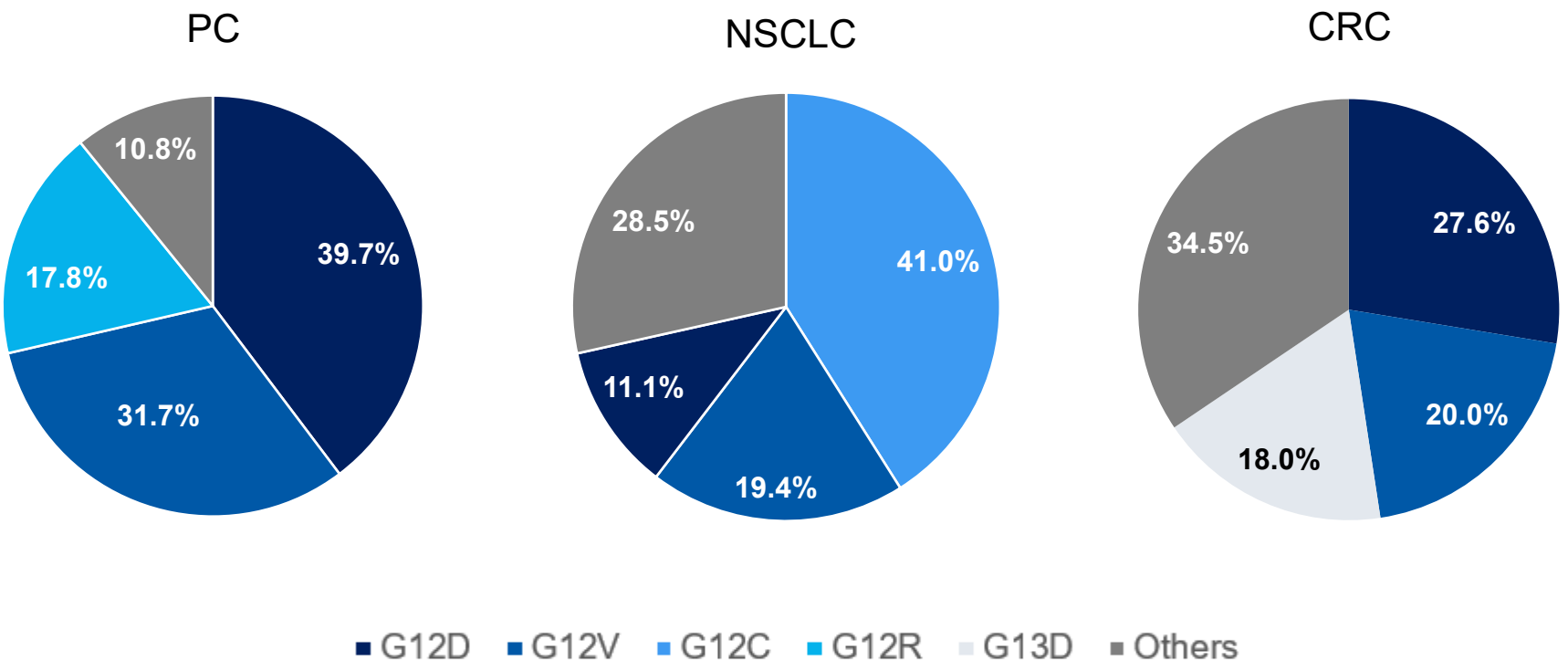


RAS proteins play a crucial role in normal development, driving cell growth, proliferation, and migration. In healthy cells, RAS switches quickly between active (GTP) and inactive (GDP) states in response to signals. However, when mutated, RAS* becomes locked in its active state, disregards regulatory signals, and pushes cells toward cancerous growth.

Source: Literature research, Frost & Sullivan analysis

Frequency of KRAS Mutations in Different Cancers

- KRAS mutations are detected in approximately 90% of pancreatic cancer, 30-40% of CRC, and 15-20% of lung cancer patients.
- According to U.S. data, the five most common KRAS mutant isoforms, KRAS G12D (29%), G12V (23%), G12C (15%), G13D (7%), and G12R (5%), collectively accounted for about 80% of all KRAS alterations. According to a landscape analysis of Chinese tumor samples, KRAS G12C accounted for 14.5% of all KRAS mutations.
- The top three cancers with the highest KRAS mutation rates, including PC, NSCLC, and CRC.



Source: Literature research, Frost & Sullivan analysis

Overview of KRAS G12C&G12D Mutation

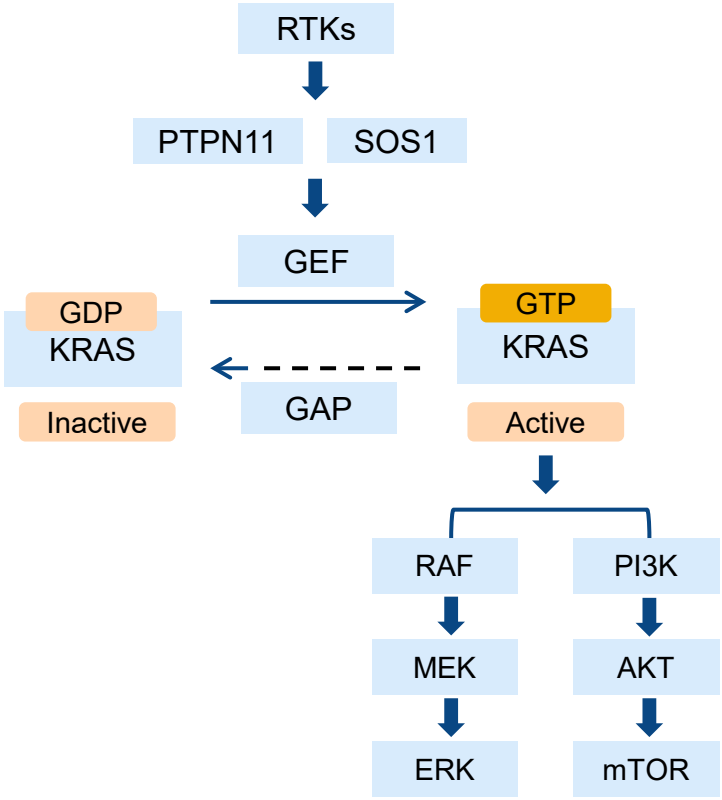
- KRAS G12 mutations are especially prevalent among the various activating KRAS mutations. KRAS G12 mutations are missense mutations that cause the replacement of glycine with a different amino acid at codon 12.
- In **KRAS G12C** mutations, glycine is substituted by **cysteine**, while in **KRAS G12D** mutations, **aspartic acid** takes the place of glycine.

KRAS G12C Mutation

- In lung adenocarcinomas, G12C mutations occur more often than G12D，likely because of the high presence of mutational signature 4, which is linked to tobacco smoking and characterized by C>A/G>T substitutions.
- The KRAS G12C variant favors the active form of the KRAS protein, resulting in a predominantly GTP-bound KRAS oncoprotein. This leads to enhanced proliferation and survival in tumor cells. The KRAS G12C mutation occurs in approximately 13% of NSCLC and in 3-4% of colorectal cancer

KRAS G12D Mutation

- G12D is the most prevalent variant in human cancer. It retains this connection between switch I and nucleotide sensing residues unlike in other mutants due to its unique aspartate residue in mutant protein, which may explain KRAS G12D's high prevalence and oncogenic potential in adenocarcinomas.
- The KRAS G12D mutation is particularly frequent in PC (approximately 35%), CRC (approximately 12%) and NSCLC (approximately 4%). Compared to the KRAS G12C mutation, the KRAS G12D mutation causes more significant disruption of intrinsic GTPase activity, resulting in a higher proportion of active GTP-bound KRAS in tumor cells.



Source: Literature research, Frost & Sullivan analysis

Proportion of Different Stages of Major Cancer Types

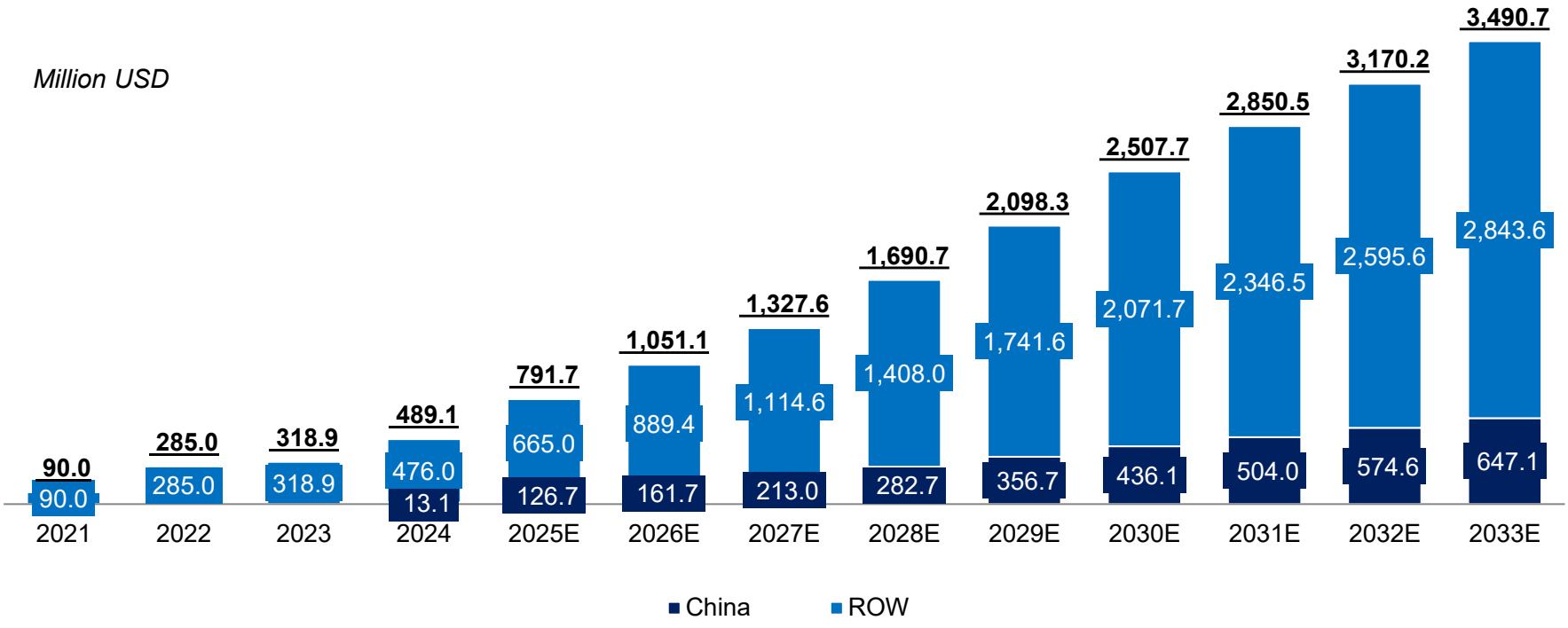
	NSCLC	CRC	PC
	• 22% of patients were diagnosed as early stage (stage I-II), 21% as locally advanced stage (stage III), and 53% as late stage patients • 30% to 55% of patients with NSCLC develop recurrence and die of their disease despite curative resection	• 35% of patients were diagnosed as early stage (stage I-II), 36% as locally advanced stage (stage III), and 23% as late stage patients • After treatment with curative intent, 30% to 40% of the patients develop recurrent disease	• 14% of patients were diagnosed as early stage (stage I-II), 29% as locally advanced stage (stage III), and 51% as late stage patients • At present, radical surgery is the only way to cure pancreatic cancer, while the recurrence rate within 2 years after surgery is 66%~92%
	• 16% of patients were diagnosed as early stage (stage I-II), 22% as locally advanced stage (stage III), and 57% as late stage patients • Surgical treatment is the first choice for early to mid stage patients, however, the postoperative recurrence and metastasis rate is still as high as 45.4%	• 56.2% of patients were diagnosed as early to mid stage • The recurrence rate after radical surgery for colorectal cancer is 30% to 40%	• The early diagnosis rate of pancreatic cancer was only 5%, the resectable pancreatic cancer was 15%~20%, and the 5-year survival rate after surgery was about 20%; Locally advanced pancreatic cancer accounts for 30%~40%
	20%–40% are resectable cancers, including most stage I–IIIa and a small proportion of stage IIIb lung cancers	Almost all patients with initially diagnosed non-metastatic and partially metastatic CRC can be resected, and systemic treatment can transform partially unresectable CRC into resectable. There is no relevant research on the specific proportion	Resectable PC accounts for only approximately 10%–15% of total PC

Global KRAS G12C Inhibitor Drug Market, 2021-2033E

- The market of KRAS G12C inhibitor drug Globally rose from 90.0 million USD in 2021 to 489.1 million USD in 2024, with a CAGR of 75.8%. It is expected to continue increasing to 3,490.7 million USD by 2033, reflecting a CAGR of 24.4% from 2024.

Global KRAS G12C Inhibitor Drug Market, 2021-2033E

CAGR	China	Global
2021-2024	-	75.8%
2024-2033E	54.2%	24.4%



Source: NMPA, FDA, Annual Report, Frost & Sullivan Analysis

Marketed KRAS 12C Inhibitor (1)

Brand Name	Generic Name	Company	Indication	Treatment Line	Nature of Drug Program	First Approval Time	Route of Administration	Efficacy	Safety	Treatment schedules	Annual Cost (thousand USD)	Annual Sales (2024)	Reimbursement coverage
达伯特	Fulzerasib	Innovent/ GenFleet	KRAS G12C mutated advanced NSCLC adult patients	2L+	Mono	2024/08/21 (NMPA)	oral	ORR 49.1% DCR 90.5% mPFS 9.7 months OS 13.3 months	SAE 14.0%, TRAEs led to dose reduction 18.3%, drug interruption 32.6%, permanent discontinuation 2.7%	600mg, BID	31.0	-	No
安方宁	Garsorasib	Chia Tai Tianqing/ Inventisbio	KRAS G12C mutated advanced NSCLC adult patients	2L+	Mono	2024/11/08 (NMPA)	oral	ORR 52.0% DCR 88.6% mPFS 9.1 months OS 14.1 months	TRAEs 95.9% TRAEs led to dose reduction 30.1%, drug interruption 41.5%, permanent discontinuation 0%	600mg, BID	35.0	-	No
艾瑞凯	Glecirasib	Jacobio/Allist	KRAS G12C mutated advanced NSCLC adult patients	2L+	Mono	2025/5/20 (NMPA)	oral	ORR 47.9% DCR 86.3% mPFS 8.2 months mOS 13.6 months	TRAEs 97.5% TRAEs led to dose reduction 37.8%, drug interruption 18.5%, permanent discontinuation 5.0%	800mg, QD	NA	-	No

Note: 1. The annual cost is calculated based on the patient using the product for one year and price in 2025; 2. The reimbursement coverage only applies to drugs approved by NMPA, and drugs listed in the United States are covered by different commercial insurances, which cannot be exhaustive

Source: Annual Report, NMPA, FDA, EMA, PMDA, Frost & Sullivan Analysis

Marketed KRAS 12C Inhibitor (2)

Brand Name	Generic Name	Company	Indication	Treatment Line	Nature of Drug Program	First Approval Time	Route of Administration	Efficacy	Safety	Treatment schedules	Annual Cost (thousand USD)	Annual Sales (2024)	Reimbursement coverage
Krazati	Adagrasib	BMS	KRAS G12C mutated locally advanced or metastatic NSCLC adult patients	2L+	Mono	2022/12/12 (FDA) 2024/01/05 (EMA)	oral	ORR 42.9% mPFS 6.5 months OS 12.6 months	TRAEs led to dose reduction 28%, drug interruption 77%, permanent discontinuation 13%	600mg, BID	280.0	126 million USD	
			KRAS G12C mutated metastatic CRC	2L	Combo with cetuximab	2024/06/21 (FDA)		ORR 34% DCR 85.1% mPFS 6.9 months mOS 15.9 months	TRAEs led to dose reduction 35%, drug interruption 62%, permanent discontinuation 2 patients (about 0.02%)				
Lumakras	Sotorasib	Amgen	KRAS G12C mutated locally advanced or metastatic NSCLC adult patients	2L+	Mono	2021/05/28 (FDA) 2022/01/06 (EMA) 2022/01/20 (PMDA)	oral	ORR 37.1% DCR 80.6% mPFS 6.3 months mOS 12.5 months	SAE 14.0%, TRAEs led to dose reduction 5%, drug interruption 34%, permanent discontinuation 9%	960mg, QD	266.9	350 million USD	
			KRAS G12C mutated metastatic CRC	1L	combo with panitumumab	2025/1/17 (FDA)		ORR 26% DCR % mPFS 5.7 months mOS Not Reached	TRAE 45.3%				

Note: 1. The annual cost is calculated based on the patient using the product for one year and price in 2025; 2. The reimbursement coverage only applies to drugs approved by NMPA, and drugs listed in the United States are covered by different commercial insurances, which cannot be exhaustive

Source: Annual Report, NMPA, FDA, EMA, PMDA, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12C Inhibitor Candidates with Phase III Clinical Trial and beyond Globally

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
达伯特 (Fulzerasib)	advanced NSCLC	Approved	Innovent/Genfleet	mono	2L+	oral	600mg, BID	ORR 49.1% DCR 90.5% mPFS 9.7 months OS 13.3 months SAE 14.0%, TRAEs led to dose reduction 18.3%, drug interruption 32.6%, permanent discontinuation 2.7%	China	2024-08-21 (NMPA)
	advanced non-sq NSCLC	Phase 1b/3		combo with sintilimab±chemotherapy	1L		GFH925 recommended dose ± sintilimab 200mg Q3W ± cetuximab 500mg/m2 Q2W ± chemotherapy	ORR 45.5% mPFS 9.6 months TRAE 95.5% TRAE (grade ≥3) 36.4%	China	2022-09-14
	metastatic CRC	Phase 1b/3		como with Cetuximab	NA		GFH925 recommended dose + cetuximab 500mg/m2 Q2W	ORR 45.8% DCR 89.6% TRAE (grade 3) 23.2% TRAE (dose reduction) 10.7% TRAE (interruption) 21.4%	China	2022-08-09
	advanced NSCLC	Phase 1b/2		combo with cetuximab	1L		GFH925 600mg BID with cetuximab 500mg/m2 Q2W, 28-day cycle	ORR 80.0% mPFS 12.5 months TRAE (dose reduction) 29.8%	EU	2023-03-06
	advanced solid tumors	Phase 1/2		mono	NA		700mg QD or 450/600/750mg BID	NSCLC: ORR 61.2%, DCR 92.5%, TRAE (any grade) 94.0%, TRAE (grade ≥3) 31.3% 600mg BID dose group: ORR 66.7%, DCR 96.7%, mPFS 8.2 months	China	2021-08-12

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12C Inhibitor Candidates with Phase III Clinical Trial and beyond Globally

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
安方宁 (Garsorasib)	advanced NSCLC	Approved	Chia Tai Tianqing/Inventisbio	mono	2L+	oral	600mg, BID	ORR 52.0% DCR 88.6% mPFS 9.1 months OS 14.1 months TRAEs 95.9% TRAEs led to dose reduction 30.1%, drug interruption 41.5%, permanent discontinuation 0%	China	2024-11-08 (NMPA)
	advanced or metastatic NSCLC, CRC, and other solid tumors	Phase 1/2		combo with Cetuximab	NA		600mg BID + cetuximab 400mg/m2 at the first day and 250mg/m2 after	ORR 45.2% DCR 92.9% mPFS 7.5months mOS not reached	China	2021-12-01
	advanced or metastatic solid tumors	Phase 1/2		mono or combo with pembrolizumab/Cetuximab/other	NA		150, 300, 600, 800, and 1200 mg QD, 400, 600, and 800 mg BID	PC: ORR 50.0%, mPFS 8.54 months, DCR 80.0%, TRAE (any grade) 70%, TRAE (grade 3) 20% CRC: ORR 20.8%, DCR 95.8%, mPFS 7.62 months, TRAE (any grade) 50%, TRAE (grade≥3) 2pts NSCLC: ORR 54.5%, DCR 81.8%, TRAE (any grade) 93.8%	US, Australia, Korea, Taiwan	2020-10-14
	locally advanced or metastatic NSCLC	Phase 1b/2		combo with pembrolizumab/cetuximab/afatinib	1L		400mg BID or 600mg QD Pembrolizumab 200mg Q3W, Afatinib 30mg QD or QOD, Cetuximab 400mg/m2 at the first day or 250mg/m2 Q1W, 21-day cycle	-	China	2022-07-14

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Blank space in efficacy and safety column means the results are not disclosed.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12C Inhibitor Candidates with Phase III Clinical Trial and beyond Globally

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
Krazati (Adagrasib)	locally advanced or metastatic NSCLC	Approved	BMS	mono	2L+	oral	600mg, BID	ORR 42.9% mPFS 6.5 months OS 12.6 months TRAEs led to dose reduction 28%, drug interruption 77%, permanent discontinuation 13%	Europe, US	2022-12-12 (FDA) 2024-01-05 (EMA)
	locally advanced or metastatic CRC	Approved		combo with cetuximab	2L			ORR 34% DCR 85.1% mPFS 6.9 months mOS 15.9 months TRAEs led to dose reduction 35%, drug interruption 62%, permanent discontinuation 2 patients (about 0.02%)	US	2024-06-21 (FDA)
	locally advanced or metastatic non-sq NSCLC	Phase 3		combo with Pembrolizumab + Chemotherapy	1L		Specified dose on specified days	-	Global	2025-03-13
	NSCLC	Phase 3		Combination with pembrolizumab	1L		Krazati 400mg BID + pembrolizumab 200mg Q3W	-	China	2024-03-27

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Blank space in efficacy and safety column means the results are not disclosed.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12C Inhibitor Candidates with Phase III Clinical Trial and beyond Globally

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
Krazati (Adagrasib)	Advanced NSCLC	Phase 2/3		Mono or combo with pembrolizumab	1L	oral	Krazati 400mg BID + pembrolizumab 200mg Q3W or Krazati 600mg BID or Pembrolizumab 200mg Q3W	ORR 44.3%, mDOR 26.3months, mPFS 11.0 months, mOS 18.3 months, TRAE 94.6%, TRAE (grade 3/4) 68.4%	US, Europe, Canada, etc	2020-11-03
	Advanced solid tumors	Phase 1/2		Mono or combination therapy	NA		Krazati QD or BID ± pembrolizumab Q3W ± cetuximab Q2W ± Afatinib	CRC: ORR 43%, DCR 86%, mPFS 6.9 months, mOS 16 months, TRAE (grade 3/4) 28%, TRAE (discontinuation) 10% NSCLC: ORR 30.3%%, mPFS 4.8 months, mOS 12.3 months, TRAE (dose reduction) 51.4%, TRAE (discontinuation) 5.7%	Puerto Rico, US	2018-12-24
	Advanced solid tumors/NSCLC	Phase 1		Combo with nab-sirolimus	NA		Dose escalation of Krazati and nab-Sirolimus	-	US	2023-05-03
	Advanced solid tumor malignancies with KRAS G12C mutation			Combo with palbociclib	NA		Dose escalation of Krazati and palbociclib	-	US	2022-01-05
	Advanced solid tumors			Combo with TNO155	NA		Krazati 600mg BID + TNO155	-	US	2020-04-01
	Advanced NSCLC and CRC			Combo with BMS-986488	NA		Specified dose on specified days	-	US, Canada, Australia	2025-01-08

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Blank space in efficacy and safety column means the results are not disclosed.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12C Inhibitor Candidates with Phase III Clinical Trial and beyond Globally

Drug8	Indication	Latest status	Company	Therapeutic strategy	Treatment line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
Lumakras (Sotorasib)	locally advanced or metastatic NSCLC	Approved	Amgen	mono	2L+	oral	960mg, QD	ORR 37.1% DCR 80.6% mPFS 6.3 months mOS 12.5 months SAE 14.0%, TRAEs led to dose reduction 5%, drug interruption 34%, permanent discontinuation 9%	Europe, US, Japan	2021-05-28 (FDA) 2022-01-06 (EMA) 2022-01-20 (PMDA)
	metastatic CRC	Phase 3		Combo with Panitumumab and FOLFIRI	1L		Lumakras QD ± Panitumumab and FOLFITI Q2W	ORR 78% DCR 95% mOS 1.5months grade ≥ 3 TRAEs 58%	US, Argentina, Australia, Korea, etc	2024-02-12
	Stage IV or advanced stage IIIB/C non-sq NSCLC			Combo with platinum doublet	1L		Lumakras 960mg QD + carboplatin and pemetrexed	ORR 88.9% mPFS 6.6 months mOS 20.6 months grade ≥ 3 TRAEs 90%	US, Europe, Japan, etc	2023-06-27
	metastatic CRC			Combo with panitumumab	2L+		Lumakras 960/240 mg QD + panitumumab	Lumakras 960mg: ORR 30.2%, DCR 71.7%, mPFS 5.8 months Lumakras 240mg: mOS 11.9 months, ORR 7.5%, DCR 69.8%, mPFS 4.0 months	US,Spain, Korea, etc	2022-01-20

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12C Inhibitor Candidates with Phase III Clinical Trial and beyond Globally

Drug8	Indication	Latest status	Company	Therapeutic strategy	Treatment line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
	Advanced PC	Phase 2		combo with chemo	1L		Lumykras 960 mg QD ± chemotherapy	-	Spain, France	2025-03-18
	Advanced solid tumors, advanced NSCLC	Phase 1/2		Mono and combined therapy	NA		Lumakras 960mg QD ± chemotherapy	NSCLC: mPFS 5.6 months, mOS 11.6 months, ORR 33.6%, TRAE (grade3/4) 26.8% PC: ORR 21.1%, DCR 84.2%, mPFS 3.98 months, mOS 6.87 months CRC: ORR 9.7%, TRAE (grade 3) 10%	US, Europe, Japan, etc	2018-07-26
	Advanced solid tumors with KRAS p.G12C mutation	Phase 1		Mono or combo with other anti-cancer therapies	NA		Lumakras 960mg QD ± panitumumab 6mg/kg Q2W ± FOLFIRI ± other anti-cancer drugs	CRC: ORR 75%, DCR 95% NSCLC: mPFS 5.6 months, mOS 11.6 months, ORR 33.6%, TRAE (grade 3/4) 26.8%	US, Europe, Australia, etc	2019-12-04

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.
Blank space in efficacy and safety column means the results are not disclosed.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12C Inhibitor Candidates with Phase III Clinical Trial and beyond Globally

Drug8	Indication	Latest status	Company	Therapeutic strategy	Treatment line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
Glecirasib (JAB-21822)	advanced or metastatic NSCLC	Approved	Jacobio/Allist	Mono	2L+	oral	800mg QD	cORR 49.6% DCR 86.3% mPFS 8.2 months mDOR 14.5 months mOS 17.5 months	China	2025-05-20 （NMPA）
	Locally advanced or metastatic NSCLC	Phase 3		Combo with JAB-3312	1L		JAB-21822+JAB-3312, 21-days cycle	ORR 64.7%, mPFS 12.2 months	China	2024-05-16
	Locally advanced or metastatic PC	Phase 2		mono	2L+		800 mg QD	-	China	2023-08-18
	advanced CRC, small intestinal cancer, appendiceal cancer	Phase 1b/2		combo with cetuximab	NA		JAB-21822+ cetuximab 21-days cycle	With cetuximab group: mDOR 5.1 months, mPFS 6.1 months, mOS 19.3 months, ORR 50%, DCR 87%, TRAEs(all grade) 97.7%, Grade 3-4 TRAEs 19.1%	China	2022-01-19
	advanced solid tumors	Phase 1/2		mono	NA		QD, 21-days cycle	PDAC: ORR 46.4%, DCR 96.4%, mDoR 4.1 months, mPFS 5.5 months	China	2021-06-29
JMKX001899	advanced or metastatic NSCLC	NDA	Jemincare	Mono	2L+	oral	JMKX001899 500mg QD	DCR 87.6% ORR 52.4% mPFS 7.2months All TRAE 95.2% grade ≥ 3 TRAEs 40%	China	2025-06-05

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.
Blank space in efficacy and safety column means the results are not disclosed.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12C Inhibitor Candidates with Phase III Clinical Trial and beyond Globally

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
MK-1084	metastatic NSCLC with confirmed PD-L1 TPS ≥50%	Phase 3	MSD	Combo with pembrolizumab	1L	oral	MK-1084 QD + pembrolizumab 200mg on Day 1 of each 21-day cycle (Q3W) for up to 35 cycles	ORR 71% AE 96% TRAE 79% grade 3-4 TRAEs 42%	US, South Korea, Ukraine, Chile	2024-04-03
	locally advanced or metastatic CRC	Phase 3		combo with cetuximab, chemo ± Bevacizumab	1L		MK-1084 QD, cetuximab Q2W, chemo Q2W	ORR 58% DCR 92%	Global	2025-05-30
Olomorasib	advanced NSCLC with confirmed PD-L1 TPS ≥50%	Phase 3	Eli Lilly	Combo with pembrolizumab ± chemotherapy	1L	oral	olomorasib 50 mg or 100 mg BID + pembrolizumab plus	ORR 90% DCR 95% PFS(12-month) 59.8%	China, US, Europe, etc	2023-11-07
	NSCLC	Phase 3		Combo with pembrolizumab or Durvalumab	adjuvant		Olomorasib + Pembrolizumab up to 1 year followed by olomorasib alone for up to 3 years	-	Global	2025-03-24
Divarasib (RG6330)	advanced or metastatic NSCLC	Phase 3	Roche	Mono	2L+	oral	Divarasib QD	ORR 55.6% mDOR 18.0 months mPFS 13.8 month TRAE 94% grade 3-4 TRAE 17%	China, Korea	2022-10-11
	Advanced or Metastatic non-sq NSCLC	Phase 3		Combo with pembrolizumab ± chemotherapy	1L		Divarasib QD + Pembrolizumab Q3W ± chemotherapy Q3W	-	Global	2025-01-27
JDQ443	Loacally advanced or metastatic NSCLC	Phase 3	Novartis	Mono	2L+	Oral	-	ORR 30.0% TRAE 64.1% Gr 3 TRAEs 10.3%, no Gr 4-5 TRAEs	Global	2021-11-24

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.
Blank space in efficacy and safety column means the results are not disclosed.

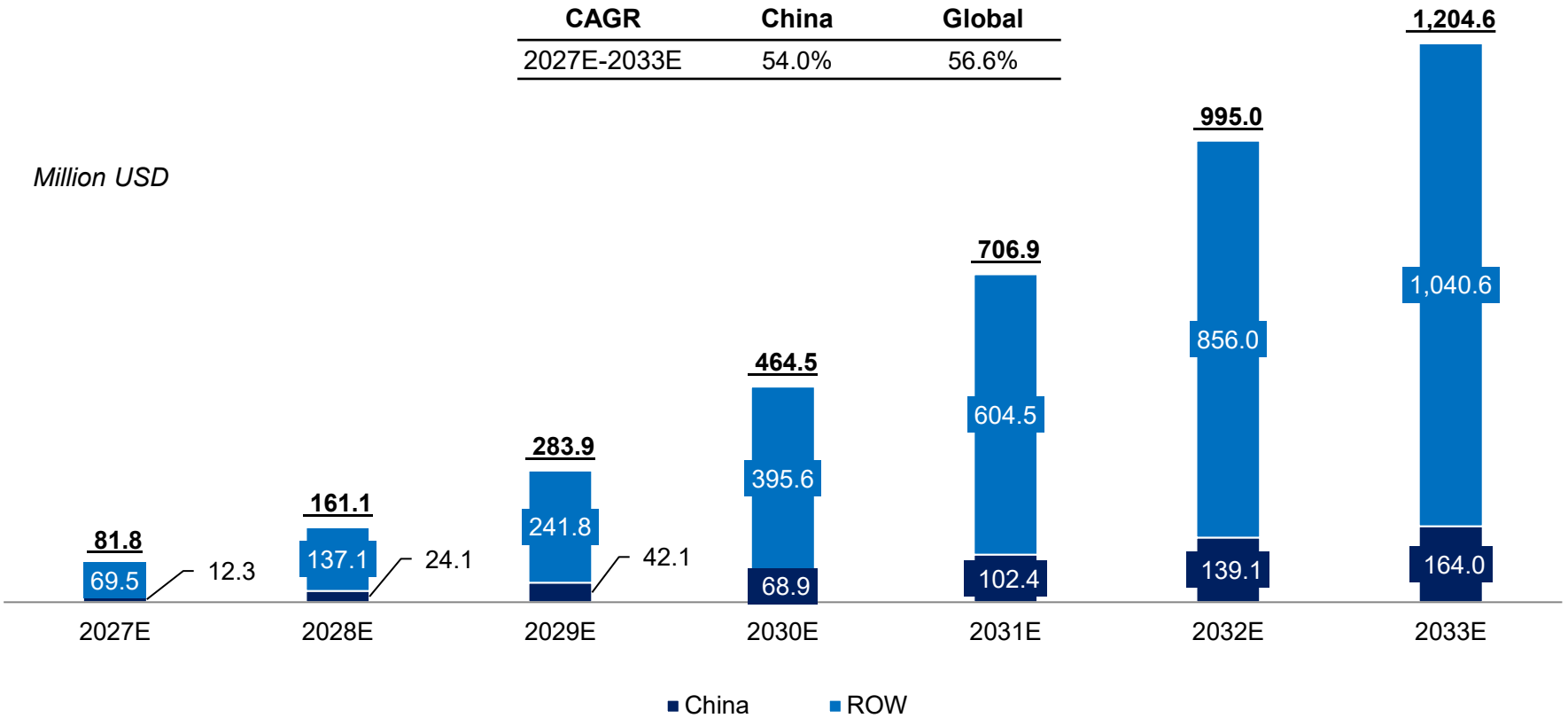
Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Global KRAS G12D Inhibitor Drug Market, 2027E-2033E

- The market of KRAS G12D inhibitor drug Globally is expected to rise from 81.8 million USD in 2027 to 1,204.6 million USD in 2033, with a CAGR of 56.6%. At the same time, the KRAS G12D inhibitor market in China is expected to increasing to 164.0 million USD by 2033, reflecting a CAGR of 54.0% from 2027.

Global KRAS G12D Inhibitor Drug Market, 2027E-2033E

CAGR	China	Global
2027E-2033E	54.0%	56.6%



Source: NMPA, CDE, FDA,ClinicalTrials, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12D Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
AZD0022	Advancer solid tumors, NSCLC, PDAC, CRC	Phase 1/2a	AZ	Mono or combo with Cetuximab	2L+	oral	AZD0022 ± cetuximab at the assigned dose level, dose level not disclosed	-	US, China	2024-09-19
DN022150	Advanced solid tumors	Phase 1/2a	DE NOVO	Mono	2L+	Infusion	20/50/100/200/300mg QW/Q2W/Q3W	-	China	2024-08-02
RNK08954	Advanced solid tumors	Phase 1/2	Ranok Therapuetics	Mono	2L+	oral	RNK08954 QD, 21-day cycle	-	US, China	2024-10-08
GDC-7035	Advanced or metastatic solid tumors	Phase 1/2	Genentech	Mono or combo with other drugs	NA	NA	administered at the assigned dose level, dose level not disclosed	-	NA	2024-10-01
GFH375/ VS-7375	Metastatic pancreatic cancer	Phase 2	GenFleet/ Verastem	Mono	2L+	oral	administered at the assigned dose level, dose level not disclosed	-	China	2025-05-30
	Advanced solid tumors	Phase 1/2		Mono	NA		GFH375 100/200/400/600/750/900 mg QD and 300mg BID	All pts: ORR 38%, DCR 90%, TRAE (grade≥3) 29%, SAE 15.6%, TEAE (interruption) 21% PDAC: ORR 52%, DCR 100% NSCLC:)RR 42%, DCR 83%	China	2024-07-01
	Advanced solid tumors	Phase 1/2a		Mono	NA		administered at the assigned dose level, dose level not disclosed	-	US	2025-06-13

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12D Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
HRS-4642	PDAC	Phase 2	HengRui	Combo with chemothrapy	NA	Infusion	administered at the assigned dose level, dose level not disclosed	-	China	2024-09-19
	Advanced solid tumors	Phase 1/2		Combo with Adebrelimab or SHR-A1921	NA		HRS-4642 + Adebrelimab/SHR-9839/HRS-4642, dose level not disclosed	-		2024-04-26
		Phase 1		Mono	NA		15/50/100/200 /300 mg QW, 21-day cycle	NSCLC: DCR 90.0% All patients: DCR 77.8%, TRAE (grade≥3) 33.3%		2022-09-06
TSN1611	Advanced solid tumors	Phase 1/2	Tyligand	Mono	1L+	oral	administered at the assigned dose level, dose level not disclosed	ORR 25%, DCR 67% (600-800mg, BID)	US	2024-04-26
HBW-012336	Advanced solid tumors	Phase 1/2	Hyperway	Mono	2L+	oral	administered at the assigned dose level, dose level not disclosed	-	China	2025-06-18
HS-10529	Advanced solid tumors	Phase 1	Hansoh	Mono	NA	oral	HS-10529, 21-day cycle	-	China	2025-05-06
LY3962673	Advanced solid tumors	Phase 1	Eli Lilly	Mono or combo with Cetuximab and chemotherapy	2L+	oral	LY3962673 ± chemotherapy at the assigned dose level, dose level not disclosed	-	US	2024-9-19

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of KRAS G12D Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
QTX3046	Advanced solid tumors	Phase 1	Quanta Therapeutics	Mono, or combined with cetuximab	2L+	oral	QTX3046 ± cetuximab, dose level not disclosed	-	US	2024-05-24
QLC1101	Advanced solid tumors	Phase 1	Qilu Pharmaceutical	Mono	1L+	oral	QLC1101 BID, 21-day cycle	-	China	2024-05-08
	Unresectable or metastatic solid tumors	Phase 1/2b		Combined with QL1203/QL2107/QL1706/docetaxel	NA		QLC1101 600-1200mg BID, 14-day cycle	-	China	2025-05-21
AST2169	Advanced solid tumors	Phase 1	Allist Pharmaceuticals	Mono	1L+	Infusion	42/150/300/400/500/600mg at the 1, 8 and 15 day of one 21-day cycle	-	China	2024-04-02
INCB161734	Advanced or metastatic solid tumors	Phase 1	Incyte Corporation	Mono, or combined with other anti-cancer therapies.	1L+	oral	INCB161734 ± protocol-defined dose strength based on cohort assignment	-	Australia, US, Belgium, Canada, France, Italy, Spain	2023-12-21
INCB186748	Advanced or Metastatic Solid Tumors, PDAC, CRC	Phase 1		Comined with cetuximab/GEMNabP/mFOLFIRINOX	2L+	NA	administered at the assigned dose level, dose level not disclosed	-	US	2025-02-10
Zoldnrasib	Advanced solid tumors	Phase 1	Revolution Medicines	Mono, and combined with RMC-6236	2L+	oral	600mg BID or 1200mg QD	NSCLC: ORR 61%, DCR 89%	US	2023-09-15

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of Pan-KRAS Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
PF-07985045	advanced solid tumors, NSCLC, CRC, PDAC	Phase 1	Pfizer	mono or combo with other anti cancer therapies	part I: 2-3L part II: PDAC 1L, CRC 1L+, NSCLC 1L	oral	PF-07985045 administered at the assigned dose level ± cetuximab/pembrolizumab/sasanlimab/SHP2 ± chemotherapy, 21/28-day cycle	-	US, Japan, Puerto Rico	2024-11-26
PF-07934040	Advanced Solid Tumors Harboring Mutations in the KRAS Gene	Phase 1		Combo with other Targeted Agents	part I: 2-3L part II: PDAC 1L, CRC 1L+, NSCLC 1L	oral	PF-07934040 administered at the assigned dose level ± cetuximab/pembrolizumab/sasanlimab/SHP2 ± chemotherapy, 21/28-day cycle	-	China, US, Puerto Rico	2024-06-07
QTX3544	advanced solid tumors	Phase 1	Quanta Therapeutics	mono or combo with cetuximab	2L+	oral	QTX3544 administered at the assigned dose level ± cetuximab	-	US	2024-12-04
QTX3034	Solid tumors with KRASG12D mutation	Phase 1		Mono, or combined with cetuximab	2L+	oral	QTX3034 administered at the assigned dose level ± cetuximab	-	US	2024-01-26

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of Pan-KRAS Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
JAB-23E73	advanced solid tumors	Phase 1/2a	Jacobio	mono	NA	oral	5/10/40mg QD, 21-day cycle	-	China, US	2024-11-11
LY4066434	locally advanced or metastatic solid tumors	Phase 1	Eli Lilly	mono or combo with other treatments	NA	oral	LY4066434 administered at the assigned dose level ± cetuximab ± chemotherapy	-	China, US, Belgium, Japan, Spain, Taiwan	2024-09-23
BGB-53038	advanced or metastatic solid tumors	Phase 1	BeiGene	mono or combo with tislelizumab	NA	oral	BGB-53038 administered at the assigned dose level ± Tislelizumab and cetuximab	-	China, US, Australia, Korea, New Zealand, Spain	2024-09-05
YL-17231	Advanced solid tumors	Phase 1	Yingli Pharmaceutical	Mono	NSCLC: 2L CRC: 3L others: 2L+	oral	0.25-10mg BID, 21-day cycle	-	China	2023-10-12
BI 3706674	Unresectable Metastatic KRAS Wild Type Amplified GAC, EAC and AGEJ	Phase 1	Boehringer Ingelheim	Mono	NA	oral	administered at the assigned dose level, dose level not disclosed	-	US, Japan, Korea, Taiwan	2023-09-28
BI 1701963	KRAS Mutated Advanced or Metastatic Solid Tumours	Phase 1		Mono and and Combined With Trametinib	2L+	oral	BI 1701963 50/100/200/400/800 mg, QD ± Trametinib	TRAE 64%	Germany, Netherlands, US	2019-10-01

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of Pan-KRAS Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
BBO-11818	locally advanced and unresectable or metastatic NSCLC, PDAC, CRC, or other solid tumor with KRAS mutation	Phase 1	TheRas/ BridgeBio Oncology Therapeutics	Mono and combined with pembrolizumab, pembrolizumab +/- cis/carboplatin + pemetrexed, or cetuximab	NA	oral	administered at the assigned dose level, dose level not disclosed	-	US	2025-04-08
ALTA3263	Advanced solid tumors with KRAS mutations, PDAC, NSCLC, CRC	Phase 1	Alterome Therapeutics	Mono	NA	oral	administered at the assigned dose level, dose level not disclosed	-	US	2025-02-19
ERAS-4001	Advanced Solid Tumors	Phase 1	Erasca	Mono and combined with pembrolizumab/panitumumab	NA	oral	administered at the assigned dose level, dose level not disclosed	-	NA	2025-06-15
KQB365	Advanced Solid Tumors with either a KRAS G12C or KRAS G12S mutation	Phase 1	Kumquat Biosciences	mono or combined with cetuximab	NA	Intravenous	administered at the assigned dose level, dose level not disclosed	-	US	2024-12-06
AMG410	KRAS-altered advanced or metastatic solid tumors	Phase 1	Amgen	mono or combined with Pembrolizumab or Panitumumab	NA	oral	administered at the assigned dose level, dose level not disclosed	-	US, Australia	2025-07-30

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of Pan-RAS Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
RMC-6236	metastatic PDAC	Phase 3	Revolution Medicines	mono	2L+	oral	administered at the assigned dose level, dose level not disclosed	-	US, Europe, Japan, Puerto Rico	2024-10-03
	Locally Advanced or Metastatic RAS mutant NSCLC	Phase 3		mono	2L+		administered at the assigned dose level, dose level not disclosed	-	US, Puerto Rico	2025-03-18
	Gastrointestinal solid tumors	Phase 1/2		combo with SOC or novel agents	NA		RMC-6236 + 5-fluorouracil-based regimens RMC-6236 + cetuximab with or without mFOLFOX6 RMC-6236 + gemcitabine + nab-paclitaxel RMC-9805 with or without RMC-6236 + 5-fluorouracil-based regimens RMC-9805 with or without RMC-6236 + cetuximab with or without mFOLFOX6 RMC-9805 with or without RMC-6236 + gemcitabine + nab-paclitaxel	-	US, Europe	2024-06-06
	RAS-mutated NSCLC	Phase 1/2		Combo with pembrolizumab, with or without chemotherapy	2L+		RMC-6291 BID/RMC-9805 QD or BID ± RMC6236 QD + pembrolizumab Q3W ± chemotherapy (Q3W-Q4W)	-	US, Europe	2023-12-08
	Advanced KRAS G12C Mutant Solid Tumors	Phase 1		Combo with RMC-6291	2L+		RMC-6291 + RMC-6236 administered at the assigned dose level, dose level not disclosed	-	US, Europe, Puerto Rico	2023-11-13

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of Pan-RAS Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
RMC-6236	RAS mutant advanced solid tumors	Phase 1		Mono	2L+	oral	doses ranging from 160 mg to 300 mg QD	KRAS G12X mutation in the PDAC 2L treatment (300mg daily): mPFS 8.8 months, OS 100% KRAS G12X mutation in the NSCLC 2L treatment (120-220mg daily): mPFS 9.8 months, mOS 17.7 months any RAS mutation in the 2L treatment (300mg daily): mPFS 8.5 months, OS 97%	US	2022-05-18
JYP0015/ERAS-0015	RAS mutant advanced solid tumors	Phase 1/2	JOYO Pharma/Erasca	Mono	NA	oral	4/8/16mg QD, 21-day cycle, 4 cycles	-	China	2025-03-07
	RAS mutant advanced or metastatic solid tumors	Phase 1		Mono or in combination with pembrolizumab or panitumumab	NA		NA	-	US	2025-05-21
LUNA18	Locally Advanced or Metastatic Solid Tumors	Phase 1	Chugai Pharmaceutical	Mono or in combination with other anti-cancer drugs	NA	oral	LUNA18 ± cetuximab administered at the assigned dose level, dose level not disclosed	-	US, Japan	2021-08-19

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of Pan-RAS Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
RO7673396	Advanced solid tumors with RAS mutation	Phase 1	Roche	Mono	NA	NA	administered at the assigned dose level, dose level not disclosed	-	Australia, New Zealand	2025-03-19
VVD-159642	Advanced solid tumors, PDAC, CRC, NSCLC	Phase 1	Vividion Therapeutics	Mono or combination with sotorasib/trametinib	NA	oral	administered at the assigned dose level, dose level not disclosed	-	US, Australia	2025-02-03
HRS-7172	Advanced solid tumors with RAS mutation	Phase 1	HengRui	Mono	NA	NA	administered at the assigned dose level, dose level not disclosed	-	China	2025-08-21

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Overview of Pan-RAS Inhibitor and Drug Design Difficulties

- Regardless of the mutated site of the pan-RAS inhibitor, it is a multiselective triple-complex inhibitor designed to comprehensively block the RAS protein. The overall strategy for inhibiting pan-RAS has been divided into two classes of inhibitors, **direct-binding pan-RAS inhibitors and indirect binding pan-RAS inhibitor**.
- Direct-binding pan-RAS inhibitors bind directly to RAS proteins and inhibit RAS signaling. These inhibitors target binding sites shared by all RAS isozymes, enabling them to bind directly and suppress the entire RAS signaling network, regardless of the specific isozyme or mutated codon.
- Indirect binding pan-RAS inhibitor that binds to RAS-interacting proteins and inhibits RAS protein-protein interactions to reduce RAS signaling, such as inhibitors that target RAS-activating proteins to suppress RAS.

Development Prospects

- The role of RAS in tumorigenesis is well established, and for RAS-targeted therapies, there has been progress in the study of KRAS G12C mutation-specific inhibitors, but the group of patients who can benefit from KRAS G12C inhibitors is essentially limited to those who carry the KRAS G12C mutation.
- Both intrinsic and acquired mechanisms of resistance have been reported, suggesting that allele specificity may be detrimental. For example, compensatory activation of unsuppressed wild-type (WT) NRAS and HRAS isozymes can free cancer cells harboring KRAS(G12C) mutations from allele-specific suppression or other mutations in KRAS.

- Pan-RAS inhibition is an alternative drug discovery strategy that can overcome these potential limitations by targeting all RAS isozymes co-expressed in a population of tumor cells with a single inhibitor to block constitutively activated RAS regardless of the underlying mutation.
- In addition, innovative solution strategies are developing new approaches based on existing targets, e.g. a functional antibody co-coupled molecular drug based on pan-RAS is also able to achieve signaling inhibition.

Design Difficulties

- **Not suitable for selective covalent targeting:**
  It was found that most RAS oncoproteins with missense mutations are unsuitable for selective covalent targeting, but may be susceptible to non-covalent inhibition by forming a triple complex with CYPA.
- **Toxicity:**
  Pan-RAS inhibitors, which target a wide range of RAS, have a greater potential to overcome drug resistance, but because they can indiscriminately inhibit wild-type RAS, they are also theoretically more toxic. To be more specific, pan-RAS inhibitors prioritize broader RAS pathway inhibition over the specificity of isozyme- or mutation-specific inhibitors, aiming to address resistance and reach a wider patient population. However, this reduced specificity can lead to toxicity problems if unintended off-target effects occur.

Source: Literature research, Frost & Sullivan analysis

Major Players in Global RAS Drug Market

MIRATI THERAPEUTICS Bristol Myers Squibb™

- It is a commercial stage targeted oncology company, RAS portofolio includes KRAZATI, MRTX1133 and MRTX0902.
- In 2023, BMS acquired Mirati for $58.00 per share, representing $4.8 billion equity value and up to $5.8 Billion including the contingent value right acquisition brings KRAZATI®.

RAS product matrix

Drug	Indication	Treatment Line	Approach	Stage
KRAZATI (adagrasib, Kras G12C Inhibitor)	NSCLC	2L+	Mono	Approved
	CRC	2L	Combo with Cetuximab	Approved
	Other 5+ pepelines exploring different drug combinations and expanding indications			
MRTX0902 (SOS1:KRAS Inhibitor)	Solid tumors	1L+	Mono/Combo with KRAZATI	Phase I/II

Revolution Medicines™

- It is a clinical-stage precision oncology company developing novel targeted therapies for RAS-addicted cancers.
- Company's R&D pipeline comprises RAS(ON) inhibitors that bind directly to RAS variants, and RAS companion inhibitors that target key nodes in the RAS pathway or associated pathways.

RAS product matrix

Drug	Indication	Treatment Line	Approach	Stage
RMC-6236 (Pan-Ras Inhibitor)	PDAC	2L+	Mono	Phase III
	NSCLC	2L+	Mono	Phase III
			Combo with Pembrolizumab	Phase I/II
	Gastrointestinal slod tumors	1L+	Combo with chemo/anti EGFR	Phase I/II
	Solid tumors	2L+	Mono	Phase I
RMC-6291 (Kras G12C Inhibitor)	Solid tumors	2L+	Mono/Combo with RMC-6236	Phase I
	NSCLC	2L+	Combo with Pembrolizumab	Phase I/II
RMC-9805 (Kras G12D Inhibitor)	Solid tumors	2L+	Mono/Combo with RMC-6236	Phase I

Source: Official Website, Annual Report, ClinicalTrials.gov, Frost & Sullivan

Entry Barriers of RAS Drug Market

Substantial Technical Challenges	• Since RAS proteins are usually smooth in shape, it is difficult to design selective inhibitors. Additionally, the high affinity for GTP/GDP of RAS proteins and the absence of known allosteric regulatory sites further increase the difficulties of targeted therapies. • It will be cumbersome to identify effective therapeutics for each mutant RAS protein. though directly targeting conserved ligand binding sites on all RAS proteins could provide a single therapeutic approach, further research is still needed to enhance their ability to selectively inhibit mutated RAS proteins in order to reduce toxicity and side effects • The mechanism of the resistance problem of RAS drugs is complex, including primary resistance, acquired resistance due to mutation escape, and adaptive resistance, which poses a challenge to the design of RAS drugs.
Market Uncertainty	• RAS drug development has a high risk of clinical failure, mainly due to issues with efficacy or toxicity. The high risk of clinical failure continues to be a major barrier, discouraging investment in this space despite recent breakthroughs with KRAS inhibitors. • RAS mutations are present in a wide range of cancers, and the response to RAS-targeted therapies can vary widely among different patient populations.
High R&D Cost	• Developing RAS inhibitors requires extensive preclinical studies to understand their effects on multiple signaling pathways and to optimize drug candidates for potency and selectivity. For instance, the mechanism of RAS drugs resistance is complex, including primary resistance, acquired resistance due to mutation escape, and adaptive resistance, all of which require considerable research efforts. The monetary and time investment required for these studies are significant and could be anentry barrier especially for emerging pharmaceutical companies.

Source: Frost & Sullivan Analysis

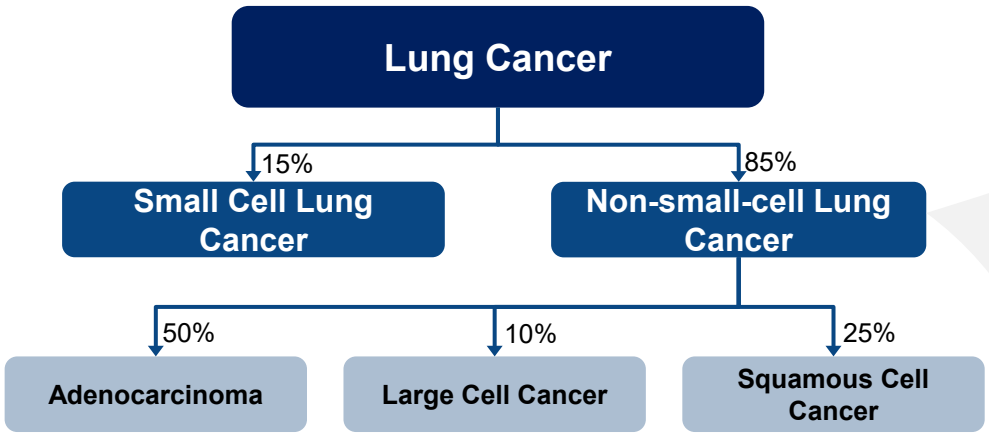
Future Trends of RAS Drug Market

Exploring Other RAS Inhibitors	• Currently, all RAS drugs approved worldwide are KRAS G12C inhibitors. Research will be expanded to target other KRAS mutations such as G12D, G12V and G13D, as well as NRAS and HRAS mutations, to provide therapeutic options for a wider range of cancers. One area of focus is the development of pan-RAS inhibitors, which target multiple RAS isoforms or mutations simultaneously. These inhibitors aim to treat a broader range of RAS-driven cancers by blocking the activity of different RAS variants, thereby overcoming the limitations of mutation-specific therapies.
Increasing Focus on Combination Therapies	• One of the most promising trends is the development of combination therapies that include RAS inhibitors along with other targeted agents, immunotherapies, or chemotherapy. These combinations aim to enhance treatment efficacy, reduce the development of drug resistance, and address the complexity of cancer signaling pathways.
Extending the Breadth of RAS Inhibitors	• Recent research has focused on designing novel modalities, including pan-RAS drugs, bioconjugates, RAS degraders, toxins, immunotherapy, and siRNA-based approaches, each offering distinct advantages. For instance, FAScon, a class of bioconjugates featuring a combination of antibody and small molecule drug targeting separate components of the same signaling pathway, has the potential to realize both precise targeting and synergistic effects of the large and small molecules, and to prevent premature release of payload in the blood and enables conjugation of hydrophobic small molecules at a high drug-to-antibody ratio.

Source: Frost & Sullivan Analysis

Overview of Non-small-cell Lung Cancer (NSCLC)

- Non-small-cell lung cancer (NSCLC) is any type of epithelial lung cancer other than small cell lung cancer (SCLC). The most common types of NSCLC are squamous cell carcinoma, large cell carcinoma, and adenocarcinoma. All types can occur in unusual histologic variants and developed as mixed cell-type combinations.
- Symptoms of more advanced NSCLC cases include bone pain, headache, weakness and vomiting.



- Most common subtype.
- Adenocarcinoma is usually found in outer parts of the lung, it tends to grow slower than other types of lung cancer.

- It can appear in any part of the lung. It tends to grow and spread quickly, which can make it harder to treat.

- These cancers start in early versions of squamous cells, which are flat cells that line the inside of the airways in the lungs.

Source: Literature Review, Frost & Sullivan Analysis

Incidence of Oncogenic Driver Alterations in NSCLC

Gene Mutation	Percentage
EGFR mutation	45%-50% (Asian), ~20% (Western Countries)
ALK fusion	3%-5%
ROS1 fusion	~2%
BRAF V600E	1%-2%
NTRK fusion	Less than 1%
KRAS G12C mutation	~4% (Asian), ~13% (Western Countries)
MET14 exon skipping mutation	~3%
RET fusion	1%-2%
ERBB2 mutation	1%-6%

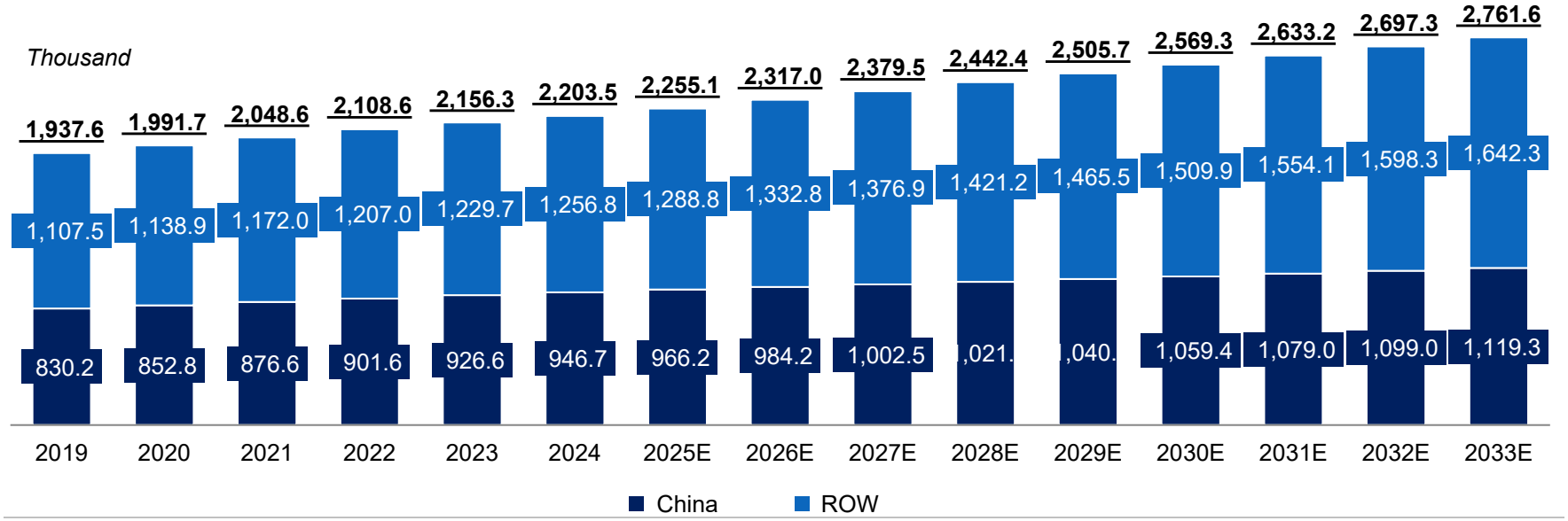
Source: Literature Review, Frost & Sullivan Analysis

Global and China Incidence of NSCLC, 2019-2033E

- The global incidence of NSCLC rose from 1,937.6 thousand cases in 2019 to 2,203.5 thousand cases by 2024, demonstrating an CAGR of 2.6%. Forecasts indicate that by 2033, the number of cases will increase to 2,761.6 thousand, with CAGR of 2.5%.
- Between 2019 and 2024, the number of NSCLC cases in China grew from 830.2 thousand to 946.7 thousand, reflecting a CAGR of 2.7%. Projections suggest that by 2033, the incidence will increase to 1,119.3 thousand cases, with a CAGR of 1.9%.

Global and China Incidence of NSCLC, 2019-2033E

Period	CAGR		
	China	ROW	Global
2019-2024	2.7%	2.6%	2.6%
2024-2033E	1.9%	3.0%	2.5%



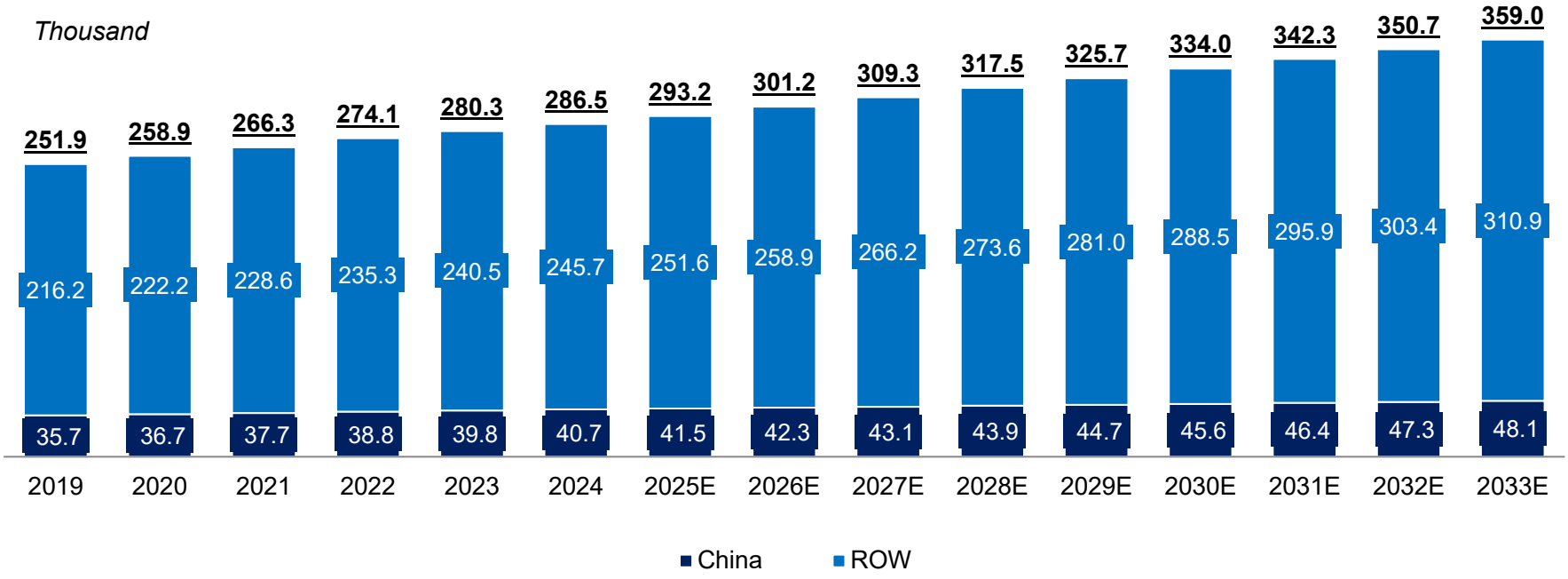
Source: Frost & Sullivan Analysis

Incidence of KRAS G12C mutated NSCLC, 2019-2033E

- The number of new cases of KRAS G12C NSCLC globally rose from 251.9 thousand to 286.5 thousand between 2019 and 2024, with a CAGR of 2.6%. It is expected to continue increasing to 359.0 thousand by 2033, reflecting a CAGR of 2.5% from 2024.

Incidence of KRAS G12C mutated NSCLC, 2019-2033E

CAGR	China	Global
2019-2024	2.7%	2.6%
2024-2033E	1.9%	2.5%



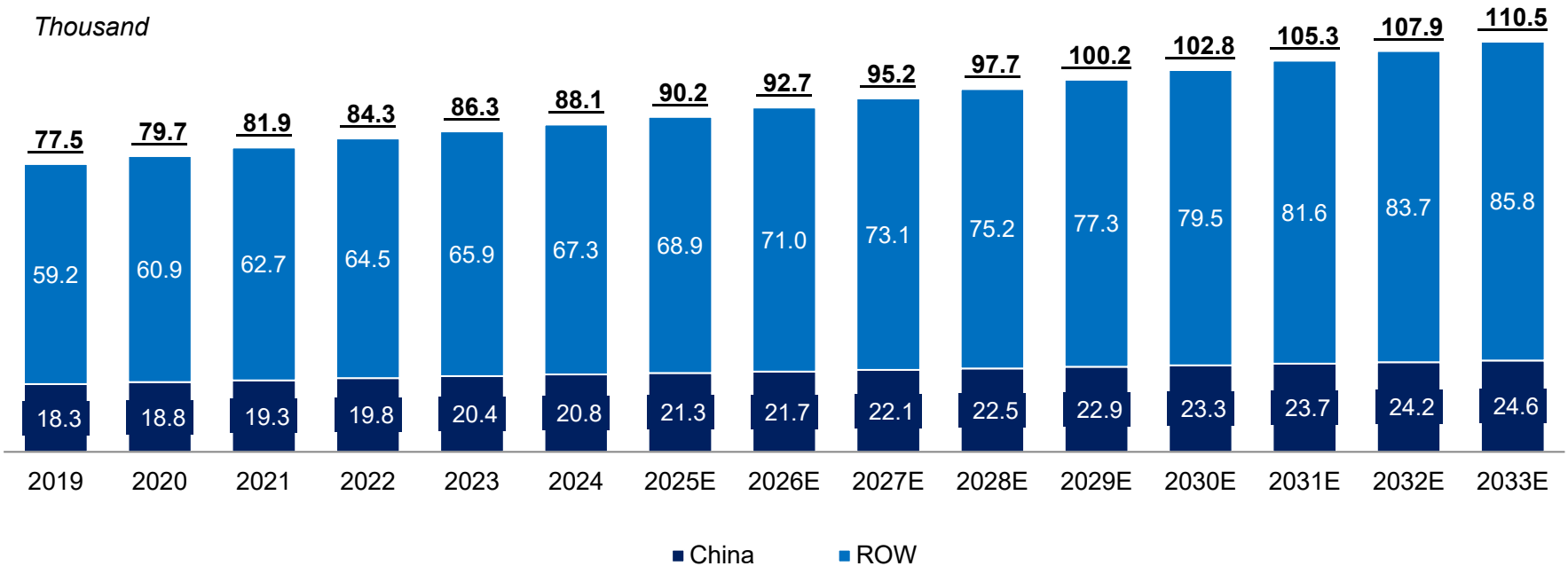
Source: IARC, NCCN, Frost & Sullivan Analysis

Incidence of KRAS G12D mutated NSCLC, 2019-2033E

- The number of new cases of KRAS G12D NSCLC globally rose from 77.5 thousand to 88.1 thousand between 2019 and 2024, with a CAGR of 2.6%. It is expected to continue increasing to 110.5 thousand by 2033, reflecting a CAGR of 2.5% from 2024.

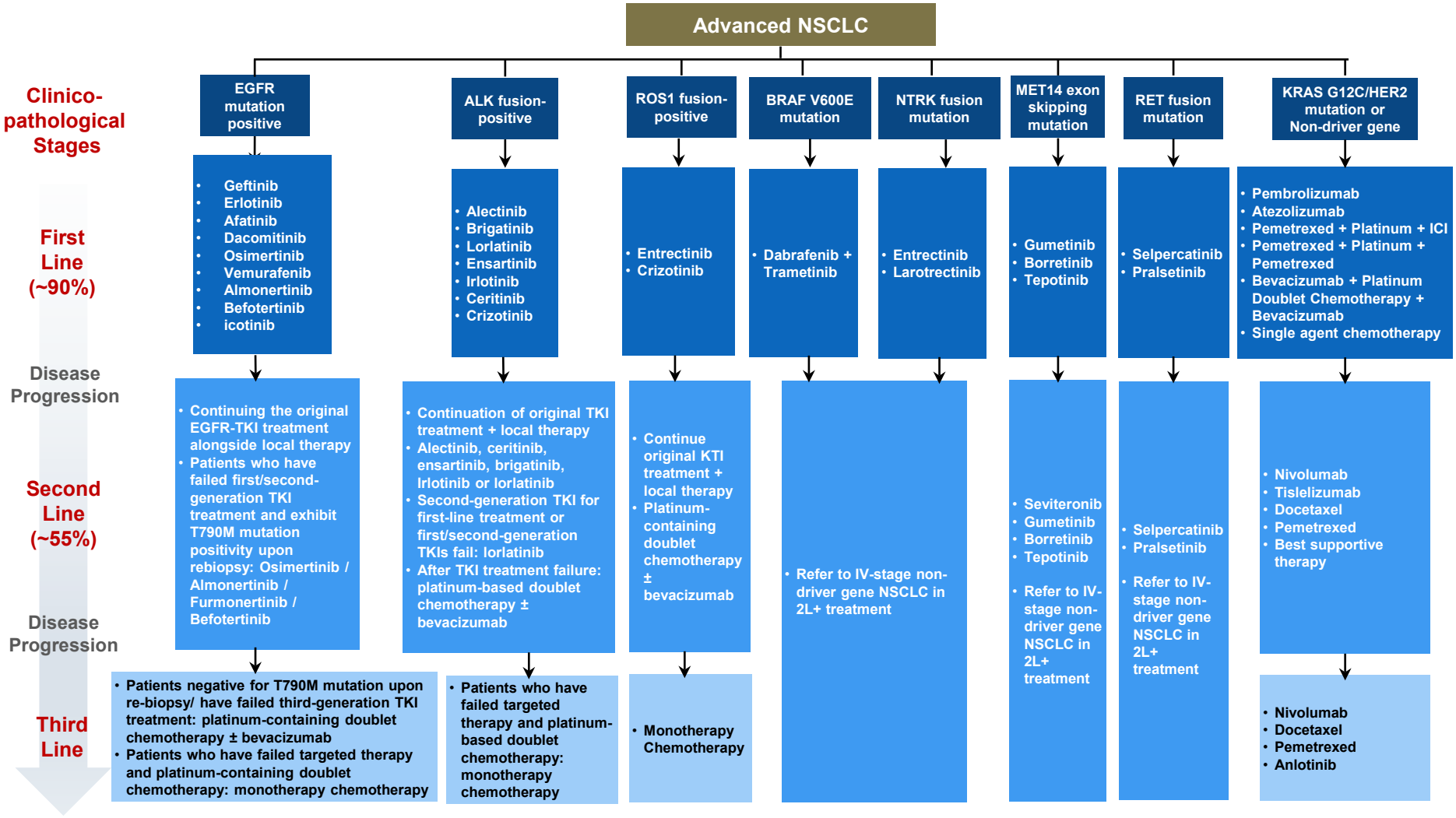
Incidence of KRAS G12D mutated NSCLC, 2019-2033E

CAGR	China	Global
2019-2024	2.7%	2.6%
2024-2033E	1.9%	2.5%



Source: IARC, NCCN, Frost & Sullivan Analysis

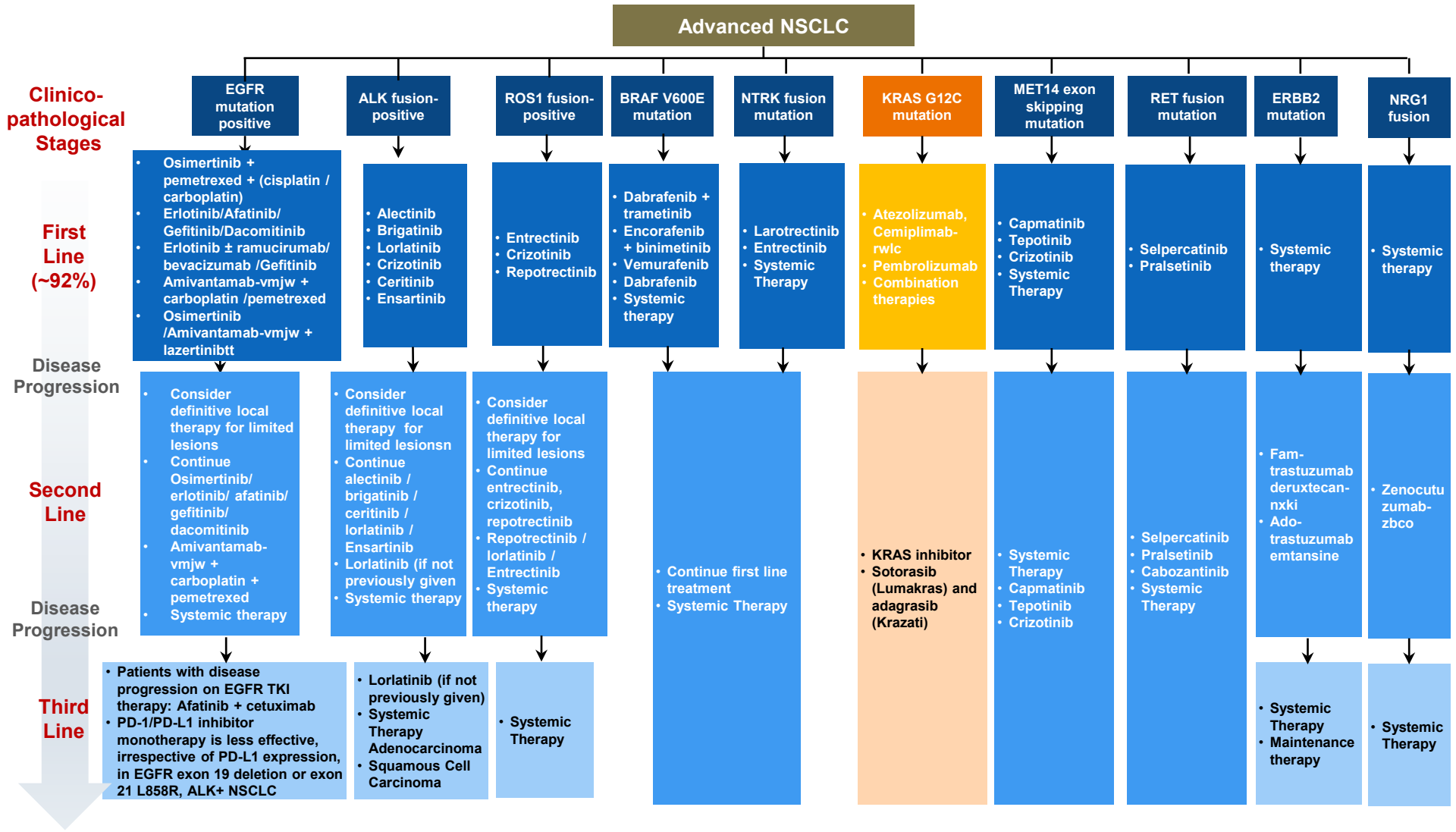
Treatment Paradigm of Advanced NSCLC in China



ICI: Immune Checkpoint Inhibitor

Source: CSCO2024, Frost & Sullivan Analysis

Treatment Paradigm of Advanced NSCLC in U.S.



Source: NCCN2025v3, Frost & Sullivan Analysis

Unmet Needs in NSCLC Treatment

Low Survival Rate

- The 5-year survival rate for lung cancer in China is comparable to that of the US, at 19.7% - 19.4% (based on survey periods in China from 2012-2015 and the U.S. from 2008-2014), which is significantly lower than other major cancers (e.g., breast cancer). This situation is primarily due to a lack of early detection tools and only limited early-stage diagnosis.
- In China, the majority of NSCLC patients are diagnosed at a late stage. Approximately 60-70% of patients are in Stage IV at diagnosis, leading to a significant disparity in survival rates.
- The prognosis of patients with unresectable locally advanced NSCLC (LA-NSCLC) has not been improved, and the current standard treatment mode is synchronous radiotherapy. Despite the standardized treatment, most of the patients still have rapid progression of the disease and poor prognosis, and the 5-year overall survival rate is only 15%~25%.

Lack of targeted drugs for KRAS mutation therapy

- Some studies have shown that primary resistance to existing inhibitors in NSCLC is closely related to KRAS mutations, and various clinical trials have demonstrated that KRAS mutation-positive patients are resistant to EGFR inhibitors such as Erlotinib, Gefitinib, or chemotherapy, which ultimately leads to progressive deterioration of the disease and largely reduces the quality of life of patients. Since EGFR is located upstream of KRAS, some studies have used anti-EGFR-TKIs and mABs to counteract KRAS mutations, but the results showed that they could not produce an inhibitory effect on KRAS mutations, and the therapeutic response was poor.
- Currently, there is no particularly effective targeted therapy for KRAS-mutant NSCLC in China. Two targeted drugs for patients with KRAS G12C mutations that are already on sale, Adagrasib and Sotorasib, neither has been approved in China.
- However, in 21 August 2024, Fluzerasib co-developed by GenFleet and Innovent, has been approved in China, which can help Chinese patients with KRAS G12C mutation to solve the problem of not having KRAS G12C targeted drugs.

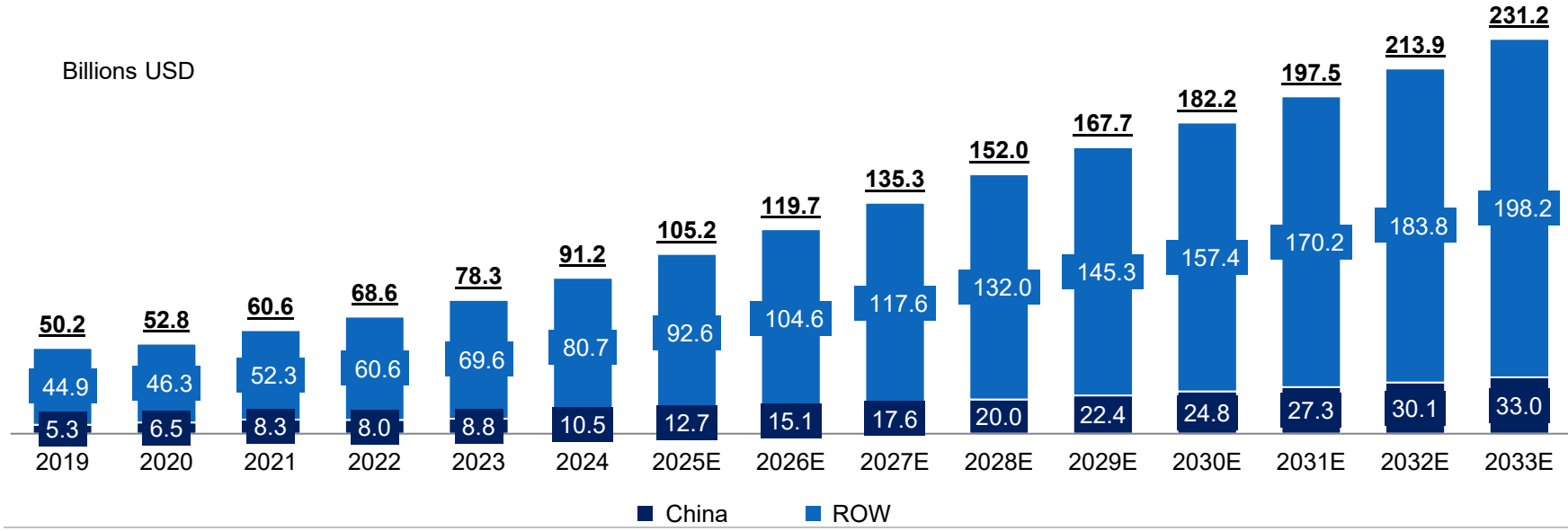
Source: Literature Review, Frost & Sullivan Analysis

Global NSCLC Drug Market Size, 2019-2033E

- Global NSCLC drug market size grow from 50.2 billion USD in 2019 to 91.2 billion USD in 2024, with a CAGR of 12.7%. Global NSCLC drug market size is expected to continue increasing to 231.2 billion USD in 2033, with a CAGR of 10.9%.
- China NSCLC drug market size grow from 5.3 billion USD in 2019 to 10.5 billion USD in 2024, with a CAGR of 14.7%. China NSCLC drug market size is expected to continue increasing to 33.0 billion USD by 2033, reflecting a CAGR of 13.6% from 2024 to 2033.

Global NSCLC Drug Market Size, 2019-2033E

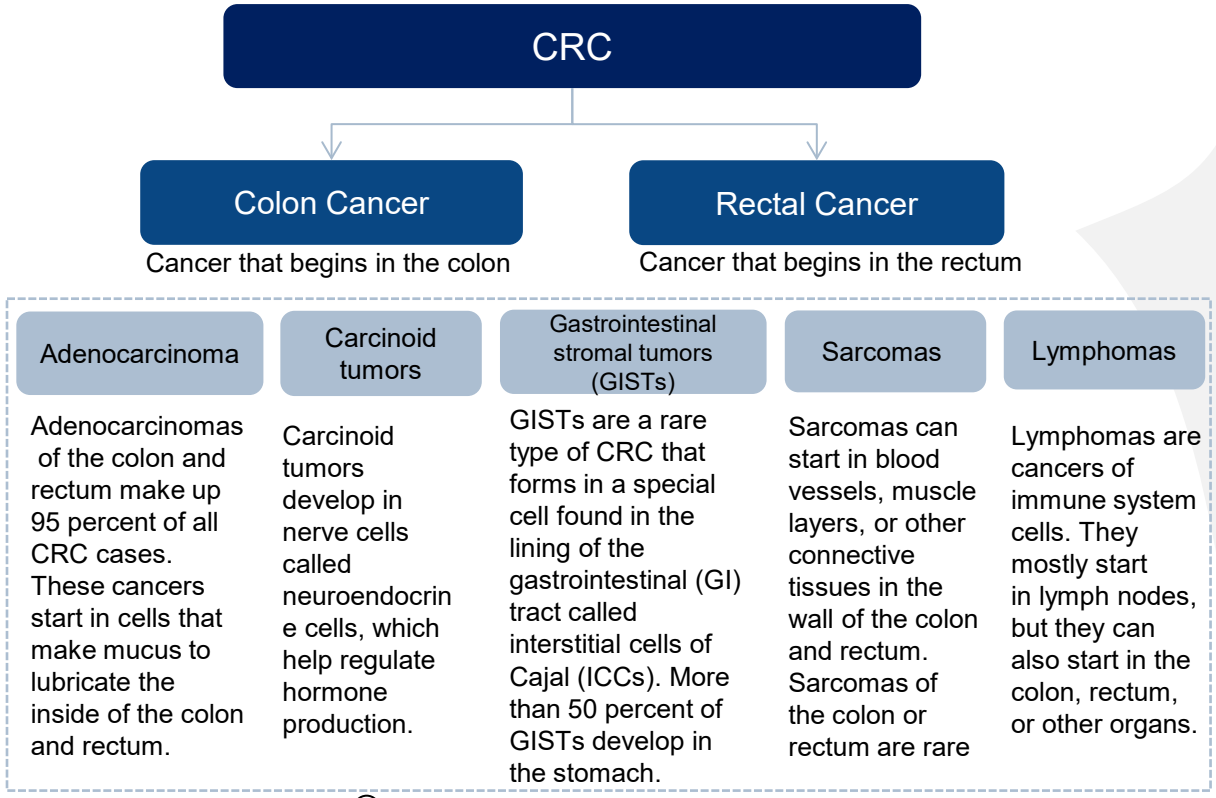
Period	CAGR		
	China	ROW	Global
2019-2024	14.7%	12.4%	12.7%
2024-2033E	13.6%	10.5%	10.9%

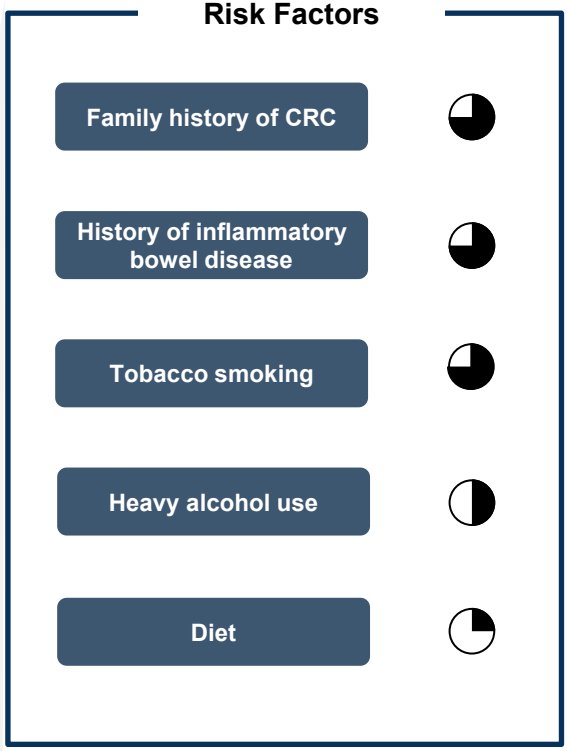


Source: Frost & Sullivan Analysis

Overview of Colorectal Cancer

- Colorectal cancer(CRC), also known as bowel cancer, colon cancer, or rectal cancer, is any cancer that affects the colon and the rectum. the colon is part of the large intestine or large bowel. The rectum is the passageway that connects the colon to the anus. Most CRCs develop first as polyps, which are abnormal growths inside the colon or rectum that may later become cancerous if they are not removed.
- In China, the incidence and mortality of CRC rank the 3rd and 5th respectively among all malignant tumors in 2019.





● The most relevant factor ○ The least relevant factor

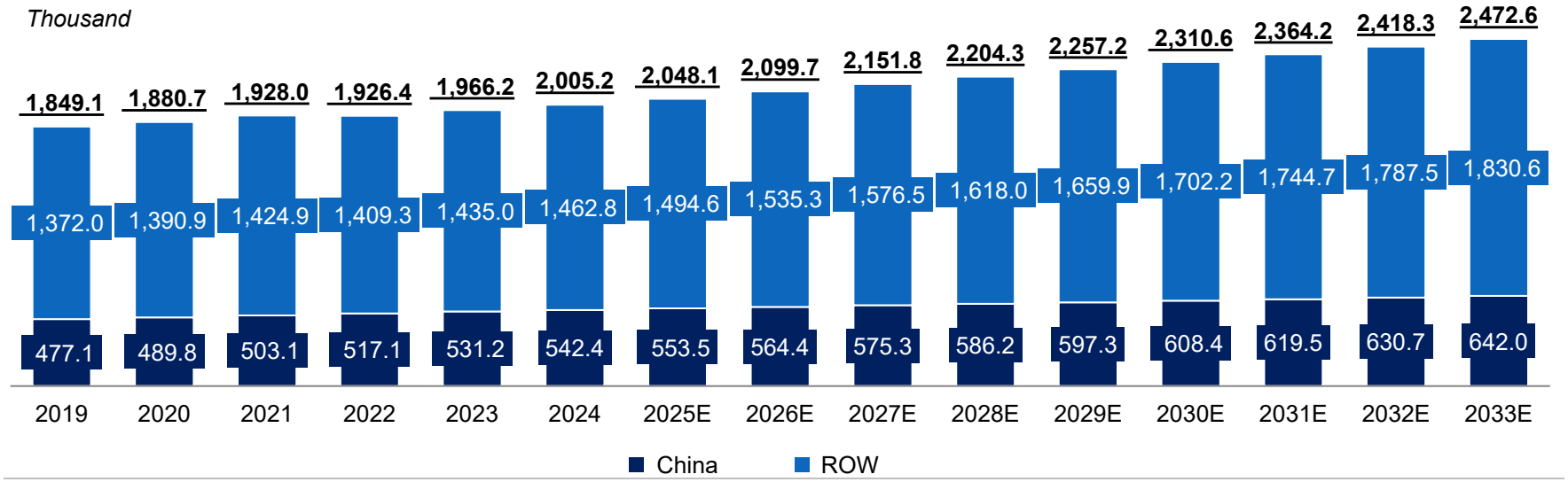
Source: Literature Review, Frost & Sullivan Analysis

Global and China Incidence of CRC, 2019-2033E

- Colorectal cancer(CRC) is one of the most prevalent cancers in the world, with the number of new cases of colorectal cancer reaching 1,849.1 thousand in 2019 and further reaching 2,005.2 thousand in 2024, at a CAGR of 1.6%. It is predicted that this number will continue to grow at the same rate of increase, reaching 2,472.6 thousand by 2033.
- In 2019, the incidence of colorectal cancer in China reached 477.1 thousand, and reached 542.4 thousand in 2024 with a CAGR of 2.6%. It is predicted that the number will continue to grow, and reach 642.0 thousand by the year of 2033, with CAGR of 1.9%.

Global and China Incidence of CRC, 2019-2033E

Period	CAGR		
	China	ROW	Global
2019-2024	2.6%	1.3%	1.6%
2024-2033E	1.9%	2.5%	2.4%



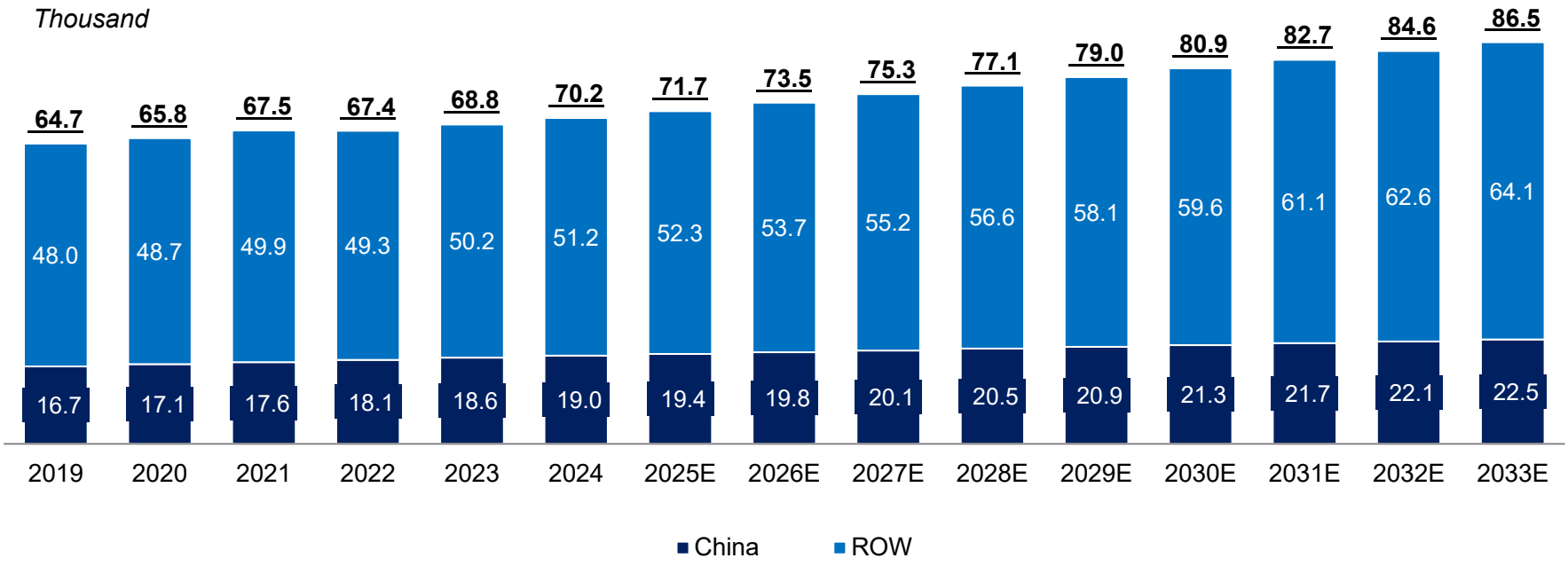
Source: WHO, IARC, NCC, Frost & Sullivan Analysis

Incidence of KRAS G12C mutated CRC, 2019-2033E

- The number of new cases of KRAS G12C CRC globally rose from 64.7 thousand to 70.2 thousand between 2019 and 2024, with a CAGR of 1.6%. It is expected to continue increasing to 86.5 thousand by 2033, reflecting a CAGR of 2.4% from 2024.

Incidence of KRAS G12C mutated CRC, 2019-2033E

CAGR	China	Global
2019-2024	2.6%	1.6%
2024-2033E	1.9%	2.4%



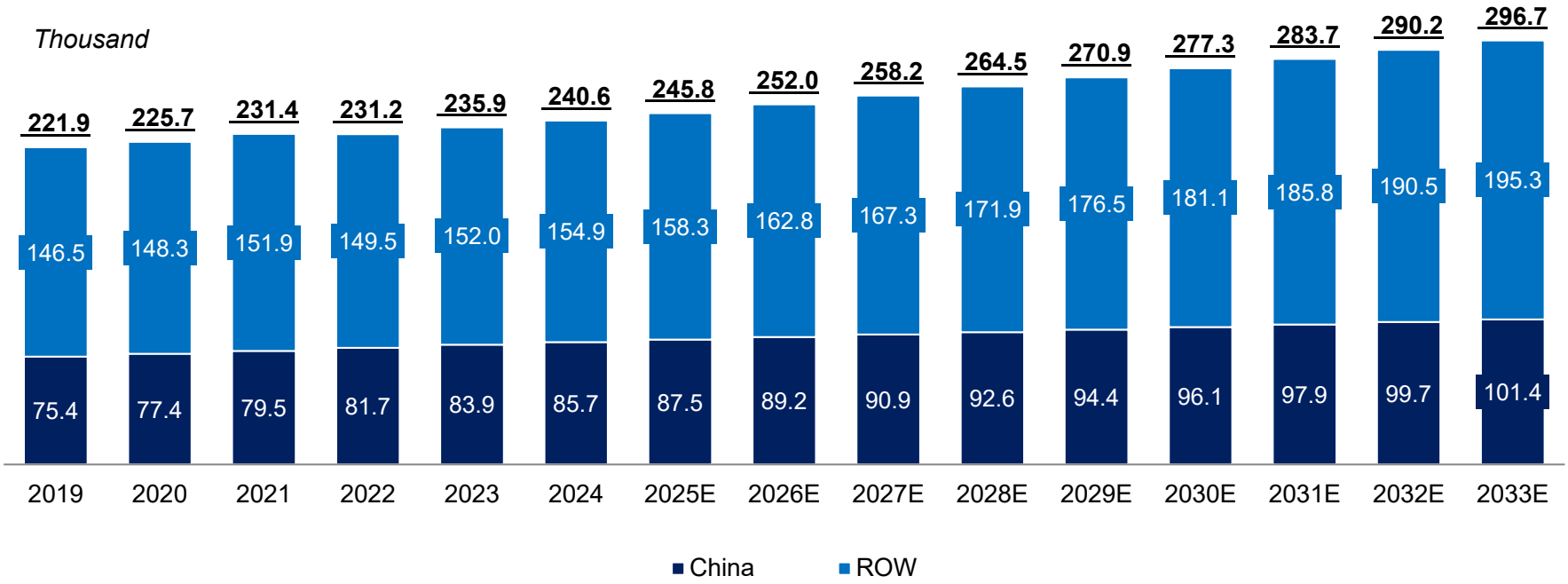
Source: IARC, NCCN, Frost & Sullivan Analysis

Incidence of KRAS G12D mutated CRC, 2019-2033E

- The number of new cases of KRAS G12D CRC globally rose from 221.9 thousand to 240.6 thousand between 2019 and 2024, with a CAGR of 1.6%. It is expected to continue increasing to 296.7 thousand by 2033, reflecting a CAGR of 2.4% from 2024.

Incidence of KRAS G12D mutated CRC, 2019-2033E

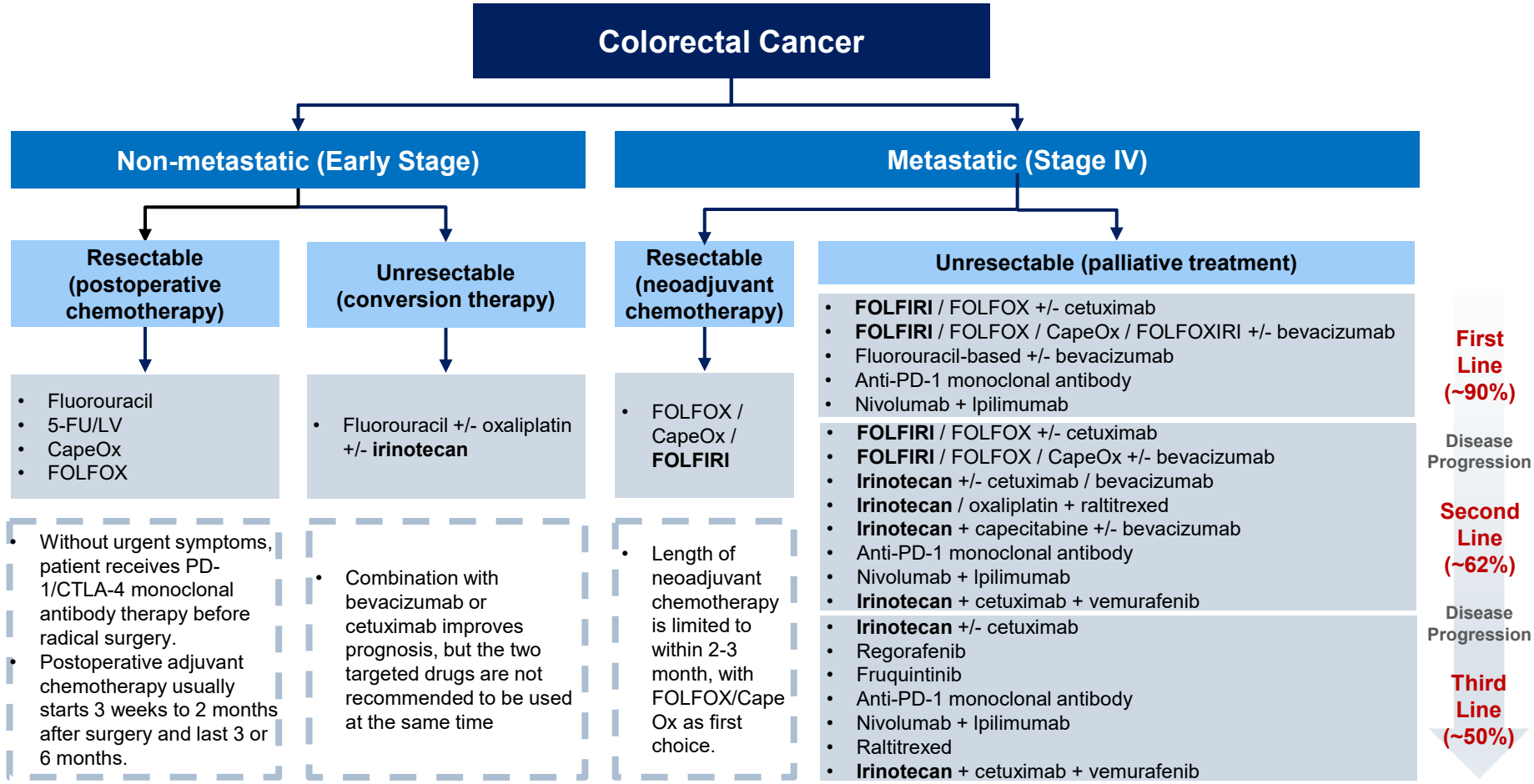
CAGR	China	Global
2019-2024	2.6%	1.6%
2024-2033E	1.9%	2.4%



Source: IARC, NCCN, Frost & Sullivan Analysis

Treatment Paradigm of CRC in China

- In China, CSCO guideline on CRC recommends using CPT analogue drug (irinotecan) in both conversion therapy of non-metastatic unresectable CRC and metastatic CRC.

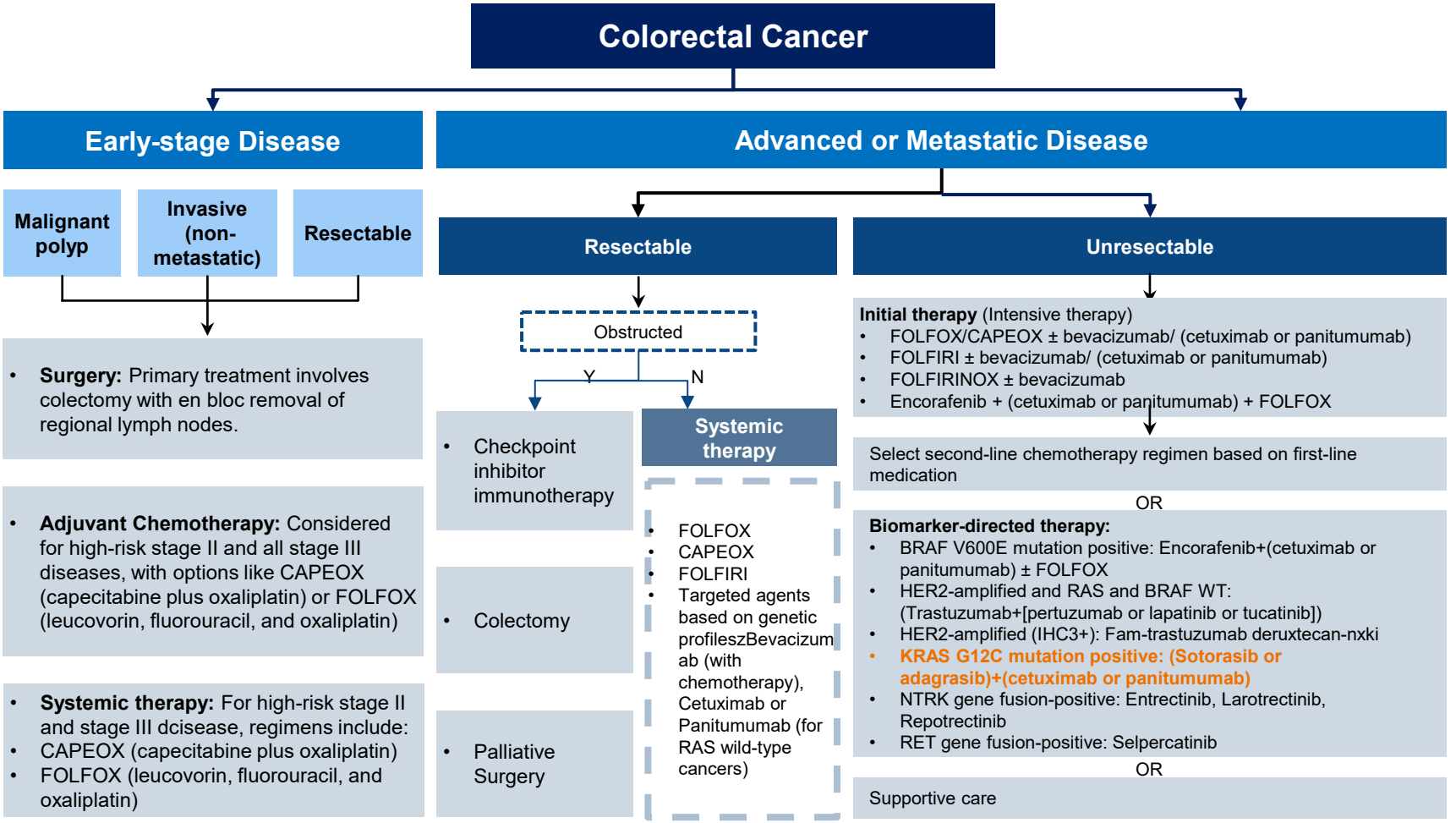


*Notes: 1. FOLFOX=oxaliplatin + leucovorin + 5-FU; **FOLFIRI=irinotecan** + leucovorin+ 5-FU; CapeOx=oxaliplatin + capecitabine.*

Source: CSCO 2024, Frost & Sullivan Analysis

Treatment Paradigm of CRC in the U.S.

- CRC is a cancer that affects the colon (large intestine) or rectum. It is one of the most common types of cancer worldwide and can cause serious injury and death.



Source: NCCN 2025, Frost & Sullivan Analysis

Unmet Needs in CRC Treatment

High Incidence Rates among young patients

- The number of young patients has been on the rise recently, and this trend is expected to continue over the next decade.
- Studies has shown that there has been a concerning rise in CRC cases among individuals under 50 years old in some high-income countries (HICs), and the incidence of CRC in young patients is notably higher in Asian and African populations.

High Mortality Rate

- Based on GLOBOCAN 2022 data, CRC ranks as the second leading cause of cancer-related deaths and the third most frequently diagnosed cancer globally. In 2023, there were 20.8 million new cancer cases and approximately 10 million deaths.

Poor Outcome

- The challenging outcomes that some patients with mCRC experience are partly due to the highly heterogeneous nature of the disease, which complicates the development of targeted treatments. While many other cancers benefit from a greater availability of targeted therapies, mCRC remains underserved in this area. Despite extensive research efforts, there is still a relative scarcity of targeted treatments that effectively address the alterations commonly found in mCRC patients.

Low Survivor Quality of life

- CRC survivors experience lower physical and mental quality of life compared to age-matched individuals without cancer. While the most significant issues and symptoms arise within the first three years, long-term treatment effects can persist, including fatigue, sleep disturbances, fear of recurrence, anxiety, depression, negative body image, sensory neuropathy, gastrointestinal issues, urinary incontinence, and sexual dysfunction.

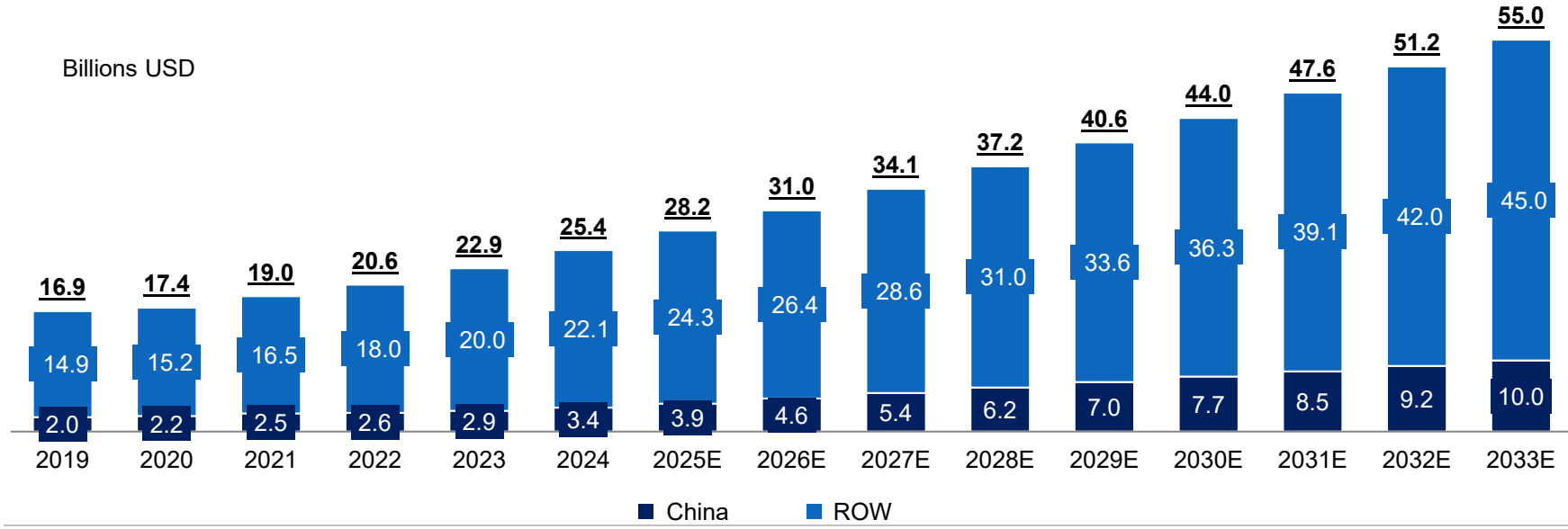
Source: Literature Review, Frost & Sullivan Analysis

Global CRC Drug Market Size, 2019-2033E

- Global CRC drug market size grow from 16.9 billion USD in 2019 to 25.4 billion USD in 2024, with a CAGR of 8.5%. Global CRC drug market size is expected to continue increasing to 55.0 billion USD in 2033.
- China CRC drug market size grow from 2.0 billion USD in 2019 to 3.4 billion USD in 2024, with a CAGR of 10.7%. China CRC drug market size is expected to continue increasing to 10.0 billion USD by 2033, reflecting a CAGR of 12.9%.

Global CRC Drug Market Size, 2019-2033E

Period	CAGR		
	China	ROW	Global
2019-2024	10.7%	8.2%	8.5%
2024-2033E	12.9%	8.2%	8.9%



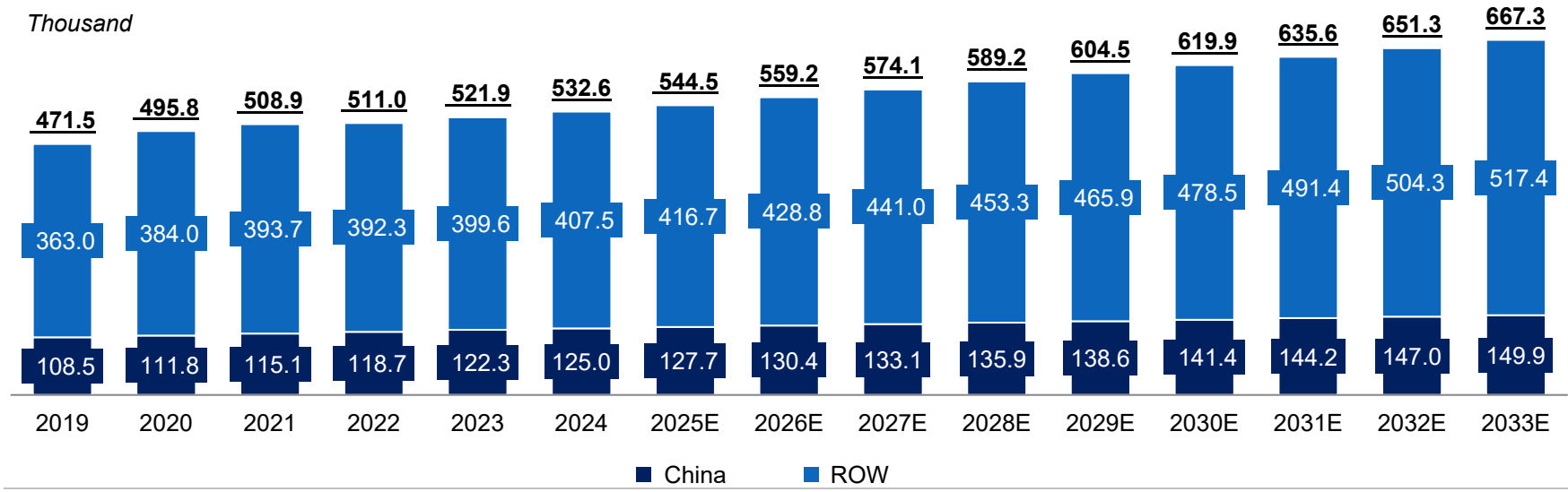
Source: Frost & Sullivan Analysis

Global and China Incidence of Pancreatic Cancer, 2019-2033E

- Global new cases of pancreatic cancer has reached 532.6 thousand in 2024 with a CAGR of 2.5% from 2019 to 2024. The global incidence of pancreatic cancer is estimated to reach 667.3 thousand in 2033, representing a CAGR of 2.5% from 2024 to 2033.
- China pancreatic cancer new cases is 108.5 thousand in 2019 and has reached 125.0 thousand in 2024, with a CAGR of 2.9%. It is expected to be 149.9 thousand in 2033, with a CAGR of 2.0% from 2024 to 2033.

Global and China Incidence of Pancreatic Cancer, 2019-2033E

Period	CAGR		
	China	ROW	Global
2019-2024	2.9%	2.3%	2.5%
2024-2033E	2.0%	2.7%	2.5%



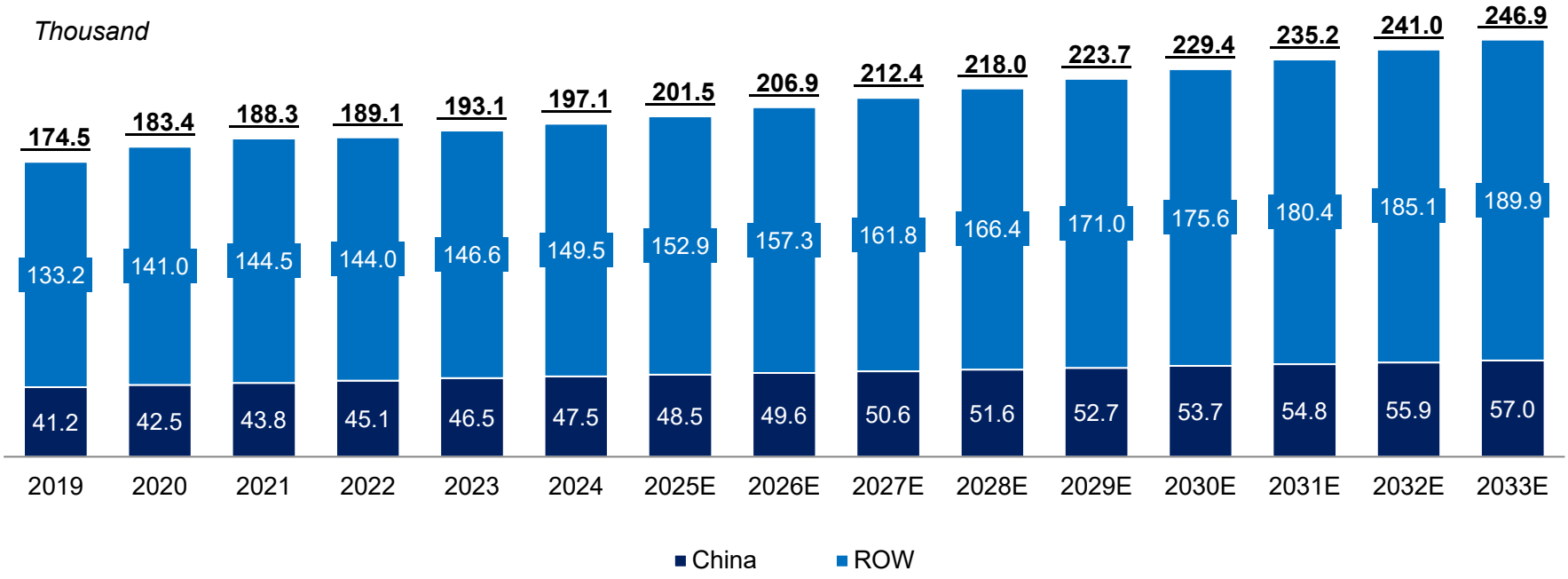
Source: Frost & Sullivan Analysis

Incidence of KRAS G12D mutated PC, 2019-2033E

- The number of new cases of KRAS G12D PC globally rose from 174.5 thousand to 197.1 thousand between 2019 and 2024, with a CAGR of 2.5%. It is expected to continue increasing to 246.9 thousand by 2033, reflecting a CAGR of 2.5% from 2024.

Incidence of KRAS G12D mutated PC, 2019-2033E

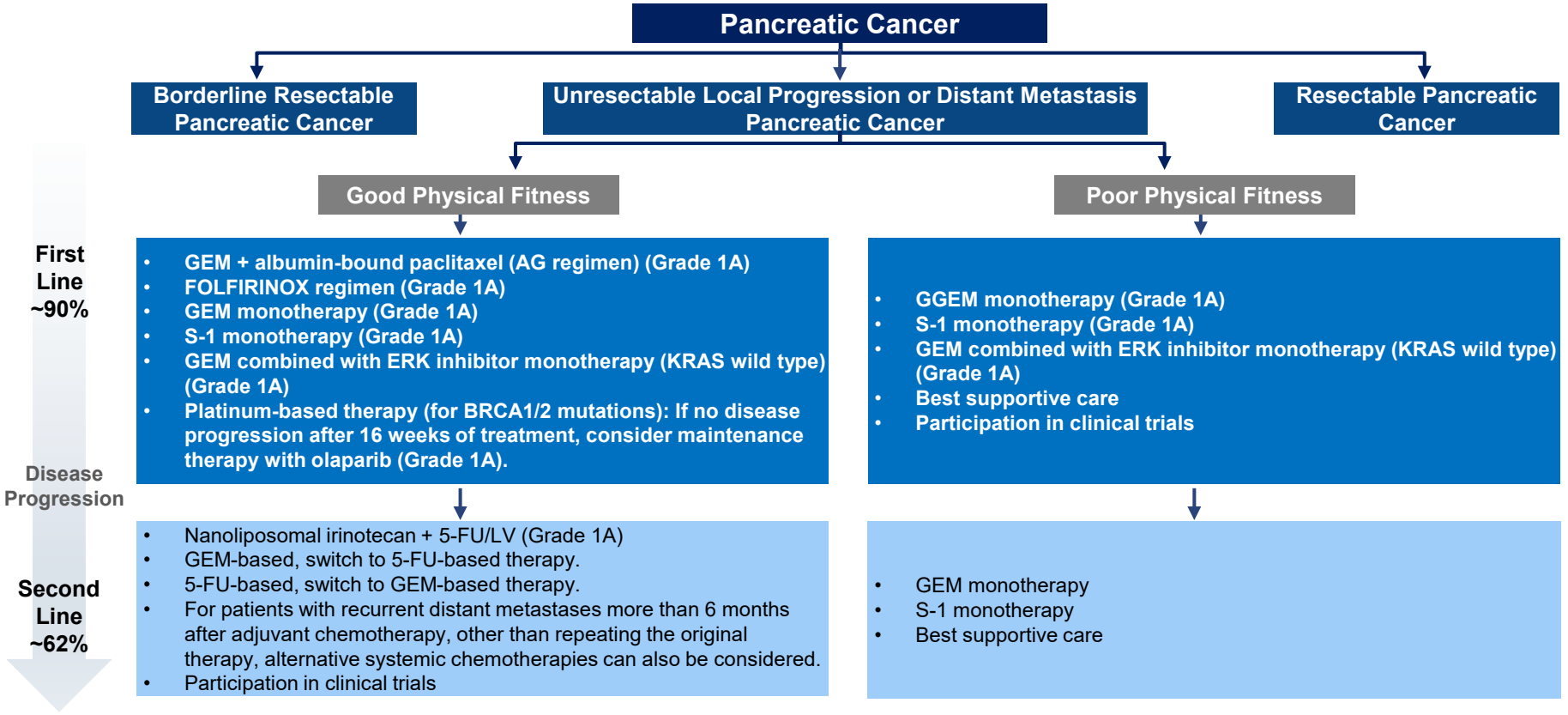
CAGR	China	Global
2019-2024	2.9%	2.5%
2024-2033E	2.0%	2.5%



Source: IARC, NCCN, Frost & Sullivan Analysis

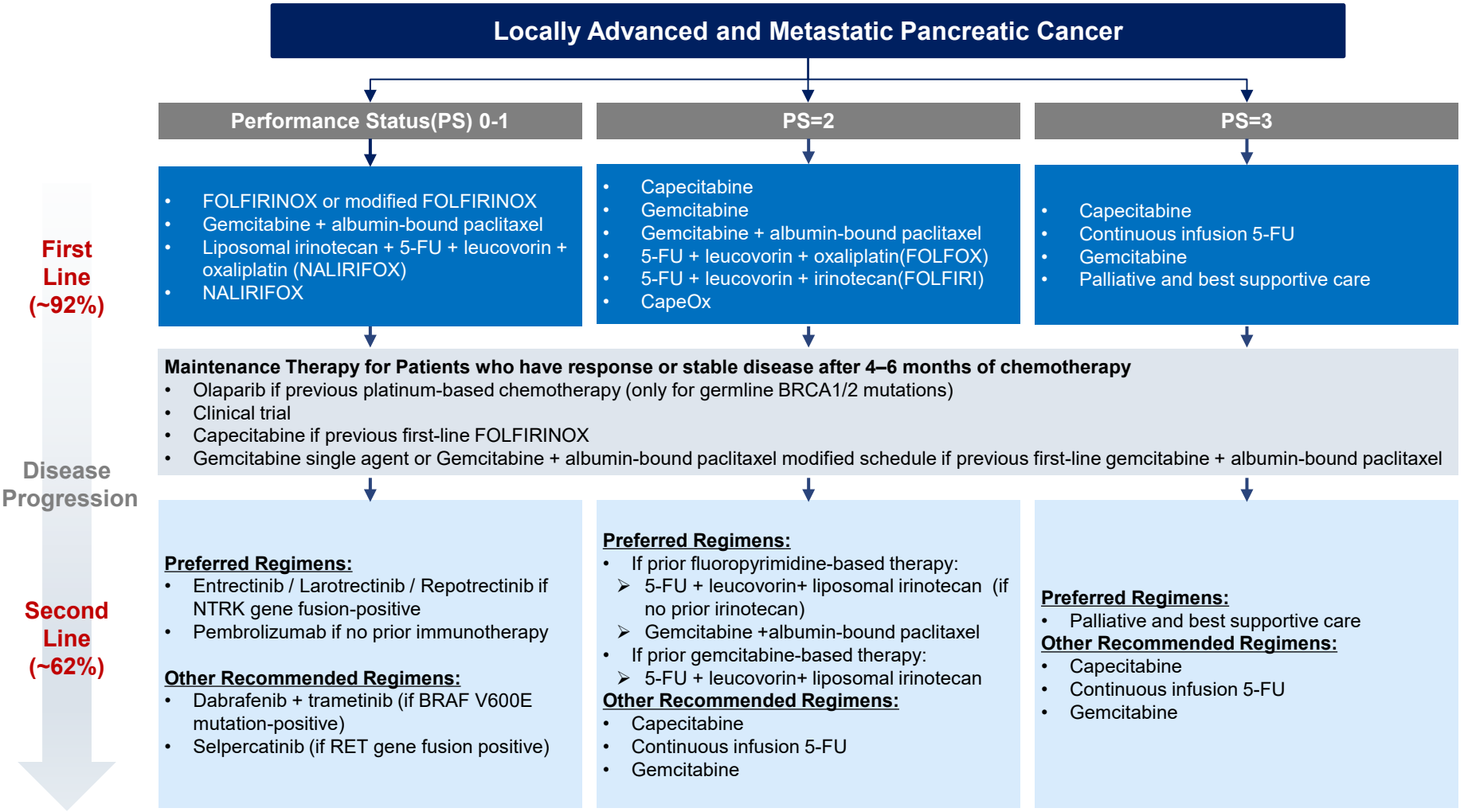
Treatment Paradigm of Pancreatic Cancer in China

- The treatment of pancreatic cancer mainly includes surgical treatment, radiotherapy, chemotherapy, interventional therapy, ERCP related treatment and TCM treatment. Currently, the option of targeted therapies is quite limited. Several targeted therapies besides erlotinib have been assessed in combination with gemcitabine, but none has been shown to significantly impact outcomes.



Source: CSCO2024, Frost & Sullivan analysis

Treatment Paradigm of Pancreatic Cancer in U.S.



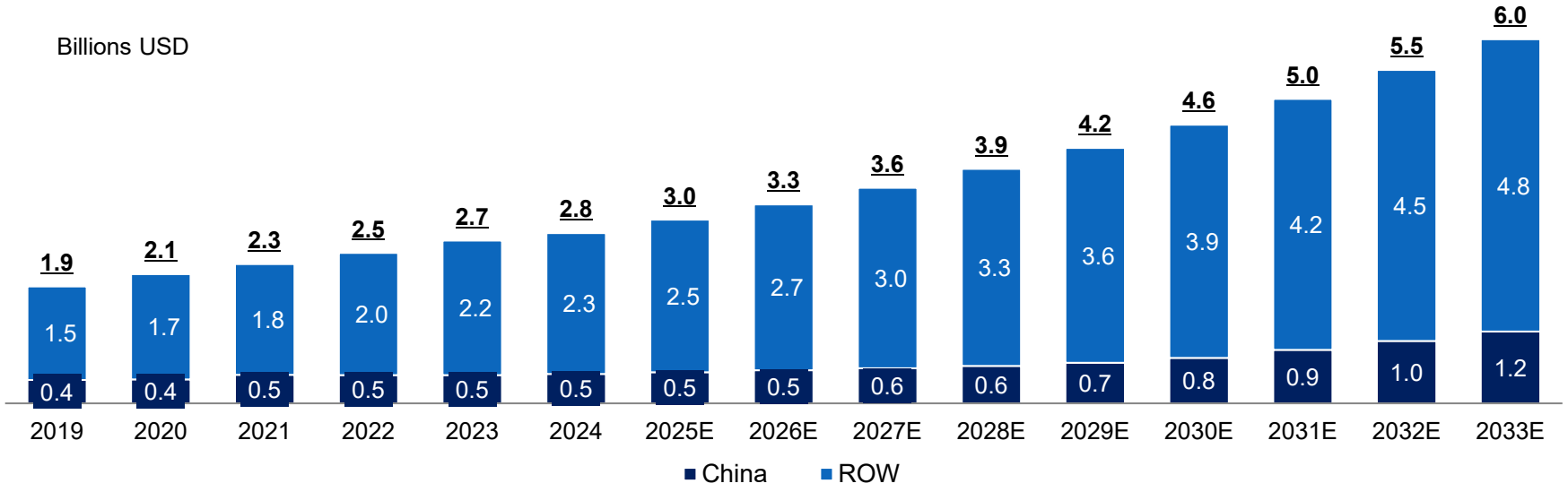
Source: NCCN2025v2, Frost & Sullivan Analysis

Global and China Pancreatic Cancer Drug Market Size, 2019-2033E

- Global pancreatic cancer drug market is estimated to increase from USD 1.9 billion in 2019 to 2.8 billion in 2024, with a CAGR of 7.8%. In the future, the global pancreatic cancer drug market will further increase to USD 6.0 billion in 2033, with a CAGR of 8.8% from 2024 to 2033.
- The pancreatic cancer drug market in China is estimated to increase from 0.4 billion USD in 2019 to 0.5 billion USD in 2024, with a CAGR of 4.6%. In the future, the China pancreatic cancer drug market will further increase to 1.2 billion USD in 2033, with a CAGR of 10.4% from 2024 to 2033.

Global and China Pancreatic Cancer Drug Market Size, 2019-2033E

Period	CAGR		
	China	ROW	Global
2019-2024	4.6%	8.5%	7.8%
2024-2033E	10.4%	8.5%	8.8%

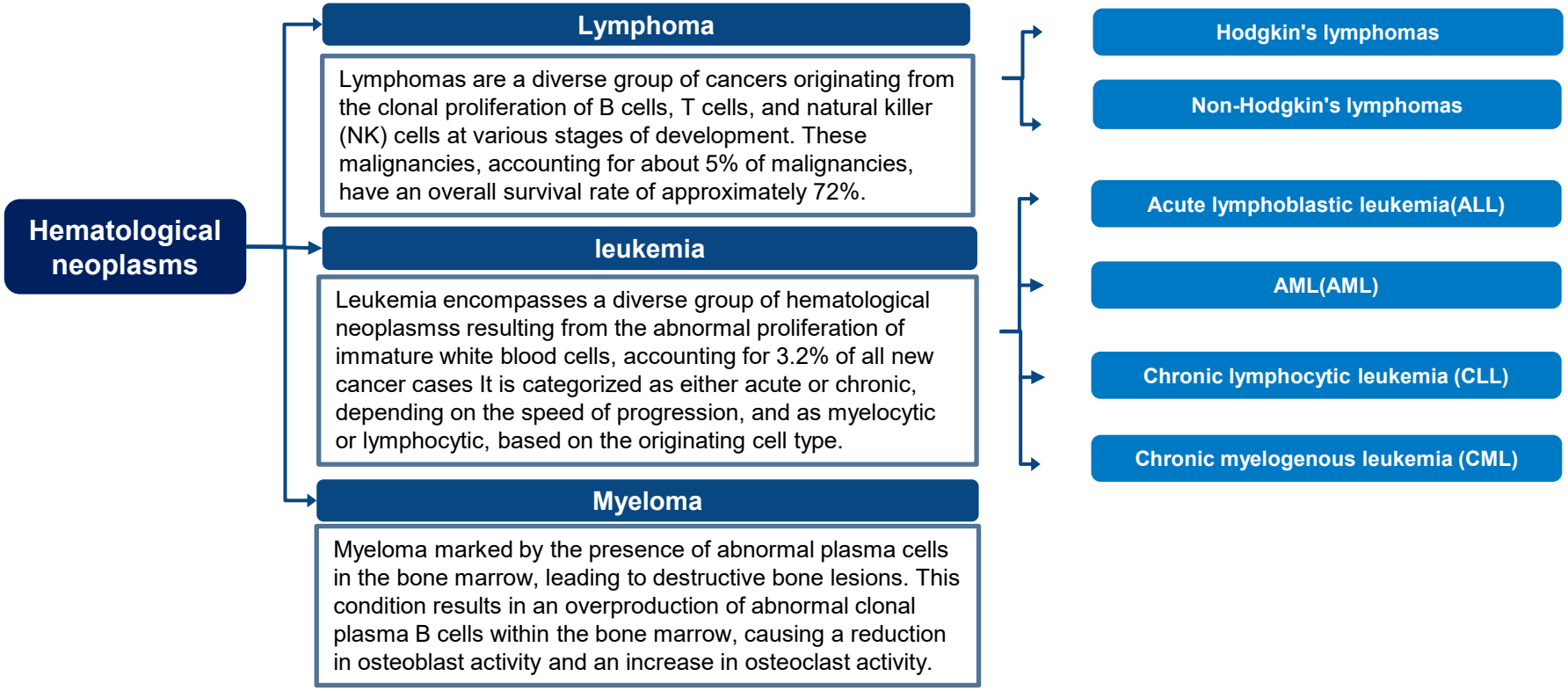


Source: Frost & Sullivan Analysis

Table of Contents

Overview of Hematological Neoplasms

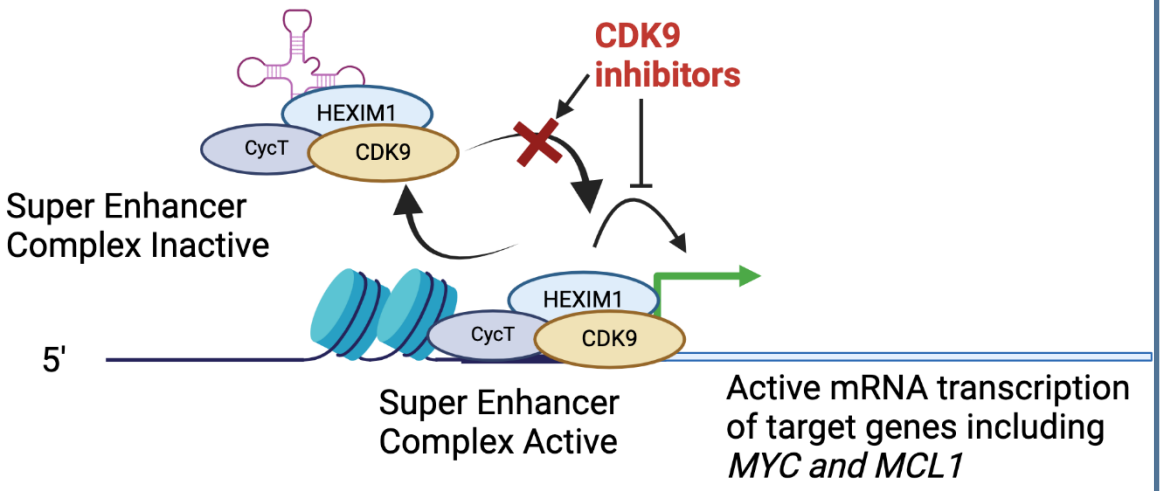
- Hematological neoplasms is a group of malignant tumors that arise from the halted differentiation and unchecked, immortal proliferation of hematopoietic cells, resulting in dysfunction of the biological system and progression to a terminal stage.
- Hematological neoplasms is a distinct category of cancers, characterized by significant variability in their types and subtypes, as well as in their treatment approaches. In some cases, the disease is aggressive, necessitating extensive and often debilitating treatments, which may include prolonged inpatient care, such as bone marrow transplants and chemotherapy.



Source: Literature Review, Frost & Sullivan Analysis

Overview of Cyclin-Dependent Kinases 9 (CDK9)

- Cyclin-dependent kinases (CDKs) are a group of serine/threonine kinases that must pair with cyclins to carry out their functions. These enzymes play roles in various cellular processes, such as the cell cycle, apoptosis, transcription, and differentiation. CDKs are frequently overexpressed in various cancers, positioning them as promising targets for novel drug therapies.
- Transcription-associated CDKs, particularly **CDK9** in conjunction with cyclin T, constitute the core of the positive transcription elongation factor b (P-TEFb). This complex is responsible for phosphorylating RNA polymerase II (RNAPII), thereby promoting the transcription elongation of most protein-coding genes. Inhibiting P-TEFb is crucial in tumors that persistently produce short-lived proteins like MYC, myeloid cell leukemia 1 protein (MCL1), and cyclin D1, which play significant roles in the development of many hematological malignancies.



- **CDK9 inhibitors have emerged as promising therapeutic agents** for various hematologic cancers due to their ability to reduce the levels of short-lived oncogenic proteins, induce apoptosis, and inhibit tumor growth.
- CDK9 inhibitors continue to show potential in preclinical models, particularly in AML(AML), where they have demonstrated efficacy in reducing key oncogenic proteins and prolonging survival in animal models and clinical studies.

Source: Literature Review, Frost & Sullivan Analysis

Competitive Landscape of CDK9 Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
QHRD107	R/R AML	Phase 2	Qianhong Biopharma	Combo with venetoclax and azacitidine	3L+	oral	40/60/80mg BID + venetoclax QD according to a ramp-up schedule to a maximum dose of 400 mg, 28-day cycle	ORR 41.3%, mOS 12.8 months, ORR 60.9%	China	2023-8-18
GFH009/SLS009	R/R DLBCL	Phase 1/2	GenFleet/ SELLAS	Combo with zanubrutinib	3L+	infusion	GFH009 60/75/100mg QW + Zanubrutinib 160mg BID, 28-day cycle	All pts: ORR 67%, AE (grade≥3) 55.6%; non-GCB DLBCL: DCR 83%	China	2024-2-18
	R/R PTCL			Mono	3L+		GFH009 QW, 21-day cycle	-	China	2023-5-25
	R/R hematologic malignancies			Mono and combo with venetoclax and azacitidine	Lymphoma 3L+, AML 2L		45/60mg QW or 30mg BIW + venetoclax + azacitidine	ORR: 44% (AML-MR), 50%(AML MR with Myelomonocytic/ Myelomonoblastic (M4/M5) Subtype) mOS: 8.9 months (AML-MR), 8.8 months (all r/r to venetoclax-based regimens pts)	US, China	2020-10-19
SYHX1903	R/R hematologic malignancies	Phase 1/2	CSPC	Mono	NA	oral	SYHX1903 QD	-	-	2021-09-24

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of CDK9 Inhibitor

Drug	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
AZD4573	R/R haematological malignancies	Phase 1/2	AstraZeneca	Combo with anti-cancer agents	2L+	infusion	AZD4573 6/9/12mg QW ± acalabrutinib 100mg BID	ORR 50%, CR 25%	Australia, US, Europe	2020-11-16
PRT2527	R/R hematologic malignancies	Phase 1	Prelude Therapeutics	Mono and combo with zanubrutinib or venetoclax	1L+	infusion	PRT2527 9/15/18mg/m2 QW ± Zanubrutinib QD/BID	ORR: 17.4% (mono), 38.5% (combo with zanubrutinib)	US, Canada, Europe	2022-12-27
Voruciclib	R/R B cell malignancies or AML	Phase 1	MEI Pharma	Mono or Combo with venetoclax	3L+	oral	Voruciclib 7 dose levels between 50 mg and 300 mg on days 1-14 of 28-day cycles, Venetoclax was administered at 200 mg on days 1-21 and 400 mg on days 22-28	death 17.1%	US	2018-06-06
TG02	R/R HGG	Phase 1	CotheraBio	Mono	2L+	oral	100/150/200/250 mg BIW	mPFS 1.77 months, TRAE (grade 3/4) 50%	China	2019-1-18
YK-2168	Histologically or cytologically confirmed advanced or unresectable solid tumors, and R/R NHL	Phase 1	YOKO Pharmaceutical	Mono	1L+	infusion	5mg QW ramp-up to a maximum dose of 30 mg, 21-day cycle	-	China	2021-11-17

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Overview of Acute myeloid leukemia (AML)

- AML is characterized by a rapid increase in the number of immature blood cells, in which the genetic information of the blood cells is damaged, and cannot shoulder the responsibility of normal blood cells.
- AML is usually found in the blood and bone marrow, the spongy, red tissue in the inner part of the large bones. It can sometimes spread to other parts of the body. AML usually progresses quickly and aggressively, requires immediate treatment.

Etiology

- AML is caused by a DNA mutation in the stem cells in the bone marrow that produce red blood cells, platelets and infection-fighting white blood cells. The damage to the genetic material or DNA in the blood-forming cells cause problems with blood cell development. This type of damage is called an acquired mutation. When blood cells do not develop as expected, it causes a build-up of many immature cells called myeloblasts or blasts. Blasts do not act like fully developed, healthy blood cells and do not help a person's immune system work, which lead to a series of disorders.
- It's not known what triggers the genetic mutation in AML, although a number of different things increase the risk of developing condition.

Subtypes of AML

Myeloid Leukemia	Monocytic Leukemia (Monoblastic)	Acute Promyelocytic Leukemia (APL)
• The cancer is in the cells that normally produce neutrophils	• Leukemia cells look like monocytes, which is a kind of white blood cells.	• Cancer cell stops maturing when the cell is at the promyelocyte stage. • Due to genetic translocation at [t(15;17)].

Fatigue & Weakness ***Bone, back, or abdominal pain*** ***Bleeding does not stop easily*** ***Shortness of breath*** ***Fever & Frequent infections***

Symptoms of AML

The symptoms of AML usually develop over a few weeks, becoming more severe as the number of immature white blood cells increases.

Risk Factors

- Increasing Age
- Smoking
- Genetic Disorders
- Previous Cancer Treatment
- Harmful Chemicals
- Other Marrow Disorders
- High Doses of Radiation

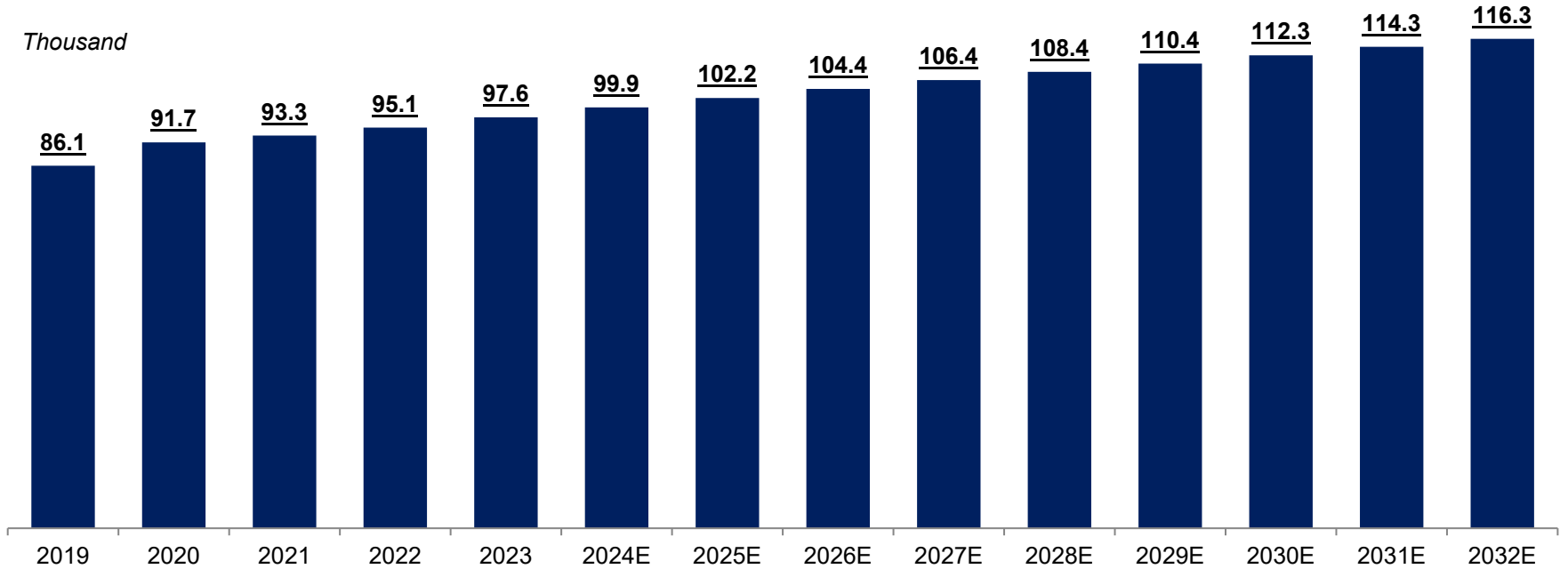
Source: Literature Review, Frost & Sullivan Analysis

Incidence of AML Globally, 2019-2032E

- From 2019 to 2023, the number of new cases of AML globally rose from 86.1 thousand to 97.6 thousand, with a CAGR of 3.2%. It is expected to continue increasing to 116.3 thousand by 2032, reflecting a CAGR of 2.0% from 2023.

Incidence of AML Globally, 2019-2032E

Period	CAGR
2019-2023	3.2%
2023-2032E	2.0%



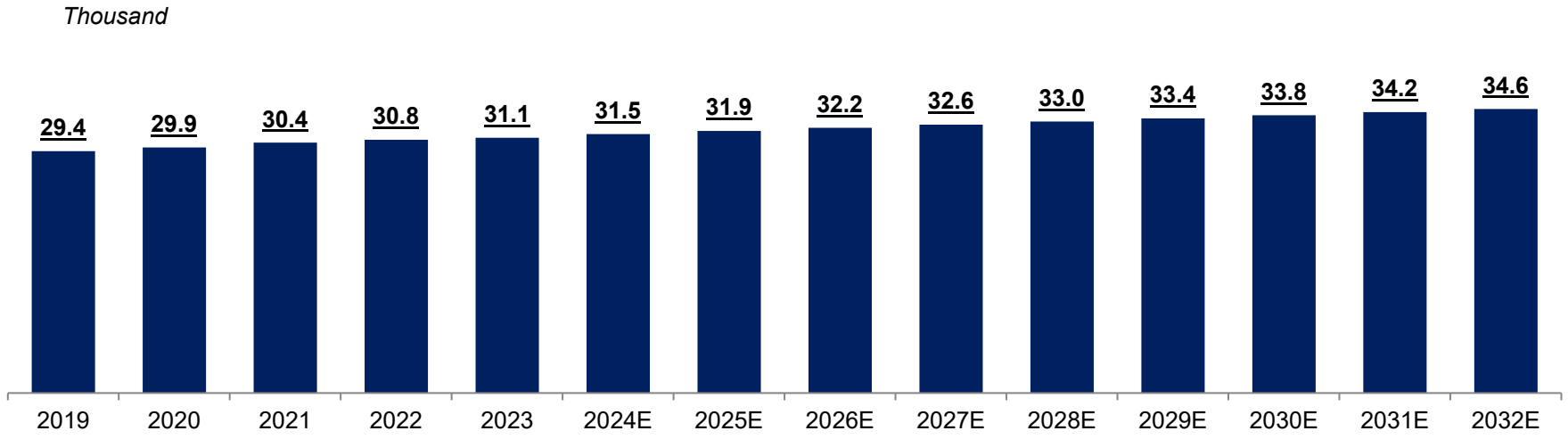
Source: Literature research, NCC IARC, Frost & Sullivan Analysis

Incidence of AML in China, 2019-2032E

- From 2019 to 2023, the number of new cases of AML in China rose from 29.4 thousand to 31.1 thousand, with a CAGR of 1.4%. It is expected to increase to 34.6 thousand in 2032.

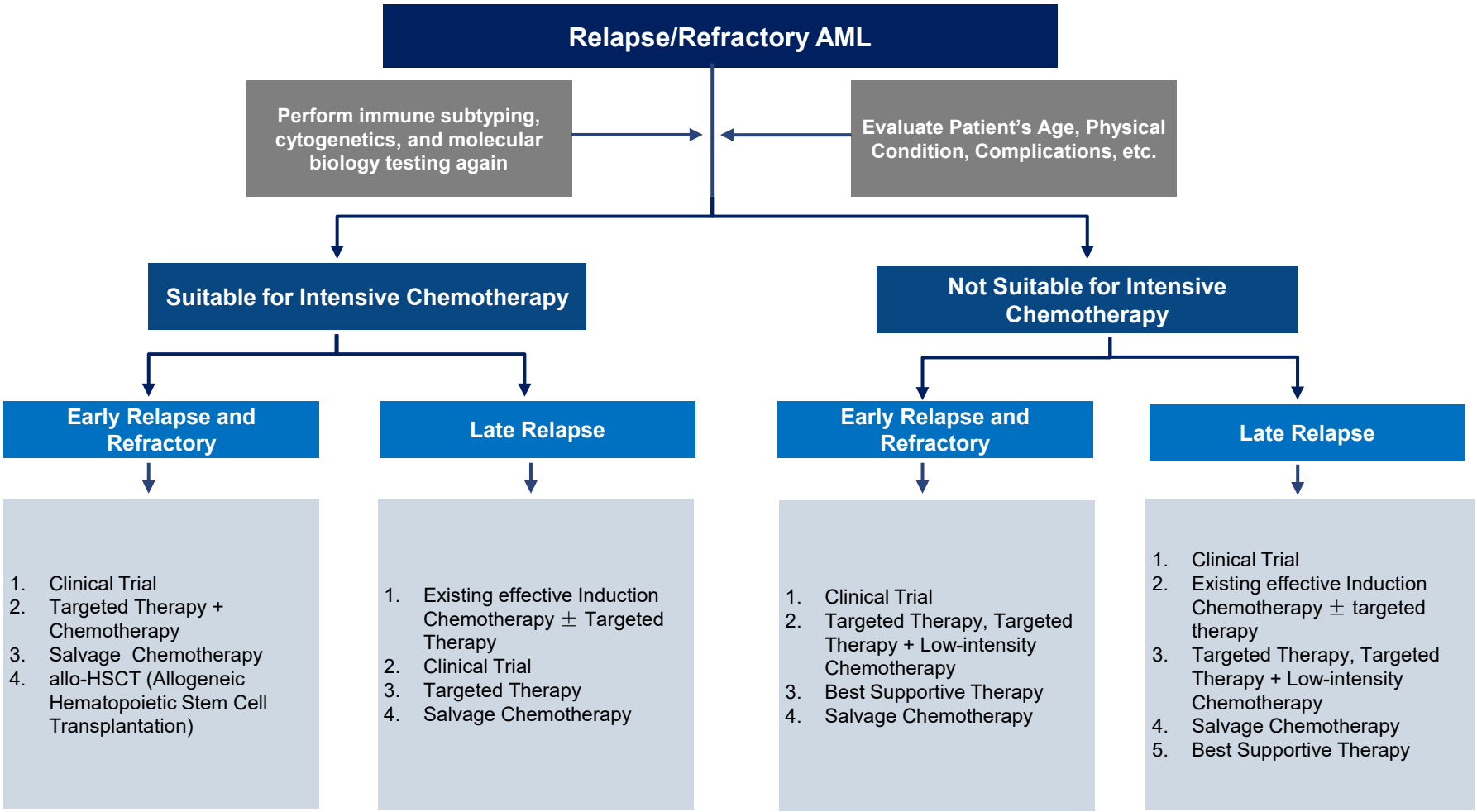
Incidence of AML in China, 2019-2032E

Period	CAGR
2019-2023	1.4%
2023-2032E	1.2%



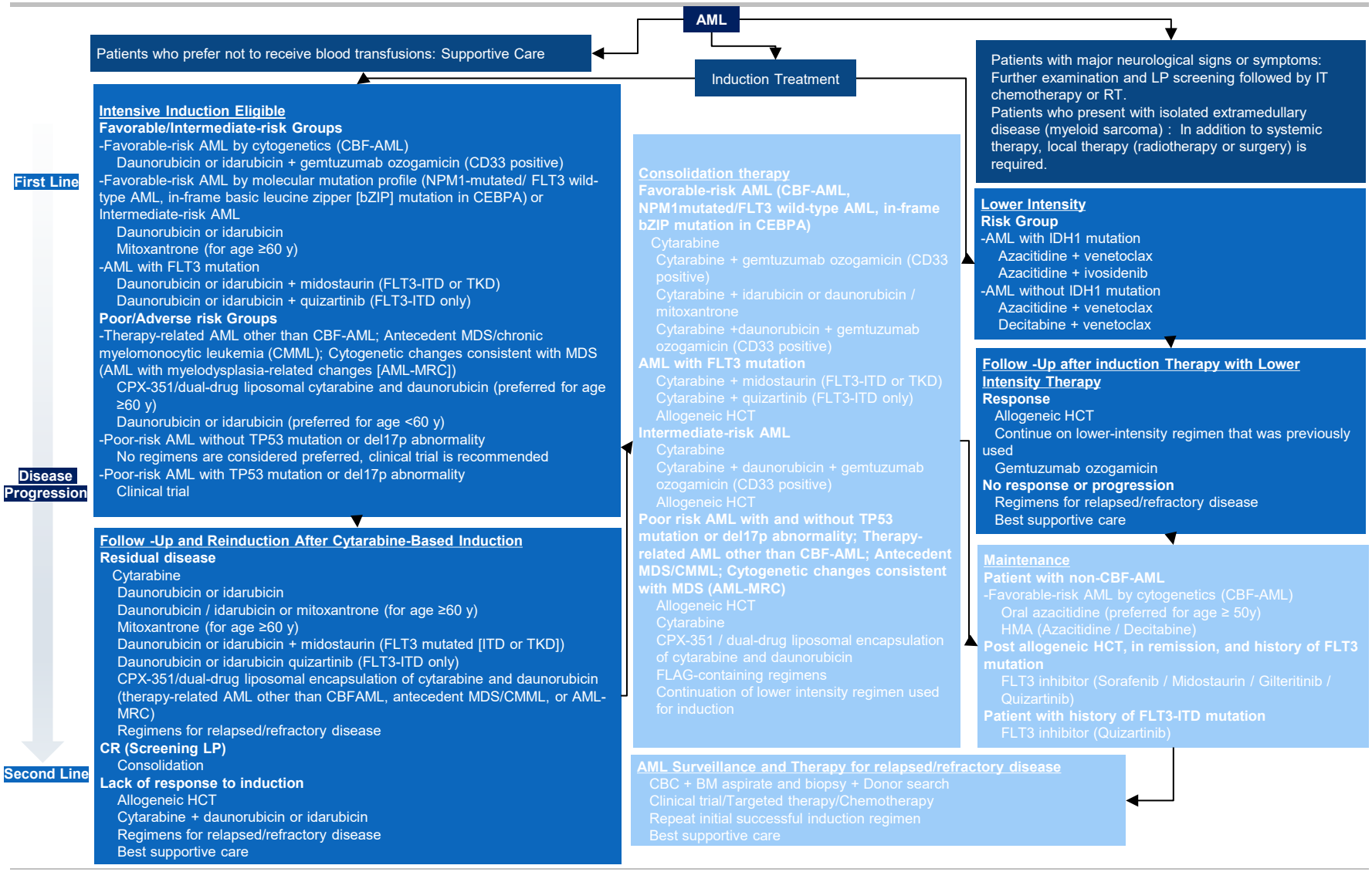
Source: Literature research, NCC, IARC, Frost & Sullivan Analysis

Treatment Paradigm of AML in China



Source: 中国复发难治性急性髓系白血病诊疗指南（2023年版）, Frost & Sullivan Analysis

Treatment Paradigm of AML in U.S.



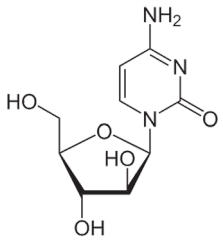
- *Source: NCCN, Frost & Sullivan Analysis*

Unmet Needs in AML Treatment

- Currently, the main treatment option of AML is chemotherapy represented by cytarabine-based therapies.
- However, The limitation of current treatment, the obstinate nature of the disease and the disparities among different age groups indicates that the treatment of AML still exists large unmet needs.

Main treatment options

- Chemotherapy, represented by cytarabine-based therapies, is the main treatment option of AML
- Intense chemo might not be recommended for patients in poor health, thereby advanced age by itself is one of a barrier to getting chemo.



Future prospects

- However, there are certain problems with this therapy, which needs to be improved in the near future.
- Both high relapsed/refractory rate and existence of vulnerable populations has demonstrated a large unmet need in AML treatment, indicating the need of developing therapies that could benefit R/R disease, especially in older populations.

High relapsed/refractory rate

- Due to the limitation of current treatment and the obstinate nature of the disease, over 50% of patients will ultimately experience progression due to relapsed/refractory (R/R) disease.

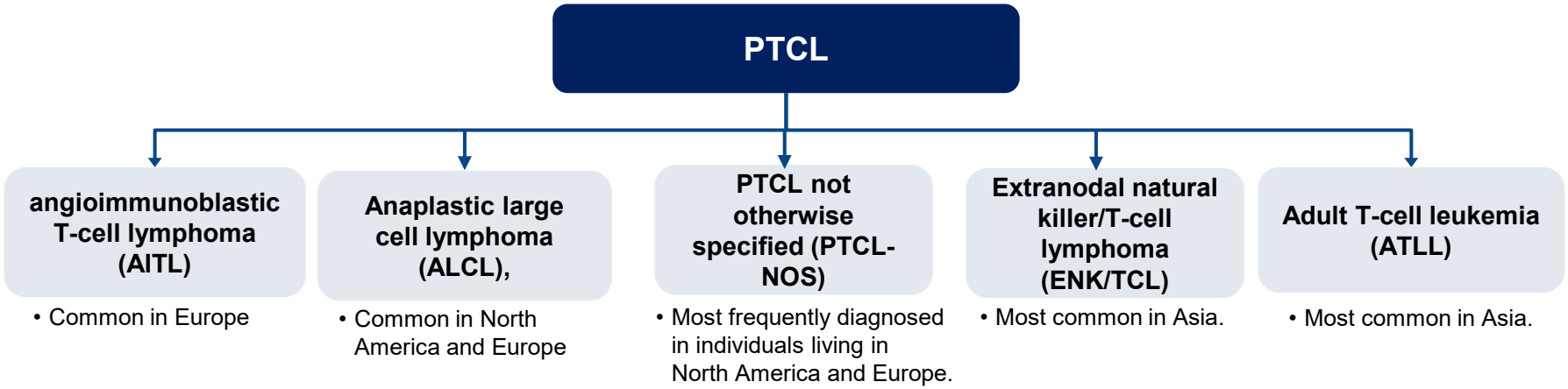
Existence of vulnerable populations

- In addition, AML exhibits large disparities among patients of different age groups, with older adults experience shorter survival and are at greater risk for treatment-related toxicity compared to younger AML patients.
- Management of AML is dependent on the individual's medical fitness for intensive antileukemic therapy, with intensive chemotherapies mainly used to treat fit AML patients who are more tolerated, bringing them higher chance of getting disease remission.
- Older patients (typically above 60), however, are less tolerated to intensive chemotherapies due to age-related comorbidities and impaired performance status, and thereby more likely to be characterized as medically unfit or frail. For these unfit/frail patients, conventional chemotherapies bring limited clinical benefit to them.

Source: Literature Review, Frost & Sullivan Analysis

Overview of Peripheral T Cell Lymphoma (PTCL)

- PTCL represents a diverse group of lymphomas that make up 5% to 15% of non-Hodgkin lymphomas (NHL) in the western world. This group includes both peripheral (systemic) and cutaneous forms, originating from T-cells and NK cells. Clinically, these lymphomas are frequently aggressive.
- In general, nodal, extranodal, and leukemic PTCL are typically aggressive diseases, with a five-year survival rate of approximately 30%.



Risk Factors

• According to International Prognostic Index (IPI), One point is assigned for each of the following risk factors:

- Age greater than 60 years
- Stage III or IV disease
- Performance status, which uses a scale to evaluate a person's ability to perform daily tasks of living without help.
- More than one lymph node involved
- Elevated serum lactate dehydrogenase (LDH)

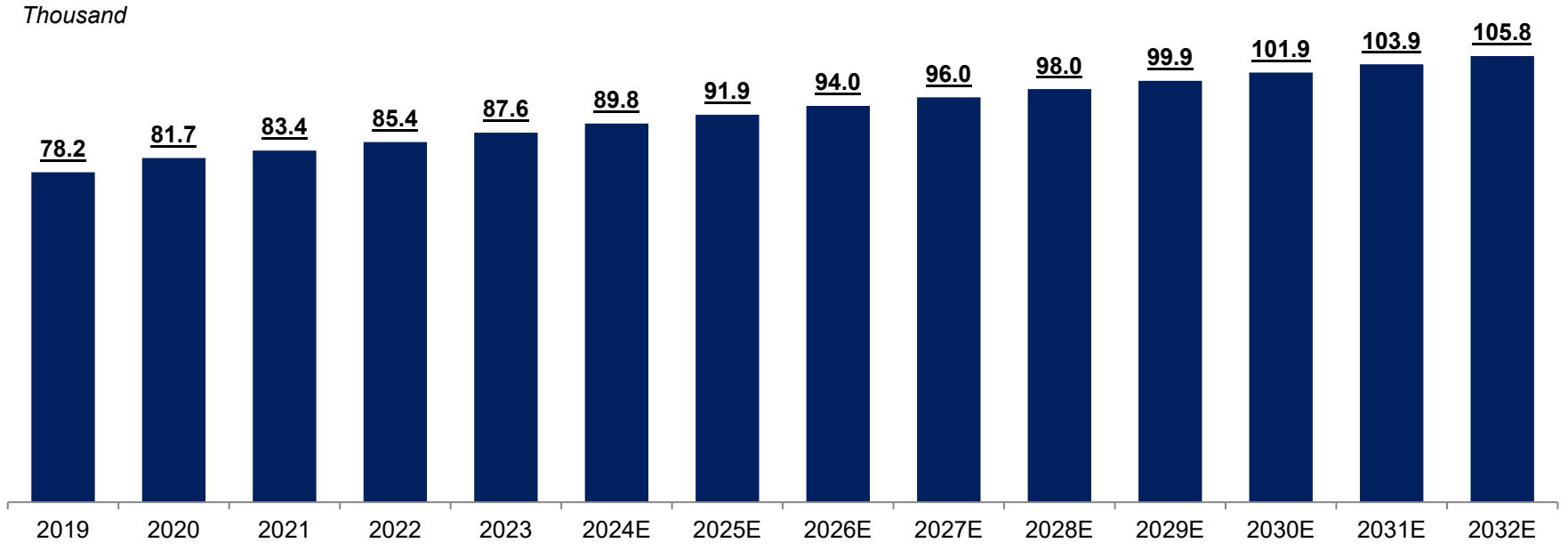
Source: Literature Review, Frost & Sullivan Analysis

Incidence of PTCL Globally, 2019-2032E

- From 2019 to 2023, the number of new cases of PTCL globally rose from 78.2 thousand to 87.6 thousand, with a CAGR of 2.9%. It is expected to continue increasing to 105.8 thousand by 2032, reflecting a CAGR of 2.1% from 2023.

Incidence of PTCL Globally, 2019-2032E

Period	CAGR
2019-2023	2.9%
2023-2032E	2.1%



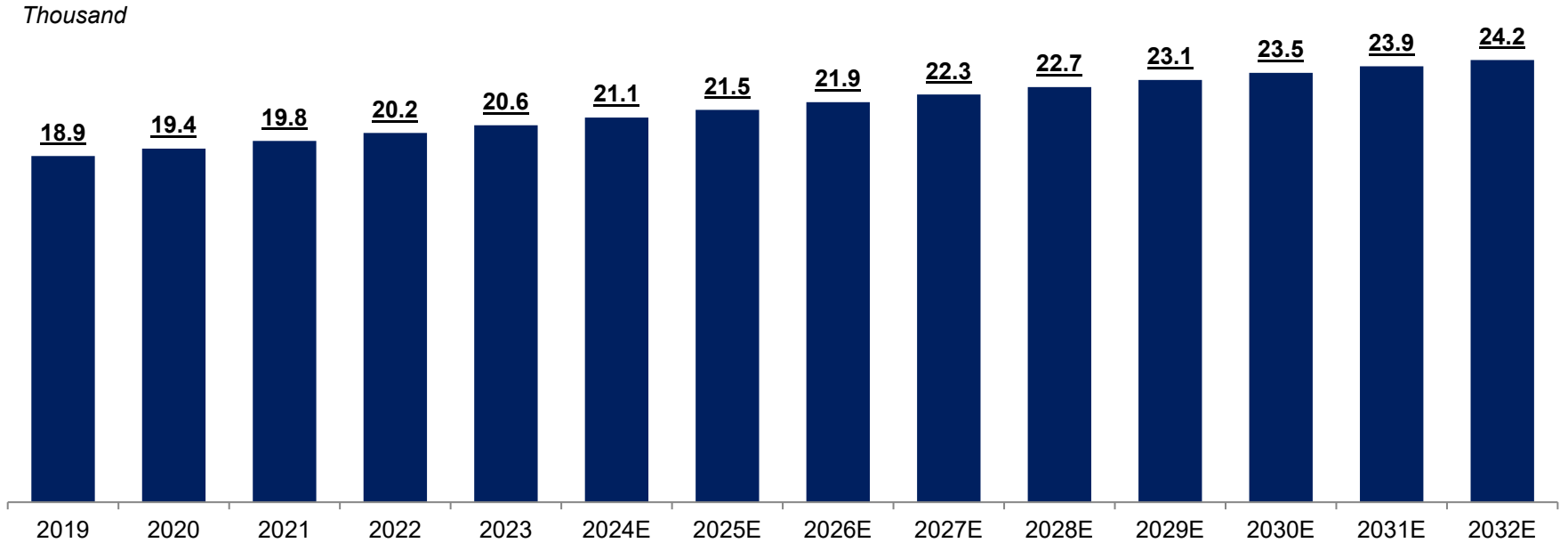
Source: Literature research, NCC, IARC, Frost & Sullivan Analysis

Incidence of PTCL in China, 2019-2032E

- The number of new cases of PTCL in China rose from 18.9 thousand in 2019 to 20.6 thousand in 2023, with a CAGR of 2.2%. It is expected to continue increasing to 24.2 thousand by 2032.

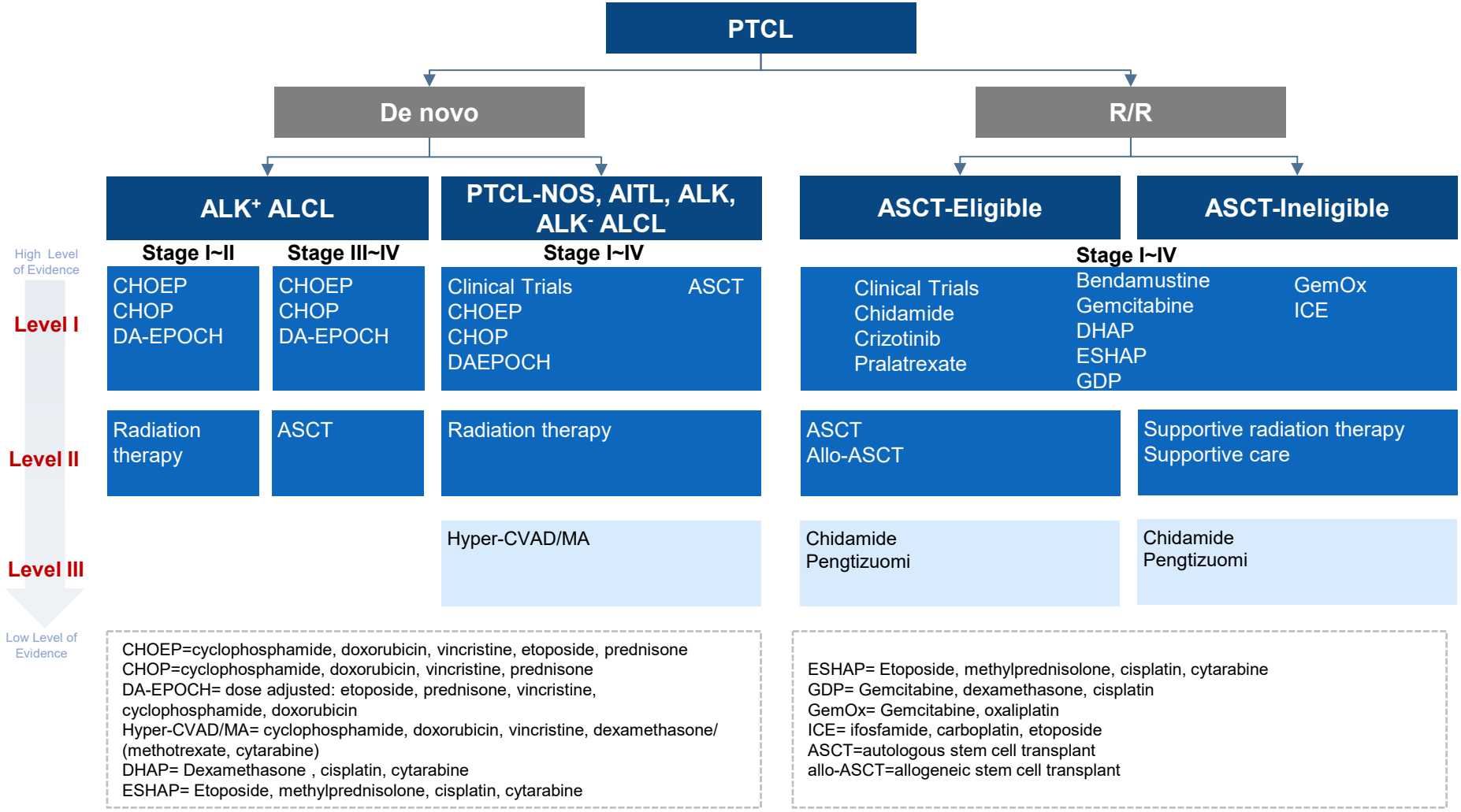
Incidence of PTCL in China, 2019-2032E

Period	CAGR
2019-2023	2.2%
2023-2032E	1.8%



Source: Literature research, NCC, IARC, Frost & Sullivan Analysis

Treatment Paradigm of PTCL in China

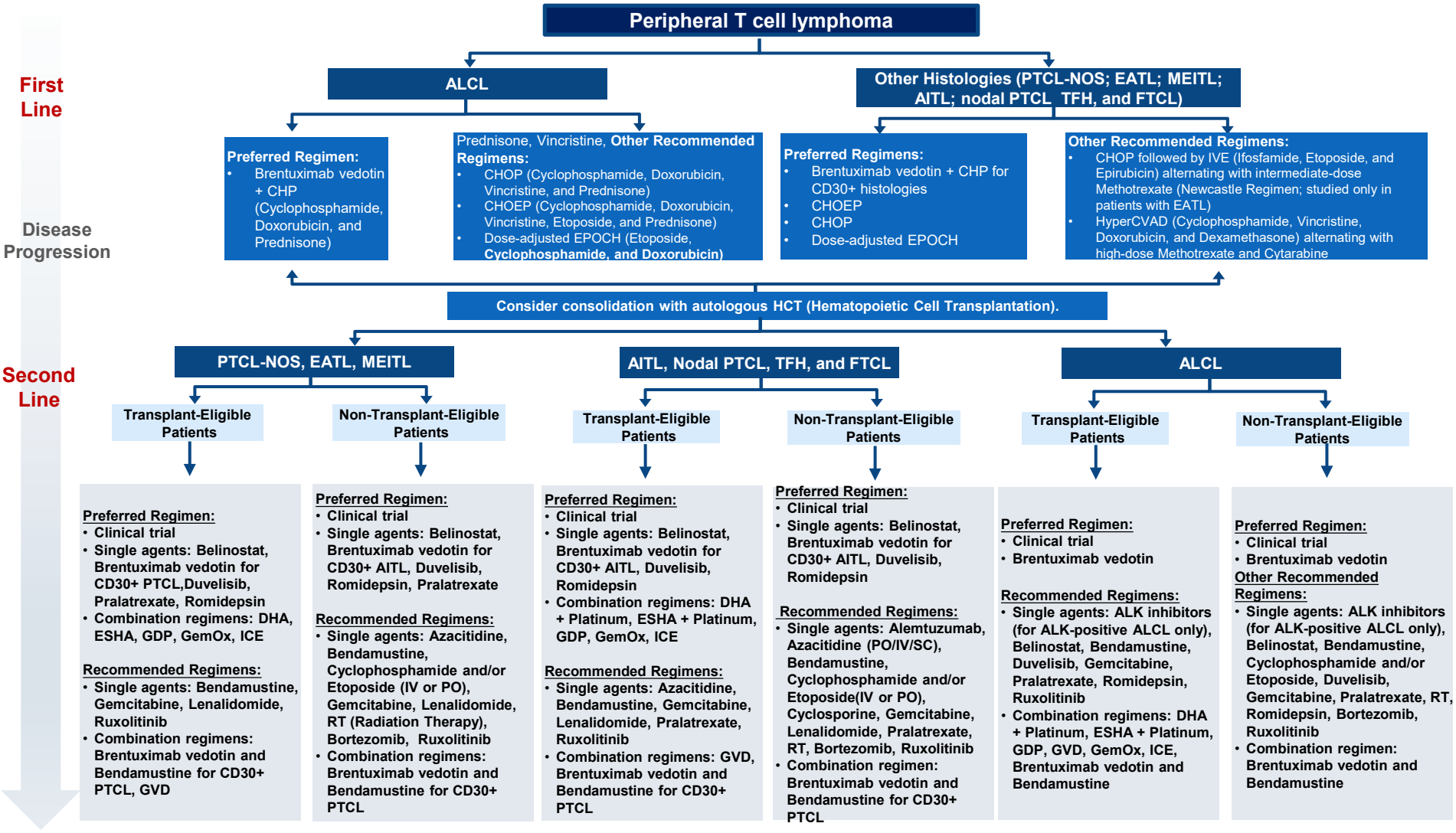


CHOEP=cyclophosphamide, doxorubicin, vincristine, etoposide, prednisone
CHOP=cyclophosphamide, doxorubicin, vincristine, prednisone
DA-EPOCH= dose adjusted: etoposide, prednisone, vincristine, cyclophosphamide, doxorubicin
Hyper-CVAD/MA= cyclophosphamide, doxorubicin, vincristine, dexamethasone/ (methotrexate, cytarabine)
DHAP= Dexamethasone , cisplatin, cytarabine
ESHAP= Etoposide, methylprednisolone, cisplatin, cytarabine

ESHAP= Etoposide, methylprednisolone, cisplatin, cytarabine
GDP= Gemcitabine, dexamethasone, cisplatin
GemOx= Gemcitabine, oxaliplatin
ICE= ifosfamide, carboplatin, etoposide
ASCT=autologous stem cell transplant
allo-ASCT=allogeneic stem cell transplant

Source: CSCO淋巴瘤诊疗指南2020版, Frost & Sullivan Analysis

Treatment Paradigm of PTCL in U.S.



Source: NCCN, Frost & Sullivan Analysis

Unmet Needs in PTCL Treatment

- PTCL has a poor clinical prognosis and a high recurrence rate. Progression or relapse of PTCLs affect about 70% of patients, typically occurring early, within the first year after initial diagnosis, and leading to poor outcomes, with a median OS of around 6 months.

Drug Resistance

- The development of relapsed or refractory disease in PTCL is quite common due to the onset of drug resistance during treatment. Although various treatment options are available, none have proven universally curative, and drug resistance tends to emerge eventually with continued treatment. While intrinsic and acquired resistance can coexist, they are often differentiated. Intrinsic resistance originates from the disease itself and frequently results in treatment refractoriness, whereas acquired resistance develops through the acquisition of resistance-related characteristics, either through mutations or non-mutational mechanisms during treatment, often leading to disease relapse. Sources of treatment resistance include tumor heterogeneity, tumor microenvironment, multiple drug resistance, signaling pathways.

Tumors Heterogeneity

- PTCL encompasses a highly diverse group of diseases, marked by the lack of specific molecular markers and distinct morphological characteristics.

Tumor microenvironment

- The development of lymphoma is not solely dependent on tumor-autonomous mechanisms; it also necessitates complex interactions within the tumor microenvironment (TME). The TME includes not only tumor cells but also immune cells, stromal cells, blood vessels, and the surrounding extracellular matrix. The interactions between stromal and tumor cells within this environment, along with the secretion of soluble factors, have been recognized as factors contributing to treatment resistance in various cancers.

Signaling pathways in PTCL

- The drug resistance mechanisms in lymphoma are intricately linked to various signaling pathways within lymphoma cells.
- For example, mutations in DDX3X can lead to cell cycle arrest and loss of transcriptional activation of NF-κB and MAPK pathways, leading to poor prognosis.

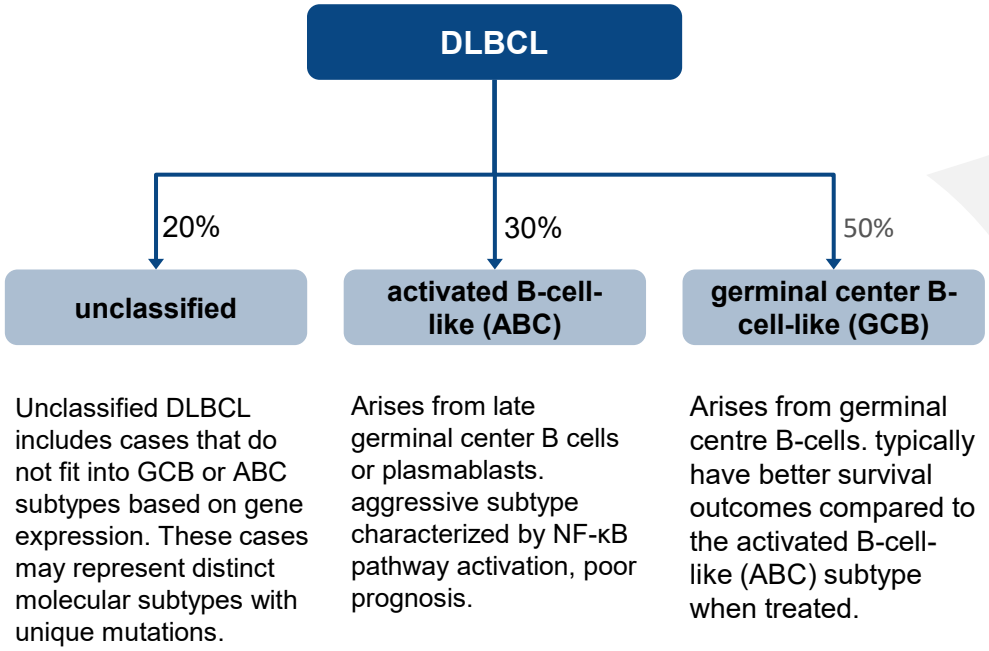
Multiple Drug Resistance

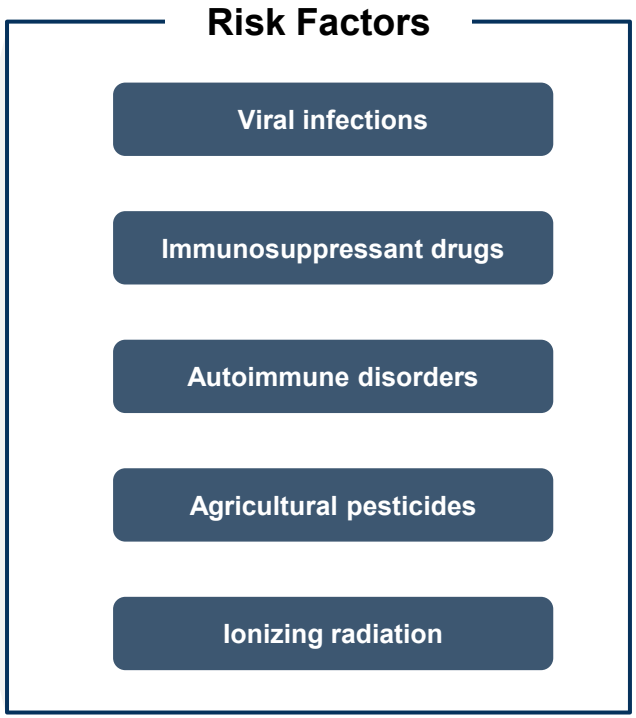
- It has become clear that mutations in those epigenetic regulators have a widespread impact on lymphoma progression and drug responsiveness. The capacity to silence multiple genes simultaneously, through the regulation of numerous genes, contributes to the development of polygenic drug resistance.

Source: Literature Review, Frost & Sullivan Analysis

Overview of Diffuse Large B-Cell Lymphoma (DLBCL)

- DLBCL is a fast-growing and aggressive type of non-Hodgkin lymphoma that originates from B cells; it is typically treated with a combination of cancer drugs, but not all cases respond to treatment, and ongoing research is exploring alternative therapies for resistant or recurring forms.
- Symptoms of DLBCL cases include Unexplained fever, Heavy night sweats, Unexplained weight loss.





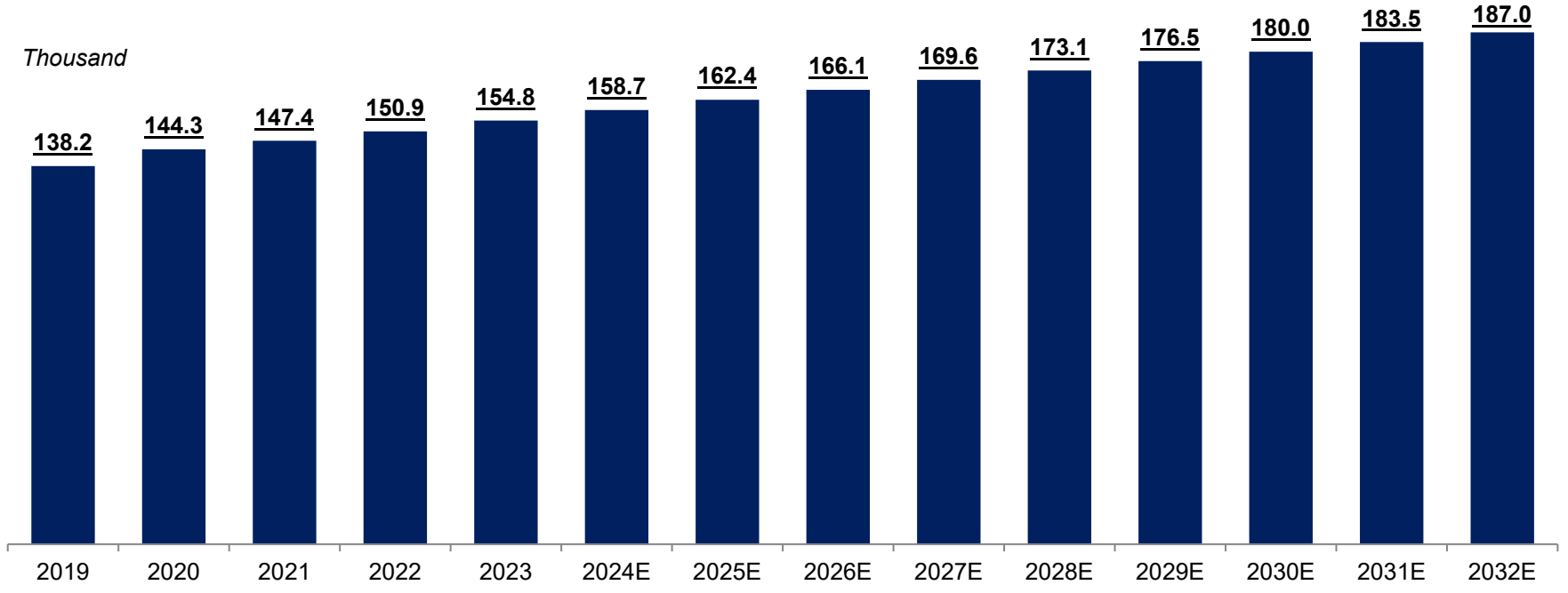
Source: Literature Review, Frost & Sullivan Analysis

Incidence of DLBCL Globally, 2019-2032E

- From 2019 to 2023, the number of new cases of DLBCL globally rose from 138.2 thousand to 154.8 thousand, with a CAGR of 2.9%. It is expected to continue increasing to 187.0 thousand by 2032, reflecting a CAGR of 2.1% from 2023.

Incidence of DLBCL Globally, 2019-2032E

Period	CAGR
2019-2023	2.9%
2023-2032E	2.1%



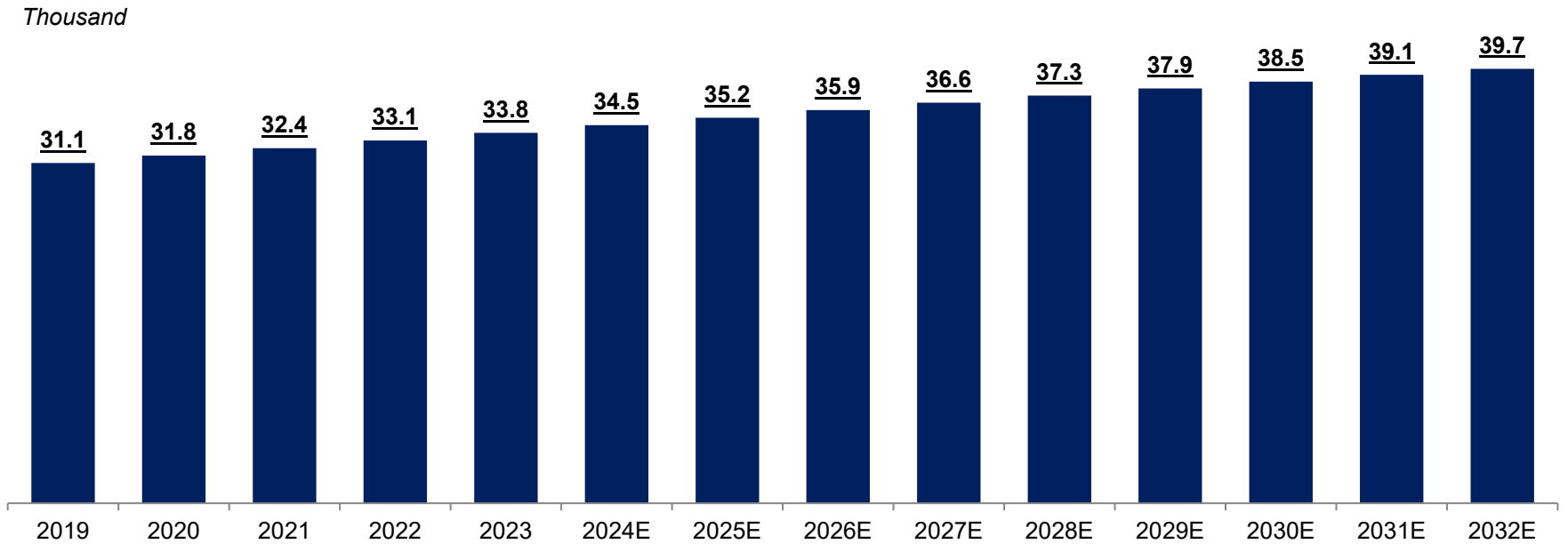
Source: Frost & Sullivan Analysis

Incidence of DLBCL in China, 2019-2032E

- The number of new cases of DLBCL in China rose from 31.1 thousand in 2019 to 33.8 thousand in 2023, with a CAGR of 2.2%. It is expected to continue increasing to 39.7 thousand by 2032, reflecting a CAGR of 1.8% from 2023.

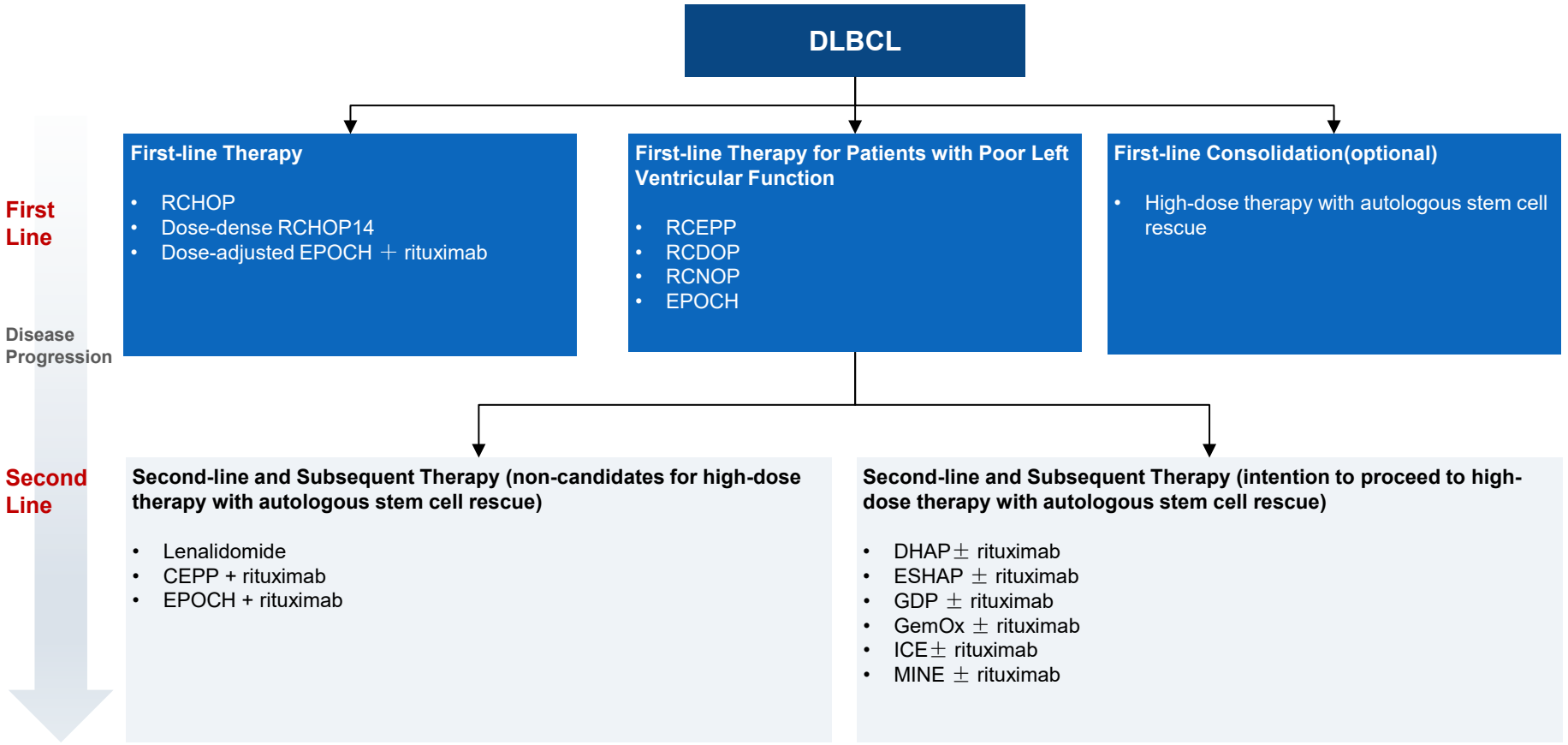
Incidence of DLBCL in China, 2019-2032E

Period	CAGR
2019-2023	2.2%
2023-2032E	1.8%



Source: Frost & Sullivan Analysis

Treatment Paradigm of DLBCL in China

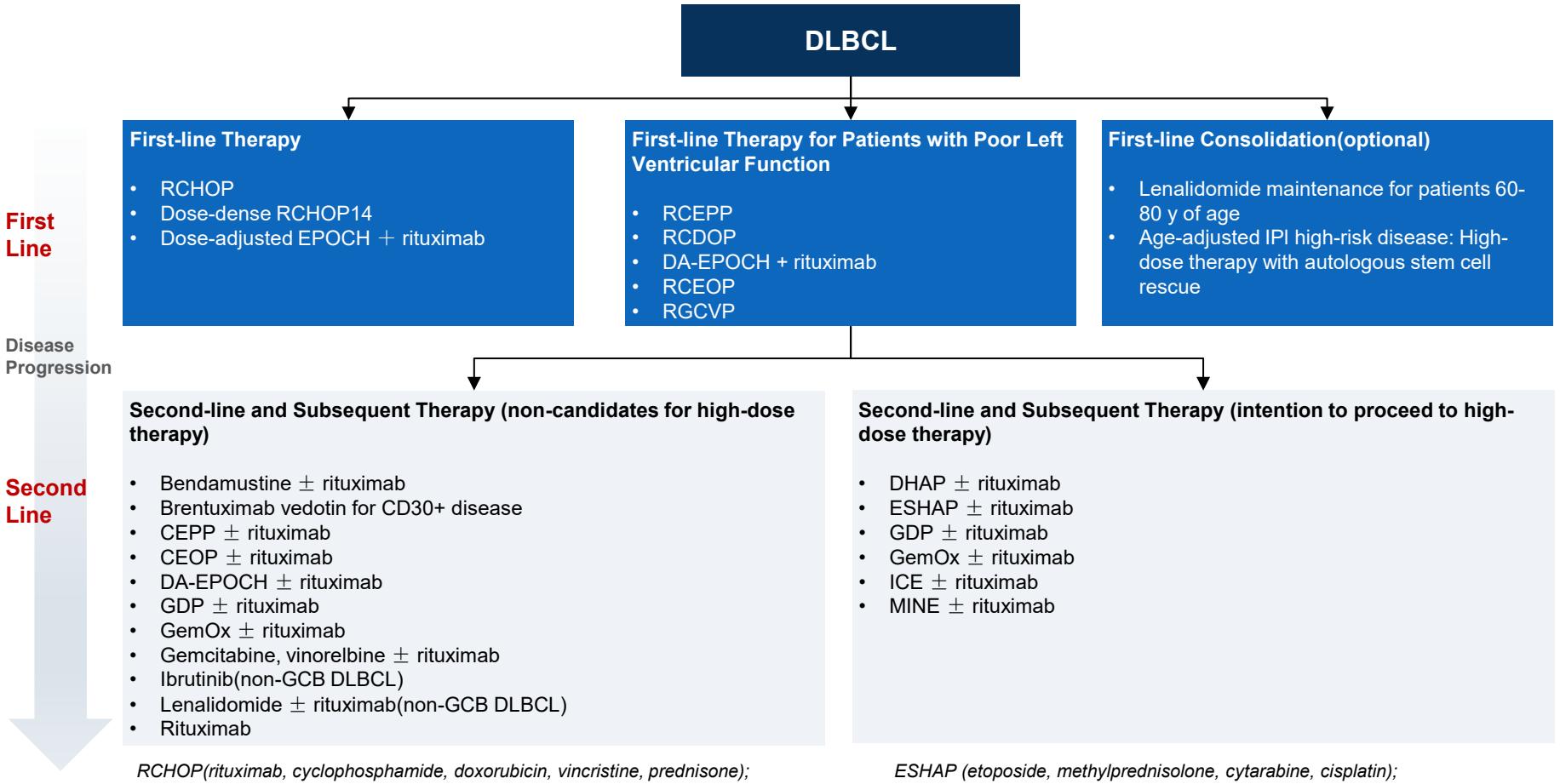


RCHOP(rituximab, cyclophosphamide, doxorubicin, vincristine, prednisone);
EPOCH (etoposide, prednisone, vincristine, cyclophosphamide, doxorubicin);
RCEPP (rituximab, cyclophosphamide, etoposide, prednisone, procarbazine);
RCDOP(rituximab, cyclophosphamide, liposomal doxorubicin, vincristine, prednisone);
RCNOP(rituximab, cyclophosphamide, mitoxantrone, vincristine, prednisone);
CEPP (cyclophosphamide, etoposide, prednisone, procarbazine);

DHAP(dexamethasone, cisplatin, cytarabine);
ESHAP (etoposide, methylprednisolone, cytarabine, cisplatin);
GDP(gemcitabine, dexamethasone, cisplatin);
GemOx (gemcitabine, oxaliplatin);
ICE(ifosfamide, carboplatin, etoposide);
MINE (mesna, ifosfamide, mitoxantrone, etoposide).

Source: 《中国弥漫大B细胞淋巴瘤诊断与治疗指南》, Frost & Sullivan Analysis

Treatment Paradigm of DLBCL in U.S.



RCHOP(rituximab, cyclophosphamide, doxorubicin, vincristine, prednisone);
EPOCH (etoposide, prednisone, vincristine, cyclophosphamide, doxorubicin);
RCEPP (rituximab, cyclophosphamide, etoposide, prednisone, procarbazine);
RCDOP(rituximab, cyclophosphamide, liposomal doxorubicin, vincristine, prednisone);
DA-EPOCH(etoposide, prednisone, vincristine, cyclophosphamide, doxorubicin);
RCEOP (rituximab, cyclophosphamide, etoposide, vincristine, prednisone);
RGCVP(rituximab, gemcitabine, cyclophosphamide, vincristine, prednisolone),
DHAP(dexamethasone, cisplatin, cytarabine);

ESHAP (etoposide, methylprednisolone, cytarabine, cisplatin);
GDP(gemcitabine, dexamethasone, cisplatin);
GemOx (gemcitabine, oxaliplatin);
ICE(ifosfamide, carboplatin, etoposide);
MINE (mesna, ifosfamide, mitoxantrone, etoposide);
CEOP (cyclophosphamide, etoposide, vincristine, prednisone);
CEPP (cyclophosphamide, etoposide, prednisone, procarbazine),

Source: NCCN, Frost & Sullivan Analysis

Unmet Needs in DLBCL Treatment

High Relapse Rate

- DLBCL is the most prevalent type of aggressive lymphoma, characterized by rapid progression and high aggressiveness, and is overwhelmingly sensitive to chemotherapy at initial treatment.
- Depending on individual risk factors, chemoimmunotherapy using rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisone (R-CHOP) can cure around 60–65% of patients. However, one-third of patients primary refractory or will relapse (R/R DLBCL) after an initial response. These patients typically have a poor prognosis, with the majority eventually succumbing to the disease.

Highly Heterogeneous

- DLCBL is a highly heterogeneous disease with diverse clinical presentations and treatment responses. Although several new molecular subtype classification systems have been explored in recent years, approximately half of the patients cannot be classified into a specific subtype, and these molecular subtypes are still lacking to guide treatment.

Optimal Combination of New Treatments and Drugs

- No uniform driver gene pathology alteration has been identified in DLBCL, thus traditional small molecule targeted inhibitors or epigenetic modification drugs, whose monotherapy is difficult to cure DLBCL. and immunotherapy, which disregards molecular targets and signaling pathway abnormalities, has emerged as an important addition to the treatment of R/R DLBCL. How to optimally combine these new therapeutic approaches and drugs will be a challenge that continues to be explored and solved.

Source: Literature Review, Frost & Sullivan Analysis

Table of Contents

Overview of TGF-β

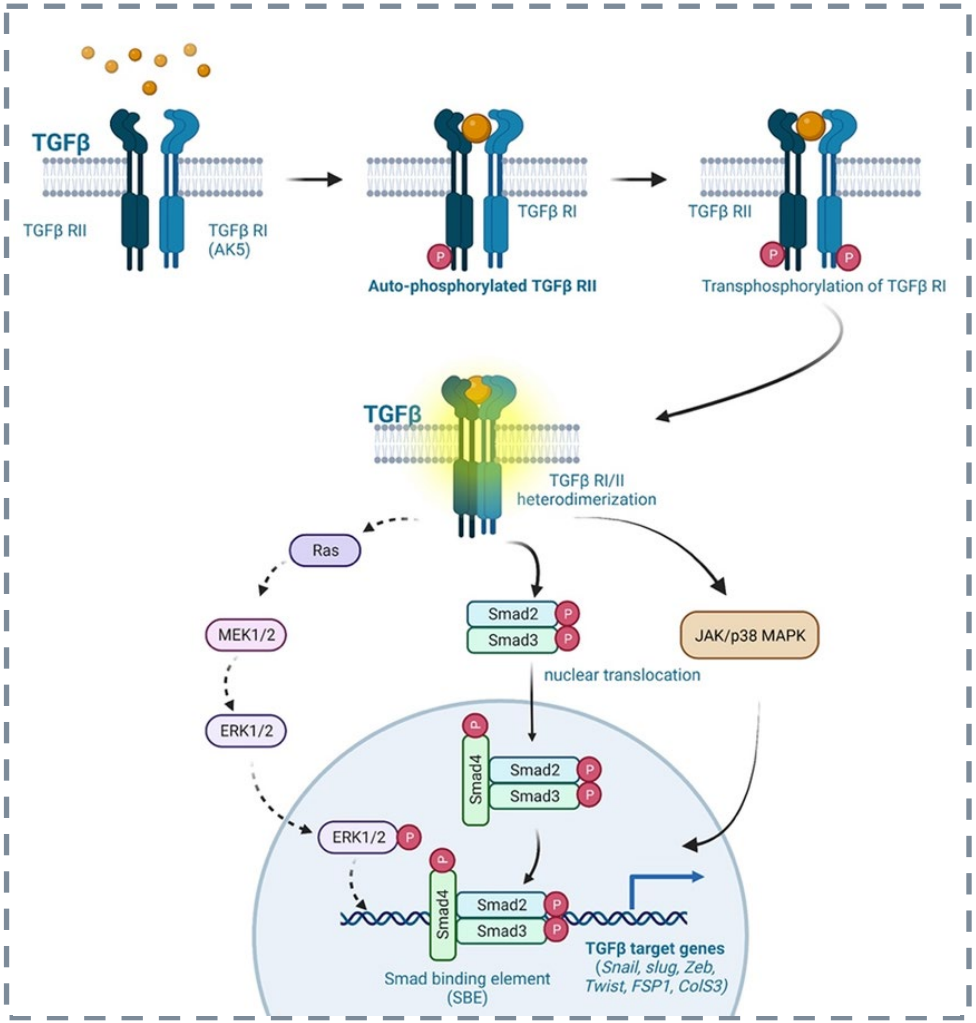
TGF-β

- Transforming growth factor (TGF)-β is a versatile cytokine produced by nearly all tissues and cell types. TGF-β signaling can trigger various cellular responses and plays an essential role in processes such as embryonic development, wound repair, tissue maintenance, and immune system balance in healthy individuals.

- At the plasma membrane, TGF-βs interact with receptor kinases that initiate phosphorylation-based signaling to downstream effectors, primarily SMAD proteins, and mediate oligomerization-dependent signaling to ubiquitin ligases and intracellular protein kinases.

TGF-β Inhibitor

- Small-molecule receptor kinase inhibitors: Activation of Smad2 and Smad3 by TGF carriers is blocked by preventing ATP from binding to TGF receptors.
- Antibodies: TGF-β Antibody binds TGF-β and inhibits its binding to the TGF-β receptor, and also inhibits activation of latent TGF-β.
- Ligand traps: Used to block TGF-β1 and TGF-β3, but not TGF-β2.
- Latent TGF-β : Latent TGF-β binds to GARP to form a complex that releases active TGF-β through a series of processes. This antibody selectively binds to the above complexes to inhibit the release of active TGF-β.



Source: Literature Review, Frost & Sullivan Analysis

Competitive Landscape of TGF-β R1 Inhibitor

Drug names	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
AGMB-129	Fibrostenotic crohn's disease	Phase 2	Agomab Therapeutics	Mono	Not Applicable	oral	200mg twice-daily or 100mg QD	-	US, Italy,Canada,etc.	2023-05-06
AGMB-447	Idiopathic pulmonary fibrosis	Phase 1		Mono	Not Applicable	inhaled	a single dose of AGMB-447, multiple doses of AGMB-447 over 7 days or multiple doses of AGMB-447 over 14 days	-	United Kingdom	2023-12-26
GFH018	Unresectable, locally advanced stage III NSCLC	Phase 2	Genfleet Therapeutics	Combo with toripalimab and concurrent chemoradiotherapy	1L	oral	80mg QD 7day-on/7day-off + Toripalimab 240mg Q3W + chemotherapy	-	China	2022-05-23
	Advanced solid tumor	Phase 1/2		Combo with toripalimab	2L+		GFH018 40/80mg BID for 14day-on/14day-off + Toripalimab 3mg/kg Q2W	All r/m NPC pts: ORR 26.1%, mPFS 2.0 months, DCR 43.5% r/m NPC pts without prior treatment of ICIs: ORR 40%, mPFS 9.0 months, DCR 60%	China, Australia	2021-06-04
	Advanced solid tumor	Phase 1		Mono	NA		5/10/20/30/40/50/65/85 mg BID, 14day-on/14day-off, 28-day cycle or 85mg BID, 7day-on/7day-off	DCR 25.0%, TRAE 86.0%, TRAE (grade≥3) 6%	China	2021-09-21

Note: Ongoing Clinical trials with first posted date up to 2025/06/20, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of TGF-β R1 Inhibitor

Drug names	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
LY2157299	Metastatic castration-resistant PC	Phase 2	Eli Lilly	Combo with enzalutamide	NA	oral	LY2157299 150mg BID on 1-14 days of each cycle + Enzalutamide 160mg QD on 1-28 days of each cycle	-	US	2015-05-22
	advanced liver cancer			mono or combo with Sorafenib	NA		150mg BID for 14 days	CR 32%	China	2015-07-10
	Metastatic castration-resistant PC			Combo with enzalutamide	1L		150mg BID for 14 days	ORR 5%, SAE 30%	US	2015-05-22
LY3200882	Solid Tumor	Phase 1		Mono and combo with LY3300054, Gemcitabine + nab-Paclitaxel or Cisplatin + Radiation	NA	oral	50 mg BID 2-weeks-on/2-weeks-off and 35 mg BID 3-weeks-on/1-week-off	DCR 75%, TEAE 93.5%, TEAE (LY3200882-related) 39.6%	US, Italy,Canada,etc.	2016-10-18
Vactosertib	Adolescents and adults with recurrent, refractory or progressive osteosarcoma	Phase 1/2	MedPacto	Mono	2L+	oral	150/200/250mg BID, 5day-on/2day-off, 4-week cycle	-	US, Korea	2022-10-20
SH3051	Advanced malignant solid tumor	Phase 1	Sanhome Pharmaceutical	Mono	1L+	oral	20/40/60/80/100 mg BID, 28-day cycle	-	China	2020-03-27

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of TGF-β R1 Inhibitor

Drug names	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
YL-13027	Metastatic PC	Phase 1b/2	YingLi Pharmaceutical	combo with chemotherapy, with or without HY-0102	NA	oral	YL-13027 180mg BID + Nab-paclitaxel 125mg/m2, D1、D8、D15 Q4W + Gemcitabine 1000mg/m2, D1、D8、D15 Q4W ± HY-0102 10mg D1、D15 Q4W	-	China	2024-10-29
	Advanced solid tumors	Phase 1/2		Combo with sintilimab	1L+		YL-13027 240/360mg BID + sintilimab 200mg Q3W, 21-day cycle	-	China	2022-07-14
	Solid tumors	Phase 1		Mono	1L+		start with initial dose 60mg BID, 28-day cycle	TEAE (grade≥3): gamma-glutamyltransferase increased (7.7%), haemoglobin decreased (0%), blood alkaline phosphatase increased (7.7%), aspartate aminotransferase increased (0%) and blood phosphorus decreased (0%)	China	2019-06-14

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Overview of Nasopharyngeal Cancer(NPC)

- NPC is a type of head and neck cancer mostly common in epithelia cells lining the inner surface of the nasopharynx. Nasopharynx is located at the upper part of the pharynx that lies behind the nasal cavity. Due to this central location and its innocuous, subtle symptoms, early diagnosis of nasopharyngeal carcinoma is difficult.
- Early stage of NPC is asymptomatic. The presenting symptom which prompts most people to seek doctors is a lump and mass in the neck, following by nasal blockage, nasal bleeding, and aural impairment. Other symptoms may include trouble breathing, talking, or facial pain and numbness.

NPC

Non-Keratinizing Squamous cell Carcinoma	Keratinizing Squamous Carcinoma	Basaloid Squamous Cell Carcinoma (BSCC)
An aggressive cancer that tends to spread quickly to surrounding tissues and lymph nodes and accounted for most of nasopharyngeal carcinoma. It is strongly associated with Epstein-Barr virus (EBV).	The mucosa cancer cells in nasopharynx are covered by keratin. It is less common than non-keratinizing squamous cell carcinoma and usually develop among individuals over 40 with a history of drinking alcohol.	BSCC is one of the rarest and most aggressive variants of squamous cell carcinoma which often associated with heavy smoking and alcohol drinking habit. Few of squamous cell carcinoma are classified as BSCC.

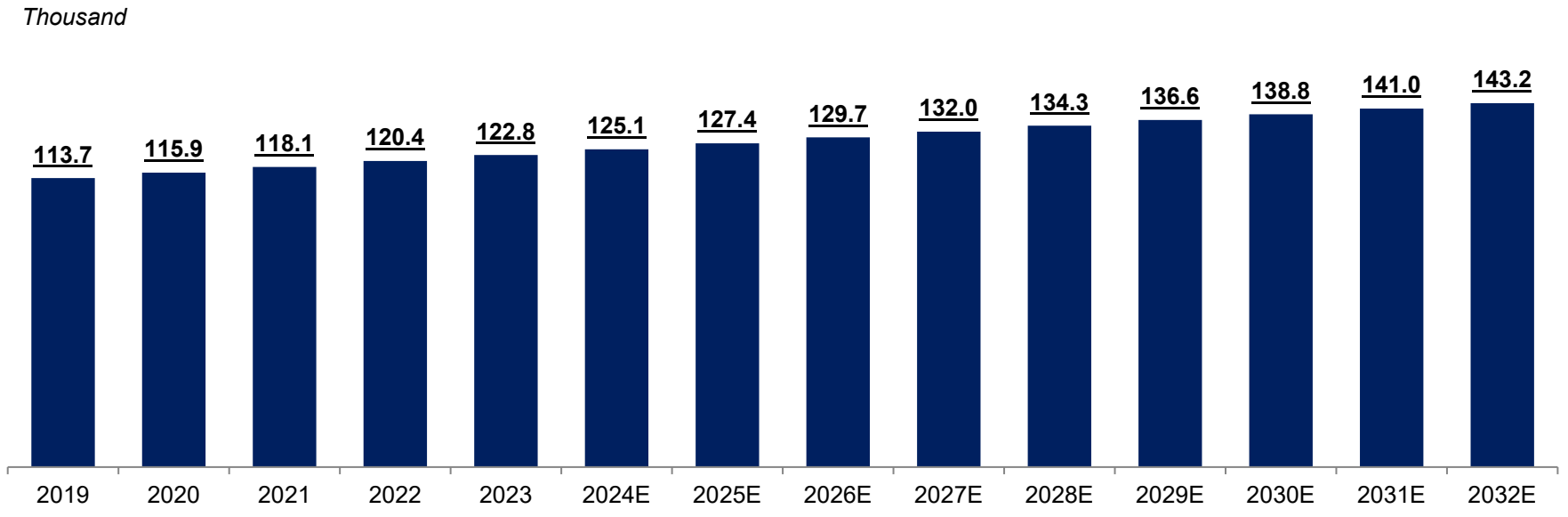
Source: NIH, Frost & Sullivan Analysis

Incidence of NPC Globally, 2019-2032E

- The number of new cases of NPC globally rose to 122.8 thousand in 2023, with a CAGR of 1.9% from 2019 to 2032. It is expected to grow to 143.2 thousand in 2032.

Incidence of NPC Globally, 2019-2032E

Period	CAGR
2019-2023	1.9%
2023-2032E	1.7%



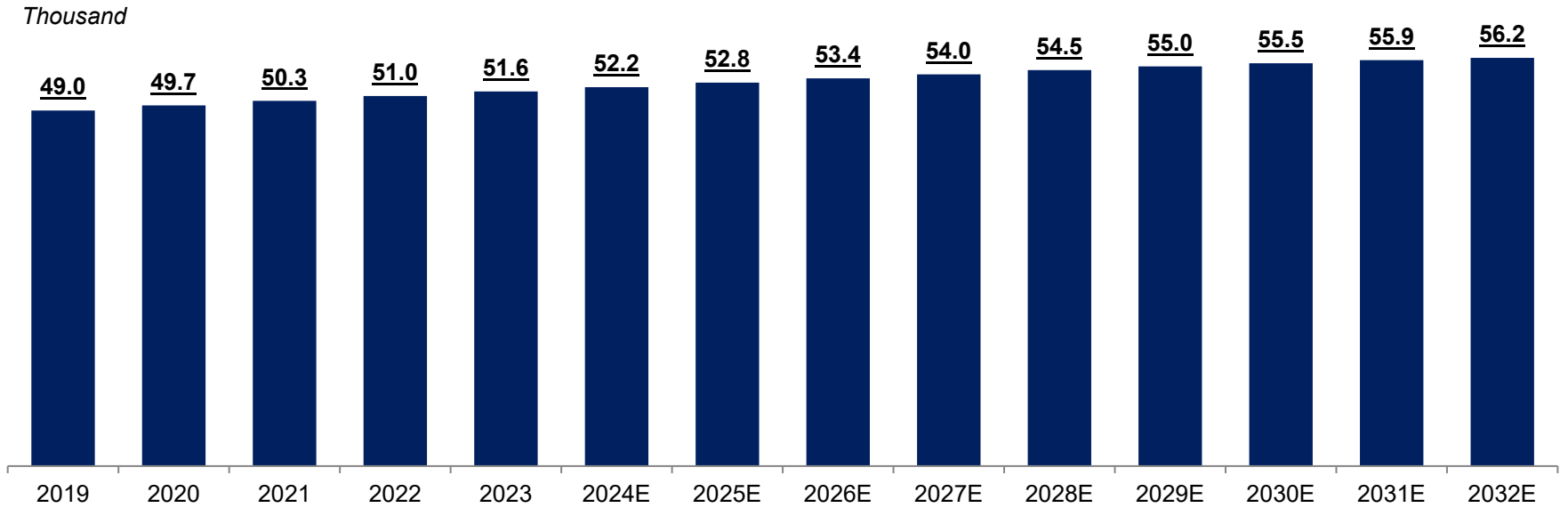
Source: Frost & Sullivan Analysis

Incidence of NPC in China, 2019-2032E

- The number of new cases of NPC in China rose from 49.0 thousand in 2019 to 51.6 thousand in 2023, with a CAGR of 1.3% from 2019 to 2023. It is expected to grow to 56.2 thousand in 2032.

Incidence of NPC in China, 2019-2032E

Period	CAGR
2019-2023	1.3%
2023-2032E	1.0%



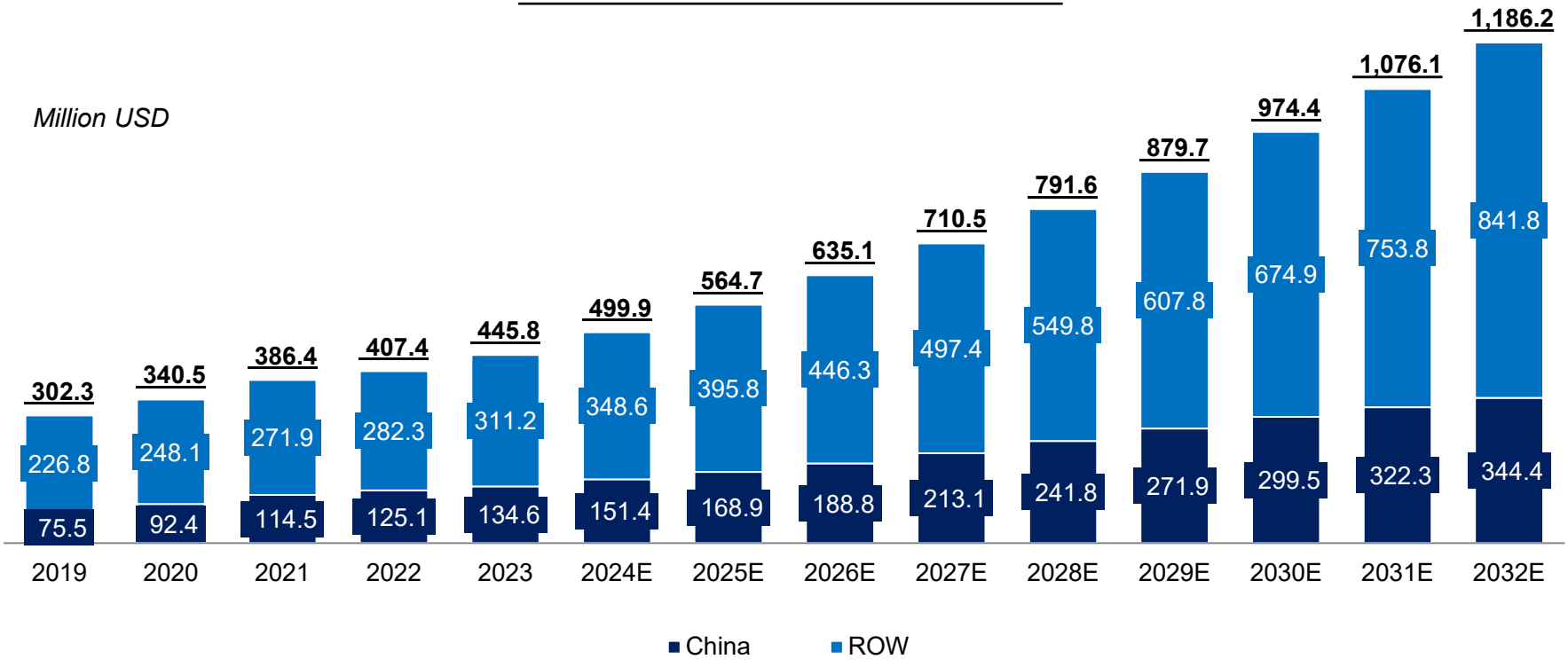
Source: Frost & Sullivan Analysis

Global NPC Drug Market, 2019-2032E

- The market of NPC Globally rose from 302.3 million USD in 2019 to 445.8 million USD in 2023, with a CAGR of 10.2%. It is expected to continue increasing to 1,186.2 million USD by 2032, reflecting a CAGR of 11.5% from 2023.

Global NPC Drug Market, 2019-2032E

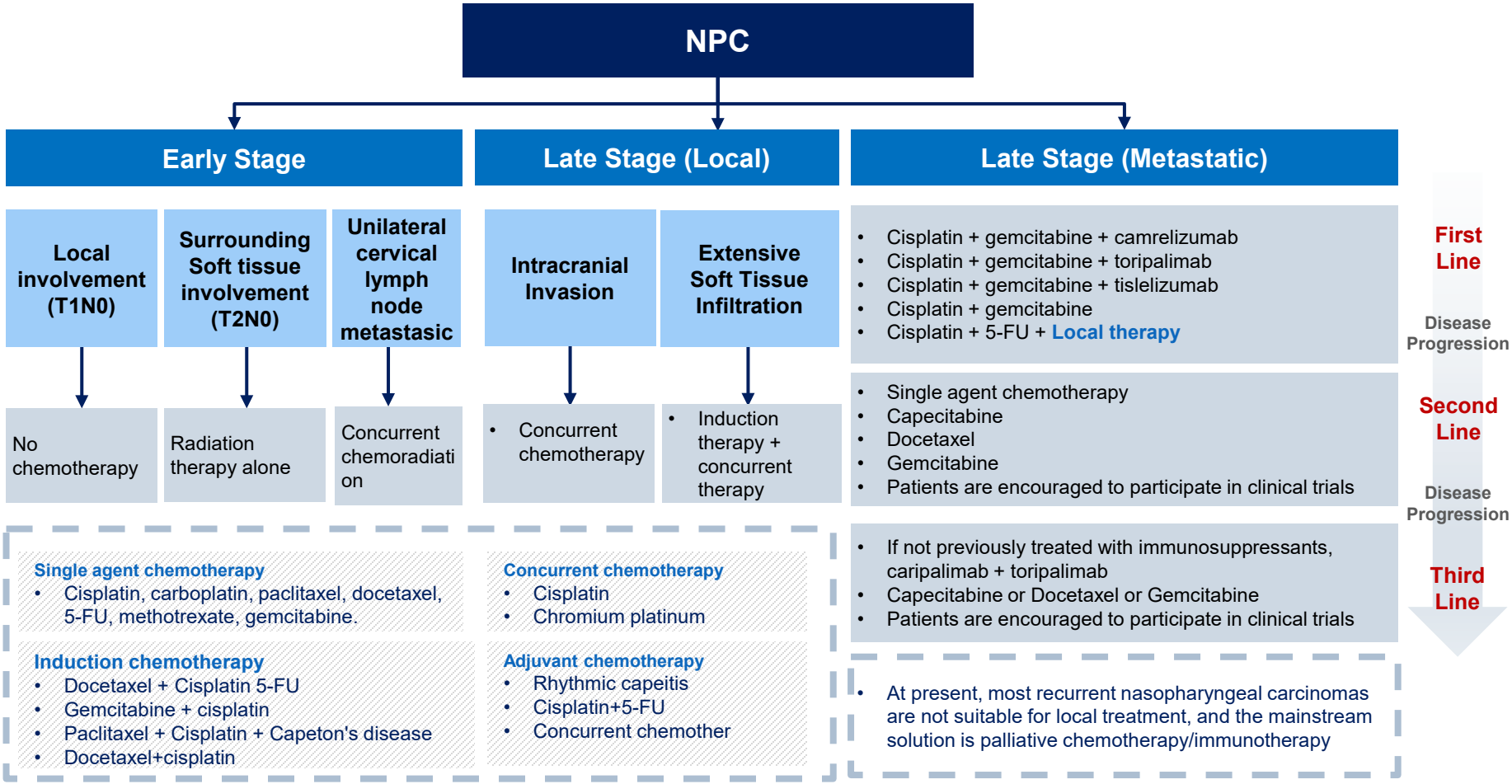
CAGR	China	Global
2019-2023	15.5%	10.2%
2023-2032E	11.0%	11.5%



Source: NMPA, FDA, Annual Report, Frost & Sullivan Analysis

Treatment Paradigm of NPC in China

- The diagnosis and treatment of NPC should attach great importance to the role of the multidisciplinary team, especially for patients with locally advanced and advanced nasopharyngeal cancer.



Source: CSCO 2023, Frost & Sullivan Analysis

Treatment Paradigm of NPC in U.S.

- The NCCN guidelines provide corresponding guidance for systemic therapy of nasopharyngeal cancer and emphasize that the recommended treatment regimen is based on clinical trial data of EBV-related nasopharyngeal cancer.

Disease Stage	Treatment				
M0	Early Stage (T1-2) →	Definitive Radiotherapy(RT) to nasopharynx Elective Radiotherapy(RT) to neck	± Concurrent systemic therapy	• For patients with early-stage tumors RT alone was recommended because this approach provides excellent locoregional control and avoids the potential toxicity of additional chemotherapy.	
	Advanced Stage (T3-4) →	**Concurrent systemic therapy/ RT:** Platinum-based regimens	**Systemic Therapy/RT Followed by Adjuvant Chemotherapy:** Cisplatin + RT followed by cisplatin/5-FU	**Induction/Systemic Therapy:** • Gemcitabine/cisplatin • Docetaxel/cisplatin/5-FU	**Clinical trials**
M1	**Oligometastatic disease** →	• Induction chemotherapy followed by RT • Cisplatin/RT • Concurrent cisplatin + RT • Systemic therapy			
	Widely metastatic and Good PS →	• Definitive RT to primary and regional nodesn (preferred) and to oligometastases as indicated • Continued systemic therapy			
	Widely metastatic and Poor PS →	• Best Supportive care			

Recurrent, Unresectable (with no sugery or RT option)

First-Line Treatments:
- Cisplatin/gemcitabine
- Cisplatin/gemcitabine with toripalimab-tpzi

Subsequent-Line Therapy:
- Toripalimab-tpzi after disease progression on platinum-containing therapy

Single Agents:
- Cisplatin, carboplatin, paclitaxel, docetaxel, 5-FU, methotrexate, gemcitabine, capecitabine

Source: NCCN 2024, Frost & Sullivan Analysis

Overview of Nasopharyngeal Cancer(NPC)

- NPC is a type of head and neck squamous cell carcinoma (NHSCC) mostly common in epithelia cells lining the inner surface of the nasopharynx. Nasopharynx is located at the upper part of the pharynx that lies behind the nasal cavity. Due to this central location and its innocuous, subtle symptoms, early diagnosis of nasopharyngeal carcinoma is difficult.
- Early stage of NPC is asymptomatic. The presenting symptom which prompts most people to seek doctors is a lump and mass in the neck, following by nasal blockage, nasal bleeding, and aural impairment. Other symptoms may include trouble breathing, talking, or facial pain and numbness.
- Studies have shown higher expression levels of B7H3 in approximately 68.5% of HNSCC patients.

NPC

Non-Keratinizing Squamous cell Carcinoma	Keratinizing Squamous Carcinoma	Basaloid Squamous Cell Carcinoma (BSCC)
An aggressive cancer that tends to spread quickly to surrounding tissues and lymph nodes and accounted for most of nasopharyngeal carcinoma. It is strongly associated with Epstein-Barr virus (EBV).	The mucosa cancer cells in nasopharynx are covered by keratin. It is less common than non-keratinizing squamous cell carcinoma and usually develop among individuals over 40 with a history of drinking alcohol.	BSCC is one of the rarest and most aggressive variants of squamous cell carcinoma which often associated with heavy smoking and alcohol drinking habit. Few of squamous cell carcinoma are classified as BSCC.

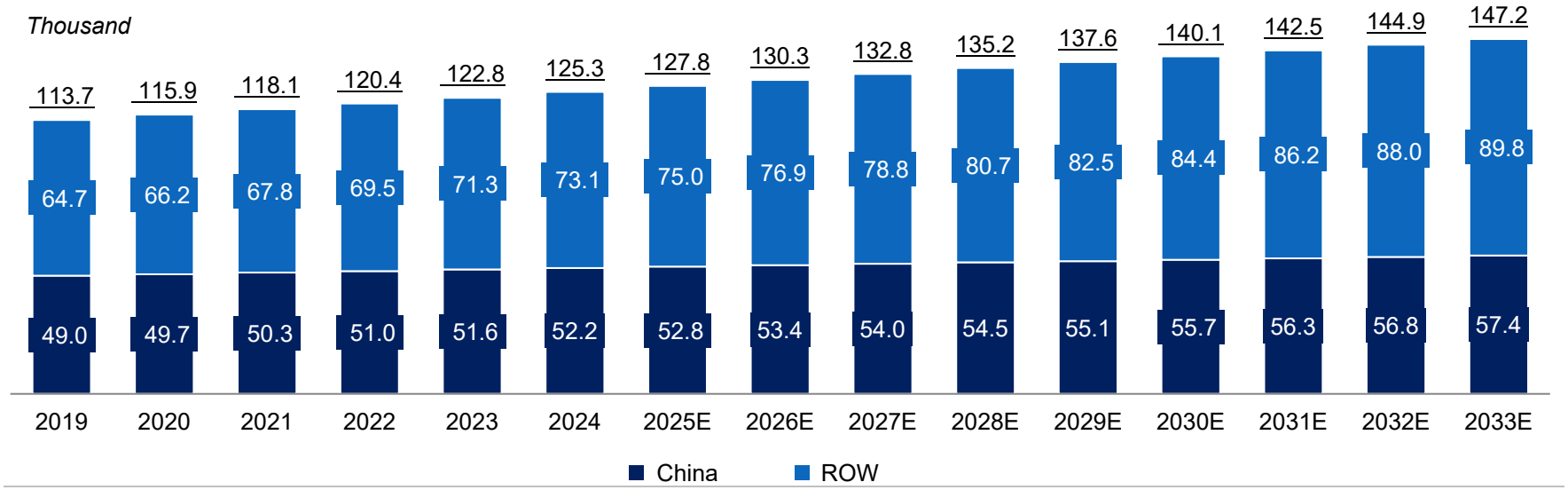
Source: NIH, Literature review, Frost & Sullivan Analysis

Global and China Incidence of NPC, 2019-2033E

- The number of new cases of NPC globally rose to 125.3 thousand in 2024, with a CAGR of 2.0% from 2019 to 2024. It is expected to grow to 147.2 thousand in 2033, with a CAGR of 1.8%.
- The number of new cases of NPC in China rose from 49.0 thousand in 2019 to 52.2 thousand in 2024, with a CAGR of 1.3% from 2019 to 2024. It is expected to grow to 57.4 thousand in 2033.

Global and China Incidence of NPC, 2019-2033E

Period	CAGR		
	China	ROW	Global
2019-2024	1.3%	2.5%	2.0%
2024-2033E	1.1%	2.3%	1.8%



Source: Frost & Sullivan Analysis

Treatment Paradigm of NPC in U.S.

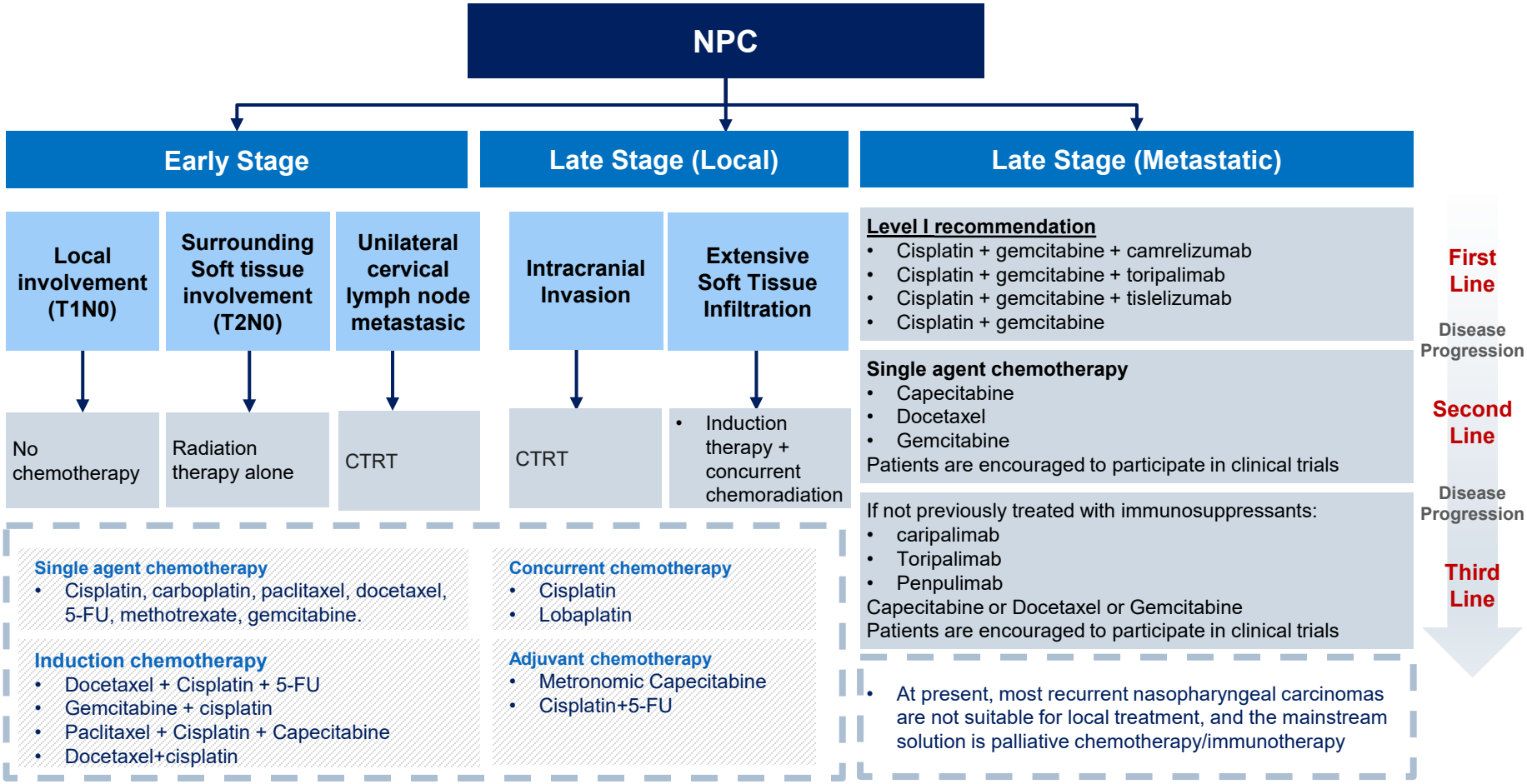
- The NCCN guidelines provide corresponding guidance for systemic therapy of nasopharyngeal cancer and emphasize that the recommended treatment regimen is based on clinical trial data of EBV-related nasopharyngeal cancer.

Disease Stage	Treatment				
M0	**Early Stage (T1-2)** →	Definitive Radiotherapy(RT) to nasopharynx	± Concurrent systemic therapy	• For patients with early-stage tumors RT alone was recommended because this approach provides excellent locoregional control and avoids the potential toxicity of additional chemotherapy.	
	Advanced Stage (T3-4) →	**Clinical trials**	**Induction chemotherapy followed by systemic therapy/RT:** • Gemcitabine/cisplatin • Docetaxel/cisplatin/5-FU	**Concurrent systemic therapy/ RT Followed by Adjuvant Chemotherapy:** Cisplatin + RT followed by cisplatin/5-FU	**Concurrent systemic therapy/ RT:** Platinum-based regimens
M1	**Oligometastatic disease** →	• Induction chemotherapy followed by RT +/- Cisplatin or maintenance capecitabine • Concurrent cisplatin + RT • Systemic therapy	**Recurrent, Unresectable (with no sugery or RT option)** **First-Line Treatments:** • Cisplatin/gemcitabine ± toripalimab-tpzi/tislelizumab-jsgr/other PD-1 inhibitor • Combination therapy or single agents including Cisplatin/5-FU/Carboplatin/docetaxel etc. **Subsequent-Line Therapy:** • Toripalimab-tpzi after disease progression on platinum-containing therapy • Immunotherapy		
	Widely metastatic and Good PS →	• Definitive RT to primary and regional nodesn (preferred) and to oligometastases as indicated • Continued systemic therapy			
	Widely metastatic and Poor PS →	• Best Supportive care			

Source: NCCN 2025v2, Frost & Sullivan Analysis

Treatment Paradigm of NPC in China

- The diagnosis and treatment of NPC should attach great importance to the role of the multidisciplinary team, especially for patients with locally advanced and advanced nasopharyngeal cancer.



CTRT: concurrent chemoradiotherapy

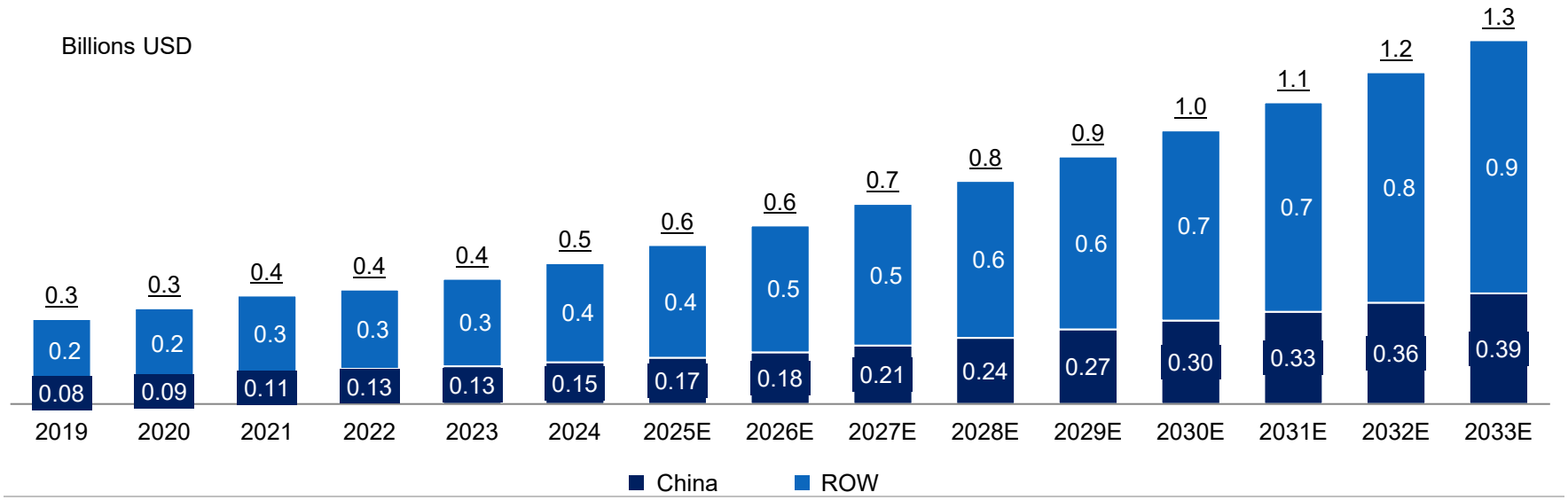
Source: CSCO 2024, Frost & Sullivan Analysis

Global and China NPC Drug Market Size, 2019-2033E

- Global NPC drug market is estimated to increase from 0.3 billion USD in 2019 to 0.5 billion in 2024, with a CAGR of 10.6%. In the future, the global NPC drug market will further increase to USD 1.3 billion in 2033, with a CAGR of 11.1% from 2024 to 2033.
- China NPC drug market is estimated to increase from 0.08 billion USD in 2019 to 0.15 billion USD in 2024, with a CAGR of 14.5%. In the future, the China NPC drug market will further increase to USD 0.39 billion in 2033, with a CAGR of 11.5 % from 2024 to 2033.

Global and China NPC Drug Market Size, 2019-2033E

Period	CAGR		
	China	ROW	Global
2019-2024	14.5%	9.2%	10.6%
2024-2033E	11.5%	11.0%	11.1%



Source: Frost & Sullivan Analysis

Unmet Needs in NPC Treatment

Lack of Effective Screening

- In addition to further study in NPC treatment, effective population screening may improve the detection rate of early-stage NPC, which is conducive to the early treatment of NPC. By now, the detection of early-stage NPC is mainly through EBA IgA antibody (EA-IgA), anti-EBV capsid antigen (VCA-IgA), anti-EBV nuclear antigen 1 (EBNA1-IgA), while the extensive application is restricted by the low sensitivity and specificity.

Multidrug Resistance

- Combined chemotherapy is one of the main methods to treat patients with NPC. Despite the majority of patients with metastatic NPC typically experiencing a good initial response to chemotherapy, frequent recurrences can occur due to the development of multidrug resistance (MDR) against chemotherapeutic agents. Multidrug resistance (MDR) is a major clinical obstacle in the successful treatment of patients with metastatic nasopharyngeal carcinoma (NPC). MDR is often associated with an increased efflux of drugs due to some proteins such as P-glycoprotein (P-gp) and multidrug resistance-associated protein 1 (MRP1), which belong to the ATP-binding cassette transporters. The involvement of P-gp and MRP1 in MDR is due to their overexpression in resistant tumor cells.

Adverse Reactions

- 51.7 % of patients with oncology treatment experienced grade 3/4 toxicities. There were severe toxicity such as temporal lobe necrosis (30.8 %) and grade 3/4 hearing loss (30.8 %).
- The main toxicity of combination nimotuzumab and chemotherapy is grade 3/4 leukopenia (62.9 %).

Radioresistance

- The radioresistance of NPC is one of the main reasons for the low efficacy of radiotherapy.
- It is widely believed that some miRNAs are upregulated or downregulated in radiation-resistant NPC cells and can reduce or enhance the sensitivity of tumor cells to radiation. Mechanisms of non-coding RNA on radioresistance of NPC includes the regulation of PTEN expression, activation of the Ras-MAPK pathway and interference in mitochondrial-mediated oxidation reaction.

Severe Late Adverse Events of Radiotherapy

- There was a significantly increased rate of adverse events after using IMRT at 5 years. About 53% of the patients had grade 3-4 late adverse events in 184 previously irradiated patients undergoing second course of IMRT.
- Combination treatment including targeted therapy and IMRT or concurrent chemoradio-therapy is presumably to be future options, which may reduce radiation or chemotherapy toxicities and open new avenues for the improvement of the expected functional outcome for patients with advanced NPC.

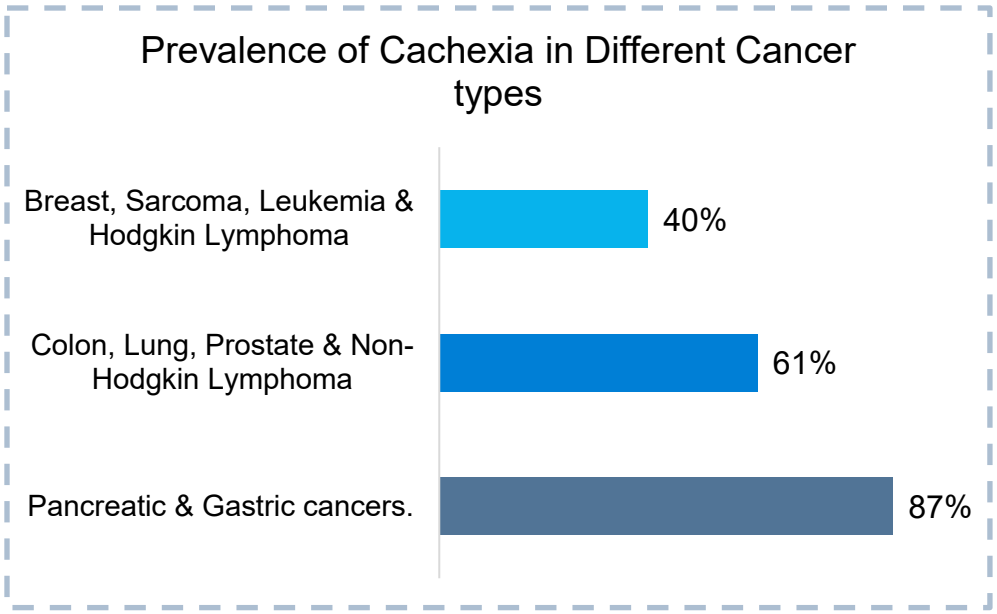
Source: Frost & Sullivan Analysis

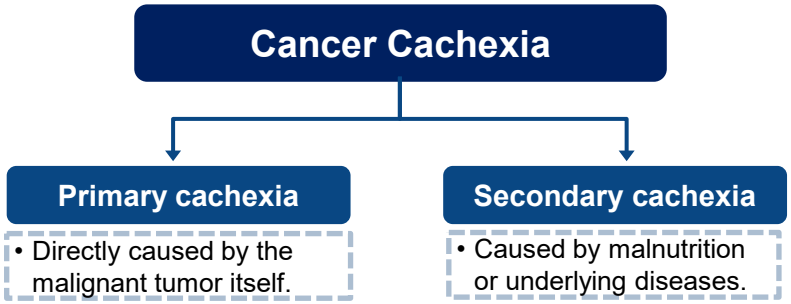
Table of Contents

Overview of Cancer Cachexia

- Cachexia is a complex disease characterized by weight loss due to the breakdown of skeletal muscle and adipose tissue, disrupted metabolic regulation, and decreased food intake. It is driven by catabolic factors released by tumors into the bloodstream, as well as physiological processes like imbalanced inflammatory responses, proteolysis, autophagy, and lipolysis, commonly seen in cancers such as gastric, pancreatic, esophageal, lung, liver, and bowel cancer.
- Cancer cachexia not only diminishes the quality of life for cancer patients but also reduces the effectiveness of chemotherapy, increases its toxicity, and leads to higher cancer-related mortality and healthcare costs.

Overall, cachexia is responsible for 20% of all cancer-related deaths and is an indicator of poor prognosis.





- Cachexia can be detected early and effectively intervened, but once it progresses to an advanced stage, both anti-tumor and nutritional treatments are unlikely to be effective. Therefore, staging cachexia is crucial.
- According to the course of the disease, cancer cachexia is divided into three stages: **pre-cachexia, cachexia, and refractory cachexia.**

Source: Literature Review, Frost & Sullivan Analysis

Marketed Cancer Cachexia Drug

Brand Name	Generic Name	Company	Indication	First posted date
Adlumiz	Anamorelin Hydrochloride	Helsinn	Cancer cachexia in NSCLC, GC PC and CRC	2021-01 (PMDA)

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: Annual Report, NMPA, FDA, EMA, PMDA, Frost & Sullivan Analysis

Competitive Landscape of Cancer Cachexia Drug

Drug	Target	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country	First posted date
Ponsegromab	GDF15	cancer, cachexia, and elevated GDF 15	Phase 2	Pfizer	Mono	NA	subcutaneous	100/200/400 mg every 4 weeks for 12 weeks	100mg group: body weight +2.02%, TRAE 7.7% 200mg group: body weight +3.48%, TRAE 8.9% 400mg group: body weight +5.61%, FAACT-ACS (12-week) 4.11, FAACT-5IASS (12-week) 2.30	US, Europe, China, Japan	2022-09-19
		cachexia and metastatic PDAC	Phase 2b/3		Combo with standard of care chemotherapy	1L		200/400mg Q4W	-	NA	2025/5/25
Anamorelin Hydrochloride	GHSR	Cancer Induced-Weight Loss and Anorexia in Advanced PC	Phase 2	Helsinn	Combo with standard of care chemotherapy	1L	oral	100mg QD, 24-week cycle	-	US	2021-04-14
		Cachexia/anorexia in NSCLC	Phase 1		Combo with standard of care chemotherapy	1L		100mg QD, 24-week cycle	body weight change from baseline: 1.938kg (Placebo: 0.594kg)	China, US, Bularia, Europe, etc.	2018-11-15
TCMCB07	MC4R, MC3R	Cachexia of CRC	Phase 2	Endevica Bio	Combo with standard of care chemotherapy	1L	subcutaneous	12.5/25/50mg QD, 28-day cycle	-	US, Canada	2025-04-22

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of Cancer Cachexia Drug

Drug	Target	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country	First posted date
Visugromab	GDF15	cachexia	Phase 2/3	CatalYm	Mono	NA	intravenous	NA	-	NA	2025-08-08
NGM120	GFRAL	Colorectal Cancer with Cachexia	Phase 2	NGM Biopharmaceuticals	Mono	NA	subcutaneous	Q4W/Q8W	-	US	2025-06-24
STC008	GHSR	Cachexia of NSCLC, C, PC, CRC and other advanced solid tumors	Phase 1a	Sintanovo	Mono	NA	subcutaneous	10/30/100/300/500/750μg or 1/1.25/1.5mg, single dose	-	China	2024-09-29
JMT203	GFRAL	Cachexia	Phase 1	JMT-Bio	Mono	NA	subcutaneous	5-300mg, Q3W	-	China	2024-01-04
AV-380	GDF15	Metastatic Cancer Patients With Cachexia	Phase 1	AVEO Pharmaceuticals	Combo with standard of care chemotherapy	1L	infusion	7 doses in total, the 2nd dose will be 28 days after the 1st, the remaining 5 doses will be given every 2 weeks	-	US	2023-05-19
DS010	-	Cachexia	Phase 1	Dartsbio	Mono	NA	intravenous	15-400mg, single dose	-	China	2025-04-28
GFS202A	GDF15, IL6	Cachexia	Phase 1	GenFleet	Mono	NA	intravenous	240mg, Q3W, 12 weeks	-	China	2025-03-19

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Cancer Cachexia Treatment and Unmet Needs

Current Treatment

Cancer Cachexia Interventions	Descriptions
Nutritional Interventions	Nutritional interventions aim to improve quality of life and possibly extend survival. Even in refractory cachexia, appropriate nutritional intake can provide psychological comfort and improve quality of life.
Pharmacological Interventions	**No drugs are currently FDA-approved for cancer cachexia treatment**. Progestogens can increase appetite and food intake, increase body mass, and improve nutritional parameters. Glucocorticoids can improve appetite to a similar extent as megestrol acetate. Adjuvant therapy with traditional Chinese medicine has a positive effect on cancer cachexia.
Other Interventions	Exercise may improve strength, muscle function, and quality of life by regulating cytokine expression and enhancing protein synthesis. Psychosocial support can reduce patient distress.

Unmet Needs

No Fully Effective Interventions

- Current treatment options for cachexia are limited, and many of the available therapies are palliative.
- In the refractory stage of cachexia, nutritional interventions may not fully reverse weight loss and metabolic abnormalities. Additionally, the risks and burdens of nutritional interventions may outweigh their potential benefits.
- there was only one approved drug specifically for the treatment of cancer cachexia globally.

High Incidence Rate

- Cancer cachexia affects around half of all cancer patients and up to 86% during the final 1-2 weeks of life.

High Death Rate

- Cancer cachexia is responsible for causing death in 22%–30% of cancer patients.
- Refractory cancer cachexia decreases cancer survival rates by 30%.

Source: Literature Review, Frost & Sullivan Analysis

Entry Barriers of Cancer Cachexia Drug Market

Complexity of Causes	• The pathogenesis of cancer cachexia is complex and involves multiple factors, including tumors, chronic inflammation, and etc. This makes drug development difficult and requires drug design for specific etiologies. Mainly due to the complexity of cause of cancer cachexia, there is no effective means of reversing cancer cachexia, which is still in the exploratory stage.
Lack of Clinical Evidence	• The first drug approved globally is anamorelin hydrochloride in Japan, but its impact on physical functioning, quality of life, and overall survival have not been clearly indicated, and other drugs for the treatment of cancer cachexia are still in the early stages of clinical research.
Difficulty in Clinical Trials	• Clinical trials of drugs for cancer cachexia require long periods of time and significant resources, as the patient population is relatively small and severely ill. In addition, there are challenges in the design and execution of clinical trials and the need to ensure the safety and efficacy of the drugs.

Source: Frost & Sullivan Analysis

Future Trends of Cancer Cachexia Drug Market

Increasing Needs	• Global cancer incidence is rising, with a global cancer incidence of 20.8 million in 2023 and projected to grow to 25.5 million by 2032. The continued rise in incidence is likely to lead to an increase in the number of patients suffering from cancer cachexia, and the demand for effective drugs in treating cachexia is expected to rise in the future.
Advancements in Targeted Drug Development	• Currently, the main drugs used for the treatment of cancer cachexia are appetite stimulants and a number of symptom-control drugs, and many targeted drugs are under active research or have been initially applied in the clinic. Pharmaceutical companies are actively developing innovative drug candidates that can intervene at different stages, and R&D investment in the area of targeted therapies for cancer cachexia will continue to increase.
Personalized and Comprehensive Treatment	• Due to the complexity of cause of cancer cachexia, personalized treatment strategies are designed for different populations. Multi-pathway and multi-target drug combination therapy, and clinical multidisciplinary collaboration (MDT) for all-around intervention therapy, including drugs, diet, nutritional support conditioning, psychological support, physical exercise, etc., should be the best coping strategy to improve the therapeutic efficacy.
Increasing Awareness	• In the future, researchers will continue to study the causes of cancer cachexia, and the awareness about cancer cachexia among healthcare professionals and patients will increase, leading to better diagnosis and more aggressive treatment strategies.

Source: Frost & Sullivan Analysis

Table of Contents

Overview of Autoinflammatory Disease

- Autoinflammatory diseases are rare conditions marked by chronic or recurrent systemic inflammation, primarily driven by the overactivation of innate immune mediators and cells such as neutrophils and monocytes/macrophages. Autoinflammatory diseases encompass a wide range of conditions, such asFamilial Mediterranean Fever (FMF), Tumor necrosis factor receptor-associated periodic syndrome (TRAPS), Cryopyrin-associated periodic syndromes (CAPS), and etc

Comparison of Autoinflammatory and Autoimmune Disease

Autoimmune	Autoinflammatory
Adaptive Immunity	Innate Immunity
• Autoimmune diseases (AI) are characterized by immune system dysfunction, resulting in a loss of tolerance toward the body's own tissues. This is driven by autoreactive T and B cells and involves a complex, multifactorial pathogenesis where both genetic predispositions and environmental factors contribute to disease onset. Over 80 such conditions can affect vulnerable individuals.	• Autoinflammatory diseases (AIF) are a relatively new and expanding group of self-directed inflammatory disorders, clinically described as periodic fever syndromes but also with episodes of acute inexplicable inflammation involving the innate immune system. They are characterized by inflammatory episodes at disease-prone sites, in the absence of autoreactive T cells and high autoantibody titers. • Despite the differences in primary players, they share common characteristics with AI diseases, such as self-tissue directed inflammation in the absence of an obvious infectious trigger or injury. While in AIFs the innate immune system directly causes tissue inflammation, in AIs the innate immune system activates the adaptive system and this later activates the inflammatory process.

Source: Literature Review, Frost & Sullivan Analysis

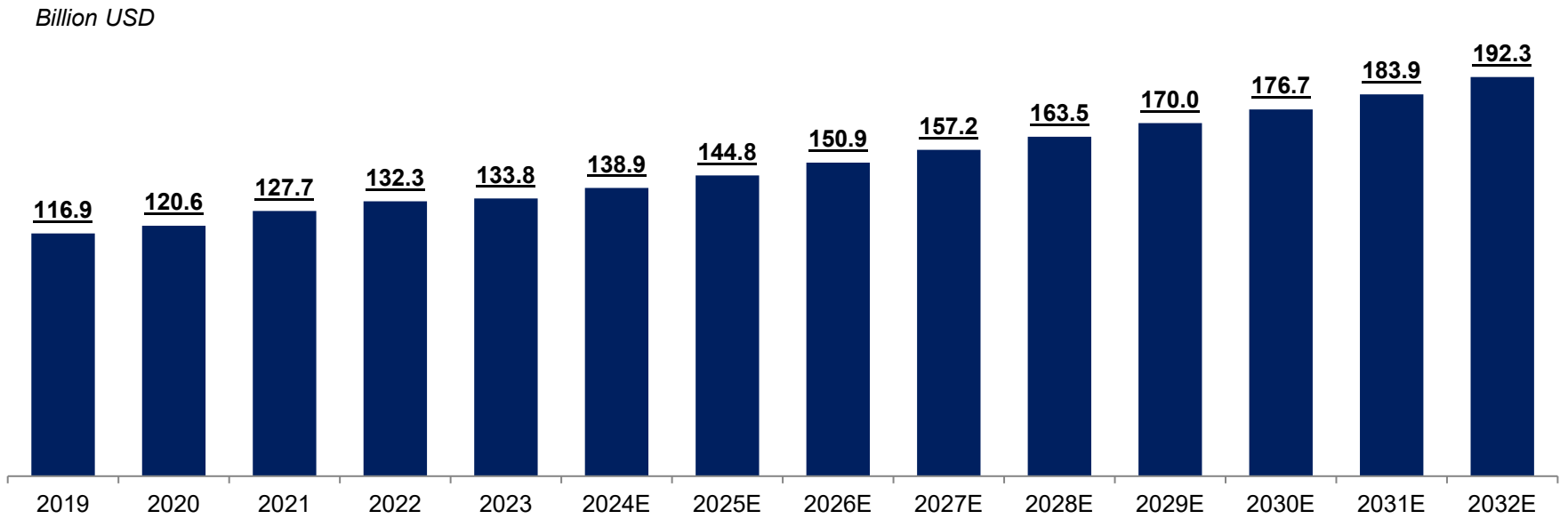
Table of Contents

Global Autoimmune Disease Drug Market, 2019-2032E

- The global autoimmune disease drug market size is expected to grow from USD 133.8 billion in 2023 to USD 192.3 billion in 2032 with a CAGR of 4.1%.

Global Autoimmune Disease Drug Market, 2019-2032E

Period	CAGR
2019-2023	3.4%
2023-2032E	4.1%



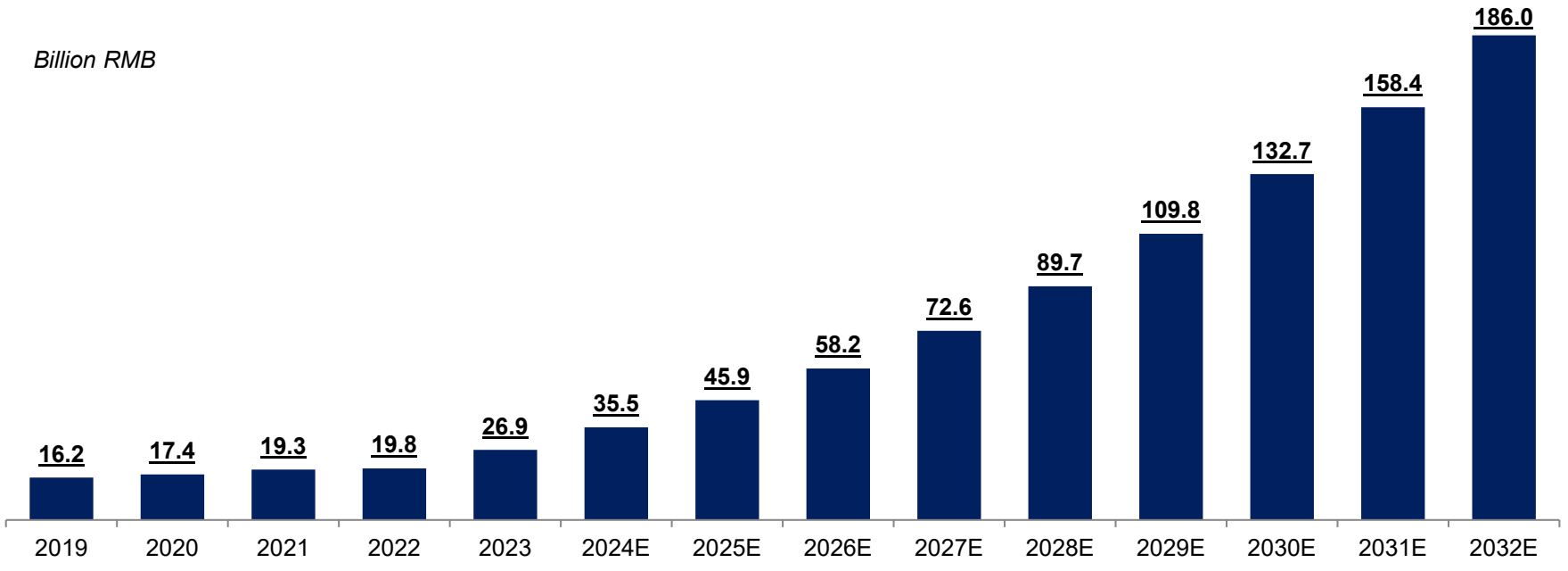
Source: Frost & Sullivan Analysis

China Autoimmune Disease Drug Market, 2019-2032E

- In 2023, China autoimmune disease drug market size reaches RMB 26.9 billion, and is expected to grow to RMB 186.0 billion in 2032 with a CAGR of 24.0%from 2023.

China Autoimmune Disease Drug Market, 2019-2032E

Period	CAGR
2019-2023	13.4%
2023-2032E	24.0%

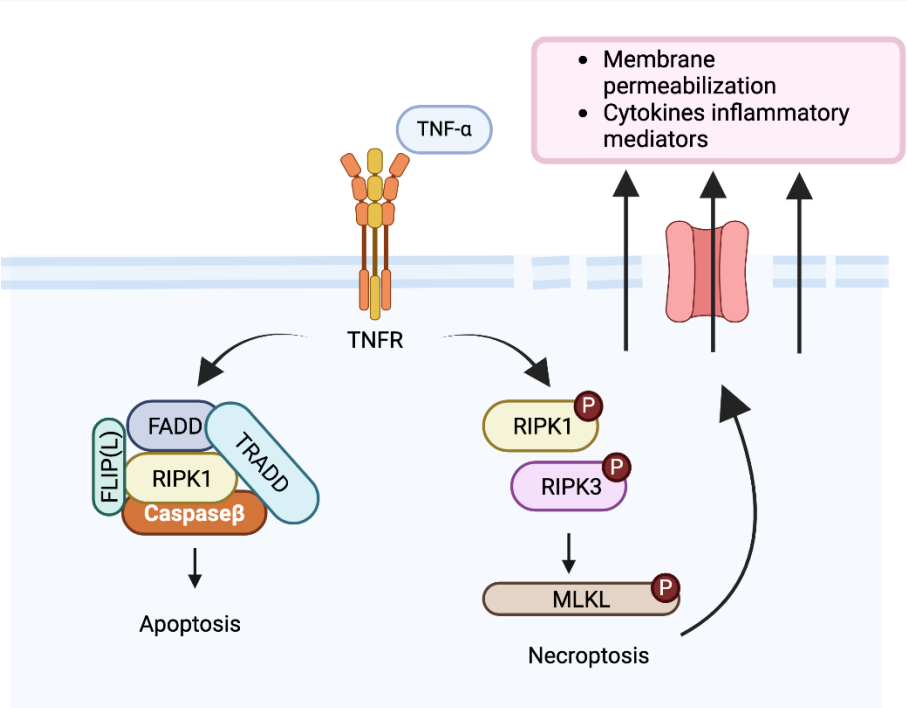


Source: Frost & Sullivan Analysis

Table of Contents

Overview of Receptor-interacting serine/threonine-protein kinase 1 (RIPK1)

- RIPK1 is a key regulator that determines whether a cell will activate pro-survival NF-κB signaling or death in response to various inflammatory and pro-death stimuli associated with human diseases. Activation of RIPK1 kinase has been observed in post-mortem pathological samples from individuals with autoimmune and neurodegenerative disorders, and inhibiting RIPK1 kinase activity has proven effective in numerous animal models of human diseases.



- Inflammatory mediators like TNFα, trigger necroptosis through TNFR1, IFNR, TLR3/4, and Fas/TRAILR pathways, with TNFα/TNFR1 being the most studied. Following TNFα-TNFR1 interaction, RIPK1 forms complexes that determine cell fate: Complex I promotes survival via NF-κB, Complex IIa induces apoptosis via caspase-8, and Complex IIb (the "necrosome") drives necroptosis through RIPK1, RIPK3, and MLKL activation. Necroptosis contributes to **cardiovascular diseases like atherosclerosis** by causing cell death, inflammation, and inflammasome activation.

- RIPK1 is a key driver of inflammation in atherosclerosis due to its role in activating the NF-κB pathway and promoting the release of inflammatory cytokines.
- Given the **elevated levels of RIPK1 expression** in human atherosclerotic lesions, RIPK1 is proposed as a **potential therapeutic target** to reduce residual inflammation in patients at high risk of coronary artery disease.

Source: Literature Review, Frost & Sullivan Analysis

Competitive Landscape of RIPK1 Inhibitor

Drug names	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
GDC-8264	Cardiac Surgery-Associated Acute Kidney Injury and Major Adverse Kidney Events prevention	Phase 2	Genentech	mono	Not applicable	oral	single- (5–225 mg) and multiple- (50 and 100 mg) once daily, up to 14 days	-	US, Australia, Europe, Canada, etc.	2024-09-19
ABBV-668	Moderate to severe UC	Phase 2	AbbVie	Mono	Not applicable	oral	BID, for 52 weeks	-	US, Belgium, France, etc	2022-10-06
Eclitasertib	Adult with moderate to severe UC	Phase 2	Sanofi & Denali Therapeutics	Mono	Not applicable	oral	administered at 3 assigned dose levels, dose level not disclosed	no study drug-related severe or serious AEs reported, At doses of 100 mg and above, > 90% inhibition of RIPK1 phosphorylation in human peripheral blood mononuclear cells was observed with eclitasertib at 12 h post-dose	US, China, Europe, etc.	2022-10-20
LY3871801	Moderately-to-severely active RA	Phase 2	Eli Lilly & Rigel Pharmaceuticals	Mono	Not applicable	oral	administered at the assigned dose level, dose level not disclosed	No TEAEs	US, United Kingdom, France, etc.	2023-05-08
AC-003	aGVHD	Phase 1b	Accro Bioscience	Combo with glucocorticoid	Not applicable	oral	BID or QD, 28-day cycle	-	China	2023-12-12

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Competitive Landscape of RIPK1 Inhibitor

Drug names	Indication	Latest status	Company	Therapeutic strategy	Treatment Line	Route of Administration	Treatment Schedules	Efficacy & Safety	Country /region	First posted date
GFH312	Inflammatory conditions (healthy volunteer)	Phase 1	GenFleet	Mono	Not applicable	oral	a single ascending dose up to 500 mg (part I) or once-daily repeated doses up to 200 mg for 14 days (part II)	TEAE: part I 42.1%, part II 63.2%	Australia, China	2020/12/21
SIR9900	Systemic Inflammatory Response Syndrome (healthy volunteer)	Phase 1	SIRONAX	Mono	Not applicable	oral	30mg QD, 10-day cycle or 200mg for one day	-	China	2025/4/16

Note: Ongoing Clinical trials with first posted date up to 2025/08/18, initiated by companies are included.

Source: CDE, Clinical Trials, Frost & Sullivan Analysis

Entry Barriers of RIPK1 Drug Market

Scientific Difficulty	• The complex structure of RIPK1 requires in-depth structural biology studies to understand its active site and mechanism of action.RIPK1 is involved in complex signaling pathways. A deep understanding of molecular biology and cellular signaling is required to develop drugs that precisely target RIPK1. This complexity makes it difficult for new companies lacking expertise or technology to enter the market. • In addition, researchers need to continuously optimize RIPK1 inhibitors in order to improve activity and selectivity. • Current RIPK1 inhibitors are limited to specific chemotypes, so the development of novel approaches to inhibit RIPK1 activation remains a serious challenge.
Safety Concern	• Although the targeting of RIPK1 itself appears to be relatively safe at least in short-term studies, the clinical development of some of compounds has been discontinued due to potential safety signal. Adverse events tend to be drug-specific, and related to off-target effects. Headache and gastrointestinal events are the most common. Elevated liver enzymes were observed with some drugs.
Blood-brain Barrier Crossing	• Studies have shown that elevated RIPK1 activity in the brain drives neuroinflammation and cell necrosis, and it is believed to be associated with various CNS and autoimmune diseases. Therefore, designing RIPK1 inhibitors that can penetrate the blood-brain barrier will be the key to breakthrough, which requires considerable biocompatibility and transmembrane capability. Developing compounds that can safely and effectively penetrate the blood-brain barrier without causing toxicity poses considerable difficulties.

Source: Frost & Sullivan Analysis

Future Trends of RIPK1 Drug Market

Advancements in Drug Development	• The important regulatory role of RIPK1 between inflammatory response, apoptosis and necrotic apoptosis signaling pathways, and the fact that the kinase structure of RIPK1 is ideally suited for the development of pharmacologically specific small-molecule inhibitors, have now made RIPK1 an important drug target among the pharmaceutical companies.
Broad Therapeutic Applications	• RIPK1 inhibitors are currently being investigated in clinical trials for a wide range of therapeutic applications in the treatment of a variety of human diseases, including autoimmune diseases, neurodegenerative disorders and others. For example, it has now been found that RIPK1 degradation mediated through PROTAC can trigger immune cell death and enhance the effectiveness of antitumor therapies. RIPK1 has also demonstrated its promising potential in the treatment of atherosclerosis-related diseases.
Combination Therapies	• To reduce potential side effects and enhance effectiveness, RIPK1 inhibitors may increasingly be developed in combination with other drugs. These combination therapies can target multiple pathways in diseases like neurodegeneration and autoimmune disorders, potentially leading to better patient outcomes and reduced drug resistance.

Source: Frost & Sullivan Analysis

Table of Contents

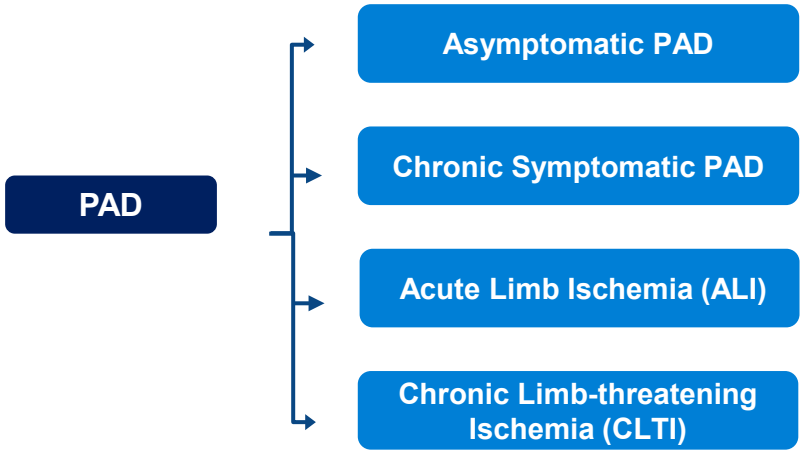
Overview of Peripheral Arterial Disease (PAD)

- PAD refers to a condition where the distal arteries of the limbs are affected, leading to impaired blood supply to the body. Arteries transport blood from the heart to various parts of the body, but as cholesterol levels in the arteries increase and scar tissue forms, the arteries can narrow, leading to PAD. When cholesterol and scar tissue accumulate and cause plaque to block the artery, it restricts blood, oxygen, and nutrients from flowing to the arms and legs.
- The primary causes of PAD include atherosclerosis, inflammation, trauma or injury, anatomical abnormalities of ligaments or muscles, or radiation exposure, with atherosclerosis being the most common cause. In addition, smoking, diabetes, hypertension, high cholesterol, obesity, aging, and a family history of the disease are major risk factors for PAD.

Symptom

- The most common symptom is intermittent claudication, characterized by fatigue, pain, or discomfort in the leg muscles during physical activity, which subsides with rest. This pain occurs because the blocked arteries restrict blood flow to the muscles involved in the activity.
- Other common symptoms of PAD include warmth or pain in the feet and toes, leg cramps, cold skin on the legs or feet, diabetic foot ulcers, hair loss, slow toenail growth, absent or weak pulses in the legs or feet, chronic pain, and gangrene.
- Complications of PAD can include critical limb ischemia, stroke, and heart attack.

Clinical Subsets of PAD



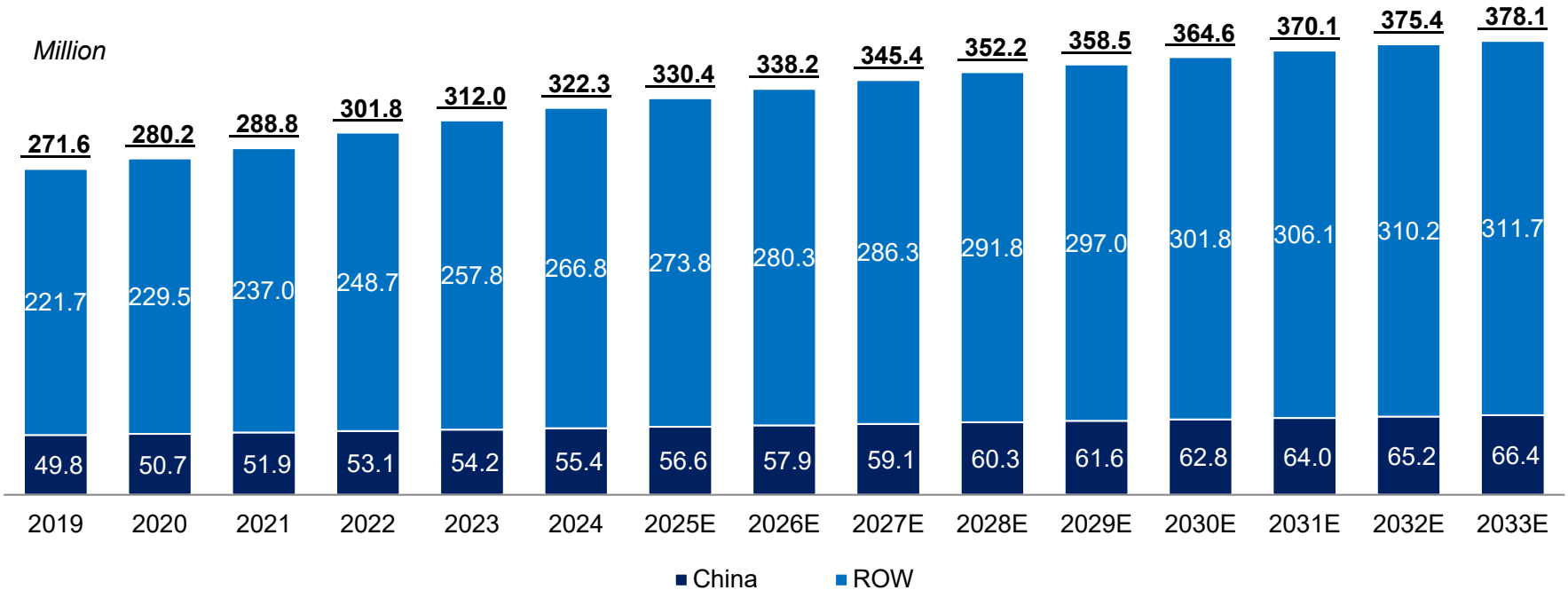
Source: Literature Review, Frost & Sullivan Analysis

Prevalence of PAD, 2019-2033E

- The prevalence of PAD Globally rose from 271.6 million in 2019 to 322.3 million in 2024, with a CAGR of 3.5%. It is expected to continue increasing to 378.1 million by 2033, reflecting a CAGR of 1.8% from 2024.

Prevalence of PAD, 2019-2033E

CAGR	China	Global
2019-2024	2.2%	3.5%
2024-2033E	2.0%	1.8%



Source: NMPA, FDA, Annual Report, Frost & Sullivan Analysis

PAD Treatment & Unmet Needs

PAD Therapy	Descriptions
Medical Therapy and Preventive Foot Care for Patients With PAD	Antiplatelet and Antithrombotic Therapy (Aspirin, P2Y12 inhibitors, Rivaroxaban, etc.), Lipid-Lowering Therapy (Statins), Antihypertensive Therapy, Smoking Cessation, Diabetes Management (GLP-1, SGLT-2) and Other Medical Therapies for Cardiovascular Risk Reduction, Medications for Leg Symptoms in Chronic Symptomatic PAD (eg., Cilostazol), Preventive Foot Care for PAD.
Exercise Therapy for PAD	Supervised Exercise Therapy (SET) can help to to improve functional status, walking performance, and QOL in patients with chronic symptomatic PAD.
Revascularization	Patients with PAD may undergo endovascular or surgical revascularization procedures on an as-needed basis to reconstruct diseased arteries to facilitate other clinically necessary procedures, including catheter-based cardiac or vascular procedures (e.g., transfemoral aortic valve replacement, endovascular abdominal aortic aneurysm repair, mechanical circulatory support).

Challenge

Lack of specific pharmacological therapies targeting the inflammatory mechanisms of PAD

Currently, vascularization, including percutaneous endovascular balloon dilatation or stenting, is the mainstay of treatment for patients with claudication that has reached more than severe severity, and there is a lack of specific pharmacological therapies targeting the inflammatory mechanisms of PAD.

Inefficient Early Detection

One major challenge is its early detection, as patients often remain asymptomatic for years.

Effective And Less Invasive Treatment Strategies

Many patients remain asymptomatic until the disease becomes critical, necessitating invasive surgical and pharmacological interventions. While surgical revascularization can be lifesaving, it poses significant risks. This underscores a critical unmet need for more effective and less invasive treatment strategies to improve patient outcomes and reduce associated risks.

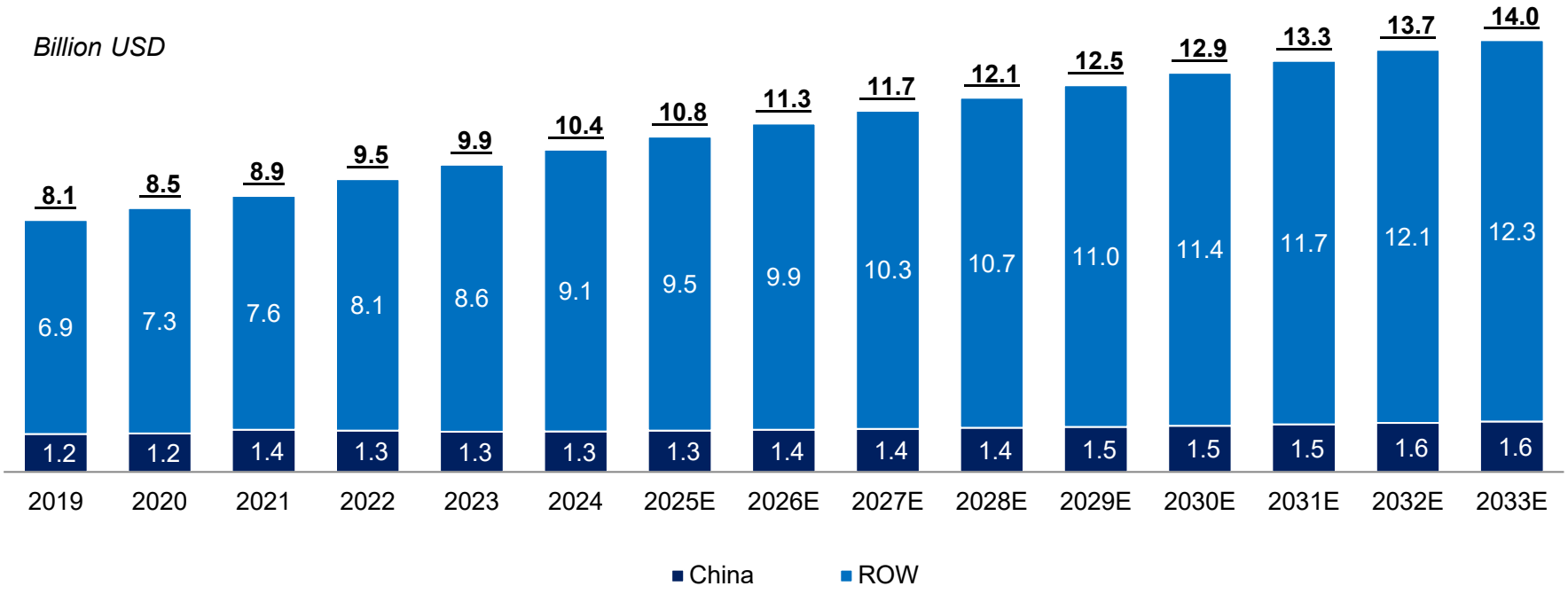
Source: ACC/AHA/AACVPR/APMA/ABC/SCAI/SVM/SVN/SVS/SIR/VESS Guideline for the Management of Lower Extremity Peripheral Artery Disease, Literature Review, Frost & Sullivan Analysis

Global PAD Drug Market, 2019-2033E

- The market of PAD Globally rose from 8.1 million USD in 2019 to 10.4 million USD in 2024, with a CAGR of 5.0%. It is expected to continue increasing to 14.0 million USD by 2033, reflecting a CAGR of 3.3% from 2024.

Global PAD Drug Market, 2019-2033E

CAGR	China	Global
2019-2024	1.3%	5.0%
2024-2033E	2.5%	3.3%



Source: NMPA, FDA, Annual Report, Frost & Sullivan Analysis

Table of Contents

Overview of Primary Biliary Cholangitis (PBC)

- PBC is a chronic, progressive autoimmune cholestatic disease primarily targeting the liver. The main pathological feature is non-suppurative inflammation of the small intrahepatic bile ducts, eventually leading to liver fibrosis and cirrhosis.
- PBC mainly affects middle-aged and older women, with clinical features including high titers of serum antimitochondrial antibodies (AMA), elevated bile enzymes, and characteristic liver pathology. The disease is primarily caused by genetic and environmental factors, though its pathogenesis remains unclear. Clinical presentation is often insidious, with some patients already exhibiting cirrhosis at the time of diagnosis. In recent years, as understanding of the disease has improved, more early-stage patients are being diagnosed, showing liver pathology at the small bile duct inflammation stage and responding relatively well to treatment.

Current Challenge In PBC Treatment

Lack of Efficient Treatment

- At present, only **two treatments** for PBC are approved by the FDA: ursodeoxycholic acid (UDCA) and obeticholic acid (OCA).
- Currently, the clinical drug treatment for PBC still **primarily** relies on ursodeoxycholic acid (UDCA).
- Up to **40%** of patients with PBC have an incomplete response to UDCA, necessitating additional treatment.
- There are few effective drugs available for second-line treatment, and currently, the **only** FDA-approved second-line medication is 6-ethyl chenodeoxycholic acid, known as obeticholic acid.

POOR PROGNOSIS

Source: Literature Review, Frost & Sullivan Analysis

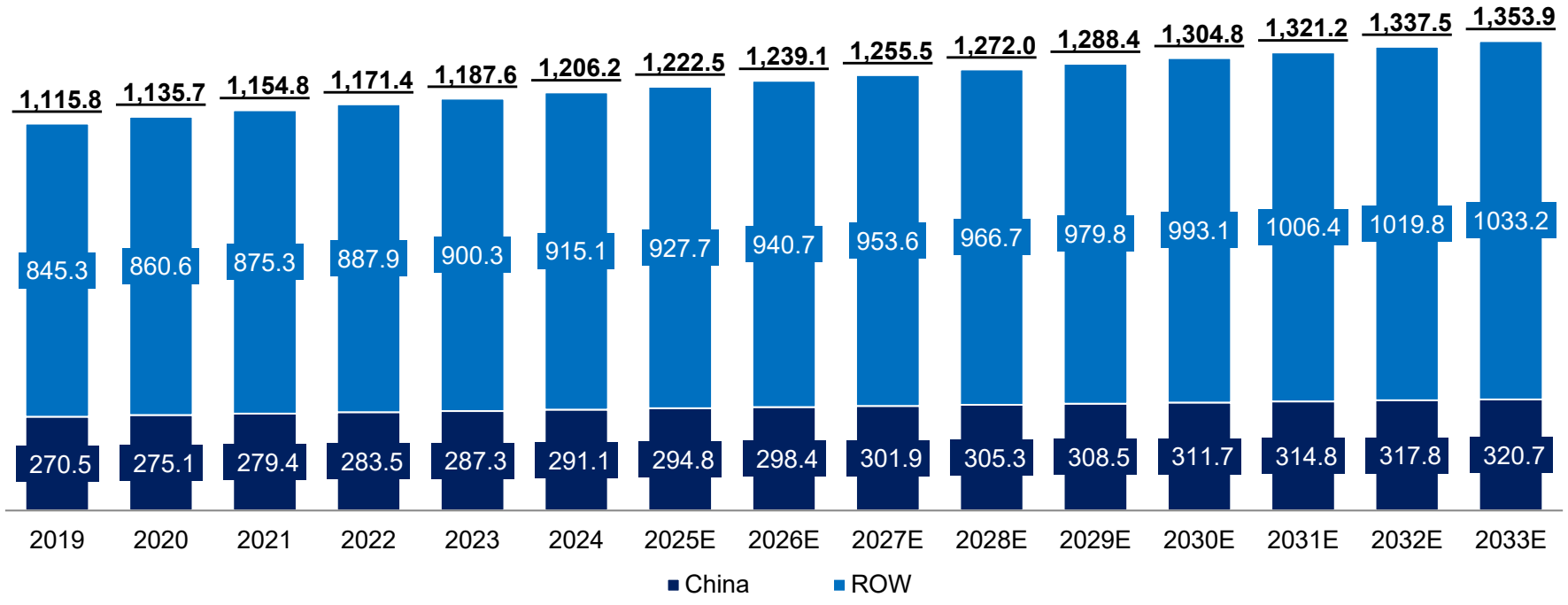
Prevalence of PBC, 2019-2033E

- The prevalence of PBC globally rose from 1,115.8 thousand in 2019 to 1,206.2 thousand in 2024, with a CAGR of 1.6%. It is expected to continue increasing to 1,353.9 thousand by 2033, reflecting a CAGR of 1.3% from 2024.

Prevalence of PBC, 2019-2033E

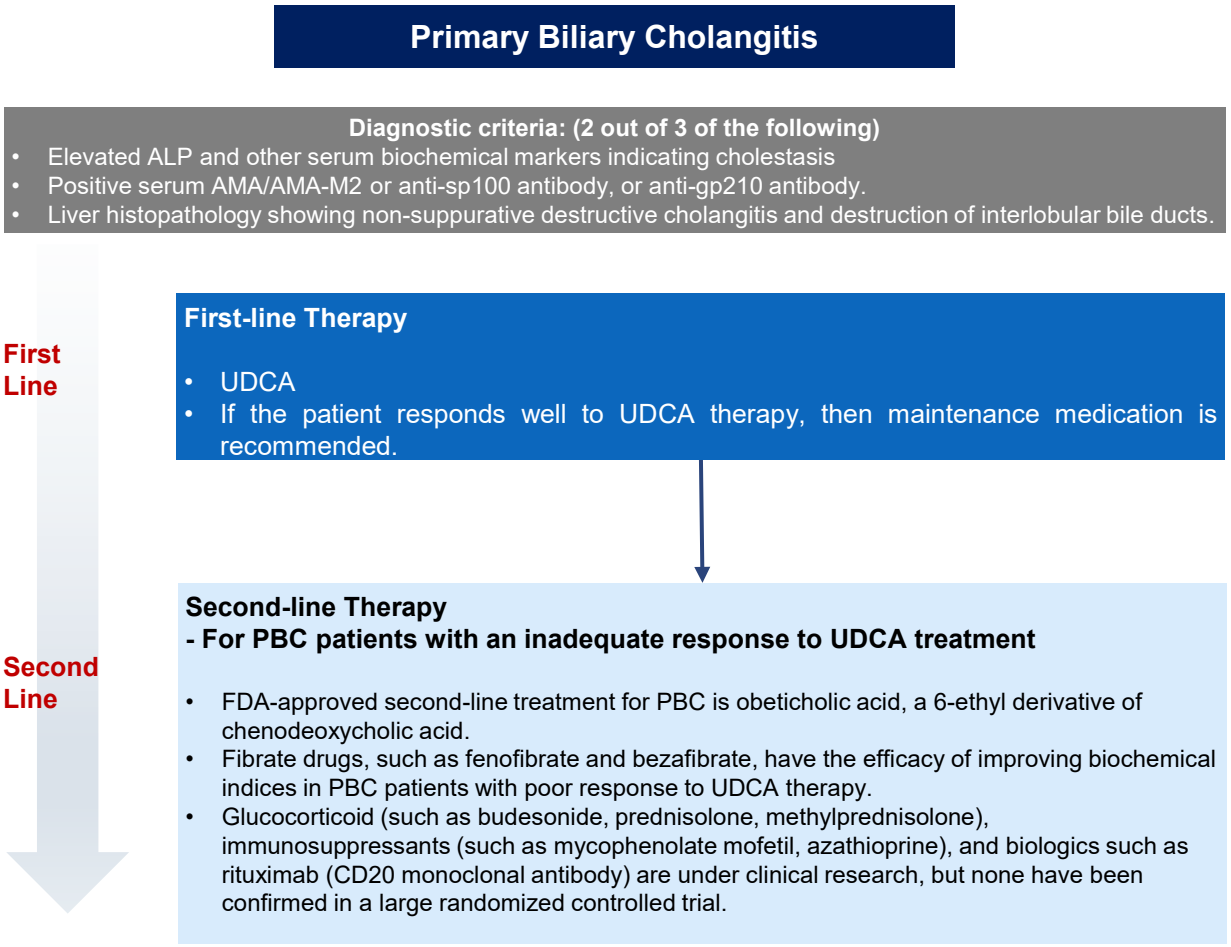
CAGR	China	Global
2019-2024	1.5%	1.6%
2024-2033E	1.1%	1.3%

Thousand



Source: NMPA, FDA, Annual Report, Frost & Sullivan Analysis

Treatment Paradigm of PBC in China



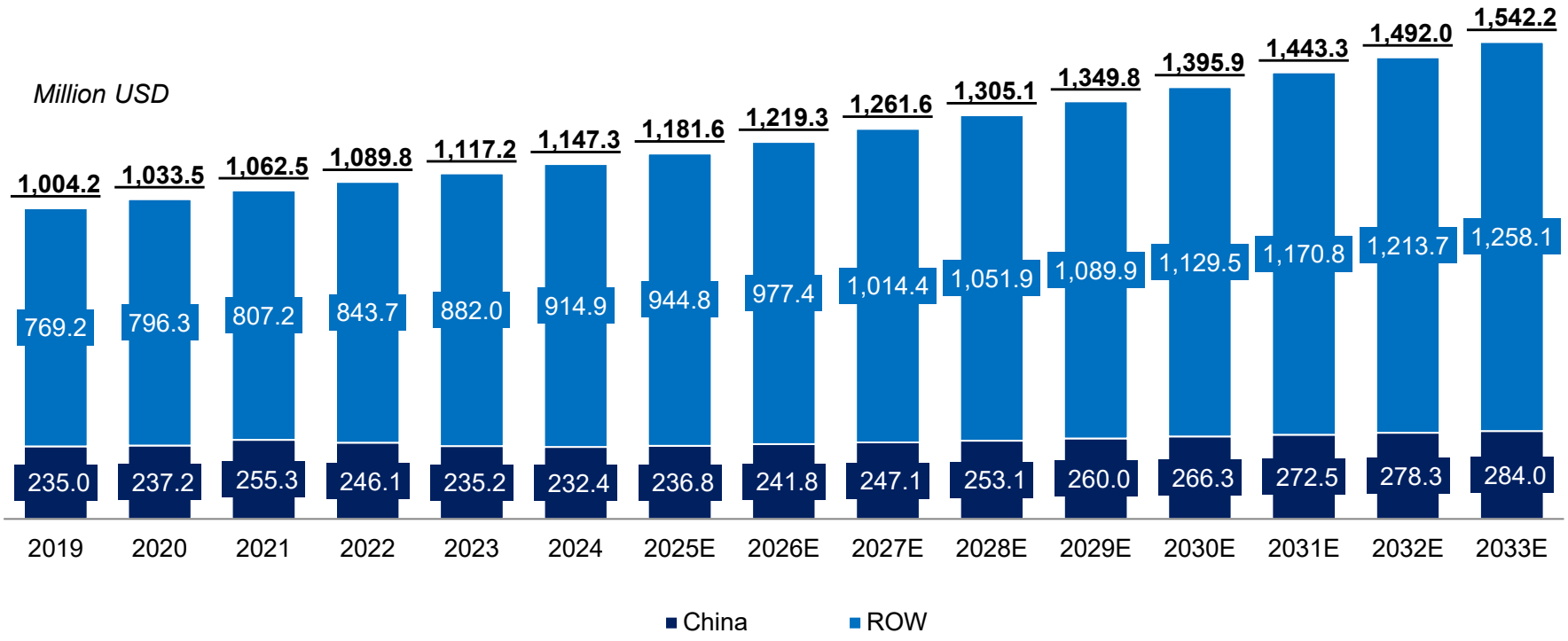
Source: 《原发性胆汁性胆管炎诊疗规范（2021）》, Frost & Sullivan Analysis

Global PBC Drug Market, 2019-2033E

- The market of PBC Globally rose from 1,004.2 million USD in 2019 to 1,147.3 million USD in 2024, with a CAGR of 2.7%. It is expected to continue increasing to 1,542.2 million USD by 2033, reflecting a CAGR of 3.3% from 2024.

Global PBC Drug Market, 2019-2033E

CAGR	China	Global
2019-2024	-0.2%	2.7%
2024-2033E	2.3%	3.3%



Source: NMPA, FDA, Annual Report, Frost & Sullivan Analysis

Confirmation

1. As of the 8th Dec 2024, there was no approved KRAS G12D inhibitor drug globally.
2. Since it is impractical to generate a mutant-specific inhibitor for each mutation of RAS proteins, pan-RAS approaches, which inhibit all mutant and wild-type RAS isoforms, offer theoretical advantages over their mutant-specific counterparts. Pan-targeting approaches have the potential to block compensatory activation of wild-type RAS proteins and prevent the emergence of acquired resistance to mutant-specific inhibitors. Pan-RAS may also have potentially broad applications and long-lasting therapeutic benefits across various cancer types. Drug candidates that dampen excessive activities of RAS proteins in a pan-RAS manner could potentially enable sequential therapies to overcome resistance to mutant-specific treatments.
3. Pan-RAS approaches are differentiated from and potentially superior to pan-KRAS approaches that aim to address multiple KRAS mutations at the same time. Pan-KRAS "off" state inhibitors are vulnerable to adaptive resistance caused by mitogen-activated protein kinase ("MAPK") reactivation via upstream receptor tyrosine kinase signaling. Moreover, pan-KRAS "off" state inhibitors have been found ineffective against certain KRAS mutants, such as KRAS G12R or KRAS Q61X, which exhibit nearly complete impairment of GTPase activity in tumor cells. Therefore, a pan-RAS "on" state inhibitor would potentially encompass a larger patient population and yield better clinical outcomes compared to existing pan-KRAS "off" state inhibitors.
4. RAS-targeting therapies present a significant market opportunity.
5. As of the 8th Dec 2024, there was no approved Pan-Ras drugs globally.
6. Genfleet's RAS-targeting product candidate matrix also renders us one of the companies with the most comprehensive innovative drug portfolio addressing the RAS proteins in the world.
7. As of the 8th Dec 2024, there was no approved RIPK1 inhibitor drugs globally.
8. Given the observed elevation of RIPK1 expression in human atherosclerotic lesions, RIPK1 has been viewed as a potential therapeutic target for reducing residual inflammation in patients at high risk of developing coronary artery disease and subsequently PAD.
9. Genfleet is globally the first company that not only has advanced an RIPK1 inhibitor to the Phase II clinical trial-ready stage for the treatment of PAD with IC but also seeks to explore PBC as a potential indication.
10. As of the 8th Dec 2024, there was no approved CDK9 inhibitor drugs globally.
11. As of the 8th Dec 2024, there was no approved TGF-β R1 inhibitor drugs globally.

Confirmation

12. GFH375 was among the most advanced orally bioavailable KRAS G12D inhibitors in the world in terms of development status as of 8th Dec 2024.
13. As of the 8th Dec 2024, a few pan-KRAS inhibitors with publicly available information targeted solely the “off” state of KRAS protein, generally sparing the NRAS and HRAS proteins.
14. The global addressable patient number of the RIPK1 inhibitor drugs reached 313.2 million in 2023 and is anticipated to reach 367.9 million in 2032