Independent Market Research (IMR) on

Global and Indian Medical Consumables, Pharma Packaging and Infusion bags market

Frost & Sullivan

08.09.2025

DISCLAIMER

The market research process for this study has been undertaken through secondary/desk research and primary research, which involves discussing the market status with subject matter experts.

The research methodology used is a mix of secondary and primary research, where the quantitative market information was sourced from secondary data sources, primary research, and trusted portals. The information is subject to fluctuations due to possible business and market changes. Frost & Sullivan's estimates and assumptions are based on varying levels of quantitative and qualitative analyses, including industry journals, company reports, and information in the public domain.

The data has been collated from publicly available sources such as industry reports, annual reports, company filings, and the Ministry of Corporate Affairs (MCA) database. For any figures related to the financial year, FY is used; otherwise, the calendar year applies. Forecasts, estimates, predictions, and other forward-looking statements contained in this report are inherently uncertain because of changes in factors underlying their assumptions, events, or combinations of circumstances that cannot be reasonably foreseen. Actual results and future events could differ materially from forecasts, estimates, predictions, or such statements. All financial and operational details for Medicap Healthcare are for continuing operations and are provided by the company.

Frost & Sullivan has prepared this study independently and objectively and has taken adequate care to ensure its accuracy and completeness. We believe that this study presents an accurate and fair view of the Pharma Packaging, Medical Consumables, Infusion package and Caps and Closures market in selected geographies within the limitations of, among others, secondary statistics and primary research, varying scenarios created due to the COVID-19 pandemic, and it does not purport to be exhaustive. Our research has been conducted with an "overall industry" perspective, and it may not necessarily reflect the performance of individual companies in the industry. Frost & Sullivan shall not be liable for any loss suffered because of reliance on the information contained in this study. This study should also not be considered a recommendation to buy or not to buy the shares of any company or companies as mentioned in it or otherwise.

ABBREVIATIONS

Abbreviation	Full Form
GDP	Gross Domestic Growth
CAGR	Compound Annual Growth Rate
G7	Group of Seven
ASEAN	Association of Southeast Asian Nations
USD	United States Dollars
MSME	Micro, Small and Medium Enterprises
Mn	Million
UNFPA	United Nations Population Fund
CHE	Current Health Expenditure
WHO	World Health Organisation
OOP	Out-of-Pocket
AB-PMJAY	Ayushman Bharat Pradhan Mantri Jan Arogya Yojana
Bn	Billion
NCDs	Non-Communicable Diseases
DALY'S	Disability-Adjusted Life Years
'000s	Thousands
PFCE	Private Final Consumption Expenditure
FY	Financial Year
STEM	Science, Technology, Engineering, and Mathematics
R&D	Research and Development
PLI	Production-Linked Incentive
CDSCO	**Central Drugs Standard Control Organisation**
NMP	National Master Plan
BERs	Business Environment Rankings
FDI	Foreign Direct Investment
EU MDR	European Union Medical Device Regulation
IPR	Intellectual Property Rights
BITs	Bilateral Investment Treaties
INR	Indian Rupee
IRDAI	Insurance Regulatory and Development Authority of India
PRICE	People Research on India's Consumer Economy
EHRs	Electronic Health Records
AI	Artificial Intelligence
IVD	In vitro diagnostic
MRI	Magnetic Resonance Imaging
CT	Computed Tomography
AIMED	Association of Indian Medical Device Industry
IBEF	Indian Brand Equity Foundation
D&C	Drugs & Cosmetics
MoHFW	Ministry of Health and Family Welfare
ISO	International Organisation for Standardisation

MDR	Medical Device Regulation
PPE	Personal Protective Equipment
ALOS	Average Length of Stay
HAP	Hospital-Acquired Pneumonia
EHRN	Epic Health Research Network
IV	Intravenous
PE	Polyethylene
PVC	Polyvinyl chloride
PS	Polystyrene
PC	Polycarbonate
PEEK	Polyetheretherketone
PMP	Polymethylpentene
PMMA	Polymethyl Methacrylate
ABS	Acrylonitrile butadiene styrene
PP	Polypropylene
APAC	Asia-Pacific
MLP	Multi-Layer Packaging
GHG	Greenhouse Gas
EPR	Extended Producer Responsibility
PCR	Post-Consumer Recycled
PET	Polyethylene Terephthalate
HDPE	High-Density Polyethylene
LDPE	Low-density Polyethylene
RFID	Radio-Frequency Identification
NF	Near Field Communication
TPE	Thermoplastic elastomer
QR	Quick Response Code
DCGI	Drug Controller General of India
FDA	Food and Drug Administration
EMA	European Medicines Agency
BFS	blow-fill-seal
CIP	Clean-in-Place
SIP	Sterilize-in-Place
CE	Conformité Européenne
ERAS	Enhanced Recovery after Surgery
EMA	European Medicines Agency
EMR	Electronic Medical Records
CVC's	Central Venous Catheters
ICU	Intensive Care Unit
EVA	Ethylene-Vinyl Acetate
KG	Kilogram

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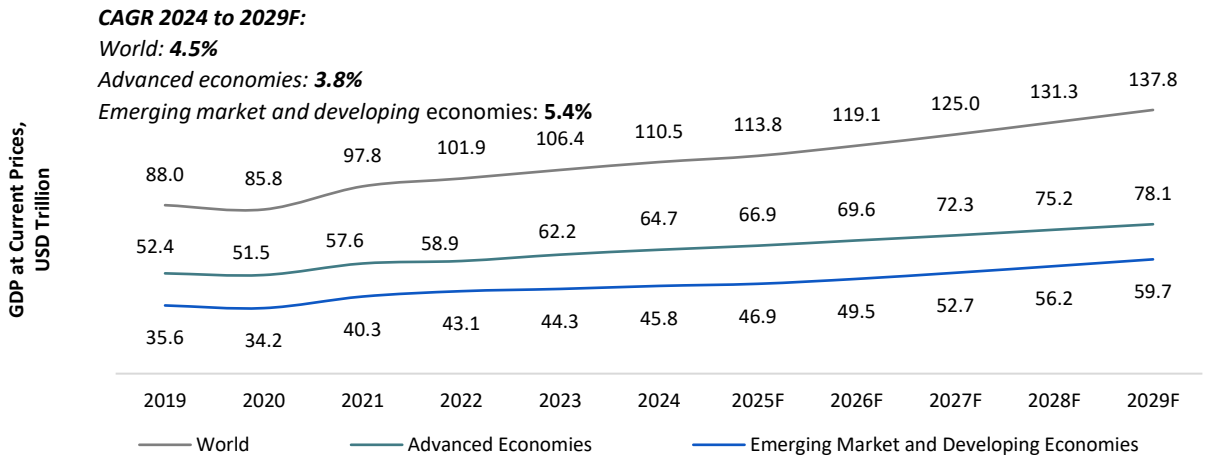
1. GLOBAL AND INDIAN MACROECONOMICS OVERVIEW

1.1. GLOBAL GDP OUTLOOK

The global GDP is estimated to grow from USD 110.5 trillion in 2024 to USD 137.8 trillion in 2029. Notably, there is a forecasted global GDP growth rate of 4.5% from 2024 to 2029 due to factors such as easing inflationary pressures and less restrictive monetary policies, and increase in household income, private consumption and private investments. The global economy continues to display clear signs of resilience with moderate GDP growth despite persistent inflation, trade tensions and geopolitical uncertainties.

Exhibit 1.1: GDP (Nominal) at Current Prices, Global, 2019-2029F



Source: World Economic Outlook-April 2025, Frost & Sullivan

1.2. GLOBAL GDP GROWTH

Global GDP growth is showing signs of rebound following the Covid-19 pandemic; with short-term sluggishness attributed to geopolitical and financial challenges expected to give way to stronger long-term growth.

1.2.1. WORLD, ADVANCED ECONOMIES, EMERGING MARKETS, AND DEVELOPING ECONOMIES

Emerging economies[1] will be the beacon of growth, outpacing GDP growth in advanced economies[1].

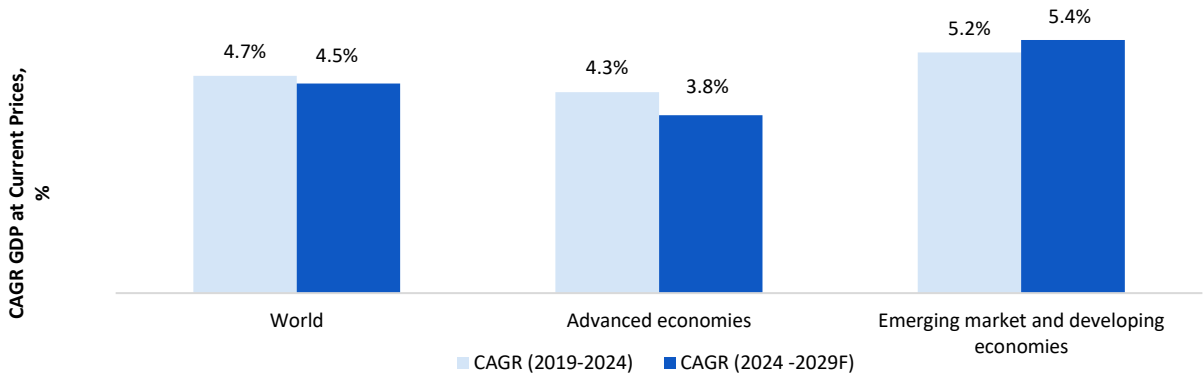
The confluence of supply chain disruptions caused due to geopolitical scenarios such as the Russia- Ukraine and Israel- Palestine conflict has resulted in significant disruptions in markets, sparking a substantial inflationary surge and exacerbating a cost-of-living crisis. Moreover, trade wars through tariff hikes by the US and other countries could have a multifaceted economic impact, with the World Bank identifying several key consequences, including increased risks to global growth, inflation concerns, and disruptions in trade and investment networks. However, it is expected to impact only selected geographies such as China, certain south-east Asian countries and Europe. In response, many nations have adopted stricter monetary policies, which, while moderating GDP growth, are still propelling it forward. This anticipated rise is buoyed by emerging markets and developing economies, which are expected to achieve a CAGR of 5.4% during 2024 to 2029. Several factors contribute to this GDP growth, including increased private consumption,

[1] https://www.imf.org/en/Publications/WEO/weo-database/2024/April/groups-and-aggregates

elevated corporate expenditures, favorable demographics, strengthened balance sheets, improved macroeconomic stability reducing the need for policymakers to tighten monetary policies, and structural policy reforms.

Conversely, advanced economies are anticipated to record a comparatively more modest CAGR of 3.8% between 2024 and 2029. Nevertheless, this marks an improvement from past figures, driven by positive employment prospects in the United States and rising consumption trends in Europe. This optimistic long-term economic outlook is poised to stimulate global investments and bolster demand in vital sectors, such as healthcare.

Exhibit 1.2: CAGR GDP (Nominal) at Current Prices, Global, 2019-2029F



Source: World Economic Outlook-April 2025, Frost & Sullivan

1.2.2. G7 Countries and key Emerging Market Countries

The GDP growth is shifting from advanced economies of G7[2] to emerging economies like Asia, particularly India.

Apart from Sub-Saharan Africa and the ASEAN 5[3], India and China are emerging as two of the largest and swiftest-growing economies. Notably, India's growth rate between 2017 and 2024 was higher than most of the major economies, except China, Mexico and the US, and India's projected GDP growth between 2024 and 2029 is nearly 1.7 times of China, 2.3 times of the US, 3.1 times of Germany, 1.8 times of UK, 3.6 times of Italy and 3.3 times of France.

India's resilience amid the pandemic, coupled with emerging geopolitical trends such as the "China plus one" strategy, thrusts it into the spotlight. Meanwhile, China contends with challenges stemming from a vulnerable property sector, geopolitical uncertainties, and waning export momentum, projecting a growth rate of 5.5% from 2024 to 2029. India's GDP at current prices reached USD 3.9 trillion in 2024 and is anticipated to climb to USD 6.1 trillion by 2029, maintaining a strong CAGR of 9.5% from 2024 to 2029.

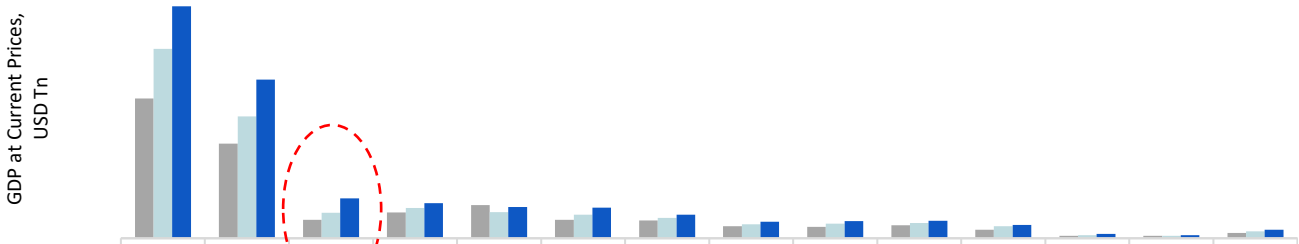
[2] https://www.imf.org/en/Publications/WEO/weo-database/2023/April/groups-and-aggregates
[3] Association of Southeast Asian Nations (ASEAN): Indonesia, Malaysia, the Philippines, Singapore, and Thailand.

As a result, India is poised to ascend as the world's third-largest economy by 2027, surpassing Japan and Germany, with a GDP surpassing USD 5.0 trillion. India aims to achieve developed economy status by 2047[4], underpinned by a strong growth projection of 9.5% between 2024 and 2029. This growth surge is fueled by escalating domestic demand, substantial government, and private global investments, reinforced global ties and reforms centered around Atmanirbhar Bharat, and a flourishing micro, small, and medium-sized enterprise (MSME) sector.

Economies such as Brazil, Mexico, the Philippines, and South Africa are also on track for robust growth. Their strengths lie in a resilient agriculture sector, burgeoning consumption trends, significant presence in nickel mining, and secure manganese supply, respectively. Although several of these economies match the growth pace of India and China, their smaller size and population make them less attractive for substantial investments.

In contrast, the G7 nations[5], characterized by mature economies, concentrated markets, and ageing populations, confront limited growth prospects. These economies are deeply affected by global banking uncertainties, ongoing conflicts (Israel-Palestine and Russia-Ukraine), and tighter monetary policies, emphasizing the dynamic shift toward rapidly growing emerging and developing Asian economies.

Exhibit 1.3: GDP (Nominal) at Current Prices, Select Countries, 2019-2029F



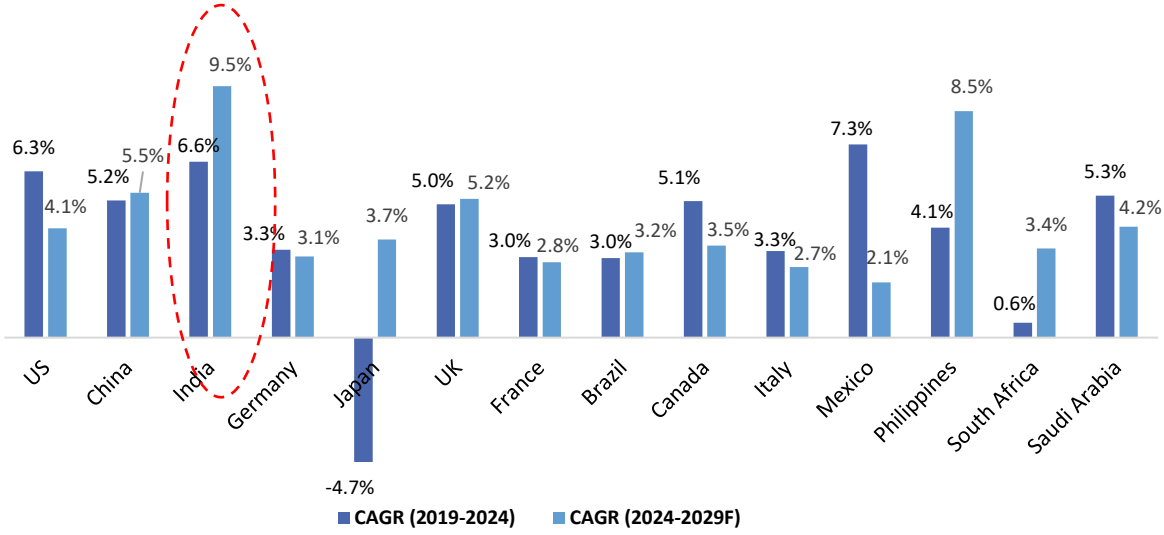
	USA	China	India	Germany	Japan	UK	France	Brazil	Canada	Italy	Mexico	Philippines	South Africa	Saudi Arabia
2019	21.5	14.6	2.8	4.0	5.1	2.9	2.7	1.9	1.7	2.0	1.3	0.4	0.4	0.8
2024	29.2	18.7	3.9	4.7	4.0	3.6	3.2	2.2	2.2	2.4	1.9	0.5	0.4	1.1
2029F	35.7	24.5	6.1	5.4	4.8	4.7	3.6	2.5	2.7	2.7	2.1	0.7	0.5	1.3

Source: World Economic Outlook-April 2025, Frost & Sullivan

[4] Invest India

[5] The G7, or Group of Seven, is an informal forum of seven major industrial democracies: the United States, Canada, France, Germany, Italy, Japan, and the United Kingdom, which focuses on global economic and political issues.

Exhibit 1.4: CAGR of GDP (Nominal) at Current Prices, Select Countries, 2019-2029F



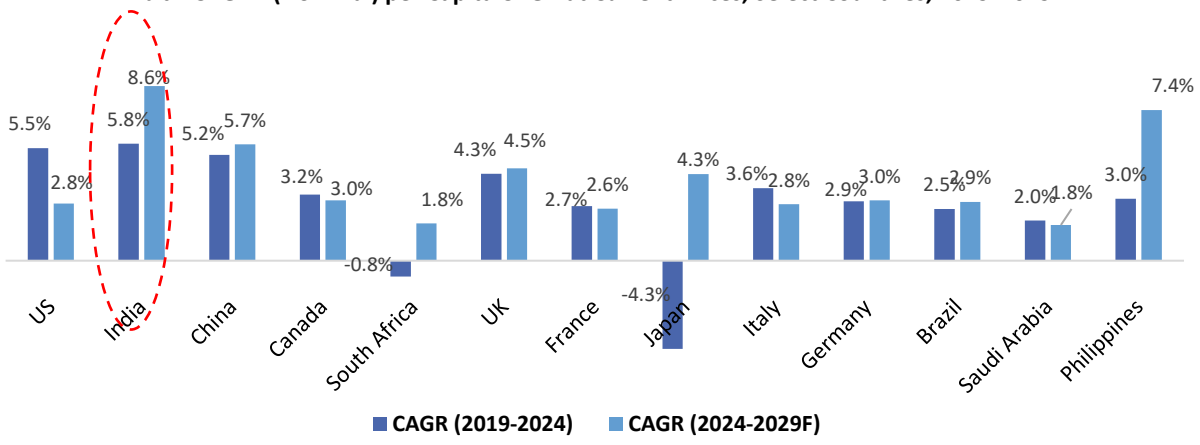
Source: World Economic Outlook-April 2025, Frost & Sullivan

1.2.3. GDP PER CAPITA

Economic growth is also evident in the rising GDP per capita, an indirect indicator of improved affordability

Economic growth is also reflected in the increasing GDP per capita, a pivotal metric for gauging economic prosperity as it provides insights into the average income and subsequent spending capacity per individual. The growth of GDP per Capita was higher in India between 2017 and 2024 compared to most of the major economies, and the country is expected to have the highest per Capita GDP growth of 8.6% compared to the major economies in the forecast years (2024 to 2029).

Exhibit 1.5: GDP (Nominal) per Capita CAGR at Current Prices, Select Countries, 2019-2029F

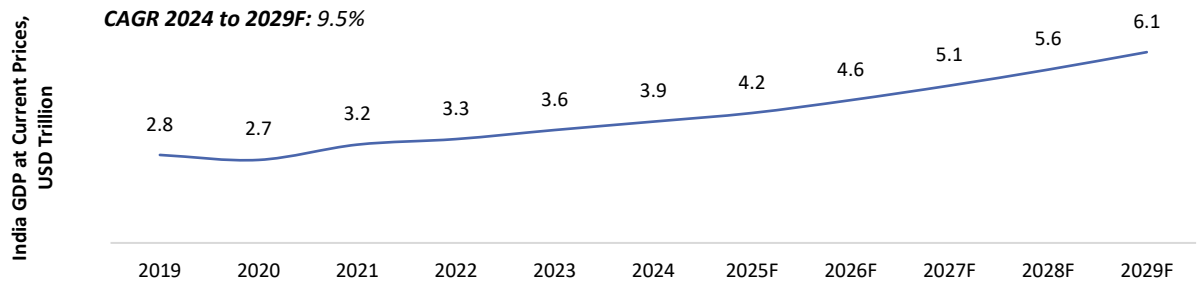


Source: World Economic Outlook-April 2025, Frost & Sullivan

1.2. INDIA GDP OUTLOOK

The Indian economy is the fifth largest in the world with a GDP (at current prices) of USD 3.9 trillion in 2024. It is expected to become the world's third-largest economy by 2027, surpassing Japan and Germany, with a GDP exceeding USD 5.0 trillion. The Indian Government aims to achieve the status of a developed economy by 2047.[6] This growth spurt is fueled by increasing domestic demand, significant domestic and international investments, enhanced global relationships, reforms based on Atmanirbhar Bharat[7], and a thriving micro, small, and medium-sized enterprise (MSME) sector.

Exhibit 1.6: GDP (Nominal) at Current Prices, India, 2019-2029F



Source: World Economic Outlook-April 2025, Frost & Sullivan

Table 1.1: Growth Rates for India GDP (Nominal) at Current Prices		
	CAGR (2019 – 2024)	**CAGR (2024 – 2029F)**
India	6.6%	9.5%

Source: World Economic Outlook-October 2024, Frost & Sullivan

1.3. GDP OF TOP STATES IN INDIA

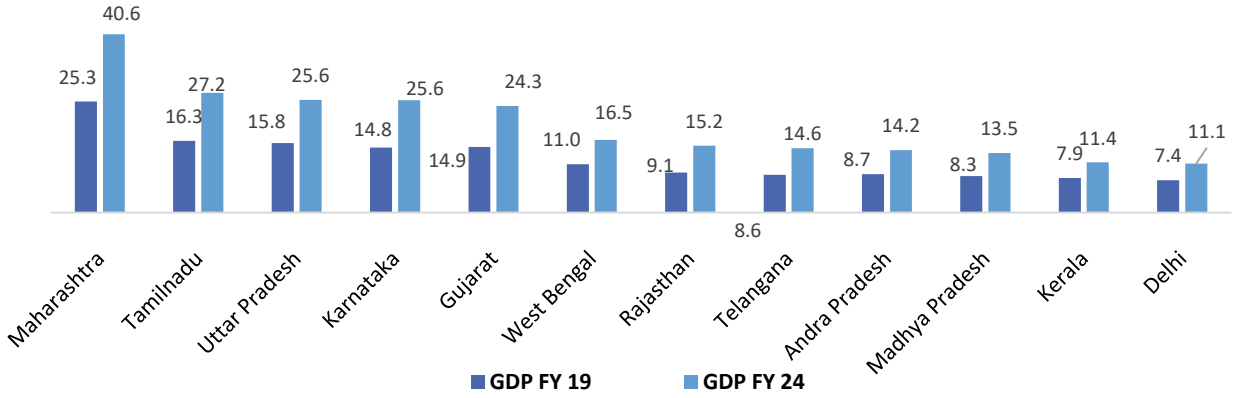
India is witnessing increased commercial activity in many states and some big states will grow their GDP significantly by 2030.

Top 5 states in terms of GDP in India (Maharashtra, Tamil Nadu, Uttar Pradesh, Karnataka and Gujarat) accounted for 48.0%, and the top 12 states accounted for 80% of the country's GDP in FY 2024. Most of the top 12 states have grown at above 10% CAGR from FY 2019 and FY 2024. It is expected that these top states will significantly grow their share of GDP by 2030.

[6] Invest India

[7] Atmanirbhar Bharat, or "Self-reliant India," is a vision and initiative introduced by the Indian government. It aims to make India a self-reliant and economically strong nation. This concept emphasizes the importance of reducing dependence on imports and promoting domestic production and manufacturing.

Exhibit 1.7: GDP (Nominal) of top 12 states (in Lakh Crore), FY 2019 and FY 2024



Source: Ministry of Statistics and Program Implementation, GoI

Table 1.2: Projected Growth rate of Top 12 states by GDP (FY 19 – FY 24)	
Maharashtra	9.9%
Tamil Nadu	10.8%
Uttar Pradesh	10.1%
Karnataka	11.6%
Gujarat	10.2%
West Bengal	8.4%
Rajasthan	10.8%
Telangana	11.3%
Andra Pradesh	10.2%
Madhya Pradesh	10.3%
Kerala	7.7%
Delhi	8.6%

Source: Ministry of Statistics and Programme Implementation (MOSPI); Frost & Sullivan

1.4. GROWTH DRIVERS FOR INDIA'S GDP

India's unique demographic dividend and commendatory reforms are accelerating economic growth in the country.

1.4.1. DEMOGRAPHIC ADVANTAGE

India not only holds the distinction of being the world's most populous nation but also possesses a uniquely expanding working-age demographic, which stands in sharp contrast to many regions facing ageing and shrinking working populations. As of 2023, half India's population (50.1%) belonged to the working age group of 25 to 64 years, showing an increase from 44.1% in 2010, and this percentage is projected to further rise to 52.1% by 2028.[8] India's youthful population presents a significant competitive advantage in terms of labor force availability. Moreover, the country's large pool of graduates, particularly in Science, Technology, Engineering, and Mathematics (STEM) fields, proficient in English, distinguishes India from other nations. This advantage proves especially beneficial in skill-intensive industries such as medical device research and development (R&D) and manufacturing. Additionally, the rapid urbanization and rising income levels of the working population will stimulate demand for goods and services, further propelling growth. Further, the increase in urban population and per capita income fuels the growth of GDP. India's Per capita income has more than doubled from INR 46,492 in 2010 to 98,374 in 2023.

Table 1.3: India's select demographic and economic metrics

Metric	2010	2023
Population (Bn)	1.24	1.44
Urban Population (%)	31.0%	36.0%
Age group 25 – 64 (%)	44.1%	50.1%
Per capita Income (INR)	46,492	98,374

Source: UN Population Division, Ministry of Statistics & Programme Implementation, Frost & Sullivan

1.4.2. POSITIVE GOVERNMENT REFORMS

From economic to structural reforms, the government's initiatives have bolstered investment and streamlined growth across several sectors, most notably pharmaceutical and medical device manufacturing.

1.4.2.1. GOVERNMENT REFORMS FOR MANUFACTURING SECTOR

Historically, manufacturing has contributed 16-17% to the country's GDP. With a focus on boosting manufacturing across sectors including automotive, engineering, chemicals, pharmaceuticals, medical devices, and consumer durables through initiatives like the Production-Linked Incentive (PLI) scheme, PM Gati Shakti- National Master Plan (NMP), and industrial development schemes in states with industrial backwardness, the manufacturing sector is expected to represent 25% of GDP by 2025. These reforms are anticipated to concurrently enhance India's Business Environment Rankings (BER), particularly in infrastructure improvement, from the 14th position in the 2018-2022 period to the 10th position in the 2023-2027 period, positioning India ahead of the Philippines, Indonesia, and Vietnam.

1.4.2.2. FDI POLICY

India has been steadily enhancing its Foreign Direct Investment (FDI) policies to foster a more favorable investment environment through simplified procedures, sectoral reforms, digital initiatives,

[8] UN Population Division

Intellectual Property Rights (IPR) Protection, Bilateral Investment Treaties (BITs), and attractive incentives. The Government's 100% FDI approval for Medical Device industry under the automatic route for both brownfield and greenfield setups (introduced in 2015) is expected to boost the industry. From April 2000 to June 2024, FDI inflow in the medical and surgical appliances sector stood at USD 3.6 Bn. Strong FDI inflows also reflect confidence among global players on the Indian medical devices market.[9]

1.4.2.3. EMERGENCE OF PUBLIC INSURANCE COVERAGE AND INTEGRATION OF PUBLIC AND PRIVATE HEALTHCARE DELIVERY SECTORS

The Government of India is working towards addressing the demand and supply gap across the healthcare sector in insurance, manufacturing, and healthcare delivery services through the expansion of public insurance coverage and integration of public and private healthcare delivery sector (Increased government interventions with PM-JAY coverage, access, and upgradations)

1.4.2.4. Pradhan Mantri Jan Arogya Yojana (PM-JAY)

PM-JAY scheme under Ayushman Bharat, launched in 2018, is the world's largest health insurance, providing access to 12 crore families with INR 5 Lakh health cover per family to avail healthcare services in secondary and tertiary care hospitals (in both public and private sector). There are ~70 crore beneficiaries under the scheme. By 2047, IRDAI aims to achieve "Insurance for All", and PM-JAY is an integral part of that program. IRDAI's efforts to drive insurance penetration is likely to help India move to the top 5 countries in the global insurance market in terms of revenues by 2047.

1.4.2.5. Development of "Make in India" Programs for Pharmaceuticals and Medical devices with PLI scheme

In medical devices, India is the fourth largest in Asia and stands amongst the top 20 markets in the world. Majority of domestic manufacturers (65%) operate in the consumables segment and cater to local consumption with limited exports.

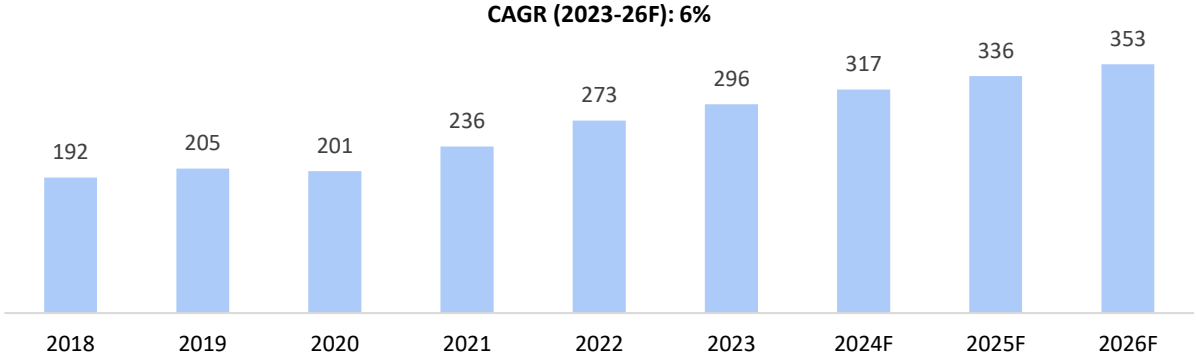
The Indian Government is taking supportive measures such as promoting indigenous manufacturing of high-tech medical devices, production-linked incentive schemes (PLIs) on medical devices and establishing new medical devices park to boost overall growth of India's domestic medical devices market. To reduce import dependency on capital equipment and high-end medical products, the Government of India has launched the 'Make in India' initiative, and as of March 2024, there were 26 approved applicants under PLI for medical devices, with a committed investment of INR 1,206 crore (USD 147 million). Under the scheme for "Promotion of Medical Device Parks", the Government of India has supported setting up four medical device parks with well-equipped infrastructure in the states of Himachal Pradesh, Madhya Pradesh, Tamil Nadu and Uttar Pradesh to support the medical devices industry in line with Atmanirbhar Bharat, promoting indigenous production and reducing the manufacturing costs.

1.4.3. DISPOSABLE INCOME IN INDIA

India's total disposable personal income increased to INR 296 trillion in 2023 from INR 192 trillion in 2018 growing at a CAGR of 9%.[10] The total disposable personal income is estimated to reach INR 353 trillion in 2026.

[9] Indian Brand Equity Federation
[10] Trading Economics, Ministry of Statistics & Programme Implementation

Exhibit 1.8: Disposable Income in India (INR Trillion), 2018-2026F
CAGR (2018-23): 9%
CAGR (2023-26F): 6%



Source: Ministry of Statistics & Programme Implementation, Frost & Sullivan

While India's Upper-middle and High-income class population is expected to have positive growth from 2021 to 2031 (5% and 12%), the Low-income and Lower-middle income population is expected to decline (-9% and -3%).

Table 1.4: Population growth across income segments, 2021-2031F

Income class	Yearly Income level at 2020-21 prices	Population (2021), Mn	Population (2031F), Mn	CAGR (2021-2031F)
Low-income	< 1.25 Lakh	196	79	-9%
Lower-middle	1.25 – 5 Lakh	732	568	-3%
Upper-middle	5 – 30 Lakh	432	715	5%
High	>30 Lakh	56	169	12%

Source: People Research on India's Consumer Economy (PRICE), Frost & Sullivan

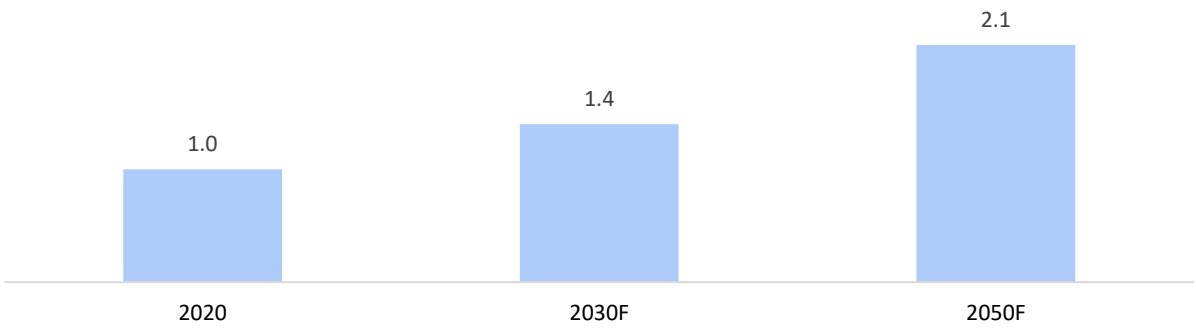
2. GLOBAL AND INDIA HEALTHCARE LANDSCAPE

2.1. RISING GLOBAL HEALTHCARE EXPENDITURE DUE TO AGEING POPULATION AND HEALTHCARE NEEDS

The global share of senior citizens will increase to about 22% by 2050, creating demand for specialized healthcare services, including acute and chronic disease treatments.

Globally, people are living longer. Most people nowadays can anticipate living well into their sixties and beyond. Both the number and percentage of older people in the population are rising in every nation on the planet. One in six individuals on the planet will be 65 years of age or older by 2030. At this point, there will be 1.4 Bn people over the age of 65, up from 1.0 Bn in 2020. The number of individuals in the world who are 65 years of age or older is expected to double (to 2.1 Bn) by 2050. It is anticipated that between 2020 and 2050, the number of people 80 years of age or older will triple, reaching 426.0 Mn. The proportion of the world's population over 65 years will nearly double from 12% in 2015 to 22% in 2050.[11] China, India, US, Japan, and Russia are the top 5 countries with largest number of older adults.[12]

Exhibit 2.1: Global Senior (65+) population (Bn), 2020 - 2050F

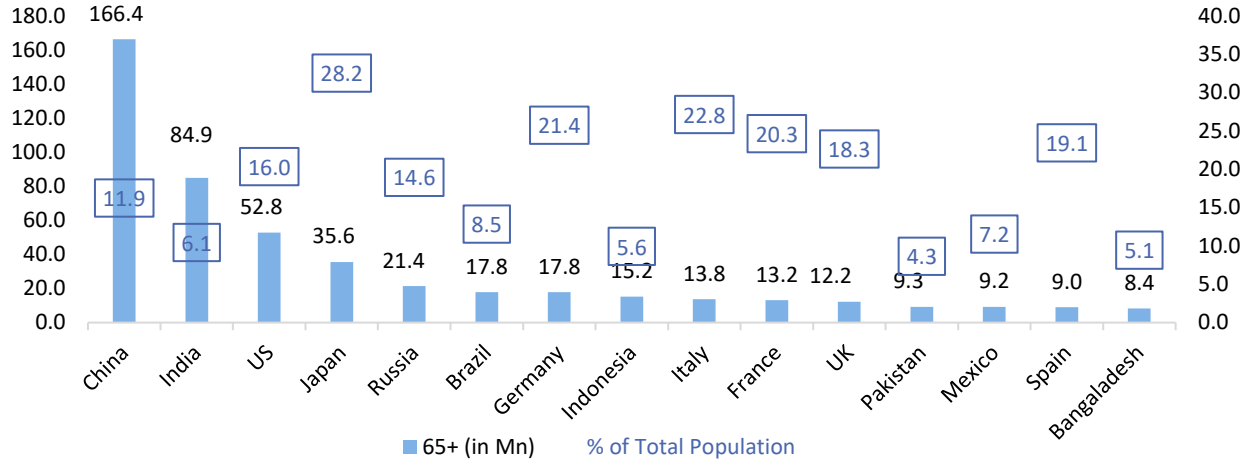


Source: Ministry of Statistics & Programme Implementation, Frost & Sullivan

In India, the proportion of the senior (65+ age group) has been increasing in recent years, and this trend is probably going to continue in the decades to come. It is anticipated that the proportion of the population over the age of 65 will rise from 6.9% in 2022 to 8.1% in 2028 and 20.8% in 2050. The elderly will make up more than 36% of the India's population by the end of the century.[13] With an ageing population and increased life expectancy, the need for healthcare services such as nutritional services, chronic health services, home-based infusion therapy and other home healthcare services is expected to accelerate. The ageing of the population increases the prevalence of acute and chronic illnesses and drives healthcare consumption.

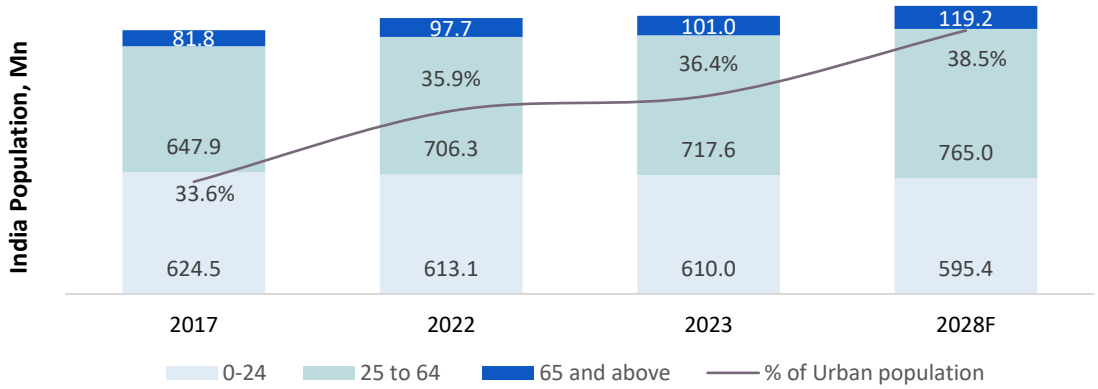
[11] WHO, Ageing and Health
[12] Population Reference Bureau, United Nations Population Division, World Population Prospects 2019
[13] UNFPA, India Ageing Report

Exhibit 2.2: Top 15 Countries with Largest Number of Older Adults, 2021



Source: Population Reference Bureau, United Nations Population Division, World Population Prospects 2019, Frost & Sullivan

Exhibit 2.3: India's Population Distribution by Age Group: 2017 - 2028F



Source: World Bank, Frost & Sullivan

2.2. GLOBAL CURRENT HEALTHCARE EXPENDITURE

Government policies, economic conditions, healthcare reforms, and personal awareness have increased healthcare spending.

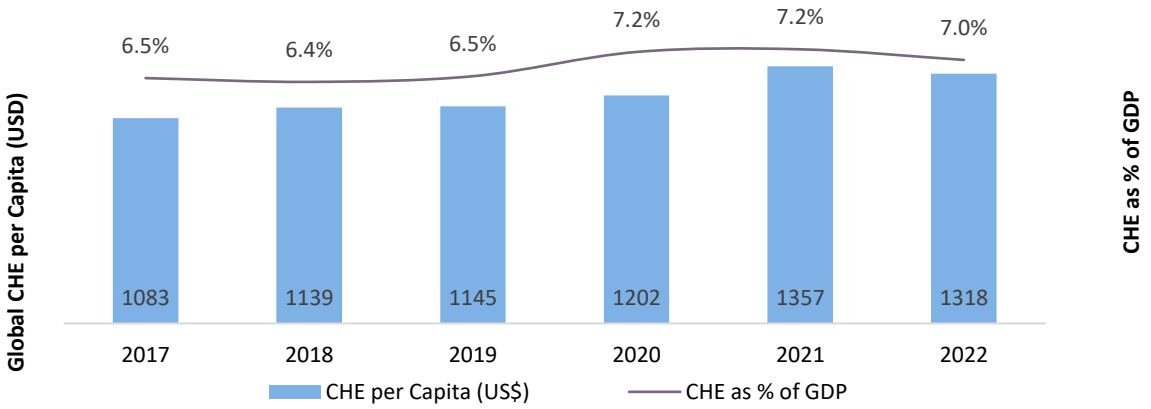
The global Current Healthcare Expenditure (CHE) per capita and CHE as a percentage of GDP are on an upward trajectory with rising economies, increased accessibility and affordability, advances in medical technology, growing prevalence of chronic diseases, ageing population, post-pandemic behavioural changes, and heightened focus on wellness and self-medication. Based on the latest available data from WHO, from 2017 to 2022, the CHE per Capita increased at a CAGR of 4.0% and the CHE as a percentage of GDP increased from 6.5% to 7.0% in 2022.

Globally (in 2022), nearly 52.0% of healthcare expenditure was financed by domestic general government sources, and 37.0% was financed from domestic private sources, out of which 30.0% was

paid out-of-pocket and 7% was through insurance, reflecting a significant financial burden borne by individuals and households. The remaining 11% is financed by external grants and aid.

Exhibit 2.4: Global Current Healthcare Expenditure (CHE) : 2017 - 2022

CHE per Capita CAGR (2017-2022) = 4.0%



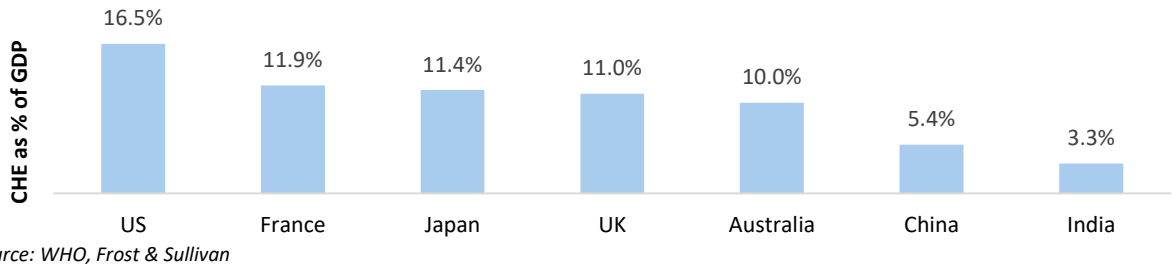
Source: WHO, Frost & Sullivan

2.3. CURRENT HEALTHCARE EXPENDITURE IN INDIA COMPARED TO OTHER KEY COUNTRIES

While India's healthcare expenditure is low compared to developed markets, the per CHE is growing as private insurance coverage increases, and government insurance schemes such as Ayushman Bharat strengthen the overall healthcare expenditure, decreasing the Out-of-pocket spending.

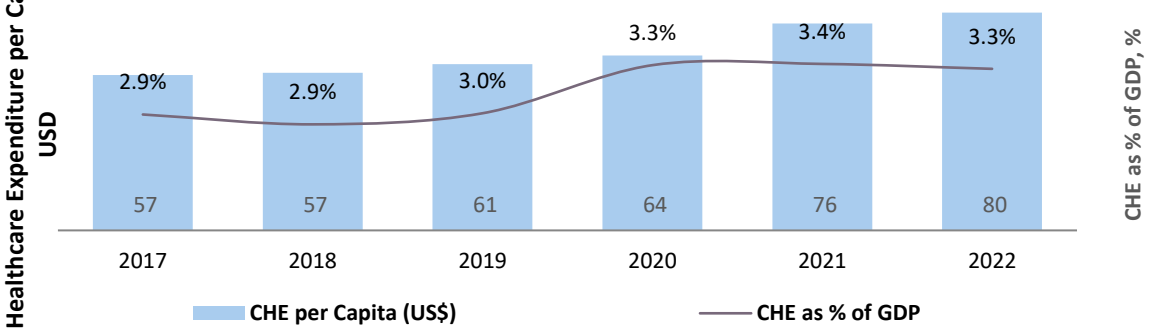
India's CHE as a percentage of GDP is a mere 3.3% in 2022, which is very low compared to major global economies. Healthcare expenditure has been historically low in India because of high dependence on Out-of-Pocket (OOP) expenditure and the under-penetration of healthcare and ancillary services. However, as private insurance coverage increases, government insurance schemes such as Ayushman Bharat widen and strengthen the overall healthcare expenditure, which is expected to increase further. The early signs of the impact of ongoing changes are already evident from declining dependence on OOP. India's Current Healthcare Expenditure (CHE) per Capita has increased from USD 57 in 2017 to USD 80 in 2022 at a CAGR of 7.0%.

Exhibit 2.5: Current Healthcare Expenditure as % GDP by Country: 2022



Source: WHO, Frost & Sullivan

Exhibit 2.6: India's CHE per capita and CHE as a % of GDP (Current Prices), 2017-2022
CAGR of CHE per Capita (2017-2022) = 7.0%

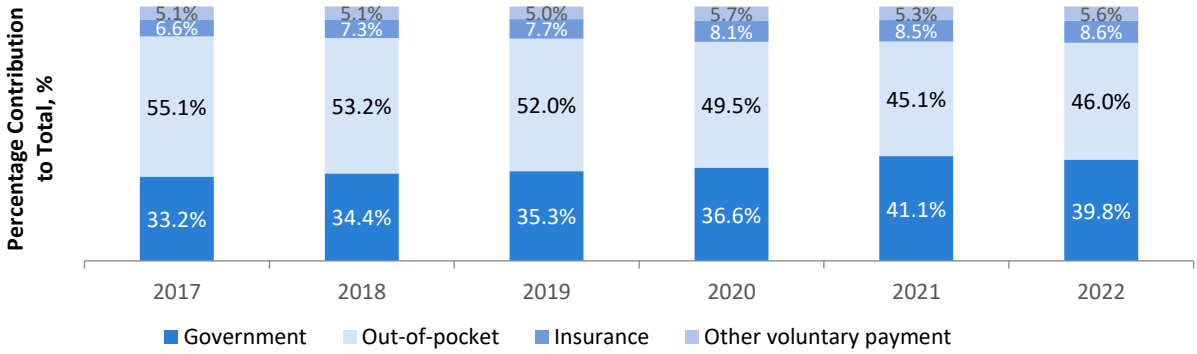


Source: WHO, Frost & Sullivan

2.4. CURRENT HEALTHCARE EXPENDITURE IN INDIA BY SOURCE OF FUNDING

Growing insurance adoption and Government spending have decreased the share of Out-of-pocket spending in healthcare expenditure in India.

Exhibit 2.7: India's CHE by Financing Source: 2017-2022



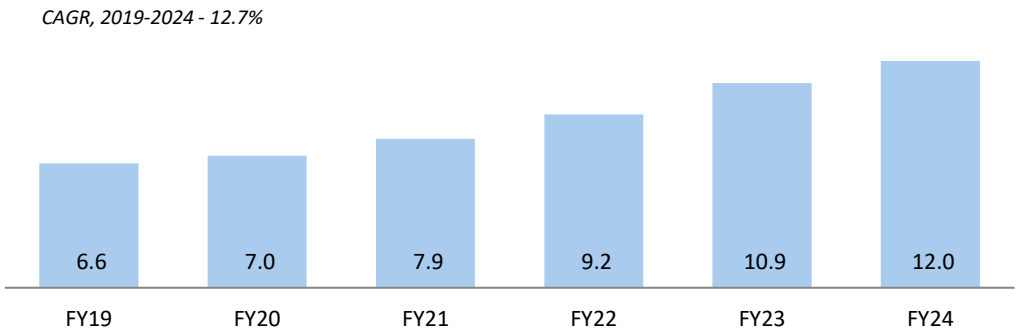
Source: WHO. Frost & Sullivan

India is witnessing increasing healthcare financing from the government. A pivotal government initiative, the Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB-PMJAY), provides comprehensive hospitalization coverage to approximately 70 crore individuals, or the lower 50% of the population. Social and private voluntary health insurance covers 20% of the population, accounting for 25 crore individuals[14]. Government expenditure as a percentage of healthcare expenditure in India has grown from 33.2% in 2017 to 39.8% in 2022, and insurance expenditure as a percentage of healthcare expenditure in India has grown from 6.6% in 2017 to 8.6% in 2022. While India's Out-of-Pocket (OOP) healthcare spending has decreased from 55.1% in 2017 to 46.0% in 2022 due to higher insurance penetration, it is notably high. Furthermore, this OOP burden surpasses that of Asian peers, who typically rely on OOP for approximately 30-35% of healthcare expenses, significantly exceeding the World Health Organization's recommended range of 15-20%[15].

[14] Niti Aayog
[15] WHO Report

The adoption of health insurance is increasing in India, where the gross premium underwritten has increase from USD 6.6 billion in FY 2019 to USD 12.0 billion in FY 2024 at a high CAGR of 12.7%. Factors such as increased awareness of health insurance products, prevention of catastrophic health expenditure by households, increase in medical costs, increased acceptance of health insurance by hospitals and increase in household income are key drivers for the adoption of health insurance.

Exhibit 2.8: Health insurance premium collection (USD Bn), 2019-2024

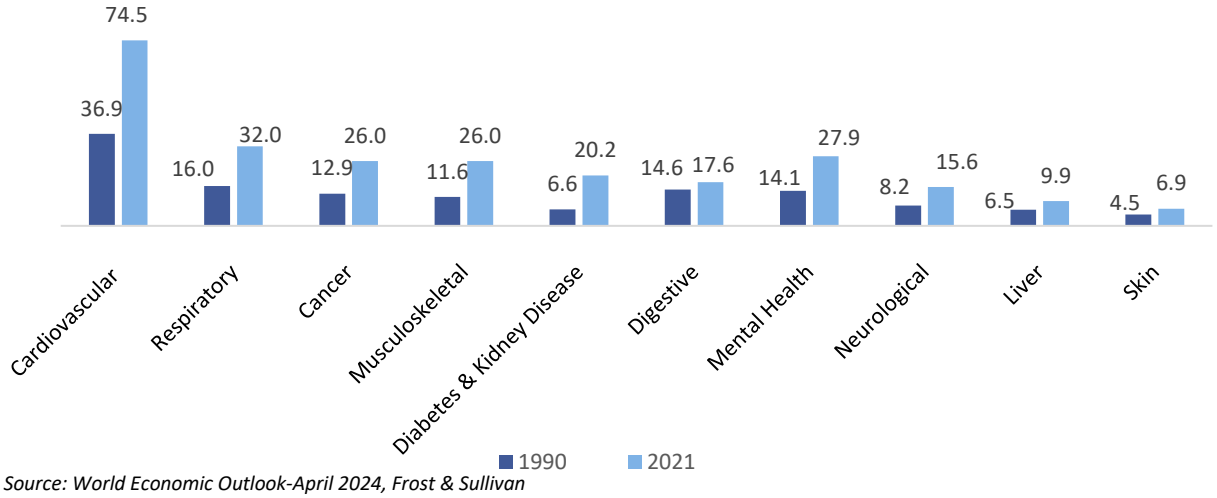


Source:IBEF, Frost & Sullivan

2.5. RISING NON-COMMUNICABLE DISEASE BURDEN

The total global disease burden from non-communicable diseases (NCDs), measured in DALYs (Disability-Adjusted Life Years)[16] per year has increased from 1,150 in 1990 to 1,700 in 2021. The top 5 NCDs globally in 2021 as per DALYs are Cardiovascular disease, Cancer, Mental disorder, Musculoskeletal disorders, and Diabetes and Kidney disease.

Exhibit 2.9: Burden of NCD in India (DALYs), 1990 and 2021



Source: World Economic Outlook-April 2024, Frost & Sullivan

The burden of NCDs for most of the major economies is increasing due to factors such as change in lifestyle and dietary habits and increasing detection of metabolic disorders. The NCD burden in India has increased by more than 50% from 1990 to 2021 (158.0 million DALYs in 1990 to 289.5 million DALYs in 2021). While the burden of most NCDs such as Cardiovascular, Neurological, Cancer, and

[16] DALYs are used to measure total burden of disease - both from years of life lost and years lived with a disability. One DALY equals one lost year of healthy life.

Musculoskeletal diseases have nearly doubled from 1990 to 2021, the burden of Diabetes and Kidney disease has more than tripled in that period.

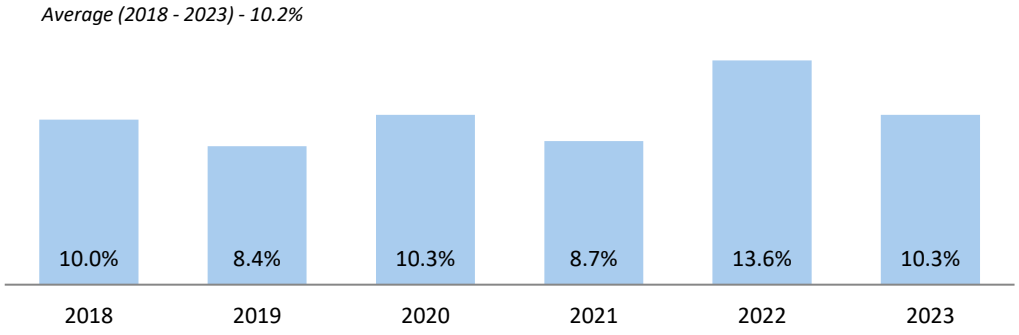
Table 2.1: Burden of NCDs as per DALY, Select Developed countries, 1990 and 2021		
Country	**1990 (DALY, in million)**	**2021 (DALY, in million)**
India	**158.0**	**289.5**
US	83.1	125.3
Germany	25.2	25.0
UK	17.7	17.4
Italy	15.9	16.6
France	14.5	16.1
Spain	9.8	11.5
Canada	6.2	9.0
South Africa	6.1	11.9
Australia	4.0	5.7
Saudi Arabia	2.7	6.7

Source: OurWorldinData, IHME, Frost & Sullivan

2.6. HEALTHCARE INFLATION IN INDIA

While annual retail inflation was at 5.69% in December 2023[17], the medical inflation is at 10.3%.[18] Over the past six years, healthcare inflation in India has outpaced general inflation rates, averaging 10.2%. The high medical inflation is due to higher demand for healthcare services due to demand factors such as rising chronic diseases, increased affordability and increasing adoption of health insurance, and supply factors such as increase in equipment, labour, and raw material costs.

Exhibit 2.10: Healthcare Inflation in India, 2018-2023

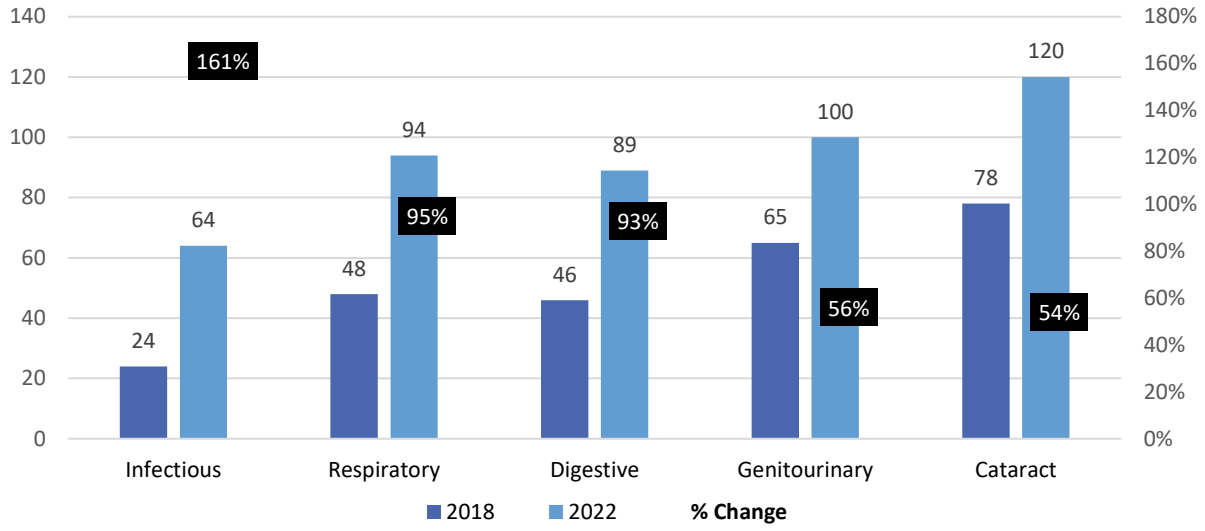


Source: Statista, Frost & Sullivan

Due to the increase in healthcare costs, health insurance claims are increasing. For instance, the average insurance claim for infectious disease has increased by 161%, and the average claim for respiratory and digestive disorders has increased by more than 90% between 2018 and 2022. Insurers must adjust their pricing to cover the escalating expenses associated with medical treatments and procedures.

[17] Pib, Ministry of Statistics & Programme Implementation
[18] Health Report of Corporate India 2023, Plum

Exhibit 2.11: Average insurance claim ('000s INR) for top ailments, 2018 and 2022



Source: Policybazaar, Frost & Sullivan

2.7. INDIA'S PRIVATE FINAL CONSUMPTION EXPENDITURE (PFCE)

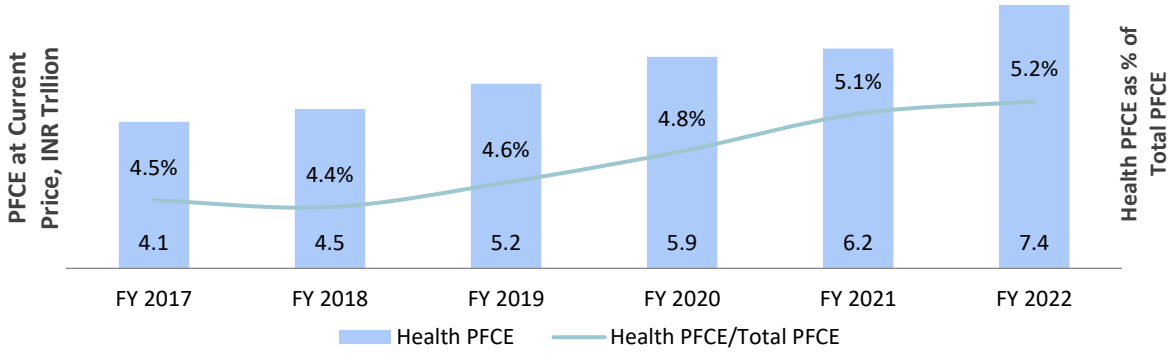
Increasing confidence in financial growth and stability in the country is also reflected in increasing PFCE, with a notable rise in expenditure on education and health.

Private Final Consumption Expenditure (PFCE), representing the expenditures made by households and individuals on goods and services, excluding government spending and net exports, constitutes the largest share of India's Gross Domestic Product (GDP). PFCE to GDP ratio at current prices during 2021-22 and 2022-23 are estimated at 61.0% and 60.9% respectively. Furthermore, the PFCE has grown from 50.3 lakh crore in FY12 to 181.3 lakh crore in FY23 at a CAGR of 12.4%. This surge in PFCE is a testament to the escalating demand for services, driven by growing confidence in the economy and personal financial stability.

Among the various components of PFCE, including housing, water, food, non-alcoholic beverages, electricity, gas, other fuels, and transportation, the most notable growth between FY 2017 and FY 2022 was observed in communication, education, and health. Health, in particular, saw a noteworthy increase, accounting for 5.2% of the total PFCE in FY 2022, up from 4.5% in FY 2017

Health PFCE encompasses expenditures related to a wide range of healthcare services, such as doctor's fees, hospital charges, medications, medical tests, and health insurance premiums, along with other healthcare-related expenses. This statistic serves as an indicator of the overall affordability and accessibility of healthcare within the nation.

Exhibit 2.12: India's PFCE on Health at Current Price: FY 2017 - FY 2022



Source: Ministry of Statistics & Programme Implementation, Frost & Sullivan

Table 2.2: Growth Rates for India's PFCE on Health at Current Price	
	CAGR (FY17 – FY22)
Health PFCE	12.5%
Total PFCE	9.3%

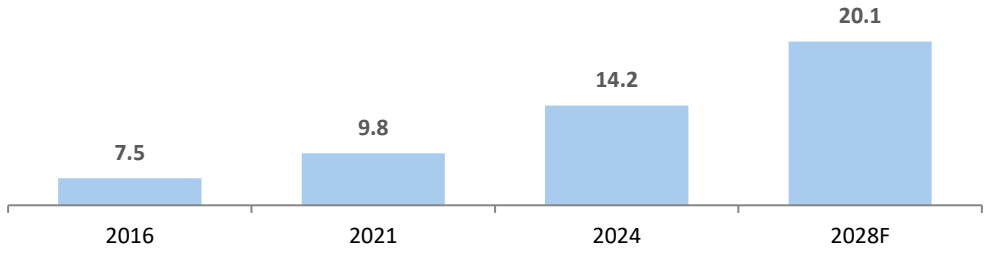
Source: Ministry of Statistics & Programme Implementation, Frost & Sullivan

3. GLOBAL AND INDIA HEALTHCARE OUTLOOK

3.2. GLOBAL HEALTHCARE OUTLOOK

The global healthcare market is undergoing significant transformation, driven by a range of factors including demographic shifts, technological advancements, and evolving healthcare needs. The integration of advanced technologies such as artificial intelligence (AI), telemedicine, wearable devices, and electronic health records (EHRs) is revolutionizing healthcare delivery. AI-driven diagnostics, robotic surgeries, and personalized medicine are improving patient outcomes and operational efficiencies. Telemedicine, in particular, has gained prominence, especially during the COVID-19 pandemic, by enabling remote patient consultations and reducing the burden on healthcare facilities.

Exhibit 3.1: Global Healthcare Market* (USD Trillion), 2016 - 2028F
CAGR 2016 - 2024: 8.3%
CAGR 2024 -2028F: 9.1%



**Healthcare market is indicative of healthcare spending, Source: WHO, WEF, Frost & Sullivan*

The global healthcare market (comprising of Healthcare services, Pharma & Biotech, Medical devices, Diagnositc services and others) has grown from USD 7.5 trillion in 2016 to USD 14.2 trillion in 2024 at a CAGR of 8.2%. It is expected to grow to USD 20.1 trillion in 2028 at a CAGR of 9.1 between 2024 and 2028. The growing incidence of chronic diseases such as diabetes, cardiovascular diseases, and cancer is another significant factor impacting the healthcare market. These conditions require ongoing management and treatment, leading to increased healthcare spending and the need for innovative medical solutions. Moreover, the globalization of healthcare is characterized by cross-border collaborations, medical tourism, and the international exchange of medical expertise and technology. Patients from developed nations often seek affordable and high-quality medical treatments in emerging markets such as India, Vietnam and Thailand, contributing to the growth of medical tourism.

The healthcare services segment comprising care delivery facilities such as hospitals, nursing homes and clinics is the largest segment in the healthcare industry with 54% share and a market size of USD 7.0 trillion in 2023. The segment is expected to grow to USD 11.1 trillion in 2028 at a CAGR of 9.7%. Pharma & Biotech segment is the second largest segment in the healthcare industry with 31% share and a market size of USD 4.0 trillion in 2023. The segment is expected to grow to USD 5.9 trillion in 2028 at a CAGR of 8.0%. Medical device is the third largest segment in the healthcare industry with a 5% share and a market size of USD 0.6 trillion. The segment is expected to grow to USD 1.0 trillion in 2028 at a CAGR of 10.7%. Diagnostic services constitute a 2% share with a market size of USD 0.3 trillion. The segment is expected to grow to USD 0.5 trillion in 2028 at a CAGR of 9.2%.

Table 3.1: Healthcare segments, Size, Share and Growth, 2023-2028

Global Healthcare market segments	Market Size (Trillion), 2023	Share (2023)	Growth (2023 – 2028F)	Market Size (Trillion), 2028F
Healthcare services	7.0	54%	9.7%	11.1
Pharma & Biotech	4.0	31%	8.0%	5.9
Medical device	0.6	5%	10.7%	1.0
Diagnostic services	0.3	2%	10.8%	0.5
Others*	1.2	9%	7.0%	1.7

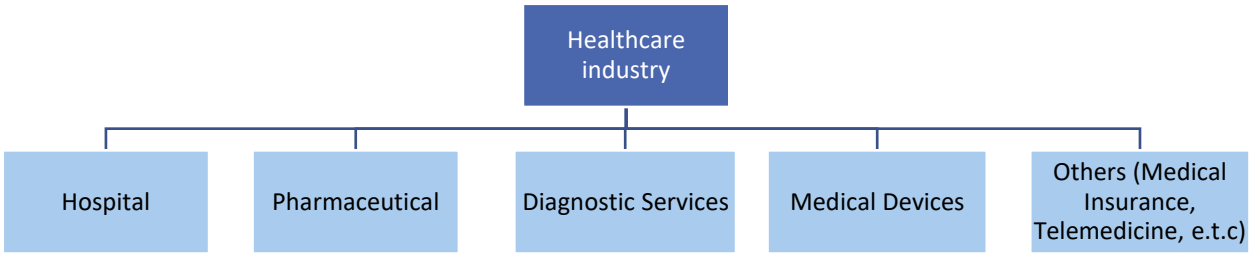
**Healthcare insurance, Home Health, Healthcare IT, etc.*
Source: Frost & Sullivan

3.3. INDIAN HEALTHCARE OUTLOOK

3.2.1. SEGMENTATION OF INDIAN HEALTHCARE INDUSTRY

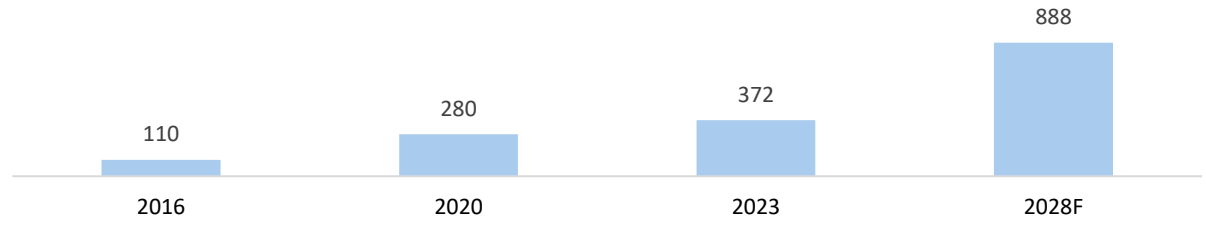
Indian Healthcare industry is segmented into Hospitals, Pharmaceuticals, Diagnostic services Medical Devices , and Others (Medical insurance,Telemedicine, etc.). The estimated market size of the Indian Healthcare industry is USD 372 Bn in 2023, and it is estimated to grow at CAGR of 19.0%.[19] The industry is expanding due to the country's rapid economic growth, middle-class income gains, and health insurance carriers' expanded market penetration. Furthermore, there has been a nationwide surge in government healthcare spending due to shifting demographics and a move from chronic to lifestyle disorders. The Indian Healthcare Market is expected to reach USD 888 Bn by 2028.[20]

Exhibit 3.2: Segmentation of Indian Healthcare industry



Source: IBEF, Frost & Sullivan

Exhibit 3.3: Indian Healthcare Market (USD Bn), 2016 - 2028F
CAGR (2016-2028F): 19.0%

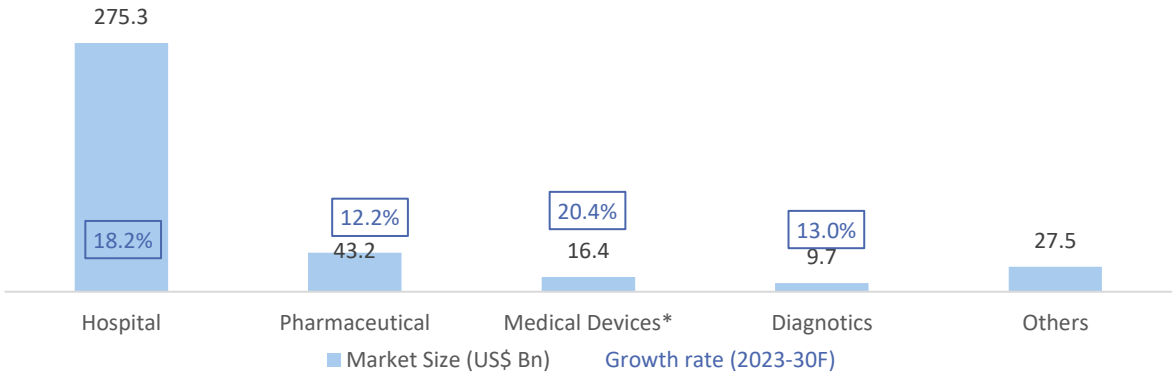


Source: IBEF, Frost & Sullivan

The Indian Healthcare market is dominated by the Hospital segment with about 74% share (USD 275.3 Bn, 2023), followed by Pharmaceutical with about 11.6% Share (USD 43.2 Bn, 2023), Medical Devices with about 4.4% share (USD 16.4 Bn, 2023), and Diagnostic services with about 2.6% share (USD 9.7 Bn, 2023).[21] Others which includes services such as Medical insurance, Telemedicine and Home Healthcare, has 7.4% share with revenue of USD 27.5 billion in 2023. Among the Healthcare segments, the Medical Device segment is expected to grow fast between 2023 and 2030 with a CAGR of about 20.4%, followed by Hospitals (18.2%), Diagnostics (13.0%) and Pharmaceuticals (12.2%).[21]

[19] IBEF, NiTi Aayog and Frost & Sullivan analysis
[20] IBEF, Frost & Sullivan estimate
[21] India Briefing, IBEF, NiTi Aayog, Invest India

Exhibit 3.4: Indian Healthcare Market, Segments (USD Bn), 2023

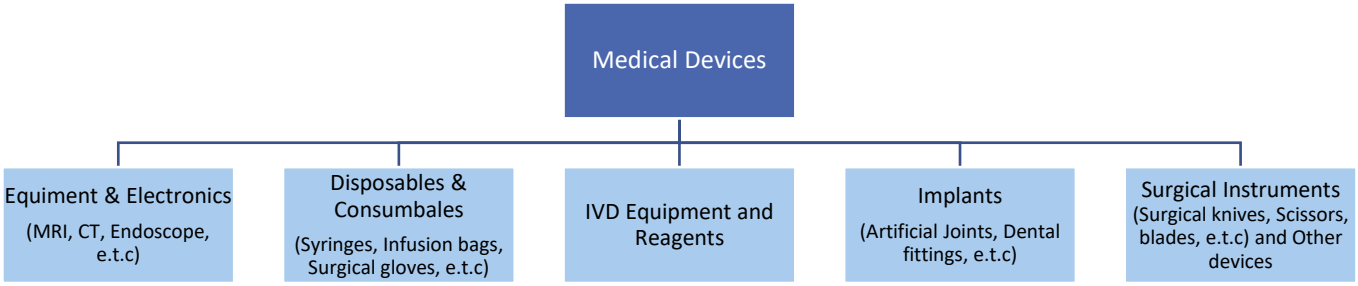


Note: Medical Device market includes exports.
Source: IBEF, Frost & Sullivan

3.2.2. Indian Medical Device Industry

Major segments of the Indian Medical device industry include Equipment and Electronics, Disposables and Consumables, IVD equipment and Reagents, Implants, Surgical Instruments and other devices. India is counted among the top 20 global medical devices market. The Indian Medical Device market[22] is estimated to reach USD 41.5 Bn by 2028 at a growth rate of 20.4% from its estimated value of USD 16.4 Bn in 2023.[23] It is estimated to contribute 1.65% of the global medical device market. Export of medical devices from India increased from USD 2.3 Bn in 2020 to USD 3.4 Bn in 2023. The Indian medical device exports are projected to reach USD 18.0 Bn in 2030.[24] The major export countries for Indian Medical devices are the US, Germany, China, Singapore, France, Türkiye, Brazil, The Netherlands, Iran, and Belgium. India exported most medical devices to the US (USD 668.9 Mn) in 2023, followed by export to Germany (USD176.2 Mn), China (USD145.6 Mn), and the Netherlands (USD 106.5 Mn).[25]

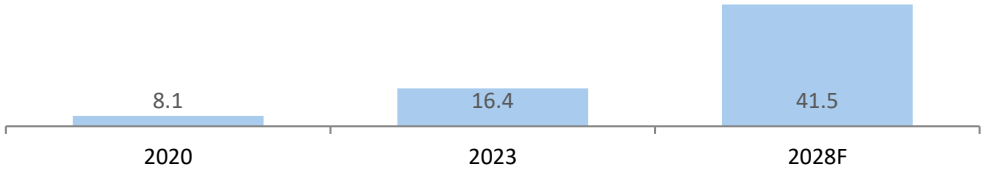
Exhibit 3.5: Key Segments of the Indian Medical Device Industry



Source: Foundation of MSME Clusters, Frost & Sullivan

[22] Includes domestic consumption and exports
[23] Foundation of MSME Clusters, Global Trade Research Initiative, Indian Brand Equity Foundation
[24] IBEF
[25] AiMED, Business Standard

Exhibit 3.6: Indian Medical Device Market* (USD Bn), 2020-2028F
CAGR 2023 - 2028F: 20.4%



**Included exports; Source: IBEF, Foundation of MSME Clusters, Frost & Sullivan*

Among the segments of the Indian Medical Device market, Equipment and Electronics has a major revenue share of the total market (47%), followed by Disposables and Consumables (26%), IVD and Reagents (12%), Implants (9%), and Surgical Instruments (6%).

Table 3.2: Market Size of Indian Medical Device Segments (USD Bn)

Segment	Market Size 2023	Share (2023)	Estimated Market Size 2028F	Forecast CAGR (2023-28F)
Equipment & Electronics	7.7	47.0%	17.5	17.8%
Disposables & Consumables	4.3	26.0%	11.5	21.8%
IVD and Reagents	2.0	12.0%	5.6	23.0%
Implants	1.5	9.0%	3.8	20.4%
Surgical Instruments	1.0	6.0%	3.1	25.4%
Total	**16.4**		**41.5**	**20.4%**

**Total may vary due to rounding error; Source: Foundation of MSME Clusters, Frost & Sullivan*

The Indian Medical Device market is transitioning from being import dependent with increase in domestic production and increasing share of exports. The Medical Device exports from India is expected to grow from USD 3.4 Bn in 2023 to USD 18.0 Bn in 2030. Increasingly, the domestic manufacturers are gaining market share and are meeting the demands of both domestic and international markets with their innovative products. As per statement by Indian Brand Equity Foundation (IBEF), India has achieved a significant milestone in the medical goods sector by transitioning to a net exporter of medical consumables and disposables in 2022-23.[26]

Table 3.3. Indian Medical Device market, Export trend (2023-2030F)

Year	2023	2030F
Indian Medical Device Market (Domestic Consumption) (USD Bn)	13.0	50.0
Indian Medical Device Exports (USD Bn)	3.4	18.0

[26] https://www.ibef.org/news/india-reverses-old-trend-in-medical-consumables-business-is-now-a-net-exporter

Total Indian Medical Device Industry including exports	**16.4**	**68.0**

Source: IBEF, Foundation of MSME Clusters, Global Trade Research Initiative, Frost & Sullivan

Indian Medical device companies have established a strong foothold in the domestic as well as international market due to their ability to deliver quality medical products, various government-led initiatives aimed at fostering growth, including the PLI Scheme and Medical Devices Parks Scheme[27], and availability of skilled talent and labor-cost advantage over global competitors. Indigenous players have achieved recognition by not only promoting the domestic production of high- end medical devices but also by exporting to the world in huge quantities. Domestic medical device manufacturers have established themselves in branded products, creating a unique brand positioning and demand/brand pull from physicians and patients.

3.2.3. Indian Medical Device Regulation

The Indian government has introduced multiple initiatives and enacted various regulations to support the development of the Medical Device sector. Under the Drugs & Cosmetics Act 1940, the Indian government regulates medical devices (i.e., tools, implants, software, and other items meant for human or animal medical use) as "drugs." The Draft Drugs and Cosmetics (Amendment) Bill, 2015, aimed to modernize the Drugs and Cosmetics Act, 1940, by introducing provisions for clinical trials and regulating medical devices while also revising Good Manufacturing Practices (GMP) for drugs and medical devices. In July 2023 , the Ministry of Health and Family Welfare (MoHFW) released a draft of the New Drugs, Medical Devices, and Cosmetics bill, aiming to replace the existing Drugs and Cosmetics Act, 1940, with the goal of modernizing regulations and ensuring quality, safety, and efficacy of drugs, medical devices, and cosmetics. In 2017, the MoHFW notified Medical Devices Rules, 2017 and the new Rules have been framed in conformity with Global Harmonisation Task Force (GHTF) framework and to conform to best international practices. Under the new rules, Medical Devices are classified as per GHTF practice, based on associated risks, into Class A (low risk), Class B (low to moderate risk), Class C (moderate to high risk) and Class D (high risk). The manufacturers of medical devices will be required to meet risk proportionate regulatory requirements that have been specified in the rules and are based on best international practices. The Indian Certification for Medical equipment Plus (2021) program by the Quality Council of India[28] and the Association of Indian Medical Device Industry (AIMEd)[29] aims to assist government agencies in identifying fake goods and forged certifications while also confirming the efficacy, safety, and benefits of medical equipment. The Indian government issued a notification in January 2022 mandating that all manufacturers of medical devices register their products with the Central Drugs Standard Control Organization (CDSCO), India's national regulatory body for cosmetics, pharmaceuticals and medical devices, to comply with the ISO 13485 certification requirement. The purpose of this criterion is to guarantee the safe manufacture and management of medical devices.

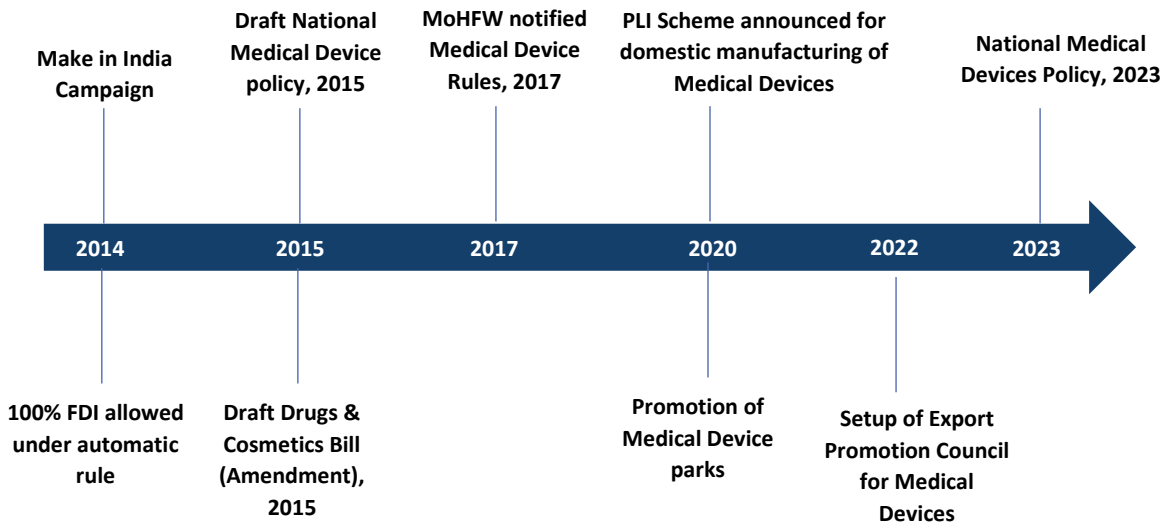
[27] The Indian government's "Promotion of Medical Devices Parks" scheme was introduced to foster domestic manufacturing of medical devices by providing financial assistance for creating common infrastructure facilities in selected states, with a total outlay of Rs. 400 crore and a tenure from FY 2020-21 to FY 2024-25.

[28] Quality Council of India (QCI) was set up in 1997 jointly by the Government of India and the Indian Industry represented by the three premier industry associations i.e. Associated Chambers of Commerce and Industry of India (ASSOCHAM), Confederation of Indian Industry (CII) and Federation of Indian Chambers of Commerce and Industry (FICCI), to establish and operate national accreditation structure and promote quality through National Quality Campaign.

[29] An Umbrella Association of Indian Manufacturers of Medical Devices covering all types of Medical Devices including Consumables, Disposables, Equipments, Instruments, Electronics, Diagnostics and Implants

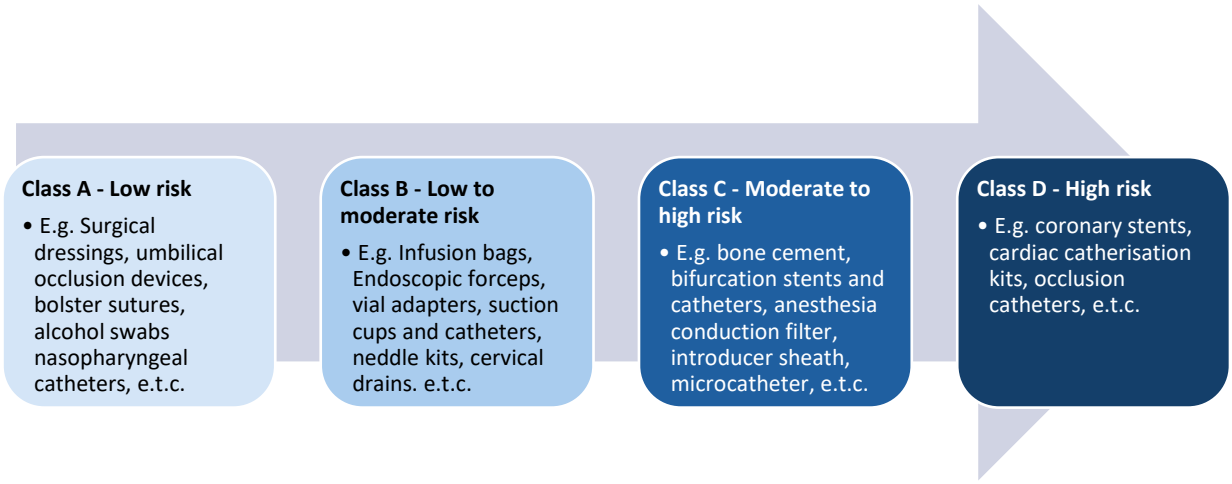
In September 2002, the Indian government announced to set up a separate Export Promotion Council (EPC) for Medical Devices to boost exports of medical devices by help exporters in promoting their products in international markets through various promotional activities including organising and participating in international trade fairs, buyer-seller meets, in line with the foreign trade policy of India. National Medical Device Policy was introduced by the Indian government in May 2023. Its objectives include providing affordable, high-quality medical devices to all people, increasing domestic manufacturing capacity, improving product quality and global competitiveness, improving clinical outcomes through early diagnosis and accurate treatment, encouraging a healthier lifestyle through the widespread use of devices, encouraging innovation in the industry, and building robust local manufacturing capabilities and resilient supply chains. To support the sector's growth and development, the strategy also seeks to simplify regulations and enable infrastructure, R&D, and innovation.

Exhibit 3.7: Timeline of Policies to Boost Medical Device Industry



Source: Frost & Sullivan

Exhibit 3.8: Classification of Medical Devices in India



Source: IBEF, Frost & Sullivan

Medical devices are categorized into one of four classes under the MDR – based on increasing risk from Class A to Class D. Class A deviceslow-risk devices such as surgical dressings, umbilical occlusion devices, bolster sutures, alcohol swabs, and nasopharyngeal catheters. Class B devices are low to moderate risk devices such as endoscopic forceps, vial adapters, suction cups and catheters, Sengstaken- Blakemore tube, feeding tubes, and gastrointestinal tubes. Class C devices are moderate to high risk devices such as anesthesia conduction filter, introducer sheath, microcatheter, imaging catheter colonic stents, and pancreatic instruments. Class D devices are high risk devices such as coronary stents, cardiac catheterization kits, cardiovascular, intravascular diagnostic catheters, and occlusion catheters. Infusion products are classified under Class B (low to moderate risk category).

4. GLOBAL MEDICAL CONSUMABLES INDUSTRY

4.1. OVERVIEW OF MEDICAL CONSUMABLES INDUSTRY

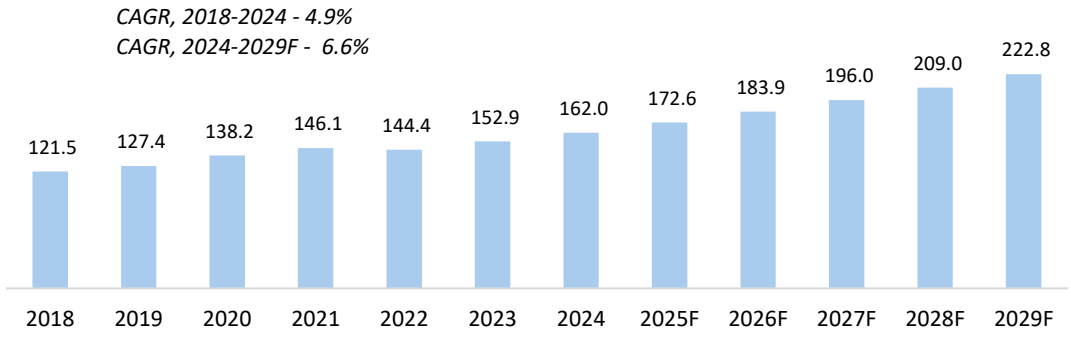
Medical consumables are supplies used in healthcare, including bandages, infusion bags, gloves, masks, syringes, and others. They are essential for treating patients and maintaining a sterile environment. The healthcare industry has undergone significant transformations in recent years, driven by a range of factors including technological advancements, demographic changes, and evolving patient needs. These changes have had a profound impact on various segments of the medical consumables market. The increase in hospital beds, rising inpatient admissions, changing inpatient profiles, and the adoption of advanced infusion products are key trends shaping the market. The emphasis on efficiency and safety is driving the demand for innovative consumables, creating opportunities for manufacturers to develop products that meet the evolving needs of healthcare providers.

4.2. GLOBAL MEDICAL CONSUMABLES MARKET

The global medical consumables market is poised for robust growth, driven by a combination of demographic shifts, technological advancements, and evolving healthcare needs. The trends towards

sustainability, digital integration, and personalized healthcare are expected to shape the future of the industry, providing opportunities for innovation and market expansion. The global medical consumables market stood at USD 162.0 billion in 2024 and is estimated to reach USD 222.8 billion by 2029, growing at a CAGR of 6.6% over the period of 2024-2029, higher than the historical CAGR of 4.9% between 2018 and 2024.

Exhibit 4.1: Global Medical Consumables Market (USD Bn), 2018-2029F



Source: Frost & Sullivan

4.2.1. GLOBAL MEDICAL CONSUMABLES MARKET SPLIT BY SEGMENT

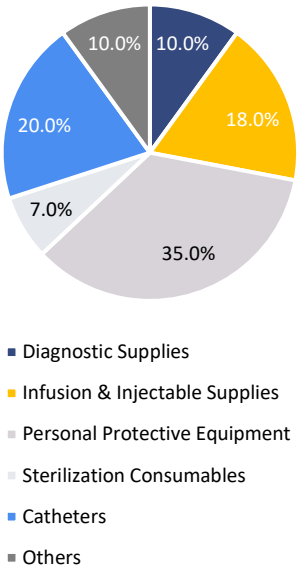
The global medical consumables market is dominated by personal protective equipment (PPE) with around 35% market share in 2024. The PPE segment has gained significant prominence, especially in the wake of the COVID-19 pandemic. It includes products such as gloves, masks, gowns, and face shields, essential for protecting healthcare workers and patients from infections. Factors such as the global pandemics and rising awareness of infection control, stricter regulatory standards and guidelines for healthcare safety, and expansion of healthcare infrastructure in emerging economies have driven the overall segmental growth.

Infusion & injectable supplies segment contributed 18% in the global market in 2024. Infusion and injectable supplies encompass products like infusion bags, syringes, needles, intravenous sets, and infusion pumps. These are critical in administering medications, fluids, and nutrients directly into the patient's body. Some of the pivotal segmental growth factors include increasing incidence of chronic diseases requiring long-term medication, growth in surgical procedures and hospital admissions, and innovations in drug delivery systems enhancing patient compliance and comfort.

Catheters make up 20% share in medical consumables. Catheters are essential for a wide range of medical procedures, from routine fluid administration to complex surgeries. Catheters come in a wide range of types, each tailored for specific medical applications such as urinary catheters, vascular catheters and central venous catheters.

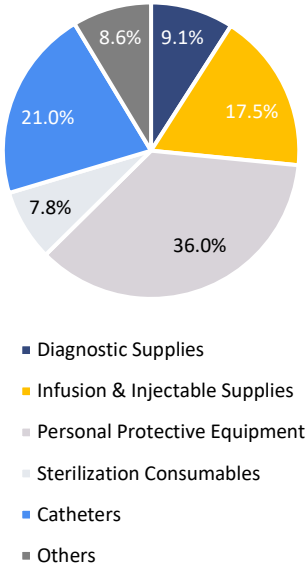
Other medical consumables such as Diagnostic supplies and Sterilization consumables have about 10% and 7% revenue share in the global medical consumables market.

Exhibit 4.3A: Global Medical Consumables Market, Revenue share by segments, 2024



Source: Frost & Sullivan

Exhibit 4.3B: Global Medical Consumables Market, Revenue share by segments, 2029F

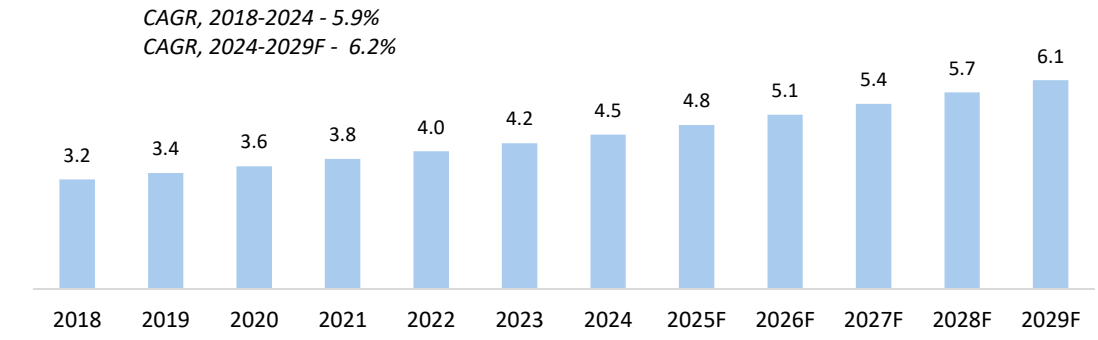


Source: Frost & Sullivan

4.3. INDIAN MEDICAL CONSUMABLES MARKET

The Indian medical consumables market was valued at USD 4.5 billion in 2024 and is estimated to reach USD 6.1 billion by 2029, growing at a CAGR of 6.2% from 2024 to 2029, higher than the historical CAGR of 5.9% between 2018 and 2024. The Indian medical consumables market is poised for continued growth in the coming years driven by factors such as government initiatives to promote domestic manufacturing, increasing healthcare expenditure and the rising prevalence of chronic diseases.

Exhibit 4.4: Indian Medical Consumables Market (USD Bn), 2018-2029F

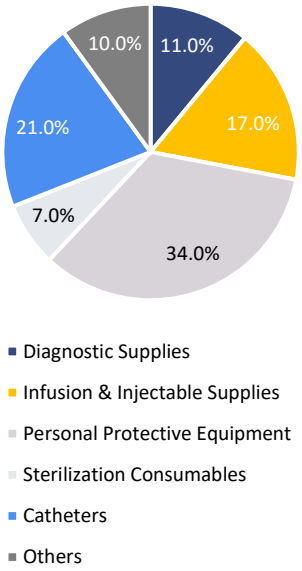


Source: Frost & Sullivan

4.3.1. INDIAN MEDICAL CONSUMABLES MARKET SPLIT BY SEGMENT

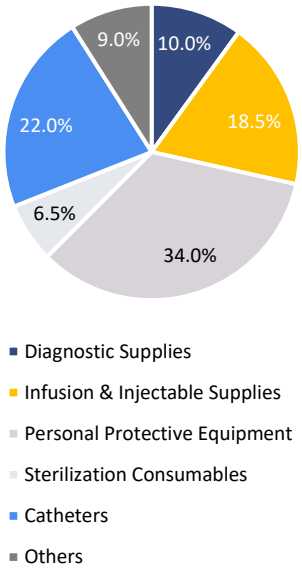
Similar to the global medical consumable market, PPE has the largest share of 34.0%, followed by Catheters (21.0%), Infusion and Injectable supplies (17.0%), Diagnostic supplies (11.0%) and Sterilization consumables (7.0%).

Exhibit 4.5A: Indian Medical Consumables Market, Revenue share by segments, 2024



Source: Frost & Sullivan

Exhibit 4.5A: Indian Medical Consumables Market, Revenue share by segments, 2029F



Source: Frost & Sullivan

4.4. FACTORS DRIVING THE GROWTH OF MEDICAL CONSUMABLES

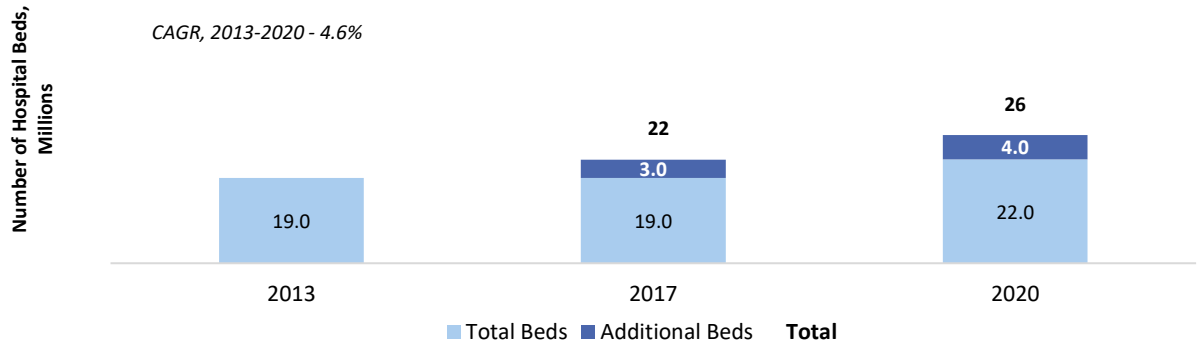
4.4.1. INCREASE IN NUMBER OF INPATIENT ADMISSIONS AND HOSPITAL BEDS

Inpatient admissions have been on the rise globally due to an ageing population, an increase in chronic diseases, and improved access to healthcare services. Growing hospital admissions, driven by the rising incidence of diseases and physical disabilities, is expected to propel the demand for medical consumables. According to the United Nations' World Population Ageing Report 2020, the global population of older individuals (aged 65 and above) is projected to exceed 1.5 billion by 2050, accounting for 16.0% of the global population. Additionally, hospital-acquired pneumonia (HAP), a lower respiratory infection commonly seen in hospitalized COVID-19 patients, further contributes to this trend. Data from the Epic Health Research Network (EHRN) indicated that hospital admissions were at 85.5% in early April 2021. The rapid growth of the ageing population and the increasing prevalence of chronic diseases are driving higher hospitalization rates, thereby fueling the demand for hospital supplies.

Commensurate to the increasing admissions, there has been a marked increase in the number of hospital beds globally. Globally, the number of hospital beds has increased from about 19 million in 2013 to about 26 million in 2020 at a CAGR of 4.6%. This growth is particularly notable in emerging markets, where governments and private investors are investing heavily in healthcare infrastructure to meet the rising demand for medical services. Developed countries are also expanding their hospital

networks, focusing on specialized care facilities to address specific health needs. The increase in inpatient admissions and hospital beds due to investment in healthcare facilities directly correlates with an increased demand for medical consumables required for patient care, including dressings, catheters, and intravenous (IV) solutions. Moreover, hospitals are focusing on efficiency, leading to a steady demand for high-quality consumables that can support faster recovery and turnover of patients. This expansion fuels the growth of the medical consumables market, prompting manufacturers to scale up production and innovate to meet diverse needs.

Exhibit 4.6: Number of Hospital Beds, Global (in Mn), 2013-2020



Source: World Bank, Our World in Data

Table 4.1: Growth in Hospital beds, India versus Global, 2013 - 2020

Region	Total no. of Beds (Mn)		Growth (2013 – 2020)
	2013	2020	
India	0.7	2.1	17.0%
Global	19.0	25.9	4.5%

Source: Frost & Sullivan

Emerging markets such as India are witnessing a higher growth in hospital beds compared to global rates, improving the capacity of hospitals for inpatient uptake.

4.4.2. CHANGES TO THE INPATIENT PROFILE FOCUSED ON TREATMENT

The inpatient profile is shifting towards more complex and chronic conditions, which necessitate longer and more intensive treatments. This change is driven by the rising prevalence of non-communicable diseases such as diabetes, cardiovascular conditions, and cancer. Consequently, the average length of stay for these patients is increasing due to the complexity of care required. This shift has led to higher consumption of specialized consumables. Products such as advanced wound care dressings, specialized IV catheters, and long-term infusion systems are seeing increased demand. Additionally, there is a growing need for consumables that support the management of chronic conditions over extended periods.

4.4.3. ADOPTION OF INFUSION PRODUCTS TO ADDRESS RESOURCE SHORTAGES

Many healthcare systems are facing resource constraints, including shortages of healthcare personnel. In response, hospitals are adopting technologies and products that can streamline care processes and reduce the burden on staff. Infusion products, such as automated IV pumps and smart infusion

systems, are increasingly being used to manage patient care efficiently. These products allow for the precise delivery of medications and fluids, reducing the need for constant monitoring by healthcare staff. This adoption helps alleviate resource shortages by enabling more effective and efficient patient management.

4.4.4. ENHANCEMENTS OF SAFETY FEATURES DRIVING ADOPTION OF INFUSION PRODUCTS

Patient safety is a top priority in healthcare settings, and there is a continuous push to enhance safety features in medical products. This focus has led to the development and adoption of infusion products with advanced safety mechanisms. Modern infusion products are equipped with features such as dose error reduction systems, automated alarms, and secure connections to prevent medication errors. These safety enhancements not only improve patient outcomes but also reduce the risk of adverse events, making them highly attractive to healthcare providers. The adoption of these products is driven by regulatory requirements and the overarching goal of improving patient safety.

4.5. SUPPLY CHAIN TRENDS OF MEDICAL CONSUMABLES

The supply chain for medical consumables is undergoing significant transformation, driven by an increasing need from healthcare providers to diversify suppliers, price stabilization, globalization of supply chain, and the growing number of largesuppliers from emerging markets. These trends are reshaping the industry, offering opportunities for enhanced efficiency, cost reduction, and improved product availability. Healthcare providers and suppliers are continuously making efforts in navigating these changes strategically to ensure a resilient and responsive supply chain that meets the evolving demands of the global healthcare market.

Exhibit 4.7: Key supply chain trend in Medical Consumables

Source: Frost & Sullivan

4.5.1. INCREASING NEED FOR DIVERSIFICATION OF SUPPLY CHAIN

The number of suppliers in the medical consumables is growing, driven by several factors, including heightened global demand for healthcare products, advancements in manufacturing technologies, and regulatory changes that have lowered barriers to entry. Moreover, The COVID-19 pandemic exposed over-reliance on China for critical medical supplies (e.g., PPE, diagnostics), prompting

countries to seek alternative suppliers. China's volatile regulatory environment and quality control concerns have led some buyers to explore suppliers in other regions. The diversification of the supply of medical consumables from China is driven by factors such as supply chain resilience, regulatory challenges, and geopolitical risks. Diversification of suppliers helps mitigate risks associated with supply chain disruptions and provides resilience against regional issues such as natural disasters or political instability. Suppliers from countries such as India, Vietnam and Malaysia are benefiting from the diversification trend and are emerging as preferred providers for low-cost and high-quality medical consumables.

Emerging markets, such as India, has observed a significant increase in number of medical consumables suppliers that has fulfilled the domestic needs as well as having a huge contribution in export trade. In the fiscal year 2022-23, India exported medical consumables and disposables worth USD 1.6 billion, surpassing imports, which stood at approximately USD 1.1 billion, as highlighted by the Union Pharma Secretary. Exports grew by 16%, while imports declined by 33%. In FY 23.[30] The government aims to replicate this success in other sectors, such as surgical instruments and electronic equipment, to reduce import dependency. Following intensified post-COVID efforts, especially due to supply disruptions from China, discussions are ongoing to analyze import-export trends and develop strategies to boost domestic production in various medical device categories.

4.5.2. PRICE STABILIZATION OF MEDICAL CONSUMABLES

Price stabilization in the medical consumables market can be attributed to factors including increased competition, economies of scale, and technological advancements. The rise in the number of medical consumables suppliers has led to more competitive pricing which has stabilized prices of consumables. Moreover, larger production volumes and automation and improved manufacturing processes have driven down production costs. Stable prices benefit healthcare providers by allowing for better budget forecasting and allocation. It also ensures that medical consumables remain affordable, contributing to the overall efficiency of healthcare delivery. Price stability can lead to increased adoption of essential medical products, thereby improving patient outcomes.

4.5.3. GLOBALIZATION OF SUPPLY CHAIN OF PACKAGING MATERIALS

The globalization of the supply chain for packaging materials used in medical consumables is a significant trend. Suppliers are sourcing materials from various parts of the world to optimize costs and enhance supply chain efficiency. This globalization is facilitated by advancements in logistics, trade agreements, and the need for high-quality, cost-effective packaging solutions. Global sourcing of packaging materials helps manufacturers reduce costs and improve product availability. With ever growing demand for medical consumables, the demand for packaging materials is on the rise. Some common plastics used in medical applications are Polyethylene (PE), Polypropylene (PP), Polyvinyl chloride (PVC), Polystyrene (PS), Polycarbonate (PC), Polyetheretherketone (PEEK), Polymethylpentene (PMP), Acrylic (PMMA), and Acrylonitrile butadiene styrene (ABS).

Global medical consumables manufacturers are eying on emerging markets such as China and India as their logistic hub to fulfil their manufacturing and supply chain needs on the back of easy availability of skilled workforce, raw material, well-established manufacturing clusters, and supportive government policies. 100% FDI is allowed in the medical devices sector In India with categories such as equipment and instruments, consumables and implants attracting the most FDI. Moreover,

[30] India Brand Equity Foundation (IBEF)

emerging markets such as India and China have strong manufacturing base for medical consumables. Around 65% of the manufacturers in India are domestic players operating in the consumables segment, and the consumables and disposables contribute more than half of medical device exports.

4.5.4. GROWING NUMBER OF LARGE SUPPLIERS FROM EMERGING MARKETS

Emerging markets, particularly in Asia and Latin America, have seen the rise of suppliers in the medical consumables sector. These suppliers are benefiting from lower production costs, growing domestic demand, and supportive government policies aimed at boosting local manufacturing capabilities. The emergence of suppliers from emerging markets has several implications such as cost competitiveness, diversification of supply sources, and innovation and customization. Products from these regions are often more cost-effective, helping to reduce overall supply chain expenses. Also, diversification of supply sources reduces dependency on traditional suppliers from developed countries and enhances supply chain resilience.

5. ASSESSMENT OF PHARMA PACKAGING INDUSTRY, GLOBAL AND INDIA

5.2. OVERVIEW OF THE PHARMA PACKAGING AND MATERIALS USED

The pharmaceutical packaging sector is essential for maintaining the safety, effectiveness, and integrity of drugs while adhering to strict regulatory requirements by offering packaging solutions that safeguard products from contamination, tampering, and environmental influences like light, moisture, and air. There is a notable focus on child-resistant and tamper-evident packaging to improve safety. As the global need for medications grows, fueled by factors such as an ageing demographic, the rising incidence of chronic illnesses, and the rise of personalized medicine, the pharmaceutical packaging industry is experiencing significant changes.

The pharmaceutical packaging sector employs a variety of raw materials, including glass, plastics, and rubber, to construct containers and enclosures that safeguard and deliver medications. The choice of packaging material depends on the particular drug along with its storage and transit requirements. Certain key performance characteristics of materials that impact selection include resistance to chemicals, barrier functions, compatibility with sterilization, durability, and clarity. Although numerous packaging types exist within the healthcare sector, some materials demonstrate superior performance compared to others. These materials are vital in ensuring that pharmaceutical products maintain ideal conditions during transit and reach the end user securely. Among the most common packaging materials are plastic and polymer-based options, glass containers, and aluminum foil. Rigid plastic is the leading choice in pharmaceutical packaging thanks to its advantages such as affordability, strength, recyclability, and reusability. Compared to flexible packaging, rigid plastic packaging offers greater strength and resilience, making it suitable for items that need additional protection and should maintain their form throughout shipping. Examples of this include packaging for drops, inhalers, bottles, prefilled polymer syringes, and ampoules. The demand for plastic packaging is on the rise due to its excellent shelf life, lightweight nature, cost-effectiveness, and its capacity to preserve freshness and lessen waste. Additionally, it can be easily molded into various shapes and sizes and customized to meet specific branding requirements. Following rigid plastics, glass and flexible plastic packaging are also prevalent in the pharmaceutical field, providing advantages such as minimized spillage and lower production costs.

Materials made from plastic and polymer, such as pharmaceutical sachets, polybags, pre-fillable syringes, and blister packs, are utilized for tablets, capsules, powders, and granules. These materials are resilient and economically viable; however, they have the potential to react with some pharmaceutical drugs. Glass containers, which consist of vials, pre-fillable syringes, and bottles, are used for both dry powder and liquid medications. They are ideal for pharmaceutical packaging because of their clarity, allowing for easy visual inspection and safeguarding against contaminants. Furthermore, they can be sterilized and recycled with ease.

Table 5.1: Comparison of Key Materials used in Pharma Packaging

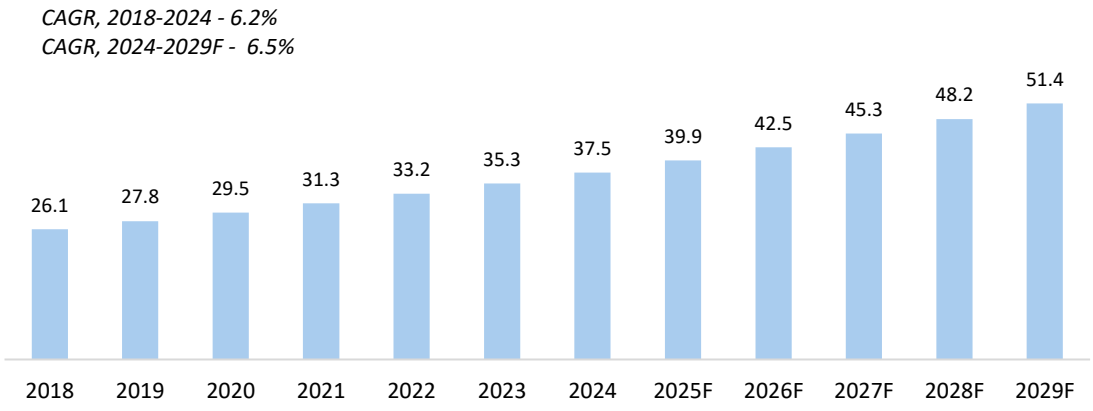
Material	Applications	Advantages	Disadvantages
Plastic	Bottles, blister packs, syringes, pouches, closures	Low in cost, Light weight, Flexible, Recyclability, Easy to transport, Non-fragile	Permeable to moisture, Poor physical stability, Non-suitable for sterilization
Glass	Vials, bottles, ampoules, syringes	Less reactive, Transparent, Suitable for sterilization, Impermeable to moisture, Easy labelling	Fragile, Heavy, increased transportation cost, Photosensitive
Metal	Closures, cans, foils, tubes	Impermeable to moisture, Durable, Non-fragile	Expensive, React to chemicals, Heavy

Source: Frost & Sullivan

5.3. GLOBAL PHARMA PACKAGING INDUSTRY

The global pharma packaging market is valued at USD 37.5 billion in 2024 and is projected to reach USD 51.4 billion by 2029, growing at a CAGR of around 6.5% during the forecast period. The growth of the industry is expected to be marginally higher than the historical growth of 6.2% between 2018 and 2024. The market is characterized by a diverse range of packaging solutions, including pre-filled syringes, ampules, vials, infusion bags and bottles and others.

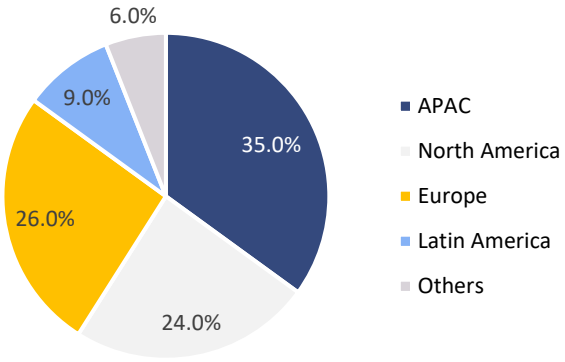
Exhibit 5.1: Global Pharma packaging Market (USD Bn), 2018-2029F



Source: Frost & Sullivan

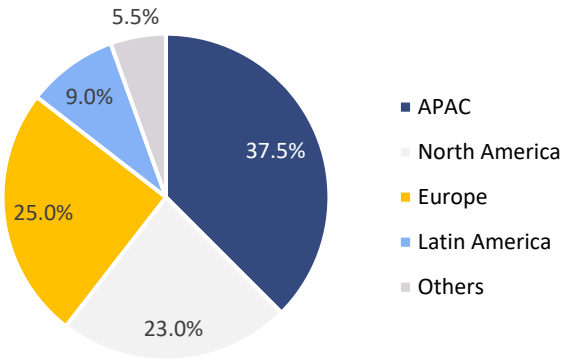
Based on the global regions, Asia-Pacific (APAC) leads the pharma packaging market, with 35% revenue share, followed by North America (24%), Europe (26%) and Latin America (9%). The APAC share is expected to increase from 35.0% in 2024 to 37.5% in 2029.

Exhibit 5.2A: Global Pharma Packaging market, share by region, 2024



Source: Frost & Sullivan

Exhibit 5.2B: Global Pharma Packaging market, share by region, 2029F

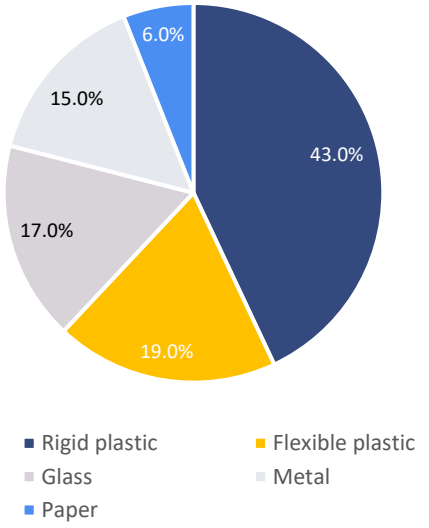


Source: Frost & Sullivan

5.3.1. Global Pharma Packaging Industry by Material

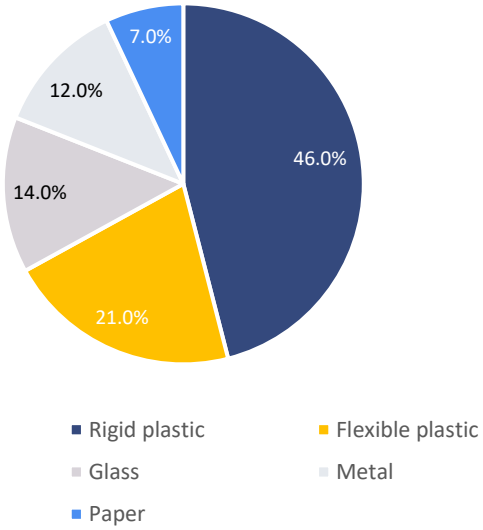
Rigid plastic has the highest revenue share of 43% among the pharma packaging products and the share is expected to rise to 46% in 2029. The usage of rigid plastic packaging in the pharmaceutical industry is projected to rise due to the ageing population, which contributes to more health issues and disabilities as life expectancy increases. This trend will boost the need for pharmaceuticals, thereby fostering the expansion of rigid plastic packaging. In 2024, flexible plastic is anticipated to hold a 19% revenue share, expected to grow to 21% by 2029. The increase in the share of plastic materials is due to increased adoption, decreasing raw material costs and increasing number of manufacturers. The revenue share of glass and metal is expected to decline from 17% and 15% in 2024 to 14% and 12% in 2029 respectively.

Exhibit 5.3A: Global Pharma Packaging Market, Revenue share by material type, 2024



Source: Frost & Sullivan

Exhibit 5.3B: Global Pharma Packaging Market, Revenue share by material type, 2029F



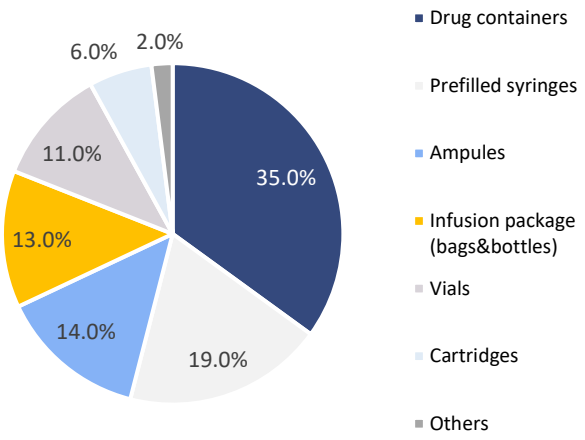
Source: Frost & Sullivan

Plastic packaging can be more environmentally friendly than alternatives like glass, metal, and multi-layer packaging (MLP) when assessing aspects such as energy use, greenhouse gas (GHG) emissions, and resource management throughout the product's lifecycle. Furthermore, India's strict Extended Producer Responsibility (EPR) regulations are driving the industry towards a circular economy. For instance, laws requiring the use of recycled plastic content are boosting the demand for Post-Consumer Recycled (PCR) plastic. These regulations encourage collaboration among stakeholders to develop supportive infrastructure. Considering the current recycling capabilities and infrastructure, rigid plastics are in a strong position to achieve EPR targets in India.

5.3.2. Global Pharma Packaging Industry by Products

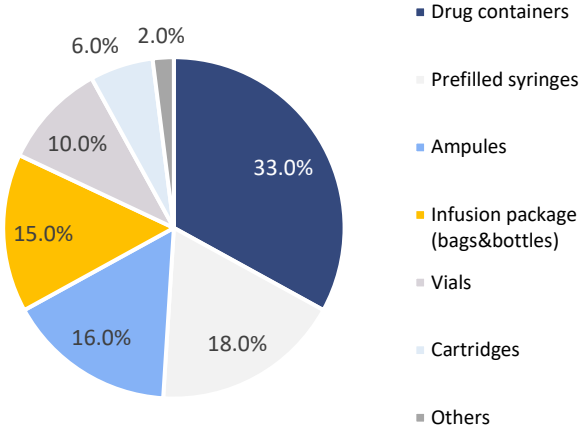
There are a variety of pharma packaging products such as drug containers, prefilled syringes, infusion packages, ampules, vials and cartridges. Among the products, drug container has the highest revenue share (35.0%) in 2024, followed by prefilled syringes (19.0%), ampules (14.0%), infusion package -bags and bottles (13.0%), vials (11.0%), and cartridges (6.0%). While the share of products such as drug containers and prefilled syringes is expected to drop from 2024 to 2029, the share of infusion packages is expected to raise from 13.0% in 2024 to 15.0% in 2029.

Exhibit 5.4A: Global Pharma Packaging market, share by products, 2024



Source: Frost & Sullivan

Exhibit 5.4B: Global Pharma Packaging market, share by products, 2029F

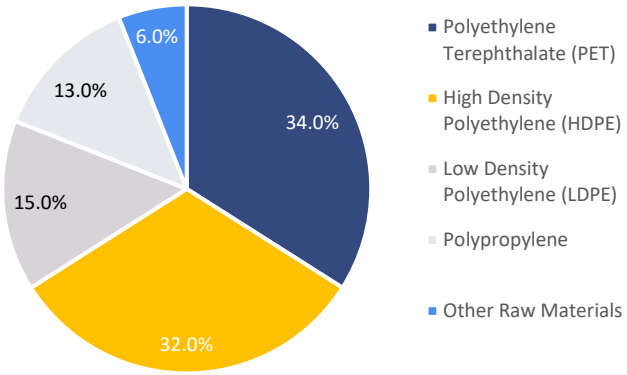


Source: Frost & Sullivan

5.3.3. Global Pharma Packaging Industry by Raw materials

The primary raw materials used in parenteral packaging are glass and polymers. The glass used in packaging is made from sodium carbonate, sand, and limestone. Rigid plastic packaging, which holds a significant share of the pharmaceutical packaging market, is made from durable materials such as polypropylene (PP), polyethylene terephthalate (PET), high-density polyethylene (HDPE), and polyvinyl chloride (PVC). The rigid packaging industry is vulnerable to fluctuations in raw material prices, particularly those of crude oil and natural gas, which have a major impact on production costs. Changes in crude oil prices, often driven by geopolitical tensions or market dynamics, directly affect the cost of petrochemical-based plastic resins. As a result, managing the volatility of raw material prices and ensuring a stable supply chain presents considerable challenges for industry players, ultimately affecting cost predictability and profitability. Flexible plastic packaging, on the other hand, is made from pliable plastic films or laminates, such as polyethylene (PE) and polypropylene (PP), often combined with aluminum foil or paper.

Exhibit 5.4: Rigid Pharma Packaging, Revenue share by raw material type, 2024



Source: Frost & Sullivan

- Polyethylene terephthalate (PET), is a popular material often used for rigid plastic packaging, and it is a polyester-based thermoplastic polymer derived from Polyethylene. It is considered one of the preferred packaging systems for injectable, solid oral formulations and liquid orals. It is commonly used due its light weight, durability against breakage, and easy recycling.

- High-density polyethylene (HDPE) is another widely utilized material in rigid plastic packaging. This material is extensively employed by the pharmaceutical sector for drug containers due to its excellent moisture barrier properties and resistance to most solvents, strong acids, and alkalis. HDPE is preferred for its durability, strength, and chemical resistance, making it a suitable packaging option for industries like pharmaceuticals and personal care. Similar to PET, HDPE can also be recycled, which supports sustainable packaging solutions.

- In pharmaceutical packaging, Low-density Polyethylene (LDPE) bags are considered a suitable and cost-effective solution to protect the products from outside conditions. it is highly resistant to acids, alcohols, bases, or esters and has good resistance toward aldehydes and ketones.

- Polypropylene (PP) is regarded for its multifunctionality and durability against chemicals and high temperatures. Its clear characteristics provide a view of the contents, and its excellent flexibility in production methods, like injection molding and thermoforming, establishes it as a top choice for rigid plastic packaging in many industries. Infusion solution bags serve as the primary packaging for infusion solutions and are created from polypropylene film. These bags are hermetically sealed to maintain the sterility of the solution inside.

5.3.4. KEY EMERGING TRENDS IN PHARMA PACKAGING INDUSTRY

1. Sustainability Initiatives- Pharmaceutical companies are adopting sustainable packaging solutions such as using recyclable materials, reducing packaging waste, and optimizing packaging design for resource efficiency to minimize environmental impact and meet regulatory requirements.

2. Single-Use Packaging- Single-use packaging formats such as pre-filled syringes, vials, and ampoules are gaining popularity due to their convenience, accuracy, and reduced risk of contamination. They are acknowledged for their ability to reduce drug wastage by preventing overfilling, eliminating dosing errors, and minimizing the risk of contamination. These packaging formats enhance patient safety and support the growing demand for self-administered medications and enable rapid drug delivery during emergencies.

3. Patient-Centric Packaging- As personalized medicine becomes more prevalent, there is a growing emphasis on patient-centric packaging designs that enhance medication adherence, ease of use, and patient safety. Packaging features such as easy-to-open blister packs, color-coded labelling, and clear dosage instructions help improve patient compliance and outcomes.

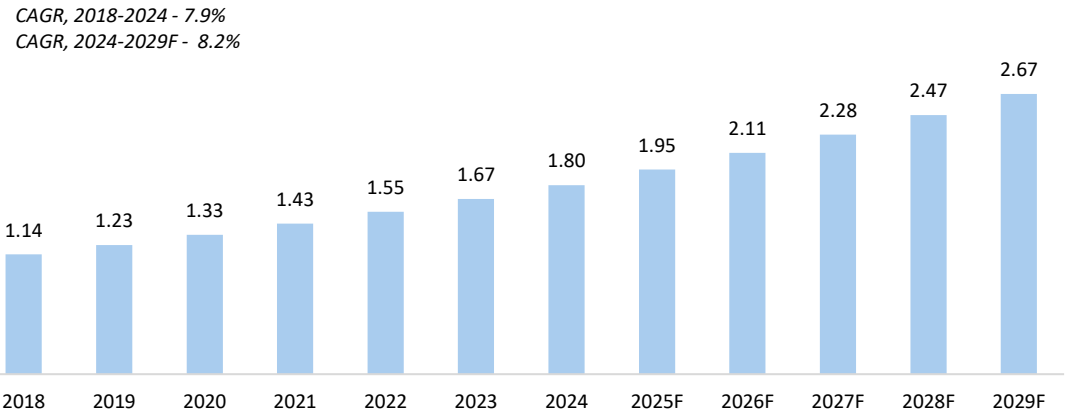
4. Anti-Counterfeiting Technologies- To ensure and enable authentication and verification of product authenticity throughout the supply chain, advanced anti-counterfeiting technologies such as holograms, covert markers, and digital watermarks are being integrated into pharmaceutical packaging to combat counterfeit drugs and protect brand integrity.

5. Child-Resistant and Smart Packaging- Integration of smart technologies such as RFID (Radio-Frequency Identification) tags, NFC (Near Field Communication), and QR codes enable pharmaceutical companies to track and trace products throughout the supply chain and facilitates patient engagement through features like medication reminders and dosage tracking. In addition to preventing accidental ingestion by children, pharmaceutical companies are increasingly using child-resistant closures and packaging designs to help reduce the risk of accidental ingestion by children and enhancing safety.

5.4. INDIAN PHARMA PACKAGING INDUSTRY

The Indian pharma packaging market is valued at USD 1.80 billion in 2024 and is projected to reach USD 2.67 billion by 2029. The market has historically grown at a CAGR of 7.9%. from 2018 to 2024. Due to the well-established pharmaceutical industry, rising investments in the sector, the expanding population, increasing health awareness, and rising life expectancy, the market for plastic pharmaceutical packaging solutions in India is anticipated to grow at a CAGR of 8.2% during the forecast period (2024 to 2029).

Exhibit 5.5: Indian Pharma packaging Market (USD Bn), 2018-2029F



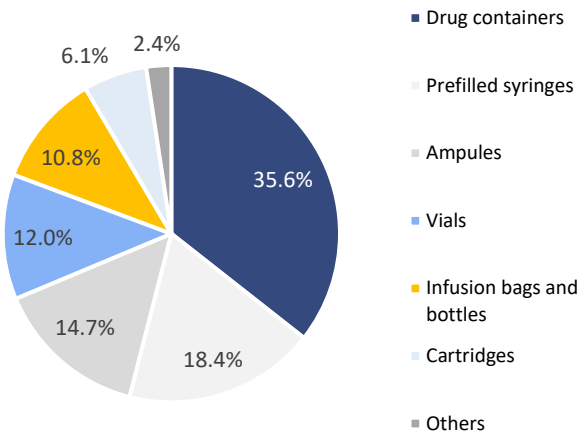
Source: Frost & Sullivan

Indian pharmaceutical market is valued at USD 65 billion in 2024 and it is estimated to touch USD 130 billion in 2030. Indian pharmaceutical industry ranks third in pharmaceutical production by volume, and it supplies over 50% of global demand for various vaccines, 40% of generic demand in the US and 25% of all medicine in the UK. India's drugs and pharmaceuticals exports stood at USD 27.82 billion in FY24 (April-March) and stands at USD 14.42 billion in FY25 (April-September). The domestic pharmaceutical industry includes a network of 3,000 drug companies and ~10,500 manufacturing units. India enjoys an important position in the global pharmaceuticals sector.[31] The growth in the Indian pharmaceutical industry will propel the pharma packaging industry as well.

Among the pharma packaging products in India, drug container has the highest revenue share (35.6%) in 2024, followed by prefilled syringes (18.4%), ampules (14.7%), vials (12.0%), infusion package -bags and bottles (10.8%), and cartridges (6.1%).

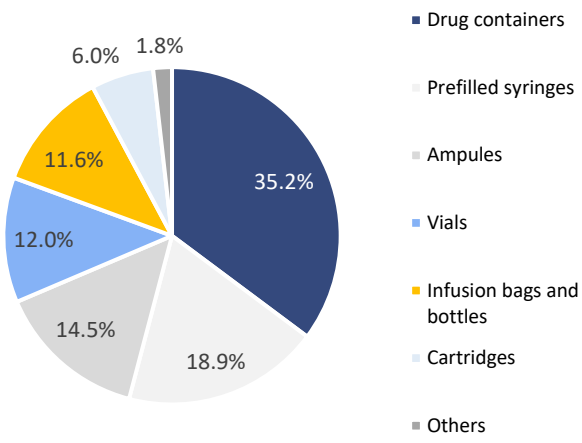
[31] IBEF

Exhibit 5.4A: Indian Pharma Packaging market, share by products, 2024



Source: Frost & Sullivan

Exhibit 5.4B: Indian Pharma Packaging market, share by products, 2029F

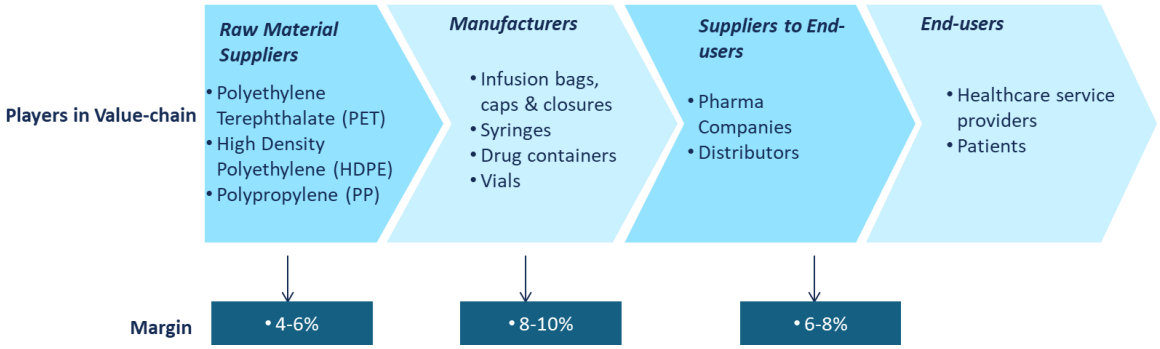


Source: Frost & Sullivan

5.4.1. Value Chain of Indian Pharma Packaging Industry

The Pharma packaging industry value chain comprises of raw material suppliers, manufacturers, suppliers to end-users and End-users. The raw material suppliers include raw material suppliers such as plastics. These materials include Polypropylene, Polyethylene, Terephthalate, Low-Density Polyethylene, High-Density Polyethylene, and more, providing basics of production for packaging purposes. The importance of raw materials in achieving competitiveness in the upstream portion of the value chain is growing year-by-year. The manufacturers of products develop appropriate packaging solutions from the raw materials by adhering to quality standards, and some manufacturers are involved in the production of both raw materials and products. Suppliers deliver finished products to end-users either without further processing or with processing such as filling with drugs. Most of the pharmaceutical manufacturing companies procure products such as drug containers, vials and infusion bags from manufacturers and supply it to end-users by filling it with drugs.

Exhibit 5.5: Participants in the value chain of Pharma packaging industry



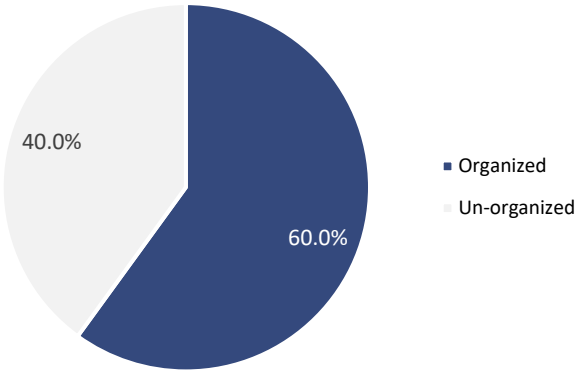
Source: Frost & Sullivan

Raw material suppliers for pharmaceutical packaging typically operate with slim profit margins of 4-6%. Bulk purchasing by manufacturers, while beneficial for cost control, can further squeeze these margins. The cost of producing pharmaceutical plastic packaging is heavily influenced by the price of

raw materials like polymers. Manufacturers, despite adding value and facing high operational costs, typically enjoy slightly higher profit margins of 8-10%. However, rising raw material costs directly impact their profitability, especially when they cannot pass these increased expenses onto customers. This creates opportunities for alternative packaging materials or suppliers that offer more cost-effective solutions. Suppliers, with profit margins of 6-8%, play a crucial role in efficiently delivering products to end-users through effective storage and logistics.

The Indian pharma packaging market is primarily dominated by organized players, holding roughly 60% of the market share. The remaining 40% is controlled by smaller, unorganized players. This industry is currently undergoing a significant shift, moving from a fragmented landscape towards a more consolidated structure with larger, organized players taking the lead. This presents a prime opportunity for these established players to further expand their market share by acquiring smaller, unorganized companies. This consolidation is driven by the advantages of economies of scale, access to cutting-edge technologies, and the need to comply with stricter regulations.

Exhibit 5.6: Indian Pharma Packaging market, Organized Vs. Unorganized, 2024



Source: Frost & Sullivan

5.4.2. Growing Exports from India

India is a major exporter of Pharma packaging products and medical consumables. While India imported 398 shipments of Pharma packaging products from March 2023 to February 2024, it exported 6,414 shipments from March 2023 to February 2024.[32] Notably, India became the net exporter of medical consumables in FY2024, where its exports surged by about 60% from USD 1.1 billion in FY2022 to USD 1.6 billion in FY2023. Whereas the imports of medical consumables declined by 27% in from USD 1.5 billion to USD 1.1 billion in the same period.

Table 5.2: Pharma Packaging products and Medical consumables, Export and Import shipments FY 2023-2024

Category	Total export shipments			Total import shipments		
	FY 2024	FY 2023	YoY Growth	FY 2024	FY 2023	YoY Growth
Pharma Packaging products	6,414	5,727	12.0%	398	386	3.0%
Medical consumables	1,781	1,054	69.0%	1,646	1,761	-7.0%

Source: Frost & Sullivan, Volza

5.4.3. Supply Chain Disruption and Impact of Raw Material Supply on Pharma Packaging

The pharmaceutical industry relies on complex global supply chains to manufacture and distribute medications to patients worldwide. Disruptions in these supply chains can have significant consequences, including drug shortages, increased costs, and compromised patient safety. Pharmaceutical packaging manufacturers play a crucial role in this process, ensuring that medications are safely and effectively delivered to patients. However, they are also vulnerable to supply chain disruptions.

Supply factors such as rising labour and energy costs, disruption in the supply of raw materials due to geo-political factors, and decreased concentration of suppliers could increase the price of raw materials for manufacturers. The rising cost of raw materials could impact the profit margins if the high cost is not passed on to customers downstream. However, significant price increases often allow packaging manufacturers to pass the costs onto other stakeholders in the value chain. The availability of raw materials at the optimal process enables manufacturers and distributors to achieve competitiveness. Often, organized and scaled pharma packaging manufacturers have bulk purchase agreements with raw material suppliers to offset the fluctuating cost of raw materials. Other measures by scaled manufacturers include, diversifying suppliers to reduce the risk, investing in technology to automate process and improve efficiency and maintaining a larger inventory of raw materials.

[32] Volza

5.4.4. KEY GROWTH DRIVERS OF INDIAN PHARMACEUTICAL PACKAGING INDUSTRY

1. Increasing Demand for Pharmaceuticals

The rising demand for pharmaceutical products in India is a significant driver of growth in the packaging sector. Factors contributing to this demand include:

Growing population: India, with a population exceeding 1.4 billion, is witnessing an increase in healthcare needs, particularly in chronic disease management and preventive care. This surge in demand for medications necessitates efficient and reliable packaging solutions to ensure product integrity and safety.

Healthcare awareness: Increased awareness of health issues and the importance of medication adherence among the population is driving the demand for pharmaceutical products, thereby boosting the need for effective packaging solutions that enhance usability and safety

2. Regulatory Compliance

Stringent regulatory requirements imposed by authorities such as the Drug Controller General of India (DCGI) and international bodies like the Food and Drug Administration (FDA) and European Medicines Agency (EMA) are compelling pharmaceutical companies to adopt advanced packaging solutions. Compliance with these regulations ensures product safety, traceability, and tamper-evidence, which are critical for maintaining consumer trust and market access

3. Technological Advancements

The integration of advanced technologies in pharmaceutical packaging is enhancing efficiency and safety. Key technological advancements driving growth include:

Smart packaging solutions: The adoption of smart packaging technologies, such as RFID and NFC, allows for real-time tracking and monitoring of pharmaceutical products throughout the supply chain. This ensures that medications are stored and transported under optimal conditions, thereby maintaining their efficacy.

Sustainable packaging innovations: The shift towards eco-friendly packaging materials, such as biodegradable plastics and recyclable solutions, is gaining momentum. This trend is driven by regulatory pressures and consumer demand for sustainable practices, leading to innovations that minimize environmental impact.

4. Growth of Biopharmaceuticals

The increasing focus on biopharmaceuticals is creating a demand for specialized packaging solutions that can maintain the stability and integrity of sensitive biologics. As the biopharmaceutical sector expands, packaging companies are required to innovate and develop solutions that cater to the unique needs of these products.

5. Rising Export Opportunities

India is one of the largest exporters of pharmaceuticals globally, supplying over 50% of Africa's generic needs and a significant portion of medicines to the United States and the United Kingdom.[33] The growth of the export market is driving demand for high-quality packaging solutions that comply

[33] Press Information Bureau, Government of India

with international standards, thereby enhancing the competitiveness of Indian pharmaceutical products in the global market.

6. Increased Investment in R&D

The Indian pharmaceutical industry is witnessing a surge in research and development (R&D) activities, leading to the introduction of innovative drugs and therapies. This trend necessitates advanced packaging solutions that can accommodate new drug delivery systems and ensure product safety and efficacy.

7. Focus on Patient-Centric Packaging

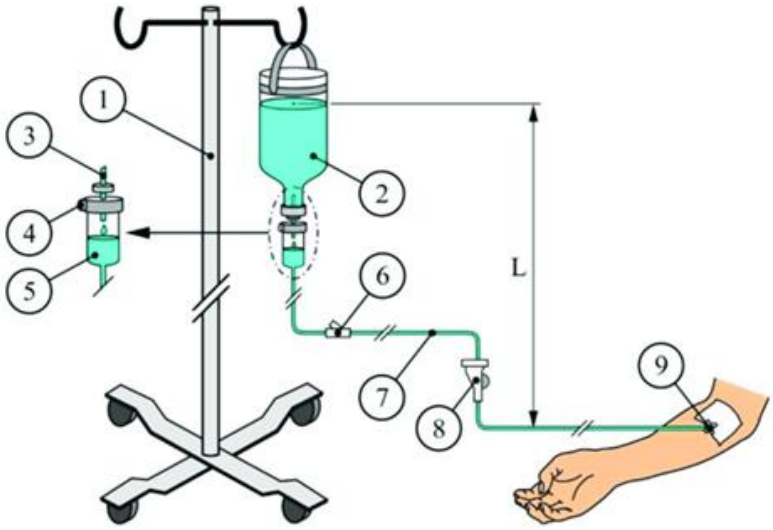
The trend towards personalized medicine is driving the need for customized packaging solutions that cater to individual patient needs. Pharmaceutical companies are increasingly developing packaging that enhances medication adherence and improves overall patient experience, thereby contributing to market growth.

6. INDIAN INTRA-VENOUS (IV) INFUSION PACKAGE MARKET

6.2. IMPORTANCE OF IV INFUSION THERAPY

IV infusion therapy is a versatile medical treatment used to deliver fluids, medications, and nutrients directly into the bloodstream. This bypasses the digestive system, allowing for faster absorption and more direct delivery to the body's tissues. This method ensures immediate therapeutic effects, making it essential for various medical conditions and wellness applications.

Exhibit 6.1: Schematic representation of Intra-venous (IV) fluid administration



Intravenous (IV) infusion therapy set: 1-pole/stand, 2-IV bottle/bag, 3-spike, 4-air valve, 5-drip chamber, 6-piggyback port, 7-IV tubing, 8-roller clamp, and 9-cannula.

Source: Oros, Dragana & Penčić, Marko & Šulc, et al, Applied Sciences. 11. 513-1–513. 10.3390/app11020513.

In India, the price of intravenous fluid packs are controlled by the National Pharmaceutical Pricing Authority, which sets ceiling prices for the packs.

6.2.1. KEY APPLICATIONS OF INFUSION THERAPY

Dehydration management: IV therapy is used to treat dehydration caused by illness, surgery, or severe diarrhea. Balanced solutions like crystalloids are preferred to maintain electrolyte balance and prevent complications such as fluid overload or renal dysfunction.

Post-Surgical recovery: Patients often experience dehydration and malnutrition after surgery. IV infusions provide hydration, electrolytes, and nutrients to aid tissue repair, accelerate healing, and reduce post-surgery pain.

Antibiotics administration: IV administration is crucial for treating severe infections, ensuring rapid and effective delivery of medications. This method allows precise control over dosage and timing, which is essential for managing infections and preventing antibiotic resistance**.**

Chemotherapy: Cancer patients undergoing chemotherapy may experience dehydration, nutrient deficiencies, or side effects. IV infusions can replenish fluids, vitamins (e.g., B12 and C), and provide anti-nausea medications to manage these issues.

Pain management: IV therapy is highly effective for acute pain management, delivering pain relief almost instantly compared to oral or other routes. This is particularly useful in postoperative settings or for severe, sudden pain.

Blood transfusions: IV therapy is essential for administering blood products, which is crucial in managing conditions like severe anemia, trauma, and surgical blood loss. Rapid and controlled delivery helps stabilize critical patients.

Nutrition support: IV therapy provides essential nutrients (e.g., vitamins, trace elements, electrolytes) to patients who cannot consume food orally. This is particularly important for patients with gastrointestinal disorders or those unable to eat due to medical conditions .

Immune Support: IV therapy can boost the immune system by delivering high concentrations of vitamins and minerals (e.g., vitamin C, zinc, B-complex vitamins) to help prevent infections and reduce the duration of illnesses .

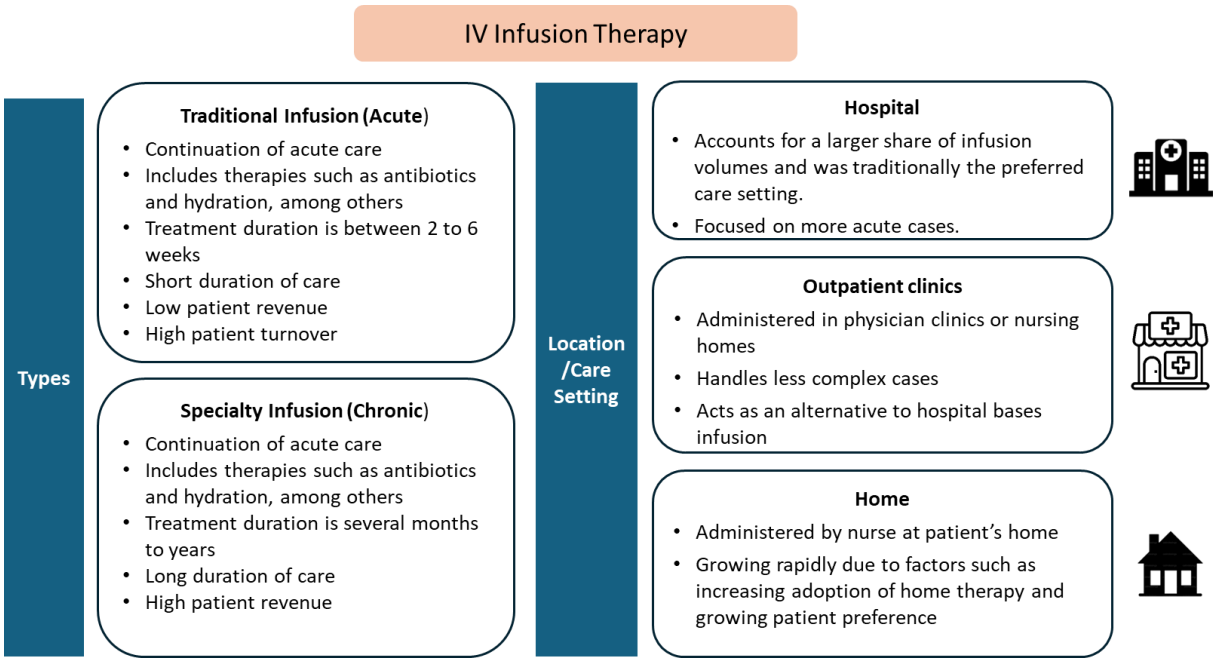
Chronic Fatigue Syndrome: IV infusions provide energy-boosting nutrients to combat fatigue and improve quality of life for patients with chronic conditions .

Cardiac Arrest: IV administration allows medications to quickly enter the bloodstream, providing immediate effects where rapid treatment is necessary .

6.2.2. INFUSION THERAPY TYPE AND CARE SETTING

Based on the type, infusion therapy is classified as traditional or acute infusion therapy and specialty or chronic infusion therapy. Traditional or acute infusion therapy are typically administered in hospital setting or specialty surgery centers, and is primarily used for short-term, acute conditions requiring rapid medication delivery. The applications of acute infusion therapy include antibiotics administration, pain management, dehydration therapy, trauma care and chemotherapy. Specialty or chronic infusion therapy are focused on long-term treatment of chronic conditions that require ongoing medication delivery, and they are increasingly being administered in home settings, outpatient centers, or specialty clinics. The applications of acute infusion therapy include cancer treatment, neurological disorders and autoimmune disorders.

Exhibit 6.2: Intra-venous Infusion therapy, Types and Care setting



Source: Harris Williams, Frost & Sullivan

6.2.3. Benefits of IV Infusion Therapy

- **Rapid Absorption:** Medications and nutrients enter the bloodstream quickly, providing immediate effects.

- **Full Bioavailability:** Bypassing the digestive system ensures that the entire dose reaches the bloodstream, making the treatment more effective.

- **Precise Control:** Accurate dosing is possible, which is crucial for medications with a narrow therapeutic window.

- **Continuous Delivery:** IV infusions can provide a steady supply of medication over time, maintaining consistent therapeutic levels in the blood .

6.3. PRODUCT DESCRIPTION AND KEY FEATURES OF IV INFUSION PACKAGE

IV infusion package (bags/bottles) are critical medical devices designed for the safe and sterile delivery of intravenous fluids, medications, and nutritional solutions directly into a patient's bloodstream. These package are manufactured using high-quality materials such as medical-grade polypropylene (PP), polyethylene (PE), or glass, ensuring durability, transparency, and compatibility with a wide range of parenteral liquids (e.g., glucose, saline, antibiotics, and nutrient solutions). IV bottles/bags are available in various sizes (50ml–100ml) and designs, including hanging hooks for easy administration and amber-colored coatings to protect light-sensitive medications. They are widely used in hospitals, clinics, and emergency care settings for fluid/electrolyte replacement, medication delivery, and nutritional support.

The production process involves fully automated systems, such as BFS (blow-fill-seal) technology or integrated washing-filling-sealing machines, which streamline manufacturing while maintaining sterility and precision. Key steps to manufacture IV Infusion package include:

- **Preform Injection:** Molding preforms for bottle formation.
- **Blow Molding:** Heating and shaping preforms into bottles with uniform dimensions.
- **Sterilization:** Using depyrogenation tunnels or nitrogen charging to eliminate contaminants.
- **Filling:** Precise liquid dispensing with automated controls.
- **Sealing:** Secure closure with caps or crimping mechanisms.

6.3.1. KEY FEATURES OF IV INFUSION PACKAGE (BAGS/BOTTLES)

An IV infusion package typically refers to a set of components used to administer fluids, medications, or blood products directly into a patient's vein. These packages are designed for single use and are sterile to prevent infection. Their key features, such as sterility, precise flow control, and ergonomic design, make them indispensable in various clinical settings.

- **Material quality:** Prepared from medical-grade raw materials such as Polypropylene or Polyethylene, lightweight, durable, recyclable, with low extractable and ash content, and complies with regulations such as FDA, EU MDR and ISO standards.
- **Sterility and safety:** IV infusion sets are individually packaged and sterilized to prevent infections and ensure patient safety. The materials used are medical-grade and comply with standards such as CE and ISO 13485. Automated production ensures minimal human intervention, reducing contamination risks. Nitrogen protection during filling maintains low oxygen levels and prevents microbial growth. Features like CIP/SIP (clean-in-place/sterilize-in-place) enable seamless sanitation.
- **Precision and consistency:** High-filling accuracy (±1.5%) and uniform bottle dimensions ensure reliable dosing. Built-in quality control systems guarantee compliance with regulatory standards.
- **Design flexibility:** Customizable sizes (50ml–500ml) and shapes (round/flat) to accommodate diverse medical needs. Hanging hooks and barrier coatings (e.g., amber colour) enhance

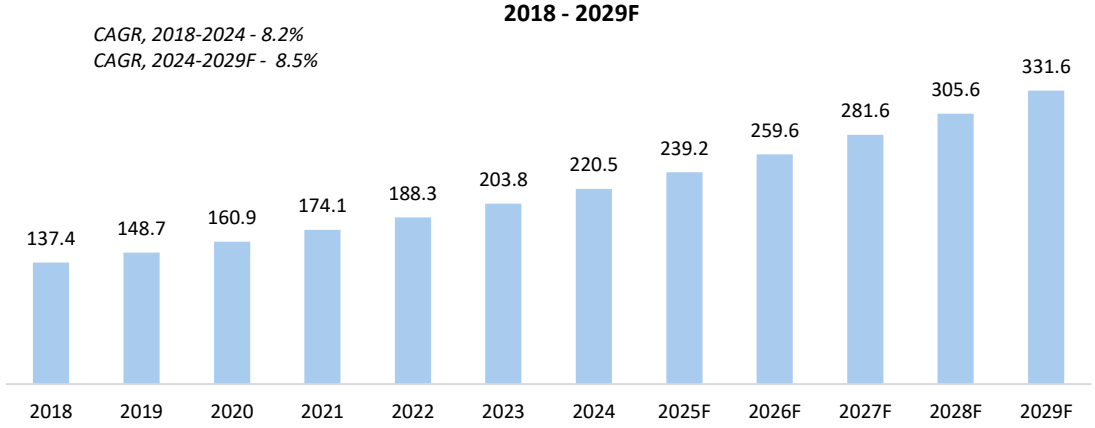
usability and protect sensitive drugs. The connectors are designed to be compatible with various IV bags and administration devices, ensuring seamless operation

- **Sustainability:** IV package is made of recyclable materials with green labelling to reduce environmental impact, aligning with global standards.

6.4. MARKET SIZE AND FORECAST OF IV INFUSION PACKAGE (BOTTLES AND BAGS), INDIA

The IV infusion package (Bottles and Bags) market in India is valued at USD 220.5 million in 2024, and it is expected to grow at a CAGR of 8.5% to reach USD 331.6 million in 2029. Increasing demand due to the growing number of hospitalizations, rising prevalence of chronic diseases, ageing population, adoption of acute care services at home and expansion of healthcare infrastructure in India are propelling the market. Further, there is increased participation of domestic companies, providing cost-effective solutions in the market.

Exhibit 6.4: Indian Infusion Package (Bottles and Bags) market size (USD Mn) and forecast, 2018 - 2029F



Source: Frost & Sullivan

IV infusion therapy demand is normally linked to the number of hospital beds. The demand is estimated to increase at a rate of 9.0% to 12.0% per annum. Areas with high population density and average temperatures are major consumption areas of I.V. fluids. Demand is high Uttar Pradesh, Rajasthan, Haryana, Bihar, Madhya Pradesh and West Bengal. North India alone accounts for one-third of the total demand in the country.[34]

There is a huge unmet need in terms of bed requirement in India which is an additional 2.4 million beds and this results in an increased need of IV fluid adoption per bed compared to countries such as the US, Australia and China.

Table 6.1. IV usage and bed requirement, select countries

Country	IV Fluid Usage per Bed per Year (in Liters)	Beds/1000 population	Gap as per WHO bed requirement/1000 population	Additional bed Requirement (in Mn)
US	~215	2.8	0.3	0.08
Australia	~143	2.5	0.5	0.01

[34] Entrepreneurindia

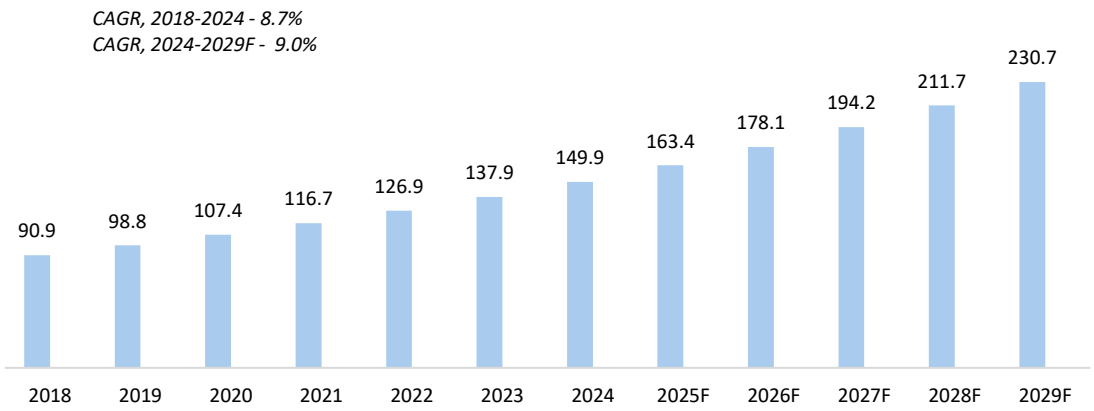
India	**~108**	**1.3**	**1.7**	**2.4**
China	~62	6.9	-3.9	-5.5

Source: WHO, journal articles, Frost & Sullivan

6.5. MARKET SIZE AND FORECAST OF IV INFUSION BOTTLES, INDIA

The IV infusion bottles market in India is valued at USD 149.9 million in 2024, and it is expected to grow at a CAGR of 9.0% to reach USD 230.7 million in 2029.

Exhibit 6.5: Indian Infusion bottles market size (USD Mn) and forecast , 2018 - 2029F



Source: Frost & Sullivan

Among the infusion package materials, bottles has a higher share of about 85% and PVC bags has a share of about 15% in 2024. While PVC bags offer convenience, concerns about plasticizer leaching and drug interactions have led to increased preference for glass bottles and the development of non-PVC plastic alternatives.

Benefits of Glass Packaging in Infusion:

Glass has been a traditional choice for packaging IV solutions due to its inertness, transparency, and stability.

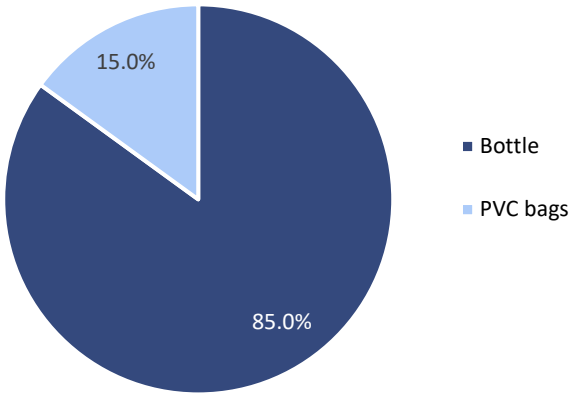
Chemical Inertness: Glass is chemically inert, ensuring compatibility with a wide range of IV solutions, including saline, dextrose, and medications. It minimizes the risk of leaching or interaction between the container and its contents, preserving the purity and efficacy of the solution.

Transparency: Glass bottles offer excellent transparency, allowing healthcare professionals to visually inspect the solution for clarity, particulate matter, or discoloration. This transparency facilitates quality control and ensures the integrity of the IV solution.

Rigidity: Glass bottles are rigid and robust, providing structural integrity and protection to the IV solution during handling, transportation, and storage. They are less prone to deformation or damage compared to plastic containers.

Recyclability: Environmental concerns also favor the use of bottles over PVC bags. Glass is highly recyclable and offers significant sustainability advantages when properly recycled.

Exhibit 6.5: Split of Indian IV Infusion package market by material type, 2024



Source: Frost & Sullivan

In India, the leading suppliers of Infusion bottles are Aculife Healthcare, Amanta Healthcare, Axa Parentarels, B. Braun Medical India Pvt Ltd and Denis Chem Lab Ltd. In addition to supplying to domestic market, the companies export the bottles to multiple countries.

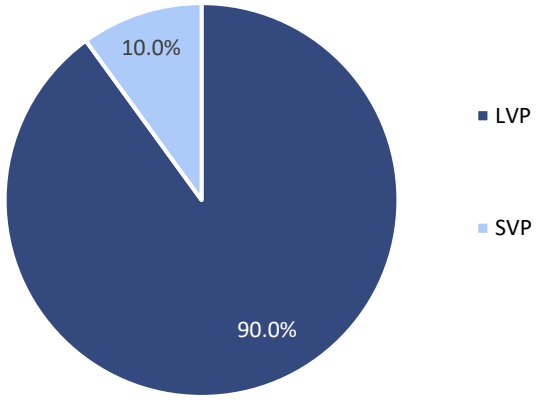
6.5.1. Type of Infusion Solutions – Large Volume Parenteral and Small Volume Parenteral Solutions

Based on the volume of infusion solution, it is categorized as Large- volume parenteral solutions (LVPs) and Small- volume parenteral solutions (SVPs).

- Large-volume parenteral solutions (LVPs) typically refer to parenteral solutions with a volume exceeding 100 ml per container and packed in bottles. Common types include glucose injection, sodium chloride injection, glucose and sodium chloride injection, and compound sodium chloride injection. Examples are 0.9% Sodium Chloride for Injection and 5% Dextrose for Injection. LVP can be administered through multiple routes, including direct injection into the blood, open body cavities, and surgical areas.

- Small-volume parenteral solutions (SVPs) refer to parenteral solutions with a volume below 100 ml per container. These solutions often contain active pharmaceutical ingredients (APIs), which are used for medication delivery and are intended for intermittent intravenous administration (usually defined as an infusion time not lasting longer than 6-8 hours). SVP are mainly packaged in vial, ampoule or pre-filled syringe. Examples include injections of antibiotics, vitamins, and anti-tumor drugs.

Exhibit 6.6: Split of Indian IV bottles by type of Parenteral solution, 2024

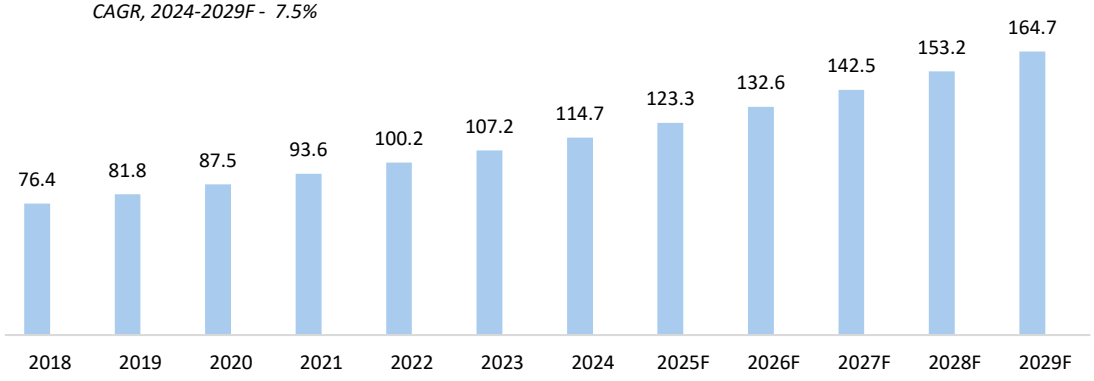


Source: Frost & Sullivan

- LVP makes up a major share of the infusion bottle market with about 90% share. While the LVP solutions are packed in bottles, the SVP solutions are mostly packed in vials, ampoules or pre-filled syringes compared to bottles. The LVP market in India is expected to grow from 114.7 Mn in 2014 to 164.7 Mn in 2029 at a CAGR of 7.5%.

Exhibit 6.7: Large Volume Parenteral bottle market size (USD Mn) and forecast , 2018 - 2029F

CAGR, 2018-2024 - 7.0%
CAGR, 2024-2029F - 7.5%



Source: Frost & Sullivan

6.5.2. Growth Drivers of Large Volume Parenteral Solution Market

The large-volume parenteral (LVP) solution market is experiencing significant growth, driven by several key factors:

Requirement of nutritional support during pregnancy

LVPs play a crucial role in providing nutritional support and fluid replacement for pregnant women. For instance, severe malnutrition in pregnant women is associated with intrauterine growth restriction, preterm delivery, congenital malformations, low birth weight, and perinatal mortality. Parenteral nutrition is recommended for pregnant women whose nutritional needs cannot be met through oral or enteral intake. LVPs are increasingly adopted as part of total parenteral nutrition to maintain or restore optimal nutritional status for mothers and fetuses.

Unique benefits offered by LVP Solutions

LVPs offer advantages such as faster drug administration, lower postoperative inflammatory responses, reduced infection rates, improved postsurgical immune competence, adequate nutrient supply, and shorter hospital stays. These benefits make LVPs a preferred choice for patients and healthcare providers, driving market growth.

Growing Number of Hospital Admissions and Surgical Procedures

The global increase in hospital admissions and surgical procedures has driven demand for LVP solutions. Most surgical interventions require fluid and electrolyte management, with LVPs playing a critical role in preoperative and postoperative care. For instance, during surgeries, LVPs are used to replenish fluids and electrolytes, stabilize blood pressure, and maintain acid-base balance. Their demand is particularly high in intensive care units (ICUs) and postoperative recovery wards.

Expansion of Home Healthcare Services

The growing scope of home healthcare services has increased the demand for portable, user-friendly LVP products suitable for home care settings. More patients require IV therapies at home, and LVP solutions meet this need by providing safe and effective treatment. The expanding geriatric population, which often suffers from chronic diseases and limited mobility, is driving the adoption of home healthcare services. In India, the elderly population (aged 60 and above) is projected to increase from 138 million in 2021 to 194 million by 2031. Home care services that administer doses to elderly patients are on the rise, further boosting the demand for LVP solutions.

Increasing Prevalence of Chronic Diseases

The rising incidence of chronic diseases such as diabetes, cancer, and cardiovascular conditions has led to greater reliance on LVP products. These conditions often require long-term intravenous (IV) therapy or nutritional support with hydration. For example, according to the Department of Biotechnology of the Government of India, non-communicable diseases account for 53% of overall deaths and 44% of disability-adjusted life years lost. Additionally, India has approximately 77 million people with diabetes, a number projected to reach 134 million by 2045. Chronic disease patients often depend on LVP solutions for effective disease management and recovery.

6.5.3. MANUFACTURING OF LARGE VOLUME PARENTERAL SOLUTION MARKET

LVPs are available in various volume ranges, including 100–250 ml, 250–500 ml, 500–1000 ml, 1000–2000 ml, and over 2000 ml. Different volume specifications cater to diverse clinical needs. For instance, smaller volumes (100–250 mL) are suitable for short-term fluid replacement or medication administration, while larger volumes (1000–2000 ml or more) are primarily used for extensive fluid resuscitation, nutritional support, and other applications.

The LVP solutions are available in plastic bottles, glass bottles and soft PVC bags. Among these, plastic bottles hold more share due to their advantages of being lightweight, durable, and easy to transport and use. There is a growing focus on developing more advanced and safer packaging materials for LVP bottles. For instance, non-PVC soft bags are increasingly being adopted as alternatives to traditional PVC materials due to their better safety and environmental performance.

Blow-Fill-Seal (BFS) Technology is an advanced aseptic technology for efficiently producing LVP containers such as bottles and bags. It enables compact and fast production of LVP containers ranging from 50 to 1000 ml. BFS technology continues to evolve, improving production efficiency and product quality. Additionally, the development of single-use technologies and high-concentration formulations is driving the LVP market forward

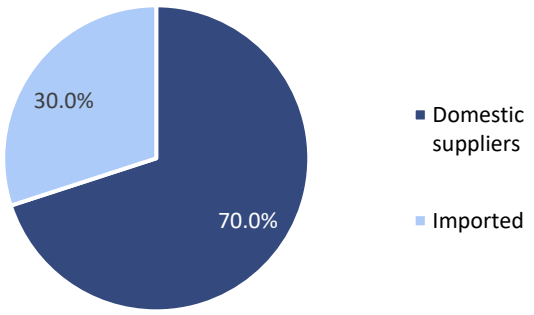
LVP bottles are usually packaged in quantities ranging from 100 ml to 1 litre. The packaging materials must meet pharmaceutical standards, ensuring sterility and pyrogen-free quality. The bottles are sterilized using methods such as autoclaving to ensure they are free of microorganisms and pyrogens.

The production of LVPs requires strict compliance with Good Manufacturing Practices (GMP) standards to ensure sterility and pyrogen-free quality. Common manufacturing processes include blow-fill-seal (BFS) technology, which integrates container molding, solution filling, and sealing in a single step under aseptic conditions. This technology improves production efficiency and product quality.

6.6. SUPPLY OF INFUSION BOTTLE, DOMESTIC PRODUCTION AND IMPORTS

The IV infusion bottle market in India is a mix of domestic production and imports, with domestic manufacturers playing an increasingly significant role. About 70% share of the market is dominated by domestic suppliers and 30% is imported by international brands. However, imports remain crucial for meeting the demand for high-quality and specialized products. While a sizeable portion is domestically produced, some specialized or high-quality IV infusion bottles are still imported from multinational pharmaceutical companies, particularly for critical care settings. Domestic manufacturers often have a cost advantage, allowing them to offer more affordable IV infusion bottles. The growing healthcare infrastructure and government initiatives to promote domestic manufacturing are expected to further boost the production of IV infusion bags in India, reducing the dependency on imports over time. Domestic manufacturers in India produce a substantial portion of the IV infusion bags used in the country. The growth of the domestic healthcare industry and the increasing focus on self-reliance have boosted the production of IV infusion bags locally.

Exhibit 6.8: Split of Indian IV Infusion bottle market by domestic and imported, 2024



Source: Frost & Sullivan

India exports a variety of intravenous (IV) infusion products, including saline solutions, dextrose solutions, nutrient-rich IV fluids, and various types of infusion sets, with major exporters being pharmaceutical companies manufacturing sterile medical disposables, primarily targeting markets overseas where there is a demand for affordable IV fluids. India leads the world in intravenous infusion exports followed by China and Vietnam.[35] India exports infusion products to countries in Africa, Southeast Asia, Middle-east and Latin America. The year of 2024 accounted for the highest amount of intravenous infusion exports. Total 22 shipments weighing 394 Tons were exported in the year 2024. Otsuka pharmaceutical, Aculife healthcare and Fresenius Kabi account for 70% of India's total intravenous infusion exports.[36]

[35] Volza
[36] Zauba

6.6.1. KEY FACTORS DRIVING INDIA'S IV INFUSION BOTTLE EXPORTS

1. Cost Advantage

- Low-cost labour and manufacturing Costs: India's relatively lower labour costs and its ability to produce high-quality IV bags at lower prices compared to competitors like China and the U.S. attracts buyers.
- Economies of scale: A large domestic market allows manufacturers to refine products and achieve cost efficiencies, supporting competitive pricing for exports.

2. Favorable Government Policies

- Production Linked Incentive (PLI) Scheme: Government incentives encourage domestic manufacturing, enhancing production capacity and export potential.
- Regulatory reforms: Improved compliance with international quality standards (e.g., ISO, CE) and safety norms boost market credibility.

3. Technological Advancements

- Shift to Non-PVC Materials: Eco-friendly alternatives (e.g., glass bottles) to address global concerns about PVC toxicity, aligning with sustainability trends.
- Innovative designs: User-friendly, portable, and smart IV bags (e.g., with RFID tags) cater to evolving healthcare needs.

4. Global Demand Drivers

- Rising chronic diseases and ageing population: Increased demand for IV therapy due to the growing prevalence of chronic diseases such as cardiovascular diseases, cancer, and diabetes.
- Surgical procedure growth: Higher demand for IV bags in perioperative care due to the increasing number of traditional and minimally invasive surgeries
- Home Healthcare expansion: Portable IV bags for home care are gaining traction in emerging markets due to increased adoption of home healthcare services for acute conditions.

5. Strategic Partnerships

- Collaborations with global Firms: Partnerships with multinational companies enhance market reach and technological capabilities.
- **Established manufacturing hubs:** Pharma and medical consumable manufacturing clusters across multiple states create a favourable ecosystem for manufacturing and partnerships

6. Pandemic Impact

- COVID-19 Surge: Increased demand for IV therapy during the pandemic accelerated exports, highlighting India's role in global healthcare supply chains.

6.7. IV INFUSION THERAPY TRENDS

The IV infusion therapy market is undergoing significant transformations driven by technological advancements, changing healthcare needs, and evolving patient preferences. Key trends such as the growth in alternative care settings, technological innovations, and a focus on patient safety are shaping the future of IV therapy. These trends are expected to enhance patient outcomes, improve treatment efficiency, and drive market growth in the coming years.

1. Growth in Alternative Care Settings

Transition to Specialized Clinics and Home Care:

There is a growing trend of shifting IV therapy procedures from traditional hospital settings to alternative care settings such as specialty clinics, surgical centers, and home care environments. This shift is driven by the desire for more convenient and cost-effective treatment options.

Home care reduces the risk of cross-contamination and allows patients to receive treatment in the comfort of their own homes, improving their quality of life .

Mobile and Versatile IV Options:

The demand for mobile IV options is increasing, enabling patients to receive treatment "on the go" whether in hospitals, at home, or even outdoors. This aligns with the concept of early mobilization, which is a crucial component of enhanced recovery after surgery (ERAS) protocols .

2. Technological Advancements

Smart Infusion Pumps and Connectivity:

The development of smart infusion pumps and connected medical devices is a significant trend. These devices provide real-time data and alerts, improving patient safety and treatment efficiency. Connectivity between infusion pumps and Electronic Medical Records (EMRs) allows for automatic verification of drug prescriptions, reducing the risk of medication errors. Central dashboards use data from connected devices to monitor treatment status, manage patient flows, and optimize staff scheduling .

Nanoparticle-Based IV Solutions:

New formulations of IV solutions are being developed to improve efficacy and reduce side effects. For example, nanoparticle-based IV solutions are being explored for their potential to enhance drug delivery and targeting .

3. Rising Demand for Chronic Disease Treatment

Growing Prevalence of Chronic Diseases:

The increasing prevalence of chronic diseases such as cancer, diabetes, and autoimmune diseases is driving the demand for IV therapy. These conditions often require long-term medication and monitoring, making IV therapy a critical treatment option.

Aging Population:

The aging baby boomer population is contributing to the growth of the IV therapy market, as older adults are more likely to require hospitalization and IV treatment.

4. Focus on Patient Safety and Infection Control

Needleless Administration Systems:

The demand for needleless administration systems is increasing to reduce the risk of needlestick injuries and improve patient safety. These systems also help minimize the risk of infection.

Antimicrobial Coatings:

Central venous catheters (CVCs) with antimicrobial coatings are gaining popularity due to their ability to reduce the risk of infection in patients requiring long-term indwelling catheters.

5. Personalized and Preventative Healthcare

Personalized Medicine:

The trend toward personalized medicine is driving the adoption of IV therapy for wellness supplements, vitamin infusions, and hydration. Patients are increasingly seeking treatments that preserve health and prevent future ailments .IV therapy's adaptable approach to health maintenance is increasing its acceptance and uptake among consumers.

Preventative Healthcare:

Consumers are becoming more conscious of maintaining hydration and nutrient levels, leading to a growing demand for IV hydration therapy for wellness purposes.

6. Market expansion and competition

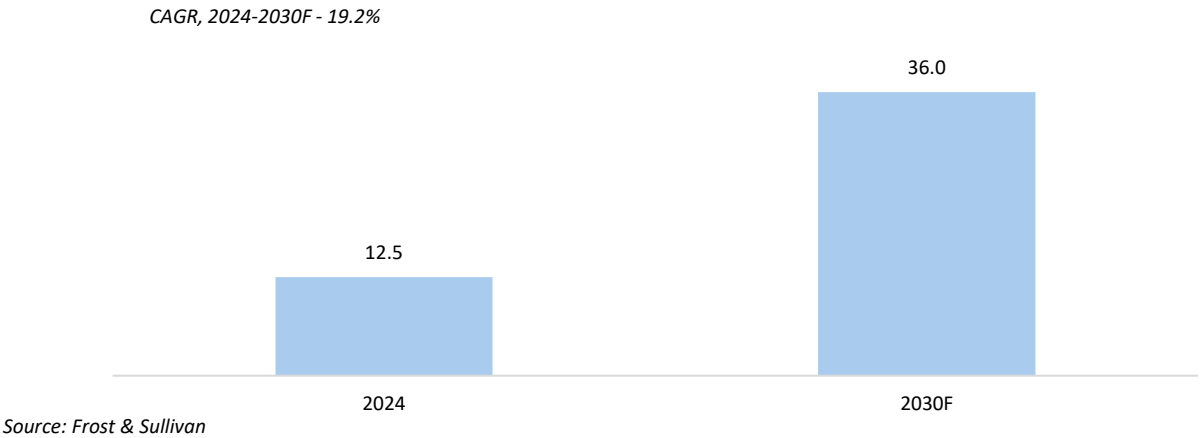
Growth in Emerging Markets:

The Asia-Pacific region such as China and India are expected to be the fastest-growing market for IV therapy and vein access devices, driven by the demand for advanced technologies, increasing disease burden and patient population, and the increasing prevalence of chronic diseases such as kidney disorders and diabetes.

6.8. GROWTH OF HOME HEALTHCARE MARKET AND DEMAND FOR IV THERAPY

Indian Home Healthcare has evolved and grown to a USD 12.5 billion market in 2024. This segment is expected to grow to a USD 36.0 billion market by 2030. The growth of India's home care market is a key catalyst for the adoption of IV infusion therapy. Factors such as the rising prevalence of chronic diseases, technological advancements, cost-effectiveness, and pandemic-driven shifts toward home care are reshaping the healthcare landscape. As the market continues to expand, IV therapy will play a critical role in providing convenient, safe, and personalized treatment options for patients in India.

Exhibit 6.9: Indian Home Healthcare Market (USD Bn), 2024-2030F



Source: Frost & Sullivan

Home healthcare is increasingly preferred, promoted, and incentivized worldwide due to its cost-effectiveness and extensive reach. Similarly, the home care sector in India has evolved, demonstrating the capacity to deliver reliable, digitally enabled, and advanced care at home. This industry is one of the fastest-growing segments of healthcare and has the potential to develop into a hyper-scaled care delivery model. With the adoption of digital and virtual care technologies, home healthcare can now provide acute and critical care in various locations.

In India, numerous home healthcare providers offer services across preventive, promotive, chronic, acute, rehabilitative, and palliative care, all within the comfort of the patient's home. By 2050, India's elderly population is expected to triple, accounting for 20% of the country's total population. Historically, 60–80% of the demand for home care has come from senior citizens seeking long-term supportive care at home. However, the second wave of the COVID-19 pandemic has highlighted the importance of Indian home healthcare as a robust support system within the healthcare continuum, enabling the delivery of advanced and safe care at home. The pandemic has opened new avenues for care delivery, allowing health seekers to access specialized healthcare tailored to their specific needs on demand, and making these services available outside traditional medical institutions.

Demand drivers for Home based care services in India propelling home infusion adoption

The home healthcare market in India is experiencing significant growth, driven by a confluence of factors including demographic shifts, technological advancements, and changing consumer preferences. Below are the key demand drivers shaping the expansion of this sector:

1. Aging Population and Rising Chronic Diseases

Demographic shift: India's aging population is a major driver of the home healthcare market. The elderly population is projected to reach more than 300 million by 2050, accounting for 20% of the national population. This demographic shift has increased the demand for personalized home care services, especially for seniors with mobility issues and chronic health conditions.

Chronic disease prevalence: The rising incidence of chronic diseases such as diabetes, hypertension, arthritis, and cardiovascular diseases has further fueled the demand for home healthcare. Approximately 70% of seniors in India have at least one chronic disease, necessitating ongoing medical attention and care .

2. Technological Advancements

Portable and user-friendly devices: Technological innovations have made healthcare devices more portable, user-friendly, and convenient for patients. These advancements enable high-quality care to be delivered in the comfort of patients' homes, enhancing the appeal of home healthcare services .

Telemedicine and remote monitoring: The integration of telemedicine and remote monitoring technologies has significantly improved the quality and accessibility of home healthcare. These tools allow healthcare providers to monitor patients' vital signs and health status in real-time, ensuring timely interventions and reducing the need for frequent hospital visits .

3. Cost-Effectiveness and convenience

Reduced healthcare costs: Home healthcare is significantly more cost-effective than traditional hospital care. Patients can save 10% to 25% on overall medical treatment costs by opting for home-based care. For instance, setting up an ICU facility at home costs between USD 95 and USD 125 per day, compared to USD 450 to USD 650 per day in a hospital ICU .

Convenience and comfort: Home healthcare allows patients to receive treatment in a familiar and comfortable environment, reducing the stress and inconvenience associated with hospital stays. This is particularly beneficial for patients with mobility issues or those who require long-term care .

4. Shift in consumer preferences

Preference for Home-based care: There is a growing trend among urban families to prefer home healthcare for its convenience and personal touch. Busy lifestyles and nuclear family structures have reduced the availability of caregivers, increasing the demand for professional in-home care services .

Focus on preventative care: The rising awareness of preventative healthcare has led to increased demand for at-home health checkups and wellness programs. This shift toward patient-centered care is driving the growth of the home healthcare market .

5. Government initiatives and policies

Accessibility and affordability: Government initiatives aimed at making healthcare more accessible and affordable are further boosting the home healthcare sector. Policies that promote home-based care and digital health technologies are creating a favorable environment for market growth .

Health insurance penetration: While health insurance penetration in India is still low, it is gradually increasing. Improved insurance coverage for home healthcare services is expected to drive further adoption .

6. Impact of the COVID-19 Pandemic

Minimizing exposure to healthcare facilities: The COVID-19 pandemic accelerated the adoption of home healthcare as patients sought to minimize their exposure to hospitals and medical facilities. Lockdowns and movement restrictions increased the need for medical care at home, further driving the demand for home healthcare services .

7. Urbanization and lifestyle changes

Urban lifestyle: Urbanization and changing lifestyles have led to increased demand for convenient and reliable healthcare services. Home healthcare provides a solution that fits well with the busy schedules of urban families .

Nuclear family structure: The growth of nuclear families has reduced the availability of traditional caregivers, increasing the need for professional home care services. Providers are now offering specialized services such as geriatric care and rehabilitation to meet this demand.

6.9. OVERVIEW OF INFUSION BAGS MANUFACTURING

The increasing use of injections for delivering drugs, liquid substances, and other nutritional products directly into the bodies of patients who are weak, and have difficulty in swallowing or absorption of nutrients, is the major factor augmenting the demand for infusion bags. The ease of availability and affordability of intravenous bags have made them widely preferred packaging solutions. Various countries across the world, have limited capacity in terms of procuring infusion pumps for intravenous therapy, due to which, the demand for IV bags is on the rise, globally.

An increase in research and development efforts and innovations in intravenous and blood bags is expected to positively influence the growth of the medical fluid bags market. Medical facilities such as hospitals, clinics, and homecare environments choose medical fluid bags that comply with regulatory packaging standards (e.g. US FDA and EU MDR). Consequently, the rising use of medical fluid bags for accurate body fluid collection and storage during various biomedical procedures will drive market expansion in the coming years. The IV infusion bag market is evolving rapidly, driven by advancements in materials science, technology, and sustainability efforts. Manufacturers are embracing trends such as eco-friendly materials, smart technology, and customization to meet the changing needs of healthcare providers and patients. By focusing on innovation, sustainability, and collaboration, IV infusion bag manufacturers are playing a crucial role in improving patient care and shaping the future of healthcare.

1. Shift to eco-friendly materials

Non-PVC alternatives: Traditional PVC-based IV bags are being replaced by non-PVC materials such as polypropylene (PP), polyethylene (PE), and ethylene-vinyl acetate (EVA). These alternatives are more environmentally friendly and eliminate harmful chemicals like DEHP (diethylhexyl phthalate), which is commonly found in PVC.

Biodegradable materials
Manufacturers are developing biodegradable IV bags to reduce medical waste. These eco-friendly alternatives align with the growing push for sustainability in healthcare.

2. Advancements in packaging and materials

Multi-layered IV bags: Recent advancements include multi-layered IV bags that offer superior protection against contamination and leakage. These bags ensure the stability of intravenous solutions during storage and transportation.

Tamper-evident seals and ergonomic designs: Manufacturers have introduced tamper-evident seals and ergonomic designs to improve user convenience and safety. Such features cater to the growing demand for reliable and efficient products in the market.

3. Customization and personalization

Tailored solutions: Healthcare providers are increasingly seeking IV bags that can be tailored to specific patient needs. Customization can include adjusting the volume, adding specific medications or electrolytes, or providing unique labelling to meet regulatory and hospital requirements.

Specialized packaging: Pediatric and geriatric patients benefit from tailored intravenous therapies stored in customized packaging. These innovations not only address specific medical needs but also contribute to the overall growth of the IV fluid market.

4. Technological innovations

AI and automation: Artificial intelligence (AI) and automation have revolutionized IV fluid manufacturing by enhancing efficiency and precision. Automated systems streamline production processes, reducing human error and ensuring consistent quality.

Smart IV bags: The integration of smart technologies, such as RFID tags and sensors, in IV fluid bags allows for improved inventory management, tracking, and monitoring of bag contents. This enhances patient safety and efficiency.

5. Lightweight and portable designs

Home and ambulatory Care: With the rise of home healthcare and ambulatory care services, there is an increasing demand for lightweight and portable IV bags that are easy to transport and store. Traditional glass bottles and bulky containers are being replaced by flexible, compact IV bags that are more convenient for patients and caregivers.

User-Friendly Features: Manufacturers are developing IV bags with built-in safety features that prevent accidental spills or leaks, making them easier to handle and reducing the risk of errors during administration.

6. Regulatory compliance and quality control

Stringent standards: The manufacturing and marketing of IV fluid bags are subject to stringent regulations, including compliance with quality standards and safety norms. Meeting these regulatory requirements is crucial for market players.

Quality Management Systems: Implementing robust quality management systems and adhering to regulatory guidelines enhances patient safety and trust. Manufacturers are adapting to these regulatory requirements to ensure compliance and maintain market credibility.

7. Market Expansion and strategic partnerships

Emerging markets: The healthcare infrastructure in emerging markets is rapidly developing, presenting significant growth opportunities for the IV fluid bags market. As access to healthcare improves and medical facilities expand, the demand for IV fluid bags is expected to rise in these regions.

Collaborations and partnerships: Companies in the IV fluid bags market have formed strategic collaborations and partnerships to enhance their product portfolios, expand their market reach, and leverage each other's expertise.

6.9.1. Overview of Raw Material Trends

The plastic packaging industry is facing a significant rise in the prices of plastic materials, largely due to increased raw material costs. This surge has led to higher costs for finished products, with the market experiencing greater demand than supply due to limited raw materials. Cost inflation is broad-based, affecting raw materials, labor, distribution, and energy. In particular, rising prices of plastic resins increase production costs for IV infusion bags. Manufacturers may struggle to maintain profit margins if they cannot pass these costs onto customers, potentially leading to reduced investments in innovation and growth. Energy costs are also a concern for polymer manufacturers, as the packaging sector is energy-intensive. Disruptions in the supply of polypropylene (PP) and polyethylene (PE) from Russia, following the invasion of Ukraine, further contribute to rising raw material prices. As a result, IV infusion bag manufacturers face challenges in a highly competitive market where pricing is essential.

The key raw materials used to manufacture infusion packages mainly include medical-grade polypropylene (PP) and polyethylene (PE). The material composition of IV bags plays a critical role in patient safety, drug compatibility, and environmental responsibility. While PVC-based IV bags remain widely used due to their affordability, non-PVC alternatives like EVA, polypropylene, and copolyester ether are gaining popularity due to their reduced health risks and improved sustainability. As healthcare facilities continue to prioritize patient safety and environmental responsibility, demand for DEHP-free and eco-friendly IV bags is expected to rise.

6.9.1.1. BENEFITS OF POLYPROPYLENE (PP) AND PRICE TRENDS

Polypropylene remains a critical material in the manufacturing of IV infusion bags due to its mechanical properties, chemical resistance, and cost-effectiveness.

- **Characteristics**: Polypropylene-based IV bags are sterile, durable, and autoclavable, making them suitable for a wide range of medical applications. They have high heat resistance, allowing for autoclave sterilization, and do not require plasticizers, reducing contamination risks

- **Applications**: Polypropylene is increasingly used for IV and parenteral nutrition bags due to its strong chemical compatibility with various IV solutions

The price of polypropylene has shown significant fluctuations in recent quarters, driven by factors such as feedstock costs, geopolitical tensions, and supply-demand dynamics. Understanding these trends is essential for manufacturers and healthcare providers to manage costs and ensure the availability of high-quality IV infusion bags.

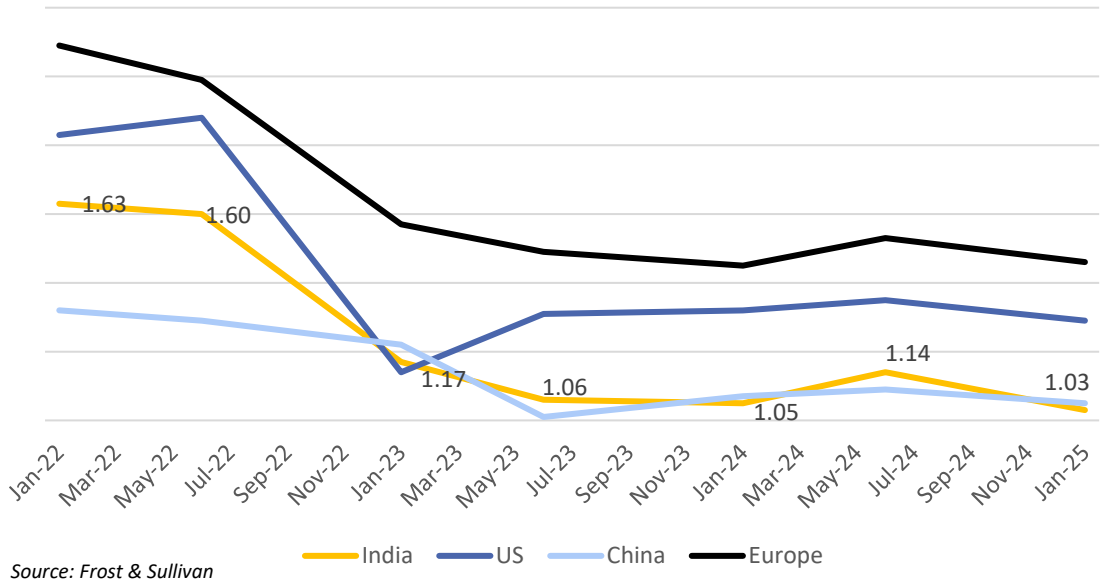
Factors influencing price trends

- **Feedstock Costs**: Fluctuations in the prices of crude oil and propylene, key feedstocks for polypropylene production, have a significant impact on PP prices.
- **Geopolitical Tensions**: Political and military conflicts, such as the Israel-Hamas war and drone attacks on Russian oil refineries, have disrupted oil supplies and influenced PP prices.
- **Supply and Demand Dynamics**: Changes in demand from downstream industries, such as packaging and automotive, and supply disruptions due to maintenance shutdowns or natural disasters, affect PP prices.
- **Regulatory and Environmental Factors**: Government initiatives to limit plastic usage and environmental regulations can influence the demand for polypropylene.

Price trend of Polypropylene

The price of polypropylene (PP), the major raw material used to manufacture IV infusion bags, is declining across the regions. In India, while the price of Polypropylene remained higher compared to China at USD 1.63 per Kilogram (KG) in January 2022, it declined to USD 1.03 per KG in January 2025, which is lower compared to China. However, the price in India consistently stays lower compared to the US and Europe region. The price has declined by 37% between January 2022 and January 2025. The decreasing cost of PP enables manufacturers to stay competitive, and improve their operating margin or decrease the price of the infusion bag to pass on the benefit to customers.

Exhibit 6.10: Polypropylene Price Trend (USD/KG), 2022 - 2025



Source: Frost & Sullivan

6.10. KEY INDIAN SUPPLIERS OF INFUSION PACKS

Table 6.2. Key Indian Suppliers/Companies of Infusion Packs			
Company	**HQ**	**Founded**	**Products**
Amanta healthcare Pvt Ltd	Gujarat, India	1994	Formulations, Fluid Therapy, Diluents, Respules, Injections, Ophthalmics, Medical Devices
Aculife Healthcare Pvt Ltd	Gujarat, India	2014	Infusions (Bottle and Bag), Injectables, Anaesthesia (Gaseous and Injectable), Critical care medicines (Including Parenteral Nutrition), Ophthalmics, Respiratory Products, Dermatology & Gel segment, Oral shots, Contact lens cleaning solutions
Fresenius Kabi India Pvt Ltd	Pune, India	1995	Oncology drugs, Parenteral Nutrition, MedTech, Innovative I.V. Containers, Enteral Nutrition, Nephrology.
Axa Parenterals (India) Ltd	Uttarakhand, India	2005	Fluid Therapy – LVP, Eye Drops, Ear Drops, Nasal Drops, Respules, Injectables
B. Braun Medical India Pvt Ltd	Mumbai, India	1984	Anesthesia, Cardio-Thoracic Surgery, Continence Care & Urology, Degenerative Spinal Disorders, Diabetes Care, Extracorporeal Blood Treatment, Infection Prevention, Infusion Therapy, Vascular Therapy, Neurosurgery, Nutrition Therapy, Orthopaedic Joint Replacement, Ostomy Care, Pain Therapy, Sterile Goods Management, Wound Management
Otsuka Pharmaceutical India Pvt Ltd	Ahmedabad, India	2012	Anti-infectives, Oncology, Intravenous fat emulsion, Intravenous fluids, Enteral nutrition, Parenteral amino acids solution

Table 6.3: Financial analysis of Key Indian Suppliers/Companies of Infusion Packs, FY 24							
Parameter	**Amanta Healthcare**	**Aculife Healthcare Pvt Ltd**	**Fresenius Kabi India Pvt Ltd**	**Axa Parenterals (India) Ltd**	**B. Braun Medical India Pvt Ltd**	**Otsuka Pharmaceutical India Pvt Ltd ****	**Amanta Healthcare (FY25 Data)**
Operating Revenue (INR Mn)	2,803.4	6,143.4	8,297.1	2,148.7	6,542.6	NA	2,747.1
Operating Income CAGR (FY22-24)	11.5%	8.7%	0.3%	17.2%	9.9%	NA	6.8%
Operating EBITDA (INR Mn)	574.9	1,242.8	1,317.9	352.3	447.1	NA	596.7
Operating EBITDA CAGR (FY22-24)	3.5%	5.8%	19.5%	12.3%	-*	NA	3.6%
PAT (INR Mn)	36.3	618.1	1,184.8	199.3	146.6	NA	105.1
PAT CAGR (FY22-24)	-74.0%	-0.1%	-*	6.7%	-*	NA	-42.0%
Operating EBITDA Margin	20.5%	20.2%	15.9%	16.4%	6.8%	NA	21.7%
PAT Margin	1.3%	10.1%	14.3%	9.3%	2.2%	NA	3.8%
ROE	5.3%	13.4%	19.8%	7.8%	-66.0%	NA	12.4%
ROCE	12.8%	11.7%	23.0%	10.8%	25.4%	NA	13.7%

Source: Company financial filings and annual reports

*PAT in FY is negative

** Data for FY24 was not available.

7. OVERVIEW OF CAPS AND CLOSURES IN IV INFUSION PACK

7.2. PRODUCT DESCRIPTION AND KEY FEATURES ABOUT CAPS MARKET

Caps and closures are critical components of IV infusion packaging systems, ensuring sterility, safety, and functionality during fluid administration. The demand for the infusion bag caps are driven by factors such as rising prevalence of chronic diseases requiring IV therapy, increasing number of surgical procedures and hospital admissions, growing geriatric or ageing population, rising demand for home healthcare and technological advancements in IV therapy. IV infusion bag caps are designed to fit securely on the ports of IV bags, ensuring that the contents remain uncontaminated until they are ready to be administered. These caps are typically made from medical-grade materials that are safe for use in healthcare settings. They come in various designs, including tamper-evident features, to enhance safety and prevent unauthorized access.

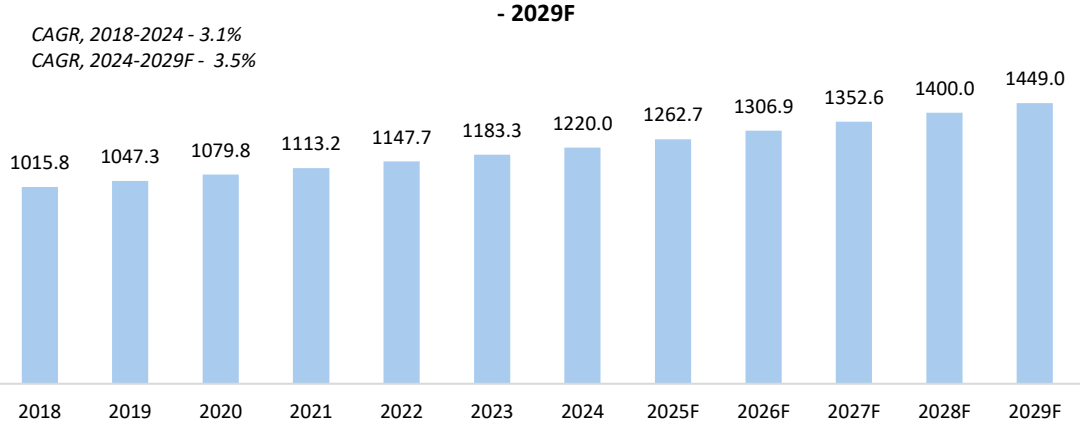
The key features of the infusion bag caps are:

- **Sterility:** IV infusion bag caps are manufactured and packaged under sterile conditions to maintain the sterility of the IV fluids. They are typically sterilized by gamma radiation or ethylene oxide gas.
- **Compatibility:** These caps are designed to be compatible with a variety of IV bag ports and materials. They ensure a secure fit and prevent leakage, regardless of the bag type.
- **Ease of Use:** IV infusion bag caps are designed for easy application and removal. They typically have a simple push-on or twist-on mechanism, allowing healthcare professionals to quickly access the IV bag port when needed.
- **Protection:** These caps provide a protective barrier against contamination, preventing bacteria and other microorganisms from entering the IV bag. This helps to reduce the risk of infection for patients.
- **Durability:** IV infusion bag caps are made from durable materials that can withstand the rigors of medical use. They are resistant to cracking and breaking, ensuring the integrity of the IV fluid pathway.
- **Latex-Free:** Many IV infusion bag caps are latex-free, reducing the risk of allergic reactions in patients with latex sensitivities.
- **Color Coding:** Some caps may be color-coded to differentiate between different types of IV fluids or medications. This helps to prevent medication errors and ensures patient safety.

7.3. MARKET SIZE AND FORECAST OF CAPS AND CLOSURES, GLOBAL AND INDIA

The global infusion pack caps and closures market is valued at USD 1,220.0 million in 2024 and it is expected to increase to USD 1449.0 million in 2029 at a CAGR of 3.5%. The need for high-quality, secure packaging solutions to ensure the integrity of infusion packs, the growing adoption of high-price Euro Head caps due to improved usability and safety features, and the increase in overall infusion pack market growth are driving demand for the caps and closures globally.

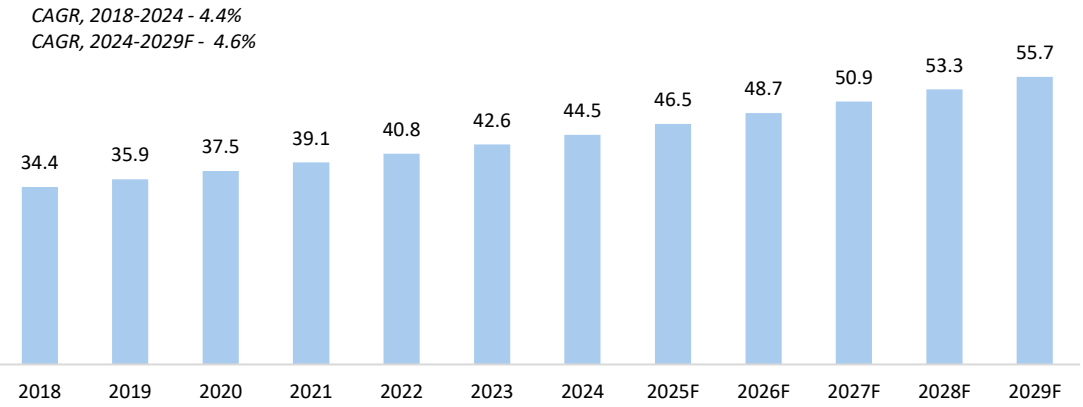
Exhibit 7.1: Global infusion pack Caps and Closures market size and forecast (USD Mn), 2018 - 2029F



Source: Frost & Sullivan

The infusion pack caps and closures market in India is valued at USD 44.5 million in 2024 and it is expected to increase to USD 55.7 million in 2029 at a CAGR of 4.6%.

Exhibit 7.2: Indian Caps and Closures market size and forecast (USD Mn), 2018 - 2029F



Source: Frost & Sullivan

7.4. MANUFACTURING TRENDS OF INFUSION PACK CAPS

The manufacturing of Caps for infusion bags is a precise process that involves processes to ensure quality, safety, and efficiency.

1. Advanced molding techniques:

- **Injection molding:** Injection molding remains the dominant process for manufacturing infusion pack caps due to its high-volume production capability, precision, and cost-effectiveness. Manufacturers are increasingly using advanced injection molding techniques, such as multi-cavity molds and hot runner systems, to improve efficiency and reduce waste.
- **Multi-component molding:** Some infusion caps may incorporate multiple materials, such as a polypropylene body with a TPE (Thermoplastic elastomer) seal. Multi-component molding allows for the simultaneous molding of these different materials, streamlining the manufacturing process.

2. Automation and robotics:

- **Automated production lines:** Manufacturers are increasingly automating their production lines to improve efficiency, reduce labor costs, and ensure consistent product quality. This includes automated handling of raw materials, molding processes, and packaging.
- **Robotics:** Robots are being used for tasks such as material handling, part removal from molds, and quality control inspections.

3. Material Innovations:

- **Improved polymers:** Manufacturers are exploring new polymer formulations to enhance the properties of infusion pack caps, such as improved flexibility, chemical resistance, and sterilization compatibility.
- **Sustainable materials:** There is a growing trend towards the use of more sustainable materials, such as bio-based plastics or recycled plastics, to reduce the environmental impact of infusion pack cap manufacturing.

4. Quality Control and Inspection:

- **Automated inspection systems:** Automated vision systems are being used to inspect caps for defects, such as cracks, contamination, or dimensional inaccuracies. This helps to ensure high product quality and reduces the risk of faulty caps reaching the market.
- **In-process quality control:** Manufacturers are implementing in-process quality control measures to monitor critical parameters during the manufacturing process, such as temperature, pressure, and cycle time. This helps to identify and correct potential issues early on.

5. Cleanroom Manufacturing:

- **Controlled environments:** Infusion pack caps are typically manufactured in cleanroom environments to maintain sterility and prevent contamination. Cleanrooms are designed to minimize the number of airborne particles and microorganisms, ensuring that the caps meet the stringent requirements for medical devices.

6. Focus on Safety and Compliance:

- **Regulatory compliance:** Manufacturers must adhere to strict regulatory requirements and guidelines for medical device manufacturing, such as ISO 13485 and FDA regulations.
- **Safety features:** Infusion pack caps are designed with safety features to prevent contamination and leakage. Manufacturers are continuously improving these features to enhance patient safety.

7. Customization and Design:

- **Customization options:** Manufacturers may offer customization options for infusion pack caps, such as different colors, sizes, or designs, to meet the specific needs of their customers.
- **Ergonomic design:** There is a trend towards designing infusion pack caps that are easy to use and handle for healthcare professionals.

8. Supply Chain Optimization:

- **Efficient supply chains:** Manufacturers are focusing on optimizing their supply chains to reduce lead times, minimize costs, and ensure the timely delivery of raw materials and finished products.

7.5. TYPES OF CAPS AND THEIR IMPORTANCE

Euro Head caps and Nipple Head caps are essential components in the IV infusion bag market, offering safety, functionality, and regulatory compliance.

Importance of Nipple Head Caps:

- These have a protruding "nipple" that is designed to be directly connected to an IV set.
- They are generally considered a more cost-effective option.
- They may have a simpler design, potentially with a higher risk of leakage or contamination compared to Euro Head Caps.
- They are designed for standardized conical IV sets.
- The absence of a medication septum, minimizes the material input ratio
- Nipple Head Caps are generally more economical to produce, making them a viable option for applications where cost is a primary concern. This is especially relevant in high-volume settings or in regions with limited resources
- The absence of extra parts, like the medication septum, reduces the amount of material needed to produce the caps.

Importance of Euro Head Caps:

- These typically feature a flat top with a port that can be accessed by piercing.
- They often incorporate a rubber disc or septum, allowing for multiple punctures while maintaining a secure seal.
- They are designed for applications requiring a high degree of sterility and leak prevention, such as IV infusions.
- They often have a peel-off aluminum foil layer for extra sterility.

7.5.1. INCREASED PREFERENCE OF EURO HEAD CAPS COMPARED TO NIPPLE HEAD

Increasingly, manufacturers and end users are preferring Euro Head caps for infusion packs. The transition to Euro Head caps from Nipple Head caps is driven by technological advancements ensuring better safety and usability, regulatory compliance, and the growing demand for user-friendly and sustainable packaging solutions. Euro Head caps offer universal compatibility, tamper-evident features, and eco-friendly materials, making them the preferred choice in the IV infusion bag market. Euro Head Caps for IV infusion bags are a reliable and convenient solution for healthcare

providers who need to connect IV bags to administration sets. Their secure, leak-proof, and easy-to-use design makes them a popular choice for use in hospitals and other medical settings. There are different types of Euro Head caps such as double flip cap, double port cap, ring pull cap, double ring pull cap, foil cap, and dual port foil cap.

Euro Head Caps outperform Nipple Head Caps in safety, precision, and compliance, making them ideal for modern healthcare needs.[37] Their market growth is fueled by advancements in medical packaging, regulatory pressures, and the expansion of IV-based therapies. While cost remains a barrier, their benefits in patient safety and product integrity position them as a long-term investment for healthcare systems.

Key benefits of Euro Head Caps include:

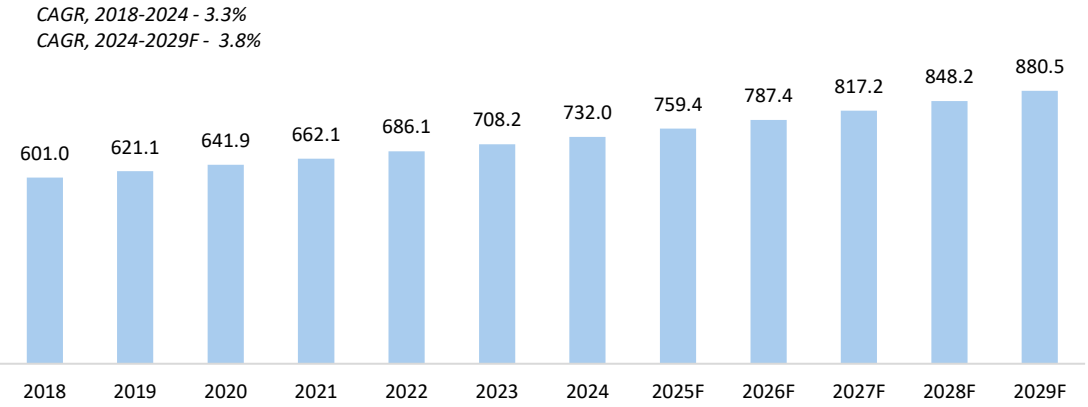
- **Secure closure:** The Euro Caps have a unique locking mechanism that ensures a secure connection between the I.V bag and the administration set. This helps prevent accidental disconnections and leaks.
- **Easy to use:** The Euro Caps have a simple design that allows for easy and quick connection and disconnection between the I.V bag and the administration set.
- **Leak-proof:** The Euro Caps have a leak-proof design that prevents the contents of the I.V bag from spilling. This helps ensure that the medication is delivered safely and effectively to the patient.
- **Compatibility:** The Euro Caps are compatible with a wide range of I.V bags and administration sets.
- **Safe to use:** Euro Caps are made from materials that are safe for use in medical applications and are also transparent, allowing healthcare professionals to easily monitor the fluid level in the I.V bag.

7.6. MARKET SIZE AND FORECAST OF EURO HEAD CAPS, GLOBAL AND INDIA

The global Euro Head caps market is valued at USD 732.0 million in 2024, and it is expected to grow at a CAGR of 3.8% to reach USD 880.5 million in 2029.

[37] First Rubber, Kraiburg TPE

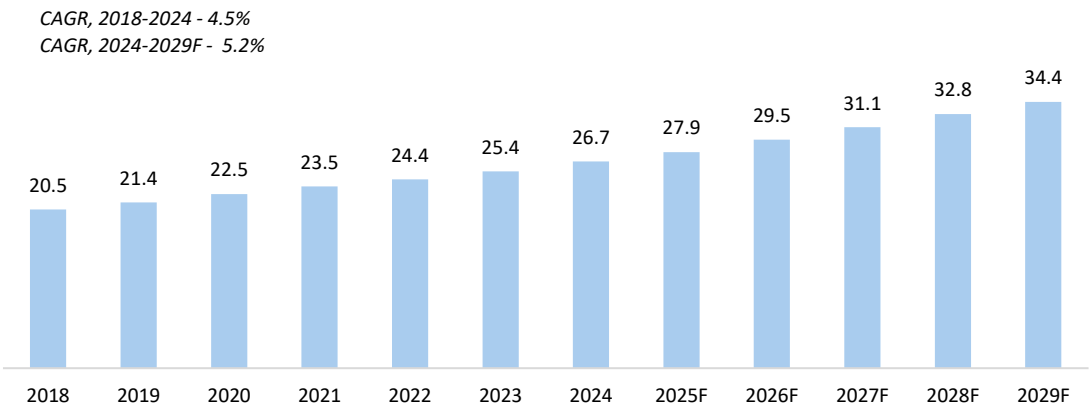
Exhibit 7.3: Global Euro Head caps market size and forecast (USD Mn), 2018 - 2029F



Source: Frost & Sullivan

The Euro Head caps market in India is valued at USD 26.7 million in 2024, and it is expected to grow at a CAGR of 5.2% to reach USD 34.4 million in 2029. The growth of Euro Head caps in the forecast period is expected to be higher than in the historical period. Further, the Euro Head cap is expected to grow at a higher rate compared to Nipple Head in the forecast period (5.2% vs. 3.7%).

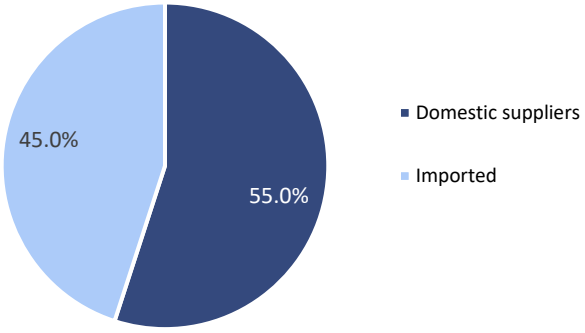
Exhibit 7.4: Indian Euro Head caps market size and forecast (USD Mn), 2018 - 2029F



Source: Frost & Sullivan

In India, the Euro Head caps are supplied by both domestic and international companies. **Scaled domestic manufacturing companies such as Medicap Healthcare Limited, is not only meeting the growing domestic demand for Euro Head caps, but also export to other countries, offering high-quality products that comply with international standards**.

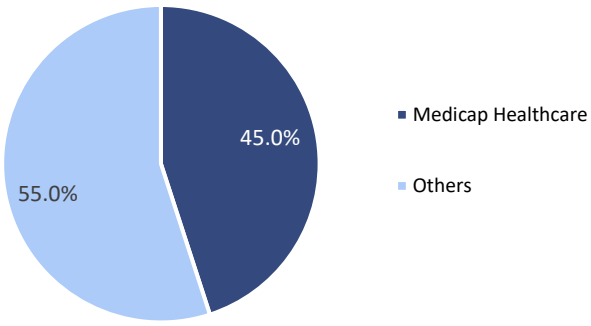
Exhibit 7.5: Split of Indian Euro Head infusion caps market by domestic and imported, 2024



Source: Frost & Sullivan

About 55% of the domestic market share is dominated by Indian suppliers and 45% is imported by international brands. **Among the Indian companies which export Euro Head caps to international markets, Medicap Healthcare has a dominant volume share of 45%, followed by other companies[38].** Major countries of exports are Malaysia, Saudi Arabia, Egypt, Sudan, Ghana, Portugal and Brazil. **Notably, Medicap has about 1.4% of the global market share and about 40.0% domestic market share in terms of revenue for Euro Head caps in 2024.[39]**

Exhibit 7.6: Indian company share of export volumes of Euro Head caps, 2024



Source: Volza, Frost & Sullivan

[38] Other companies include large company such as Prasad Meditech and other small unorganized players.
[39] Calculated based on Medicap's revenue from Euro Head cap and the market size of the global and Indian Euro Head cap. INR to USD conversion rate of 85.6232 (as on 31st Dec, 2024 from RBI Reference Rate) is used for calculating the market share market rate for USD conversion.

Key factors for the growing emergence and success of domestic players in the market

- **Focus on quality:** Domestic companies adhere to strict quality control measures and certifications to ensure that their products meet the required standards.
- **Advanced manufacturing facilities:** Domestic companies have invested in modern manufacturing facilities and technologies to produce high-quality caps efficiently.
- **Strong distribution networks:** Domestic companies have established strong distribution networks to reach customers across India.
- **Competitive Pricing:** Domestic companies offer competitive pricing to cater to the price-sensitive Indian market while maintaining quality standards.
- **Customer Focus:** Domestic companies focus on meeting the specific needs of their customers and providing excellent customer service.

Importance of domestic manufacturing of Euro Head caps:

The presence of these domestic manufacturers is crucial for the Indian infusion package industry due to the below factors:

- **Reduces reliance on imports:** It reduces the dependence on imported Euro Head caps, making the supply chain more secure and reliable.
- **Supports local economy:** It creates jobs and contributes to the growth of the Indian economy.
- **Ensures affordability:** It helps to keep the prices of Euro Head caps competitive, making them more affordable for healthcare providers and patients.

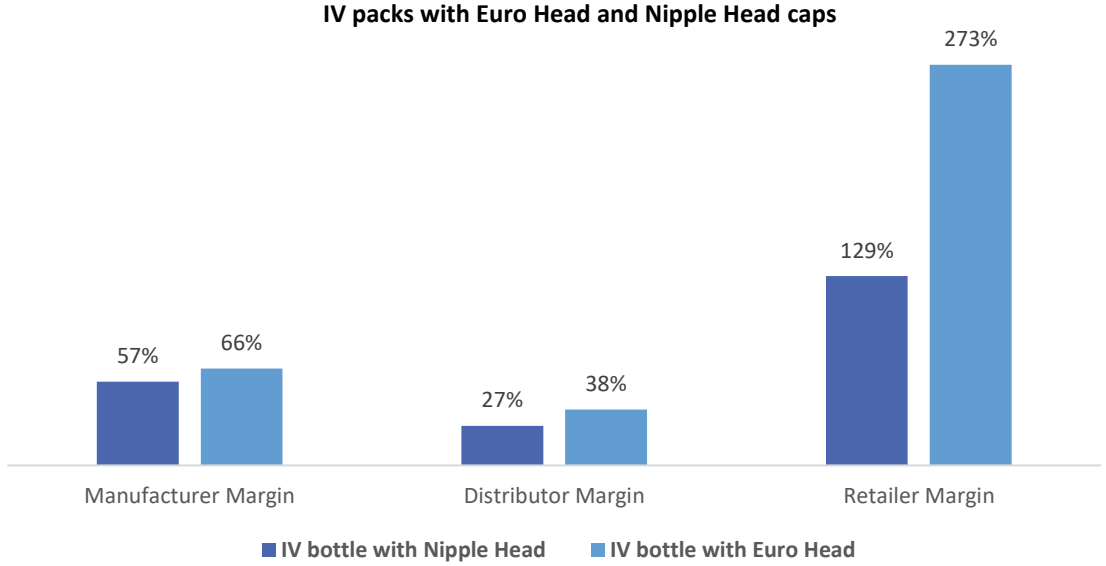
Overall, domestic companies in India are playing a vital role in meeting the demand for Euro Head caps, ensuring a steady supply of this essential component for infusion therapy.

7.6.1. Infusion Packs with Euro Head cap Yield Higher Margin for Distributors and Retailers

IV Infusion packs with Euro Head caps can yield higher margins for manufacturers, distributors and retailers due to several factors, including product differentiation, operational efficiency, and market demand.

Manufacturers' margin for selling IV packs with Euro Head cap to distributors is 66% versus 57% for Nipple Head cap. The distributor's margin for selling IV packs with Euro Head cap to the retailer is 38% versus 27% for Nipple Head cap. Similarly, the retailer margin for selling IV packs with Euro Head cap to the end customer is 273% versus 129% for Nipple Head cap. Due to the attractive margin for Euro Head cap IV infusion packs, the preference for it is high among the trade channel members.

Exhibit 7.7: Margins across trade channels for IV packs with Euro Head and Nipple Head caps



Source: Frost & Sullivan

High margins, increased end user demand, regulatory compliance and improved safety and usability of Euro Head caps are propelling the growth of the IV packs with Euro Head caps.

7.6.2. Market Growth Drivers of Euro Head caps

Euro Head Caps are experiencing significant growth in the infusion package market due to several key factors, including technological advancements, regulatory compliance, changing healthcare practices and increasing adoption of health insurance. Euro Head Caps offer advanced materials, innovative designs, and smart technology integration, making them a preferred choice for healthcare providers and patients. The shift towards eco-friendly alternatives and sustainable practices further enhances their market appeal. Future growth will be driven by continued innovation, regulatory compliance, and the expansion of healthcare services in emerging markets.

Key growth drivers for Euro Head Caps include:

1. **Increasing Demand for IV Therapy**

   - **Rising prevalence of chronic diseases**: The growing incidence of chronic diseases such as cardiovascular disorders, cancer, and diabetes has led to a higher demand for IV therapy, thereby driving the market growth for IV fluid bags.

   - **Growing surgical procedures**: The increasing number of surgical procedures, both elective and emergency, has led to a surge in the demand for IV fluid bags to ensure proper hydration and medication administration during the perioperative period.

   - **Expanding geriatric population**: The ageing population is more susceptible to various diseases and often requires intravenous therapy. As the geriatric population grows, the demand for IV fluid bags is expected to increase significantly.

2. **Increasing adoption of insurance:** Increasing health insurance penetration in several countries, including India, is a major driver behind the growing demand for premium infusion bottles with

Euro head caps. As more of the population gains access to health insurance, it changes the dynamics of healthcare consumption, moving patients and providers toward higher-quality, safer, and more advanced medical products. When a patient is covered by insurance, the financial burden of a medical procedure, including the cost of high-quality medical supplies, is significantly reduced. This empowers them to demand or accept superior products. Healthcare providers, particularly private hospitals that cater to insured patients, are incentivized to use premium, modern medical supplies. This not only enhances patient safety and outcomes but also aligns with the standards required by insurance companies.

3. **Technological Advancements and Material Innovation**

- **Advanced materials**: The introduction of non-PVC alternatives has improved the safety profile of IV fluid bags. Euro Head Caps are designed to be compatible with these advanced materials, ensuring better biocompatibility and reduced health risks.

- **Innovative designs**: Euro Head Caps offer user-friendly features such as tamper-evident seals, breakable rings, and self-sealing septa, which enhance their ease of use and reduce the risk of contamination.

- **Smart technology integration**: The integration of smart technologies such as RFID tags and QR codes into Euro Head Caps enables automated inventory management, traceability, and authentication throughout the supply chain.

4. **Regulatory Compliance and Quality Standards**

- **Stringent regulations**: Euro Head Caps meet stringent healthcare standards such as FDA QSR and EU MDR/IVDR, ensuring compliance with quality and safety norms.

- **Focus on sterility and integrity**: Manufacturers are implementing robust quality management systems to ensure the sterility and integrity of IV fluid bags throughout the supply chain, addressing concerns about contamination and product safety.

5. **Expansion of Home healthcare and Outpatient infusion**

- **Home healthcare services**: The growing trend of home healthcare services has created a significant opportunity for Euro Head Caps. Offering user-friendly and portable IV fluid bags enhances convenience and comfort for patients receiving intravenous therapy at home.

- **Reliable and tamper-evident seals**: Euro Head Caps ensure product integrity in non-clinical environments, making them ideal for home healthcare settings.

6. **Sustainability and eco-friendly packaging**

- **Eco-friendly materials**: There is a growing demand for biodegradable and sustainable packaging materials. Euro Head Caps made from eco-friendly materials such as sugarcane bagasse are gaining traction in the market. The increasing environmental awareness is

driving the demand for eco-friendly IV fluid bags. Euro Head Caps made from non-PVC materials are well-positioned to capitalize on this trend.

- **Sustainable practices**: Manufacturers are developing recyclable and sustainable packaging solutions to address environmental concerns, aligning with the increasing environmental consciousness among healthcare providers and patients.

7. Market dynamics

- **Regional Growth**: The healthcare infrastructure in emerging markets is rapidly developing, presenting significant growth opportunities for Euro Head Caps. As access to healthcare improves and medical facilities expand, the demand for IV fluid bags is expected to rise in these regions

7.6.3. BRIEF PROFILE OF SELECT GLOBAL AND INDIAN COMPANIES MANUFACTURING INFUSION BOTTLE CAPS AND CLOSURES

Table 9.1: Profile of select Global companies			
Company	**HQ**	**Description**	**Select products**
First Rubber (Hebei Xiangyi International Trading Co.)	Shijiazhuang, China	• First Rubber is one of the core subsidiaries of Desheng Group, founded in 1965, the researcher and manufacturer of the first butyl rubber stopper in China. • Xiangyi international is the trading company of First Rubber, and mainly provides pharmaceutical packaging materials such as Rubber stopper for Injection, Rubber stopper for vacuum blood collection, Rubber stopper for lyophilization, PP disc, Aluminium flip-off seal, Euro cap and Glass bottle, Non-PVC film for IV bags, and PP granules etc.	Glass bottle, European lid, Aluminum flip-off seal, Rubber stopper, Medical use products, Polypropylene granule, Rubber component for Pumps, Conveyor belt
Wealth Packing (YangZhong Wealth Metal Co.,Ltd.)	Yangzhong, China	• Wealth Packing is a manufacturer and exporter of pharmaceutical packing materials and solar products. The company's major products are Flip-off cap, Tear-off cap,	Bottle closures, Euro cap, Foil cap, Plastic hanger, Aluminium cap for dental cartridge, Glass vial,

		and Euro cap (PP or PE) for plastic I.V bottles/bags. The company's production capacity is 40 billion pieces and it exports to more than 28 countries.	Prefilled syringe, Rubber stopper
CRH Health (Suzhou CRH New Material Technology Co., Ltd.)	Jiangsu, China	CRH Health was founded in 2005 and located in Suzhou City of China. The company has 300 employees and has 22,000 sq. meters of plant area. Suzhou CRH is devoted to researching, developing, producing and selling pharmaceutical-class packaging materials, including PP caps, PP ports, rubber stoppers and modified-formula PP resins.	Euro cap, Isoprene gasket, Rubber stopper, PP resin, Spike port
Hunan Runfuture Pharmatech Co., Ltd.	Hunan, China	Hunan Runfuture Pharmatech Co., Ltd was founded in 2015 and is one of the biggest suppliers of pharmaceutical package material, APIs and spray nozzles.	Infusion and Dialysis bag, Glass vial, Syrup bottle, Glass ampoule, Flip-off cap, Euro cap, Spike port

Source: Company website, annual report

Table 9.2: Profile of select Indian Companies

Company	HQ	Description	Products
Medicap Healthcare	Gujarat, India	Medicap started operations in 2014 as a partnership firm and then subsequently in 2017 was converted into a public limited company. The company operates from a 70,000 sq. ft. state-of-the-art manufacturing facility with the latest technology. Medicap is fast emerging as a strong and reliable partner to the Pharma and healthcare industry with our comprehensive portfolio of closures, particularly through Euro Head caps.	Euro Head caps (Ring pull, Foil cap, Double flip, Double port, Double ring pull, Dual port foil cap), Plastic cap, Protector cap, Preform with hanger (100 and 500 ml)
Prasad Meditech	Maharashtra, India	• Prasad Meditech is a manufacturer of Euro Head Caps used in IV bottles and	Euro Head cap, Foil twin-port cap, Infusion port for IV bags, Euro caps for

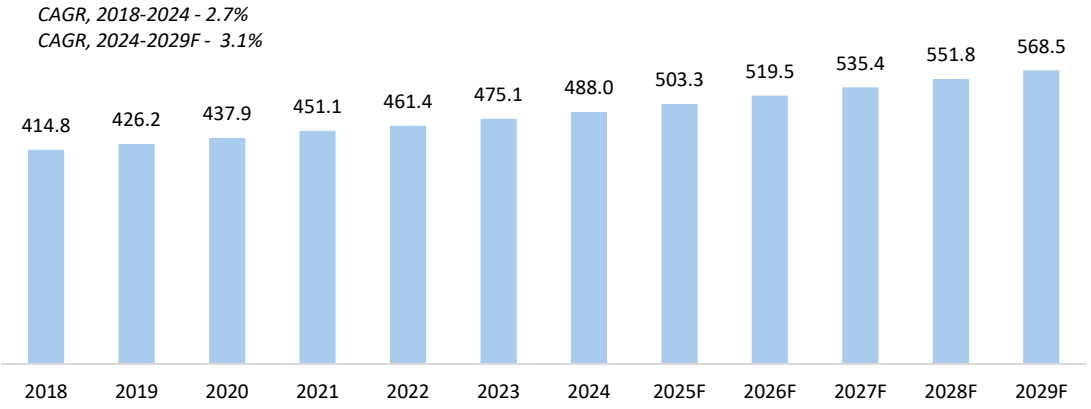
		bags made from BFS and FFS technology, using medical grade raw material PP and easy break off twin head.	PP bags and bottle, PP screw cap, Rubber disc.

Source: Company website, annual report

7.7. MARKET SIZE AND FORECAST OF NIPPLE HEAD CAPS, GLOBAL AND INDIA

The global Nipple Head caps market is valued at USD 488.0 million in 2024 and it is expected to grow at a CAGR of 3.1% to reach USD 568.5 million in 2029. Nipple Head caps is expected to grow at a slower rate compared to the Euro Head caps due to transition towards Euro Head caps.

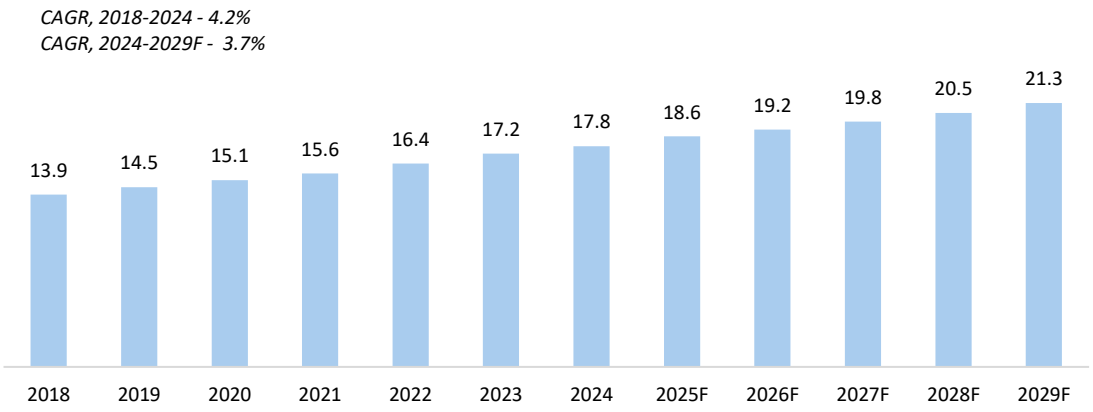
Exhibit 7.8: Global Nipple Head caps market size and forecast (USD Mn), 2018 - 2029F



Source: Frost & Sullivan

The Nipple Head caps market in India is valued at USD 17.8 million in 2024 and it is expected to grow at a CAGR of 3.7% to reach USD 21.3 million in 2029. While there is moderate growth for Nipple Head cap due to end-user demand factors such as volume growth in hospitalizations and infusion therapy, there is increased preference for Euro Head caps due to greater benefits compared to Nipple Head caps.

Exhibit 7.9: Indian Nipple Head caps market size and forecast (USD Mn), 2018 - 2029F



Source: Frost & Sullivan

7.7.1. Key raw material used for Infusion Pack Caps

The key raw materials used for manufacturing Caps used in infusion packs are:

- **Polypropylene (PP)**: This is a common and primary material due to its durability, chemical resistance, and ability to withstand thermal damage. It ensures the caps can maintain their integrity during sterilization processes and resist degradation from the solutions they contain.
- **Polyethylene (PE)**: Often used in combination with PP or as a standalone material, PE contributes to the sealing properties and overall strength of the caps. It can be found in various grades to meet specific performance requirements.
- **Medical-grade foil**: This type of foil is used in some Euro Head cap designs, typically for easy peel-off features. It is also medical-grade to prevent contamination.

These materials are chosen for their compatibility with pharmaceutical standards, ensuring the safety and efficacy of the IV infusion process. They are also selected for their ability to provide a secure and airtight seal, preventing leakage and maintaining the sterility of the contents.

Polypropylene (PP) granules is used as the main material for producing infusion pack caps. Qualities of the material include good processability, low-temperature resistance, good fragmentation performance, transparent and safe, moderate opening force, ageing resistance, and strong stability.

7.7.2. Features of Polypropylene Granules

- **Purity:** Pharma-grade polypropylene granules are characterized by high purity levels. They are manufactured and processed to meet stringent quality standards, ensuring minimal impurities that could potentially affect the pharmaceutical products.

- **Chemical resistance:** Polypropylene is known for its excellent chemical resistance. Pharma-grade polypropylene granules are designed to resist a wide range of chemicals, making them suitable for use in various pharmaceutical formulations.

- **Sterilizability:** These granules can withstand sterilization processes, including autoclaving, gamma irradiation, and ethylene oxide treatment. This property is crucial in pharmaceutical applications where sterility is a primary concern.

- **Low extractables:** The material has low levels of extractables, meaning it releases minimal substances into the pharmaceutical product it comes into contact with. This is essential to prevent contamination of medications and ensure their efficacy.

- **Consistency in quality:** Manufacturers of pharma-grade polypropylene granules adhere to strict quality control measures to ensure consistency in material properties, including color, size, and mechanical characteristics.

- **Versatility:** Pharma-grade polypropylene can be molded into various shapes and sizes, making it a versatile material for different pharmaceutical applications.

- **Cost-effective:** Polypropylene is generally more cost-effective than some alternative materials, providing an economical solution for pharmaceutical packaging and manufacturing.

- **Regulatory compliance:** The use of pharma-grade polypropylene ensures compliance with regulatory standards and requirements for pharmaceutical packaging and manufacturing processes.

The manufacturing trends of Euro Head caps for infusion bags are focused on ensuring safety, efficiency, and compliance with regulatory standards. The use of high-quality materials like polypropylene and polyethylene, advanced manufacturing processes and a focus on regulatory compliance and clean room production are key trends in this industry.

7.7.3. POLYETHYLENE IN INFUSION CAP MANUFACTURING

While Infusion pack caps are primarily made of polypropylene (PP), some Euro Head caps are designed with polyethylene components. In infusion pack caps, the type of polyethylene most commonly used is high-density polyethylene (HDPE), due to its strength, durability, and resistance to moisture, making it suitable for pharmaceutical packaging, particularly for sensitive medications delivered through infusion bags.

Key benefits of HDPE include:

- **Chemical resistance:** HDPE offers good resistance to chemicals, which is crucial for preventing interactions with the medication inside the infusion bag.
- **Moisture barrier:** Its high density provides a barrier against moisture vapor, ensuring the integrity of the medication.
- **Suitable for sterilization:** HDPE can withstand sterilization processes required for medical devices.

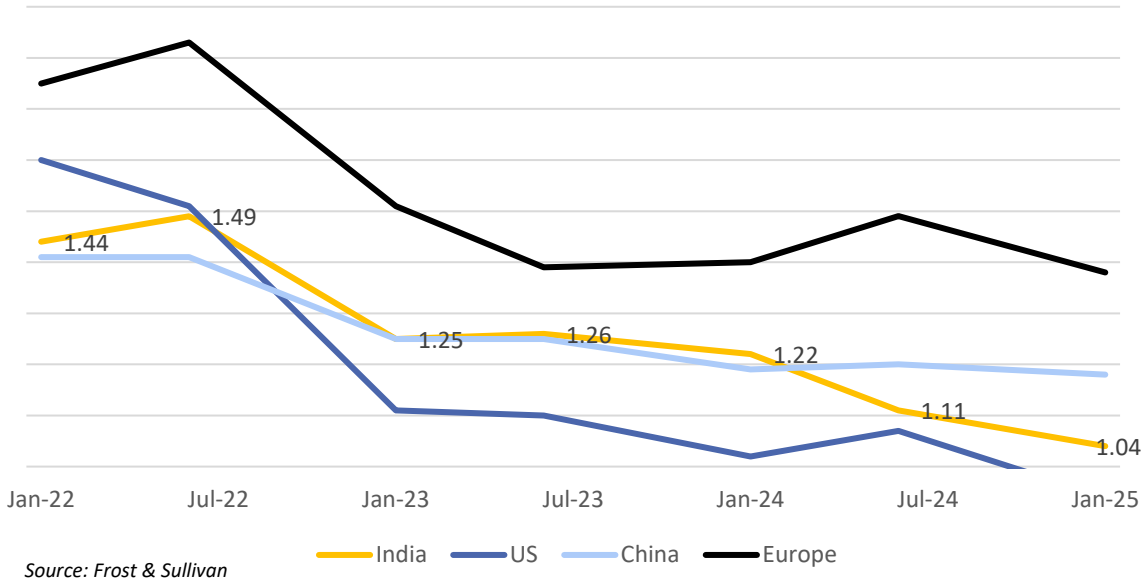
The price of HDPE has shown significant fluctuations in recent quarters, driven by factors such as feedstock costs, geopolitical tensions, and supply-demand dynamics. Understanding

these trends is essential for manufacturers and healthcare providers to manage costs and ensure the availability of high-quality caps for IV infusion bags.

Price trend of HDPE

The price of HDPE is on a declining trend across the regions. In India, while the price of Polypropylene remained higher at USD 1.22 per Kilogram (KG) compared to China (1.19 per KG) until March 2024, it declined to USD 1.04 per KG in January 2025, which is lower compared to China (1.18 per KG). Moreover, the price in India consistently stays lower compared to the Europe region. The price of HDPE in India has declined by 28% between January 2022 and January 2025 due to factors such as the easing of feedstock Ethylene prices, surplus supply, increase in domestic production and inventory build-up The decreasing cost of HDPE enables manufacturers to stay competitive and improve their operating margin or decrease the price to pass on the benefit to customers.

Exhibit 7.10: High-Density Polyehtylene (HDPE) Price Trend (USD/KG), 2022 - 2025



Source: Frost & Sullivan

7.8. KEY INDIAN AND GLOBAL COMPANIES IN INFUSION CAPS AND CLOSURES MARKET

Among the companies assessed for product portfolio comparison, Medicap Healthcare is the only company to have a wide portfolio of products for infusion packaging. The company specializes in various types of Euro Head caps as well as Preforms.

Table 7.1: Profile of select Indian and global companies manufacturing infusion package caps

Company/ Peers	Euro Head cap								Preform
	Ring Pull		Foil Cap		Dual Port Foil Cap	Double Port	Double Flip		
	39 mm	32/30 mm	39 mm	32/30 mm	39 mm	39mm	29 mm	32/30 mm	100/500ml
Medicap Healthcare Limited	✓	✓	✓	✓	✓	✓	✓	✓	✓
Prasad Meditech	✓	✓	✓	X	✓	X	✓	✓	X
International peers									
First Rubber (Hebei Xiangyi International Trading Co.)	✓	X	X	X	X	X	X	X	X
Wealth Packing (YangZhong Wealth Metal CO.,Ltd.)	✓	✓	✓	X	X	X	X	X	✓

CRH Health (Suzhou CRH New Material Technology Co.,Ltd.)	✓	✓	✓	X	X	✓	X	✓	X
Hunan Runfuture Pharmatech Co., Ltd.	X	✓	X	X	X	X	X	✓	X

Source: Company website and product brochures

8. OVERVIEW OF PREFORMS MARKET FOR INFUSION PACKS

8.2. PRODUCT DESCRIPTION AND KEY FEATURES PREFORMS

In infusion package manufacturing, a "Preform" refers to a pre-shaped, partially formed plastic component, typically made Polypropylene. It is a test-tube like shape with a finished neck that is later expanded and shaped into the desired infusion bottle design using air pressure.

Preforms are created using an injection molding machine where molten Polypropylene resin is injected into a mold cavity under high pressure, forming the basic shape. Preforms act as the starting point for creating the final infusion bottle through a blow molding process. Preforms can be customized in terms of size, shape, and neck finish to meet specific requirements for different infusion solutions.

Polypropylene-based preforms play a crucial role in the production of infusion packs due to their biocompatibility, chemical resistance, sterilization compatibility, and cost-effectiveness. These preforms are used to create a variety of medical products, including IV bags, bottles, syringes, and catheters, which are essential for the safe and efficient delivery of fluids and medications in medical settings

8.3. MANUFACTURING TRENDS IN PREFORMS

The manufacturing trends of preforms used in infusion pack manufacturing reflect advancements in materials, automation, and sustainability. Here are the key trends:

1. **Automation in Preform Production**:
    - **Automated Fiber Placement (AFP)**: This technology enhances precision in dry fiber preform manufacturing, enabling high production rates and consistent fiber orientation. It reduces manual labor and waste while improving repeatability and quality .
    - **Integrated Systems**: Fully automated production lines, such as those for polypropylene (PP) infusion bags, combine preform injection, blow molding, and filling-sealing processes, streamlining workflows and minimizing contamination risks .

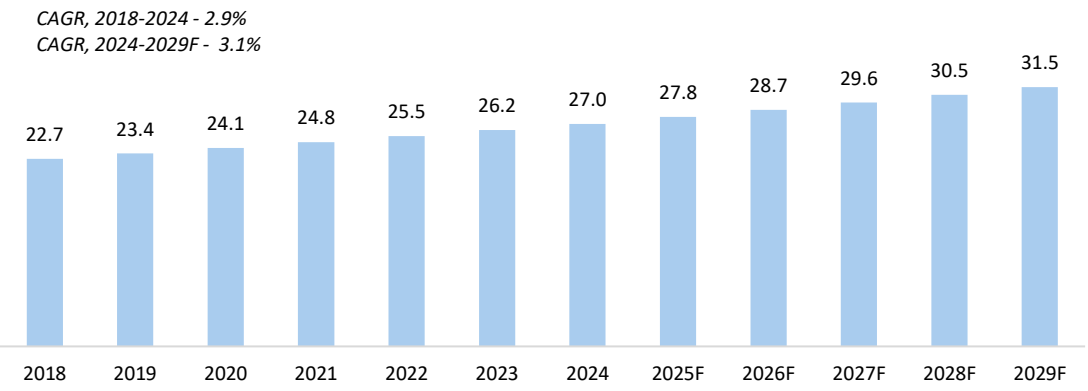
2. **Resin Infusion Technologies**:
    - **Out-of-Autoclave Processes**: Techniques like Vacuum-Assisted Resin Transfer Molding (VARTM) and resin transfer molding (RTM) are replacing autoclaves, reducing energy costs and enabling large, complex preforms with low void content (<1%) .
    - **Dry Fiber Preforms**: Use of dry fibers preforms in resin infusion processes lowers material costs and eliminates refrigeration needs, while maintaining mechanical performance comparable to autoclave-cured prepregs .
3. **Material Innovations**:
    - **Medical-Grade Plastics**: Polypropylene (PP), polyethylene (PE), and thermoplastic elastomers (TPE) are favored for their safety, biocompatibility, and resistance to thermal/compression forces. TPE, in particular, offers eco-friendly, non-toxic options .
    - **Eco-Friendly Materials**: Growing emphasis on sustainability drives adoption of recyclable and non-PVC materials to reduce environmental impact .
4. **Quality and Cost Management**:
    - **In-Process Monitoring**: Automated systems detect defects in real-time, enabling dynamic adjustments and predictive maintenance, which improves first-time-right rates and reduces rework .
    - **Cost Reduction**: Automation and resin infusion technologies lower production costs by minimizing labor, material waste, and energy consumption .
5. **Sustainability and Compliance**:
    - **Waste Reduction**: Precision manufacturing and integrated processes minimize material scrap .
    - **Regulatory Alignment**: Strict quality control ensures compliance with medical standards (e.g., sterilization via Ethylene Oxide, low hemolysis rates) .

These trends collectively aim to enhance efficiency, product quality, and sustainability in preform manufacturing for infusion packs, aligning with broader industry demands for cost-effectiveness and environmental responsibility.

8.4. MARKET SIZE AND FORECAST OF PREFORMS, GLOBAL AND INDIA

The global Preforms market is valued at USD 27.0 billion in 2024 and it is expected to grow at a CAGR of 3.1% to reach USD 31.5 billion in 2029. The preforms market is growing in response to the increasing demand for safe, reliable, and convenient intravenous infusion solutions, driven by factors such as an aging population, technological advancements, and the expansion of healthcare services globally.

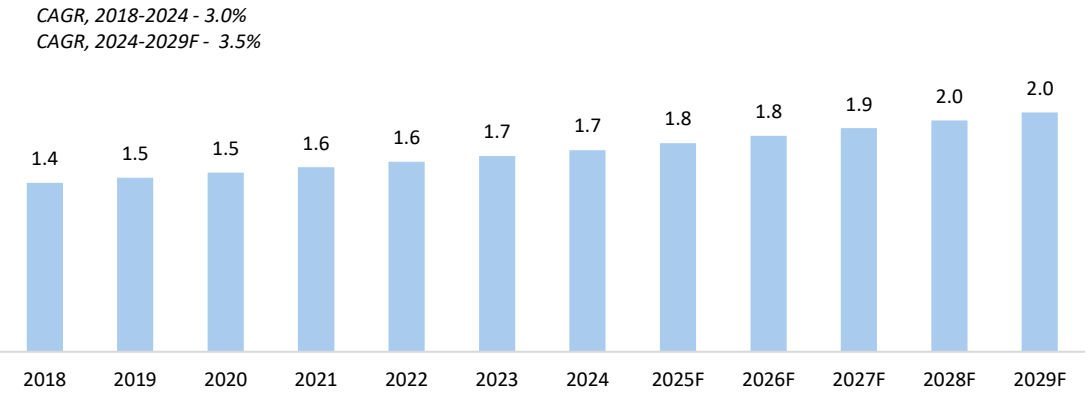
Exhibit 8.1: Global Preforms market size and forecaset (USD Bn), 2018 - 2029F



**Note: The market includes overall prefroms and not specifically the preforms used for manufacturing infusion packs*
Source: Frost & Sullivan

The Preforms market in India is valued at USD 1.7 billion in 2024 and it is expected to grow at a CAGR of 3.5% to reach USD 2.0 billion in 2029. Preforms are incredibly versatile, and their applications span across numerous industries such as pharmaceutical packaging, beverage industry and food packaging.

Exhibit 8.2: Indian Preforms market size and forecaset (USD Bn), 2018 - 2029F



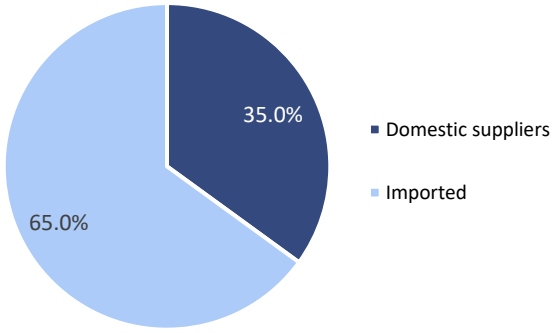
**Note: The market includes overall prefroms and not specifically the preforms used for manufacturing infusion packs*
Source: Frost & Sullivan

8.5. STRENGTHENING DOMESTIC MANUFACTURING IS CURTAILING THE COUNTRY'S RELIANCE ON IMPORTS

While India is a major importer of preforms, it has a significant and expanding domestic Preform manufacturing sector. This growth is driven by the increasing demand in end-user industries such as healthcare and food and beverage. Many domestic companies are investing in advanced manufacturing technologies to meet this demand. While domestic production is strong, imports still play a role, particularly for specialized Preforms or when there are supply chain fluctuations.

Government policies, such as "Make in India" and PLI (Production Linked Incentive) scheme are encouraging domestic manufacturing. Fluctuations in raw material prices and global supply chains can also affect the balance between domestic production and imports. There's a clear trend towards increasing domestic production in India, driven by the growing consumer market and government initiatives. However, imports of specialized preforms and raw materials will likely continue.

Exhibit 8.3: Split of Indian Preform market by domestic and imported, 2024



Source: Frost & Sullivan

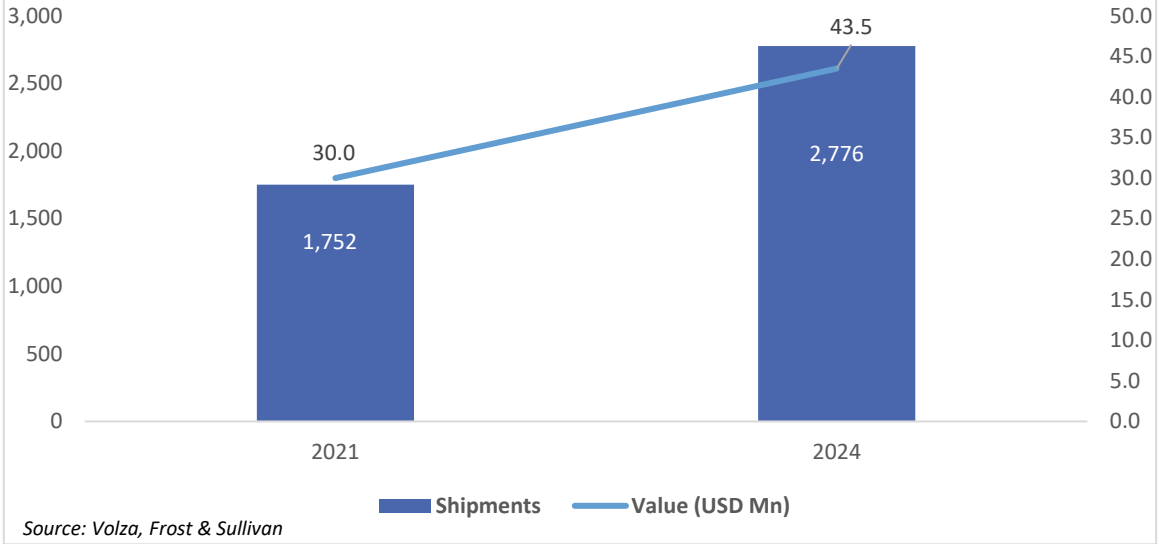
8.6. EXPORTS OF PREFORMS FROM INDIA

The Asia-Pacific region is the fastest-growing market for Preforms, driven by the increasing demand for packaging in emerging economies like China, Japan, and India. This is due to the growing population and the rising consumption of beverages, food, and pharmaceutical products. The high recycling rate of plastic products in India is another factor that's driving the growth of the Preform market. This shows that India is not only a major exporter but also a leader in sustainability. India has a unique advantage in terms of its high recycling rate and the availability of raw materials. This gives Indian exporters a competitive edge in the global market.

India's exports of Preforms have grown from 1,752 shipments in 2021 to 2,776 shipments in 2024 at a CAGR of 16.6%. The value of shipments has grown from USD 30.0 million in 2021 to USD 43.5 million in 2024. The high growth in exports validates that India is a major player in this market, and as the demand for Preforms is increasing, India is capitalizing on this trend.

There are very few organized manufacturers focusing on Preforms for intra-venous infusion package. Medicap is one among the leading companies manufacturing 100 ml and 500 ml Preform with Hanger for infusion packs.

Exhibit 8.2: Export shipments of Preforms from India, CY 2021 - CY 2024
CAGR (2021 - 2024) = 16.6%



Source: Volza, Frost & Sullivan

9. INDUSTRY THREATS AND CHALLENGES

The pharma packaging and medical consumables industry must navigate a complex landscape of regulatory, environmental, and technological challenges while prioritizing patient safety and product integrity.

- **Commoditization pressure**: Medical consumables are increasingly viewed as commodities, leading to price competition and margin compression. Public and private payers are seeking regular price cuts, making it difficult for companies to invest in innovation and quality improvement. Moreover, inflation and rising material costs put pressure on profit margins. Balancing cost control with maintaining product quality is a key challenge.
- **Supply chain and manufacturing issues**: The industry relies on complex global supply chains, which are vulnerable to disruptions from factors like geopolitical events such as tariff hikes, wars, natural disasters, and pandemics. Manufacturing processes must be efficient and reliable to avoid costly setbacks. Dependence on global supply chains exposes manufacturers to disruptions from geopolitical events, natural disasters, and economic instability. Raw material shortages and delays can impact production schedules.
- **Sustainability concerns:** The industry generates a significant amount of waste, particularly plastic. There's increasing pressure to develop sustainable packaging and consumable solutions. while maintaining the protective qualities needed for drug safety. This requires careful material selection and testing to ensure compliance with regulatory standards.
- **Technological Advancements:** Keeping pace with advancements in materials science and manufacturing technologies is essential to remain competitive. Tailor-made injection molding machines and ultra-high-speed fully automated assembly machines ensure product quality without manual intervention. Machines for automatic assembly of easy-peel foil caps for IV infusion soft bags and bottles ensure high precision and a high-qualified rate, and operate efficiently and reliably, meeting the production demands of Euro head caps. State-of-the-art machinery, such as automated production lines and restricted access barrier systems, has significantly enhanced production efficiency, product quality, and safety while reducing costs. However, it has also raised the industry's entry barriers, consolidating the market position of established manufacturers and intensifying competition for new entrants. As a result, new entrants must possess substantial financial resources, technological capabilities, and management expertise to overcome these challenges and achieve sustainable development in the industry.
- **Price pressure and volume constraints**: Budget restrictions from payers are putting downward pressure on prices, while some governments are trying to curb testing volumes to address perceived inappropriate prescribing by doctors. This creates tension in the system and strains the industry's capacity to invest and protect margins.
- **Global economic fragmentation**: U.S.-China trade tensions and broader global economic fragmentation create challenges for medical consumables manufacturers in emerging markets. Tariffs and supply chain disruptions are increasing costs and limiting growth potential. Further, economic downturns can impact healthcare spending and demand for medical consumables.

- **Entry barriers**: High capital requirements, strict regulatory approvals, intellectual property challenges, and intense market competition act as barriers to entry for new entrants in the market. Establishing an infusion cap manufacturing unit requires significant financial investment constructing a state-of-the-art production line and compliance with regulatory standards.

10. SWOT ANALYSIS OF MEDICAP HEALTHCARE

Themes	Description
Strengths	• **Market Position:** Medicap Healthcare has established itself as a dominant player in the Pharma packaging industry, specifically in the manufacturing of Euro Head caps for infusion bottles and Preforms for infusion packs. The company is an early entrant in the industry with minimal competition in the Indian market, established customer relationships and efficient manufacturing processes. • **Specialized Products:** The company focuses on niche products that are essential components in the infusion packaging, which can command premium pricing and higher margins. • **Strategic Location:** Being based in India, Medicap Healthcare benefits from lower labor and production costs compared to companies in more developed economies, which can provide a competitive edge in pricing
Weakness	• **Product Range Limitation**: The company's focus on a limited range of products (Euro Head caps and Preforms) could be a weakness if demand for these products declines or if there are technological advancements that render them obsolete. • **Regulatory Compliance**: The healthcare industry is heavily regulated, and any failure to comply with relevant regulations could result in significant penalties, loss of market access, or reputational damage.
Opportunities	• **Growing Healthcare Market**: The global healthcare market is expanding, driven by factors such as an aging population, increasing prevalence of chronic diseases, and rising healthcare expenditures. This growth creates opportunities for Medicap Healthcare to increase its sales and market share. • **Outsourcing Trends**: There is a trend towards outsourcing in the medical device industry, which could benefit Medicap Healthcare as companies look for specialized suppliers for components like Euro Head caps and Preforms. • **Diversification**: Medicap Healthcare could explore diversification into related products or services, such as other types of medical packaging or components, to reduce its reliance on a limited product range and tap into new markets.
Threats	• **Economic Downturns**: Economic recessions or slowdowns can lead to reduced healthcare spending, which may negatively impact demand for medical products and services, including those produced by Medicap Healthcare. • **Regulatory Changes**: Changes in healthcare regulations or standards could require Medicap Healthcare to invest significant resources in product modifications or compliance measures, potentially affecting its profitability. • **Threat of Substitutes**: Increased adoption of Nipple Head caps due to low cost could pose a threat to Medicap Healthcare as it is focused on only Euro Head cap. Similarly, the development of advanced materials like TPE (Thermoplastic Elastomer) for Euro Head Caps, which offer better resilience, resealing abilities, and compliance with stringent medical standards, could pose a threat to the

	traditional PP (polypropylene) and PE (polyethylene) materials used by Medicap Healthcare. • **Threat of New Entrants**: The entry of new players into the Euro Head Cap market could intensify competition, leading to price pressures and potentially affecting Medicap Healthcare's market share and profitability. New entrants may offer lower-priced alternatives, forcing MEDICAP Healthcare to adjust its pricing strategy to remain competitive. As more companies enter the market, there is a risk of market saturation, especially if the growth in demand does not keep pace with the increase in supply. This could lead to a highly competitive environment where companies vie for a limited customer base, potentially resulting in reduced profit margins. New entrants may introduce products that align with emerging trends, such as sustainability or smart packaging solutions. If these trends gain traction, Medicap Healthcare may need to adapt its product offerings to meet changing customer preferences and avoid losing market share. • **Supply Chain Disruptions**: Disruptions in the supply chain, such as raw material shortages, transportation delays, or geopolitical issues, could impact Medicap Healthcare's ability to produce and deliver its products on time, leading to customer dissatisfaction and potential loss of business.

11. FINANCIAL BENCHMARKING OF MEDICAP HEALTHCARE AND SELECT COMPANIES IN PHARMA PACKAGING INDUSTRY

Table 10.1: Financial analysis of Medicap Healthcare and select Indian and Global Peers*, FY 25

Parameter/ Company	Medicap Healthcare (Figures in INR Mn)*	Indian Peers (Figures in INR Mn)		Global Peers (Figures in USD Mn)		
		Huhtamaki India Ltd.**	EPL Ltd.*	Berry Global**	West Pharmaceutical Services**	Amcor*
Total Revenue FY 25	1099.1	25,548.3	42,569.0	12,258.0	2,893.2	15,009.0
Operating Revenue FY25	1083.0	25,211.8	42,133.0	12,258.0	2,893.2	15,009.0
Operating Revenue CAGR (FY22 – FY25)	10.4%	-1.3%	7.1%	-8.0%	0.1%	1.1%.%
EBITDA FY25	371.6	1,173.4	8,381.0	1,984.0	743.9$	1,768.0$
EBITDA CAGR (FY22 – FY25)	19.3%	2.5%	13.8%	-2.9%	-4.1%	-2.4%
PAT FY25	266.2	879.7	3,638.0	516.0	492.7	511.0
PAT CAGR (FY22 – FY25)	22.0%	-#	18.1%	-17.9%	-8.3%	-14.1%
ROCE FY25	18.5%	6.0%	16.7%	9.6%	24.5%	5.7%
RoE FY25	27.3%	7.5%	16.4%	15.1%	17.7%	6.5%
EBITDA Margin FY25	34.3%	4.7%	19.9%	16.2%	25.7%	11.8%
PAT Margin FY25	24.6%	3.5%	8.6%	4.2%	17.0%	3.4%

*Data is for FY25

**Data is for FY24. The company follows calendar Year as financial Year (FY24=CY24)

#Since there was loss in FY22

$Other income not reported

Source: Company financial filings and annual reports

Note:

- There are no comparable Indian and Global peers which are publicly listed in the infusion caps and closures segment.
- There is no exact comparable company for product mix portfolio similar to Medicap Healthcare.
- No financial data (including revenue, margin) are available for the peer group companies (Indian as well as global players)
- No installed / utilized capacity data are available for the peer group companies (Indian as well as global players)
- Product mix portfolio of Huhtamaki India Ltd and EPL Ltd includes Euro Head Caps along with many others products & hence included for financial comparison purpose on boarded category.

Formulas used for financial analysis

- EBITDA = Sum of profit/(loss) before tax and exceptional items, plus depreciation and amortization expense and finance costs , less other income
- EBITDA Margin = EBITDA divided by revenue from operations
- PAT Margin = PAT divided by revenue from operations
- RoE = PAT divided by average shareholder equity
- RoCE = EBIT divided by Capital Employed
- EBIT= Sum of Profit Before Tax and Finance cost
- Capital Employed = Sum of Total Equity and Total Borrowing less Cash and Bank balance