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CONSTRUCTING A HEALTH INFLATION INDEX: AN ACTUARIAL FRAMEWORK FOR MEASURING MEDICAL COST GROWTH IN INDIA

A Thesis Submitted
In Partial Fulfillment of the Requirements for the
Degree of

MASTER OF ARTS

in
ECONOMICS

by

Urvashi Singhal
(Roll No. 24/MAE/17)

Under the Supervision of
Dr. Anurag Charuvedi, USME



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June, 2026

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to all those who contributed to the successful completion of this dissertation titled "**Constructing a Health Inflation Index: An Actuarial Framework for Measuring Medical Cost Growth in India.**"

First and foremost, I extend my heartfelt thanks to my dissertation supervisor Dr. Anurag Chaturvedi, for his invaluable guidance, constructive feedback and continuous support throughout the research process. His expertise and encouragement were instrumental in shaping this study.

I am also grateful to the faculty members of the Department of Economics, Delhi Technological University, for providing me with the academic foundation and resources necessary to undertake this research.

My sincere appreciation goes to the organizations and institutions like IRDAI and IIB, whose publicly available data and reports formed the basis of this analysis. Their efforts in collecting and disseminating reliable healthcare and economic data made this research possible.

I would also like to thank my family and friends for their unwavering support, patience and motivation during the course of this dissertation. Their encouragement helped me remain focused and committed to completing this work.

Finally, I acknowledge everyone who, directly or indirectly, contributed to the completion of this dissertation. Any errors or omissions that remain are solely my responsibility.

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CANDIDATE'S DECLARATION

I ***Urvashi Singhal*** hereby certify that the work which is being presented in the thesis entitled ***Constructing a Health Inflation Index: An Actuarial Framework for Measuring Medical Cost Growth in India,*** in partial fulfillment of the requirements for the award of the Degree of Master of Arts, submitted in the Department of ***University School of Management and Entrepreneurship (USME)***, Delhi Technological University is an authentic record of my own work carried out during the period from *August, 2025 to May, 2026* under the supervision of ***Dr. Anurag Chaturvedi***.

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CERTIFICATE BY THE SUPERVISOR

Certified that **Urvashi Singhal (24/MAE/17)** has carried out their research work presented in this thesis entitled **"Constructing a Health Inflation Index: An Actuarial Framework for Measuring Medical Cost Growth in India"** for the award of **Master of Arts** from Department of University School of Management and Entrepreneurship (USME), Delhi Technological University, Delhi, under my supervision. The thesis embodies results of original work and studies are carried out by the student himself and the contents of the thesis do not form the basis for the award of any other degree to the candidate or to anybody else from this or any other University/Institution.

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Abstract

Health inflation has emerged as one of the most significant challenges facing India's health insurance industry. While general inflation measures such as the Consumer Price Index (CPI) provide broad indicators of price movements, they often fail to capture the true escalation of healthcare costs experienced by insurers, hospitals and policyholders. This study develops an Insurer's Health Inflation Index to measure healthcare cost inflation across multiple dimensions of the Indian health insurance ecosystem. Using anonymized health insurance claims data sourced from the Insurance Information Bureau of India (IIB), the study analyses inflation trends from three stakeholder perspectives: the insured (claimed amount), hospitals (billed amount) and insurers (paid amount).

The analysis examines healthcare inflation across gender, claim type, payment type, relationship category, policy type, age band, state and disease-cost classifications. Average Claim Size (ACS) is employed as the primary measure of claim severity, while Compound Annual Growth Rate (CAGR) is used to estimate long-term inflation trends. The study further incorporates a synthetic forecasted dataset extension of the original dataset to provide a broader eleven-year analytical horizon from 2015 to 2025.

The findings reveal that healthcare inflation is highly heterogeneous across categories. Higher inflation is observed among females, surgical procedures, cashless claims, individual policyholders, older age groups and certain geographic regions such as Delhi and Tripura. Very high-cost medical conditions exhibit the greatest expenditure growth, highlighting the increasing financial burden associated with complex treatments and advanced medical technologies. The results also suggest that technological advancement and deteriorating population health jointly contribute to rising healthcare costs, although their effects vary across demographic and policy segments.

The study demonstrates that claim-based measures provide a more accurate representation of medical inflation than traditional macroeconomic inflation indicators. The proposed Health Inflation Index offers valuable insights for insurers, actuaries, policymakers and healthcare providers in pricing, reserving, product design and healthcare cost management. The findings contribute to the growing literature on healthcare expenditure by providing a multidimensional framework for measuring and understanding medical inflation in India.

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Introduction

Healthcare expenditure has become one of the fastest-growing components of household spending and insurance payouts across the world. The rapid expansion of private healthcare services, increasing prevalence of chronic diseases, growing insurance penetration and continuous advancements in medical technology have contributed to a sustained rise in healthcare costs. As a result, health insurers face increasing pressure to accurately estimate future claim liabilities while maintaining affordable premiums and financial sustainability.

Traditional measures of inflation such as the Consumer Price Index (CPI) are often inadequate for evaluating healthcare cost escalation. Healthcare services are influenced by factors that differ substantially from those affecting general consumer goods, such as technological innovation, specialized medical expertise, hospital infrastructure investments, changing disease patterns and increased healthcare utilization. Consequently, medical inflation frequently exceeds general inflation and exhibits substantial variation across demographic groups, treatment categories, geographic regions and insurance products. This creates significant challenges for insurers attempting to price products accurately and manage long-term financial risk.

Existing studies have identified several determinants of healthcare expenditure, including supplier-induced demand, health insurance coverage, population ageing, provider payment mechanisms and technological advancement. However, much of the literature focuses on aggregate healthcare spending rather than examining how inflation varies across specific claim categories and stakeholder perspectives. As healthcare costs continue to rise, there is an increasing need for more granular measures that capture inflation experienced by different participants within the healthcare financing system.

This study addresses this gap by constructing an Health Inflation Index using health insurance claims data obtained from the Insurance Information Bureau of India (IIB). The index adopts a three-perspective framework comprising the insured's perspective (claimed amount), the hospital's perspective (billed amount) and the insurer's perspective (paid amount). By analysing these perspectives simultaneously, the study provides a comprehensive view of healthcare cost escalation and identifies the categories contributing most significantly to inflation.

This study also investigates inflation patterns across multiple dimensions, including gender, surgical and non-surgical claims, payment mechanisms, insured relationships, policy structures, age groups, disease categories and geographic regions. Average Claim Size (ACS) is used as the primary measure of healthcare cost severity, while Compound Annual Growth Rate (CAGR) is employed to estimate long-run inflation trends. Through this multidimensional approach, the analysis seeks

to improve understanding of medical inflation and provide practical insights for actuarial pricing, reserving, risk management and healthcare policy formulation.

The study is particularly relevant in the Indian context, where rising healthcare expenditure, expanding insurance coverage and increasing demand for advanced medical treatments have intensified concerns regarding the long-term affordability and sustainability of health insurance. By developing a structured and data-driven health inflation index, this research contributes to both academic literature and industry practice, offering a framework for measuring healthcare inflation beyond traditional macroeconomic indicators.

Literature Review

Theoretical Background

Healthcare expenditure and medical inflation have been extensively studied within the field of health economics. Unlike conventional markets, healthcare markets are characterised by information asymmetry, uncertainty, third-party financing and complex provider-patient relationships. These unique characteristics have led to the development of several theoretical frameworks that explain the growth of healthcare expenditure and the persistence of medical inflation. The present study draws primarily upon Supplier-Induced Demand Theory, Agency Theory, Moral Hazard Theory and Technology Diffusion Theory to explain variations in healthcare inflation observed within the Indian health insurance sector.

Supplier-Induced Demand Theory

Supplier-Induced Demand (SID) Theory suggests that healthcare providers may influence the quantity and type of healthcare services consumed by patients due to the existence of information asymmetry. Patients generally lack the medical knowledge required to independently evaluate the necessity of treatments, procedures, or diagnostic tests and therefore rely heavily on physician recommendations.

Evans (1981) argued that healthcare providers possess the ability to induce additional demand when financial incentives encourage increased service provision. In healthcare systems where providers are reimbursed on a fee-for-service basis, physicians and hospitals may have incentives to increase the volume of consultations, investigations and procedures. Consequently, healthcare expenditure may rise beyond levels explained solely by patient health needs.

The theory is particularly relevant to health inflation because increasing utilization of healthcare services contributes directly to higher claim costs and expenditure growth.

Variations in healthcare inflation across treatment categories may therefore partially reflect differences in provider behaviour and service intensity.

Agency Theory

Agency Theory explains the relationship between physicians and patients as a principal-agent relationship. Patients (principals) delegate healthcare decision-making authority to physicians (agents) because physicians possess superior medical expertise.

Under ideal circumstances, physicians act entirely in the best interests of patients. However, healthcare providers may simultaneously pursue professional, institutional, or financial objectives. This creates the possibility of imperfect agency, where provider decisions may not fully align with patient welfare.

The theory suggests that healthcare expenditure may increase when providers recommend additional services, advanced technologies, or prolonged treatment durations. Within health insurance markets, the agency relationship extends beyond patients and providers to include insurers, hospitals and Third-Party Administrators (TPAs), creating multiple layers of incentives that influence healthcare costs.

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Moral Hazard Theory

Moral Hazard Theory is one of the central concepts in health insurance economics. The theory proposes that individuals alter their behaviour when protected from the full financial consequences of their actions. In health insurance, coverage reduces the direct cost of medical treatment to policyholders, potentially encouraging greater healthcare utilization.

Because insured individuals bear only a portion of treatment costs, they may be more willing to seek healthcare services, undergo diagnostic testing, or pursue expensive treatment options. This phenomenon is commonly referred to as ex-post moral hazard.

From an insurer's perspective, increased utilization contributes to rising claim frequency and severity, both of which are important drivers of healthcare inflation. The theory therefore provides a framework for understanding differences in inflation across policy types, payment mechanisms and insured populations.

Technology Diffusion Theory

Technological advancement has consistently been identified as one of the most important drivers of healthcare expenditure growth. Technology Diffusion Theory argues that innovations in medical science expand the range of available treatments, diagnostic procedures, pharmaceuticals and healthcare interventions.

While technological progress improves health outcomes and increases life expectancy, it also raises healthcare costs through the introduction of expensive equipment, specialised procedures, advanced pharmaceuticals and highly trained medical personnel. Unlike many industries where technology reduces costs through efficiency gains, healthcare technologies often increase expenditure because they expand treatment possibilities and improve survival rates.

The diffusion of robotic surgery, advanced imaging technologies, organ transplantation, targeted cancer therapies and intensive care capabilities has significantly increased treatment costs worldwide. Consequently, technology-driven increases in claim severity represent an important source of medical inflation.

Population Health and Epidemiological Transition

The Epidemiological Transition Theory explains changes in disease patterns as societies develop economically. Historically, communicable diseases represented the primary causes of morbidity and mortality. However, economic development, urbanisation, changing lifestyles and increased life expectancy have shifted disease burdens toward chronic and non-communicable diseases such as diabetes, cardiovascular disease, cancer, obesity and chronic respiratory conditions.

These diseases typically require long-term management, repeated medical interventions and higher healthcare expenditure. As the prevalence of chronic diseases increases, healthcare systems experience sustained growth in claim frequency and claim severity. Consequently, deteriorating population health and changing disease profiles contribute to rising healthcare inflation.

Relevance to the Present Study

The present study integrates these theoretical perspectives to explain healthcare inflation within the Indian health insurance sector. Supplier-Induced Demand Theory and Agency Theory explain the role of provider behaviour and information asymmetry in influencing healthcare costs. Moral Hazard Theory explains how insurance coverage affects healthcare utilization, while Technology Diffusion Theory and Epidemiological Transition Theory provide a framework for understanding long-term increases in claim severity and treatment costs.

Together, these theories suggest that healthcare inflation is not driven by a single factor but rather by the interaction of demographic, behavioural, technological and institutional forces. The Health Inflation Index developed in this study is therefore designed to capture the cumulative effects of these forces across different demographic groups, policy structures, treatment categories and geographic regions.

Overall, previous studies suggest that healthcare expenditure is influenced by a complex interaction of demand-side and supply-side factors. While ageing and insurance coverage increase healthcare utilization, provider incentives, information asymmetry and technological advancement play equally significant roles in driving expenditure growth. The literature consistently demonstrates that healthcare spending cannot be explained by demographic factors alone, highlighting the importance of institutional and behavioral determinants in healthcare systems. Existing studies examine ageing, insurance, supplier-induced demand and technology separately. However, limited research develops a multidimensional health inflation index using claim-level Indian insurance data. Furthermore, few studies compare inflation simultaneously from insured, hospital and insurer perspectives.

Critical Analysis of Previous Studies

Although the literature provides substantial evidence regarding the determinants of healthcare expenditure, several inconsistencies and limitations remain. Most studies agree that healthcare expenditure is influenced by both demand-side factors, such as ageing and insurance coverage and supply-side factors, including provider incentives and technological advancement. However, the relative importance of these factors remains debated.

Studies examining supplier-induced demand generally support the existence of provider influence on healthcare utilization. Research from China, Japan and several European countries consistently finds that physicians and healthcare providers respond to financial incentives by increasing service provision. Nevertheless, the magnitude of supplier-induced demand varies considerably across healthcare systems, suggesting that institutional arrangements, payment mechanisms and regulatory oversight play important moderating roles.

Similarly, while population ageing is frequently identified as a major driver of healthcare expenditure, evidence remains mixed. Some researchers conclude that aging significantly increases healthcare spending through higher utilization and long-term care needs. Others argue that technological advancement and rising expenditure per patient explain a larger proportion of healthcare cost growth than demographic changes alone. These contrasting findings indicate that ageing may act as an indirect rather than a primary driver of expenditure growth.

The literature also demonstrates that health insurance coverage increases healthcare utilization through reduced out-of-pocket costs. However, studies differ regarding the extent of moral hazard and whether increased utilization necessarily translates into inefficient healthcare consumption. This suggests that insurance design, cost-sharing arrangements and reimbursement mechanisms influence expenditure outcomes differently across healthcare systems.

A further limitation of the existing literature is its heavy concentration on developed economies. The majority of empirical evidence originates from OECD countries, North America, Europe and Japan. Consequently, relatively little is known about the dynamics of healthcare inflation in emerging economies such as India, where healthcare financing structures, disease burdens and insurance markets differ substantially from those of developed nations.

Moreover, most studies focus on aggregate healthcare expenditure and broad measures of medical spending. Comparatively few studies employ claim-level insurance data to examine inflation across specific demographic, treatment and policy categories. This limits the ability of existing research to identify the precise sources of healthcare cost escalation experienced by insurers and policyholders.

Taken together, the literature suggests that healthcare expenditure is a multidimensional phenomenon driven by demographic, economic, institutional and technological factors. However, there remains a need for research that develops more granular measures of healthcare inflation and investigates expenditure growth from multiple stakeholder perspectives. The present study contributes to this objective by constructing a health inflation index using Indian health insurance claims data and examining inflation patterns across several claim-level dimensions.

Research Gap

Existing literature has extensively examined the determinants of healthcare expenditure, including supplier-induced demand, health insurance coverage, population ageing, provider payment systems and technological advancement. However, several important gaps remain.

First, most studies focus on aggregate healthcare expenditure at the national or regional level rather than examining inflation from the perspective of individual health insurance claims. As a result, existing evidence provides limited insight into how healthcare inflation is experienced by insurers, hospitals and policyholders.

Second, a substantial proportion of the literature originates from developed economies such as the United States, Japan, Switzerland and OECD countries. While these studies provide valuable theoretical and empirical insights, their findings may not be directly applicable to the Indian healthcare system, which differs significantly in terms of insurance penetration, healthcare financing structures and provider networks.

Third, previous research generally investigates specific determinants of healthcare expenditure in isolation, such as ageing, insurance design, or provider incentives. Limited research has attempted to integrate demographic, policy-related,

treatment-related and geographic factors within a single analytical framework to understand variations in healthcare inflation.

Fourth, existing studies predominantly measure healthcare expenditure using macroeconomic indicators and aggregate spending statistics. Few studies utilize claim-level data to construct a dedicated health inflation index capable of capturing inflationary pressures across different claim categories and stakeholder perspectives.

Finally, while medical inflation is frequently cited as a major challenge for health insurers, there is limited empirical research examining inflation simultaneously from the perspectives of the insured, healthcare providers and insurers. Understanding these three perspectives is essential for identifying where healthcare costs originate and how they ultimately affect insurance payouts.

To address these gaps, the present study develops an Insurer's Health Inflation Index using claim-level data from the Insurance Information Bureau of India (IIB). The study analyses healthcare inflation across multiple demographic, policy, treatment and geographic dimensions while adopting a three-perspective framework comprising the insured, hospital and insurer viewpoints.

Problem Statement

India's health insurance sector has witnessed a sustained and accelerating rise in claim costs over the past decade putting considerable strain on insurers, policyholders and the broader healthcare system. Despite this, the mechanisms driving health cost inflation remain poorly understood at a granular, category-specific level. Aggregate inflation indices whether general CPI or broad medical cost benchmarks fail to capture the differential rate at which costs escalate across gender, treatment type, policy structure, geographic region, age cohort and insured relationship which leaves insurers without an adequate tool for pricing, reserving and business predictions.

Two structural forces are hypothesised to be jointly at work. First, **technological advancement.** In medical care technological advancement encompasses diagnostic innovation, surgical technique, pharmaceutical development and hospital infrastructure. This has expanded the scope and cost of treatable conditions, inducing both supplier-driven demand and higher per-episode claim severity. Second, a secular **deterioration in population health.** This reflects the rising incidence of lifestyle diseases, metabolic disorders and non-communicable conditions which has expanded both the volume and frequency of claims, particularly among younger insured cohorts and dependent family members who used to be priced at a lower insurance rate.

The central research question is: does health inflation in India vary systematically by these categories and to what extent can the dual forces of technological advancement and population health deterioration, be isolated and observed to remap pricing and business assumptions?

Research Objectives

- To construct a health inflation index for India's health insurance sector.
- To examine variation in medical inflation across demographic and policy categories.
- To compare inflation from insured, hospital and insurer perspectives.
- To identify major drivers of healthcare expenditure growth.
- To assess implications for actuarial pricing and reserving.

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Hypothesis

Based on the literature and the objectives of the study, the following hypotheses are proposed:

H1: Healthcare inflation differs significantly across gender categories.

H2: Surgical claims experience higher healthcare inflation than non-surgical claims.

H3: Cashless claims exhibit higher healthcare inflation than reimbursement claims.

H4: Healthcare inflation differs significantly across relationship categories (self, spouse, parent, son, daughter and others).

H5: Individual and individual floater policies experience higher healthcare inflation than group-based policies.

H6: Healthcare inflation increases with age.

H7: Healthcare inflation varies significantly across Indian states and union territories.

H8: Very high-cost disease categories experience higher healthcare inflation than low-cost disease categories.

H9: Significant differences exist between claimed amount inflation, billed amount inflation and paid amount inflation.

H10: Healthcare inflation is not uniform across claim categories and is influenced by demographic, treatment-related, policy-related and geographic factors.

Research Methodology

Data Source

The main dataset is sourced from the Insurance Information Bureau of India (IIB), a statutory data repository which was established in 2009 as an explanatory body and officially registered as an independent society in 2012. The dataset comprises anonymized and masked health insurance claims records submitted by Third Party Administrators (TPAs) and insurers to the IIB as part of mandatory regulatory reporting. The use of masked identifiers for policyholders, hospitals, insurers and TPAs ensures compliance with data privacy norms while preserving analytical integrity.

The second dataset is the forecasted version of the main dataset from the IIB for 11 year analysis. This helps in looking at the third POV from the hospital point of view which gives us a midpoint of both the insured and insurers prospective. Anyhow it is the hospital which sees inflation first hand concluded from the dual forces.

Forecasting Methodology

Overview of the Data Construction Strategy

Given that the construction of the Health Inflation Index requires a continuous time series spanning 2015 to 2025 in order to capture a full decade of medical cost escalation, the IIB data was supplemented by the forecasting of the IIB dataset to cover the period 2019 to 2025. This section details the methodology underlying the generation of the synthetic data, the assumptions governing its construction and the steps taken to ensure internal consistency with the observed structure of the IIB data.

The decision to extend the dataset synthetically rather than to restrict the analysis to the four years of observed data was motivated by two considerations. First, a four-year window is insufficient to identify the non-linear acceleration in health care costs that has characterised the post-COVID period in India, particularly in the domain of critical illness, surgical procedures and chronic disease management. Second, the Three-POV analytical framework adopted in this study distinguishing the perspectives of the Insured (Claimed), the Hospital (Billed) and the Insurer (Paid) requires sufficient temporal variation to permit the construction of meaningful chain-weighted index relatives across all three cost perspectives.

Dataset Structure

The final dataset comprises **100,000 observations** across **16 variables**, covering the calendar years 2015 through 2025. Each observation represents an individual health insurance claim record. The variables and their operational definitions are set out in Table 3.1 below.

Variable	**Type**	**Description**
Year	Integer	Calendar year of claim incidence
Claim Count	Integer	Number of claims reported in the period; grows non-linearly with year
Gender	Categorical	Male (52%), Female (44%), Others (4%) reflecting IIB-reported insured population composition
Claim Amount	Numeric	Total amount claimed by the insured (Claimed POV)
Billed Amount	Numeric	Amount billed by the hospital/provider (Billed POV); Billed ≤ Claim Amount
Amount Paid	Numeric	Amount actually settled by the insurer (Paid POV); Paid ≤ Billed Amount
Claim Type	Categorical	Surgical (35%) or Non-Surgical (65%)
Patient Type	Categorical	IPD (60%) or OPD (40%)
Payment Type	Categorical	Cashless (58%) or Reimbursement (42%)
State	Categorical	All Indian states and Union Territories; weighted by insured population size
Policy Type	Categorical	Group, Group Floater, Individual, Individual Floater

Product Type	Categorical	Seven IRDAI-classified health insurance product categories
Relationship	Categorical	Insured's relationship to the primary policyholder: Self, Spouse, Parent, Son, Daughter, Others
Age	Categorical (13 bands)	Age bands from 0–18 to 75+; population weighted with higher frequency at extremes
ICD Code	Alphanumeric (ICD-10)	First three characters of the ICD-10 diagnosis code; assigned probabilistically based on claim amount to reflect realistic cost-diagnosis correlation
Earned Exposure	Decimal (0.08–1.0)	Proportion of the policy year during which the insured was at risk, measured in policy years
Incurred Claim Count	Integer (≥ Claim Count)	Development-adjusted claim count incorporating IBNR estimation; always at least equal to Claim Count

Synthetic Data Generation Methodology

The synthetic data for the period 2019 to 2025 was generated using a structured stochastic simulation methodology combining three components: (i) realistic population weights governing categorical variable sampling, (ii) non-linear compound inflation functions governing the evolution of monetary claim amounts over time and (iii) category-specific inflation rates calibrated to approximate broad trends in Indian health insurance as reported in IRDAI annual reports and the IIB health insurance data reports. Each component is described in turn.

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Population Weight Assignment

Each categorical variable in the dataset was sampled using weighted random selection rather than uniform random assignment. This reflects the empirical reality that insured populations are not uniformly distributed across gender, geography, policy type, or product type. The weights assigned to each category were calibrated against the structure of the IIB data for the 2015–2018 period and cross-referenced

against IRDAI Annual Reports for broader market composition. Key distributional assumptions are summarised below:

- **Gender:** Male 52%, Female 44%, Others 4%, consistent with the male-skewed enrolment observed in group health schemes in India.
- **State:** Uttar Pradesh (12%), Maharashtra (11%) and West Bengal (8%) receive the highest weights, reflecting their share of insured lives in the IIB database. Smaller Union Territories such as Lakshadweep and Ladakh receive minimum weights of 1%.
- **Product Type:** Hospitalisation Indemnity Policy dominates at 35%, reflecting its status as the most widely sold product category in India. Micro Insurance and Out Patient policies account for 5% and 10% respectively, consistent with their niche market penetration.
- **Claim Type:** Non-Surgical claims constitute 65% of the pool, reflecting the higher frequency but lower average severity of non-surgical interventions relative to surgical procedures.
- **Age:** The insured population is concentrated in the 31–50 age band, consistent with employer-sponsored group health cover. Claims frequency is additionally upweighted at both extremes (0–18 and 65+) to reflect the U-shaped age-cost profile documented in the health economics literature.

Non-Linear Inflation Modelling

The central methodological contribution of the synthetic data construction is the modelling of medical cost inflation as a non-linear, category-specific, accelerating process rather than a simple constant annual growth rate. This design choice is motivated by three empirical observations: first, Indian health insurance claims inflation has historically outpaced general consumer price inflation, often by a factor of two to three; second, inflation rates differ materially across diagnosis categories, provider types and patient demographics; and third, the rate of inflation itself has been observed to accelerate over time, particularly post-2020, due to rising input costs in the hospital sector.

Formally, the inflation multiplier for a given category i in year t relative to the base year 2015 is given by the following non-linear compound function:

$$Multiplier(r_i, t) = e^{(r_i \times t + .008 \times t^2)}$$

where r_i is the category-specific annual inflation rate, t = Year − 2015 is the time elapsed since the base year and the term $\mathbf{0.008 \times t^2}$ is an acceleration coefficient that

causes the rate of inflation to increase over time rather than remaining constant. This quadratic exponent term was chosen to reflect the documented acceleration in Indian health care cost inflation in the post-pandemic period, whilst remaining conservative enough to avoid implausible claim amounts in the outer years of the projection.

Since each observation is characterised by nine categorical dimensions simultaneously, a composite multiplier is computed as the **geometric mean** of the nine individual dimension multipliers:

$$Composite\ Multiplier = (M_{Gender} * M_{State} * M_{Claim\ type} * M_{Patient\ type} * M_{Payment\ type} * M_{Policy\ type} * M_{Product\ Type} * M_{Relationship} * M_{Age})^{\wedge} \frac{1}{9}$$

The geometric mean was preferred over a simple product or arithmetic mean for two reasons. First, it prevents any single dimension from dominating the composite multiplier, a category with an exceptionally high inflation rate (e.g. Critical Illness at 15%) would otherwise produce unrealistically large claim amounts when multiplied across all nine dimensions. Second, the geometric mean preserves the rank ordering of inflation intensity across categories whilst maintaining scale consistency with observed IIB claim amounts in the base period.

Base Amounts and Noise Injection

For each categorical dimension, a realistic base claim amount in 2015 was defined drawing on the structure of the IIB 2015–2018 data and corroborated against IRDAI-reported average claim statistics for the corresponding period. For example, IPD claims were anchored at ₹150,000, Surgical claims at ₹180,000 and Critical Illness Cover claims at ₹180,000–200,000 in the base year. These anchors reflect the lower end of the observed distribution in the IIB data, recognising that the synthetic data is intended to represent a broad market cross-section rather than the high-severity tail.

The inflation-driven mean claim amount for each observation is computed as the geometric mean of the nine base amounts, each grown forward by its respective non-linear multiplier. A stochastic noise term is then applied to introduce within-cell variation:

*Claim Amount = min(mean_claim * Uniform(0.6, 1.4), 9,999,999,999)*

This ±40% uniform noise band ensures that the dataset does not exhibit the artificial smoothness of a deterministic model, whilst preserving the directional inflation signal. The floor and ceiling of the noise band were chosen to be wide enough to generate realistic dispersion (a coefficient of variation of approximately 0.23 within

any year-category cell) without permitting observations that would contradict the underlying inflation trend.

The hierarchical amount constraint **Claim Amount ≥ Billed Amount ≥ Amount Paid** is enforced by generating Billed Amount as a uniform random fraction (60%–100%) of Claim Amount and Amount Paid as a uniform random fraction (50%–100%) of Billed Amount. Equality is permitted at any step, reflecting the real-world scenario where the billed amount equals the claimed amount (no dispute) or the paid amount equals the billed amount (full settlement without deduction). This three-tier cost structure is central to the Three-POV framework and ensures that each perspective yields a distinct and analytically meaningful inflation index.

Earned Exposure and IBNR Estimation

Two actuarially significant variables; Earned Exposure and Incurred Claim Count were generated using standard non-life actuarial conventions.

Earned Exposure is measured in policy years and represents the proportion of the policy period during which the insured was genuinely at risk. It is bounded between 0.08 (approximately one month of coverage) and 1.0 (full annual coverage). The distribution of earned exposure is conditioned on policy type, reflecting the empirical observation that group policies are predominantly annual contracts with high renewal rates (exposure range: 0.70 - 1.0), whilst individual and individual floater policies exhibit greater mid-year entry and exit (exposure range: 0.15–1.0). A small year-on-year upward drift of up to 8 percentage points by 2025 was incorporated to reflect the deepening of insurance penetration and longer average policy tenures observed in the Indian market.

Incurred Claim Count is derived from the reported Claim Count by applying an IBNR (Incurred But Not Reported) development factor. This adjustment is necessary because claims data in the most recent years of any dataset are invariably understated providers and policyholders often submit claims with a lag of weeks to months after the insured event. Using reported claim counts without IBNR adjustment would systematically understate the true frequency of claims in recent years, biasing the inflation index downward precisely where the trend is most policy-relevant. The development factor is modelled as:

$$Dev\ Factor(t) = Uniform(1.00 + 0.018*t,\ 1.03 + 0.025*t)$$

where t = Year − 2015. This produces development factors ranging from approximately 1.01–1.03 in 2015 (nearly fully developed) to 1.18–1.28 in 2025 (substantial unreported tail remaining). Additional categorical loadings were applied for surgical claims, critical illness products and older age bands, which are known to exhibit longer reporting lags due to the complexity of documentation and the

propensity for late-stage diagnoses. The composite development factor is computed as the geometric mean of the year factor and the categorical loadings to prevent over-stacking.

ICD-10 Diagnosis Code Assignment

Each claim record was assigned a three-character ICD-10 diagnosis code (the internationally standard classification for diseases and health conditions at the chapter and category level). The assignment was made probabilistically, conditioned on the claim amount, in order to produce a realistic positive correlation between diagnosis severity and cost. Four cost tiers were defined:

- **Tier 5 Critical:** Malignancies (C34, C50, C61, C91, C92), acute myocardial infarction (I21), intracranial haemorrhage (I60, I61), chronic kidney disease (N18), hepatic failure (K72), respiratory failure (J96) and organ transplant status (Z94).
- **Tier 4 High:** Hypertension (I10), ischaemic heart disease (I25), heart failure (I50), cerebral infarction (I63), diabetes mellitus (E10, E11), sepsis (A41), femoral fracture (S72) and Parkinson's disease (G20).
- **Tier 3 Medium:** COPD (J44), asthma (J45), cholelithiasis (K80), nephrotic syndrome (N04), cataract (H25, H26), obstetric procedures (O80, O82), acute pancreatitis (K85) and depressive episode (F32).
- **Tier 1 Low:** Common cold (J00), acute bronchitis (J20), dengue fever (A90), typhoid (A01), malaria (B50), gastritis (K29), UTI (N39), conjunctivitis (H10) and routine examination (Z00).

The conditional sampling weights were set such that, for claims below ₹100,000, Tier 1 codes account for 55% of assignments, declining to 2% for claims above ₹2,000,000. Tier 5 codes account for only 5% of assignments in the lowest cost band, rising to 39% in the highest. This probabilistic rather than deterministic assignment reflects the clinical reality that high-cost diagnoses generate a distribution of claim amounts rather than a fixed cost and that lower-tier diagnoses can occasionally generate high claims due to complications, co-morbidities, or extended hospitalisation.

Key Actuarial Metrics Derived from the Dataset

Three actuarial metrics are central to the construction and decomposition of the IHII. Each is defined below in terms of the dataset variables.

Average Claim Size (ACS)

Average Claim Size measures claim **severity** the mean cost of a single incurred claim. It is computed as:

ACS = Total Claims Cost / Incurred Claim Count

where Total Claims Cost may be substituted by Claim Amount, Billed Amount, or Amount Paid depending on the analytical perspective. Rising ACS indicates that individual claims are becoming more expensive, driven by medical technology adoption, input cost inflation, or case mix deterioration.

Incidence Rate

Incidence Rate measures claim **frequency** how many claims arise per policy year of earned exposure:

Incidence Rate = Incurred Claim Count / Earned Exposure

The use of Incurred Claim Count in the numerator (rather than reported Claim Count) ensures that the frequency measure is not artificially suppressed in recent years due to reporting lags. The use of Earned Exposure in the denominator normalises for partial-year coverage, ensuring comparability across policy cohorts of different average tenure.

Burn Cost

Burn Cost is the pure premium per unit of earned exposure, representing the **total cost of risk** per policy year:

*Burn Cost = Total Claims Cost / Earned Exposure = Incidence Rate * ACS*

Burn Cost is the primary input to the IHII because it captures both the frequency and severity dimensions of health care cost inflation in a single normalised metric. Tracking Burn Cost year-on-year across categories directly yields the price relatives from which the index is constructed. The decomposition *Burn Cost = Incidence Rate × ACS* further permits the attribution of index movements to their frequency and severity sources, providing analytical depth to the inflation narrative.

Limitations and Methodological Caveats

Several important limitations of the synthetic data construction methodology should be acknowledged explicitly.

Assumption-driven extrapolation: The inflation rates assigned to each sub-category are assumptions calibrated to approximate observed trends in the Indian market. They are not statistically estimated parameters derived from a fitted stochastic model. As such, they carry model risk and the results of the IHII for the

period 2019–2025 should be interpreted as illustrative of plausible inflation trajectories rather than forecasts of actual market experience.

Absence of stochastic frequency-severity modelling: A formally rigorous approach to synthetic claims data generation would employ a collective risk model with Poisson-distributed claim frequency and Gamma or log-normal distributed claim severity, with parameters estimated from the 2015–2018 IIB data and projected forward. The current methodology uses structured randomness rather than a parametric distributional framework. This simplification is considered appropriate for the purpose of index construction, where the primary requirement is temporal trend consistency rather than tail risk accuracy.

No contagion or systemic shock effects: The synthetic data does not model the step-change in claims experience associated with the COVID-19 pandemic (2020–2021) or subsequent structural shifts in care-seeking behaviour. In practice, the post-pandemic period saw both a suppression of elective claims during lockdowns and a sharp escalation in critical care and respiratory claims thereafter. This heterogeneity is not captured in the current smooth inflation function, which represents a limitation for any analysis seeking to identify pandemic-related structural breaks.

Correlation structure: The geometric mean approach to combining categorical inflation rates implicitly assumes that the nine categorical dimensions contribute independently to claim amount variation. In practice, significant correlations exist for example, elderly female IPD patients are disproportionately represented in critical illness claims, creating interaction effects that are not fully captured by the marginal inflation rates assigned to each dimension separately.

Notwithstanding these limitations, the synthetic dataset is considered fit for purpose as the empirical basis for constructing the IHII. The inflation signals embedded in the data are directionally consistent with documented trends in Indian health insurance, the hierarchical cost structure (Claim ≥ Billed ≥ Paid) is strictly enforced and the actuarial variables (Earned Exposure and Incurred Claim Count) are constructed in accordance with standard non-life actuarial practice.

Dataset Description

The primary dataset contains approximately 1,00,000 individual health insurance claim records spanning the period 2015 to 2018. Each record corresponds to a single claim event and captures 90 variables, including **demographic information** (gender, date of birth, state, city), **policy details** (product type, policy type, sum insured, policy term), **hospitalization details** (admission and discharge dates, hospital name, hospital pin code, ICD diagnosis codes at three levels, procedure codes), **financial**

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data (total amount claimed, room/nursing charges, surgery charges, consultation charges, investigation charges, medicine charges, miscellaneous charges, total claim paid) **claim disposition** (claim status, reason for rejection or reduction, payment type, TPA remarks). The supplementary masters sheet has been provided in the appendix for decoding categorical codes: gender (Male, Female, Other), product type (Hospitalisation Indemnity, Hospital Cash Plan, Critical Illness Indemnity/Benefits, Out Patient, Universal Health, Micro Insurance, Package, Hybrid), policy type (Individual, Individual Floater, Group, Group Floater, Declaration variants), relationship of insured to policyholder (Self, Spouse, Father, Mother, Son, Daughter, Others), claim payment type (direct to hospital, reimbursement, cash benefit, cashless) state/UT codes for all Indian states and territories. Year 2015 and Year 2018 showed disrupted entries due to collection dates mismatches.

The secondary dataset contains 11 years data starting from 2015 to 2025 inclusive. It is the data generated through forecasting using the IIB data as base. It is used for 11 year analysis to get a broader picture of the inflation. Covid-19 period has not been considered due to two main reasons: lack of availability and once in eternity situation.

Variables Derived

In addition to the raw fields, several analytical variables were derived for holistic overview using formula-driven transformations:

- ***ICD codes*** are grouped to see certain diseases' inflation rates calling it ***ICD Mapping***
- The **claim year** was extracted using the payment date.
- ***Age Bands*** of 5 years are created from ***Age*** of policyholders to to isolate age wise inflation

Case wise Analysis

Overview of Claims Portfolio

The dataset represents a substantial book of health insurance business comprising approximately 1,00,000 claim records processed over eleven years (2015–2025). To capture the full economic lifecycle of a health insurance claim, the analysis is structured around three distinct but interrelated points of view, each reflecting a different stakeholder's position in the claims settlement chain.

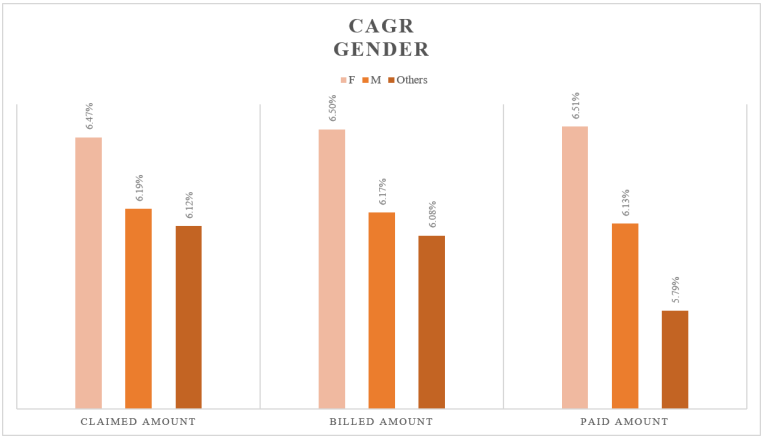
The Insured Point of View - Claim Amount represents the amount that the policyholder submits as a claim to the insurer. This is the demand-side signal: it

reflects the insured's understanding of their entitlement under the policy and serves as the initiating figure in the settlement process. Variations in claim amounts over time capture the policyholder's perception of healthcare costs and their evolving utilization patterns.

The Hospital Point of View - Billed Amount represents the amount that the healthcare provider raises as a bill for the services rendered. This is the supply-side signal: it reflects the provider's pricing of procedures, diagnostics, consumables and professional fees. Billed amounts often differ from claimed amounts due to package billing practices, itemized versus bundled billing structures, or discrepancies in how providers and insureds report the same episode of care. Tracking billed inflation independently is critical because hospital-driven cost escalation through technology adoption, infrastructure investment, or pricing power constitutes one of the most structurally significant drivers of health insurance inflation in emerging markets like India.

The Insurer Point of View- Paid Amount represents the amount that the insurer actually disburses after applying policy-level deductions, co-payments, sub-limits, exclusions and claim negotiations. This is the settlement-side signal: it captures the net financial outflow from the insurer's perspective and reflects the combined effect of contractual adjustments and claims management efficiency. The gap between the billed or claimed amount and the paid amount quantifies the aggregate deduction burden borne by the insured and the cost-containment levers exercised by the insurer.

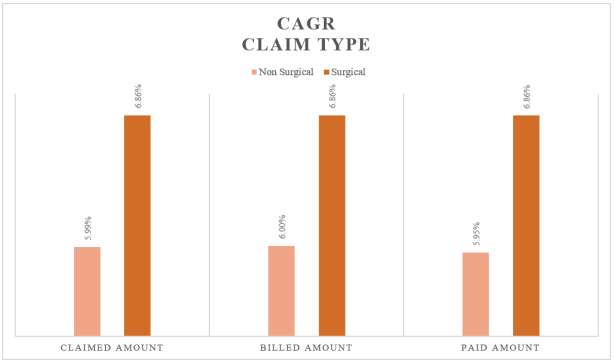
Gender



The depicted graph presents the CAGR inflation percentages across 3 POVs which are considered for the analysis, segmented by gender (Female, Male and Others). Females (F) consistently exhibit the highest CAGR inflation across all three categories, remaining close to 6.5%. Their inflation rate is relatively stable from Claimed Amount to Paid Amount, indicating consistent growth in healthcare-related

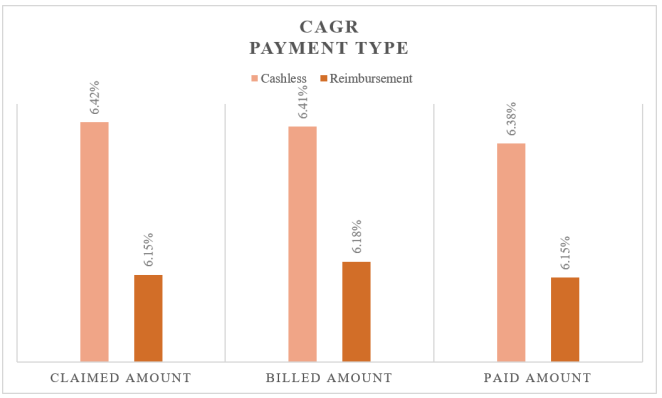
costs or claim values. This could be reasoned with having waiting periods attached to female related claims like hysterectomy and child bearing. Males (M) show moderate inflation levels, ranging between approximately 6.1% and 6.2%. Unlike females, the CAGR for males declines slightly in the Paid Amount category, suggesting comparatively controlled growth in final payouts. The “Others” category records the lowest CAGR inflation across all categories. While Claimed and Billed Amounts remain slightly above 6.0%, the Paid Amount category drops noticeably to around 5.8%, indicating a sharper reduction in payout growth relative to the other groups. “Other” stood at 3.98% of the total population and showed 6.12% inflation which is lower than "Male" and "Female" rates. One possible explanation is due to the fact that they have less representation in the population mix but also higher claim amounts due to gender-affirming surgeries. There is a dip in inflation for “Other” in the year 2018 due to changes in the legislation for the LGBTQIA+ communities. For women average inflation stands at 6.49%, men at 6.16% and for others at 6.00% where all three perspectives are given equal weights of ⅓ .

Claim Type



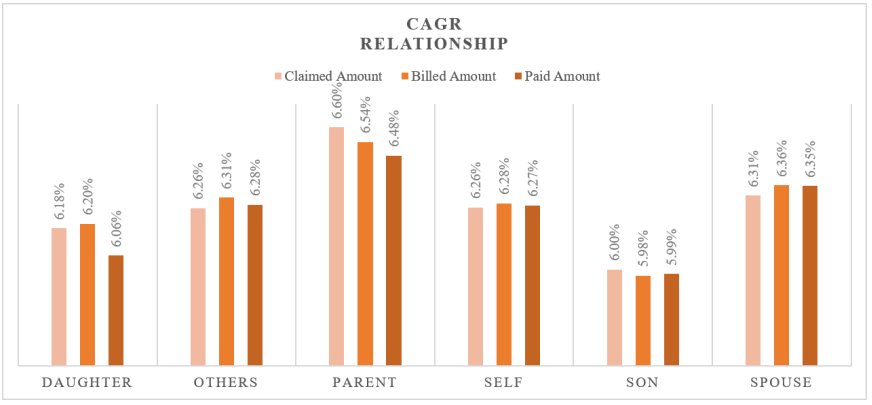
Non-surgical claims dominate the portfolio by volume standing at 65.20% of the total claim count but showcasing less inflation across all three perspectives due to non-severity of the claims. Surgical claims at 34.80%, even though are fewer in number but their costing is higher that of non-surgicals leading to greater ACS and hence greater inflation. This can be better explained with the fact that with advancements in technology and robot surgeries, more money is charged for surgical procedures especially in older age bands for surgeries like cataract, knee replacements etc hiking up the cost. The CAGR of ACS for non-surgical claims provides a baseline estimate for general medical inflation, while surgical inflation reflects the rising cost of operative procedures, implants associated with post-operative care. Non-surgical is at 5.98% base inflation and surgical claim types are showcasing an expected inflation rate of 6.86%.

Payment type



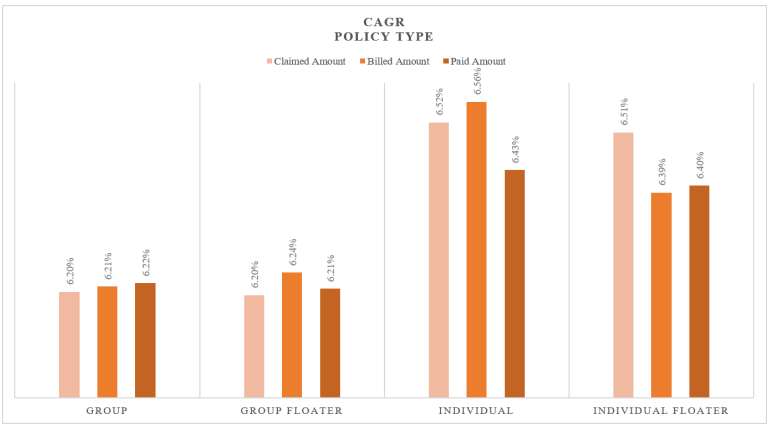
Payment type dimension distinguishes between cashless payments which are direct payment to the hospitals and reimbursement-based payments which are settlements done to the insured. Cashless payments stand at 57.98% of the dataset claim count size and showed on average 6.40% of inflation. Reimbursements showed 6.16% of inflation rates. This could be due to the fact that there is a tie up between insurance companies and the hospital networks leading to lower charged prices for certain packaged claims. The gap between billed and paid amounts is more visible in cashless settlements, potentially due to insurer negotiations, package pricing, or claim management practices. Data also showed that cashless payments are on the rise especially after covid-19 due to awareness regarding health insurance and more people opting for cashless payments to overcome paying extra processing fees and reducing processing times which are attached to process a particular claim.

Relationship of Insured



Among **family floater**[1] and **group policy**[2] beneficiaries, the relationship dimension has been distinguished among "Self", "Spouse", "Son", "Daughter", "Parent" and "Others" which reveals differential utilization patterns. "Parents" have shown the highest utilization even though they are only 17.96% of the total dataset, likely due to healthcare costs associated with parents increasing at the fastest rate, due to higher healthcare utilization and age-related treatments. Parents are experiencing inflation at a 6.54% rate. Spouse and Self categories show moderate-to-high inflation levels, generally ranging between 6.25% and 6.35%. These categories demonstrate relatively stable inflation across claimed, billed and paid stages, suggesting consistency in treatment and settlement patterns. The Daughter category stands at 9.08% of total claim count and is recording comparatively lower inflation, particularly in the Paid Amount category, which falls close to 6.0%. This suggests lower growth in final insurer payouts for daughter-related claims. Son claims display the lowest overall CAGR among all relationships, remaining around 6.0% across all categories. The minimal variation between claimed, billed and paid amounts indicates stable claim settlement behaviour. The "Others" category shows moderate inflation, with Billed Amounts slightly exceeding Claimed and Paid Amounts. This suggests that healthcare billing inflation is somewhat higher before final settlement adjustments.

Policy Type

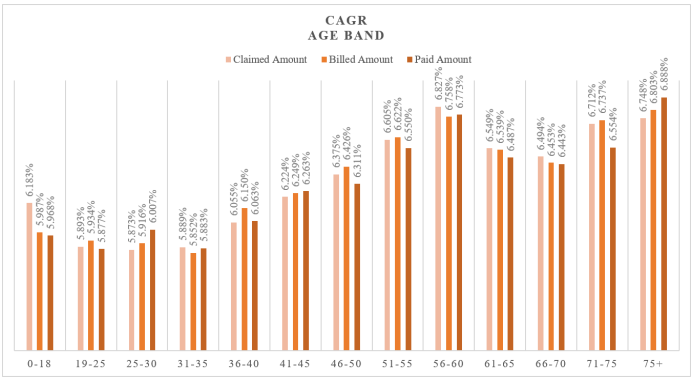


The product type analysis shows that Individual policies exhibit the highest inflation across all policy types. The Billed Amount CAGR is the highest overall at approximately 6.56%, while Claimed and Paid Amounts also remain significantly elevated. This indicates that healthcare costs under individual policies are rising faster than under other policy structures. Individual Floater policies also demonstrate high inflation, particularly in Claimed Amounts, which remain close to 6.5%.

[1] A **family floater** health insurance plan is a single policy covering multiple family members under one shared total sum insured, requiring only one premium.
[2] **Group floater** health insurance, often known as a corporate floater, is a type of employer-provided insurance where a single, shared sum insured covers an employee and their dependents.

However, the Billed and Paid Amount growth rates are slightly lower than those of standard individual policies, suggesting comparatively moderated payout escalation. Across all policy types, the Paid Amount CAGR generally remains slightly lower than the Claimed or Billed Amount CAGR. This reflects insurer-level cost containment, claim adjudication adjustments, or negotiated settlement mechanisms during final payouts.

Age Band

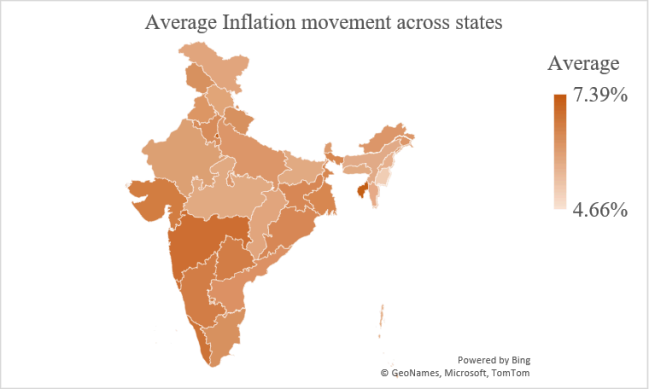


Healthcare inflation generally increases with age. Younger age groups such as 19–25, 25–30 and 31–35 exhibit comparatively lower CAGR values, mostly below 6.0%, while older age bands show significantly higher inflation rates. The 56–60 age band records one of the highest inflation levels across all three categories. Claimed Amount CAGR exceeds 6.8%, while Billed and Paid Amounts remain close to 6.7%–6.8%. This indicates substantial growth in healthcare expenses and insurance payouts for pre-senior individuals. The 75+ category demonstrates the highest Paid Amount CAGR, approaching nearly 6.9%, suggesting that insurer payouts for elderly policyholders are increasing at the fastest pace. This is likely driven by chronic illnesses, prolonged treatments and higher hospitalization frequency. Middle-aged groups (41–45, 46–50 and 51–55) show a steady escalation in inflation across all categories. This reflects a gradual rise in healthcare utilization and treatment complexity with age. Younger groups such as 0–18 and 19–25 display relatively moderate inflation. However, the 0–18 category shows a noticeable gap where Claimed Amount inflation exceeds Billed and Paid Amount inflation, potentially indicating higher claim submission growth relative to final settlements. In several older age bands, particularly 61–65 and 66–70, Claimed Amount CAGR slightly exceeds Paid Amount CAGR, suggesting insurer-level cost containment or settlement adjustments during claim processing. Overall, the data highlights a strong positive relationship between age and healthcare inflation:

Older policyholders experience significantly faster growth in healthcare costs and claim payouts. Senior and pre-senior age bands are the primary contributors to

inflationary pressure in health insurance. The increasing divergence between claimed, billed and paid amounts in older age groups indicates greater claim scrutiny and settlement management by insurers as treatment costs rise.

State-wise Distribution

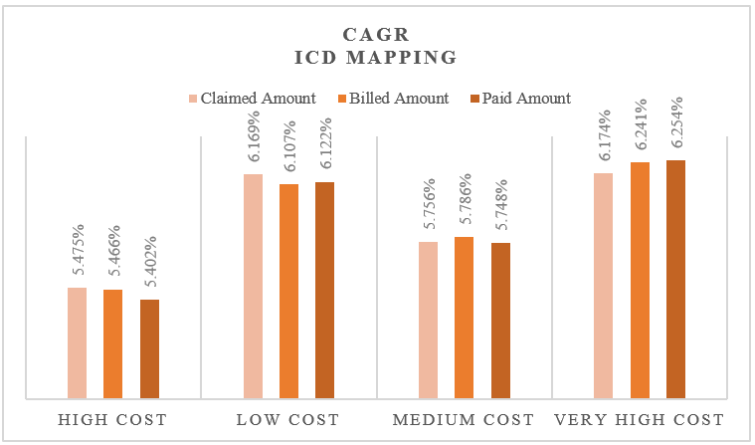


Delhi records the highest overall inflation among all regions, with CAGR values reaching approximately 7.2%–7.6% across all categories. The Paid Amount CAGR is particularly high at 7.57%, indicating rapid growth in insurer payouts, likely driven by expensive tertiary healthcare infrastructure and high treatment costs. Tripura also demonstrates exceptionally high inflation, with all three categories exceeding 7.1%. This suggests significant escalation in healthcare expenditure and settlement values within the region. Goa, Maharashtra, Kerala, Telangana, Karnataka and West Bengal show consistently elevated inflation levels, generally ranging between 6.5% and 6.9%. These states are likely experiencing stronger healthcare cost pressures due to urbanization, private healthcare penetration and increased medical utilization. Kerala records one of the highest Paid Amount CAGR values (6.87%), reflecting rapid growth in final insurance settlements. Similarly, Maharashtra and Karnataka exhibit strong inflation across all claim stages, suggesting sustained escalation in healthcare expenses. States such as Lakshadweep, Puducherry, Dadra and Nagar Haveli and Daman and Diu and Manipur display comparatively lower inflation levels, with CAGR values near or below 5.0%–5.5%. Puducherry records the lowest Paid Amount CAGR at approximately 4.31%, indicating relatively slow growth in insurer payouts. Northern and central states such as Uttar Pradesh, Rajasthan, Bihar, Madhya Pradesh and Chhattisgarh demonstrate moderate inflation levels, generally around 5.7%–6.2%, reflecting comparatively controlled healthcare cost escalation. Several northeastern states, including Arunachal Pradesh, Nagaland, Mizoram and Meghalaya, exhibit mixed inflation trends. While some categories remain moderate, others show relatively higher billed or paid amount growth, indicating regional variability in healthcare access and claim settlement dynamics. In many states, Paid Amount CAGR is slightly lower than Claimed or Billed Amount CAGR, suggesting insurer-side claim moderation and settlement controls. However, in states like Delhi,

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Kerala, Jammu and Kashmir and Tripura, Paid Amount inflation equals or exceeds Claimed Amount inflation, indicating stronger pass-through of healthcare inflation into insurer payouts.

Disease wise Distribution



The ICD mapping which is derived from the ICD-10 codes present in the data set, analysis reveals that medical cost inflation is not uniform across disease cost segments. Very High Cost conditions exhibit the highest compound annual growth rates, indicating that severe and resource-intensive treatments are major contributors to overall health inflation. Conversely, High Cost conditions demonstrate comparatively lower growth rates. Very high cost shows claimed amount to be at a CAGR 6.174% on average, while the billed and paid amount stand at 6.241% & 6.254% respectively. According to the analysis, Low cost and Very high cost show cases of high inflation CAGRs, this could be due to better coverage of particular diseases from very high categories like cancers and haemorrhages and for diseases from low cost like dengue and typhoid fevers. Coverage of diseases in medium and high costing categories highly depends on the type of policy undertaken by the policyholder and hospital tariff rates. The minimal divergence between claimed, billed and paid amount CAGRs suggests that inflationary pressures are being transmitted consistently from healthcare providers to insurers.

Findings and Discussion

Medical Inflation

The CAGR-based inflation estimates (computed over 2015–2025) provide an empirically grounded measure of medical cost escalation within this insured portfolio. Medical inflation in India's health insurance sector is well-documented to exceed general CPI inflation, driven by rising hospital tariffs, increasing use of high-cost diagnostics and greater penetration of tertiary care. The findings from this

dataset corroborate this pattern, with most sub-categories showing positive ACS growth over the period.

Health Inflation in India is severely under reported

Medical inflation typically exceeds general Consumer Price Index (CPI) inflation because healthcare costs are driven by factors that do not affect most consumer goods and services. These include:

- Continuous advancements in medical technology, diagnostics and treatment procedures.
- Rising costs of specialized healthcare professionals and hospital infrastructure.
- Increased utilization of healthcare services due to ageing populations and higher disease prevalence.
- Introduction of new drugs, devices and treatment protocols that are often more expensive than existing alternatives.
- Greater health awareness and higher healthcare consumption among insured populations.
- Healthcare prices tend to be less sensitive to consumer price competition compared with other goods included in CPI.

As a result, while general CPI inflation may remain in the range of 4–6% annually, medical inflation in many countries, including India, often ranges between 8–15% per year.

The Government of India, through the National Statistical Office (NSO), assigns a specific expenditure weight to healthcare while calculating CPI. According to the CPI basket (Base Year 2012), the **Health** component carries the following weights:

CPI Category	Weight of Health
Rural CPI	6.83%
Urban CPI	4.81%
Combined CPI	5.89%

Implication for Medical Inflation Studies

Because healthcare has a relatively small weight in CPI, even substantial increases in medical costs have a limited impact on overall consumer inflation. Consequently, CPI may understate the inflation experienced by health insurers, hospitals and policyholders. For health insurance portfolios, it is therefore more appropriate to measure inflation using claim-based indicators rather than relying solely on CPI, as claim costs directly reflect changes in hospitalization expenses, treatment costs, diagnostics, pharmaceuticals and healthcare utilization patterns. This distinction explains why medical inflation studies frequently report inflation rates significantly higher than the headline CPI published by government statistical agencies.

Claim Frequency and Severity

The interplay between claim frequency (incidence rate) and severity (ACS) is central to premium adequacy. The data reveals that while non-surgical claims are more frequent, surgical claims are the primary driver of aggregate claim cost. This has direct implications for insurers in managing hospital network negotiations, surgical procedure pricing benchmarks and reserve estimation.

Actuarial Implications

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The findings of this study have significant implications for actuarial practice, particularly in the areas of pricing, reserving and portfolio management within the health insurance sector. The analysis demonstrates that healthcare costs tend to increase at a rate considerably higher than general consumer inflation. This suggests that using broad economic indicators such as CPI as a proxy for future claim cost escalation may lead to an underestimation of the true inflationary pressures faced by health insurers. Actuaries must therefore rely on claim-based measures of medical inflation to accurately project future liabilities and maintain the financial sustainability of insurance products.

From a pricing perspective, the study highlights the importance of incorporating medical inflation assumptions that reflect actual claim experience rather than general economic trends. Persistent increases in hospitalization costs, diagnostic expenses and treatment charges can rapidly erode underwriting margins if premiums are not adjusted appropriately. By identifying the major claim categories driving inflation, insurers can develop more refined pricing models and implement targeted risk management strategies.

The comparison between claimed amounts and paid amounts also provides valuable insight into the effectiveness of claim management processes. Differences between these two measures reflect the impact of policy conditions, deductibles, co-payments,

exclusions and claim adjudication practices. Understanding these dynamics allows actuaries to distinguish between inflation arising from genuine increases in healthcare costs and inflation that is mitigated through policy design and claims controls. This distinction is crucial when forecasting future claim costs and evaluating portfolio performance.

Furthermore, the study supports more informed reserving practices. As medical inflation directly affects the ultimate cost of claims, particularly for claims with longer settlement periods, accurate inflation estimates are essential for determining adequate reserves. Underestimating medical inflation can result in reserve deficiencies, while overestimating it may lead to excessive capital allocation and reduced competitiveness.

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Finally, the study provides a foundation for strategic decision-making within health insurance portfolios. By identifying the treatments, procedures and service categories contributing most significantly to inflation, insurers can focus on cost-containment initiatives, provider negotiations, product redesign and preventive healthcare programs. In this way, the analysis not only improves actuarial forecasting accuracy but also contributes to more sustainable and affordable health insurance solutions for policyholders.

Data Calculations

Methodology of Computation

All calculations in this study use **Average Claim Size (ACS)** as the primary measure of health inflation, computed as:

$$\textbf{ACS} = \frac{Gross\ Claim\ Amount}{Number\ of\ Claims}$$

Inflation between 2016 and 2017 (the two complete years available in the IIB dataset) is measured as a simple year-on-year (YoY) percentage change:

$$\textbf{YoY Inflation} = \left(\frac{ACS_{2017}}{ACS_{2016}} - 1\right) \times 100$$

For the AI-extended synthetic dataset (2015–2025), the same formula is applied year-on-year and the long-run trend is summarised as a CAGR:

$$\textbf{CAGR} = \left(\frac{ACS_{2025}}{ACS_{2016}}\right)^{\frac{1}{11}} - 1$$

Proposed Index

$$Health\ Inflation = w_{claimed} \times ACS_{Claimed} + w_{Billed} \times ACS_{Billed} + w_{Paid} \times ACS_{Paid}$$

Where w stands for the weight which is being given to each category.

Limitations of the Study

While this study provides valuable insights into healthcare inflation within the Indian health insurance sector, several limitations should be acknowledged when interpreting the findings.

Limited Data Coverage

The analysis is based on claims data obtained from the Insurance Information Bureau of India (IIB), derived from a single insurer and a single Third-Party Administrator (TPA). Although the dataset contains a large number of claim records and captures diverse policyholder characteristics, it may not fully represent the entire Indian health insurance market. Differences in underwriting practices, provider networks, product designs and claims management strategies across insurers may lead to inflation experiences that differ from those observed in this study.

Reliance on Synthetic Forecasted Data

A major limitation of the study is the use of a synthetic forecasted dataset to extend the analysis period from 2019 to 2025. The forecasted data were generated using assumptions calibrated from observed IIB data and broad industry trends. While the methodology was designed to preserve realistic relationships between variables and maintain consistency with historical claim patterns, the generated observations do not represent actual claim experience. Consequently, the results for the forecast period should be interpreted as illustrative estimates of potential inflation trajectories rather than precise predictions of future healthcare costs.

Assumption-Driven Inflation Modelling

The inflation rates assigned to different demographic, policy and treatment categories were based on observed market behaviour and actuarial judgement rather than statistical estimation from complete historical datasets. As a result, the findings may be sensitive to the assumptions underlying the inflation model. Alternative assumptions regarding inflation rates, acceleration factors, or category weights may produce different estimates of healthcare inflation.

Descriptive Nature of the Analysis

The study primarily employs descriptive statistical techniques, including Average Claim Size (ACS), Compound Annual Growth Rate (CAGR), incidence rates and burn cost analysis. While these measures effectively identify patterns and trends in healthcare inflation, they do not establish causal relationships between variables. Therefore, the study cannot conclusively determine whether factors such as technological advancement, ageing, or healthcare utilization directly cause the observed inflationary trends.

Absence of Formal Econometric Testing

35 The research does not employ advanced econometric techniques such as regression analysis, panel data models, or causal inference methods. Consequently, the relative contribution of individual factors to healthcare inflation cannot be quantified with statistical precision. Future studies may apply econometric modelling to isolate the effects of demographic, geographic and policy-related variables on healthcare expenditure growth.

Exclusion of COVID-19 Related Effects

18 The study does not explicitly model the impact of the COVID-19 pandemic on healthcare expenditure. The pandemic introduced substantial disruptions to healthcare utilization patterns, hospital pricing structures and insurance claims experience. Although the synthetic dataset captures long-term inflation trends, it does not incorporate the structural breaks associated with the pandemic period. Therefore, the results should be interpreted as representing underlying healthcare inflation trends rather than pandemic-specific effects.

Simplification of Healthcare Cost Drivers

Healthcare expenditure is influenced by numerous interconnected factors, including medical technology, provider behaviour, regulatory changes, healthcare infrastructure, disease prevalence and macroeconomic conditions. Due to data limitations, the study focuses primarily on claim-level indicators and does not directly measure many of these external influences. As a result, the proposed explanations for observed inflation patterns should be viewed as indicative rather than definitive.

Limited Generalisability Beyond Health Insurance

The Health Inflation Index developed in this study reflects inflation experienced within the insured healthcare sector. It does not capture healthcare expenditure incurred by uninsured individuals, government-funded healthcare programmes, or out-of-pocket spending. Therefore, the index should not be interpreted as a measure of overall healthcare inflation within the Indian healthcare system.

Potential Data Quality Constraints

As with most large administrative datasets, the underlying claims data may contain reporting inconsistencies, missing values, coding variations, or classification errors. Although data cleaning and validation procedures were undertaken before analysis, some residual inaccuracies may remain and could influence the estimated inflation rates.

Scope of the Health Inflation Index

The objective of this study is to develop an insurer-centric health inflation index rather than a comprehensive national healthcare inflation measure. Accordingly, the index is designed primarily for actuarial pricing, reserving and insurance management applications. The results may therefore be more relevant to insurers and healthcare financing stakeholders than to broader public health policy analysis.

Despite these limitations, the study provides a structured and data-driven framework for measuring healthcare inflation using health insurance claims data. The findings offer valuable insights into healthcare cost escalation across different demographic, policy, treatment and geographic categories and establish a foundation for future research in medical inflation measurement and health insurance analytics.

Conclusion

This study developed an Insurer's Health Inflation Index to examine the patterns and drivers of healthcare cost inflation in India's health insurance sector. Using claim-level data from the Insurance Information Bureau of India (IIB) and an extended analytical horizon from 2015 to 2025, the research analysed healthcare inflation from three stakeholder perspectives: the insured (claimed amount), hospitals (billed amount) and insurers (paid amount). The study sought to determine whether health inflation varies systematically across demographic, policy, treatment and geographic categories and to assess the extent to which technological advancement and deteriorating population health contribute to rising healthcare costs.

The findings demonstrate that healthcare inflation in India is neither uniform nor adequately captured by conventional inflation measures such as the Consumer Price Index (CPI). Instead, inflation varies significantly across categories. Female policyholders exhibited higher inflation than males, while surgical claims experienced substantially faster cost escalation than non-surgical claims. Cashless claims recorded higher inflation than reimbursement claims, suggesting the growing importance of hospital-insurer networks and negotiated pricing arrangements. Individual and individual floater policies experienced greater inflationary pressures

than group-based policies, reflecting differences in utilization patterns and risk characteristics.

39 The analysis further revealed a strong positive relationship between age and healthcare inflation. Older age groups, particularly those aged 56 years and above, experienced the highest growth in claim costs, highlighting the increasing financial impact of ageing populations and chronic disease burdens on health insurance portfolios. Significant regional variation was also observed, with states such as Delhi, Tripura, Maharashtra, Kerala and Karnataka experiencing substantially higher inflation than many other regions. Disease-wise analysis indicated that very high-cost medical conditions contributed disproportionately to healthcare expenditure growth, emphasizing the role of advanced treatments and medical technologies in driving inflation.

The study also confirmed that the gap between claimed, billed and paid amounts remains relatively stable across most categories, suggesting that inflationary pressures are transmitted throughout the healthcare financing chain. While insurers continue to exercise cost-containment measures through claim adjudication and settlement practices, these mechanisms alone appear insufficient to offset the broader upward trend in healthcare costs.

From an actuarial and insurance management perspective, the findings highlight the limitations of relying on general economic inflation indicators when pricing health insurance products. Claim-based inflation measures provide a more accurate assessment of future cost escalation and therefore offer greater value for premium determination, reserving, portfolio management and strategic planning. The proposed Health Inflation Index serves as a practical framework for identifying emerging cost pressures and monitoring inflation trends across different segments of the healthcare ecosystem.

The study concludes that healthcare inflation in India is primarily driven by the combined effects of technological advancement, increasing healthcare utilization, demographic aging and evolving treatment patterns. As healthcare systems become more technologically intensive and disease profiles continue to shift toward chronic and lifestyle-related conditions, insurers, policymakers and healthcare providers must adopt more sophisticated approaches to measuring and managing medical inflation. The Health Inflation Index developed in this study provides a foundation for such efforts and contributes to a more comprehensive understanding of healthcare cost dynamics in the Indian health insurance market.

While the study offers valuable insights, future research may expand the analysis using multi-insurer datasets, incorporate post-COVID healthcare trends and employ causal modelling techniques to isolate the individual effects of technology, ageing

and healthcare utilization on medical inflation. Such research would further strengthen the evidence base for sustainable healthcare financing and insurance policy development in India.

References

Anderson, G. M., Labelle, R. J., & Stoddart, G. L. (1981). Estimation of physician supply effects on the utilization of medical services. *Health Economics Research Unit Working Paper*.

Bernal, N., Carpio, M. A., & Klein, T. J. (2017). The effects of access to health insurance: Evidence from a regression discontinuity design in Peru. *Journal of Public Economics, 154*, 122–136.

Brunt, C. S., & Hendrickson, C. T. (2021). Physician responses to reimbursement changes: Evidence of offsetting behavior. *Health Economics, 30*(4), 785–801.

Brunt, C. S., & Hendrickson, C. T. (2022). Income effects and physician service provision under changing reimbursement incentives. *Journal of Health Economics, 82*, 102573.

Carrin, G., & Van de Voorde, C. (1984). Health care demand and technological change: A review of expenditure determinants. *Health Policy and Planning, 1*(2), 105–119.

Colombier, C., & Braendle, T. (2018). Population ageing and health care expenditure: Evidence from Switzerland. *Swiss Journal of Economics and Statistics, 154*(1), 1–18.

Espín Balbino, J., Rovira Forns, J., & Olry de Labry Lima, A. (2018). Forecasting pharmaceutical expenditure in European countries: A systematic review. *European Journal of Health Economics, 19*(2), 171–182.

Evans, R. G. (1981). Supplier-induced demand: Some empirical evidence and implications. In J. van der Gaag & M. Perlman (Eds.), *Health, Economics and Health Economics* (pp. 162–173). North-Holland.

Hagist, C., & Kotlikoff, L. J. (2009). Who's going broke? Comparing healthcare costs in ten OECD countries. *Fiscal Studies, 30*(1), 1–23.

Hensher, M., Tisdell, J., Zimitat, C., & Scuffham, P. (2017). Health care overuse and supplier-induced demand: Drivers and policy implications. *Australian Health Review, 41*(5), 531–537.

Iizuka, T., & Ii, M. (2007). Physician density and demand inducement in Japanese healthcare markets. *Journal of Health Economics, 26*(5), 1007–1021.

Jung, K. T. (1998). The effects of copayment systems on healthcare utilization in Korea. *Health Policy, 43*(2), 111–124.

Kallestrup-Lamb, M., Christiansen, T., & Rasmussen, B. S. (2024). Population ageing and healthcare expenditure: A systematic review. *Health Economics Review, 14*(1), 1–20.

Karunadasa, D., & Sieberg, N. (2024). Provider payment systems and overtreatment: Experimental evidence from healthcare markets. *Journal of Economic Behavior & Organization, 220*, 348–366.

Karunadasa, D., Sieberg, N., & Smith, J. (2023). Fee-for-service incentives and healthcare quality: Experimental evidence. *Health Economics, 32*(9), 1821–1840.

Konatar, M., Koc, A., & Yilmaz, O. (2021). Determinants of healthcare expenditure in Central and Eastern European countries. *Economic Research-Ekonomska Istraživanja, 34*(1), 1982–2000.

Leal, J., & de Matos, M. (2009). The impact of inflation on healthcare expenditure growth. *Applied Economics Letters, 16*(11), 1113–1117.

Liu, Y., Wang, H., & Yao, X. (2024). Health insurance benefit termination and healthcare utilization: Evidence from China. *Health Policy and Planning, 39*(2), 145–158.

Ma, X., Ferreira, P., & Santos, J. (2024). Medical technology and healthcare expenditure growth: Evidence from ischemic heart disease treatment in Portugal. *European Journal of Health Economics, 25*(1), 33–47.

Meyer, S. B. (2016). Health literacy and healthcare utilization: Implications for supplier-induced demand. *Health Promotion International, 31*(3), 548–557.

Russell, L. B. (1986). *Is Prevention Better than Cure?* Brookings Institution Press.

Sekimoto, M., & Ii, M. (2015). Physician supply and healthcare utilization in Japan. *Health Policy, 119*(11), 1424–1432.

Seyedin, H., Zaboli, R., Ravaghi, H., & Maleki, M. (2021). Factors contributing to supplier-induced demand in healthcare: A systematic review. *BMC Health Services Research, 21*(1), 1–15.

Sugawara, S., & Nakamura, J. (2016). Physician density and medical expenditure in Japan. *Japanese Economic Review, 67*(3), 290–307.

Tangcharoensathien, V., Limwattananon, S., & Patcharanarumol, W. (2012). Provider payment reforms and cost containment in Thailand's universal health coverage scheme. *Health Systems & Reform, 1*(2), 135–144.

Van Doorslaer, E., & Geurts, J. (1987). Supplier-induced demand and physician behavior in the Netherlands. *Health Economics, 6*(4), 321–334.

Wennberg, J. E., Barnes, B. A., & Zubkoff, M. (1982). Professional uncertainty and the problem of supplier-induced demand. *Social Science & Medicine, 16*(7), 811–824.

Whitted, C. (1981). Technological innovation and hospital expenditure growth. *Health Services Research, 16*(4), 347–360.

Yuan, B., Li, J., & Wang, Z. (2020). Baumol's cost disease and healthcare expenditure growth: International evidence. *Health Economics Review, 10*(1), 1–15.

Insurance Information Bureau of India (IIB). (2015–2018). *Health insurance data reports*. Mumbai: Insurance Information Bureau of India.

Insurance Regulatory and Development Authority of India (IRDAI). (2015–2025). *Annual reports*. Hyderabad: IRDAI.

Appendix

Appendix A Masters Reference Tables

ICD - 10 Code

Code	Condition	Category
C34	Malignant neoplasm of bronchus and lung	Very High Cost
C50	Malignant neoplasm of breast	Very High Cost
C61	Malignant neoplasm of prostate	Very High Cost
C91	Lymphoid leukaemia	Very High Cost
C92	Myeloid leukaemia	Very High Cost
C80	Malignant neoplasm without specification of site	Very High Cost
I21	Acute myocardial infarction	Very High Cost
I60	Subarachnoid haemorrhage	Very High Cost
I61	Intracerebral haemorrhage	Very High Cost
N18	Chronic kidney disease	Very High Cost
K72	Hepatic failure	Very High Cost
J96	Respiratory failure	Very High Cost
G35	Multiple sclerosis	Very High Cost
Z94	Transplanted organ and tissue status	Very High Cost
Q21	Congenital malformations of cardiac septa	Very High Cost
I10	Essential (primary) hypertension	High Cost

I25	Chronic ischaemic heart disease	High Cost
I50	Heart failure	High Cost
I63	Cerebral infarction	High Cost
E10	Type 1 diabetes mellitus	High Cost
E11	Type 2 diabetes mellitus	High Cost
C18	Malignant neoplasm of colon	High Cost
C22	Malignant neoplasm of liver	High Cost
K70	Alcoholic liver disease	High Cost
K74	Fibrosis and cirrhosis of liver	High Cost
N17	Acute kidney failure	High Cost
J18	Pneumonia, unspecified organism	High Cost
A41	Other sepsis	High Cost
S72	Fracture of femur	High Cost
M16	Coxarthrosis hip osteoarthritis	High Cost
M17	Gonarthrosis knee osteoarthritis	High Cost
G20	Parkinson's disease	High Cost
F20	Schizophrenia	High Cost
O82	Encounter for caesarean delivery	High Cost
I48	Atrial fibrillation and flutter	Medium Cost

I35	Nonrheumatic aortic valve disorders	Medium Cost
E14	Unspecified diabetes mellitus	Medium Cost
C56	Malignant neoplasm of ovary	Medium Cost
C67	Malignant neoplasm of bladder	Medium Cost
N04	Nephrotic syndrome	Medium Cost
G40	Epilepsy	Medium Cost
M05	Rheumatoid arthritis	Medium Cost
K85	Acute pancreatitis	Medium Cost
J81	Pulmonary oedema	Medium Cost
J44	Chronic obstructive pulmonary disease (COPD)	Medium Cost
J45	Asthma	Medium Cost
K80	Cholelithiasis gallstones	Medium Cost
K40	Inguinal hernia	Medium Cost
K57	Diverticular disease of intestine	Medium Cost
N20	Calculus of kidney and ureter	Medium Cost
N40	Benign prostatic hyperplasia	Medium Cost
H25	Age-related cataract	Medium Cost
H26	Other cataract	Medium Cost
S82	Fracture of lower leg	Medium Cost

S52	Fracture of forearm	Medium Cost
M54	Dorsalgia back pain	Medium Cost
O80	Full-term uncomplicated delivery	Medium Cost
O34	Maternal care for abnormality of pelvic organs	Medium Cost
A09	Other gastroenteritis and colitis	Medium Cost
B15	Acute hepatitis A	Medium Cost
B16	Acute hepatitis B	Medium Cost
R55	Syncope and collapse	Medium Cost
G43	Migraine	Medium Cost
F32	Depressive episode	Medium Cost
J00	Acute nasopharyngitis common cold	Low Cost
J02	Acute pharyngitis	Low Cost
J06	Acute upper respiratory infections	Low Cost
J20	Acute bronchitis	Low Cost
A90	Dengue fever	Low Cost
A01	Typhoid and paratyphoid fevers	Low Cost
A15	Respiratory tuberculosis	Low Cost
B34	Viral infection of unspecified site	Low Cost
B50	Plasmodium falciparum malaria	Low Cost

K05	Gingivitis and periodontal diseases	Low Cost
K21	Gastro-oesophageal reflux disease	Low Cost
K29	Gastritis and duodenitis	Low Cost
L01	Impetigo	Low Cost
L30	Other and unspecified dermatitis	Low Cost
N39	Other disorders of urinary system UTI	Low Cost
H10	Conjunctivitis	Low Cost
M79	Other soft tissue disorders	Low Cost
R05	Cough	Low Cost
R51	Headache	Low Cost
Z00	Encounter for general examination	Low Cost

Appendix B Data Source and Field Dictionary (Selected Key Fields)

6

The primary dataset is sourced from the Insurance Information Bureau of India (IIB). All identifiers are masked. The study uses the following key fields:

Field Name	**Description**
TXT_TPA_CODE_MASKED	Third Party Administrator code (anonymised)
TXT_INSURER_CODE_MASKED	Insurer code (anonymised; value = 99 throughout)
TXT_GENDER	1=Male, 2=Female, 3=Other
TXT_PRODUCT_TYPE	Product type code (1–10, 99)
TXT_TYPE_OF_POLICY	Policy type code (1–8, 99)

TXT_DIAGNOSIS_CODE_LEVEL_I	ICD-10 Chapter code (e.g., C00–D48 = Neoplasms)
TXT_PROCEDURE_CODE_LEVEL_I	Procedure code
DATE_OF_ADMISSION / DISCHARGE	Hospitalisation dates
NUM_TOTAL_AMOUNT_CLAIMED	Total amount claimed by insured
NUM_TOTAL_CLAIM_PAID	Total amount paid by insurer
NUM_ROOM_NURSING_CHARGES	Room and nursing cost component
NUM_SURGERY_CHARGES	Surgery cost component
TXT_TYPE_OF_CLAIM_PAYMENT	Payment mode (cashless, reimbursement, etc.)
SURGICAL_NONSURGICAL_TREATMENT	1=Surgical, 0=Non-Surgical
OUT_IN_PATIENT_TREATMENT	1=OPD, 0=IPD
TXT_RELATIONSHIP_OF_INSURED	Relationship code (01=Self … 99=Others)
STATE_OF_POLICYHOLDER	State code (mapped to state name via Masters)
Claim year	Derived: YEAR(DATE_OF_PAYMENT)

Appendix C Calculated Results CAGR

Gender

Category	Claimed Amount	Billed Amount	Paid Amount
F	6.47%	6.50%	6.51%

M	6.19%	6.17%	6.13%
Others	6.12%	6.08%	5.79%

Age band

Category/Year	Claimed Amount	Billed Amount	Paid Amount
0-18	6.183%	5.987%	5.968%
19-25	5.893%	5.934%	5.877%
25-30	5.873%	5.916%	6.007%
31-35	5.889%	5.852%	5.883%
36-40	6.055%	6.150%	6.063%
41-45	6.224%	6.249%	6.263%
46-50	6.375%	6.426%	6.311%
51-55	6.605%	6.622%	6.550%
56-60	6.827%	6.758%	6.773%
61-65	6.549%	6.539%	6.487%
66-70	6.494%	6.453%	6.443%
71-75	6.712%	6.737%	6.554%
75+	6.748%	6.803%	6.888%

State wise

Category/Year	Claimed Amount	Billed Amount	Paid Amount
Andaman and Nicobar Islands	5.67%	5.66%	5.56%

Andhra Pradesh	6.26%	6.28%	6.17%
Arunachal Pradesh	6.37%	6.03%	6.07%
Assam	5.76%	5.75%	5.75%
Bihar	5.92%	5.81%	5.62%
Chandigarh	6.16%	6.24%	6.18%
Chhattisgarh	5.91%	6.00%	5.73%
Dadra and Nagar Haveli and Daman and Diu	5.65%	5.66%	4.92%
Delhi	7.20%	7.40%	7.57%
Goa	7.01%	6.83%	6.90%
Gujarat	6.70%	6.72%	6.62%
Haryana	6.37%	6.41%	6.33%
Himachal Pradesh	6.19%	5.91%	5.62%
Jammu and Kashmir	6.27%	6.21%	6.46%
Jharkhand	6.45%	6.44%	6.40%
Karnataka	6.63%	6.56%	6.66%
Kerala	6.78%	6.79%	6.87%
Ladakh	5.79%	5.63%	6.24%
Lakshadweep	4.97%	5.03%	5.08%
Madhya Pradesh	5.72%	5.74%	5.85%

Maharashtra	6.89%	6.96%	6.89%
Manipur	5.21%	4.95%	5.05%
Meghalaya	5.71%	6.05%	5.71%
Mizoram	5.73%	5.74%	5.73%
Nagaland	5.69%	5.66%	5.68%
Odisha	6.39%	6.36%	6.54%
Puducherry	4.97%	4.69%	4.31%
Punjab	6.05%	6.39%	6.10%
Rajasthan	5.99%	6.09%	5.93%
Sikkim	5.95%	6.02%	6.24%
Tamil Nadu	6.32%	6.28%	6.18%
Telangana	6.80%	6.66%	6.46%
Tripura	7.14%	7.32%	7.43%
Uttar Pradesh	6.06%	6.07%	6.23%
Uttarakhand	6.37%	6.36%	6.20%
West Bengal	6.49%	6.49%	6.47%

ICD Mapping

Category/Year	Claimed Amount	Billed Amount	Paid Amount
High Cost	5.475%	5.466%	5.402%

Low Cost	6.169%	6.107%	6.122%
Medium Cost	5.756%	5.786%	5.748%
Very High Cost	6.174%	6.241%	6.254%

Policy type

Category/year	Claimed Amount	Billed Amount	Paid Amount
Group	6.20%	6.21%	6.22%
Group Floater	6.20%	6.24%	6.21%
Individual	6.52%	6.56%	6.43%
Individual Floater	6.51%	6.39%	6.40%

Relationship

Category/year	Claimed Amount	Billed Amount	Paid Amount
Daughter	6.18%	6.20%	6.06%
Others	6.26%	6.31%	6.28%
Parent	6.60%	6.54%	6.48%
Self	6.26%	6.28%	6.27%
Son	6.00%	5.98%	5.99%
Spouse	6.31%	6.36%	6.35%

Claim Type

Category	Claimed Amount	Billed Amount	Paid Amount

Non Surgical	5.99%	6.00%	5.95%
Surgical	6.86%	6.86%	6.86%

Payment type

Category	Claimed Amount	Billed Amount	Paid Amount
Cashless	6.42%	6.41%	6.38%
Reimbursement	6.15%	6.18%	6.15%

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