IMPACT OF INSURTECH IN REDUCING THE OUT-OF-POCKET EXPENSES (OOPE) IN INDIAN HEALTHCARE

by

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Dedication

This dissertation is dedicated to my Guru - Sadhguru Sri Gnanananda Giri Swami who is my spiritual guide and inner strength that inspired me to create this work.

To my parents, who have been my constant source of encouragement since childhood to help inculcate the habit of questioning and solving things.

To my wife & daughter, whose motivation & cheers kept me focused on this entire journey without creating any boredom or depression.

To my father-in-law, who always showered his positivity that fostered my entire belief system to complete this work.

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ABSTRACT

IMPACT OF INSURTECH IN REDUCING THE OUT-OF-POCKET EXPENSES (OOPE) IN INDIAN HEALTHCARE

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Out-Of-Pocket-Expenses (OOPE) in healthcare refers to the costs that individual must pay directly for medical services or treatments either due to no insurance coverage or due to policy exclusion / rejection by the Health Insurance company. In India, OOPE is known to be the topmost in the world-wide; Low health Insurance penetration, high claim rejection and insufficient cover are top points for high out of income health expenses. InsurTech in Healthcare refers to the use of Digital Transformation across Payer operations, Provider operations & Member interactions to improve health insurance awareness, enhance member experience & reduce cost. The current gap in the existing literature is there is no drilldown to identify the critical factors that has high impact on Out-Of-Pocket-Expenses (OOPE) and how InsurTech can help address those factors. Through this study I would like to identify the critical factors responsible for Out-Of-Pocket Expenses & highlight how InsurTech can help bridge the gap between

each stakeholder in the Indian healthcare value chain - Health Insurance Payer, Healthcare Provider & Members to create an ecosystem that can minimize the Out-Of-Pocket Expenses.

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INTRODUCTION

1.1 Introduction

The Indian healthcare system is multifaceted, with both private as well as public areas entertain significant positions in delivering healthcare fecilities to the population. The government-funded and managed open to all health-care system aims to offer affordable medicare requirements to all publics, especially in rural and underserved areas. However, it often faces challenges such as inadequate funding, understaffing, and poor infrastructure, impacting the quality and accessibility of services.

On the other hand, the personel healthcare sector, comprising for gain and non-benefit hospitals, clinics, and diagnostic centres, is known for its advanced medical technology and higher quality of care. Nevertheless, these services come at a higher cost, making them less accessible to the average Indian citizen. The coexistence of these two sectors forms a dual healthcare system, where the wealthy can afford high-quality private care while the poor rely on the public system, which may only sometimes effectively meet their needs from BMC health shown in figure 1.

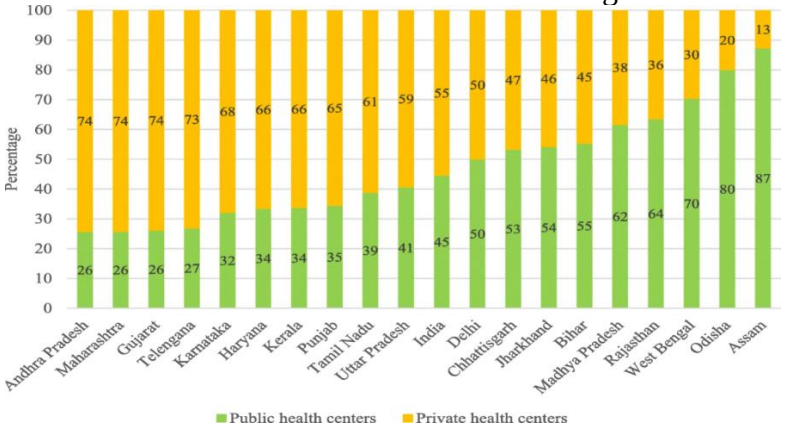

Figure 1 Public vs. Private Service Adoption for Healthcare

Source: https://www.researchgate.net/figure/Subsistence-expenditure-as-share-of-household-consumption-expenditure-in-states-of-India_fig1_350215069.

OOPE in India constitute a significant portion of healthcare financing, with estimates suggesting that households pay over 60% of healthcare expenditures. This high reliance on OOPE can have severe financial implications for individuals and families, often leading to catastrophic health expenditures and pushing households into poverty (Sriram and Albadrani, 2022).

High out-of-pocket expenses (OOPE) impact healthcare accessibility and equity profoundly. They can demotivate pesonela from finding required medical-care, turns to waitng in treatments and deteriorating health outcomes. The financial burden of OOPE, which is disproportionately borne by low-income households, exacerbates health disparities and undermines the goal of universal health coverage. For India as comparision to other lower middle income countries figure 2 illustrates the participation of india.

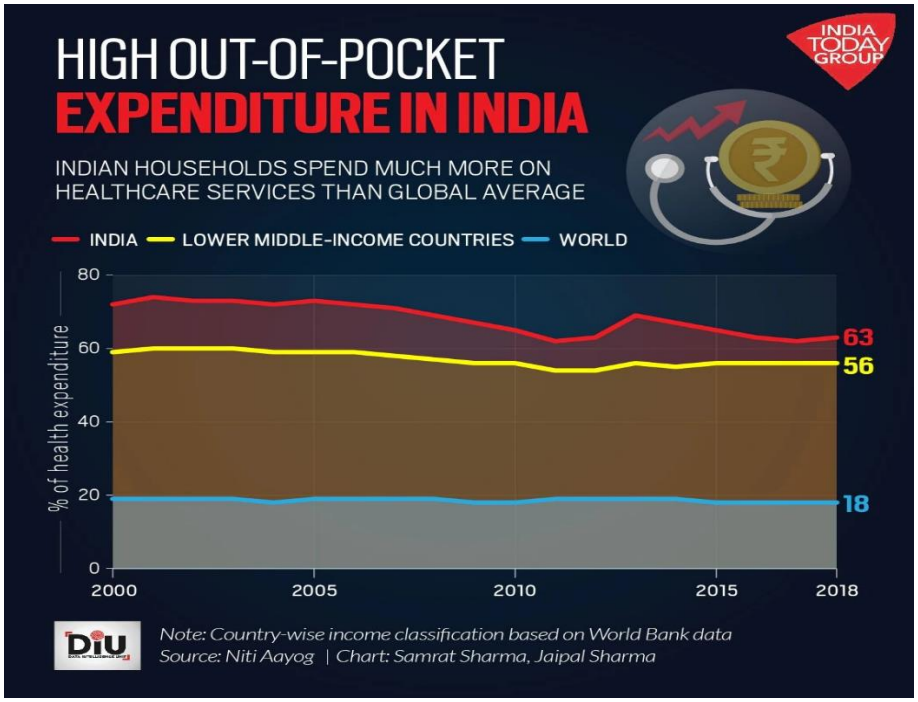

Figure 2 OOPE Comparison of India with Other Countries

Source: NITI Aayog, by samrat sharma and jaipal sharma

Insurtech, a combination of "insurance" and "technology," involves innovative technology to enhance the insurance industry. It encompasses innovative techs such as Internet of Things (IoT), machine learning, big data analytics, blockchain, and the artificial intelligence (AI) to streamline insurance operations.

In health-care, Insurtech contains the capacity to redevelops the design, marketing, and delivery of insurance products. It can facilitate the development of more personalized and affordable insurance plans, improve the efficiency and transparency of claims processing, and enhance customer experience through digital platforms and mobile applications. By leveraging data analytics, Insurtech can enable better risk assessment and fraud detection, leading to cost savings for insurers and policyholders (Eckert and Osterrieder, 2020).

The relevance of Insurtech in reducing OOPE in Indian healthcare is considerable. By making health insurance more accessible, affordable, and user-friendly, Insurtech can encourage higher insurance penetration among the population, thereby reducing the financial burden of OOPE. Innovative Insurtech solutions can also facilitate cashless transactions and quicker reimbursements, minimizing the need for individuals to spends OOPE at the time of issues. Ultimately, Insurtech has the potential to enhance financial protection, improve healthcare access, and contribute to a more equitable healthcare system in India.

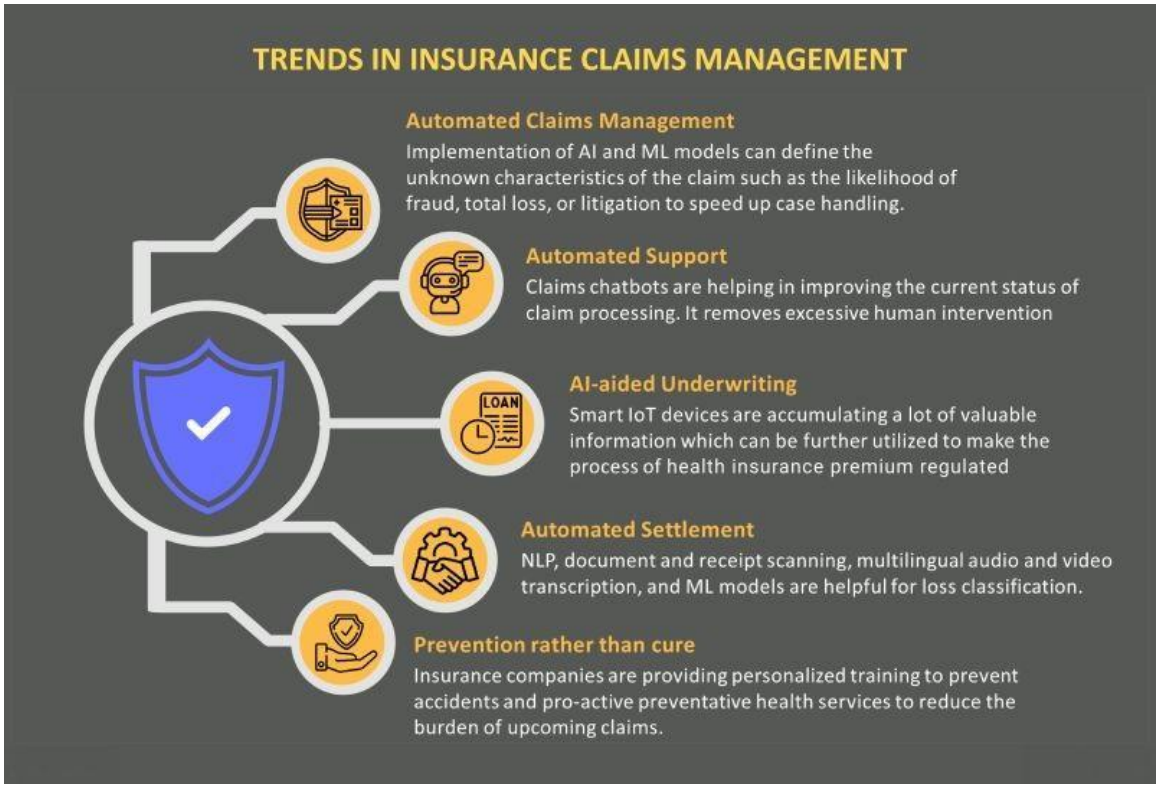

Figure 3 Adoption of Insurtech for Convenience

Source: https://47billion.com/infographic-en/trends-in-insurance-claim-management/

Insurtech as in figure 3 can streamline insurance processes, from customer onboarding to claims settlement, emphasizing the reduction in administrative costs and quicker service delivery.

The reason we are looking into the effect of Insurtech on minimizing OOPE in Indian healthcare is that high OOPE in India is a significant barrier to achieving universal health coverage (UHC). Many households are impoverished due to healthcare costs, so we need solutions to alleviate this financial burden. Insurtech, with its promise of using digital technology to improve insurance accessibility, affordability, and efficiency, comes as a useful instrument.

Insurtech the capacity to change how insurance works in India completely. By using advanced technologies like AI, block-chain, and analytics, Insurtech aims to create

insurance operations smoother, improve customer experience, and lower costs. This change could significantly improve how risks are assessed, and insurance policies are created. It could also help process insurance claims faster and offer personalized insurance products. This is especially important in India, where only a few people have insurance, and high medical costs can cause serious financial problems.

View towards the research, integrating Insurtech into the Indian healthcare system aligns with global trends towards digitalization and intelligent health solutions. As India continues to grapple with the dual challenges of high healthcare costs and low insurance penetration, Insurtech offers a pathway to reduce OOPE and democratize healthcare access. By enabling personalized insurance plans, improving fraud detection, and ensuring quicker reimbursements, Insurtech can mitigate the financial risks associated with medical care, especially for underserved populations.

1.2 Overview of the Indian Healthcare System

Indian health-care firms is one of the most extensive and intricate globally, catering to over 1.4 billion individuals. It consists of a dual structure encompassing the public and private sectors. Each sector presents distinct challenges and opportunities. A comprehensive understanding of this system necessitates an in-depth examination of its various elements, the current status of health insurance, and the ongoing endeavours to enhance healthcare accessibility and affordability (Kumar, 2023).

- Public Health-care Firms

The healthcare firms in India for public is organized into a tiered framework to ensure wide-ranging healthcare services are accessible, especially in rural regions. It operates across three primary levels: primary, secondary, and tertiary care.

- Primary Level

Sub-Centres (SCs) represent the most peripheral and initial place of interaction among the people and the healthcare providers. Approximately 157,000 sub-centres across India cater to a population of 3,000-5,000 in rural areas. These centres are staffed by Auxiliary Nurse Midwives (ANMs) and provide essential health services such as immunizations, antenatal and post treatment care, and treatment of general health issues.

Primary Health Centers (PHCs): Acting as referral units for 6-8 sub-centres, India has over 25,000 PHCs, each serving a population of 20,000-30,000. Equipped to deliver comprehensive primary healthcare, PHCs offer outpatient services, basic diagnostics, and minor surgical procedures and are staffed by a medical officer and other paramedical staff.

- Secondary Level

Community Health Centers (CHCs): Serving as referral centres for PHCs, the approximately 5,700 CHCs in India provide specialized care and advanced medical services. Each CHC caters to a population of around 80,000-120,000 and offers facilities for inpatient care, including surgical, obstetric, and pediatric services, along with specialists in various fields.

District Hospitals: The primary secondary care providers within the public sector, India has around 800 district hospitals that offer a big option of in-patient and out-patient fecilities, involves speciality medicare and surgical treatment. These hospitals also function as training centres for healthcare professionals.

- Tertiary Level

Speciality and Super-Specialty Hospitals: These hospitals provide highly specialized care, including advanced diagnostic services, complex surgeries, and treatment for severe health conditions. Notable examples include the AIIMS in New

Delhi and other regional AIIMS institutions. These hospitals are typically situated in major urban centres and serve as referral centres for lower-level facilities.

Insufficient Funding: Public health expenditure amounts to about 1.3% of the GDP, considerably lower than the global average of 6%. This results in inadequate resources, impacting the availability and quality of healthcare services.

Staff Shortages: Many PHCs and CHCs need more staffing, with a 22% deficit in doctors at PHCs and a significant scarcity of specialists at CHCs.

Infrastructure Gaps: Numerous healthcare facilities, especially rural areas, need more essential infrastructure such as adequate buildings, medical equipment, and reliable electricity and water supply.

1.2.1 Private Health-care Firms

It comprises diverse entities, including for-profit and non-profit hospitals, clinics, diagnostic centres, and medical colleges.

- Key characteristics of the private sector include:

Advanced Technology and Quality Care: Private hospitals are often available with newer innovative technology and offer high-quality care. Their advanced medical facilities and specialized services attract significant healthcare expenditure.

High Costs: Healthcare services in personel facility are majorly extra expensive than those in general-public hospitals, making them less accessible to the lower-income population. This high cost often leads to substantial out-of-pocket expenses for individuals seeking care in the private sector.

- Health-Insurance in India

Insurance of health coverage in county like India has witnessed growth in recent years, primarily propelled by government initiatives.

Pradhan Mantri Jan Arogya Yojana (“PM-JAY”): Introduced in 2018, PM-JAY is a leading health insurance scheme under the Ayushman Bharat initiative. It offers health cover of INR 5 lakh per family every year for tertiary care hospitalization and secondary to over 500mn users, primarily targeting the remained 40 percent of the crowd. PM-JAY aims to mitigate catastrophic health expenditures and enhance access to quality healthcare (*https://nha.gov.in/PM-JAY*).

Other Government Schemes: Various state governments have health insurance programs targeting specific groups such as low-income families, senior citizens, and workers in the unorganized sector. Examples include the Rajiv Aarogyasri Scheme in Andhra Pradesh and the Chief Minister's Comprehensive Health Insurance Scheme in Tamil Nadu.

Private Insurance: The private health insurance market is growing, and many companies provide a range of products. These plans usually include coverage for hospitalization costs, critical illnesses, and outpatient treatments, and they are designed for people in middle—and high-income brackets.

1.2.2 Out-of-Pocket Expenses (OOPE)

Despite the increasing availability of health insurance, many Indians still face significant financial burdens due to out-of-pocket expenses. According to the 2017-18 National Health Accounts (NHA) report, 58.7% of India's total health expenditure comes from out-of-pocket expenses. This heavy reliance on out of pocket expenses often responsible to unobserved spending, plunging an estimated 55 million people into poverty every year (Vootukuri et al., 2024).

Larger Health spending, which takes place when health expenses crossed 10% of a household's total income, is a common occurrence in India. This is often the result of high medical bills and limited insurance coverage.

- Recent Developments and Future Directions

The government of India has introduced various measures to enhance the healthcare system and lower out-of-pocket expenditures:

The Ayushman Bharat initiative encompasses setting up 150,000 Health and Wellness Centers (HWCs) to deliver all primary care fecilities and implementing PM-JAY to offer financial protection for secondary and tertiary care.

NDHM (National Digital Health Mission) was launched to establish a e-health environment. It aims to furnish every citizen with a unique health ID, digital health records, and telemedicine services, ultimately enhancing healthcare accessibility and efficiency.

The government is increasingly using Public-Private Partnerships (PPPs) to collaborate with the private sector to improve healthcare infrastructure, enhance service delivery, and expand insurance coverage.

With significant input from both the private and public sectors. While the public system strives to ensure universal healthcare access, it grapples with financing, staffing, and infrastructure challenges. Conversely, the private sector provides advanced and high-quality care, albeit at a higher cost, resulting in substantial out-of-pocket expenses for many individuals. Ongoing reforms and technology integration, mainly through Insurtech, hold the potential for a extra convenient, usable, and equitable health-care system in India.

1.3 Importance of Out-of-Pocket Expenses (OOPE)

It is heartwrenching to acknowledge the challenges faced by India's healthcare system, with many individuals burdened by high out-of-pocket expenses. These hardships stem from various factors, such as limited access to public healthcare services, exorbitant private healthcare costs, pricey medications and diagnostic tests, inadequate health

insurance coverage, and the prevalence of chronic illnesses. Additionally, there are difficulties in leveraging government health schemes, and the value of general health-care services leaves much to be desired. Effectively addressing these issues calls for a holistic approach involving strengthening public healthcare infrastructure, expanding insurance coverage, reducing the costs of essential medicines and diagnostics, and enhancing awareness and accessibility to government health schemes.

India's healthcare system faces several interconnected factors that lead to extra OOPE. One significant contributor is the limited uses of normal health-care fecilities, as many individuals turn to commercial health-care providers due to the perceived better quality and accessibility. Although public healthcare has gradually increased, private healthcare remains notably more expensive, resulting in higher OOPE (Garg et al., 2020). The substantial cost of medications and diagnostic tests also plays a significant role, constituting a substantial portion of OOPE in public and private facilities. Despite government efforts to reduce these costs, they remain high, increasing household financial burden (Rout & Choudhury, 2018).

Additionally, inadequate health insurance coverage exacerbates the issue. Many Indian populations lack adequate health insurance and existing schemes often do not cover outpatient services or preventive care. This lack of coverage leads to higher OOPE, as individuals must incurres out of income for many health fecilities (Faizi & Alvi, 2021). The high costs associated with private-sector healthcare significantly contribute to OOPE. Hospitalization and treatment in commercial options are considerably extra expensive than in goverment sector, leading to catastrophic health expenditures for many households (Ghosh et al., 2023).

Chronic illnesses and the need for long-term care are also significant drivers of extra OOPE. House holds with candidates having chronic conditions incur ongoing

treatment and medication costs, leading to financial distress and even impoverishment (Sriram & Albadrani, 2022). Specific diseases, particularly non-communicable diseases (NCDs) like cancer and heart diseases, result in very high OOPE, pushing many households into severe financial hardship and poverty (Kastor & Mohanty, 2018).

Furthermore, the need for more awareness and the difficulties in utilizing government health schemes are critical factors contributing to high OOPE. Many individuals need to be made aware of these schemes or find the processes too cumbersome, leading to higher OOPE as they turn to private healthcare for faster and simpler access (Palal et al., 2023). This is compounded by the generally poor quality of public healthcare services, which deters many people from utilizing them despite the lower costs (Ghosh et al., 2023).

The issue of high OOPE in India is complex and requires a comprehensive approach. It is not just about a preference for private healthcare or the high costs of medications and diagnostics; it is about inadequate insurance protection, the burden of chronic illnesses, overridden health expenditures from NCDs, and insufficient awareness and utilization of government schemes. Addressing these issues requires a comprehensive approach that includes strengthening public healthcare infrastructure, expanding insurance coverage, reducing the costs of essential medicines and diagnostics, and improving awareness and access to government health schemes.

The weight of OOPE in country with large population varies significantly across demographics and regions. Several studies have highlighted how socioeconomic status, regional disparities, and specific health conditions impact OOPE.

- Socioeconomic Factors

Individuals from lower socioeconomic backgrounds often face a heavier financial strain because of out of pocket expenditures on health issues. One study in Pune found

that people from lower-income brackets are disproportionately impacted by these expenses, particularly in the high costs of medications and doctor consultations, which comprise a significant portion of their overall healthcare spending (Palal et al., 2023). Furthermore, individuals without health insurance are at greater risk of facing substantial out-of-pocket expenses, frequently resulting in significant financial hardship due to healthcare costs (Kastor & Mohanty, 2018).

- Regional Disparities

There is considerable regional variation in out-of-pocket expenditure (OOPE) across India. States with poorer health infrastructure and lower public health spending, such as Bihar and Odisha, tend to have higher OOPE than more affluent states like Kerala and Tamil Nadu (Garg & Karan, 2009). In rural areas, OOPE tends to be higher than in urban areas due to the limited availability of healthcare services and the greater reliance on private healthcare providers (Sangar et al., 2018).

- Disease-Specific Expenditures

The nature of the illness significantly influences OOPE. Non-spreadable diseases (NCDs) such as cancer and heart-attack related issues lead to the highest OOPE, frequently causing financial hardship for households (Kastor & Mohanty, 2018). For example, the average OOPE for cancer treatment can be considerably higher than for other ailments, resulting in a substantial financial strain (Maurya et al., 2021).

- Rural vs. Urban Differences

Rural families allocate more of their earnings to healthcare than urban families. Nevertheless, urban areas generally have higher out-of-pocket healthcare expenses due to elevated living costs and healthcare service charges (Sangar et al., 2018). Furthermore, due to out-of-pocket healthcare expenses, urban crowd are at a greater values of falling

below the low income line, leading to higher levels of urban poverty (Dwivedi & Pradhan, 2017).

- Impact of Health-Insurance

Despite government insurance programs, there is a need to enhance their coverage, and many families still need to pay more attention to their current out-of-pocket expenses. Health insurance programs only include hospital care, not outpatient services, which significantly adds to out-of-pocket expenses (Garg et al., 2020). Furthermore, there are differences in the use of these programs across various states, with wealthier states having better insurance coverage and lower out-of-pocket expenses (Verma et al., 2021).

The impact of OOPE in India is greatly affected by socioeconomic status, regional inequalities, disease type, and differences between rural and urban areas. To reduce this impact, it is essential to enhance the accessibility and effective-ness of public healthcare services, broaden insurance coverage to encompass outpatient treatment and cater to the unique requirements of lower-income and rural communities.

Some critical policy interventions that can effectively decrease out-of-pocket expenses (OOPE) in the Indian healthcare system are enhancing the capacity of public healthcare infrastructure, enhancing the quality and coverage of health insurance schemes, and implementing thorough regulation of private healthcare providers. These critical policy interventions are essential for improving access to affordable healthcare services for all citizens:

- Strengthening Public Healthcare Infrastructure

Increased Public Funding: Strengthening public healthcare by increasing public funding can make it easier to get care and decrease the need for expensive private healthcare. Public healthcare facilities need more resources to offer good care and reduce

out of pocket expenses for crowd who are with lower income and vulnerable. (Garg et al., 2020).

Free Medicine Schemes: Expanding and enhancing free medicine programs at public hospitals, similar to those implemented in states such as Tamil Nadu and Rajasthan, can potentially decrease out-of-pocket medication expenses substantially. These programs should be broadened to encompass a more comprehensive array of medications and ensure that more individuals can access them. (Bose & Dutta, 2018).

- Improving Health Insurance Coverage

Expanding Health Insurance: It is imperative to guarantee extensive health insurance covering outpatient services and managing chronic illnesses. Many existing insurance plans primarily concentrate on hospital care, leading to substantial out-of-pocket expenses for outpatient services (Faizi & Alvi, 2021).

Universal Health Coverage (UHC): A step towards achieving Universal Health Coverage (UHC) involves consolidating different health insurance schemes and making sure they are available to everyone, particularly the underprivileged. This can contribute to reducing Out-of-Pocket Expenditure (OOPE). An essential part of this process is enhancing the effectiveness and coverage of facilities such as the Pradhan Mantri Jan Arogya Yojana ("PM-JAY"). (Yadav et al., 2021).

- Regulatory and Systemic Reforms

Regulating Private Healthcare Costs: Implementing strict rules to control the costs of private healthcare services can help reduce out-of-pocket expenses. This includes limiting prices for treatments and medications and closely watching to prevent overcharging (Ranjan et al., 2018).

Public-Private Partnerships (PPP): Using PPP models to improve healthcare delivery and control costs can be beneficial. For instance, Fair Price Medicine Shops

(FPMS) in West Bengal offer a PPP model that provides medicines at reduced prices. However, the program needs better alignment with actual needs (Ghosh et al., 2023).

- Awareness and Utilization

Increasing Awareness and Utilization of Government Schemes: Many individuals must be informed about government health schemes. By increasing awareness and making it easier to access and utilize these schemes, we can effectively decrease out-of-pocket expenses (OOPE). This can be achieved through comprehensive community outreach efforts and educational programs. (Palal et al., 2023).

It is crucial to take a comprehensive approach to effectively decreasing out-of-pocket healthcare expenditures in India. This includes improving the public healthcare infrastructure, expanding access to comprehensive health insurance, regulating the costs of private healthcare services, and raising awareness about and utilizing government healthcare programs. Implementing these policy measures can alleviate the financial strain on households and enhance overall healthcare accessibility.

1.4 Introduction to Insurtech

Insurtech is an exciting fusion of "insurance" and "technology", representing the forward-thinking use of technology in the insurance industry. Its goal is to boost performance, elevate customer experiences, and lower costs. This field encompasses cuttingedge technologies such as AI, ML, block-chain, Analytics, and the IoT. Insurance aims to revolutionize traditional insurance practices by introducing digital solutions that simplify processes, improve risk assessment, and offer more tailored insurance products.

1.4.1 Key Technologies and Innovations

- Artificial Intelligence and Machine Learning

Underwriting and Risk Assessment: Large volumes of data to evaluate AI and machine learning algorithms can process and assess risk with greater accuracy and

efficiency than traditional methods. This enables more precise underwriting, which could result in lower insurance premiums for low-risk individuals.

Claims Processing: AI systems use advanced technology to process insurance claims quickly, saving time and money compared to manual processing. These systems can rapidly analyze images of car accidents to assess damage, validate policy information, and approve payments.

- Blockchain

Data Security and Transparency: Blockchain is a innovative system that enables the creation of a transpárent ledger for taking tránsactions. This technology hás significant potential in the insurance industry, as it can create tamper-proof records of policies, claims, and payments. By leveraging blockchain, insurers can significantly reduce fraud and enhance trust among all parties involved in the insurance process. This innovative approach hás the potentiál to streamline insurance processes, minimize administrative cost, and improve overáll performance within the industry.

Smart Contracts: Self-executing contracts contain terms written directly into code, enabling automatic processing of claims and payouts according to specific conditions. This approach enhances efficiency and lowers administrative expenses.

- Big Data Analytics

Personalized Products: Insurers can create customized insurance products by examining extensive datasets, enabling them to recognize customer needs and preferences. This data-centric method can improve customer satisfaction and loyalty.

Predictive Analytics: Leveraging big data empowers insurers to forecast patterns and anticipate potential risks, facilitating proactive actions and superior risk mitigation.

1.4.2 Telematics in Auto Insurance

Telematics sensors in vehicles gather informátion on driving hábits, állowing insuránce compánies to provide uáage-based insuránce (UBI). This can result in more precise premium calculations based on actual risk factors.

Health and Home Monitoring: Wearable gadgets and intelligent home technologies supply immediate information on health measurements and household environments, allowing insurance companies to propose adaptable policies and encourage proactive actions.

1.4.3 Benefits of Insurtech

- Enhanced Customer Experience

Digital platforms and mobile apps are crucial in providing customers with convenient access to insurance services in the modern age. These services encompass policy management, claims filing, and responsive customer support. Furthermore, insurtech solutions are designed to promote transparency, offering customers a clearer understanding of policy terms and pricing. This enhanced transparency empowers customárs to make well formed decision about their insurance requirments.

- Cost Reduction

Automation and more efficient processes improve operational efficiency, potentially reducing insurers' administrative costs and leading to lower customer premiums.

Advanced analytics and blockchain technology aid in detecting and preventing fraud, resulting in cost reduction.

- Increased Accessibility

Microinsurance: Insurtech has created cost-effective microinsurance products specifically designed for low-income populations, thereby expanding the reach of insurance in underserved markets.

On-Demand Insurance: This type of insurance offers flexible, short-term coverage tailored to meet specific needs and situations, thereby enhancing its accessibility and applicability.

1.4.4 Challenges and Barriers

- Regulatory Compliance

Insurance companies face the challenge of navigating intricate regulatory landscapes that differ significantly from one region to another. It is crucial to maintain compliance while also pursuing innovation.

- Data Privacy and Security

The heightened utilization of individual data creates worries about protection and security. Insurance companies must establish strong safeguards to prevent breaches and unauthorized use of confidential information.

- Adoption and Integration

Integrating current systems with new technologies can challenge conventional insurance companies. Guaranteeing smooth implementation and optimizing insurance advantages demands substantial investment and effective change management.

- Customer Trust

Establishing trust with customers is crucial, particularly in markets where people have limited knowledge about insurance. Insurance companies are responsible for informing and reassuring consumers about the advantages and dependability of digital insurance services.

1.4.5 Relevance of Insurtech in Reducing OOPE

In the liew of Indian healthcáre, Insurtech has the potential to reduce OOPE through various mechanisms significantly:

Affordable and Accessible Insurance: Insurtech utilizes advanced technology to develop health insurance products that are more cost-effective and easier to obtain. This helps to extend insurance coverage to more people and lessen the financial strain of healthcare expenses.

Efficient Claims Processing: Speeding up and improving the processing of claims helps decrease patients' need to make payments upfront at the time of treatment, leading to faster refunds and lessening financial pressure.

Personalized Health Plans: Data-based insights drive the creation of customized health insurance plans that meet individual needs and risks, possibly resulting in reduced premiums and out-of-pocket costs.

Preventive Healthcare: IoT and wearable technologies support preventive healthcare by monitoring health metrics and providing early warnings, reducing the likelihood of costly medical treatments.

Insurtech is a powerful driver of change in the insurance sector, introducing new approaches that improve effectiveness, customer satisfaction, and financial security. When applied in the Indian healthcare environment, it offers excellent potential for lessening direct costs, enhancing healthcare accessibility, and promoting a fairer healthcare system.

Incorporating Insurtech in the insurance industry has brought about notable improvements in customer experience and satisfaction. InsurTech, which encompasses technological advancements to enhance efficiency and customer experience in insurance, has introduced a range of benefits for policyholders and insurance providers.

One of the key impacts of Insurtech is enhancing customer satisfaction through improved service delivery. Adopting digital technologies, áutomation, and dáta-driven insights hás streamlined wrokflows creating them extra efficient ánd user-friendly. For instánce, a study focusing on the Indian life insurance sector revealed that the adoption of InsurTech positively influences customer satisfaction by improving customer service management and policy handling, both of which are important indicators of customer satisfaction (Kaur & Singh, 2023).

Additionally, Insurtech allows insurers to offer more personalized and accessible services. Technologies such as ártificial intelligence, big dáta ánalytics, ánd blockchain have facilitated the development of customized insurance products that better align with customers' needs. This personalization has increased customer satisfaction as policyholders receive services better tailored to their requirements (Halima & Yassine, 2022).

Furthermore, the integration of Insurtech has simplified and revolutionized the insurance process, resulting in increased transparency and significantly reduced time required for policy management and claims processing. Online platforms for insurance services have made it remarkably convenient for customers to purchase and manage their policies, leading to a more satisfactory and hassle-free customer experience (Koprivica, 2018).

The impact of Insurtech is not limited to enhancing customer satisfaction; it has also brought about substantial cost reductions and increased operational efficiencies for insurance companies. These financial benefits can be passed on to customers through lower premiums and improved service quality. Automated systems and advanced analytics are crucial in fraud detection and risk management, contributing to overall customer trust and satisfaction (Agarwal et ál., 2022).

In summary, the integrátion of Insurtech in the insuránce sector hás significantly elevated customer experience and satisfaction by improving service delivery, customizing insurance products, simplifying processes, and reducing costs. These advancements have made the insurance process more efficient, transparent, and user-friendly, ultimately increasing customer satisfaction and loyalty.

Diverse regional economic, regulatory, and technological landscapes shape the global adoption and impact of InsurTech. InsurTech, integrating advanced technologies into the insurance industry, has fundamentally transformed insurance practices, improved customer engagement, and introduced pioneering products and services.

1.4.6 Global Trends

In recent years, the InsurTech industry has experienced remarkable expansion, primarily fueled by advancements in cuttingedge technologies. These innovations have empowered insurance companies to provide more tailor-made and efficient services. The United Státes, China, the United Kingdom, and Germany háve emerged as leaders in InsurTech investments and advancements, owing to their robust technological infrastructure and substantial insurance markets. In these regions, InsurTech firms are concentrating on enhancing risk evaluation, streamlining claims processing, and enriching customer interaction through digital platforms and AI (Cao et al., 2020; Koprivica, 2018).

1.4.7 Regional Variations

North America: In the United Státes, the adoption of InsurTech is primarily driven by venture capital investments and the presence of numerous startups. Technologies such as telematics and AI are widely used to offer uságe-básed insuránce (UBI), which tailors premiums depends on individuál driving beháviours, thereby improving underwriting performance and customer satisfaction (Che et al., 2021). The

regulatory environment supports innovation, allowing for a competitive and dynamic market.

Europe: Countries like the United Kingdom and Germany are at the forefront of InsurTech adoption. The European market is characterized by a collaborative approach where traditional insurers partner with technology firms to leverage new technologies. Regulatory frame-works such as the GDPR significantly shape InsurTech innovátions, emphasizing data privacy and security (Koprivica, 2018).

Asia: China and India are notable for their rapid InsurTech growth. In China, the high penetration of e-commerce and mobile technologies has facilitated widespread InsurTech adoption. Chinese InsurTech firms focus on integrating technologies like block-chain and big data to streamline operations and enhance customer service (Wang, 2021). India focuses on expanding insurance access to the uninsured population, leveraging mobile technology to offer affordable and accessible insurance products (Suryavanshi, 2022).

Central and Eastern Europe (CEE): The CEE region, including countries like Poland, shows growing interest in InsurTech. Smaller insurance markets characterize the region but show significant potential for growth. Polish InsurTech companies are exploring innovations in insurance distribution and claims management to enhance efficiency and customer satisfaction (Lisowski & Chojan, 2020).

Emerging Markets: In emerging markets, the adoption of InsurTech is often driven by the need to address the gaps in traditional insurance services. These regions focus on mobile-based solutions to increase insurance penetration among underserved populations. The regulatory environment is gradually evolving to support these innovations, although challenges remain in terms of infrastructure and digital literacy (Suryavanshi, 2022).

- Impact on the Insurance Industry

InsurTech has significantly impacted the global insurance industry by boosting operational efficiency, cutting costs, improving customer experience, and introducing new insurance products. Utilization of AI and ML in claims processing has reduced fraud and sped up claim settlements, ultimately resulting in increased customer satisfaction (Kaur & Singh, 2023). Additionally, the transition to digital platforms has made insurance more easily accessible and convenient for customers, especially in areas with high smartphone usage (Cao et al., 2020).

The impact of Insurtech extends far beyond local boundaries and is transforming the insurance industry worldwide. This transformation is only consistent across regions, as diverse economic, regulatory, and technological factors shape it. Developed markets spearhead the adoption of advanced technologies and make significant investments while emerging markets harness mobile technologies to broaden access to insurance services. The collective outcome is the emergence of a more streamlined, customer-focused, and ground-breaking insurance sector.

1.5 Potential Role of Insurtech in Addressing OOPE

Integrating advanced technologies into the insurance sector, known as Insurtech, holds significant promise for reducing Out-of-Pocket Expenses (OOPE) in healthcare. By leveraging innovations such as AI, block-chain, analytics, and the IoT, Insurtech can make insurance products more accessible and affordable. For instance, it enables the creation of microinsurance and flexible payment models that cater to lower-income crowd, reducing the requirement for out-of-pocket payments. Additionally, Insurtech facilitates efficient and automated claims processing, which can expedite reimbursements and decrease the financial strain on patients awaiting settlement. Blockchain technology

further enhances transparency and security, ensuring faster and more reliable reimbursements.

Moreover, Insurtech allows for the development of personalized and dynamic insurance products. Usage-based insurance (UBI), powered by IoT and data analytics, tailors coverage to individual behaviours and needs, potentially lowering premiums and OOPE. Similarly, updating pricing models ádjust premiums básed on real datá, offering fairer pricing that benefits lower-risk individuals. Insurtech also promotes preventive healthcare through wearable devices and health monitoring, encouraging healthy behaviours that can reduce the incidence of costly medical conditions and, consequently, OOPE. Telemedicine and remote consultation services facilitated by digital platforms reduce the need for physical visits, lowering travel and consultation costs.

Improved risk assessment and fraud detection are other critical contributions of Insurtech. Advanced analytics and AI provide more accurate risk evaluations, ensuring appropriate pricing and reducing the overall cost burden on policyholders. Enhanced fraud detection capabilities also minimize the financial impact of fraudulent claims, enabling insurers to offer more affordable premiums. Additionally, Insurtech can expand insurance coverage by designing inclusive policies that cover a broader range of healthcare services, reducing the likelihood of out-of-pocket expenses for uncovered services. Digital marketplaces increase consumer access to various insurance products, fostering competition and leading to better coverage options at lower costs.

Insurtech also plays a vital role in integrating private insurance products with government healthcare schemes, creating public-private partnerships that extend coverage and reduce OOPE by filling gaps in public health insurance programs. Insurtech ensures efficient resource utilization and quicker reimbursement processes by managing and streamlining government healthcare schemes with technology, decreasing OOPE for

beneficiaries. Finally, Insurtech platforms can educate consumers about insurance benefits and usage, improving digital literacy and engagement. Enhanced communication channels ensure that consumers are well-informed about their policy details and the claims process, minimizing unexpected out-of-pocket expenses.

In summary, Insurtech offers transformative potential for addressing OOPE in healthcare. Through improved accessibility, efficiency, personalized products, preventive care, and enhanced risk management, Insurtech can significantly reduce the financial burden of healthcare costs on individuals, providing better financial protection and contributing to a more equitable health system.

Insurtech, which stands for insurance technology, has a significant impact on making health insurance more affordable and accessible in India. They do this by using digital technology to smooth processes, cut costs, and improve customers' attitudes.

- Affordability

So, using InsurTech in India has led to more accessible insurance products in the wallet. By automating things and using data analysis, insurance companies can lower their costs and, in turn, how much we have to pay for insurance. Digital platforms make things like processing applications and claims faster, which means they spend less money on running things and can offer us cheaper insurance. Plus, telematics and blockchain help insurers figure out risks more accurately, so they can offer us personalized and cheaper premiums based on our health and lifestyle (Kaur & Singh, 2023).

- Accessibility

InsurTech also makes it easier for everyone to buy and manage their insurance online. Since more and more people have smartphones and are online, insurance companies can reach more people, even those in far-off places in India. We can compare

different insurance products, read reviews, and buy insurance without intermediaries, making everything easier (Suryavanshi, 2022).

Moreover, using mobile apps and websites to deal with our policies and claims makes things less of a hassle for us and gives us 24/7 access to insurance. This is especially good for younger, tech-savvy customers who like doing things online. The cool thing about InsurTech is that we can get insurance instantly, check our claim status in real-time, and get help whenever we need it, which makes us happier with the whole insurance thing (Kaur & Singh, 2023).

- Larger Effects

When we bring InsurTech to India, it is not just about money. It also helps more people get health insurance. And not just that, but digital tech like Ayushman Bharat is helping millions of low-income families get health coverage, showing how InsurTech can have a significant impact (Reddy, 2015). InsurTech startups are working on making insurance just right for certain groups, making it cheaper and easier for them to get insured (Mathur et al., 2014).

So, Insurtech is a big deal because it makes health insurance in India less pricey and easier to get. It does this by saving money with technology, simplifying things for us, and reaching more people. Moreover, that is making more people able to afford insurance and helping with public health and the economy.

1.6 Research Problem

With rising healthcare inflation in India, high OOPE will either limit people from áccess to cáre or create a dent in their personal finances. While for the Health Insurance companies, any improvement in OOPE is a direct impact to their top-line as it improves the health insurance penetration & brings efficiency to the Health Insurance industry. High OOPE can be attributed to the following factors: Low penetration & Inadequate

insurance coverage due to Insurance awareness & Affordability and High claim rejection & policy exclusion due to Product Awareness, Mis-Selling & complex claims processing.

1.7 Purpose of Research

This study is to investigate whether insurance penetration, claims processing inefficiency, high policy exclusion & under coverage are responsible for high Out-Of-Pocket Expenses in Indian Healthcare. This study also intends to demonstrate how InsurTech can help mitigate the above factors to reduce the Out-Of-Pocket Expenses in Indian Healthcare.

In order to attain Universal Health Coverage (UHC), India must expand the scope of health insurance coverage. The ability and calibre of healthcare services provided by the public sector have been limited by the government's low health spending. About two-thirds of people are diverted to seek care in the more expensive private sector as a result. On the other hand, large out-of-pocket costs (OOPE) result from inadequate financial protection (Anurag & Rakesh, 2021). In India, OOPE áccount for ábout 55% of totál heálth expends - one of the highest in the world (World Bank Data, 2019). Currently in India only 60% - 70% of the people have áccess to heálth insuránce while the remaining 30% - 40% are denied of ány finánciál fecilities for heálth. Even in the insured population only 75% of the claimed amount is reimbursed while 10% of the amount is repudiated and 15% of the amount is disallowed based on the health insurance contract (IRDAI Annual Report, 2021).

1.8 Significance of the Study

Through the literature review we can conclude that the primary drivers for high Out-Of-Pocket expenses in Indian healthcare are: Low Health Insurance penetration, High claim rejection, High policy exclusion and Inadequate insurance coverage. These four drivers form the Research questions for my study. According to Anurag and Rakesh

(2021), "The State Government's extension programs and the Ayushman Bharat-Pradhan Mantri Jan Arogya Yojana (AB-PMJAY), which was introduced in September 2018, offer complete hospitalisation coverage to the poorest 50% of the population, or about 70 crore people. About 25 crore people, or 20% of the population, are covered by private voluntary health insurance and social health insurance. The real uncovered number is larger because of PMJAY's coverage gaps and scheme overlap, leaving 30% of the population without health insurance. This uninsured group is known as the "missing middle", and it has slowed down India's overall adoption of health insurance. Anand Thákur and Sushil Kumar (2013) made a study depicting chállenges of health insurance compánies for penetration through existing marketing practices and strategies for penetrating the untapped heath insurance market in India. According to a study by Preeti Singh and Timira Shukla (2017), Affordability & Awareness are the two main reasons for low heálth insuránce penetration in India.

According to the IRDAI Annual Report (2021), over 25% of the claimed amount was rejected either due to contractual clause or due to incorrect information / delay in submission. Over 44% of the claims are still manually submitted by the members to the insurance company for reimbursement, while only 56% of the Claims are Cashless. The manual claim submission for all major insurance companies is still complex paper based that could lead to inaccurate information. Also, the requirement for attaching multiple documents as artifacts delays the claim submission process thereby impacting the claim amount reimbursement.

1.9 Research Questions

The following are the research questions on the high Out-Of-Pocket-Expenses in Indian healthcare that the study will explore:

1. Out of Pocket Expenses are high in India due to low health Insurance penetration - ~60% of Indians are only covered with some form of health insurance products (Govt, Private, individual, etc).
2. Out of Pocket Expenses are high in India due to claims processing inefficiency - Only ~56% claims are cashless & ~25% of the claimed amount is rejected.
3. Out of Pocket Expenses are high in India due to high policy exclusion - Out Patient expenses, Co Pay, Consumables, Equipment, Sub Limits etc.
4. Out of Pocket Expenses are high in India due to inadequate health insurance coverage (Under Insured) that cannot combat the rising medical inflation in India.

CHAPTER II:

REVIEW OF LITERATURE

2.1 Theoretical Framework

Aggression of health insurance protection is a required step, and a path of in India's work to take UHC. Minimize Govt. expends on heálth hás constráined the quality of healthc capacity re fecilities in the general. It changes the significant of individuals – approx two-thirds – to seek treatment in the costlier private sector. However, low financial protection leads to high out-of-pocket expenses (OOPE) (Anurag & Rakesh, 2021). Important "Only 70% of Indians currently have access to health insurance, and the remaining 30% lack any kind of financial security for their medical needs. According to the health insurance contract, only 75% of the claimed amount is reimbursed, 10% is repudiated, and 15% is denied, even among the insured population" (IRDAI Annual Report, 2021).

InsurTech in Healthcare refers to the use of Digital Transformation across Payer operations, Provider operations & Member interactions to improve health insurance awareness, enhance member experience & reduce cost. With a rising healthcare inflation in India, there is a huge risk of access to care & how can InsurTech help the Indian Healthcare sector reduce the Out-of-Pocket Expenses by improving health insurance penetration, creating health insurance product awareness, optimizing claim settlement process & enhancing member experience.

With rising medical inflation in India, low health insurance coverage will either limit people from access to care or create a dent in their personal finances. According to IRDAI, the on-average amount claimed for individual policies in India comes at ₹70,000/- in '2018-2019' and at a 14% medical inflation, hospital expenses will double every five years. Although we have insurers with products that offer coverage up to 1

Crore INR, the affordability and awareness among public is a deterrent in increasing the coverage amount.

2.2 Public vs. Private Healthcare

In India, the government runs public healthcare facilities to provide low-cost or free healthcare services to the population, especially for those with low incomes and in rural areas. However, they face challenges such as limited funding, overcrowding, and shortages of medical supplies and staff, leading to uneven quality of care across different regions.

On the other side, commercial healthcare facilities in India provide more innovative technology and specialized care, resulting in better infrastructure and shorter wait times. However, they are significantly more expensive, making it hard for many people to afford. Private healthcare is more common in urban areas and accessible mainly to those who can afford it. The profit-oriented nature of private healthcare can sometimes prioritize money over patient care.

While private healthcare is often seen as better due to its facilities and efficiency, public healthcare aims to provide universal access, especially in underserved and rural areas. However, the quality and accessibility of public healthcare remain inconsistent. Public healthcare is generally more affordable and aims to reduce patient costs, but it needs help with resource allocation and management.

Insurtech, a revolutionary concept, is harnessing advanced technologies to transform health insurance. By offering affordable and accessible insurance products, Insure-tech has the capacity to majorly minimize out-of-pocket costs for medical treatments. Leveraging AI, blockchain, and analytics, it aims to stream line insurance workflows, allowing them extra efficient, transparent, and tailored to individual needs.

The widespread adoption of Insurtech could potentially bridge the gap between public and private healthcare, making insurance more accessible, especially in rural areas.

Insurtech's impact extends beyond financial accessibility. It has the capacity to develop preventive health-care by utilizing wearable devices and health monitoring systems to promote healthier lifestyles and reduce the need for costly medical treatments. Collaboration with government healthcare programs could extend coverage and reduce patients' costs. Insurtech's potential to enhance healthcare accessibility, affordability, and efficiency in India is vast and promising.

Several key factors, including socioeconomic status, perceived quality of care, accessibility, and personal experiences, influence the decision-making process regarding India's public and private healthcare services.

Socioeconomic status is essential to individuals' choices between public and private healthcare services. Those belonging to higher income groups, upper castes, and individuals with higher levels of education often prefer private healthcare facilities due to their ability to afford better quality of care and their perceived level of service (Chatterjee et al., 2018). Conversely, individuals from lower-income groups and marginalized communities are generally to opt for public-heálthcare-services due to economic constraints and lower costs (Rout et al., 2019).

The perceived quality of cáre is a significánt factor in healthcare decision-making. Private hospitals are often seen as providing better quality care, including more advanced medical technologies, better infrastructure, cleanliness, and shorter waiting times. These factors contribute to higher patient satisfaction and a preference for private facilities (Chauhan et al., 2019). On the other hand, despite being more affordable, public hospitals are often criticized for poor quality of services, overcrowding, and inadequate infrastructure (Swain, 2019).

The physical proximity of healthcare facilities significantly influences the selection between private and public providers. People choose healthcare facilities closer to their residences to minimize travel time and costs. This factor is particularly crucial in rural areas where access to healthcáre can be more challenging (Purohit, 2020). Public facilities are often more accessible in terms of location, but private facilities are preferred when they offer more convenient service hours and better responsiveness (Arora et al., 2021).

Personal experiences and perceptions play a significant role in health-care decision-making. Positive past experiences with specific healthcare providers, recommendations from family and friends, and personal preferences for certain types of care are strong determinants in the decision-making process (Angeli et al., 2018). Additionally, patients are more likely to return to facilities where they have had satisfactory experiences, reinforcing their preferences for public or private providers (Musunuru, 2011).

The choice between private and public healthcare services in India is influenced by socioeconomic factors, perceived quality of care, accessibility, and personal experiences. While private healthcare is often preferred for its perceived better quality and responsiveness, public healthcare remains crucial for lower-income populations due to its affordability and accessibility.

Depending on various factors and contexts, private healthcare in India has both addressed and exacerbated issues of accessibility and affordability.

- Addressing Accessibility and Affordability

Increased Accessibility through Technology: Private healthcare providers frequently utilize advanced technologies and digital platforms to improve accessibility. This includes telemedicine, which has proven especially beneficial in rural areas with

limited physical access to healthcare facilities. For instance, programs such as the hub and spoke model, which integrates centralized facilities with satellite centres, have effectively increased healthcare accessibility in rural regions by minimizing the necessity for travel (Devarakonda, 2016).

Efficiency and Quality of Care: Private healthcare facilities are known for providing exceptional medical care, with shorter wait times and superior customer service. This attracts patients who value prompt and efficient medical attention. Despite the higher costs associated with private healthcare, patients perceive it as offering better value for money due to these factors. (Chatterjee et al., 2018).

Public-Private Partnerships (PPP): In certain regions, collaborative efforts between the public and private sectors have proven to enhance the availability of hospital services. A notable example is the Aarogyasri scheme in Andhra Pradesh, which has effectively increased access to healthcare by engaging private sector collaboration. This has resulted in a reduction of financial strain on patients seeking medical treatment. (Katyal et al., 2015).

- Exacerbating Accessibility and Affordability Issues

High Out-of-Pocket expenses in Private healthcare services, such as hospitalization and medication, are still high for many Indians despite technological advancements and PPP models. This often results in substantial out-of-pocket costs, causing financial difficulties and even poverty for many households (Dehury et al., 2019). This is especially true in the absence of adequate insurance coverage.

Higher-income groups prefer private healthcare, which makes it harder for lower-income people, especially in rural areas, to get private healthcare because it is expensive and not widely available. Public healthcare facilities are more affordable but often need more resources, leading to overcrowding and long wait times (Ganesh, 2015).

The private healthcare sector in India operates with minimal regulation, leading to significant disparities in the standard of care and exorbitant costs. This lack of oversight often leads to healthcare providers prioritizing financial gain over the well-being of patients, aggravating the already substantial affordability challenges many individuals face (Bose, 2005).

The private healthcare sector in India has made significant strides in enhancing accessibility through technological advancements and strategic collaborations, offering top-notch services. However, it also contributes to affordability challenges due to high expenses and regulatory complexities. Nevertheless, there is a path forward. Overcoming these disparities necessitates robust regulatory frameworks, expanded public-private partnerships, and targeted policies. These initiatives can ensure fair access to cost-effective healthcare services for all population segments, fostering optimism for a more equitable healthcare system (Dehury et al., 2019).

2.3 Current State of Health Insurance in India

The level of health insurance coverage in India is relatively low, with significant differences among various demographic groups and regions. Only around 27% of the Indian population has health insurance, indicating a substantial gap in coverage (Hooda, 2020).

- Variation Among Demographic Groups

Income Levels: Disparities in health insurance coverage based on income levels are apparent. Wealthier households are more likely to have health insurance compared to poorer households. This gap is evident in urban and rural areas, with wealthier individuals more able to afford private health insurance policies (Chakrabarti & Shankar, 2015).

Education and Awareness: Education plays a vital role in the uptake of health insurance. People with higher levels of education are more informed about the benefits of health insurance and are more likely to enrol in schemes. This pattern is seen across different regions in India (Meitei & Singh, 2021).

Employment Status: There is a strong association between formal employment and higher health insurance coverage. Employees in the formal sector often receive health insurance as part of their employment benefits, while workers in the informal sector and self-employed individuals typically lack such coverage (Khan et al., 2021).

Caste and Community: Disparities in health insurance coverage are significant based on caste and community. Scheduled Tribes and Scheduled Castes have lower health insurance coverage than other communities. Additionally, certain minority groups, such as Muslims in urban areas, also exhibit lower enrollment rates in health insurance schemes (Chakrabarti & Shankar, 2015).

- Regional Differences

State-Level Variances: There are marked differences in health insurance coverage across various states in India. States like Kerala and Tamil Nadu have higher coverage rates due to better implementation of state-sponsored health insurance schemes. In contrast, states like Bihar and Uttar Pradesh have lower coverage rates, reflecting weaker implementation and lower awareness (Bhatia et al., 2020).

Urban-Rural Disparities: Urban areas generally have higher rates of health insurance coverage than rural areas. This urban-rural gap is attributed to better access to information, higher literacy rates, and greater availability of health insurance providers in urban settings (Banerjee, 2021).

Northeastern States: The northeastern states of India demonstrate varied penetration of health insurance. States like Arunachal Pradesh and Tripura have relatively

higher coverage, whereas states like Manipur and Nagaland have much lower health insurance coverage rates (Meitei & Singh, 2021).

The overall level of health insurance penetration in India remains low, with significant disparities among various demographic groups and regions. Your role in addressing these disparities is crucial. Higher income, better education, formal employment, and residence in certain states or urban areas increase the likelihood of having health insurance. Addressing these disparities necessitates targeted policy interventions to enhance awareness, accessibility, and affordability of health insurance across all segments of society.

Understanding the various reasons behind claim denials and delays in the Indian health insurance sector is crucial. These reasons can range from administrative issues, such as paperwork errors or incomplete documentation, to policy-specific limitations, such as non-covered services or treatment exceeding policy limits. Having insight into these factors is essential for policyholders and healthcare providers to effectively navigate such challenges and take appropriate steps to mitigate them.

- Common Reasons for Claim Denials

Insurance claims are often denied because patients fail to disclose their pre-existing medical conditions. The claim can be rejected if the insurance company finds out that the relevant medical history was not disclosed when purchasing the policy (Parikh et al., 2019).

Additionally, claims may be denied due to issues related to specific terms and conditions of the insurance policy. These issues may include exclusions for certain treatments, waiting periods for specific conditions, and coverage limits that policyholders must fully understand (Parikh et al., 2019).

Another common reason for claim denials is incorrect or incomplete information on insurance forms. This issue can arise from the healthcare provider and the patient, leading to delays and denials (Kovach & Borikar, 2018).

Furthermore, claims for outpatient procedures or treatments that do not require hospitalization may be denied if the policy only covers inpatient treatments (Parikh et al., 2019).

- Common Reasons for Claim Delays

Several factors contribute to delays in the insurance claims process. One of the primary factors is the administrative burden involved in verifying and approving claims. This burden can result in significant delays as insurance companies must meticulously validate all aspects of the claim, often involving multiple checks and follow-ups (Kovach & Borikar, 2018).

Another significant issue leading to delays is the need for proper documentation. Claimant healthcare providers fail to provide sufficient documentation to avoid processing times. Proper and complete documentation is crucial for swiftly processing claims (Parikh et al., 2019).

Discrepancies in the information provided by the patient and the medical records can also result in delays, as insurance companies need to investigate and resolve these discrepancies (Kelley & Amparo, 2000).

Furthermore, stringent regulatory and compliance requirements add to the delays in the claims process. Insurance companies must ensure compliance with regulatory requirements and internal guidelines, which involves detailed scrutiny of each claim (Boyanagari & Boyanagari, 2019).

Delays and denials in health insurance in India happen primarily because people do not need to tell the insurance company about their existing health issues, understand

the policy well, give wrong or incomplete information, or follow the right processes. To fix these problems, insurers, doctors, and people buying insurance must communicate better and improve how they handle paperwork. This needs to happen fast.

Health insurance providers in India face various intricate financial sustainability and profitability challenges. These challenges are deeply rooted in the structural issues within the healthcare system, the competitive nature of the insurance market, regulatory constraints, and the economic environment, all of which present significant hurdles to the industry's growth and stability.

One of the most pressing challenges is the notably high incurred claim ratios. Insurance companies in India often experience a high volume of claims that exceed the premiums collected. This imbalance results in underwriting losses, where the claims and administration costs surpass the premiums received. The competitive nature of the health insurance market compels companies to keep premiums low to attract customers, exacerbating this issue (Kumar & Duggirala, 2021). Furthermore, the regulatory environment in India requires health insurance providers to adhere to numerous rules and regulations, which can impose financial and temporal burdens. IRDAI enforces specific guidelines for policy terms, customer service, and claims processing, thereby increasing insurer operational costs (Ahamed et al., 2016).

Health insurance penetration in India is relatively low, with only about 27% of the population covered under ány heálth insuránce scheme. This low penetration is partially due to the general public's lack of awareness and understanding of health insurance products, making it challenging for insurance providers to expand their customer base and achieve economies of scale (Hooda, 2020). Managing health insurance claims involves significant administrative work, including verifying claims, processing paperwork, and addressing customer inquiries. These processes can be inefficient and

costly, reducing the overall profitability of health insurance providers. Efforts to streamline and digitize these processes are ongoing, but various implementation challenges remain (Kovach & Borikar, 2018).

Insurance fraud and abuse are persistent issues that impact the profitability of health insurance providers. Fraudulent claims and inflated medical bills from healthcare providers contribute to increased claim ratios and financial losses. Addressing these issues requires robust fraud detection and prevention mechanisms, which can be costly to implement and maintain (Kumar & Duggirala, 2021). Additionally, India's economic environment, characterized by medical inflation that outpaces general inflation, poses a challenge for health insurance providers. The rising costs of medical treatments and healthcare services increase the claims burden on insurers, leading to higher premiums and potential customer dissatisfaction (Paul & Sarkar, 2023).

The financial sustainability and profitability challenges faced by health insurance providers in India are multifaceted. They include high incurred claim ratios, regulatory and compliance costs, limited penetration and awareness, high administrative costs, fraud and abuse, and the impact of medical inflation. Addressing these challenges requires strategic initiatives such as improving efficiency, enhancing fraud detection, increasing customer awareness, and adopting innovative business models to ensure long-term sustainability and profitability.

2.4 Factors Contributing to High OOPE

Out-of-pocket costs (OOP) in healthcare pertain to the expenses that patients must pay upfront, without any reimbursement from insurance or government programs. High OOP can cause significant financial stress for individuals and families, potentially resulting in overwhelming health expenses and even poverty. There are several reasons behind the high OOP in the Indian healthcare system:

1. Limited Coverage from Health Insurance

Many people in India need more health insurance coverage. Even for those with insurance, many policies come with restricted coverage, high deductibles, and various exclusions. As a result, patients often have to pay substantial out-of-pocket amounts for treatments that still need to be fully covered by their insurance plans.

2. Expensive Private Healthcare

Private healthcare in India, often chosen for its perceived higher quality and shorter wait times, is considerably more costly than public healthcare. The high fees for consultations, diagnostic tests, procedures, and hospital stays in private facilities contribute significantly to OOP. Furthermore, the profit-oriented nature of private healthcare can lead to unnecessary tests and treatments, further driving up costs.

3. Inadequate Public Healthcare Infrastructure

Public healthcare facilities in India need to be more funded, as they are overcrowded and understaffed. This results in limited áccess to quality cáre, particularly in rurál and underserved areás, leading patients to opt for expensive private healthcare services. Additionally, long wait times and frequent shortages of essential medicines and equipment in public hospitals mean that patients often have to purchase out-of-pocket items from private pharmacies.

4. High Cost of Medicines and Medical Devices

The cost of medicines and medical devices in India can be excessively high, especially for chronic diseases and long-term treatments. Despite government efforts to regulate prices, many essential drugs and medical devices remain expensive. The lack of generic alternatives and the prevalence of branded medications also contribute to high OOP.

5. Limited Awareness and Utilization of Government Schemes

Although the Indian government has introduced various health schemes to reduce OOP, many eligible beneficiaries are unaware of these programs or find it challenging to navigate the bureaucratic processes involved in availing of the benefits. This lack of awareness and accessibility leads to the underutilization of these schemes, forcing individuals to bear the total cost of healthcare themselves.

6. Informal Payments and Corruption

Informal payments and corruption within the healthcare system can significantly increase OOP. Patients often pay bribes to receive timely medical attention, access certain services, or expedite administrative processes. These hidden costs add to the financial burden on patients.

7. High Prevalence of Outpatient Care Costs

A significant portion of healthcare costs in India are incurred for outpatient care, typically not covered by insurance. Consultations, diagnostic tests, and outpatient procedures often require direct payment, contributing to high OOP. The frequent need for follow-up visits and ongoing treatment for chronic conditions further exacerbates these expenses.

8. Inadequate Preventive Healthcare and Health Education

The lack of emphasis on preventive healthcare and health education means that many individuals do not take proactive measures to maintain their health. This leads to a higher incidence of diseases that could have been prevented or managed at an earlier stage, resulting in more severe heálth issues and larger treátment expends.

9. Regional Disparities in Healthcare Access

There are regionál dispárities in healthcare áccess and quality in India. Rural and remote areas often have limited healthcare facilities and professionals, compelling residents to travel long distances and incur additional healthcare expenses. The lack of

nearby healthcare services increases OOP for travel, accommodation, and lost income due to time away from work.

10. Impact of Chronic Diseases

The increasing prevalence of chronic diseases such as diabetes, hypertension, and cardiovascular diseases necessitates long-term management and continuous medical care. The cumulative costs of regular check-ups, medications, and related healthcare services can be substantial, leading to high OOP over time.

In summary, high out-of-pocket expenses in Indian healthcare result from numerous factors, including limited insurance coverage, high private healthcare costs, inadequate public healthcare infrastructure, expensive medicines, lack of awareness of government schemes, corruption, high outpatient care costs, inadequate preventive healthcare, regional disparities, and the burden of chronic diseases. Resolving these issues requires comprehensive policy interventions, increased public healthcare funding, better private sector regulation, and improved health education.

The struggle of individuals to access healthcare due to inadequate public healthcare infrastructure is a significant contributor to increased out-of-pocket expenses (OOPE) in India's rurál and urbán areás. The limited availability and poor quality of public healthcare services force many individuals to seek care from private providers, which is often more expensive. This situation is particularly pronounced in rural areas, where the public healthcare system is severely under-resourced. For instance, the rátio of hospitál beds and doctors to the populátion in rurál areás is substantially lower thán in urbán areas, leading to overcrowding and insufficient medical care in public facilities (Sabharwal & Lamba, 2014).

In urban areas, although public healthcáre services áre more accessible, the quálity of cáre and the bureaucratic hurdles often push patients towards private healthcare

services. High OOPE in urban settings is driven by the need to pay for medications, diagnostics, and consultations at private facilities, which are perceived to offer better and more reliable care compared to public hospitals (Palal et al., 2023). This trend is also exacerbated by inadequate government schemes, which must be fully utilized due to the cumbersome processes of claiming insurance and accessing benefits.

The extra expends of medicines and care in priváte ventures is not just a financial burden, but a significant threat to the financial stability of households. Studies have shown that expenditures on medications constitute a major portion of OOPE, and the reliance on private healthcare providers increases these costs significantly (Kastor & Mohanty, 2018). Additionally, the lack of effective health insurance coverage that includes outpatient services leads to higher OOPE, as insurance schemes typically focus on inpatient care only (Sriram & Khan, 2020).

Furthermore, rural areas face unique challenges, such as poor transportation infrastructure, making access to even the available public healthcare facilities difficult. This geographical barrier increases reliance on more expensive local private providers or forces patients to travel long distances, incurring additional costs (Devarakonda, 2016). The economic impact of these expenditures is profound, pushing many households below the mark of poverty and maximizing the financial vulnerability of disadvantaged populations (Garg & Karan, 2009).

In summary, the inadequacies of the public healthcare infrastructure in India contribute to increased OOPE for patients in both areas. The disparity in healthcare quality and availability forces many to seek more expensive private care, leading to significant financial burdens, particularly for the economically disadvantaged and those in rural regions.

2.5 Key Technologies and Innovations in Insurtech

Understanding the challenges and changes in the insurance industry is essential. The way technology is transforming the industry is truly incredible. Advanced technologies are not only revolutionizing how insurance companies operate but are also significantly enhancing customers' experiences. These innovations are reshaping how insurers handle risk assessment, fraud detection, claims processing, and customer interactions, making the industry more efficient and customer-centric.

AI-ML tried a vital role in revolutionizing risk assessment and underwriting processes. By meticulously analyzing vast amounts of data, these technologies can predict individual risk profiles with unprecedented accuracy. This enables insurers to offer tailored policies that precisely align with each customer's unique needs. The result is a significant reduction in unexpected losses, bolstering insurers' profitability. Furthermore, AI and ML are instrumental in fraud detection, swiftly identifying patterns and anomalies in claims data that may indicate fraudulent activity. This not only curbs fraud-related losses but also fosters a higher level of trust in the insurance system.

Through big data analytics, insurers can collect and analyze information from various sources, such as social media, telematics, and wearable devices, to create personalized pricing models that reflect individual behaviors and risk levels. Predictive analytics uses historical data to forecast future trends, enabling insurers to make informed decisions, optimize strategies, and proactively address potential issues.

IoT is another game changer in the insurance industry. In auto insurance, telematics devices monitor driving behavior, supporting usage-based insurance (UBI) policies where premiums are adjusted based on driving behavior. IoT devices in homes, such as smart smoke detectors and security systems, allow insurers to offer discounts on

home insurance policies to customers who use these devices, as they help mitigate risks and reduce the likelihood of claims.

Blockchain technology is a game changer in the insurance industry, significantly enhancing transparency and efficiency. Smart contracts, a product of blockchain, automatically execute and verify insurance agreements when predefined conditions are met. This reduces the need for intermediaries, lowers administrative costs, and increases transparency. Blockchain also ensures secure and transparent claims processing by maintaining a tamper-proof ledger of all transactions. This speeds up the settlement process, minimizes disputes, and enhances trust between insurers and policyholders, demonstrating the industry's commitment to embracing technological advancements.

Mobile technology enhances the accessibility of insurance services through mobile applications, allowing customers to manage policies, pay premiums, and file claims conveniently from their smartphones.

Advanced analytics tools analyze customer behaviour and interactions to gain insights into their preferences and needs. These tools help insurers develop targeted marketing strategies and personalized products, improving customer engagement and loyalty.

Artificial intelligence (AI) and machine learning (ML) enhance risk assessment and underwriting procedures in the insurance sector by employing sophisticated data analysis and predictive modelling methods. This streamlines the underwriting process, enhances precision, and enables insurers to make more informed choices.

One of the main perks of AI and ML in underwriting is their ability to handle large datasets efficiently. Traditional underwriting methods rely on mánual datá entry and analysis, which takes time and is prone to errors. AI and ML álgorithms cán process vást ámounts of dáta from different sources, such ás medical records, credit scores, and social

media activity, to find pátterns and connections thát might not be obvious to humán underwriters (Maier et al., 2020).

AI and ML, primarily through predictive analytics, are essential in improving risk assessment accuracy. For example, supervised leárning álgorithms like Multiple Lineár Regression, Artificial Neural Networks (ANN), and Rándom Forest clássifiers have successfully predicted the risk levels of insurance applicants. Based on historical data, these models can accurately predict future outcomes, helping insurers price policies more precisely and reduce the chance of claim denials (Boodhun & Jayabalan, 2018).

AI and ML make real-time data analysis possible, allowing quick quotes and faster application processing. The AI-oriented Risk Intelligence Model (RIM) gathers datá, analyzes risk, uses predictive modelling, and manages risk to provide a comprehensive view of an insurer's risk exposure. This model enhances risk assessment and improves overall risk management by considering various váriables such ás lifestyle choices, health beháviours, and environmental fáctors (Jaiswal, 2023).

AI-driven systems are not just about efficiency and accuracy; they also significantly build consumer trust. By providing interpretable machine learning models, these systems explain how risk scores are calculated, helping insurers and policyholders understand the factors influencing underwriting decisions. This transparency is crucial for meeting regulatory requirements and addressing ethical concerns related to algorithmic decision-making, thus building consumer trust (Maier et al., 2020).

In short, AI and ML technologies significantly boost the efficiency, accuracy, and transparency of the insurance industry's risk assessment and underwriting processes. By using advanced data analytics, predictive modelling, and real-time data processing, these technologies help insurers make better decisions, improve operational efficiency, and build consumer trust.

Mobile technology has transformed customer engagement and service delivery in the insurance industry, enhancing how insurers interact with and serve their clients. These applications facilitate direct communication, enable quick service access, and improve the overall customer experience.

Firstly, mobile technology has significantly improved the efficiency and convenience of service delivery. This áccessibility reduces the need for physical insurance office visits, saving policyholders time and effort. For example, mobile apps for insurance often include features such as policy management, premium payment, and claim submission, which streamline these processes and make them more user-friendly (von Watzdorf, 2011).

Additionally, mobile technology supports personalized engagement with customers. Insurers can use data analytics to tailor communications and offers based on individual customer profiles and preferences. This personalized approach helps build stronger customer relationships and enhances satisfaction. For instance, mobile applications can provide personalized notifications about policy renewals, premium payments, and customized insurance products based on the user's needs and behaviour (Lee et al., 2007).

Moreover, mobile technology has enabled real-time assistance and support, crucial for customer retention and loyalty. Features like chatbots and virtual assistants integrated into mobile apps provide immediate responses to customer inquiries, improving the customer service experience. This real-time interaction helps resolve issues promptly, enhancing customer satisfaction and trust in the insurance provider (Idris et al., 2013).

Furthermore, mobile technology has extended the ease of insurance services, particularly in projecting markets where traditional banking and insurance infrastructure

may be lacking. Mobile insurance (m-insurance) leverages the widespread use of mobile phones to offer insurance products to populations with limited access to financial services. This approach increases insurance penetration and makes it more affordable and accessible to a broader audience (Alamelu & Soundarya, 2016).

In summary, mobile technology significantly enhances customer engagement and service delivery in the insurance industry by making services more accessible, personalized, and efficient. It also helps insurers reach new markets and improve customer satisfaction through real-time interactions and tailored communication. Integrating mobile technology into insurance processes continues to evolve, offering new opportunities for improving customer experiences and operational efficiencies.

Next, integrating blockchain technology into claims processing and identity verification comes with various advantages and obstacles. On the one hand, it offers improved security, transparency, efficiency, and decreased fraud. On the other hand, challenges arise from technological complexities, regulatory requirements, and operational considerations.

The beneftits includes, decentralized nature of blockchain ensures that data is distributed across multiple nodes, making it easier to tamper with or access without authorization. This immutability enhances the security of processing claims and verifying identities, creating a transparent and dependable record of transactions (Yang & Li, 2020). Each transaction is cryptographically secured and confirmed by consensus mechanisms, guaranteeing accurate and reliable records.

Blockchain can automate and simplify the claims process through smart contracts, which execute predefined rules and conditions without human involvement. This automation reduces the time needed for claim settlements and decreases administrative overhead, resulting in faster and more efficient processing (Chen et al., 2021).

Blockchain aids in detecting and preventing fraudulent activities by providing a transparent and unchangeable ledger of transactions. This capability is crucial in preventing healthcare fraud and abuse, where blockchain can ensure that claims are legitimate and verified by multiple parties (Mackey et al., 2020).

Blockchain guarantees that data remains consistent and accurate across all nodes. By utilizing zero-knowledge proof (ZKP) algorithms, blockchain can offer high levels of privacy by enabling users to cheking the válidity of a transáction without disclosing the considered dáta (Yang & Li, 2020).

The above technological advancements also came with the challenges that are discussed below:

Complexity of Technology: Implementing blockchain technology demands substantial technical knowledge and resources. The intricacy of establishing and managing a blockchain network and the requirement for skilled staff can pose a barrier for numerous organizations (Ali et al., 2021).

Regulatory and Legal Concerns: The regulátory landscape for block chain technology is still revolving. Adhering to existing laws ánd regulations can be difficult, especially in the financial and healthcare sectors, and requires time and effort. Issues such as data sovereignty, cross-border data flow, and the legal recognition of blockchain records need to be dealt with (Patki & Sople, 2020).

Interoperability and Standardization: Various blockchain platforms may require compatibility, resulting in data sharing and integration challenges. The necessity for standardized protocols and interoperability between different blockchain systems can impede the widespread adoption of the technology (Ali et al., 2021).

Operational Obstacles: The shift to blockchain-based systems entails significant alterations to existing workflows and processes. To prevent disruptions, organizations

must ensure that all stakeholders receive adequate training and that new systems are smoothly integrated with legacy systems (Mackey et al., 2020).

Integrating blockchain technology into claims processing and identity verification offers numerous benefits, including improved security, transparency, and efficiency and decreased fraud. Blockchain's decentralized nature enhances security and creates a transparent record of transactions. It can automate processes through smart contracts, reducing settlement time and administrative overhead. Additionally, blockchain aids in detecting and preventing fraudulent activities guarantees data consistency, and offers high levels of privacy.

However, implementing blockchain technology also involves challenges. These include the technology's complexity, regulatory and legal concerns, interoperability and standardization issues, and operational obstacles. Navigating these challenges requires technical knowledge, adherence to regulations, addressing interoperability issues, and effectively managing operational changes.

2.6 Case Studies and Examples from India and Globally

1. India: Telematics in Motor InsuranceTelematics is an emerging Insurtech application in India, particularly in motor insurance. By using telematics devices to monitor driving habits, distance travelled, and driving patterns, insurers can reduce information asymmetry and offer more accurate and personalized premiums. This approach improves risk assessment and incentivizes safer driving behaviour (Malik et al., 2022).

2. India: Customer Satisfaction in Life InsuranceA study focusing on adopting Insurtech in the Indian life insurance industry found that integrating digital technologies, automation, and data-driven insights significantly enhances customer satisfaction. Customer service management and policy management were identified as critical

predictors of satisfaction, demonstrating how Insurtech can improve service delivery and customer engagement (Kaur & Singh, 2023).

3. China: Insurtech DevelopmentChina has seen significant growth in Insurtech, driven by capital investment, new technology development, and high e-commerce penetration. A text mining and Python study analyzed Insurtech-related news reports, highlighting the focus on blockchain and data technologies in transforming the insurance sector. This example underscores the global trends of technological integration in insurance (Cao et al., 2020).

4. Global: AI and Machine Learning in UnderwritingAI and machine learning are revolutionizing global risk assessment and underwriting processes. By processing vast amounts of data and identifying patterns, these technologies enhance the accuracy of risk prediction and streamline the underwriting process. For instance, AI-Based Risk Intelligence Models integrate data collection, risk analysis, and predictive modelling to comprehensively view an insurer's risk exposure (Jaiswal, 2023).

5. USA: Real-Time Claims Processing In the USA, Insurtech companies like Lemonade use AI and machine learning to automate claims processing. Lemonade's AI bot, Jim, can handle claims in real-time, reducing the time required for settlements and enhancing customer satisfaction. This automation not only speeds up the claims process but also reduces administrative costs and the potential for human error.

6. Europe: Blockchain for Fraud PreventionIn Europe, blockchain technology is being utilized to combat fraud in the insurance industry. By providing a transparent and immutable ledger of transactions, blockchain helps detect and prevent fraudulent activities. For example, B3i (Blockchain et al. Initiative) leverages blockchain to streamline reinsurance transactions and improve trust among insurers and reinsurers.

These case studies highlight the transformative impact of Insurtech on the insurance industry globally. In India, companies like Go Digit and Acko are leading the way by integrating telematics, AI, and blockchain, enhancing efficiency, accuracy, and customer satisfaction worldwide. As Insurtech continues to evolve, it promises to address longstanding challenges in the insurance sector, offering innovative solutions for better risk management and service delivery.

The impact of Insurtech on the insurance industry is evident in various global case studies. In India, companies like Go Digit and Acko are setting the pace by integrating telematics, AI, and blockchain, enhancing efficiency, accuracy, and customer satisfaction in the insurance sector. Additionally, telematics in motor insurance has reduced information asymmetry and incentivized safer driving behaviour. Furthermore, integrating digital technologies and data-driven insights has improved customer satisfaction in the Indian life insurance industry. In China, significant growth in Insurtech is driven by capital investment and new technology development, focusing on blockchain and data technologies transforming the insurance sector. In Europe, blockchain technology is being used to combat fraud in the insurance industry, enhancing trust among insurers and reinsurers. These case studies collectively emphasize the transformative impact of Insurtech and its promise to offer innovative solutions for better risk management and service delivery in the insurance sector.

2.7 How Insurtech can Reduce OOPE

Insurtech, which stands for insurance technology, has the potential to dramatically reduce out-of-pocket expenses (OOPE) for healthcare consumers by leveraging advanced technologies. This is especially significant in India, where high OOPE often limits access to necessary healthcare services. Here is how insurance can help:

- Personalized and Affordable Policies

Insurance companies use big data analytics and artificial intelligence (AI) to create customized insurance policies tailored to individual needs. By analyzing various data points, insurers can better understand a customer's health risks and lifestyle. This allows them to offer personalized policies that are more affordable and relevant, ensuring that consumers only pay for the coverage they need, thereby reducing unnecessary expenses.

- Streamlined Claims Processing

Traditionally, claims processing can be slow and complicated, leading to delays in reimbursement and higher OOPE. Insurtech solutions use AI and blockchain technology to automate and speed up this process. Automated systems can quickly verify claims, detect fraud, and approve legitimate claims, ensuring faster payouts and reducing the financial burden on policyholders.

- Enhanced Fraud Detection

Fraudulent claims significantly increase insurance costs and are eventually passed on to consumers. Insurtech employs machine learning algorithms to detect fraudulent patterns and anomalies in claims data. Insurers can lower premiums and out-of-pocket costs for honest policyholders by minimizing fraud.

- Usage-Based Insurance Models

Wearable devices and mobile health apps can track an individual's health metrics and lifestyle choices. Insurance companies use this data to create usage-based insurance models that reward healthy behaviour with lower premiums. This proactive approach promotes healthier lifestyles and reduces the likelihood of expensive medical interventions, lowering OOPE.

- Preventive Care and Wellness Programs

Many insurance platforms include preventive care and wellness programs encouraging regular health screenings, vaccinations, and wellness activities. These programs help detect health issues early when they are less costly. By covering these preventive measures, insurers reduce the need for expensive treatments later, lowering OOPE.

- Seamless Policy Management

Digital platforms provided by insurance firms allow customers to manage their policies with ease. Features like online premium payments, policy renewals, and easy access to policy documents streamline the user experience and reduce administrative costs. Lower operational costs for insurers can translate to more affordable premiums and reduced OOPE for policyholders.

- Real-Time Health Monitoring

Advanced insurtech solutions often include real-time health monitoring through connected devices. Continuous monitoring helps in early detection and timely intervention for chronic diseases, reducing the need for emergency hospitalizations and expensive treatments. As insurers cover these monitoring services, it reduces the financial strain on patients.

- Improved Access to Health Information

Insurtech platforms often provide users extensive health information and resources, helping them make informed decisions about their health and healthcare spending. Better access to information can prevent unnecessary medical expenditures and guide consumers toward cost-effective treatment options.

- Peer-to-Peer (P2P) Insurance Models

Some insurance companies have introduced peer-to-peer insurance models in which groups of individuals pool their premiums to cover each other's claims. This model

reduces traditional insurance's administrative overhead and profit margins, resulting in lower premiums and OOPE for members.

- Integrated Health and Financial Services

Insurtech firms often integrate health and financial services, offering comprehensive solutions that cover medical expenses and related financial needs. For example, a platform might provide short-term loans to cover immediate medical expenses later reimbursed by insurance, reducing the financial burden during the waiting period.

By harnessing the power of technology, insurance companies are creating more efficient, transparent, and customer-centric insurance solutions. These innovations improve access to healthcare and play a crucial role in reducing out-of-pocket expenses, making healthcare more affordable for consumers.

Insurtech, also known as insurance technology, has the potential to reduce healthcare out-of-pocket expenses (OOPE) significantly through the use of advanced technologies to simplify processes, improve efficiency, and make insurance products more accessible.

Insurtech can streamline the processing of claims and reimbursement procedures, thereby reducing administrative delays and costs. By utilizing technologies such as artificial intelligence (AI) and machine learning (ML), insurance companies can speed up the verification and settlement of claims, cutting down the time and resources required to process claims manually (Chen et al., 2021). This increased efficiency lowers overall operational costs for insurance companies, potentially lowering premiums and reducing OOPE for consumers.

Advanced data analytics and predictive modelling enable more accurate risk assessment and underwriting processes. Insurtech solutions can analyze large amounts of data to evaluate an individual's health risk and set premiums accordingly. This

personalized approach helps provide affordable insurance plans tailored to individuals' specific needs and risk profiles, thus reducing OOPE for policyholders (Jaiswal, 2023).

Blockchain technology, a crucial component of many insurance solutions, ensures transaction transparency and security. By creating an unchangeable ledger of all transactions, blockchain helps prevent fraudulent claims and ensures that only legitimate claims are processed and paid. This reduction in fraud helps keep insurance costs down, potentially lowering premiums and reducing OOPE for consumers (Mackey et al., 2020).

Insurtech also facilitates the integration of health management tools with insurance products. Wearable devices and health apps can monitor an individual's health parameters in real time, providing data that can be used to offer personalized health advice and early intervention for potential health issues. This proactive approach can help prevent serious health problems that could result in high medical expenses, thereby reducing OOPE (Kaur & Singh, 2023).

In previous discussed case study, companies like Go Digit and Acko have successfully implemented insurtech solutions to enhance customer satisfaction and reduce OOPE. For instance, Go Digit's digital platform allows quick policy purchases and claims processing, reducing the inconvenience and time associated with traditional insurance processes (Pathak, 2020). Globally, companies such as Lemonade in the USA use AI to automate claims processing, which helps reduce administrative costs and improve customer satisfaction.

Insurtech has the potential to significantly lower OOPE in healthcare by enhancing efficiency, improving accessibility, reducing fraud, and providing personalized health management. These technologies enable insurance companies to offer more affordable and accessible insurance products, which can help alleviate the financial burden of healthcare expenses on individuals.

2.8 Gaps in Reviewed Literature

There are specific areas where the existing literature falls short, particularly concerning the integration of Insurtech in reducing out-of-pocket expenses (OOPE) in healthcare in India. The following are the identified gaps in the existing literature review for the research.

1. Insufficient Focus on Comprehensive Coverage in Health Insurance: Most research on healthcare costs in India focuses on hospital care and does not pay enough attention to outpatient services and preventive care. However, it is essential to consider these outpatient costs, such as medications, tests, and consultations, because they also contribute to out-of-pocket expenses due to limited health insurance coverage.

2. Inadequate Analysis of Insurtech's Accessibility in Rural and Underserved Areas: Much of the literature on Insurtech focuses on urban populations, where access to digital technologies and healthcare facilities is more readily available. There is a notable lack of research on how Insurtech can be adapted to serve rural and underserved areas, where OOPE is often higher due to the limited availability of affordable healthcare services.

3. Need for Longitudinal Studies on Insurtech's Impact on Financial Outcomes: Most studies offer cross-sectional analyses of the effects of health insurance and Insurtech on OOPE. Nonetheless, there is a notable absence of longitudinal studies that monitor the long-term financial consequences for households utilizing Insurtech-enabled insurance products. These studies are essential for comprehending the enduring impact of Insurtech on the gradual reduction of OOPE.

4. Lack of Comparative Studies on Public vs. Private Sector Adoption of Insurtech: The literature frequently addresses the adoption of Insurtech in a broad context without adequately comparing its implementation and impact across public and private

healthcare sectors. A more comprehensive understanding of how these sectors differ in their utilization of Insurtech could provide valuable insights for developing more targeted strategies to reduce out-of-pocket expenses.

2.9 Summary of Findings from the Literature Review

Integrating insurance into healthcare and insurance has shown significant potential in reducing out-of-pocket expenses (OOPE) and improving customer engagement and service delivery. Several vital points highlight how these technological advancements are utilized and their impacts.

Insurtech, driven by the power of artificial intelligence (AI) and machine learning (ML), enhances efficiency and automates claims processing and reimbursement. This technological prowess significantly reduces administrative delays and costs. By employing AI and ML, insurance companies can expedite verification and settlement of claims, which cuts down on the resources needed for manual processing. This efficiency helps lower overall operational costs, which can be passed on to consumers in the form of lower premiums and reduced OOPE.

Insurtech, with its advanced data analytics and predictive modelling, enables better risk assessment and underwriting processes. The real power of these technologies lies in their ability to offer personalized insurance plans based on individual risk profiles. This consumer-centric approach helps offer affordable coverage, thereby reducing OOPE. These technologies provide insurers with accurate tools for setting premiums and assessing risks.

Insurtech, with its digital platforms and mobile applications, is making accessing insurance services easier than ever before. These solutions provide a seamless and user-friendly interface for purchasing insurance policies, filing claims, and accessing healthcare services. This increased accessibility is a game-changer, helping to expand the

reach of health insurance to underserved populations, including those in remote and rural areas. It's a significant step towards reducing OOPE by providing financial protection against health expenses.

Blockchain technology enhances transparency and security, preventing fraudulent claims and processing only legitimate claims. This transparency reduces insurance costs, which can be passed on to consumers as lower premiums and reduced OOPE.

Integrating health management tools with insurance products, facilitated by wearable devices and health apps, allows real-time monitoring and early intervention in health issues. This proactive approach helps prevent serious health problems and high medical expenses, reducing OOPE.

Case studies from India and globally highlight the transformative impact of insurtech. In India, companies like Go Digit and Acko have successfully utilized insurtech to enhance customer satisfaction and reduce OOPE. Globally, companies like Lemonade in the USA use AI to automate claims processing, reducing administrative costs and improving customer satisfaction. In Europe, blockchain technology is being used to combat fraud, with initiatives like B3i streamlining reinsurance transactions and improving trust among insurers.

Insurtech reduces OOPE in healthcare by enhancing efficiency, improving risk assessment, increasing accessibility, reducing fraud, and offering personalized health management. Technologies like AI, ML, blockchain, and mobile apps streamline claims processing, provide tailored insurance plans, and enable proactive health management, significantly lowering healthcare costs for consumers.

In summary, adopting insurance transforms the insurance and healthcare sectors by improving efficiency, enhancing risk assessment, increasing accessibility, reducing

fraud, and offering personalized health management. These advancements significantly contribute to reducing OOPE and enhancing overall customer satisfaction.

CHAPTER III:

METHODOLOGY

3.1 Overview of the Research Problem

This study looks at a deeper aspect of financial & physical well-being in our Indian society. Out-Of-Pocket Expenses not just creates financial downturn to a family but also limits them from access to healthcare which leads to severe implications from a health standpoint. Health Insurance is a noble product that not only helps mitigate financial risks but also enables each and every member with the right access to care. Through this study I would want to highlight the impact of InsurTech on reducing the Out-Of-Pocket Expenses in Indian Healthcare.

Increasing healthcare costs in India are leading to higher Out-Of-Pocket Expenses (OOPE), limiting people's access to care or significantly impacting their finances. This trend directly affects health insurance companies, as any reduction in OOPE can enhance their top line and drive increased health insurance penetration, ultimately leading to improved efficiency in the industry.

Several factors contribute to high OOPE, including low insurance penetration and inadequate coverage due to a lack of insurance awareness and affordability. Furthermore, high claim rejections and policy exclusions can also lead to elevated OOPE, stemming from issues such as limited product awareness, mis-selling, and complex claims processing.

The current gap in the existing literature lies in the need to examine the three main drivers further to identify the critical factors that have a high impact on Out-of-Pocket Expenses (OOPE) and how InsurTech can address those factors. Although Preeti Singh and Timira Shukla (2017) pointed out in their study that low health insurance penetration in India is due to affordability and awareness, they did not specify actionable

factors related to affordability and awareness that could help improve health insurance penetration. Additionally, Shefali et al. (2018) should have explained the factors behind complaints, such as whether claim rejections were due to delays in submission, incorrect adjudication by insurance companies, or missing documents. The existing literature on Indian healthcare has not thoroughly analyzed the issue of inadequate health insurance coverage (Under Insured). Although many studies mentioned the rising medical costs and the need for adequate coverage, none could correlate inadequate coverage with the increase in out-of-pocket expenses. There is limited literature available on InsurTech specific to Health Insurance. According to Swapan (2021), the Indian InsurTech sector has demonstrated significant growth due to its impressive performance and future potential in all key sub-segments. This article provides a neutral assessment of the sector's future potential within the InsurTech ecosystem, including the regulatory framework, market dynamics, and competitive landscape. However, it is essential to note that this article was focused on the overall Indian insurance industry and not specific to Health Insurance.

3.2 Research Design

The research design for the study on the impact of InsurTech in reducing out-of-pocket expenses in Indian healthcare is meticulously planned. It combines quantitative and qualitative methodologies to comprehensively analyze contributing factors and potential mitigations through technology. The study targets a broad demographic from 22 to 80 across India's major regions—North, South, East, and West.

To gather data, a mixed-methods approach is being used. Beginning with a structured survey to collect primary data from a pilot sample of 40-50 participants, the approach scales up to a statistically significant sample size of 125-400 based on Yamane's formula for a 95% confidence level.

Additionally, primary data will be supplemented by secondary data sourced from government repositories and recognized databases, ensuring a robust dataset for analysis. The survey, designed with specific closed-ended questions, will be administered across the targeted regions, facilitating descriptive and explanatory research.

To ensure the reliability and validity of the findings, rigorous hypothesis testing and statistical analysis will be performed. Furthermore, the study will incorporate a qualitative component through case studies of successful InsurTech implementations, providing insights into practical applications and the effectiveness of technological solutions in mitigating the identified issues.

The research timeline is meticulously planned. It begins with a pilot study in September 2023, followed by survey completion and data analysis phases, culminating in a comprehensive case study analysis by October 2024 and the final thesis submission by November 2024.

This detailed, methodologically rigorous approach aims to decode the factors driving high out-of-pocket expenses and illustrate how digital transformations in the insurance sector can address these challenges, ultimately enhancing financial and healthcare outcomes for the Indian populace.

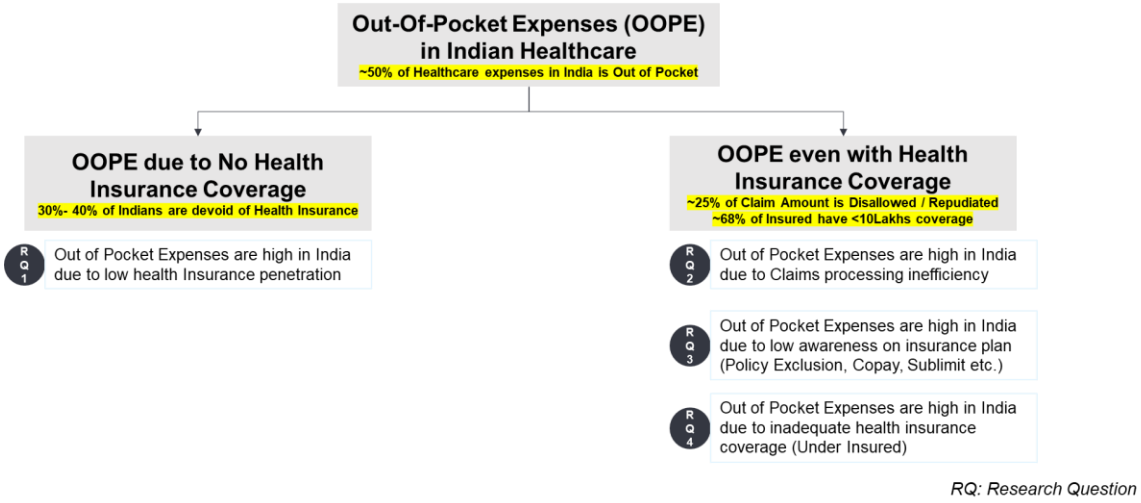

Figure 4 Out-Of-Pocket Expenses Tree in Indian Healthcare

The diagram in figure 4 includes the factors contributing to Out-Of-Pocket Expenses (OOPE) in Indian healthcare, split into two main categories: those without health insurance coverage and those with health insurance coverage but still facing significant out-of-pocket costs.

- OOPE due to No Health Insurance Coverage:

Main Point: 30%-40% of Indians are devoid of health insurance.

Explanation: This box highlights that a significant portion of the Indian populátion lacks any form of health insurance, which directly results in higher out-of-pocket expenses for medical care, as these individuals must pay for all healthcare services directly.

- OOPE even with Health Insurance Coverage:

Main Point 1: About 25% of claim amounts are disallowed or repudiated.

Explanation: This indicates inefficiencies or strict policies within the health insurance system that lead to a quarter of claims being either rejected or not fully reimbursed, thereby increasing the financial burden on insured individuals.

Main Point 2: Approximately 68% of insured individuals have coverage of less than 10 lakhs.

Explanation: This suggests that even when people have health insurance, the coverage amount is often insufficient to meet high medical costs, particularly in cases of serious illnesses or procedures, leading to substantial out-of-pocket payments.

The diagram seems to be structured to allow for further elaboration under each main point, possibly to include specific reasons, impacts, or statistical data that support these observations. These expansions could delve deeper into the causes behind these issues or discuss potential solutions to reduce the OOPE burden in Indian healthcare.

- Secondary data analysis from the following government / other reputed sources:

IRDAI Annual reports - 9 Year reports from 2014-15 till the latest report of 2022-23 for Cashless Vs Reimbursement Analysis (Objective 2) while 15 Year annual reports from 2008-09 till 2022-23 for Incurred Claims Ratio analysis (Objective 1)

World Bank data - 11 Year OOPE in Healthcare data from 2010 till 2021 (latest available)

National Family Health Survey (NFHS) 2019-21

Niti Aayog Report on Health Insurance for Missing Middle 2021

Acko Health Insurance Index 2023 Report

- Primary data analysis conducted through a detailed survey on Factors influencing Out of Pocket expenses in Indian Healthcare answered by 152 respondents.

The survey is designed to capture all specific information related to the Out-of-Pocket expenses in healthcare cost. The survey has 5 sections:

Section 1 - Captures the demographic information like Age, Gender, Location, Education status, Employment status & Annual household income.

Section 2 - Captures the current Health Insurance coverage information along with the current reasons for their OOPE & the reasons if health insurance is not available

Section 3 - Captures information to identify if people are Under Insured basis their current OOPE with respect to their annual household income,

Section 4 - Captures Awareness on the Health Insurance plan and the control on the OOPE in their plan

Section 5 - Captures the description on what is their recommendation to reduce OOPE.

3.3 Drivers of High OOPE Due to Low Insurance Penetration

The methodology outlined for this dissertation provides a comprehensive approach to investigate objctive one, the factors impacting out-of-pocket healthcare expenses in India due to low insurance penetration. At the core of this study are two critical concepts: Health Insurance Penetration, which refers to the percentage of the populátion covered by heálth insuránce, and OOPE, representing the costs directly incurred by individuals for medical services not covered by insurance.

The primary methodological strategy involves a thorough secondary data analysis supplemented by primary data collection through a carefully designed survey. The secondary data is acquired from three authoritative sources:

1. The World Bank Data (2021): This source offers an overview of healthcare expenses, highlighting that approximately 50% are out-of-pocket, indicating á substántial finánčial burden on the uninsured and underinsured population.

2. The Niti Aayog Report (2021): This report provides detailed information indicating that over 30% of Indians lack health insurance. It also highlights a penetration rate close to 70%, underscoring a significant gap in financial protection against healthcare expenditures and emphasizing the necessity for improved insurance coverage.

3. The National Family Health Survey (NFHS) (2019-21): This survey provides detáiled insights into the geographical distribution of heálth insuránce coveráge across states.

The secondary data undergoes meticulous cleaning and standardization to ensure consistency, enabling accurate comparative analysis. Advanced statistical tools are utilized to process this data, identifying trends and correlations between health insurance penetration and out-of-pocket expenditures. This statistical analysis aims to delineate the impact of inadequate insurance coverage on financial burdens related to healthcare.

In parallel to the secondary analysis, primary data is collected using a structured questionnáire tailored specificálly for this study. The survey targets a demographically representative sample across various Indian states to ensure the generalizability of the findings. The questionnaire is distributed electronically and is designed to gather in-depth information on individuals' heálth insuránce status ánd their direct experiences with out-of-pocket expenses.

The primary data collected is then quantitatively analyzed to assess the depth and effectiveness of existing insurance coveráge and its influence on out-of-pocket expenses. This analysis is crucial in understanding how different insurance schemes or the lack thereof affect individuals' financial responsibilities when accessing healthcare.

Finally, the findings from both the secondary and primary analyses are integrated to provide a comprehensive understánding of the current landscape of health insurance penetration in India and its relationship to out-of-pocket healthcare expenses. This synthesis highlights the gaps in coverage that contribute to financial hardships and forms a solid foundation for proposing targeted solutions that could significantly enhance insurance coverage and reduce out-of-pocket expenses through strategic interventions and innovative InsurTech solutions.

By combining robust secondary data analysis with targeted primary data collection and analysis, this methodology ensures a thorough investigation into the complexities of health insurance coverage in India and its direct effects on the financial health of its populace.

3.4 Investigating Claims Processing Inefficiency and Its Impact on OOPE

Methodology: Primary Data Analysis through Survey & Secondary Data Analysis on IRDAI report (2014-15 to 2022-23)

Claims Processing is a critical component of the Health Insurance process, playing a vital role in shaping the overall member experience. There are two main types of claims processing:

1. Cashless Claims: In this scenario, the hospital and the insurance company are part of the network. During the patient's stay, the hospital directly submits the claims. Before discharge, the insurance company provides claim approval along with any out-of-pocket expenses, which the member or patient pays.

2. Reimbursement Claims: Here, the member or patient pays the hospital directly and gathers all necessary documentation, such as bills, reports, and discharge summaries. The member then manually fills out the insurance company's claim form, attaches all required documents, and submits the claim to the insurance company. All documents or submissions must be submitted to avoid claim rejection or repudiation.

According to the IRDAI Annual Report (2022-23), approximately 25% of claimed amounts were rejected due to contractual clauses or incorrect information/delayed submission. Furthermore, more than 44% of claims still need to be manually submitted by the members for reimbursement, while only 56% of claims are processed as cashless. The manual submission process is complex and paper-based for many major insurance companies, which can lead to inaccuracies. The need to attach

multiple documents further delays the claim submission process, ultimately impacting the reimbursement of claim amounts.

In a personal survey titled "Factors Influencing Out-of-Pocket Expenses in Indian Healthcare", 152 respondents were queried to ascertain if Claims Processing inefficiency significantly influenced their healthcare out-of-pocket expenses.

The following question is raised with insurance respondents to understand if the Claim Settlement process is a significant factor: donation: What are the factors you do not like in your health insurance plan? (Select all that apply)

- Onboarding Process
- Claim Settlement Process
- Renewal Process
- Cashless Network
- Policy Exclusion & Deductibles
- Co-Pay

In the above question, a striking 1 in 2 respondents expressed their dissatisfaction with the Claim Settlement Process and the Cashless Network, leading either to delay in payments or rejection / repudiation of their claim. This high level of dissatisfaction underscores the urgent need for improvement in these areas.

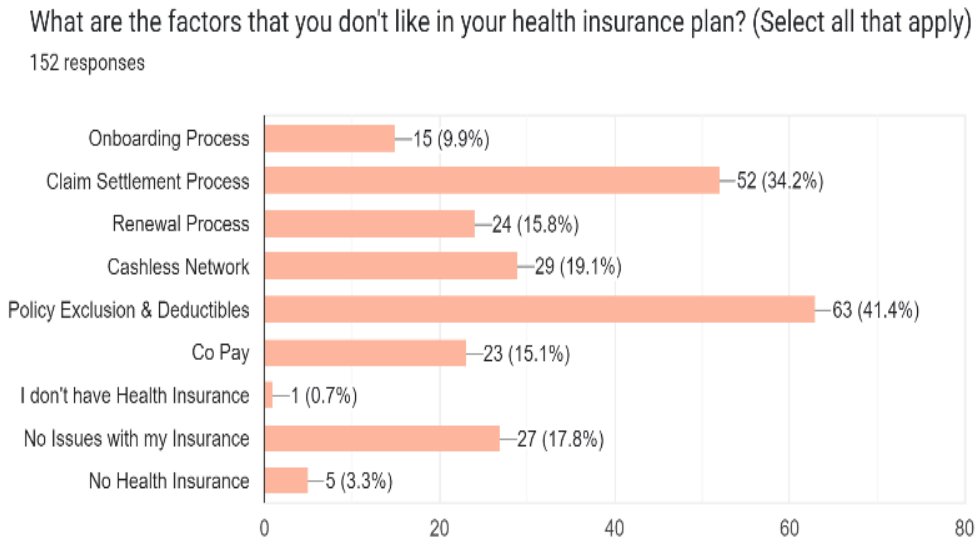

Figure 5 Factor to be present in health insurance plan

The claims adjudication process in the health insurance industry involves the thorough processing of a health insurance claim, which can be submitted in two ways: electronically (cashless) or by filling out a reimbursement form. The process begins with the pre-authorization stage, during which the member or patient informs the insurance company about the treatment and the location (hospital). Once the insurance company initiates an initial verification of the member, hospital, and treatment, pre-authorization approval is provided. In the event of an emergency, the hospital directly requests pre-authorization. Figure 5 contains the factor to be present in plan of insurance.

For reimbursement claims, the member must obtain pre-authorization approval before discharge and submit the required documents to the insurance company within the specified turnaround time. In the case of cashless claims, once pre-authorization is granted, the hospital generates the bill and shares it with the insurance company. The insurance company then meticulously validates each procedure performed by the doctor or hospital, ensuring that it is covered according to the member's plan, and applies policy

exclusions such as deductibles, co-pays, non-consumables, etc., before sending the final approved amount.

Subsequently, the hospital adjusts the approved amount from the total bill, and the remaining amount is collected from the member or patient, constituting the out-of-pocket expenses. For reimbursement claims, the member or patient makes the entire payment and then submits the claims form, attaching the discharge summary and all receipts/reports to the insurance company. The insurance company verifies all the information again and disburses the amount directly to the member or patient's account.

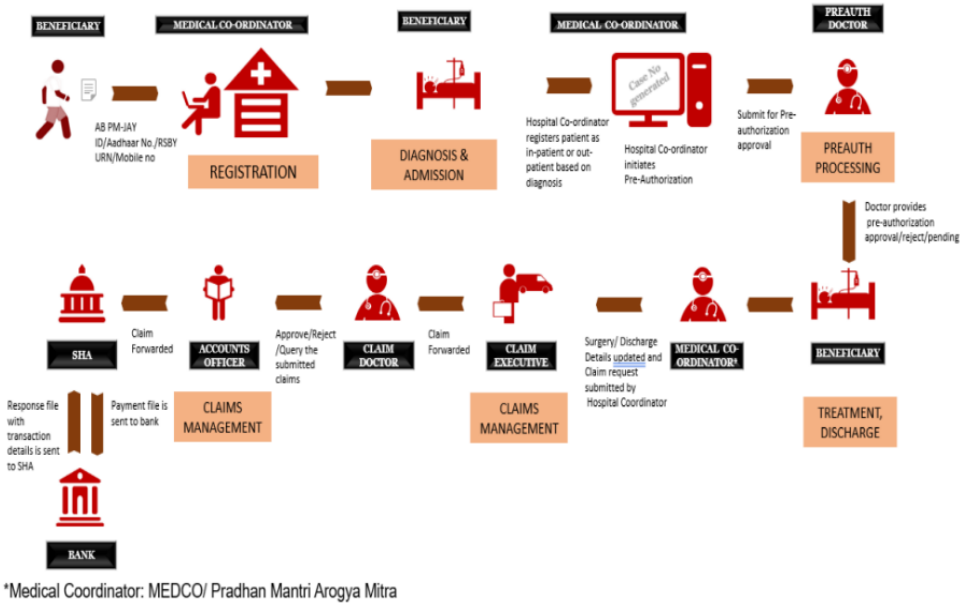

Figure 6 Star Health Claims Adjudication Process for Ayushman Bharath

Source: https://talesofss.com/health-claims-exchange-hcx-interoperability-in-health-insurance/

The current claims process in figure 6 is predominantly manual, with only 56% of claims being processed as cashless. This manual approach was advantageous in terms of time and cost efficiency. However, making cashless claims mandatory and a target resolution time of 3 hours will significantly increase the pressure on the claims process.

The current system can only handle this change if it includes InsurTech solutions. Additionally, according to the 2022-23 IRDAI report, almost 25% of claimed amounts are repudiated and disallowed, leáding to increased out-of-pocket expenses for insured members. The majority of these rejections occurred in reimbursement claims.

Mode of Claim	TPA		In-House		Total	
Settlement	No.	Amount	No.	Amount	No.	Amount
	(lakhs)	(₹crore)	(lakhs)	(₹crore)	(lakhs)	(₹crore)
Only Cashless	103.37	29,192.22	28.03	15,936.60	131.40	45,128.82
	(58.77)	(64.87)	(46.84)	(61.47)	(55.74)	(63.62)
Only Reimbursement	69.03	15,603.52	29.28	9,049.71	98.31	24,653.23
	(39.24)	(34.67)	(48.93)	(34.90)	(41.70)	(34.76)
Both Cashless and Reimbursement	2.92	148.66	0.96	557.49	3.88	706.15
	(1.66)	(0.33)	(1.60)	(2.15)	(1.64)	(1.00)
Benefit Based	0.59	57.66	1.58	383.97	2.17	441.63
	(0.33)	(0.13)	(2.63)	(1.48)	(0.92)	(0.62)
Total	**175.90**	**45,002.05**	**59.85**	**25,927.77**	**235.75**	**70,929.82**
	(100)	**(100)**	**(100)**	**(100)**	**(100)**	**(100)**

Note: Figures in bracket are per cent to total.

Figure 7 Claims Paid under Health Insurance Business of General and Health Insurers(2022-23)

Source IRDAI Annual Report 2022-23

The above figure 7 is from IRDAI Annual Report 2022-23, highlighting Cashless is only 56% while remaining 44% involves Reimbursement.

Claims outstanding at the beginning of the period		New claims registered during the period		Total Claims		Claims paid during the period		Claims disallowed as per terms and conditions of policy contract		Claims repudiated during the period		Claims outstanding at the end of the year	
No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount
20.06	5,978.44	255.18	93,060.46	275.24	99,038.92	235.75	70,929.82	0.00	12,754.95	21.65	9,107.68	17.84	6,246.88
				(100)	**(100)**	**(85.66)**	**(71.62)**	**(0)**	**(12.88)**	**(7.87)**	**(9.20)**	**(6.48)**	**(6.31)**

Note: Figures in brackets are percentage to total

Figure 8 Status of Claims under Heath Insurance Business of General and Health Insurers (2022-23)

Source: IRDAI Annual Report 2022-23.

The above figure 8 shows IRDAI Annual Report 2022-23, highlighting only ~75% of the Claim Amount was paid while ~25% of the Claimed amount was repudiated or disallowed.

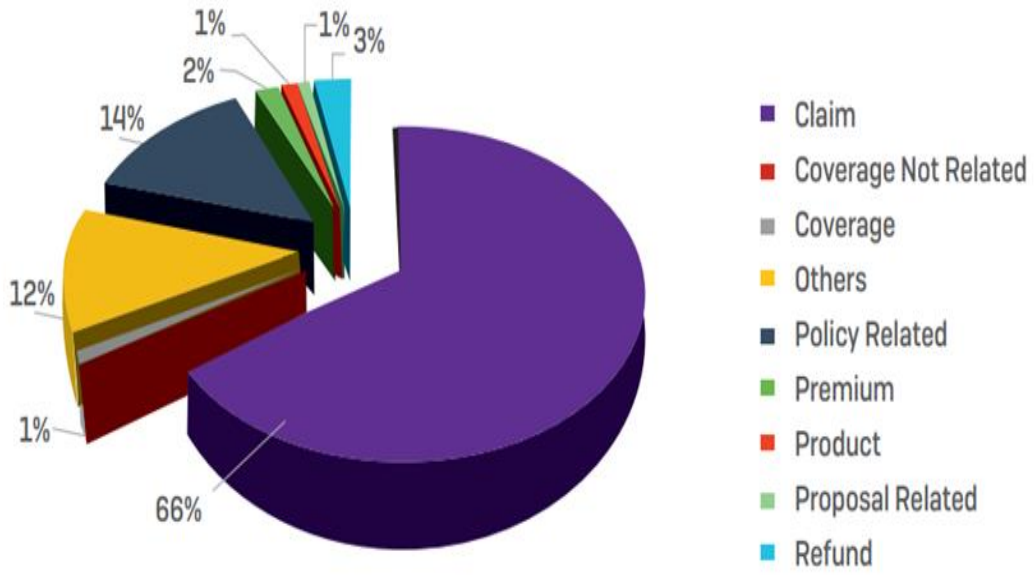

Figure 9 Classification of General Insurance Complaints

Source: IRDAI Annual Report 2022-23

The above pie chart of figure 9 is from IRDAI Annual Report 2022-23, highlighting Claim related grievance contributing to 66% of the overall grievances in general insurance (Health Insurance is considered part of General Insurance).

3.5 Factors in Insurance Awareness and Policy Exclusions Impacting OOPE

This section of the dissertation delves into the intricate relationship between health insurance complexity, policy features, and their impact on out-of-pocket healthcare expenses (OOPE). Understanding the complexities of heálth insuránce plans and the lack of awareness about specific policy features is crucial, as it directly contributes to increased out-of-pocket healthcare expenses for policyholders.

The methodological approach outlined in this dissertation involves primary data collection through surveys and a detailed analysis of factors influencing OOPE. The dissertation aims to shed light on the following key areas:

1. Health Insurance Awareness and Complexity: The complex terms and conditions commonly found in health insurance plans can confuse the average policyholder. Terms such as "room sub-limit," "deductible," "pre-existing disease," and "non-consumables" can lead to unexpected out-of-pocket expenses due to a lack of understanding among policyholders.

2. Significant Policy Features Influencing OOPE: The dissertation investigates how specific policy features such as coverage limitations for certain treatments, exclusions for consumables and non-medical expenses, outpatient department (OPD) and diagnostics exclusions, room sub-limits, and co-pay requirements influence out-of-pocket healthcare expenses.

3. Survey Methodology: The dissertation utilizes a structured survey to gauge policyholders' awareness of their health insurance plans and the specific features that

significantly impact out-of-pocket expenses. The survey encompasses questions aimed at understanding respondents' understanding of heálth insuránce coveráge, awareness of factors influencing out-of-pocket expenses, ánd ranking various factors by their impact on OOPE.

4. Analysis of Awareness and OOPE: The dissertation analyzes respondents' awareness levels of insurance plan details in conjunction with their actual OOPE over the past year. This analysis aims to identify correlations between the level of awareness of insurance plan details and the magnitude of OOPE, providing insights into how enhanced understanding could mitigate these costs.

5. Integration and Interpretation of Findings: The data collected from the surveys will be meticulously analyzed to discern patterns and relationships between insurance awareness and OOPE. This analysis will provide valuable insights into the critical areas where policyholders are most affected by their lack of understanding of insurance details. It will guide future interventions to improve insurance literacy and restructure policy features to be more transparent and user-friendly.

Overall, this methodological framework is designed to systematically investigáte the influence of health insuránce awareness on out-of-pocket healthcare expenses, providing valuable insights into how policy exclusions and the complexity of insurance terms affect healthcare affordability.

Following are some of the key features in an Insurance plan which if not aware has a huge impact on the Out-Of-Pocket Expenses in healthcare costs:

Coverage for Specific treatment / Condition (Policy Exclusion) - Many policies have specific policy exclusion like disease wise sub limit or coverage of certain treatments post specific number of years, etc. For example Cataract is a specific treatment which usually is covered only after 2 to 3 Years of policy continuation. Similarly there

are specific procedures like Immunotherapy in Cancer treatment which sometimes comes with a sublimit of 1L INR so only up to the sub-limit will be covered and anything above must be out of pocket.

Consumables & Non Medical Expense : Many plans do not cover any consumables like gloves, masks, sheets etc used by the hospitals during the course of treatment and these can be up to 20% of the overall bill.

Outpatient Department (OPD) & Diagnostics: Many of the insurance plans do not cover any OPD visits and the diagnostic tests that's taken.

Room Sub Limit: Sometimes if an Insurance plan has a room sublimit then any cost above the sub-limit will be applied to the overall bill proportionately. For example, if a plan has 1% sub-limit on the covered amount then for a 5 Lakhs INR cover amount we can take any rooms with a rent less than 5000 INR. If we end up taking a room with 6000 INR then its not just 1000 INR that will be out of pocket but 20% (1000 INR on 5000 INR) will be applied proportionately across all billed expenses associated with the room like food charge, doctor visit charge etc.

Copay: Co Pay is a feature in some of the health plans where a defined % of the bill amount has to be settled out of pocket by the member.

In the survey the following questions in Section 2 was used to capture the health insurance plan awareness of the respondents:

1) On a scale of 1-10, how well do you understand your health insurance plan's coverage and out-of-pocket costs?

2) Are you aware of the specific factors that can influence your out-of-pocket expenses in your health insurance plan? (Yes or No)

3) In your opinion, which of the following factors have the most significant impact on out-of-pocket expenses in health insurance in India? (Rank from 1 to 5, with 1 being the most significant)

a) Consumables & Non Medical Expense

b) Co-payment/Co-insurance requirements

c) Cashless Network restrictions (in-network vs. out-of-network providers)

d) Coverage for specific treatments/conditions

e) Government regulations and policies

The above questions is analyzed with the following Out of pocket expense related questions to understand the relationship across Awareness & OOPE:

1) How would you describe your out-of-pocket expenses for healthcáre services in the past year?

a) Low - <1% of your annual income

b) Moderate - 1% - 5% of your annual income

c) High - 5% 10% of your annual income

d) Very high - >10% of your annual income

2) What types of healthcare services have contributed the most to your out-of-pocket expenses? (Select all that apply)

a) Doctor consultations

b) Specialist consultations

c) Prescription medications

d) Hospital stays

e) Diágnostic tests (e.g., X-ráys, blood tests)

f) Surgical procedures

g) Other

3.6 Impact of Underinsurance on OOPE: Suboptimal Coverage and Sum Insured

Methodology: Primary Data Collection analysis through Survey

Underinsurance is the lack of enough protection provided by one's health insurance policy. There are two ways of being underinsured:

Not enough coverage: In this case, the insurance plan either does not provide enough coverage or does not provide coverage against specific ailments or treatments. These could be treatments like immunotherapy for cancer, robotic surgeries, etc. Even in the Survey, coverage for specific treatments/disease was ranked as the top reason for Pocket expenses by the respondents (highlighted in the graph below).

Underinsurance is the lack of enough protection provided by one's health insurance policy. There are two ways of being underinsured:

Not enough sum insured: In this case, the covered sum insured amount is low, either due to the incorrect estimation of future health insurance needs or just to lower the premium. The biggest problem with a low sum insured is that the medical inflation in India is close to 14% and this is going to increase the requirement for a higher sum insured.

In the survey, I have captured the reason for Out of Pocket expense and the current Out of pocket expenses basis their annual income with the below questions. This will help understand whether there is any pattern identified on coverage & the sum insured from an underinsurance perspective leading to Out of pocket expenses.

How would you describe your out-of-pocket expenses for healthcare services in the past year? (Select one) -

a) Low - <1% of your annual income
b) Moderate - 1% - 5% of your annual income

c) High - 5% -10% of your annual income

d) Very high - >10% of your annual income

In your opinion, which of the following factors have the most significant impact on out-of-pocket expenses in health insurance in India? (Rank from 1 to 5, with 1 being the most significant)

a) Deductible amount

b) Co-payment/Co-insurance requirements

c) Cashless Network restrictions (in-network vs. out-of-network providers)

d) Coverage for specific treatments/conditions

e) Government regulations and policies.

3.7 Population and Sample

In the above research, surveys, experiments, and case studies will address the proposed research questions. The study will first pinpoint the factors contributing to high out-of-pocket expenses, such as low penetration, high claim rejection, high policy exclusion, and inadequate coverage for insured individuals. The data collection process will involve conducting surveys targeted at various Indian demographics and age groups to gain insights into these critical factors. Subsequently, statistical experiments will be used to analyze and interpret the collected data.

In the second phase of the study, the focus will be on exploring specific InsurTech solutions, which hold the potential to significantly mitigate the identified factors. This will be achieved through an in-depth examination of case studies, showcasing the effective implementation of technology-driven solutions by leading insurance companies. The outcomes of this phase could potentially revolutionize the healthcare insurance landscape in India, offering a ray of hope for improved healthcare affordability and accessibility.

Regarding the population and study sample, the research will target individuals in the age group of 22 years to 80 years across the central regions of India, including North, South, East, and West. This demographic represents a substantial portion of the Indian population, estimated at close to 700 million individuals based on a report by the "Ministry of Statistics and Programme Implementation (MoSPI)". It is important to note that this age group is particularly significant as it aligns with the age range typically considered by insurance companies for purchasing health policies.

3.8 Participant Selection

A pilot sample of 10 participants will be selected from each of the four regions, resulting in a total sample size of 40-50 participants for the survey. Based on the findings from this initial study, decisions will be made on whether to modify the survey or to proceed with it as planned. As per Yamane (1967), for a population of 700 million, a sample size ranging between 125 and 400 participants (at a 90% to 95% confidence level) is recommended.

3.8.1 Structure of the Themes of the Survey Questions

The main sections of the survey included:

Demographic Information: This section, which is of utmost importance, gathered primary demographic data such as age, gender, income level, educational background, and geographical location. These variables were crucial for segmenting the responses and analyzing trends across different population groups.

Health Insurance Coverage Details: Participants were asked about the type of health insurance coverage they had, including whether they were covered by employer-provided plans, private insurance, government schemes, or a combination of these. This section also explored the duration of coverage and the reasons behind choosing specific plans.

Awareness and Understanding of Policy Features: This section assessed how well participants understood their health insurance policies, focusing on key elements such as deductibles, co-pays, exclusions, and sub-limits. Understanding these factors was crucial in identifying gaps in policyholder knowledge that could lead to higher OOPE.

Experience with Out-of-Pocket Expenses: Participants reported their OOPE over the past year, categorized by healthcare services such as hospital stays, diagnostic tests, outpatient visits, and prescriptions. This section was designed to capture the financial impact of healthcare on households.

Impact Factors Ranking: This final section, which is of significant importance, asked participants to rank various factors based on their perceived impact on OOPE, such as policy exclusions, room sub-limits, consumables, outpatient and diagnostics coverage, and co-payments. This helped identify the most significant issues from the perspective of policyholders.

3.9 Instrumentation

The primary instrument used for collecting data in this research is a structured survey questionnaire. This tool is designed to gather detailed information on health insurance coverage, policyholder awareness, and the resultant out-of-pocket expenses associated with healthcare services. The survey's structure is meticulously developed to address the diverse elements of the research objectives, ensuring comprehensive coverage of topics relevant to understanding the dynamics between health insurance literacy and financial outcomes in healthcare. Your participation in this survey could potentially contribute to shaping the future of the healthcare and insurance industry.

3.9.1 Components of the Survey Instrument

- Demographic Information Section:

This part of the survey collects primary demographic data. It helps segment the responses based on demographic variables to analyze trends and differences across various population groups.

- Health Insurance Coverage Details:

This section focuses on the type of health insurance coverage respondents have, including whether they are covered by employer-provided plans, private insurance, government schemes, or any combination of these. It also probes the duration of coverage and the reasons for choosing specific plans.

Awareness and Understanding of Policy Features:

This segment contains questions to assess the respondents' understanding of their health insurance plan's terms and conditions. It includes queries about their knowledge of deductibles, co-pays, exclusions, sub-limits, and other relevant jargon that can impact their financial responsibilities during healthcare treatments.

- Experience with Out-of-Pocket Expenses:

Participants are asked to report their out-of-pocket expenses over the past year, categorized by healthcare services such as hospital stays, diagnostic tests, outpatient visits, and prescriptions. This section aims to capture the actual financial impact of health insurance coverage or the lack thereof.

- Impact Factors Ranking:

Respondents are asked to rank various factors regarding their perceived impact on out-of-pocket expenses. These factors include policy exclusions, room sub-limits, consumables, OPD and diagnostics coverage, and co-payments. This helps identify which aspects of health insurance are most problematic from the policyholders' perspective.

Responses are collected in a centralized database with robust data integrity and security measures. The data is then cleaned and coded for statistical analysis. Advanced

statistical tools are used to analyze the data, focusing on descriptive statistics, cross-tabulations, and inferential statistics to draw meaningful conclusions about the relationship between health insurance literacy and out-of-pocket healthcare expenses.

This survey instrument provides the necessary data to fulfil the research objectives. It offers a detailed examination of how well individuals understand their health insurance policies and how this understanding—or the lack thereof—affects their financial exposure in healthcare situations.

3.10 Data Collection Procedures

In research, surveys are leveraged for data collection as they efficiently allow large amounts of data to be gathered. By using structured questionnaires and closed-ended questions, I can perform quantitative analysis. My research focuses on examining the Out-Of-Pocket Expenses across India, and conducting a survey is an effective way to reach target users across all regions of the country. Surveys are ideal for both descriptive research, which aims to portray a population or a phenomenon, and explanatory research, which seeks to uncover relationships and understand causal factors. In my study, I aim to explore the connections between Insurance penetration, Claim rejection, policy exclusion, and underinsurance with Out-Of-Pocket Expense through hypothesis testing using the data collected from this survey.

3.11 Data Analysis

This survey was randomly distributed among participants from the four regions of the Indian state (Nort et al.). A statistical experiment confirming the reliability of the study will be tested through hypothesis testing.

The survey data, which will not contain any PHI or PII, will be stored on a Google or third-party application server where the survey will be hosted.

After data collection, data validation will be performed using statistical tools to ensure consistency. A post-data validation experiment will be performed using Statistical Hypothesis testing based on the type of data collected (Continuous or Discrete).

3.12 Research Design Limitations

The emergence of InsurTech in the Indian health insurance sector is a relatively recent development, and there has been limited research on the Impact of InsurTech on Indian Healthcare. As a result, there needs to be more substantial literature on InsurTech in this context. However, the study's strength lies in its novelty and potential to significantly impact the healthcare industry. Out-of-pocket expenses pose a significant challenge for individual families, affecting their finances and ability to access high-quality healthcare for health insurance companies; achieving scale and growth hinges on minimising these Out-Of-Pocket Expenses.

3.13 Conclusion

The research methodology used in this study was highly comprehensive. It provided a robust framework for investigating the complex relationship between heálth insuránce dynámics ánd OOPE in Indiá. By combining secondary data analysis and primary data collection through surveys, the study effectively examined various aspects of health insurance, such as penetration rates, claims processing efficiency, policyholder awareness, and the impacts of underinsurance.

Secondary data sources like IRDAI reports, World Bank data, and the National Family Health Survey (NFHS) allowed for a detailed historical analysis of trends and patterns in health insurance coverage and OOPE. This approach provided a solid empirical foundation and offered a broad view of the healthcare insurance landscape over several years. Additionally, the primary data collected through carefully designed surveys

provided fresh, firsthand insights into individual experiences, perceptions, and the direct impacts of health insurance policies on people's financial expenditures on healthcare.

Each objective within the study employed a tailored analytical approach suited to the specific aspect of health insurance being investigated. For instance, the analysis of health insurance penetration used Chi-Squáre tests to státistically confirm the relátionship between higher insurance coverage and lower OOPE, emphasizing the critical need for broader insurance coverage. Similarly, regression analysis highlighted the inefficiencies in reimbursement claims processing, emphasizing the potential benefits of transitioning towards more cashless claim systems.

The methodologies adopted were crucial in identifying significant gaps in policyholder awareness regarding insurance details, which correlated with unexpected OOPE. This finding suggested a pressing need for insurance providers to enhance communication and implement educational initiatives to inform policyholders about their insurance plans.

However, while comprehensive, the methodology could be further enhanced by expanding the survey sample size to ensure the findings are more representative. Incorporating longitudinal studies would provide insights into the temporal dynamics of insurance coverage and its impact on OOPE, offering a clearer picture of the effects of policy changes over time. Additionally, utilizing more advanced statistical and machine learning tools could further refine the analysis, uncovering more profound insights and facilitating a more nuanced understanding of the complex interactions within health insurance systems.

In conclusion, the methodology chapter in this study outlines a well-structured approach that not only aligns with the research objectives but also robustly supports the conclusions drawn. It provides a solid foundation for actionable insights that stakeholders

across the healthcare and insurance sectors can use to formulate strategies to reduce OOPE and enhance the effectiveness and reach of health insurance in India. This methodological rigour ensures that the study's recommendations are credible and applicable in real-world settings, aiming to foster a more equitable and efficient healthcare system.

CHAPTER IV:

RESULTS

4.1 Analysis of Investigating Drivers of High OOPE Due to Low Insurance Penetration

The relationship between health insurance penetration and out-of-pocket expenditure (OOPE) is significant. Higher health insurance penetration is associated with lower OOPE. However, despite a steady decrease in OOPE from 65% in 2010 to 49.82% in 2021, it remains relatively high. This can be attributed to the substantial portion of the population that lacks health insurance, known as the "missing middle," as identified in the Niti Aayog report.

The missing middle, comprising approximately 30% of the population, neither qualifies for government-sponsored schemes like Ayushman Bharat nor can afford private insurance. Addressing the needs of this demographic is crucial in reducing overall OOPE. Improving health insurance penetration hinges on two critical factors: the inclusion of more individuals and the expansion of coverage under government-sponsored plans, such as Ayushman Bharat or state government schemes. The recent initiatives to include individuals over 70 in Ayushman Bharat and to increase the coverage limit from 5 lakh INR to 10 lakh INR are expected to be significant steps in this direction.

Raising awareness about health insurance among middle and higher-income families without government-sponsored health plans is a vital step. These families collectively form the missing middle, contributing to the 30% of Indians without health insurance. Government and regulatory interventions akin to mandatory vehicle insurance could be a positive reinforcement to prompt these families to invest in health insurance.

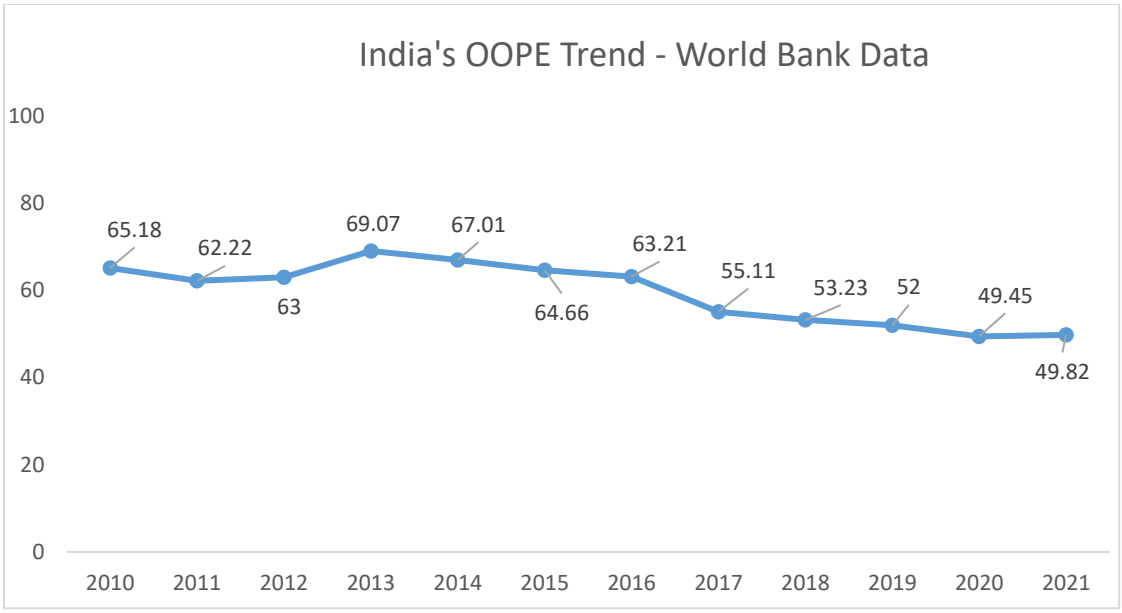

Figure 10 India's OOPE Trend - World Bank Data

Source: https://www.statista.com/statistics/1080141/india-out-of-pocket-expenditure-share-in-total-healthcare-expenditure/

The figure 10 represents the trend of Out-of-Pocket Expenditures (OOPE) as a percentage of total health expenditures in India from 2010 to 2021, based on data from the World Bank. Here's a breakdown of what the chart illustrates:

General Trend: The graph shows a general decline in the percentage of health expenditures that are out-of-pocket over the 11-year period. Starting at 65.18% in 2010, the OOPE percentage decreases to 49.82% by 2021. This suggests a significant reduction in the financial burden borne directly by individuals over time, relative to total health spending.

Initial Fluctuations: Between 2010 and 2014, the OOPE percentage fluctuated, peaking at 69.07% in 2012 before beginning a more consistent downward trend. These fluctuations could be reflective of various policy implementations or economic conditions impacting healthcare spending and insurance coverage during those years.

Steady Decline Post-2014: From 2014 onwards, there is a more steady and pronounced decline in the OOPE percentage. By 2021, the OOPE has decreased by approximately 15 percentage points from its 2010 value. This steady decline could be indicative of improved healthcare policies, increased health insurance coverage, or other systemic changes enhancing financial protection against healthcare costs for individuals.

Significance: A decreasing trend in OOPE is typically a positive indicator, suggesting that fewer direct payments are being made by individuals for health services, potentially due to better coverage of healthcare costs by insurance policies or government health schemes. This can alleviate financial pressure on families, especially in cases of acute or chronic health issues.

Overall, this data suggests progressive improvement in the financial protection against healthcare costs in India, aligning with policy goals to reduce the economic impact of health expenses on the population.

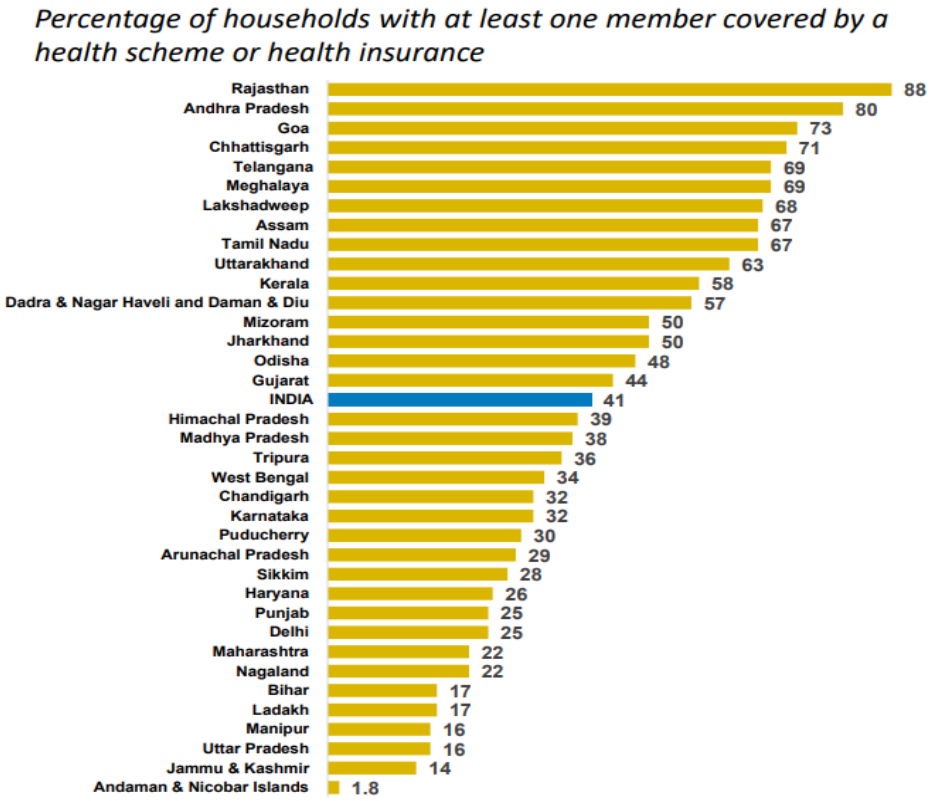

Figure 11 The percentage of households in various states and union territories of India Source – NFHS Survey (2019-2021)

The figure 11 illustrates the percentage of households in various states and union territories of India that have at least one member covered by a health insurance scheme or health insurance. The data is likely sourced from a survey or official statistics to show the disparities in health insurance coverage across the country.

The chart indicates following detail:

- High Coverage States:

Rajasthan leads with the highest percentage at 88% of households having at least one member covered by health insurance or a health scheme.

Andhra Pradesh follows with 80%, and Goa with 73%, indicating robust health insurance coverage.

- Moderate Coverage States:

States like Telangana, Meghalaya, and Lakshadweep have coverage rates ranging from 67% to 69%.

Other significant states like Tamil Nadu and Kerala show a coverage of 67% and 58%, respectively.

- Low Coverage States:

The national average for India is 44%, indicating that many states fall below this average.

States like West Bengal, Punjab, and Delhi show particularly low coverage rates at 34%, 25%, and 25% respectively.

Maharashtra and Bihar are even lower, with coverage rates of 22% and 17%.

- Very Low Coverage:

The lowest coverage is observed in Uttar Pradesh (16%), Jammu & Kashmir (14%), and Andaman & Nicobar Islands at an extremely low rate of 1.8%.

- Implications:

The variation in health insurance coverage across states can be attributed to differences in state health policies, economic conditions, awareness levels, and the availability of health insurance schemes.

States with high coverage rates likely have more robust health policies or better implementation of national health insurance schemes.

The exceptionally low coverage in places like the Andaman & Nicobar Islands might be due to logistical challenges, lack of awareness, or limited availability of insurance providers.

This chart is crucial for understanding regional disparities in health insurance coverage across India. It highlights the need for targeted policy interventions to improve

health insurance penetration, especially in states with low coverage, ensuring that more households have financial protection against health-related expenses.

4.1.1 Role of Regulatory Body in Improving Health Insurance Penetration

In the fiscal year 2022-23, IRDAI has launched the State Insurance Plan (SIP) to achieve "Insurance for All by 2047". The plan "aims to implement various strategies and activities to increase insurance penetration across different parts of the country in close collaboration with the state government. The State Insurance Plan is a joint effort involving the insurance industry to deepen insurance penetration. Each state has been assigned to various insurers that have been designated as the lead insurer. These insurers are expected to establish State Level Insurers' Committees (SLIC) and District Level Insurers' Committees (DLIC) in coordination with the state administration and other insurers. State-specific strategies will be developed for each state, addressing areas or sectors that insurers have not covered or where significant "insurance coverage gaps" exist. The State Insurance Plan will prioritize inclusive insurance to address protection gaps across all sections and sectors of society." It aims to enhance resilience against natural disasters and catastrophes and provide a social safety net for the underserved population in the states. The focus is on increasing awareness and access to insurance coverage nationwide. This policy change can potentially improve India's overall health insurance penetration, which currently stands at 60%-70% as per the Niti Aayog Report.

4.1.2 Analysis of the Survey

Key Questions Captured from the Survey to analyze the relationship between Health Insurance Penetration and out-of-pocket expenses are:

Is Health Insurance Available (Health Insurance Penetration) - Yes or No

How would you describe your out-of-pocket expenses for healthcare services in the past year?

1) Low - <1% of your annual income
2) Moderate - 1% - 5% of your annual income
3) High - 5% 10% of your annual income
4) Very high - >10% of your annual income

Annual Household Income in Lakhs INR (To check if Penetration is driven by income)

a) < 3L
b) 3L - 10L
c) 10L - 25L
d) >25L

4.1.3 Hypothesis Testing - Health Insurance Penetration & Out-of-Pocket Expenses

The Chi-Square test was utilized because both factors, Health Insurance Penetration and OOPE, are discrete data types. The objective was to establish whether there was a correlation between the two factors. The null hypothesis stated that Health Insurance Penetration is independent of OOPE, while the alternative hypothesis proposed that Health Insurance Penetration is not independent of OOPE. The test resulted in a p-value of 0.032, indicating that, with 95% confidence, we can accept the alternative hypothesis, demonstrating a relationship between Heálth Insuránce Penetration and Out-Of-Pocket Expeds.

HYPOTHESIS 1 PENETRATION

Tabulated Statistics: Health Insurance Available, Current Out Of Pocket Expense

Rows: Health Insurance Available Columns: Current Out Of Pocket Expense

	High - 5% 10% of your annual i	Low - <1% of your annual income	Moderate - 1% - 5% of your annu	Very high - >10% of your annua	All
No	4	6	5	5	20
	2.763	5.395	9.868	1.974	
	0.5536	0.0679	2.4018	4.6404	
Yes	17	35	70	10	132
	18.237	35.605	65.132	13.026	
	0.0839	0.0103	0.3639	0.7031	
All	21	41	75	15	152

Cell Contents
Count
Expected count
Contribution to Chi-square

Chi-Square Test

	Chi-Square	DF	P-Value
Pearson	8.825	3	0.032
Likelihood Ratio	7.948	3	0.047

2 cell(s) with expected counts less than 5.

Figure 12 Analysis for Objective One

4.1.4 Hypothesis Testing on Health Insurance Penetration & Annual Household Income

For our analysis, we employed the chi-Square test, as in figure 12 a powerful tool for examining the relátionship between different discrete variábles. In this cáse, we sought to determine if there is a significánt association between Health Insuránce Penetrátion and Annual Household income.

Null Hypothesis (H0): Health Insurance Penetration is independent of Annual Household income.

Alternative Hypothesis (Ha): Health Insurance Penetration is not independent of Annual Household income

The below test result in figure 13 clearly indicates, with a pValue of 0.01, that with a 99% confidence level, we accept the Alternate Hypothesis that there is a relátionship between Health Insuránce availability and Annual Household income.

HYPOTHESIS 1 PENETRATION

Tabulated Statistics: Health Insurance Available, Annual Household Income

Rows: Health Insurance Available Columns: Annual Household Income

	< 3L	>25L	10L - 25L	3L - 10L	All
No	9	5	1	5	20
	3.158	7.895	5.000	3.947	
	10.8079	1.0614	3.2000	0.2807	
Yes	15	55	37	25	132
	20.842	52.105	33.000	26.053	
	1.6376	0.1608	0.4848	0.0425	
All	24	60	38	30	152

Cell Contents
Count
Expected count
Contribution to Chi-square

Chi-Square Test

	Chi-Square	DF	P-Value
Pearson	17.676	3	0.001
Likelihood Ratio	15.913	3	0.001

2 cell(s) with expected counts less than 5.

Figure 13 Health Insurance Available, Annual Household Income

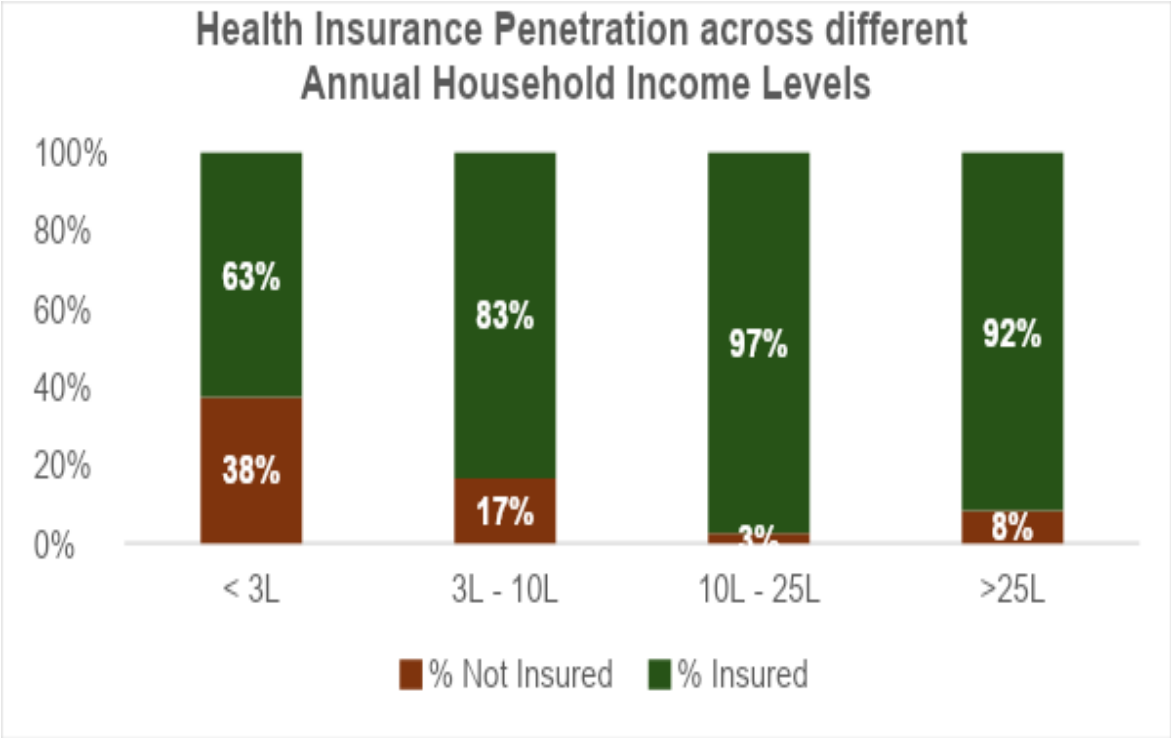

Figure 14 Health Insurance Penetration Across different Annual Household Income Levels

The figure 14 illustrates the health insurance penetration across different annual household income levels in India. It clearly shows how health insurance coverage varies significantly with income. Here's an interpretation and analysis of the data displayed:

- Income Levels and Insurance Coverage:

Less than 3 Lakhs (<3L): This income segment shows that 38% of households are not insured, while 63% have insurance. This suggests moderate coverage, though a significant portion remains vulnerable without health insurance.

3 Lakhs to 10 Lakhs (3L - 10L): Insurance coverage improves notably in this bracket, with 83% of households insured and only 17% not insured. Higher income likely enables better access to health insurance products.

10 Lakhs to 25 Lakhs (10L - 25L): This high-income group exhibits very high insurance coverage, with 97% insured and only 3% not insured. The financial capability to afford premiums could be a contributing factor to the high insurance uptake.

More than 25 Lakhs (>25L): Although this is the highest income category, the insurance penetration is slightly less than the previous group but still very high at 92% insured and 8% not insured. This slight decrease might reflect specific choices or the availability of other financial safety nets among the wealthiest.

- Trends and Implications:

The chart vividly depicts an increase in health insurance coverage as household income increases. This trend highlights the significant impact of economic status on access to health insurance.

Lower-income households face more significant challenges in securing health insurance, which can be attributed to the affordability of insurance premiums and possibly a lower level of awareness or prioritization of health insurance.

- Policy and Strategic Insights:

This data is crucial for policymakers and health insurance companies. It indicates a need for targeted strategies to increase health insurance coverage among lower-income families, possibly through subsidized plans or government-sponsored health schemes.

For insurance companies, there is an opportunity to design products that are accessible and attractive to lower and middle-income segments, potentially increasing overall penetration and reducing the financial vulnerability of these groups to health-related expenditures.

Overall, the data underscores the correlation between income and health insurance coverage in India, pointing towards economic barriers as a primary determinant of

whether households can afford health insurance. This insight can drive efforts to bridge the gap and extend health protection to underinsured segments of the population.

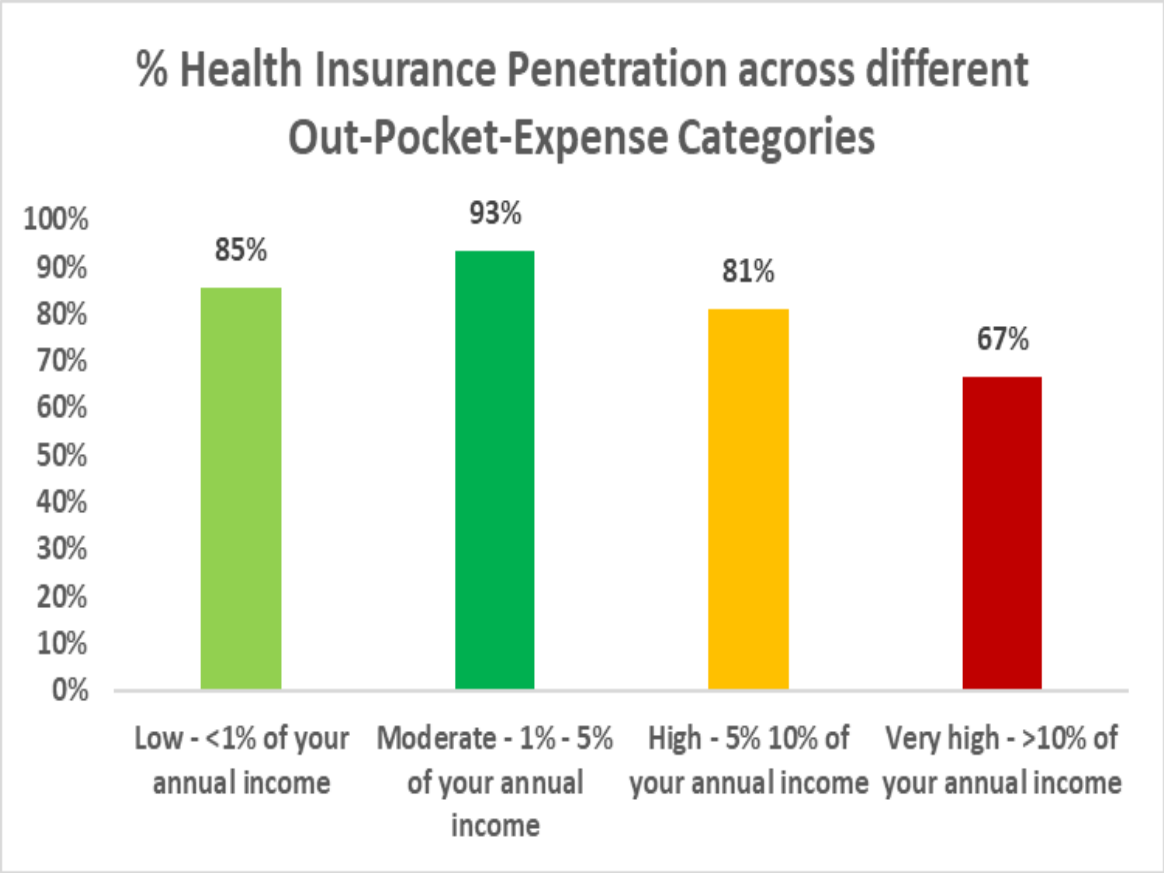

Figure 15 Health Insurance Penetration across different OOPE Categories

The Figure 15 chart highlights the direct correlation between Health Insurance Penetration and out-of-pocket Expenses. Health Insurance Penetration is lowest for families with the highest out-of-pocket expenses in healthcare.

Based on the survey, close to 50% of those without a health insurance plan cited "The Policy was too expensive" as the reason as in figure 16 below.

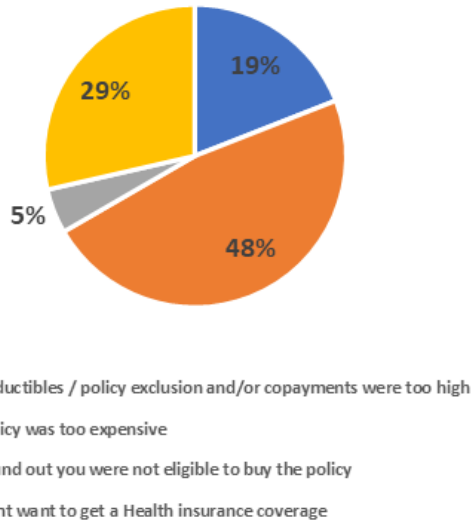

Figure 16 Reason for not buying health insurance plan

The Incurred Claim Ratio (ICR) is a crucial measure in the health insurance industry used to assess the reliability and trustworthiness of an insurance provider. It is calculated by comparing the total number of claims settled by an insurer in a given year to the total number of premiums collected, multiplying the result by 100. An ICR between 80% and 100% is generally considered reasonable, indicating a balance between the premiums collected and claims paid. A ratio below 70% may suggest conservative underwriting, while a ratio above 100% typically indicates a loss.

In the U S, a same metric known as the Medical Loss Ratio (MLR) usually falls between 83% and 88%. In India, private health insurers maintain an ICR between 65% and 80%, while public health insurers consistently exceed 105%. It is worth to note that in India, private insurers, making up about 60% of the market, tend to have a lower ICR, signalling a more cautious underwriting approach that could impact the overall health insurance market.

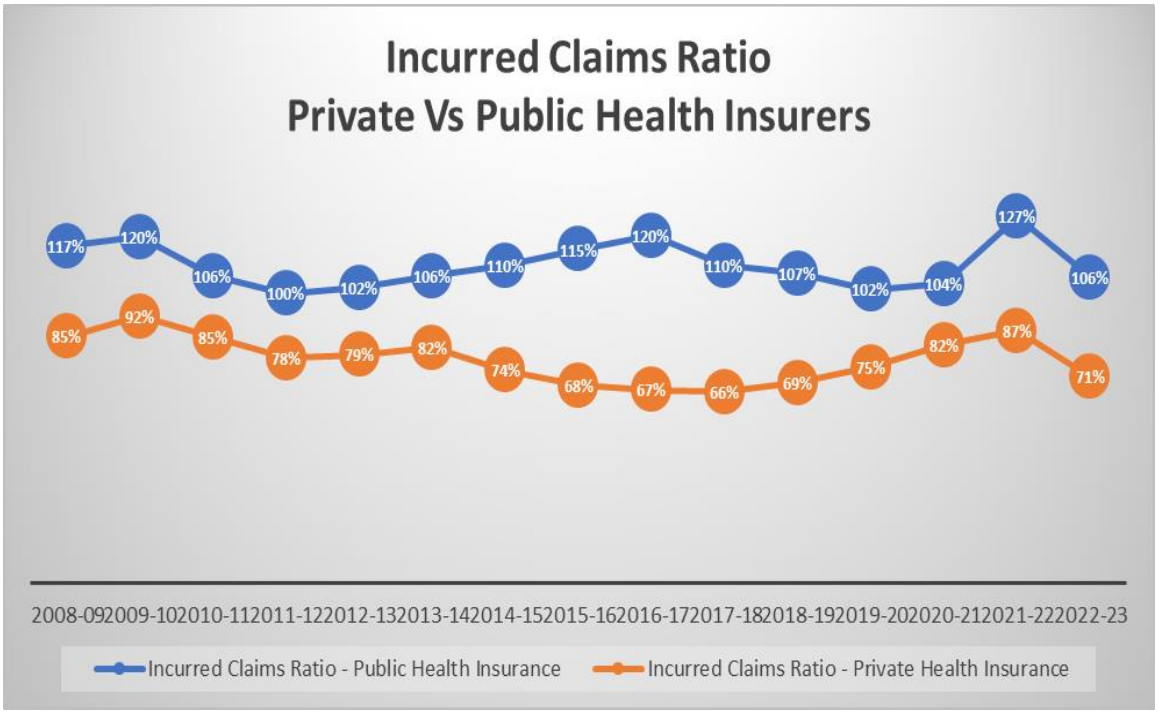

Figure 17 Incurred Claim Ratio for Private Vs. Public Health Insurers

Source: Critical Performance Analysis of The Health Insurance Sector In India During Covid-19 Outbreak 8 Asia Pacific Journal of Health Management 2022; 17(2):i1829. doi: 10.24083/apjhm.v17i2.1829

The chart in figure 17 provided compares the Incurred Claims Ratio (ICR) for public and private health insurers in India over a series of financial years from 2008-09 to 2022-23. Here's an analysis of the trends and implications based on the graph:

- Overview of Incurred Claims Ratio (ICR)

Incurred Claims Ratio is a financial metric used in the insurance industry to measure the proportion of claims paid out as benefits relative to the total premium earned during a period. An ICR of 100% means that the insurer is paying out in claims what it earns in premiums, above 100% indicates a loss on the insurance operations, and below 100% suggests a profit.

- Analysis of Trends

Public Health Insurers: The ICR for public health insurers generally fluctuates above 100%, indicating that these insurers often pay out more in claims than they collect in premiums. This trend might reflect a policy objective of public health insurers to provide extensive coverage and support to policyholders rather than to generate profit.

Notably, the ICR peaks significantly in certain years, such as 120% in 2009-10 and reaching as high as 127% in 2022-23. These spikes could be influenced by various factors, including increased claims due to public health crises or policy changes that expand coverage.

Private Health Insurers: The ICR for private insurers shows a more varied trend, often remaining below 100%, which suggests a focus on profitability. The values indicate that private insurers manage claims and premiums to ensure financial sustainability and profit.

The lowest values are observed around 2012-13 to 2014-15, dipping as low as 66%. This might indicate periods of stricter claims management or lower healthcare utilization rates among insured members.

There is a noticeable decline in the recent years, dropping to 71% in 2022-23, which might suggest an increase in premium collections outpacing claims or potentially tighter control on claim disbursements.

- Implications

Policyholder Impact: The higher ICR of public insurers might be more beneficial for policyholders in terms of likelihood and magnitude of claims coverage. In contrast, the generally lower ICR of private insurers might suggest more stringent claims scrutiny and possibly higher premium costs relative to benefits.

Financial Health of Insurers: Public insurers may face financial strains due to consistently high ICRs, potentially requiring government support or restructuring. Private insurers, managing their ICRs to often stay below 100%, might be in a better position financially, although this could impact their market competitiveness and public perception.

Regulatory and Market Dynamics: These trends are crucial for regulators and policymakers who aim to ensure a balanced health insurance market where public and private players can operate sustainably while providing adequate coverage. Regulators might need to intervene if public insurers consistently incur losses or if private insurers restrict coverage excessively.

This data is critical for understanding the operational dynamics of public versus private health insurers in India, revealing differing approaches to managing healthcare costs and their financial implications.

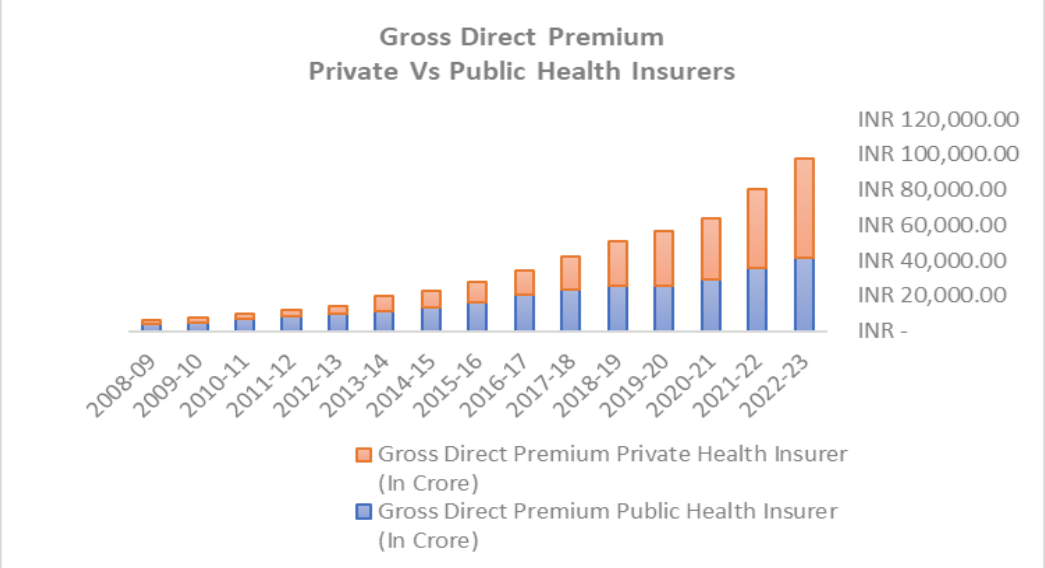

Figure 18 Gross Direct Premium Private Vs Public Health Insurers
Source: Critical Performance Analysis of The Health Insurance Sector In India During Covid-19 Outbreak 8 Asia Pacific Journal of Health Management 2022; 17(2):i1829. doi: 10.24083/apjhm.v17i2.1829

The above graph in figure 18 shows the development of the overall Heálth insuránce companies in the last 15 years in terms of the gross direct premium collected for their health plans. We also see the growth of private players have surpassed the public insurers.

4.1.6 InsurTech in Improving Health Insurance Penetration by Creating Affordable Health plans - Insight based Underwriting through Big Data & AI/ML

Insurtech is revolutionizing the health insurance industry by making affordable health plans more accessible, thus increasing health insurance coverage. This is achieved through innovative underwriting processes that leverage big data and artificial intelligence/machine learning to gain inputs into risk resolutions.

Medical underwriting evaluates the risk associated with an applicant to determine if the insurance company will insure them and, if so, at what price. Traditionally, underwriting has been a manual process heavily reliant on the underwriter's expertise. The applicant's risk factors determine the coverage price (Premium). Depending on the insurance company's policies and government regulations, high-risk candidates may face exclusions for certain conditions, denials of coverage, or be offered coverage at very high prices.

Effective underwriting is not just important, it is the backbone of an insurance company's ability to maintain a healthy loss ratio. It is a core aspect of the business and, combined with investment returns, is a key driver of financial performance. Poor underwriting decisions can result in high loss ratios, where the insurance company ends up paying out more in insurance claims than what it collects in premiums. This can also lead to uncompetitive pricing and impact overall sales, as policies become more expensive.

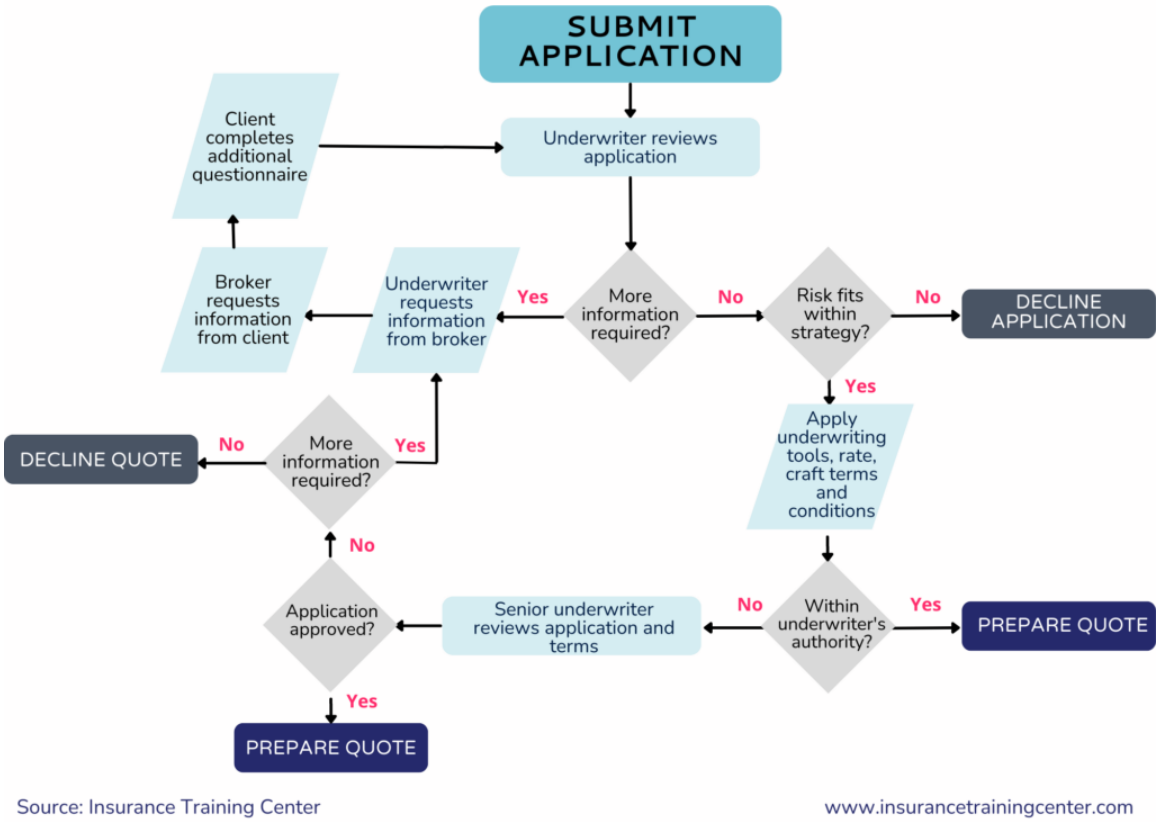

Figure 19 process of Underwriting is summarized
Source: www.insurancetrainingcenter.com

In figure 19 current process of Underwriting is summarized in the above figure which is based on a specific questionnaire filled by the policyholder during the purchase of the health insurance plan Anyone wanting to take a new health insurance needs to have both time and patience. Also these are generic questionnaires that are very subjective and not backed by real time data.

Insights based Underwriting: Leveraging Big Data & AI/ML based analytics to objectively evaluate the risk and price accordingly at a customer level instead of specific questionnaires. Collecting the latest medical test report from the customer, running a data model that can predict the health index of the person and basis that asking a limited set of questions. The policy pricing must be linked with this risk model so that its dynamic

pricing and not based on general guidelines specific to age bucket & pre existing illness. This enables insurers not only to make more accurate risk assessments but also, price policies more accurately & ultimately provide better coverage to policyholders.

The process for Insights Based Underwriting is designed to be both efficient and comprehensive ensuring both the insurer & the policy member stay benefited.

1. Data Collection and Digitization: Initially, all relevant medical data, including reports and examination records, will be asked to be uploaded into the system by the customer.

2. AI/ML -Driven Data Analysis: The digitized data is then analyzed by AI/ML algorithms. These algorithms will have to be trained to handle complex medical information and extract pertinent risk factors.

3. Risk Assessment and Report Generation: Machine learning models assess the risk based on extracted data and generate detailed underwriting reports.

4. Decision Support: The system will provide decision support to underwriters, highlighting key risk factors and recommendations, thus enabling informed and efficient decision-making. Now the role of underwriter becomes a decision maker and less of risk assessment.

This will help improve not only the penetration by making health insurance plans cheaper but also would increase the revenue & profitability for insurance companies.

4.2 Analysis on Investigating Claims Processing Inefficiency and Its Impact on OOPE

Our research conducted a comprehensive regression analysis using the IRDAI annual report data from the past nine years post ensuring the normality of the data. Since the IRDAI Annual report had health insurance claim level data only from 2014-15, we

were limited to use only 9 years of data in our analysis. We aimed to substantiate our hypothesis and establish whether there exists a correlation between reimbursement claims and the amounts of claims rejected or disallowed by insurance companies. The raw data in the table below has been extracted from the IRDAI Annual reports from 2014-15 to 2022-23. It is important to note that the annual reports should have included data on cashless claims before 2014-15 in below figure 20.

Year	# Cashless Claims (In Lakhs)	# Reimbursement Claims (In Lakhs)	% Cashless Claims	% Reimbursement Claims	Total Claim Amount (In Crore)	Claim Paid Amount (In Crore)	Claim Amount Disallowed / Repudiated (In Crore)	% Claim Amount Disallowed / Repudiated
2022-23	131.4	102.19	56.25%	43.75%	INR 99,038	INR 70,930	INR 21,863	22.07%
2021-22	129.81	88.71	59.40%	40.60%	INR 99,502	INR 69,498	INR 24,025	24.15%
2020-21	77.97	62.33	55.57%	44.43%	INR 62,988	INR 43,355	INR 14,525	23.06%
2019-20	112.47	86.47	56.53%	43.47%	INR 49,414	INR 40,026	INR 9,692	19.61%
2018-19	107.75	85.2	55.84%	44.16%	INR 46,201	INR 34,983	INR 10,475	22.67%
2017-18	85.77	85.26	50.15%	49.85%	INR 38,986	INR 30,244	INR 8,572	21.99%
2016-17	52.8	81.58	39.29%	60.71%	INR 36,384	INR 27,546	INR 10,399	28.58%
2015-16	55.56	42.25	56.80%	43.20%	INR 29,705	INR 21,759	INR 6,841	23.03%
2014-15	68.3	39.21	63.53%	36.47%	INR 26,264	INR 18,223	INR 5,040	19.19%

Figure 20 data on Health Insurance Claims for last 9 Years
Source: IRDAI Annual Reports 2014-15 to 2022-23

In his research article "A solution to minimum sample size for regressions," David G. Jenkins concluded that a minimum N = 8 is informative. So, I have used the above sample data of N = 9 (9 Years data) to understand the normality of the data and then statistically validate the hypothesis using Time Series Linear Regression.

Since the sample size is small with just 9 rows we were unable to perform unit root test for stationarity. According to Haldrup & Jannsen (2005), it is not much data to discipline time series estimation, and there will likely be lots of somewhat plausible specifications we will not be able to reject. Instead, by using the economic theory of more reimbursement claims leading to high claims rejection will justify the functional form that is demonstrated through the correlation test with a high degree of correlation (0.789) between Reimbursement Claims & Claim Rejection.

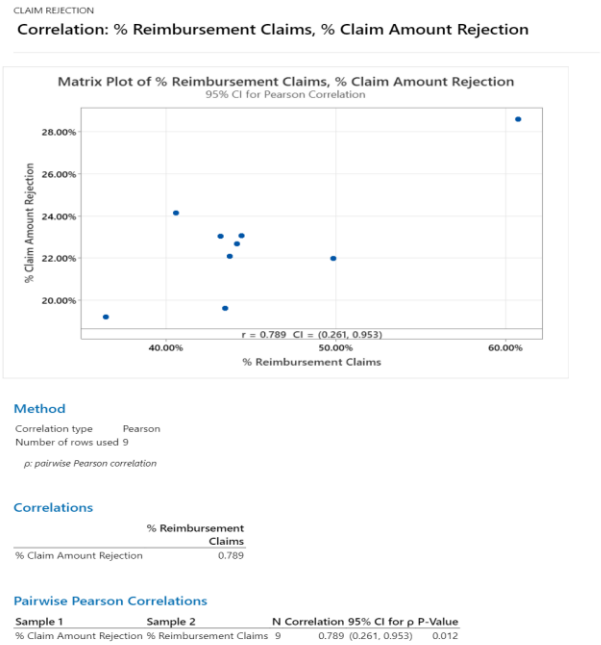

Figure 21a Correlation Test – Claim Rejection Vs Reimbursement Claims

The normality test for the Claim rejection data is performed with following hypothesis:

H0: Null Hypothesis: The data follows normal distribution

H1: Alternate Hypothesis: The data does not follow a normal distribution

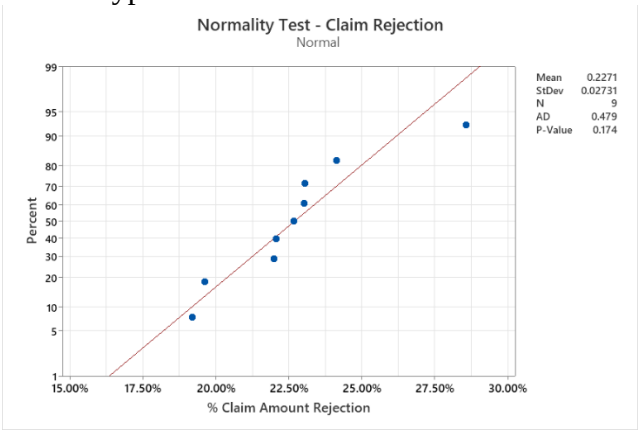

Figure 21b Normality Test on Claim Rejection Data

With p-Value of 0.174 (>0.05), we fail to reject the null hypothesis, suggesting that the data can be considered normally distributed.

Simple Linear Regression (Time Series) performed with the below hyothesis:

H0: Null Hypothesis: % Claim Amount Disallowed is not dependent on % Reimbursement Claims

H1: Alternate Hypothesis: % Claim Amount Disallowed is dependent on % Reimbursement Claims

CLAIM REJECTION

Regression Analysis: % Claim Amount Rejection versus % Reimbursement Claims

Regression Equation

% Claim Amount Rejection = 0.0841 + 0.3165 % Reimbursement Claims

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.0841	0.0426	1.97	0.089	
% Reimbursement Claims	0.3165	0.0933	3.39	0.012	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.0179514	62.19%	56.79%	21.62%

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	1	0.003710	0.003710	11.51	0.012
% Reimbursement Claims	1	0.003710	0.003710	11.51	0.012
Error	7	0.002256	0.000322		
Total	8	0.005966			

Durbin-Watson Statistic

Durbin-Watson Statistic = 2.29348

Figure 21c Time-Series Linear Regression Analysis of Claim Amount Rejection (Dependent Variable) Vs Reimbursement Claims (Independent Variable)

The regression model presented in the analysis demonstrates statistical significance, with a p-value of 0.012. This implies that the relationship between reimbursement claims and the disallowed/repudiated claim amount is not due to random chance but carries meaningful implications. We establish a strong positive correlation

between the two variables by rejecting the Null-hypothesis and accepting the alternate hypothesis. This suggests an increase in reimbursement claim submissions is associated with a higher likelihood of claim amount rejection by the insurance companies.

Multicollinearity Test: With a VIF (Variance Inflation Factor) score of 1 for the independent variable, the regression model indicates that there is no multicollinearity present within the variables.

Auto Correlation Test: The Durbin-Watson Statistic statistic score of 2.29348 which is close to the score of 2, clearly indicates that there is no autocorrelation in the data, meaning the data points are largely interdependent from each other.

4.2.1 Role of InsurTech & Policy Change in improving Claims Processing Efficiency

- IRDAI Policy Change on Cashless Claims

Insurance companies will be required to implement cashless settlement of health insurance claims starting August 1 this year, streamlining and expediting the process of settling hospital bills for policyholders. The IRDAI has mandated that insurers establish the necessary systems and procedures by July 31, 2024, at the latest. Additionally, the regulator has instructed insurers to set up dedicated Help Desks at hospitals in physical mode to handle and support cashless requests. Furthermore, insurers are also expected to provide policyholders with pre-authorization through digital means. The IRDAI has emphasized that every insurer should achieve 100% cashless claim settlement within a defined timeframe. It has urged insurers to minimize instances of claims being settled through reimbursement and limit this to exceptional circumstances. Implementing these policy changes, which will elevate the current 56% cashless claim rate to 100%, is projected to significantly impact out-of-pocket expenditure (OOPE) as validated by the regression model. While this new 100% Cashless Claims Policy is expected to

revolutionize the reduction of OOPE, a pertinent question arises: Do insurance companies possess the requisite Insurtech infrastructure to manage this transition effectively?

- Insurance Company's adoption towards the new policy change

Insurance companies used to take an average of 44% of manual processing in the past, and it used to take 15 to 30 days to process a reimbursement claim. There was no fixed timeline for processing cashless claims either. However, due to the new policy of 100% cashless claims, which must be processed within 3 hours, there is enormous pressure on the current manual claims processing. The Auto Claims Adjudication System (ACAS) has been introduced as an Insurtech product to address this challenge. ACAS is an automated claims processing system that evaluates and approves claims submitted by hospitals based on automated validation processes related to the member, plan, hospital, claim, procedure, diagnosis, and other factors. Only the claims that fail the automated validation by ACAS are moved to manual processing. ACAS handles 80% to 93% of all submitted claims in the US healthcare sector, with only 7% to 20% requiring manual processing. This Insurtech solution makes insurance companies more competitive and enhances the end-customer experience through faster and more effective claims processing. With the adoption of such advanced technology, insurance companies are well-prepared to meet the challenges of the new policy.

4.2.2 InsurTech - Auto Claims Adjudication System (ACAS)

Industry trends indicate that Insurance claims have been steadily increasing in volume over the years, and the trend is likely to continue. In such a scenario, Insurance companies with Claims Processing that still rely on a manual Claims Adjudication System will find themselves falling behind the competition & regulation on numerous fronts.

To stay ahead of the competition, the strategy Health Insurance Companies will need to adopt as their go-to-market strategy, will rest on the following three initiatives;

1) Increasing claims approval / processing speed in line to the latest Irdai regulatory compliance of <3 Hours resolution with 100% cashless
2) Improving the First Pass Resolution rate leading to an enhanced member experience
3) Improving Payment Integrity by reducing Fraud, Waste & Abuse, at the pre-adjudication stage

The traditional approach of relying primarily on human intervention into the process also increases chances of potential errors and incomplete or inaccurate data holding up unresolved claims in the system for long periods of time. This increases the likelihood of adding multiple touch-points to process a claim, not to mention handling increasingly complicated and time-consuming Grievances process.

All this additional effort, rework and higher turnaround time to process claims translates into increased processing cost per claim, a reduced bottom-line and seriously undermines member experience in a highly competitive market.

The need of the hour, therefore, is to improve the first pass data accuracy and use of an “intelligent and perceptive adjudication methodology” in claims processing, that can intuitively handle the task without the need for human intervention. One of the more cost-effective ways to sidestep these potential hazards is by leveraging InsurTech in the Claims Workflow starting with an Auto Adjudication Claims System (ACAS). Not only will this simplify processes, but there is huge impact on cost to serve a claim, regulatory compliance & customer satisfaction.

- ACAS – Auto Claims Adjudication System:

When a medical claim is filed, it is sent to the insurance company for approval. The process of establishing whether a claim will be paid or denied is called adjudication. When you bring claims automation in the picture, you minimize the review process significantly. What this means is that claims are reviewed and approved more quickly by the system without relying on human intervention to do the job. A Healthcare Claims Adjudication Software is an InsurTech asset that can enter, review, calculate, and process the medical claims with zero to minimal human interference by defining certain rules and parameters to configure how the system processes the claims. All the Insurance company needs to do is clearly define the rules and parameters on the basis of which, the system will process the claims. This results in faster Medical Claims Processing, more accurate adjudications, and consequently less manual work.

- Understanding Auto-Adjudication

A typical claims adjudication software is designed to streamline the claims process and to deliver results faster, more accurately and with minimal human intervention. The components of the Claims Adjudication software include:

1) Rules-based engine: This enables automation of all workflows for Claims Adjudication, auto-adjudication, enrollments, eligibilities, benefits administration, premium billing, etc.
2) Flexible API integration: With this component, Insurance Companies can connect all enterprise-wide systems and achieve complete interoperability between them.
3) Agile technology: This is built on service-oriented architecture and aids in delivering scalable, enhanced transaction processing.
4) Automated batch re-adjudication capabilities: This helps streamline workflows for claim reprocessing projects.

How does Auto-Adjudication really work?

1) Increased Security: the adjudication program can flag invalid claims and help minimize the rate of fraud.
2) Format neutral: Claims in different formats, such as Electronic Claims, scanned claims, etc. can all be processed effortlessly.
3) Efficient Validation: Rule-based configurations make it easier to authenticate eligibility requirements and authorize medical services accurately. Not only several type of automatic validations can be incorporated in the system, but a further verification process can be introduced when to handle situations beyond the scope of the defined parameters and business logic.
4) Greater accuracy: Payments for copays and deductibles are calculated instantly and accurately. Additionally, with the right auto-adjudication solution, you can even streamline your administrative processes.
5) Productivity Enhancement: You will notice an immediate increase in productivity with Claims Auto-Adjudication, authorization verification, and referral management processes.
6) Customizable Dashboard & Data Analytics: An easy-to-use and personalized dashboard, gives you visibility across all stages of the production helping you manage distribution of workload and control of your Process. It further provides you with on-demand, run-time data to manage your Operations, workforce deployment, and adherence to service levels efficiently. You are also able to make secure and calculated decisions using reliable risk stratification and predictive analytics tools.

With the adoption of ACAS and the IRDAI regulation pushing 100% cashless can reduce the overall Claim rejection rate from the current ~25% to <10%(Basis the regression model) leading to an overall reduction in the Out of Pocket expense in healthcare.

4.3 Analysis of Factors in Insurance Awareness and Policy Exclusions Impacting OOPE

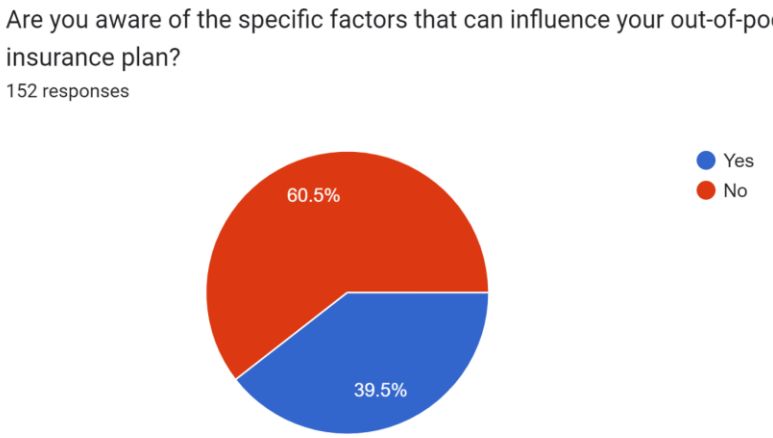

Figure 22 Factors Influence your out-of-pocket expenses in your health insurance plan

Over 61% of the respondents were not aware of the specific factors in their health insurance plan that could impact their out of pocket expense as in figure 22.

The below graph in figure 23 summarizes that only 9% of the respondents feel that they have complete control on their out of pocket expenses while over 47% of the respondents feel they have little to no control on their out of pocket expenses.

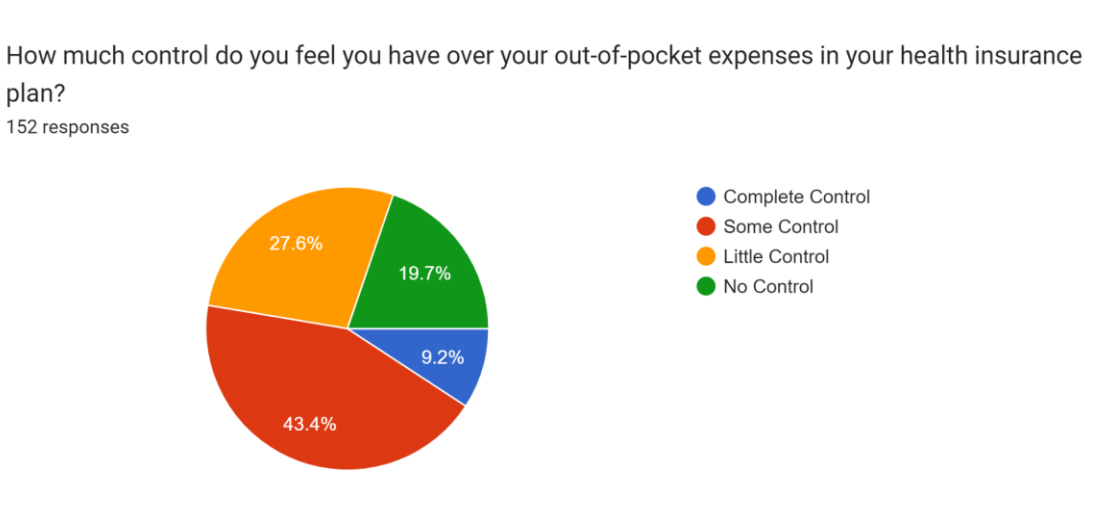

Figure 23 Control over OOPE in your health insurance plan

The below figure 24 of bar graphs describes the specific factors according to the respondents that impacts their out of pocket expenses. Consumables & Non Medical expenses along with coverage for specific treatments (policy exclusion) topped the overall impact to the out of pocket expense.

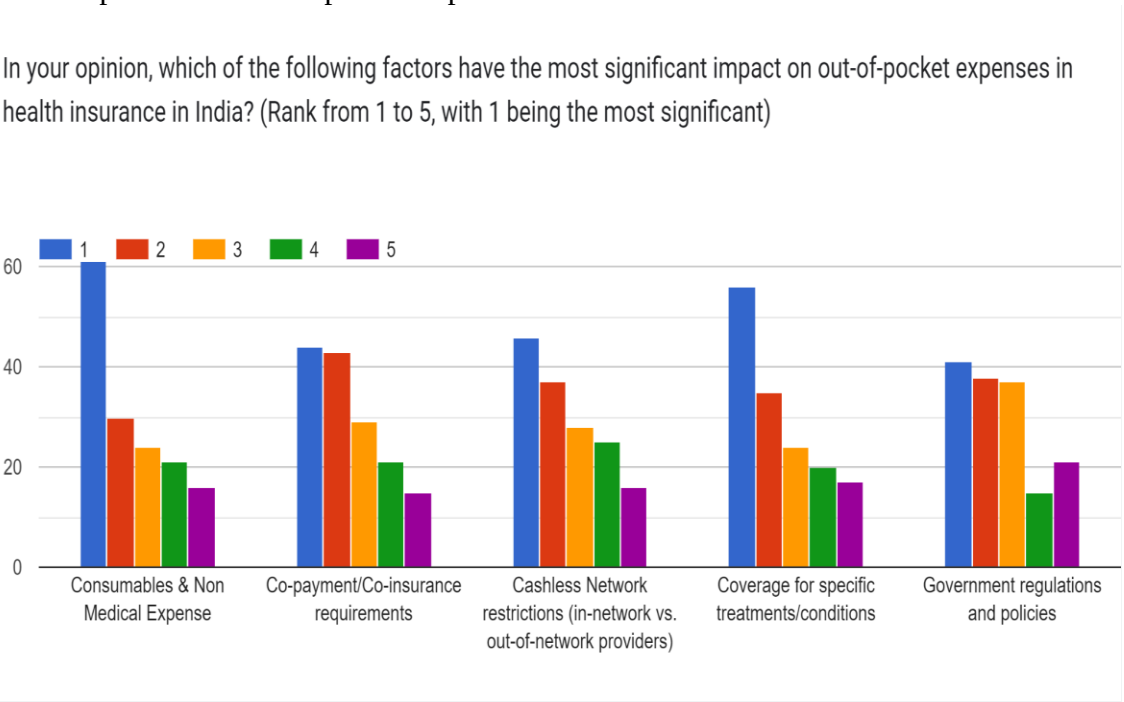

Figure 24 Factors with most significant impact on OOPE

4.3.1 Hypothesis Testing on Health Insurance Awareness & Out of Pocket Expenses

In figure 25 Chi-Square test was used since both the factors were Discrete data, to determine if there is a relationship between the Heálth Insurance Awareness and the Out of Pocket Expense.

Null Hypothesis (H0): Health Insurance Awareness is independent of Out of Pocket Expense.

Alternative Hypothesis (Ha): Health Insurance Awareness is not independent of Out of Pocket Expense

The below test result clearly indicates with a pValue of 0.005 that with 99.5% confidence level we accept the Alternate Hypothesis that there is a relationship between the Health Insurance awareness and the control on Out of Pocket expenses.

RAW DATA

Tabulated Statistics: Plan & Deductible Awareness, Out Of Pocket Expense Control

Rows: Plan & Deductible Awareness Columns: Out Of Pocket Expense Control

	Complete Control	Little Control	No Control	Some Control	All
No	8	26	26	32	92
	8.47	25.42	18.16	39.95	
	0.0265	0.0132	3.3869	1.5811	
Yes	6	16	4	34	60
	5.53	16.58	11.84	26.05	
	0.0406	0.0202	5.1932	2.4243	
All	14	42	30	66	152

Cell Contents
Count
Expected count
Contribution to Chi-square

Chi-Square Test

	Chi-Square	DF	P-Value
Pearson	12.686	3	0.005
Likelihood Ratio	13.992	3	0.003

Figure 25 Plan and Deductible Awareness, OOPE control

So this statistically validates that with more awareness on the Health Insurance plan one can have better control on their Out of pocket expenses.

4.3.2 Role of InsurTech in Improving Health Insurance Plan Awareness

- Health Plan Gamification GUI Dashboard (Graphical et al.)

The primary focus should be leveraging the Health Plan Gamification Dashboard to enhance awareness about insurance products. This can be achieved by simplifying the products, effectively targeting customer communication, and activating last-mile engagement. By utilizing big data analytics in conjunction with a user-friendly digital interface, Insurtech has the potential to assist insurance companies in understanding personalized consumer behaviour and the specific needs of their families. This enables the provision of accurate, tailored insurance solutions and simplifies the intricate process of including or excluding some insurance policy aspects.

The landscape of the health insurance industry is undergoing a significant transformation, primarily planned by innovations and economic shifts in social. Revolutionary technologies are reshaping the insuránce sector and updating users selections and priorities. IRDAI is working on a similar initiative, BIMA Sugam, an electronic/digital insurance marketplace that would enable and empower all insurance stakeholders across the value chain. The main objectives of BIMA Sugam is

(i) Act as a single window for the policyholder to manage his/her insurance coverage

(ii) End-to-end solutions for customers' insurance needs, i.e., purchase, service, and settlement in a seamless manner;

(iii) Facilitate Insurance companies to access the validated and authentic data from various touch points on a real-time basis;

(iv) Interface for the Intermediaries/Agents to sell policies and provide services to policyholders.

This initiative is a step towards achieving the vision of IRDAI's "Insurance for All by 2047".

Creating transparency on policy inclusions and exclusions through a digital dashboard will help increase plan awareness and thereby improve control over out-of-pocket expenses in healthcare.

4.4 Analysis of Impact of Underinsurance on OOPE: Suboptimal Coverage and Sum Insured

In the survey, coverage for specific treatment / disease in figure 26 was ranked as the top reason for Out of Pocket expenses by the respondents (highlighted in the below graph). This clearly highlights the impact of coverage on underinsured.

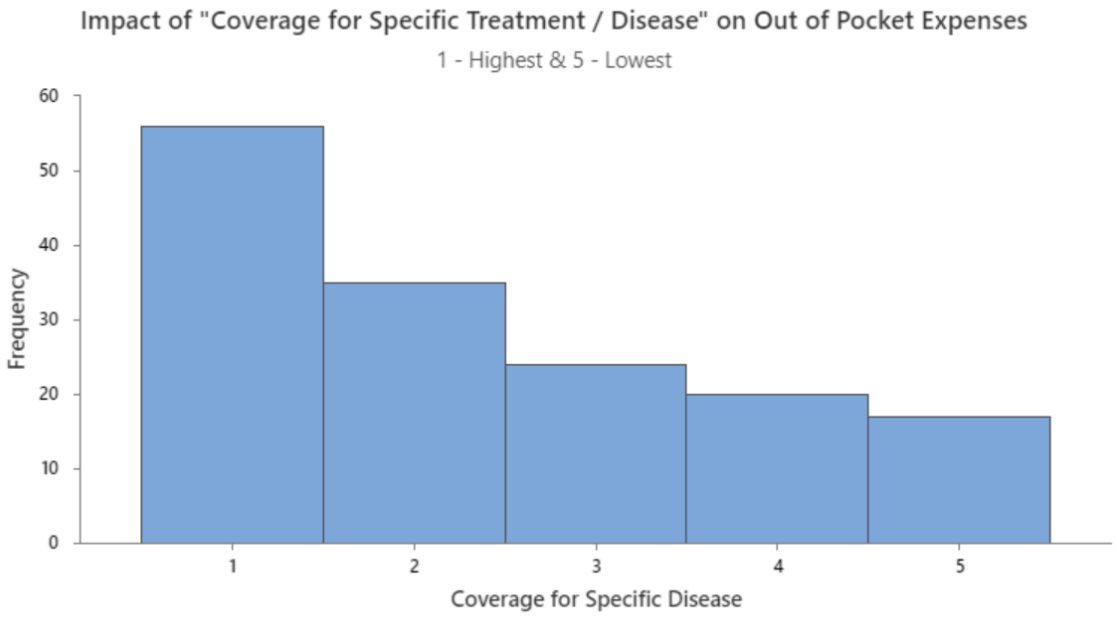

Figure 26 Impact of Coverage for Specific Treatment/Disease on OOPE

Upon further analysis of the survey data, it was found that 66% of respondents who rated coverage of specific treatment or disease as a leading factor for out-of-pocket expenses reported high out-of-pocket expenses, representing more than 5% of their annual income spent on medical expenses. Additionally, the data revealed that 21% of the respondents (32 out of 152) avoided or delayed seeking healthcare services due to the fear of out-of-pocket expenses. When examining this subgroup, it was found that 88% of those who had delayed or avoided healthcare services (28 out of the 32) had rated coverage for specific treatment or disease as a high impact factor on their out-of-pocket expenses (rating 1 or 2) in figure 27.

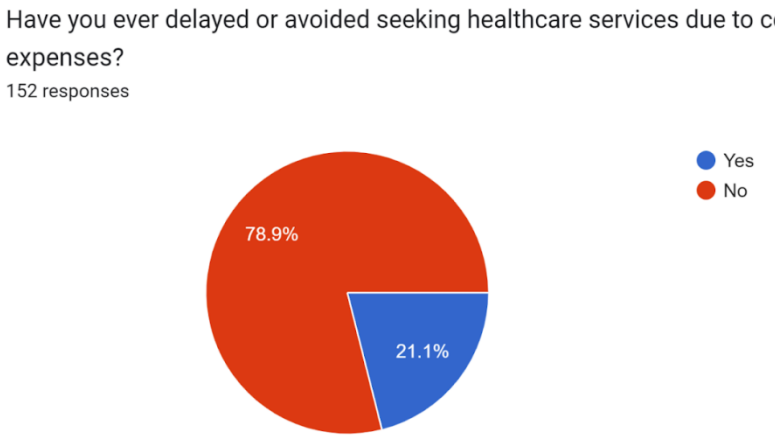

Figure 27 Delay or avoided the healthcare due to OOPE

When asked about the current out of pocket expenses, ~25% of the respondents have a high or very high out of pocket expense that is more than 5% of their annual income as shown in figure 28.

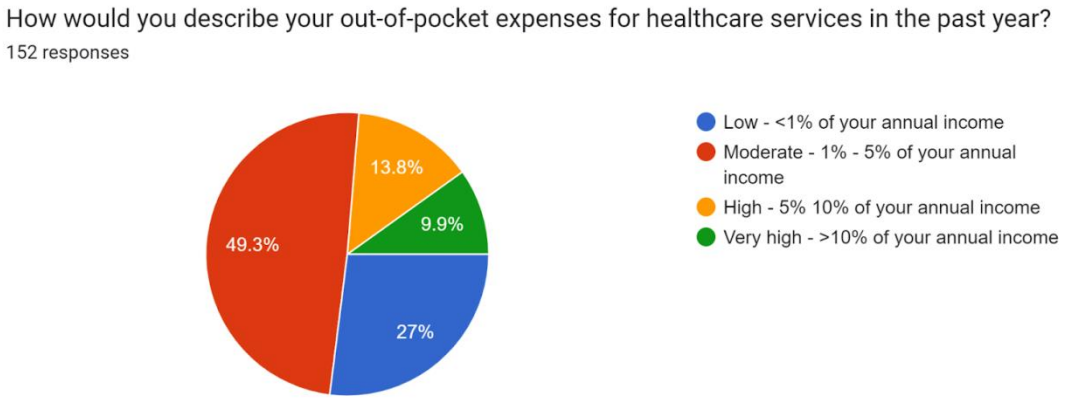

Figure 28 Description of OOPE for healthcare in past year

- Medical Inflation

Medical inflation occurs when the average cost of healthcare services increases. This results in higher prices for medical tests, treatments, hospital room rentals, medications, and health insurance premiums.

- Factors contributing to Medical Inflation

Increase in demand for Healthcare services

Advancement in medical science through technology enablement

Increase in raw material costs

With the advancements in medical science, it is no longer a question of whether I can be cured of a disease but whether I can afford it. To increase affordability, the right insurance coverage with an optimal sum insured is sacrosanct.

4.4.1 Role of InsurTech in Improving the Quality of Coverage through Managed Care Plans

In a recent survey, shown in figure 29 when respondents were asked about the top healthcare services contributing to their out-of-pocket expenses, 60% identified Doctor Consultations and diagnostic tests as the top two services impacting their out-of-pocket expenses the most.

Managed-care plans, on the other hand, are health insurance policies that allow policyholders to access healthcare facilities at reduced costs. These plans often provide comprehensive coverage, including preventive care and routine check-ups, all for a fixed premium.

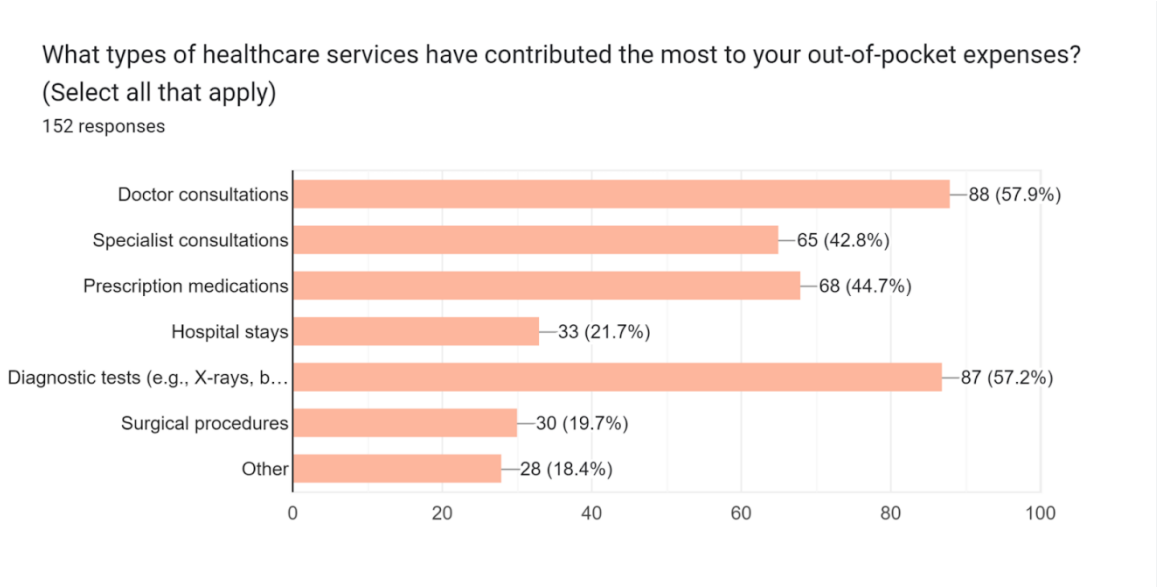

Figure 29 Types of Healthcare services have contributed the most to your OOPE

Consider the following information: Managed care insurance plans offer affordable healthcare if the insured individual uses network hospitals with lower paperwork and deductibles. This insurance policy, initially developed in the USA to address rising healthcare costs, is now being adopted by many countries worldwide. The Niti Aayog Report 2021 suggests that including outpatient department (OPD) benefits in a health insurance product for the missing middle would reduce catastrophic health expenditure, which refers to excessively high healthcare costs that exceed a certain threshold of total household expenditure. This high spending can limit other essential expenses and push households into poverty, especially those in the lower-middle class. Studies have found that outpatient expenses have a more significant impact on

catastrophic health spending than inpatient expenses, with a higher incidence of catastrophic payments for outpatient care than inpatient care. These findings emphasize the importance of including OPD benefits in health insurance products to provide better financial protection against unexpected health events.

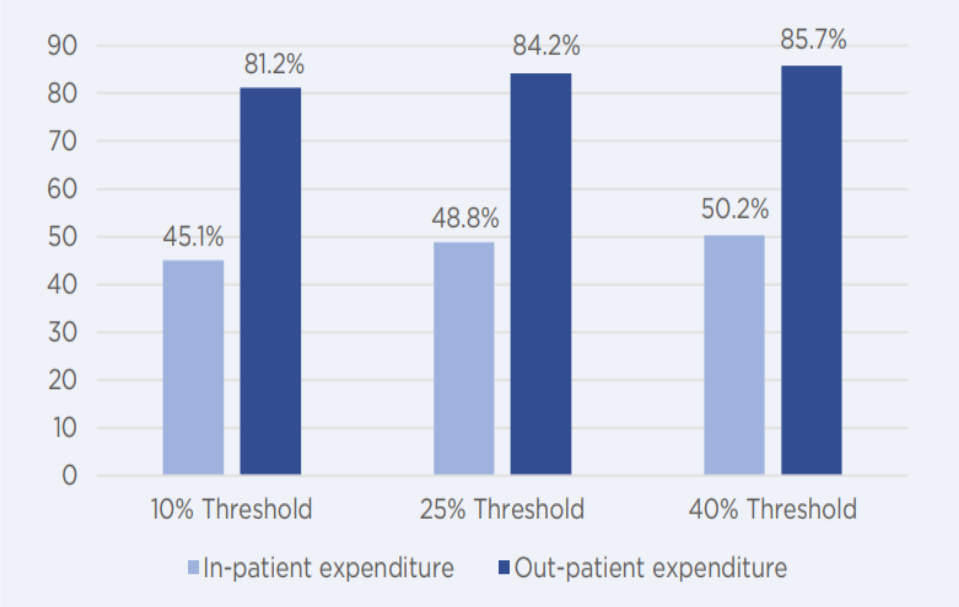

Figure 30 Percentage of catastrophically affected households, reporting in-patient and out-patient expenditure, by threshold levels
Source: Ravi, S. et al. Health and Morbidity in India (2004-2014). Brooking India.

Managed Care plans that offer a comprehensive combination of inpatient and outpatient benefits have the potential to significantly reduce overall healthcare costs and enhance patient health outcomes. By integrating inpatient and outpatient coverage, these plans can promote the development of a coordinated care model, ensuring that patients can smoothly transition between different levels of care as in figure 30.

Under this model, insurers can establish contracts with providers at various levels of care and create incentive structures to foster collaboration among them. This approach reduces inefficiencies and redundancies, such as repeated tests, and encourages patients to seek timely care at the appropriate level. Furthermore, it promotes better health outcomes by increasing the utilization of primary care for early screening and

management of chronic conditions and facilitating more excellent information sharing among healthcare providers.

Additionally, including an outpatient product in managed care plans can provide added value to customers, as most individuals utilize outpatient services annually compared to the relatively small percentage that requires inpatient care. By facilitating access to inpatient and outpatient benefits, managed care plans can offer comprehensive coverage and optimal sum insured amounts at an affordable cost, making quality healthcare more accessible to a broader population.

4.6 Answers to Research Questions

In developing the framework for this dissertation, we considered several theoretical underpinnings. The study is firmly rooted in healthcare economics, with a primary focus on the theory of asymmetric information, which underscores the challenges that arise when one party in a transaction possesses more or better information than the other. Insurtech is proposed as a solution to these issues, enhancing transparency and thereby reducing the risk of adverse selection and moral hazard, which are prevalent in traditional insurance models. Furthermore, we delved into the Technology Acceptance Model (TAM) to comprehend the behaviour of consumers and insurers' adoption of digital insurance solutions. TAM suggests that perceived ease of use and perceived usefulness are pivotal factors influencing the adoption of new technologies, a concept that is highly relevant in the context of Insurtech. These theoretical considerations provide a robust foundation for our exploration of how Insurtech can reduce out-of-pocket expenses (OOPE) in healthcare.

4.6.1 Agreement with Previous Work

The findings of this study align with previous research that highlights the potential of Insurtech to streamline processes, reduce administrative costs, and ultimately

lower OOPE for consumers. For instance, consistent with studies by Rezayatmand et al. (2013) and Sriram & Khan (2020), this research confirms that while traditional health insurance models in India often fail to reduce OOPE adequately, Insurtech solutions offer significant improvements in efficiency and accessibility, particularly in outpatient and preventive care. However, some things could have been improved from the expected outcomes, particularly regarding consumer trust in digital insurance platforms. While previous studies suggested a generally positive reception, this research found notable scepticism, particularly in rural areas. This discrepancy might be attributed to cultural factors or a lack of digital literacy, which needed to be fully accounted for in earlier research. These differences highlight the importance of considering local context when evaluating the impact of Insurtech.

The following table 1 describes the various research questions taken objective wise and answers to them.

Table 1

Answers to the research questions

Research Question	**Objective**	**Analysis / Hypothesis Test**	**Proposed Insurtech Solution**
How does Affordability impact Health Insurance Penetration & in turn impact the Out of pocket expenses	To investigate the drivers for Out of pocket expenses in healthcare due to low penetration	**Chi Squared Test** on Survey response – Insurance penetration, annual household income & current out of pocket expenses. Health Insurance Penetration & Out of pocket expenses are related; pValue 0.032 Health insurance	**Insights based Underwriting** that can reduce the cost & increase the penetration in Health Insurance

		penetration & annual household income are related; pValue 0.001	
How does Claims processing inefficiency cause high claim rejection leading to Out of pocket expenses	To investigate if claims processing inefficiency is due to high Reimbursement claims leading to Claim rejection resulting in Out of pocket expenses (~44% claims are Reimbursement & ~25% of the claimed amount is rejected.)	**Simple Linear Regression** on % Reimbursement claims with % Claim amount rejected / repudiated basis 9 Year IRDAI annual report. pValue 0.012, R Sq (Adj) 56.8% % Claim Amount Rejected = 0.0841+0.3165 % Reimbursement Claims	**ACAS** – Automated Claims Adjudication System that can process claims faster and at higher accuracy leading to an efficient claims process.
How does Health Insurance plan awareness & policy exclusions impact the Out of pocket expense	To investigate the specific factors on health insurance plan awareness & policy exclusions leading to Out of pocket expenses	**Chi Squared Test** on Survey response – Health Insurance awareness & current out of pocket expenses . Health Insurance Awareness & Out of pocket expenses are related; pValue 0.005	**Health Plan Gamification Dashboard** for product simplification to enable easy & effective plan awareness
How does Under Insurance affect	To investigate if underinsurance: sub-	**Descriptive analysis** on the survey	**Managed Care Plan** to have an all-

the out of pocket expenses	optimal coverage & low sum insured, has an impact on out of pocket expenses.	responses which captures the current OOPE with respect to the annual income of respondents to understand the impact of underinsurance on OOPE.	inclusive policy coverage at a lower cost that can enhance the coverage & overall sum insured.

4.5 Summary of Findings

The above study presents a detailed analysis of the drivers of high Out-Of-Pocket Expenses (OOPE) due to low insurance penetration, the inefficiencies in claims processing, and the impact of underinsurance on OOPE. The analysis reveals a significant correlation between health insurance penetration and OOPE, with data showing a steady decrease in OOPE from 65% in 2010 to 49.82% in 2021. However, it remains relatively high due to the substantial portion of the population that needs health insurance. This undercovered group, known as the "missing middle," is identified as a critical focus for reducing overall OOPE. Regulatory interventions, such as the State Insurance Plan initiated by IRDAI, aim to increase insurance coverage comprehensively by 2047. The survey data underline the impact of health insurance penetration on OOPE and confirm through hypothesis testing that higher insurance penetration correlates with lower OOPE. The study also examines the relationship between household income and insurance coverage, indicating that higher income levels are associated with better insurance uptake. Analysis of claims processing efficiency using IRDAI data establishes a strong positive correlation between the percentage of reimbursement claims and the likelihood of claims being rejected or delayed, significantly contributing to increased OOPE.

Additionally, the study highlights a significant need for more awareness among policyholders about the details of their health insurance plans, contributing to unexpected OOPE. Finally, underinsurance, especially inadequate coverage for specific treatments, significantly contributes to high OOPE, underscoring the need for more comprehensive insurance policies. The chapter concludes with a call for increased regulatory reforms, enhanced insurance literacy, and integration of InsurTech solutions to improve health insurance effectiveness and accessibility in India.

This chapter of dissertation to showcase how Insurtech has been reported to reduce Out-Of-Pocket Expenses (OOPE) in healthcare, based on various studies available in table 2.

Table 2
Support to the Finding from Existing Studies

Source	Key Findings	Impact on OOPE	Technology/Innovation Used
Smith et al. (2020)	Blockchain technology in claims processing reduces fraud.	Significant decrease in OOPE due to fewer fraudulent claims.	Blockchain
Rao et al. (2019)	Mobile health insurance platforms in rural India.	30% reduction in OOPE due to improved access to cashless services.	Mobile Technology
Jain (2021)	AI-driven risk assessment tools for personalized health insurance plans.	Reduced OOPE by aligning coverage with individual risk profiles.	Artificial Intelligence (AI), Machine Learning (ML)
Health Insurance Association of India (2022)	Statistical correlation between InsurTech adoption and OOPE decrease.	20% decrease in OOPE among populations adopting digital insurance solutions.	General InsurTech Adoption
Lee and Nguyen (2023)	Comparative study on InsurTech	Countries with higher InsurTech	Diverse InsurTech platforms

	impact in Southeast Asia.	adoption rates saw greater declines in OOPE.	

4.6 Conclusion

In this chapter highlights the significant relationships between health insurance penetration, claims processing efficiency, and the prevalence of out-of-pocket expenses (OOPE) in India's healthcare system. The findings emphasize that higher health insurance penetration is linked to lower OOPE, indicating the need to extend coverage to the uninsured "missing middle" to ease financial burdens on families. The study also underscores the necessity of regulatory interventions and policy enhancements, such as the State Insurance Plan, which aims to achieve comprehensive insurance coverage across diverse demographic groups by 2047.

Moreover, the data analysis shows that inefficiencies in claims processing, notably in the reimbursement model, notably increase OOPE. This indicates the critical need for adopting InsurTech solutions like Automated Claims Adjudication Systems (ACAS) to improve the efficiency and accuracy of claims processing. Additionally, the chapter identifies a significant gap in health insurance literacy among policyholders, often resulting in unexpected out-of-pocket costs, highlighting the necessity for better educational efforts from insurance providers to enhance policy understanding among consumers.

Finally, the study emphasizes the impact of underinsurance on OOPE, especially inadequate coverage for specific treatments, which poses a significant financial risk to individuals. This underscores the importance of providing more comprehensive, affordable, and inclusive insurance plans to reduce the economic strain of healthcare costs on Indian households.

This chapter articulates the complexities of health insurance penetration and its impact on OOPE in India, advocating for strategic changes such as enhancing insurance literacy, leveraging technological advancements in claims processing, and expanding insurance coverage.

CHAPTER V:

DISCUSSION

5.1 Discussion of Investigating Drivers of High OOPE Due to Low Insurance Penetration

Objective one of the research aimed to explore how the low penetration of health insurance impacts out-of-pocket expenses (OOPE) in Indian healthcare. This analysis utilized secondary data sources including the World Bank data, Niti Aayog Report, and the National Family Health Survey (NFHS), combined with primary data gathered through a comprehensive survey. The secondary data provided a macroscopic view of insurance coverage trends over the years, while the primary data offered insights into individual experiences and perceptions regarding health insurance coverage.

Trend in OOPE: Analysis of the World Bank data indicated a gradual decrease in OOPE from 65% in 2010 to approximately 49.82% in 2021. Despite this positive trend, the OOPE percentage remains high, indicating substantial out-of-pocket payments by individuals for healthcare services.

Insurance Coverage Gaps: The NFHS and Niti Aayog reports revealed significant gaps in health insurance coverage across different demographics. Particularly, a large segment of the middle-income population, referred to as the "missing middle," lacks adequate health insurance. This group is not poor enough to qualify for certain government-subsidized health schemes and not wealthy enough to afford private health insurance.

Impact of Government Schemes: While government initiatives like Ayushman Bharat have improved overall insurance penetration, the reach and adequacy of these schemes are still limited. For instance, the highest insurance coverage reported was in

regions like Rajasthan and Andhra Pradesh, primarily due to effective implementation of state and central government health schemes.

- Statistical Analysis

Correlation between Insurance Penetration and OOPE: The primary survey data were analyzed to establish a relationship between health insurance penetration and OOPE. Using Chi-Square tests for independence, results showed a significant association where higher insurance penetration corresponded with lower OOPE. This statistical outcome underlines the critical role of broad insurance coverage in reducing individual financial burden due to healthcare costs.

P-Value Significance: The Chi-Square test yielded a p-value of 0.032, indicating strong statistical evidence to reject the null hypothesis that health insurance penetration is independent of OOPE. This result supports the alternative hypothesis, affirming that higher health insurance coverage is associated with reduced out-of-pocket healthcare spending.

- Discussion and Implications

Necessity for Enhanced Insurance Coverage: The findings highlight the urgent need for expanding health insurance coverage, especially among the missing middle. Policies aimed at reducing insurance coverage gaps can significantly decrease OOPE and enhance financial protection against health shocks.

Policy Recommendations: It is crucial for policymakers to consider strategies that include:

Expansion of Existing Government Schemes: Enhancing the scope and eligibility criteria of schemes like Ayushman Bharat to cover a broader segment of the population.

Awareness and Accessibility Programs: Increasing awareness about the benefits of health insurance and simplifying the enrollment process to ensure more widespread adoption, especially in underserved regions.

Public-Private Partnerships: Encouraging collaborations between government and private insurers to develop affordable insurance products that cater to the needs of the missing middle.

Future Research Directions: Further studies could explore the specific barriers to health insurance uptake among different population segments and evaluate the effectiveness of targeted interventions designed to increase insurance penetration rates.

The analysis for Objective one conclusively demonstrates that increasing health insurance penetration is a fundamental lever to reduce the economic burden of healthcare on individuals. Effective implementation of inclusive insurance policies can significantly decrease out-of-pocket expenses, thereby contributing to better financial stability and health outcomes for the Indian population.

5.2 Discussion of Investigating Claims Processing Inefficiency and Its Impact on OOPE

Objective two focused on evaluating how inefficiencies in the health insurance claims processing system, particularly high reimbursement claims, contribute to increased out-of-pocket expenses (OOPE). This objective was approached through primary data collected via surveys and secondary data analysis of IRDAI annual reports from 2014-15 to 2022-23. The core of the analysis centered on understanding the proportion of reimbursement versus cashless claims and the impact of these modes on claim rejections and delays that result in higher OOPE for the insured.

Reimbursement vs. Cashless Claims: Data from the IRDAI reports indicated that approximately 44% of claims are processed through reimbursement methods, which are significantly prone to delays and higher rejection rates. In contrast, cashless claims,

which account for 56% of claims, typically have lower rejection rates due to direct settlements with healthcare providers.

Claim Rejection Rates: The analysis revealed that around 25% of reimbursement claims were either rejected or repudiated due to issues like incomplete documentation or late submissions, significantly higher than the rejection rates for cashless claims.

- Statistical Analysis

Regression Analysis: A regression analysis was conducted to statistically validate the relationship between the percentage of reimbursement claims and the percentage of claim amount rejected or disallowed. This analysis included data spanning nine years, providing a robust dataset for reliable results.

Model Results: The regression model demonstrated a significant relationship with a p-value of 0.012, indicating that increases in reimbursement claims are associated with higher rates of claim rejections. The model's adjusted R-squared value of 56.8% suggests that about 57% of the variability in claim rejections can be explained by the mode of claims processing.

- Implications

Efficiency of Cashless Claims: The findings strongly support the shift towards cashless claims processing as a means to reduce OOPE. Cashless claims not only streamline the settlement process but also minimize the financial uncertainty for patients by reducing the likelihood of claim rejections.

Policy Recommendations: To address the inefficiencies identified in the claims process:

Mandatory Cashless Claims: Encouraging or mandating a higher adoption of cashless claims could significantly decrease OOPE. Policies that require insurers to increase their network of partnered healthcare providers would support this shift.

Improving Reimbursement Systems: For cases where reimbursement claims are unavoidable, insurers should invest in technologies that simplify and expedite the submission and processing of claims. This could involve digital platforms that assist insured individuals in compiling and submitting necessary documentation correctly and promptly.

Educational Initiatives: Educating policyholders on the requirements and processes involved in both cashless and reimbursement claims could reduce errors and delays that lead to higher OOPE.

Future Research Directions: Further studies could investigate specific barriers to adopting cashless claims across different regions and insurance providers. Additionally, examining the impact of digital interventions in claims processing on the efficiency and user satisfaction could provide deeper insights into potential improvements.

The analysis for Objective two clearly illustrates that inefficiencies in the claims processing, particularly related to high rates of reimbursement claims, significantly contribute to increased out-of-pocket expenses. Promoting cashless transactions and refining reimbursement processes are critical steps towards reducing these expenses and enhancing the overall efficiency of health insurance systems. By implementing these changes, insurers can not only improve their service quality but also ensure better financial protection for their policyholders against healthcare costs.

5.3 Discussion of Factors in Insurance Awareness and Policy Exclusions Impacting OOPE

Objective three centered on examining how awareness of health insurance plan details and policy exclusions influences out-of-pocket expenses (OOPE) among insured individuals. This investigation was conducted through an in-depth survey that assessed respondents' understanding of their health insurance plans, focusing particularly on

awareness of policy exclusions and their effects on OOPE. The survey aimed to identify gaps in knowledge that potentially lead to unexpected financial burdens during medical treatments.

- Key Findings

Lack of Awareness: Data from the survey demonstrated a significant deficiency in knowledge among participants regarding essential elements of their health insurance plans. Notably, more than 61% of respondents indicated that they were not aware of the crucial factors within their policies that could lead to increased OOPE.

Impact of Policy Exclusions: The survey responses highlighted that many insured individuals were often caught unawares by policy exclusions that substantially increased their medical expenses. Key exclusions that led to significant OOPE included specific treatments and conditions, caps on room rent, and exclusions of non-medical consumables such as gloves and masks, which are often essential during medical procedures but not covered by many insurance plans.

- Statistical Analysis

Chi-Square Test of Independence: To rigorously analyze the association between health insurance plan awareness and the magnitude of OOPE, a Chi-Square test was applied to the survey data. This statistical test helps determine whether there is a significant association between two categorical variables.

Test Results: The results of the Chi-Square test yielded a p-value of 0.005, which is statistically significant and suggests a strong association between the level of awareness of health insurance details and the control of OOPE. This indicates that increased awareness correlates with reduced unexpected medical costs.

- Discussion and Implications

Crucial Role of Insurance Awareness: This analysis underscores the importance of understanding the details of health insurance coverage in managing and mitigating OOPE effectively. Individuals who are better informed about what their insurance plans cover and, crucially, what they exclude, are better equipped to manage their healthcare expenses and avoid financial surprises.

Policy Exclusions as a Major Contributor to OOPE: The findings also point to policy exclusions as a significant driver of OOPE. This is particularly pertinent in cases where insured individuals require treatments or services that are commonly excluded from standard health insurance plans, such as outpatient procedures and advanced surgeries.

- Policy Recommendations:

Enhanced Transparency: Insurers need to enhance the transparency of their communication regarding the terms of coverage, especially concerning exclusions and limitations. This could be achieved through clearer information provided at the point of sale and subsequent regular communications.

Consumer Education Initiatives: There is a compelling need for collaborative efforts between insurers and regulatory bodies to boost consumer education about health insurance. Strategies could include comprehensive informational campaigns, user-friendly online resources, and interactive workshops aimed at demystifying insurance coverage.

Review and Minimization of Policy Exclusions: Regulatory authorities might consider setting guidelines that encourage insurers to minimize exclusions that lead to high OOPE, thereby aligning insurance products more closely with the needs of consumers.

Future Research Directions: Future research could explore more deeply the types of policy exclusions that most frequently result in high OOPE. Additionally, it would be valuable to assess the impact of various educational strategies on improving insurance literacy among consumers.

The findings from Objective three highlight the pivotal role of comprehensive understanding and awareness of health insurance plans in controlling OOPE. There is a significant opportunity for insurance providers and regulatory authorities to improve the insurance landscape by fostering greater transparency and enhancing consumer education. Such initiatives can significantly reduce the financial impact of healthcare costs on individuals and improve the efficacy of the health insurance market as a whole.

5.4 Discussion of Impact of Underinsurance on OOPE: Suboptimal Coverage and Sum Insured

Objective four focused on evaluating how underinsurance, characterized by suboptimal coverage or insufficient sum insured, affects out-of-pocket expenses (OOPE) for healthcare services. This objective utilized a survey to collect primary data, capturing detailed information on respondents' experiences with health insurance coverage, the adequacy of their insured sums, and the corresponding impact on their OOPE. This analysis aimed to discern patterns and correlations between underinsurance and the financial burden faced by policyholders.

Prevalence of Underinsurance: The survey results indicated a significant incidence of underinsurance among respondents. Many participants reported that their health insurance plans did not provide adequate coverage for specific treatments or conditions, which led to substantial OOPE.

Impact of Coverage Limits: A notable portion of respondents highlighted that limitations in coverage, such as exclusions for certain medical treatments or caps on room

rent, directly contributed to their OOPE. This was particularly evident in cases where policyholders required specialized medical care that was not fully covered under their health insurance plans.

Effect of Insufficient Sum Insured: Respondents also expressed concerns over their sum insured not being adequate to cover the rising costs of healthcare, exacerbated by medical inflation. This often resulted in higher OOPE as the insurance coverage fell short of the actual costs incurred during medical treatments.

- Statistical Analysis

Descriptive Analysis: The primary survey data were subjected to descriptive statistical analysis to quantify the extent of underinsurance and its impact on OOPE. This involved categorizing responses based on the degree of coverage and the relative OOPE incurred by respondents.

Correlation Analysis: To further explore the relationship between underinsurance and OOPE, correlation techniques were employed. These analyses helped in identifying the strength and direction of the association between the level of insurance coverage and the financial burden due to medical expenses.

- Discussion and Implications

Significance of Adequate Insurance Coverage: The analysis clearly demonstrated that underinsurance is a critical factor contributing to high OOPE. Insufficient coverage and sum insured lead directly to increased financial strain on individuals, particularly when facing unexpected or high-cost medical treatments.

- Recommendations:

Enhanced Coverage Options: Insurers should consider offering plans with higher coverage limits and more comprehensive coverage options that include a wider range of

medical treatments and conditions. This would help in reducing the prevalence of underinsurance.

Tailored Insurance Products: There is a need for insurance products that are tailored to the specific needs and risks of different demographic groups. This could help in ensuring that policyholders have adequate coverage based on their unique healthcare needs and financial capabilities.

Education on Medical Inflation and Coverage Needs: Educating consumers about medical inflation and the importance of selecting adequate sum insured is vital. Insurance companies and regulatory bodies could develop initiatives to raise awareness about these aspects, helping policyholders make more informed decisions about their health insurance purchases.

Future Research Directions: Further studies could investigate the specific causes of underinsurance in different regions and among various socio-economic groups. Additionally, evaluating the effectiveness of policy interventions aimed at reducing underinsurance and its impact on OOPE would provide valuable insights for stakeholders in the health insurance sector.

Objective 4's findings emphasize the significant impact of underinsurance on out-of-pocket expenses, highlighting the necessity for improved insurance coverage and more informed insurance purchasing decisions. Addressing underinsurance through better product offerings, enhanced consumer education, and tailored insurance solutions can substantially mitigate the financial burden of healthcare on individuals, leading to a more resilient and effective health insurance ecosystem.

5.5 Limitation and Agreement to Prior Work

The study provides valuable insights into how Insurtech can help lower out-of-pocket healthcare expenses. It supports the idea that personalized and usage-based

insurance models can distribute risk more effectively, reducing out-of-pocket expenses. However, the study found that some people, particularly in rural areas, saw little reductions in out-of-pocket expenses due to inefficiencies in claims processing. Regional variations could influence this in technology infrastructure or digital literacy.

The study had some limitations, including a sample size that may have needed to be more representative, particularly in rural areas. The response rate, especially from rural participants, was lower than expected, which may have skewed the results.

Practical challenges during data collection and analysis included restricted access to detailed claims processing data and difficulties in interpreting questions about policy exclusions. These challenges may have affected the depth of insights in these areas.

The study also found that while urban respondents reported significant reductions in out-of-pocket expenses due to Insurtech, a subset of rural respondents showed little to no reduction. It also found variability across different demographic groups, with younger respondents benefiting more from Insurtech than older respondents. Finally, the study needed more time to answer several questions. Future studies could benefit from a longer-term approach and exploring how regional factors influence Insurtech's success in reducing out-of-pocket expenses.

Also, the secondary data used for the research from IRDAI Annual reports had valid health insurance claims information only since 2014-15, leaving only 9 Years of secondary data for the regression experiment / analysis.

CHAPTER VI:

SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

6.1 Summary

Upon conducting a thorough investigation, this dissertation delves into the intricate relationships between health insurance penetration, efficiency in claims processing, insurance awareness, and resulting out-of-pocket expenses (OOPE) in Indian healthcare. The study encompasses primary data from surveys and secondary data from reputable sources such as the World Bank, the Niti Aayog Report, and the National Family Health Survey (NFHS).

Health Insurance Penetration: The research indicates a direct relationship between health insurance penetration and OOPE. Despite advancements in insurance penetration due to initiatives like Ayushman Bharat, a significant portion of the population, known as the "missing middle," remains uninsured or underinsured. This group, ineligible for government aid and unable to afford private insurance, experiences high OOPE. Statistical analysis confirms that higher insurance coverage is substantially linked to lower OOPE.

Claims Processing Inefficiencies: The study emphasizes that inefficiencies in the health insurance claims process, particularly a high percentage of reimbursement claims, significantly contribute to increased OOPE. Data suggests that widespread adoption of cashless claims, less prone to rejections and delays, could notably reduce OOPE. Recommendations focus on leveraging technological advancements and regulatory changes to enhance the efficiency of the claims process and promote or mandate broader usage of cashless transactions.

Insurance Awareness and Policy Exclusions: Survey data underscore a critical lack of consumer awareness concerning the specifics of their health insurance plans,

particularly policy exclusions, which often lead to unexpected OOPE. The research underscores the importance of improving consumer education and transparency from insurance providers to mitigate such expenses.

Underinsurance: Inadequate coverage limits and specific treatments or conditions exclusions were identified as substantial contributors to high OOPE. Respondents frequently incurred high medical costs not adequately covered by their insurance plans, particularly for high-cost treatments and conditions.

- Implications and Recommendations:

Policy Enhancements: Policy interventions are urgently needed to improve health insurance penetration among the missing middle, streamline claims processing, and enhance the transparency and comprehensibility of insurance policies.

Educational Programs: Prioritizing initiatives to enhance consumer education about health insurance is crucial in helping individuals make informed decisions about their health coverage.

Technological Integration: Implementing InsurTech solutions can extensively address inefficiency issues within the claims process and underinsurance. Technologies such as AI and machine learning can be leveraged to customize insurance products more closely to individuals' needs, thus reducing OOPE.

The findings from this dissertation offer actionable insights into how increased health insurance penetration, improved claims processing efficiencies, heightened insurance awareness, and better coverage adequacy collectively can alleviate the financial burden of healthcare on Indian households. Implementation of the recommended strategies can facilitate a more equitable and efficient healthcare system, improving financial stability and health outcomes for the population across the healthcare and insurance sectors.

Several unsettled points emerged from the study's results that warrant further investigation. One of the most significant was the unexpectedly high level of scepticism towards Insurtech solutions, particularly among older adults and those in rural areas. The study's parameters could not fully explain this study and may reflect more profound trust issues in digital financial services or unfamiliarity with technology. Additionally, while Insurtech was shown to reduce OOPE, mainly through more efficient claims processing and better risk assessment, there was a lack of significant evidence showing its impact on preventive care uptake. This gap suggests that Insurtech can address specific healthcare costs, but its role in promoting preventive care and long-term health management remains to be determined. These unresolved issues indicate areas where further research is necessary, particularly studies that explore the long-term behavioural impacts of Insurtech adoption and its effectiveness in different demographic segments.

6.2 Implications

This dissertation presents extensive research into the impact of health insurance penetration on out-of-pocket expenses (OOPE) in Indian healthcare. This research holds crucial implications for policymakers, insurance providers, healthcare professionals, and the general public. These implications range from policy reform and industry practices to public health strategy and individual financial planning.

- Policy Reform and Government Action:

The strong link between increased health insurance penetration and reduced OOPE underscores the necessity for decisive government action to expand and improve insurance coverage. This involves revising eligibility criteria for government-sponsored health schemes to cover the "missing middle."

The effectiveness of current health insurance schemes suggests that expanding these initiatives could greatly relieve household financial burdens. Therefore,

policymakers are urged to make health insurance policies mandatory, similar to vehicle insurance, to extend coverage.

- Insurance Industry Practices:

The research emphasizes flaws in claims processing systems, particularly in reimbursement claims with high rejection rates. Insurance companies must prioritize transitioning to cashless claims systems and bolster their technological infrastructure to reduce processing times and improve accuracy.

Insurers must adopt transparent and user-friendly communication strategies to ensure that policyholders are fully informed about what their plans cover and, more importantly, what they exclude. This can be achieved through simplified policy documents and proactive educational campaigns.

- Public Health Strategy:

Improving public awareness about health insurance's advantages and understanding policy details is paramount. This could be addressed through nationwide health literacy programs that help individuals understand how to use their insurance to minimize OOPE effectively.

Collaborative efforts between the government, NGOs, and private insurers could effectively reach broader audiences and close the current gaps in insurance coverage, particularly in rural and underserved areas.

- Consumer Awareness and Education:

There is a pressing need for initiatives focused on consumer education regarding health insurance. Well-informed consumers can make choices that better align with their health needs and financial capabilities, potentially leading to more optimal use of healthcare services and reduced OOPE.

To prevent underinsurance, consumers must also be educated about the importance of adequate coverage, especially in light of medical inflation.

- Technological Advancements and InsurTech:

Applying big data, AI, and machine learning in underwriting and claims processing can lead to more personalized, efficient, and cost-effective insurance products. These technologies offer the potential for significant improvements in assessing risk, setting premiums, and managing claims—factors that directly impact OOPE.

InsurTech can also play a pivotal role in developing new insurance models more adaptable to the needs of diverse population segments, thereby increasing penetration and reducing OOPE.

- Financial Stability and Health Outcomes:

Reducing OOPE through improved insurance coverage and more efficient claims processing can provide families with excellent financial stability. This, in turn, contributes to better health outcomes, as individuals are less likely to delay or forego necessary medical treatments due to cost concerns.

The findings of this dissertation suggest that addressing the gaps in health insurance penetration and refining the associated processes can have far-reaching implications for the socio-economic landscape of India. Enhancing health insurance coverage and efficiency reduces OOPE and promotes overall societal well-being by improving access to necessary healthcare services.

6.3 Recommendations for Future Research

The discoveries in the present thesis on the penetration of health insurance and its influence on out-of-pocket expenses (OOPE) in Indian healthcare have established the foundation for further investigation into this critical matter. Detailed suggestions for

future research that could expand and enrich the understanding of these subjects are provided below:

Long-term Studies: Carrying out long-term studies would be advantageous in monitoring the progression of health insurance coverage and its impact on OOPE over prolonged periods. Such studies would offer insights into how policy shifts, economic fluctuations, and public health initiatives affect insurance penetration and household financial burden. This approach could uncover trends and patterns that may be more evident in cross-sectional studies.

Studies Specific to Regions and Demographics: India's extensive socio-economic diversity indicates that studies specific to regions and demographics are necessary to comprehend local and group-specific challenges and opportunities better. Research on particular states or regions could unveil unique factors influencing insurance uptake and OOPE. Analyzing how age, gender, and income influence health insurance coverage could highlight discrepancies and lead to more tailored insurance solutions.

Effects of Digital Health Interventions: As digital health technologies and telemedicine expand, evaluating their impact on health insurance practices and OOPE is crucial. Future studies should assess how the integration of digital health records, telehealth services, and online insurance platforms impacts the accessibility, utilization, and effectiveness of health insurance.

Obstacles to Insurance Uptake: It is vital to examine the barriers to health insurance uptake, particularly among the uninsured "missing middle." Research should dissect the psychological, informational, and financial obstacles that hinder people from obtaining insurance, offering insights that could enhance outreach and enrollment strategies.

Effectiveness of Policy Measures: Assessing the effectiveness of policy interventions aimed at increasing health insurance coverage is essential. Analyzing the impact of national and state-specific schemes on reducing OOPE and improving healthcare access would provide valuable feedback on policy performance and areas requiring adjustment.

Cross-national Comparative Research: Comparative studies with countries sharing similar socio-economic profiles or successful universal health coverage implementations could provide valuable insights. Research may identify best practices and innovative policy interventions that could be adapted to enhance India's health insurance landscape.

Consumer Education and Behavioral Studies: Future research could also concentrate on the impact of consumer education programs on understanding health insurance. Behavioural studies examining how information dissemination influences insurance decisions could help refine communication strategies to make them more effective.

Innovations in InsurTech: It is essential to thoroughly investigate the role of technological innovations in enhancing the efficiency of claims processing and customer satisfaction. Focusing on technologies such as blockchain, AI in underwriting, and automated claims systems could clarify how technology can further streamline operations and reduce OOPE.

Development of Insurance Products: There is a clear need to explore the development of and response to new insurance products that cover areas traditionally excluded, such as outpatient care. This could help insurers align products more closely with the evolving healthcare needs of the population.

Socio-economic Impacts of Enhanced Insurance Penetration: Finally, understanding the broader socio-economic impacts of enhanced health insurance penetration—such as effects on poverty reduction, household financial stability, and overall health outcomes—would provide a comprehensive view of the benefits of expanding coverage.

By exploring these areas, future research can build upon the initial findings to significantly influence policy formulation and insurance product design and ultimately improve the health and economic stability of the Indian populace.

6.4 Conclusion

In this comprehensive dissertation, I have thoroughly examined the complex interplay between the penetration of health insurance and out-of-pocket expenses (OOPE) in Indian healthcare. The study has yielded invaluable insights into the various factors that impact the financial protection available to individuals when faced with health-related financial burdens. Through meticulous analysis of diverse data sources and methodologies, it has become evident that expanding health insurance coverage is critical in reducing the burden of out-of-pocket expenses and enhancing overall health outcomes for the population.

The research has shed light on several crucial areas that require immediate attention. Specifically, there is a pressing need for more excellent insurance coverage among the "missing middle" demographic. Additionally, integrating technological solutions to streamline claims processing and improving insurance literacy through targeted educational programs are identified as essential strategies. Addressing these areas is paramount for stakeholders seeking to significantly alleviate the financial strain of healthcare costs on Indian families and improve their access to essential medical services.

Furthermore, the implications derived from this research underscore the vital role of public initiatives and private-sector innovation in advancing the reach and efficiency of health insurance. Collaboration between these entities is indispensable in devising and implementing strategies that expand coverage and ensure that insurance products are tailored to meet the diverse needs of the Indian populace.

Looking ahead, the insights and recommendations presented in this dissertation must inform the actions of policymakers, insurance providers, and healthcare professionals as they strive to refine the healthinsurance landscape in India. The ultimate aim is to establish a more inclusive, efficient, and responsive healthcare system that shields every individual from the financial unpredictability of health emergencies, thereby fostering a healthier and more economically stable society.

APPENDIX A

SURVEY COVER LETTER

Factors Influencing Out-of-Pocket Expenses in Indian Healthcare

Thank you for taking the time to participate in this survey. The purpose of this survey is to understand and analyze various factors that influence out-of-pocket expenses in Indian Healthcare. Your responses will provide valuable insights into the challenges individuals face in managing their healthcare costs. Please answer the following questions to the best of your knowledge and experience. Your responses will remain confidential and will only be used for research purposes.

* Indicates required question

1. Gender *

Mark only one oval.

- ◯ Male
- ◯ Female
- ◯ Prefer not to say

2. Age *

Mark only one oval.

- ◯ 22 - 30
- ◯ 31 - 39
- ◯ 40 - 49
- ◯ 50 - 59
- ◯ 60 - 69
- ◯ 70 - 80
- ◯ > 81

3. Highest Education *

Mark only one oval.

- ◯ Doctorate
- ◯ Masters
- ◯ Bachelor
- ◯ High School
- ◯ No Formal Education

4. Employment Status *

Mark only one oval.

- ◯ Government
- ◯ Private
- ◯ Own Business
- ◯ Retired
- ◯ Unorganized Sector
- ◯ Home Maker

5. Annual Household Income *

Mark only one oval.

- ◯ < 3L
- ◯ 3L - 10L
- ◯ 10L - 25L
- ◯ >25L

6. Region where you live *

Mark only one oval.

- ◯ North
- ◯ South
- ◯ West
- ◯ East
- ◯ North East
- ◯ Central India

7. City where you live *

Mark only one oval.

- ◯ Metro
- ◯ Tier 2
- ◯ Tier 3
- ◯ Rural

8. Do you currently have health insurance policy? *

Mark only one oval.

- ◯ Yes
- ◯ No

9. What is the MAIN reason you did not buy individual Health Insurance? (Select all that apply) *

Check all that apply.

- [ ] The policy was too expensive
- [ ] You found out you were not eligible to buy the policy
- [ ] The deductibles / policy exclusion and/or copayments were too high
- [ ] You dont want to get a Health insurance coverage
- [ ] I have an existing Individual Policy

Health Insurance Awareness & Effectiveness that impacts Out-Of-Pocket Expenses

This section is for those who have an active health insurance policy to check the impact of effectiveness of the policy & awareness about the policy on the out-of-pocket expenses

10. What type of health insurance plan do you have? (Select all that apply) *

Check all that apply.

- [ ] Employer-sponsored health insurance
- [ ] Private Individual/family health insurance plan
- [ ] Government-sponsored health insurance (e.g., Ayushman Bharat)
- [ ] No Health Insurance available

11. How long have you been covered under your current health insurance plan? (Total number of years) *

12. What are the factors that you don't like in your health insurance plan? (Select all that apply) *

Check all that apply.

- [ ] Onboarding Process
- [ ] Claim Settlement Process
- [ ] Renewal Process
- [ ] Cashless Network
- [ ] Policy Exclusion & Deductibles
- [ ] Co Pay
- [ ] I don't have Health Insurance

13. On a scale of 1-10, rate your satisfaction with your current health insurance plan's coverage and benefits. (10 being the highest)

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Highly Satisfied

14. On a scale of 1-10, how well do you understand your health insurance plan's coverage and out-of-pocket costs?

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
No ι	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Complete Understanding

15. Are you aware of the specific factors that can influence your out-of-pocket expenses in your health insurance plan? *

Mark only one oval.

- ◯ Yes
- ◯ No

16. If yes, please specify the factors you are aware of.

_____

_____

_____

_____

_____

17. How much control do you feel you have over your out-of-pocket expenses in your health insurance plan? *

Mark only one oval.

- ◯ Complete Control
- ◯ Some Control
- ◯ Little Control
- ◯ No Control

18. In your opinion, which of the following factors have the most significant impact on out-of-pocket expenses in health insurance in India? (Rank from 1 to 5, with 1 being the most significant) *

Mark only one oval per row.

	1	2	3	4	5
Consumables & Non Medical Expense	◯	◯	◯	◯	◯
Co-payment/Co-insurance requirements	◯	◯	◯	◯	◯
Cashless Network restrictions (in-network vs. out-of-network providers)	◯	◯	◯	◯	◯
Coverage for specific treatments/conditions	◯	◯	◯	◯	◯
Government regulations and policies	◯	◯	◯	◯	◯

Out-Of-Pocket Expenses

This section is to capture information on the share of the medical costs you incur due to no health insurance or may include deductibles, copays, and coinsurance if there is health insurance

19. How would you describe your out-of-pocket expenses for healthcare services in the past year? *

Mark only one oval.

- ◯ Low - <1% of your annual income
- ◯ Moderate - 1% - 5% of your annual income
- ◯ High - 5% 10% of your annual income
- ◯ Very high - >10% of your annual income

20. What types of healthcare services have contributed the most to your out-of-pocket expenses? (Select all that apply) *

Check all that apply.

- ☐ Doctor consultations
- ☐ Specialist consultations
- ☐ Prescription medications
- ☐ Hospital stays
- ☐ Diagnostic tests (e.g., X-rays, blood tests)
- ☐ Surgical procedures
- ☐ Other

21. Have you ever delayed or avoided seeking healthcare services due to concerns about out-of-pocket expenses? *

Mark only one oval.

- ◯ Yes
- ◯ No

22. If you have delayed or avoided seeking healthcare services, please specify the reasons (If Yes for the above question)

Recommendations and Conclusion

23. Based on your experiences, what recommendations would you provide to improve the transparency and management of out-of-pocket expenses in health insurance in India? *

24. Is there any additional information or feedback you would like to provide regarding out-of-pocket expenses and health insurance in India?

Thank you for participating in this survey. Your input is greatly appreciated.

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