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A Study on Economic Impact of Contaminated Food Consumption to Medical Inflation in India

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Abstract: Supply of Contamination food in the market and consumption by the consumers or individual experience severe short-term and long-term diseases which hikes healthcare expenditure as a result demand of Pharmaceuticals [drugs] increases which is also called medical inflation. Furthermore, this article expresses how foodborne diseases drive up medical inflation and their economic impacts on individual, household and nation. Consumption of contaminated food contributes not only health related issues but it also exacerbates the socioeconomic disparities such as diminishes household savings, lowering productivity of individuals, intensifying healthcare inequity, increasing long-term health expenses, and raising out-of-pocket expenditure (OOPE). WHO director emphasized role of food regulators in combating unsafe food, which causes 600 million cases of foodborne diseases and 4,20,000 deaths annually. The study aims to analyze the link between contaminated food and rising healthcare cost, offering relevant strategic policy recommendations.

Keywords: ***Contaminated Food, Foodborne-Diseases, Healthcare Expenditure, and Medical Inflation, Health Insurance Schemes***

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I. Introduction

Worldwide, food poisoning has a major negative impact on both health and the economy. 420,000 people are thought to die and 600 million become unwell each year as a result of consuming tainted food. Unsafe food is expected to cost low- and middle-income nations US$110 billion in medical bills and lost productivity. With 125,000 deaths and 40% of the burden of foodborne illness each year, children under the age of five are disproportionately affected.

Foodborne diseases cause over 600 million illnesses worldwide annually, resulting in over 420,000 fatalities. These illnesses cost low- and middle-income nations $110 billion annually in lost productivity and medical costs. Children under five are particularly affected, with 125,000 deaths and 40% of the burden of foodborne illness occurring in them. The cost of foodborne diseases is estimated to be $90 billion annually, with an estimated 2.9 million illnesses in the US resulting in up to $20.3 billion in expenses. The economic impact of foodborne illnesses is particularly high in low- and middle-income nations due to the disproportionate effect on susceptible groups and the possibility of large epidemics. Cost-causing factors include direct medical expenses, lost productivity, decreased trade and tourism, recall costs, legal expenses, and reputational harm. To avoid foodborne illnesses, it is essential to teach customers safe food handling techniques and implement food safety measures at every stage of the food chain, from production to consumption.

There is a positive relationship between healthy food and healthy life, which means the consumption of healthy food results in healthy life for human beings. There is a famous saying that healthy food is the best medicine to keep our body healthy. Our ancestors had the experience of healthy food and a healthy long life where there is no money-mind business in the market among the producers and suppliers, which results healthy environment among the males, females, and children in the society. At present, almost every food items in a market contains different types of contaminants, such as mercury, arsenic, pesticides, herbicides, rodenticides, etc., which are harmful to humans' health and create short-term and long-term diseases. Therefore, consumption of contamination food directly impacts human health in terms of diarrhoea, fever, vomiting, stomach pain, abdominal cramps, food poisoning, kidney damage, weakening of the immune system, sugar, cancer, reducing life spans, etc. As the various diseases emerge, the demand for healthcare expenditure requirements increases, which results the cost of medical goods and services increasing in the market. This includes medications, healthcare services, hospital stays, and medical equipment, and it is known as the medical inflation. There may be some factors that impart the medical inflation, such as an ageing population, increased demand for high-quality healthcare, medical innovation, medical technological advancement, and higher labour costs. These factors are directly responsible for the price rises of medical goods and services, but the prevalence of diseases due to consumption of contamination food indirectly affects the price rise of these goods and services, and it has an adverse effect on the people contribute to medical inflation and creates negative economic impact of human life.

Table No:1.1.

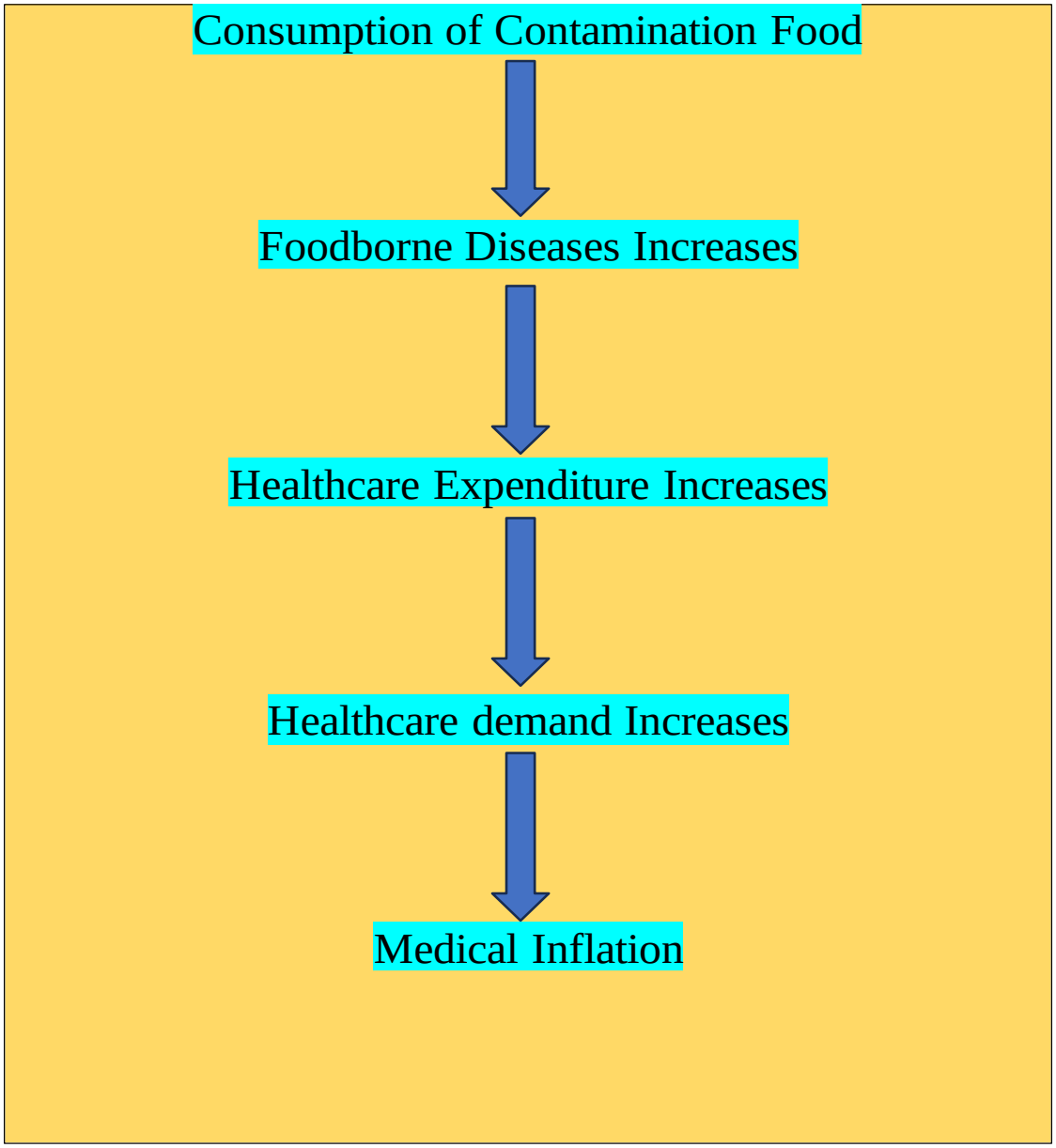
Data on Foodborne Diseases: ***Annual burden of foodborne disease in India (2010)***

	All ages	Five and above	Under five
Cases foodborne disease	**9,74,91,276**	**5,79,22,042**	**3,95,69,234**
Cases foodborne diarrheal diseases	**7,85,19,675**	**4,36,36,435**	**3,48,83,240**
Deaths foodborne disease	**1,17,174**	**87,844**	**29,330**
Deaths foodborne diarrheal disease	**64,227**	**43,922**	**20,305**
DALYs foodborne disease	**83,98,845**	**53,91,417**	**30,07,429**
DALYs foodborne diarrheal disease	**44,16,152**	**25,25,511**	**18,90,642**

Sources: FERG report and GOI census

The above table shows the burden of foodborne diseases in India out of the total cases of food borne disease 41% of them are under the age of five the remaining (69%) are above to five years of age. Total deaths due to foodborne diseases under five are around 26% and deaths due to diarrheal is 32% in the same age group. Children are affected due to foodborne diseases and the deaths are high compared to the data available. Many child deaths are un reported due to malnutrition and foodborne diseases in the country despite the efforts taken by the Central, State Governments along with the NGO and Child Welfare Unions all across the country. The following figure shows the consequences of consumption of contaminated food to Medical Inflation.

Figure



Objectives of the study

1. To study the relationship between contaminated food and medical inflation.
2. To describe the foodborne illnesses due to food contamination and their economic impact on individuals.
3. To provide a strategic policy to mitigate the consumption of contamination food and their negative impacts on individual, household and nation.

Limitations

1. The study is conceptual in nature
2. Subject to exploration of the concept Health Inflation

II. Literature Review

The 2024 study by K.R. Gopalan et al. explored the health risks of food adulteration in India, revealing its significant impact on public health. Contaminated food can lead to long-term health consequences such as acute poisoning, neurological damage, gastrointestinal problems, and even death. The majority of respondents were undergraduate students (58.57%), with 98.57% from metropolitan areas. Educational institutions play a crucial role in raising public awareness of food adulteration. 73.33% of respondents are aware of the growing prevalence of food adulteration, but a significant percentage lacks thorough information about adulterants in specific food items. Gender-based analysis showed that 38.10% of male respondents and 35.24% of female respondents are aware of the increased prevalence of food adulteration. The difference in awareness between urban and rural areas is noticeable, with only 1.90% showing the same level of awareness compared to 71.43% of respondents from urban areas. Stricter regulations, community outreach, and public health initiatives could bridge this gap and reduce the hazards of consuming tainted food. Food adulteration poses a significant threat to consumer health and safety, necessitating immediate action. Governments should implement strict laws, enforce enforcement strategies, and utilize AI-based technologies for real-time detection and blockchain for supply chain transparency. They should also focus on developing AI-driven detection systems and improving machine learning algorithms.

S. Poongavanam et al. (2023) Medical Inflation - Issues and Impact. This research has focus on medical inflation in the developing countries which increases the both unit cost and utilization cost leading to higher overall cost for healthcare. The study also reveals the factors determine the medical inflation in India such as rises of aging population, chronic diseases, high health insurance premium, Infrastructure and Hospital Expenses, and Fees Paid to Medical Professionals. It also highlights the significant increase in medical inflation about to 20% in 2022 compare to 9.2% in 2019 which shows the continue increase in healthcare cost and indicates a growing concern for healthcare affordability and this situation led to financial strain to individuals and families seeking medical care. At last, the study emphasizes the legal measures, ethical pricing, and effective government policies are needed to ensure the affordable healthcare services to individuals and households.

Khalid Salmeen Almaary (2023) Food-Borne Diseases and their Impact on Health. The paper highlighted critical issues of foodborne diseases and their effects on public health concern related to existent of antibiotic resistant bacteria in food. It finds foodborne diseases caused by common Foodborne Pathogens such as Clostridium perfringens, Listeria monocytogenes, Salmonella spp., Escherichia coli, and Campylobacter spp. And widespread of foodborne illnesses due to contaminated food handling practices, inadequate hygiene, and improper storage practices moreover bacteria are transmitted through farms,

slaughterhouses, food factories, and kitchens. Therefore, food safety remains significant challenges which have outbreaks impact on individuals, food industry and economies. The research exposes around 420,000 deaths, 50% of food-related diseases leading to nearly 2 million deaths occurs each year and $95.2 billion cost arise due to foodborne diseases in the low and middle-income countries. Eventually the study suggested the regulatory frameworks & food safety measures namely HACCP (Hazard Analysis Critical Control Point), Epidemiological surveillance system, improved food safety education, and strict regulatory policies are necessary to mitigate risks.

Mary Garvey (2019) Food Pollution: A Comprehensive Review of Chemical and Biological Sources of Food Contamination and Impact on Human Health. This research paper focused on the food pollution emphasizing chemical and biological contaminants that threaten to human health and food security. Chemical Contamination arises from agriculture, aquaculture, food, and packaging and disinfection processes, pesticides and heavy metals and persistent organic pollutants. Moreover, biological contamination includes Bacillus cereus, Listeria monocytogenes, Salmonella spp, etc. Food Pollution due to such contamination many illnesses are underreported and individuals suffers exacerbate disease transmission. The study addressing mitigation strategies such as enhanced surveillance, better sanitation practices, and stricter food safety regulations to ensure public health.

Irfan A Rather et al. (2017) The Sources of Chemical Contaminants in Food and Their Health Implications. The research discusses the prevalence of food contamination through naturally occurring substances or artificially introduced chemicals during food processing, packaging, transportation, and storage. Foodborne diseases emerge from chemicals contaminants from mild gastroenteritis to severe liver, kidney and neurological disorders. The study examines industrialization and globalization have worsened the food processing chain, leading to food contaminants has create severe health consequences it includes immune suppression, hormone disruption, reproductive abnormalities and carcinogenic effects. Furthermore, research gives preventive measures to tackle public health hazards issues like government regulate chemical limits in food through legal frameworks, following FDA prescribed pesticides limits in food, creating public awareness and regulatory actions on food contamination and food industry need to enhance transparency in food safety practices.

Alum et al (2016) Microbiological Contamination of Food: The Mechanisms, Impacts, and Prevention. According to this study contaminated food can lead to severe health issues, economic setbacks and harm to nationals and government reputations. It emphasizes on microbiological contamination food creates negative health consequences such as gastrointestinal issues, vomiting, fever, reactive arthritis, paralysis, kidney failure, and even death. Vulnerable populations include children, pregnant women, the elderly, and individuals with compromised immune systems. Moreover, it focused on impacts on economic due to foodborne illnesses notably financial losses due to high medical cost and expenses, recalls, legal actions, and also reduced consumer confidence in food products. Additionally, diseases arise from contamination food leads to fall of sales, fame damage for food companies, losses workforce productivity and possible business closure. And the study recommended the preventive and control measures such as proper handling, storage, and preparation protocols can mitigate the risk of foodborne diseases from microbiological contamination.

Robert L. Scharff (2020) studied Food Attribution and Economic Cost Estimates for Meat- and Poultry-Related Illnesses. Foodborne disease costs the US economy up to $90 billion annually, making understanding the costs of specific products or sets of products crucial for policymakers. This study calculates the cost of foodborne illnesses caused by 29 pathogens linked to U.S. Department of Agriculture-regulated nongame meat and poultry products using a combination of disease, economic burden of illness, and food attribution models. The food attribution model links foods to viruses based on expert elicitation data and outbreak data, while the economic cost model accounts for medical expenses, lost productivity, death, and pain and suffering. Meat and poultry products are estimated to be vectors for 30.9% of all foodborne

illnesses, resulting in 2.9 million illnesses annually and up to $20.3 billion in economic expenditures. Salmonella spp. in chicken and pork, Campylobacter spp. in poultry, and Toxoplasma gondii in pork are the most expensive food-pathogen pairs. Estimates of meat and poultry attribution range from 27.1 to 36.7%, with economic expenses ranging from $8.1 to $22.5 billion.

R. T. Gahukar (2014) opined that in India, food can be contaminated and adulterated, with prohibited colors being the most common additives. About 70% of deaths are food-borne, and contamination of everyday foods and milk is highly harmful and carcinogenic. The goal is to strengthen the regulatory system and prevent health problems by emphasizing food safety procedures. By educating individuals about health risks, food contamination and adulteration can be avoided. Food inspectors should be proactive in reducing food toxicity at every stage of the food supply and consumption process. Reducing fatal diseases and other health risks in India can improve communities' social life and lower the cost of health-related issues. Citizens should organize camps or campaigns to ensure safe food. The study found a lack of information about the relationship between food contamination and adulteration and its impact on human health, particularly in rural areas. Government monitoring organizations and awareness campaigns can warn of unintentional poisoning at the village level. Responsible organizations, such as the Indian Council of Medical Research and the All India Institute of Hygiene & Public Health, should conduct research and publish findings on the risk of human diseases caused by contaminated and adulterated foods.

Malik Altaf Hussain and Christopher O Dawson (2013) studied Economic Impact of Food Safety Outbreaks on Food Businesses. Microbiological food safety outbreaks are increasing due to globalized food trade, production, and supply systems. Food companies face pressure to meet global demand, leading to potential foodborne epidemics. These incidents can result in health issues and financial loss. The US economy is expected to lose $7 billion annually due to food safety incidents, including consumer notification, food removal, and lawsuit penalties. Other nations also experience similar losses due to corporate closures, lawsuits, lost markets, and decreased customer demand. To prevent unforeseen food scandals and financial losses, tangible measures are needed to increase food safety in domestic and international markets.

In 2020, M. Focker and H.J. van der Fels-Klerx conducted research on the use of economics to food safety. Food safety economics examines how economic actors in the food supply chain allocate limited resources and make decisions pertaining to food safety management. It sheds light on the financial ramifications of putting tainted food on the market, how to control and monitor food safety risks at a reasonable cost, how producers and consumers feel about these measures, and how to encourage farmers and producers to implement them. The report concluded that there are three primary parties involved: the government, consumers, and the agro-food sector. The agro-food sector bears the expenses of product recalls, control and monitoring procedures, and prevention, while consumers suffer from higher food costs and taxes. The government indirectly suffers from years of life lost or years lived with a disability due to decreased output and higher medical expenses. Food safety expenditures take up resources that could be used for public services or education. A Multi-Criteria Decision Analysis (MCDA) can be carried out to enable open policymaking and stakeholder engagement while accounting for disparate preferences and points of view. MCDA can incorporate economic factors like market impact, disease burden, and prevention costs, technical factors like ease of use or implementation, and social factors like consumer feelings about control measures. It promotes transparency in the development of efficient prevention, control, and monitoring programs and the formulation of relevant policies.

III. Burden of Long-term health cost

Food contamination like pesticide, nitrate, lead, aluminium, arsenic, fluoride, radon, mycotoxins, cadmium and etc, can result the long-term chronic diseases such sugar, diabetes and cancer etc, and its lead to increases the healthcare expenses for longer periods and the demand for such medical goods and services remains inelastic even prices are high on account of the prevalence of long term chronic diseases, the regular expenses on medical needs can creates a significant financial burden to individuals especially for low and middle income group of people additionally it becomes more challengeable to maintain the cost of living of the peoples which results they experience lower quality of life and correspondingly lessen contributions to economic development. Moreover, the burden of long-term health cost discourages the saving of the peoples rather than investment or other needs particularly among the lower- and middle-income group of population which mean the expenditure on healthcare consumption raises and hindering the socioeconomic development of the country. Therefore, the consumption of contamination food significantly contributes the long-term expenditure on medical needs and its leads to increase the prices of the pharmaceutical goods. Moreover the prolonged health cost lead to fatigue the families financially and emotionally especially in lower income group which is often leads to force them to compromise in nutrition, education and other essential needs, furthermore the existent of of unsafe or additives foods in the market are highly consumed by uneducated individuals whose belong to low- income group, rural population and marginalized communities on account of lack of education and awareness about the diseases and preventive measures so they get suffers in chronic diseases such as diabetes, sugar, and heart disease and struggle to afford medications but the educated and higher income group of individuals are more likely to seek timely care and conserve themselves from contaminated food therefore due to the education gap in the society the burden of prolonged health cost increases and infer that due to lack of education and awareness regarding the food contamination significantly contribute the prevalence of diseases and thereby increasing the medical services and driving up medical inflation.

Table 3.1: Cost of foodborne disease in India: value of a statistical life approach

Deaths from foodborne disease	*Average value of a statistical life*	*Cost of foodborne disease*
117,174	360,928	42,291,239,670

Courtesy: Zuzana Smeets Kristkova (Wageningen Economic Research) Delia Grace (ILRI) Marijke Kuiper (Wageningen Economic Research)

Human capital approach – lost GDP

Foregone output is an income-based method used to estimate the loss of life, comparing the current value of lost lifetime earnings with the monetary cost of early death. The human capital approach can be used to calculate the value of DALYs lost due to FBD. The estimated cost ranges from $12 to $56 billion, based on FERG estimates for 2010 mortality and World Bank per capita data for 2010. The friction technique, which yields significantly lower costs, is also employed by other economists.

Table 3.2: Cost of foodborne disease in India: human capital approach

DALYs from foodborne disease	*USD 2010*	*Cost of foodborne disease*
8,609,179	1,387 GDP	11,948,507,193
	1,680 per capita income	14,463,420,720
	6,490 per capita income ppp adjusted	55,873.571,710

Courtesy: Zuzana Smeets Kristkova (Wageningen Economic Research) Delia Grace (ILRI) Marijke Kuiper (Wageningen Economic Research)

a) Healthcare Inequity

The existent supply of contamination food in the market also the cause of inequity in healthcare. The food borne diseases make peoples ill-health which leads to increase the demand for such healthcare goods and services and it drives up the medical inflation, this inflation creates a disparity in different population groups such as economic class disparity, Rural and urban divide and urban poor and rich divide.

1. **Economic class disparity:** Low income group of people likely to purchase low quality or cheap products from the market which contain harmful additives like artificial colours in sweets, detergent in milk, and formalin in fish which result the diseases emerge among these group and they cannot afford to take proper treatment so they remain ill-health and consumes unprescribed medicines from local shops which lead to weakness among these group increases and after a long time they suffer in severe diseases and leading to chronic diseases and financial strained. Therefore, this scenario becomes cause to rise the demand and prices of medical goods and they again trap into medical inflation.
2. **Rural vs Urban Divide:** Urban areas has more healthcare facilities compared to rural areas, rural people suffers in health burden on account of contaminated food more prevalent in rural areas with weak regulatory and surveillance, contaminated food in rural areas occurs due lack of infrastructure like cold storage facilities and moisture proof silos are often outdated or unavailable, it results food contamination by insects, rodents and Mold which lead to bring down the safety and quality of products or foods. Additionally, the farmers in rural areas may use excessive pesticides to protect crops without understanding the safe limits, which lead to the toxic pesticide residue remain in vegetables, fruits, and grains as a result of that long term health issues arises like neurological problems, hormonal imbalance, etc. Thereby health issues increases which lead to medical burden raises but regrettably due to poor infrastructure and limited access to quality healthcare the rural people often avoid or delayed the medical care due to high cost, distance and mistrust of public hospitals.
3. **Urban poor vs Urban Rich:** even in urban areas, the poor population groups who lives in slum areas and daily wage earners are dependent on low quality foods which are adulterated or poorly stored, because of they cannot afford to organic products, certified food like wealthier they go for low quality foods which are contamination food as the result foodborne illnesses increases like diarrhea, typhoid, and cholera become more frequent. This shapes dual health system where poor suffers and rich avoid these problems.

These disparities contribute the uneven burden to public healthcare system. Moreover, the healthcare inequity is not just a health issues but also a structural problem in an economy. It augments the existing social inequalities and leaves the underprivileged group in a constant cycle of poor health and poverty. Addressing this challenge not only about food safety reforms but also required equitable investment in healthcare system.

IV. Increased Out of Pocket Expenditure (OOPE)

When contamination food drives up the medical inflation it affects the peoples especially for the underprivileged group of people, when medical expenses increase due consumption of contamination food out of the pocket expenditure for individuals increases especially for recurring illnesses, hospitalization, doctor consultations, test and other medications and leads to contribute the medical inflation. This severely affects the lower- and middle-income families force them further into poverty, according to NITI Aayog report 7% of India's population about to 10 crore people are pushed into poverty line annually due to more spend on healthcare expenditure. Increased Out-of-Pocket Expenditure on healthcare not only drives individuals into poverty but also forces them into debt and reduces their capacity to save. This in turn into undermines their overall well-being and traps them in a cycle of poverty, leading to a significant decline in their standard of living. Furthermore, increased Out-of-Pocket Expenditure on healthcare indirectly reduces the household savings and it directly effects on children education, and decreases the consumption of essential goods leading to decelerate the overall economic growth. When household families significantly spend their potion of income on healthcare on regular basis it reduces their capability to buy nutrition food as a result of this widespread of malnutrition among children and pregnant women, and malnutrition further increases susceptible to illness which lead to creating a cycle poverty where hard to escape for low- and middle-income families. It's true that government hospitals provide free treatment and charge minimum amount for some treatments like X-ray, CT-Scan, and for severe operation, while private hospitals charge huge amount for the same treatment but due to inadequate infrastructure facilities, overcrowd and mistrust of public hospitals people often compelled to seek treatment at private hospitals during casualty even though these facilities charge significantly higher fees. Though India has various government health insurance schemes like Ayushman Bharat, The Rashtriya Swasthya Bima Yojana (RSBY), etc., due to lack of awareness, complex procedures, financial constraints and limited coverage shows large section of population remains uninsured and underinsured. Even those with insurance often face exclusions on some treatments like diagnostic, chronic illness, etc., this leads to makes household people's out-of-pocket expenses unavoidable. Therefore, high out-of-pocket expenses on healthcare shows high demand of medicines, hospitalization and so on which lead to prices of such medical goods increases.

A) Low productivity and economic growth

Economic growth is very crucial to a country's development progress and people welfare and economic growth take place only when the people of a country are healthier. The supply of contamination and additives products in the market force to low-income group of people to buy and consume contamination food Which lead to foodborne illnesses increases among them, the demand for healthcare expenditure increases as a result medical inflation rises. This process not only affects the price of Pharmaceuticals but also the productivity of country's people, when individual consumes contaminated food, they suffer in both short-term and long-term health consequences which result reduces the productivity of individuals especially of workers. Symptoms like fever, vomiting, nausea, dehydration may lead to individuals miss their works for several days or even weeks, those workers are daily wage earners or works in informal sectors they loss income even in a short-term absence and it reduces the overall output in agriculture and manufacturing sector. Additionally, the chronic diseases due to consumption of contamination food like neurological disorders, kidney or liver damage and cancer lead to unable to perform mentally and physically in work places as a result forced to reduce working hours or too early retirement. Moreover, the foodborne illnesses are more susceptible to

frequent infections and also reduces the immune system among children's and elders this reduces the academic performance and reduce school attendance of children's, these children are likely to enter adulthood life with lower cognitive capacity and physical health which lead to reducing their working potential as productive workers in the economy. Mental health issues due to stress, anxiety and depression on account of constant caring for sick family members makes individuals demotivation and reduces the focus on job performance. Therefore, health complications from consumption of contaminated food leads to reduces a person's ability and work efficiently whether through reduced stamina, long-term disability, or absenteeism which results is lower productivity at individual, household, and even in national levels. This in turn becomes a challenge and barrier to sustained economic growth and development in the country.

Policy Suggestions

1. Improve the public health infrastructure in rural and urban area, it includes hospitals, clinics, laboratories, and emergency response system.
2. Implement and enforce laws to ensure the food sold and consumed is safe, hygienic and free from contamination.
3. Government should make health insurance schemes affordable and accessible to all section of society, especially for poor and informal sectors workers.
4. Authorities should conduct health literacy campaigns, especially in rural areas about health issues due to contamination food, and available health services to enable informed health decisions

V. Conclusion

The study explored the relationship between consumption of contamination food and medical inflation. Regular consumption of contaminated food leads to widespread of diseases as a result demand for healthcare products and services increases which drive up medical inflation. Moreover, foodborne illnesses not only affect the demand and prices of healthcare products and services but also effects on socioeconomic conditions of individuals such as burden of long-term health cost, healthcare inequity, increased Out-of-Pocket Expenditure (OOPE) and low productivity and economic growth. The effect of contaminated food on medical inflation remains largely ignored due to its indirect influence on health expenditure. Hence the proposed policy will help to resolve this issue such improved healthcare infrastructure, implementing and enforcing of laws to ensure food safety, make healthcare insurance schemes affordable and accessible and conduct health literacy campaigns in rural areas. Despite the fact that, there are insurance schemes for Ration card holders in few states which are offering corporate level treatment in all kinds of hospitals without charging a single penny, lack of awareness and farness to the hospitals which provide free treatment makes the people to approach nearest hospitals and they go on spending huge money for medical treatment. At the same time zonal level food department official increase their manpower and do regular visits to hotels which serve food and quality checks to be carried out time to time.

Awareness about the schemes of states and central government regarding medical insurance has to be done until everybody come to know through various means like social media, Television and Radio and NGO and other stakeholders in the society too should spread the Awareness about Medical Health Insurance Schemes for Poor and Middle class.

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