Global Life Expectancy Analysis (2000-2019): Insights from World Bank Data

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Introduction

Life expectancy serves as a crucial indicator of a population's overall health and quality of life, reflecting the impact of healthcare systems, economic stability, and social conditions. Over recent decades, global life expectancy has seen significant improvements, rising from 65 years in 1990 to approximately 73 years in 2019 (World Health Organization, 2021). Despite these advancements, substantial disparities persist between high-income and low-income regions. For instance, while countries like Japan and Switzerland boast life expectancies over 84 years, some low-income nations still report life expectancies below 65 years (World Bank, 2023).

By analyzing life expectancy data, we can uncover significant patterns and disparities that reveal much about the progress and challenges faced by different regions and communities.

To explore these relationships in detail, we will utilize the dataset available on Kaggle : Life Expectancy and Socio-Economic Data, sourced from World Bank dataset. This dataset provides a comprehensive view of life expectancy alongside various socio-economic indicators, including sanitation, undernourishment, unemployment, corruption, GDP per capita and health expenditure for 200 countries from 2000 to 2019.

By employing descriptive and prescriptive analytics techniques, we aim to identify trends, draw comparisons, and provide actionable insights into how sanitation, undernourishment, and health expenditure impact life expectancy across different countries and over time. Also, we are trying to do a case study on socio-economic factors that has affected life expectancy of India over the years.

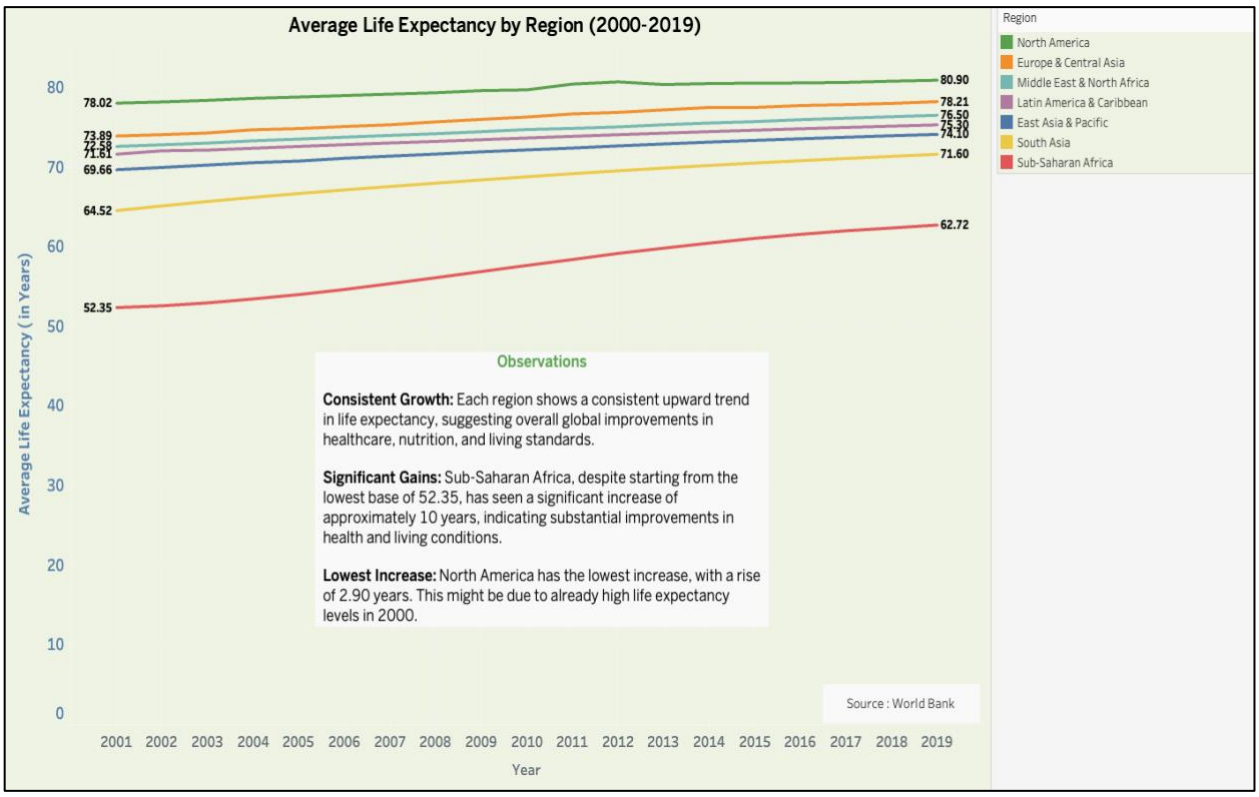
Descriptive Analysis using Visualizations

The discussed Kaggle dataset was downloaded and loaded into Tableau for visualizing the data to derive insights. In this section, we will discuss the insights from the plotted graphs, Maps to understand the life expectancy and its influencing factors.

1. Average Life Expectancy Analysis by Region:

The Average life expectancy across the region was plotted to understand how the life expectancy varies and has been improved over the 20 years.

Figure 1



The chart includes data for seven regions: North America, Europe & Central Asia, Middle East & North Africa, Latin America & Caribbean, East Asia & Pacific, South Asia, and Sub-Saharan Africa.

Insights:

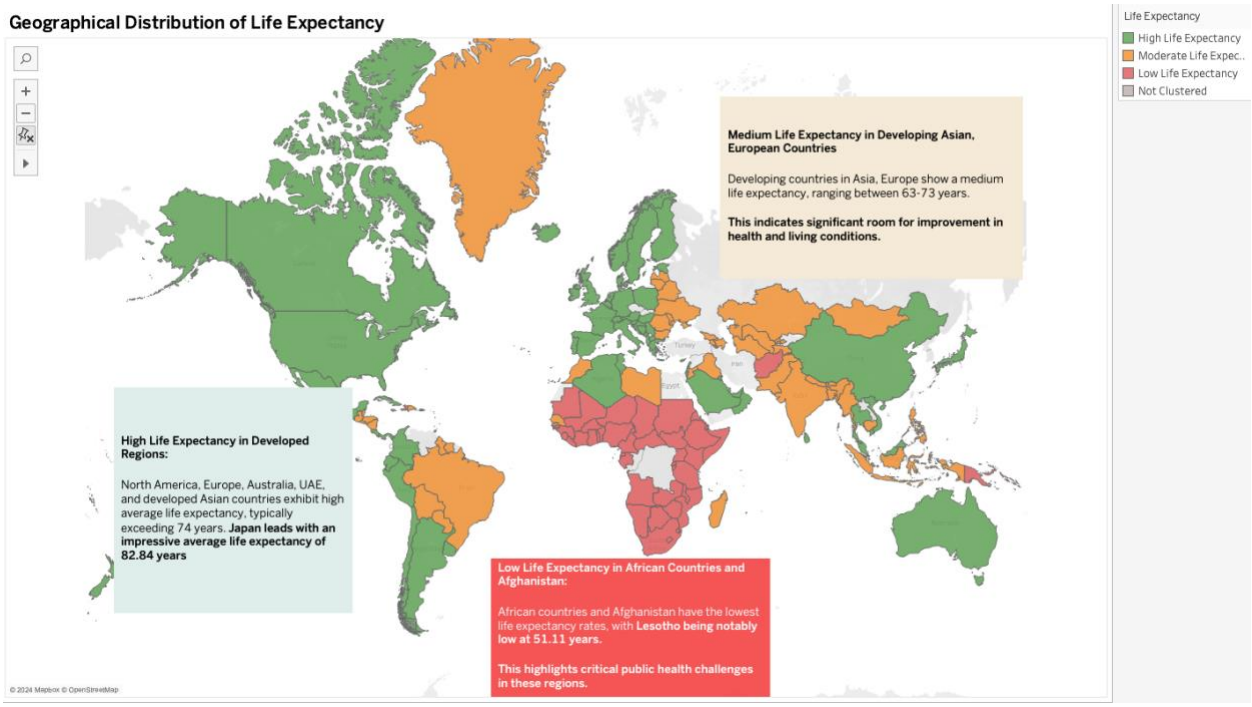
- **Significant Gains:** Sub-Saharan Africa, despite starting from the lowest base, has seen a significant increase of 11.65 years, indicating substantial improvements in health and living conditions.
- **Lowest Increase:** North America has the lowest increase, with a rise of 4.90 years. North America has the highest life expectancy, consistently around 80 years. This might be due to already high life expectancy levels in 2000.
- **Regional Disparities:** There are noticeable disparities in life expectancy improvements, reflecting different health, economic, and social advancements across regions.
- **Consistent Growth:** Each region shows a consistent upward trend in life expectancy, suggesting overall global improvements in healthcare, nutrition, and living standards.

Summarizing, Over the past 20 years, global life expectancy has generally increased, with significant regional variations. These trends reflect broader global improvements in healthcare, nutrition, and living standards, although disparities in life expectancy improvements remain evident across different regions.

2. Average Life Expectancy Analysis by Region:

The chart provides a visual representation of life expectancy across different countries and clustered over life expectancy. Here are the key insights:

Figure 2



Insights

1. **Contrasting Life Expectancy in Developed and Developing Regions:**

    - Life expectancy varies significantly across regions, with developed areas like North America, Europe, Australia, the UAE, and developed Asian countries typically exceeding 74 years. Japan stands out with an impressive average life expectancy of 82.84 years.
    - Developing countries in Asia and Europe show medium life expectancies between 63-73 years, indicating substantial room for improvement in health and living conditions.
    - In contrast, African countries and Afghanistan have the lowest life expectancy rates, with Lesotho notably low at 51.11 years, underscoring critical public health challenges in these regions.

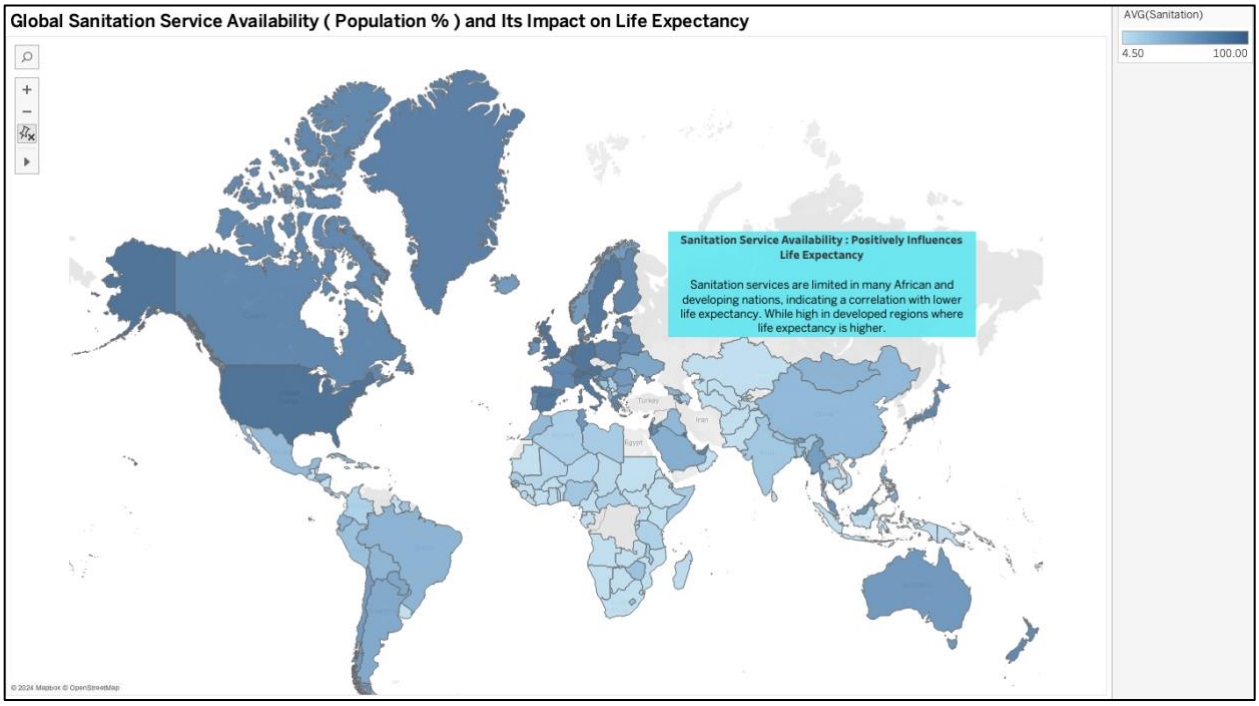
2. **Impact of Socio-Economic Factors:** The clustering pattern suggests that socio-economic factors, including income levels, education, and access to healthcare, play a significant role in determining life expectancy. Developed countries with robust economies and healthcare systems tend to have higher life expectancies.

Concluding, the map provides a clear geographical overview of life expectancy disparities, emphasizing the need for targeted health interventions and policies in regions with lower life expectancy.

3. Global Sanitation Service Availability and Its Impact on Life Expectancy

The chart visually represents life expectancy across various countries, clustered by the percentage of people with access to sanitation services. Here are the key insights:

Figure 3



Insights:

1. **Sanitation Service Availability Positively Impacts in life expectancy:**
    - Countries in North America, Europe, such as the United States, Canada, Australia, and most of Western Europe, are shaded in dark blue. This indicates a high availability of sanitation services, which contributes to higher life expectancy.
    - Countries such as Brazil, China, and some Eastern European nations are shaded in lighter blue. These countries have moderate levels of sanitation service

availability, reflecting their status as emerging economies with ongoing improvements in infrastructure.

- Many African countries and some parts of South Asia are shaded in very light blue, indicating low availability of sanitation services. This correlates with lower life expectancy in these regions, underscoring the importance of sanitation in improving public health outcomes.

2. **Intra-continental Disparities:**

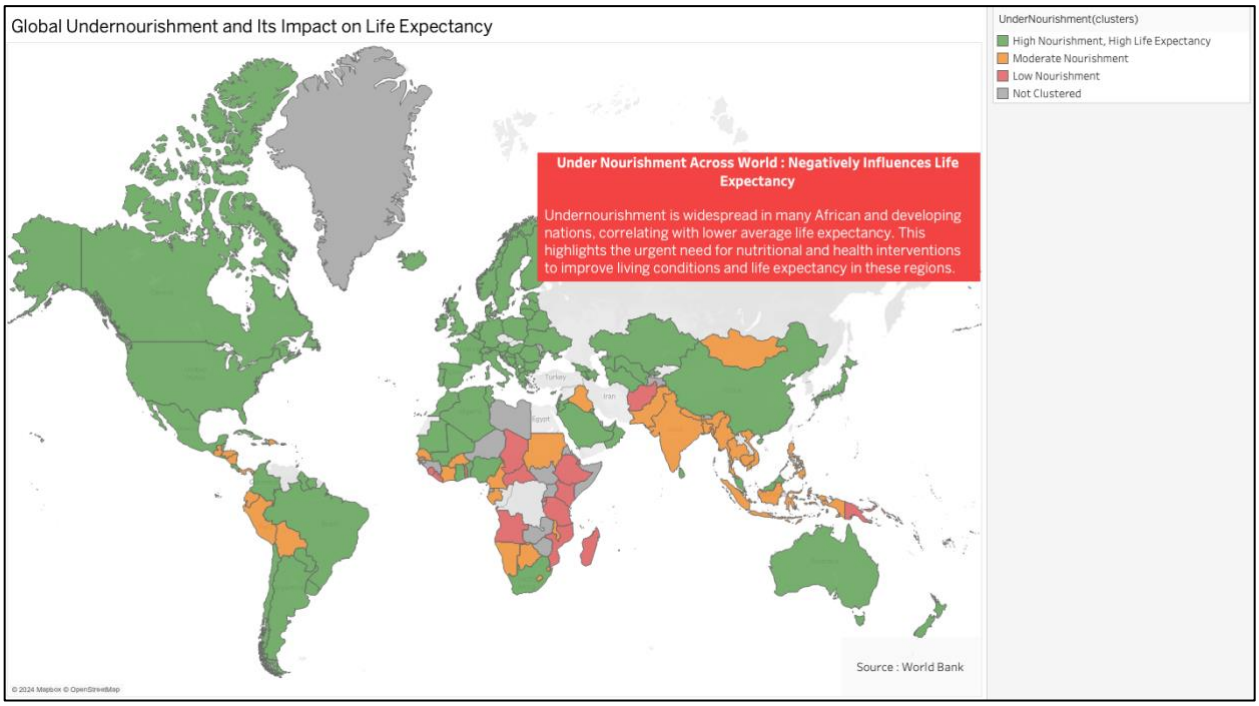
- Africa shows significant variation, with some countries like South Africa having better sanitation services compared to others. This highlights the need for targeted interventions within the continent to address these disparities. In South America, countries like Argentina and Chile have better sanitation services compared to others like Bolivia and Paraguay.

Key insights include the correlation between better sanitation availability and higher life expectancy, highlighting the impact of sanitation on public health.

4. Global Undernourishment and Its Impact on Life Expectancy

The chart illustrates global undernourishment levels and their impact on life expectancy. It reveals how countries with higher undernourishment tend to have lower life expectancy. The data underscores the critical link between nutritional status and overall health outcomes.

Figure 4



Insights:

1. **Undernourishment Positively correlates with Life Expectancy:**

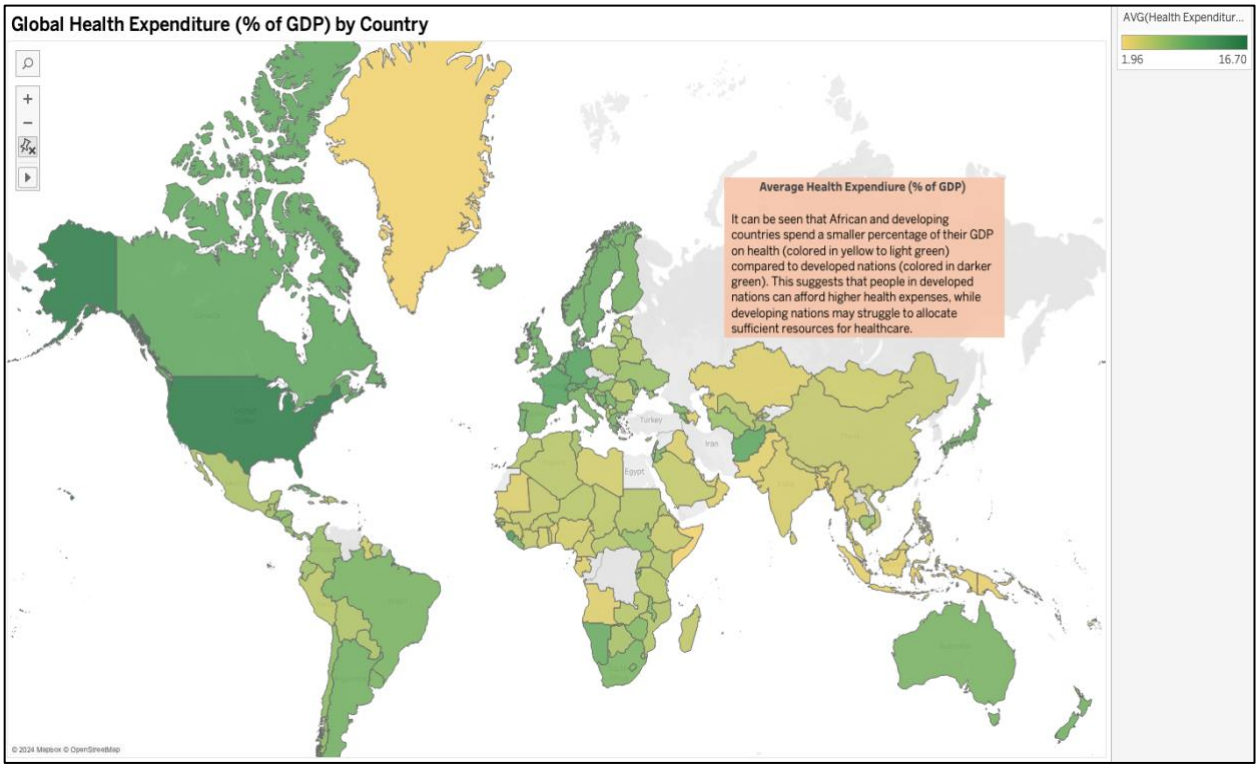
- **Low nourishment and Low Life Expectancy (Cluster 1 - Red):** African countries, including several in Sub-Saharan Africa, show high levels of undernourishment and correspondingly low life expectancy. Some countries in South Asia, such as India, and parts of Southeast Asia also fall into this category.
- **Moderate Undernourishment (Cluster 2 - Orange):** Some countries in Africa and Asia are moderately affected by undernourishment, indicating progress but still facing significant challenges.
- **High nourishment and High Life Expectancy (Cluster 3 - Green): Most developed** nations in North America, Europe, and parts of Asia and Oceania show low levels of undernourishment, correlating with higher life expectancy. This includes countries like the United States, Canada, most of Europe, and Australia.

Overall, the clusters highlight a significant disparity in undernourishment and life expectancy globally. While developed nations experience low undernourishment and high life expectancy, many African and South Asian countries still struggle with high levels of undernourishment and lower life expectancy.

5. Global Health Expenditure (% of GDP) by Country

The chart presents global life expectancy across various countries, segmented by health expenditure as a percentage of GDP.

Figure 5



Insights from Figure-5:

1. **Health Expenditure Positively impacts life Expectancy:** Countries in North America, Europe, and Oceania, such as the US, Canada, and Australia, show high health expenditure, indicating robust health infrastructure. Emerging economies like Brazil and China have moderate health spending, reflecting ongoing healthcare investments. In contrast, many African and some Asian countries exhibit low health expenditure, highlighting limited healthcare resources and broader socio-economic challenges.
2. **Variation within Continents:**
    - Africa shows a stark contrast between countries, with some nations like South Africa spending relatively more on health (light green) compared to others (yellow), highlighting intra-continental disparities.
    - In South America, there's a gradient from higher spending in the south (e.g., Argentina) to lower spending in the north.

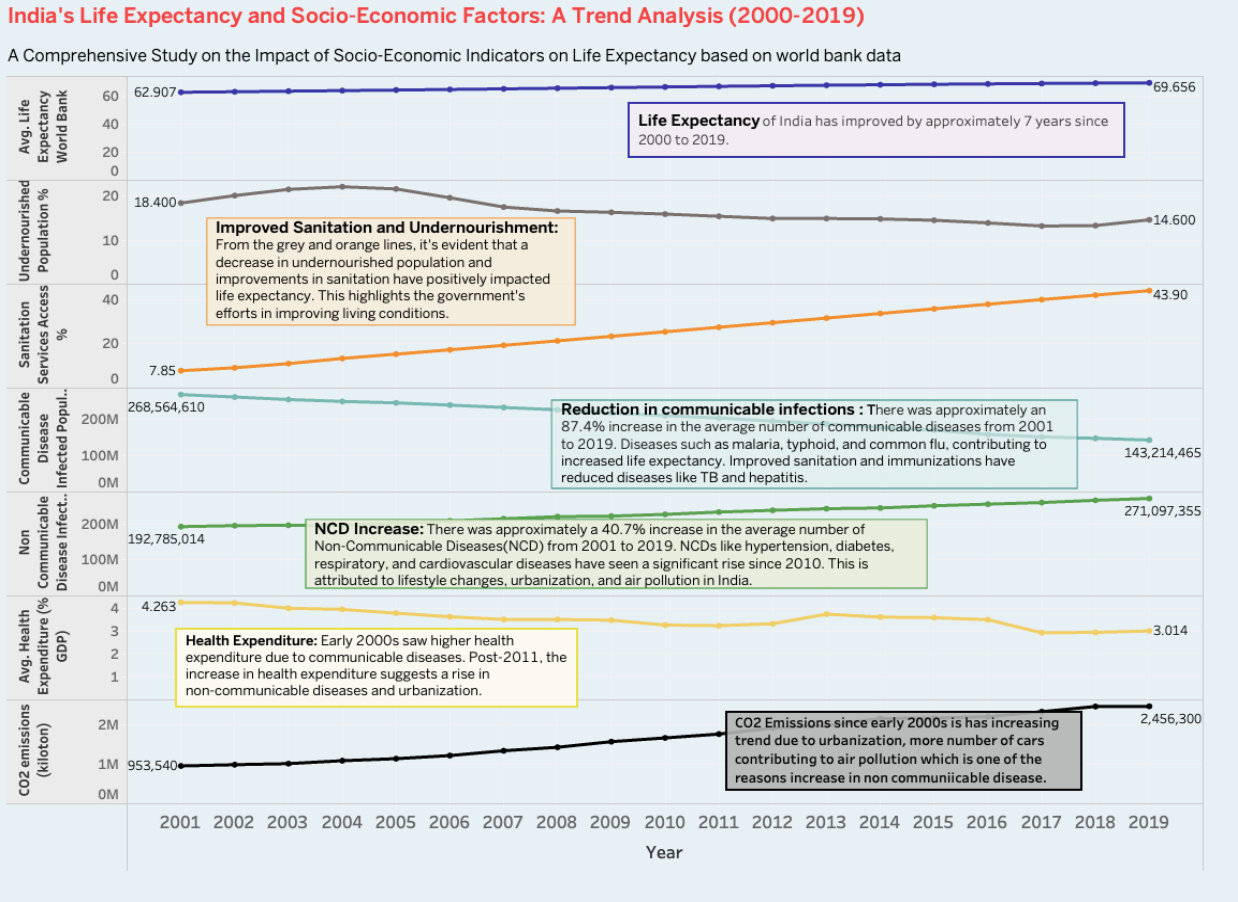
Thus, the chart emphasizes the positive impact of financial investment in healthcare on life expectancy. This highlights that people in developed nations can afford higher health expenses, while developing nations may struggle to allocate sufficient resources for healthcare.

A Comprehensive Study of India's Life Expectancy and Socio-Economic Factors

India's life expectancy has witnessed significant improvements over the past two decades, reflecting broader socio-economic advancements and public health initiatives. The period from 2000 to 2019 has seen life expectancy in India increase by approximately 10 years, a testament to various contributing factors.

Based on the factors discussed so far, the chart the has been plotted to understand the trends of socio-economic factors that influenced the life expectancy. Also, in this section we will discuss India’s health policies between 2000 and 2019, that focused on improving rural healthcare, sanitation, maternal and child health, and expanding vaccination programs, led to significant improvements in life expectancy.

Figure 6



Key Observations from Figure-6:

1. **Reduction in Undernourishment:** One of the primary drivers of increased life expectancy in India has been the substantial decrease in the percentage of the undernourished population. Government's schemes in improved food nutrition for unprivileged, and economic growth have collectively contributed to better nutritional outcomes for the population.
2. **Improved Sanitation Facilities:** Access to improved sanitation facilities has had a profound impact on public health. Efforts such as the Swachh Bharat Abhiyan (Clean India Mission) have been instrumental in reducing the spread of communicable diseases and improving general health conditions, thereby boosting life expectancy.
3. **Control of Communicable Diseases:** India has made considerable progress in controlling diseases such as malaria, typhoid, and tuberculosis. The expansion of immunization programs and better healthcare infrastructure have played critical roles in reducing the spread and mortality from these diseases.
4. **Rise in Non-Communicable Diseases (NCDs):** While communicable diseases have seen a decline, there has been a notable increase in non-communicable diseases like hypertension, diabetes, and cardiovascular ailments. This shift reflects changes in lifestyle, urbanization, and increased exposure to pollution. Despite this rise, the overall

life expectancy has continued to improve, thanks in part to better disease management and healthcare access.

5. **Healthcare Expenditure:** Increased healthcare expenditure has improved the quality and accessibility of medical services across the country. Early investments were primarily directed towards combatting communicable diseases, but recent trends show a towards managing NCDs and enhancing urban healthcare facilities.
6. **Environmental Factors:** Urbanization has increased CO2 emissions and air pollution, which are linked to respiratory and other NCDs. However, efforts to mitigate these impacts through environmental policies and initiatives to reduce vehicle emissions are underway.

India's Health Policies: Impact on Life Expectancy

Below policies demonstrate the critical role of comprehensive public health strategies in improving life expectancy and overall population health.

Sanitation:

- **Policy:** India launched the Total Sanitation Campaign (TSC) in 1999, which was later restructured as the Nirmal Bharat Abhiyan (NBA) in 2012, aimed at eliminating open defecation and promoting hygiene in rural areas.
- **Impact:** Improved sanitation reduced waterborne diseases and infections, contributing to a decline in child mortality rates and a rise in life expectancy.

Healthcare Accessibility:

- **Policy:** The National Rural Health Mission (NRHM), launched in 2005, aimed to increase access to healthcare in rural areas by improving infrastructure, human resources, and service delivery.
- **Impact:** Enhanced healthcare accessibility led to better maternal and child health outcomes, significant reductions in mortality rates, and an overall increase in life expectancy.

Immunization:

- **Policy:** The Universal Immunization Programme (UIP) was expanded during 2000s, targeting preventable diseases such as polio, measles, and diphtheria.
- **Impact:** Increased immunization coverage significantly reduced child mortality rates from vaccine-preventable diseases, contributing to an increase in life expectancy.

Tobacco Control:

- **Policy:** In response to a 54% of tobacco(smoking & chewing) users in 2000, India enacted the Cigarettes and Other Tobacco Products Act (COTPA) in 2003, ratified WHO's Framework Convention on Tobacco Control in 2004, and banned tobacco ads on

state-controlled media. Tobacco control also became a priority under the National Rural Health Mission. Further, implemented stringent tobacco control measures, including taxes, advertising bans, and public smoking restrictions.

- **Impact:** These policies contributed to a reduction in smoking rates, which in turn led to declines in tobacco-related diseases such as lung cancer and heart disease. Smoking prevalence dropped from 54% in 2000 to 28.1% in 2019.

Summarizing, the increase in life expectancy in India is a complex interplay of improved nutritional status, better sanitation, effective control of communicable diseases. While challenges remain, particularly in managing the chewing tobacco risks, rise of lifestyle-related health issues and environmental impacts, the overall trend towards longer life expectancy highlights the successes of India's socio-economic and health policies. The continuation of these efforts is essential to sustain and further improve the health and well-being of India's population.

Regional Health Programs Comparison: South-East Asia Vs African Countries

Yes, differing health policies in African and Asian countries between 2000 and 2019 had significant impacts on life expectancy. Here's how various policies influenced outcomes in selected countries:

African Countries:

1. **Botswana:**
    - **Policy:** Botswana implemented one of the most comprehensive HIV/AIDS treatment programs in Africa, including widespread access to antiretroviral therapy (ART).
    - **Impact:** This policy led to a dramatic decrease in AIDS-related deaths, which significantly improved life expectancy. By 2015, life expectancy in Botswana had rebounded after a severe decline due to the HIV/AIDS epidemic.
2. **Rwanda:**
    - **Policy:** Rwanda invested heavily in its healthcare system, focusing on maternal and child health, vaccination campaigns, and community-based health insurance (Mutuelles de Santé).
    - **Impact:** These policies led to substantial reductions in child and maternal mortality, contributing to a sharp increase in life expectancy from 49 years in 2000 to 64 years in 2015.
3. **Ethiopia:**
    - **Policy:** Ethiopia implemented the Health Extension Program (HEP), which focused on deploying community health workers to provide essential healthcare services in rural areas.
    - **Impact:** The HEP led to improvements in maternal health, immunization rates, and disease prevention, contributing to a significant increase in life expectancy from 52 years in 2000 to 64 years in 2015.

Asian Countries:

1. **Thailand:**
    - **Policy:** Thailand introduced Universal Health Coverage (UHC) in 2002, making healthcare accessible to nearly all citizens and reducing out-of-pocket expenses.
    - **Impact:** This policy contributed to reductions in mortality rates from preventable diseases and increased life expectancy from 71 years in 2000 to 75 years in 2015.
2. **China:**
    - **Policy:** China expanded its healthcare coverage under the New Rural Cooperative Medical Scheme (NRCMS) and Urban Employee Basic Medical Insurance (UEBMI).
    - **Impact:** The expansion in coverage and access to healthcare services led to declines in infant and maternal mortality rates and an increase in life expectancy from 71 years in 2000 to 76 years in 2015.
3. **Vietnam:**
    - **Policy:** Vietnam focused on improving primary healthcare, maternal and child health, and infectious disease control through widespread vaccination campaigns.
    - **Impact:** These policies led to significant improvements in public health, reducing mortality rates and increasing life expectancy from 70 years in 2000 to 76 years in 2015.

Key Differences in Policies and Outcomes:

- **Focus on HIV/AIDS in Africa:** Countries like Botswana and Rwanda prioritized HIV/AIDS treatment and prevention, directly impacting life expectancy by addressing a leading cause of mortality.
- **Universal Health Coverage in Asia:** Countries like Thailand and China focused on expanding access to healthcare through UHC, which led to improvements in life expectancy by reducing mortality from a range of diseases.
- **Community-Based Healthcare in Africa:** Programs like Ethiopia's Health Extension Program, which targeted rural populations, significantly contributed to increased life expectancy by providing essential health services to underserved areas.
- **Primary Healthcare and Vaccination in Asia:** Vietnam's focus on primary healthcare and infectious disease control through vaccination significantly reduced mortality rates, contributing to higher life expectancy.

Insights:

Differing health policies tailored to the specific health challenges of African and Asian countries led to varied outcomes in life expectancy between 2000 and 2019. In Africa, the focus on HIV/AIDS treatment and community health initiatives played a crucial role, while in Asia, the expansion of universal healthcare and vaccination campaigns were key drivers of life expectancy improvements.

Action items based on Analysis:

Based on the insights from visualizations and the case study on India, policies that helped countries improve the health, emphasizes that Sanitation**,** undernourishment, and health expenditure are critical socio-economic factors influencing life expectancy. Based on geographical data, it's evident that South Asia, Africa, and developing countries of Europe are still in need of adequate resources to upgrade their life with proper sanitation, nutrition and healthcare. Here are the prescriptions for authorities to improve the health of the people in these nations:

1. **Enhance Sanitation and Nutrition:** Investments in sanitation and nutrition are critical, particularly in regions with low life expectancy, to reduce disease and malnutrition.
2. **Implement Targeted Public Health Programs:** As discussed in Regional Health Programs Comparison, it's important to focus on diseases and health issues prevalent in low life expectancy regions, such as infectious diseases in Sub-Saharan Africa and malnutrition in South Asia.
3. **Accessible Health Systems:** Develop robust health systems with better access to healthcare services, medical supplies, and trained health professionals.
4. **Increase Health Expenditure:** Developing countries should prioritize increasing their health expenditure as a percentage of GDP to improve healthcare infrastructure and access.
5. **International Support and Collaboration:** Encourage international aid and collaboration to provide financial and technical support to the most affected regions, ensuring sustainable health improvements.

Conclusion

According to WHO, Effective sanitation reduces the incidence of waterborne diseases, contributing to longer life spans. improved sanitation can cut diarrhea rates by up to 40%. Based on Global Hunger Index, Undernourishment affects life expectancy by impairing growth and immunity, leading to higher disease susceptibility and mortality. Countries grappling with high malnutrition rates often face lower life expectancies. World Bank research emphasizes that Health expenditure enhances life expectancy by improving access to medical care and infrastructure. Nations that allocate more resources to healthcare typically achieve higher life expectancies. Also, nations should implement targeted health programs to address issues prevalent in the region. By adopting these actions, countries can work towards reducing disparities in life expectancy and enhancing global health outcomes.

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