Final Project Report

Health Spending, Service Access, and Substance Abuse: A Comparative Visualization Study

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# Introduction

Mental health is an important need for every person, yet it still grapples to get the attention it deserves to get. While millions suffer with numerous mental health conditions along with substance abuse addictions, many don't have access to the support they require. This could be due to various factors like limited health services, a shortage of trained professionals, and low investment in mental health care especially in low- and middle-income countries.  
Globally, the rising burden of mental illness and substance abuse has exposed serious gaps in the health system especially with the availability and quality of mental health workers. While the government and health care sector do allocate resources, countries around the world still face a shortage and are often not able to meet the expectations of their patients. This raises an important question - Are the current investment levels truly improving access to care and reducing harm?  
This project aims to answer this basic question through a data driven visualization analysis of how mental health care resources, national health spending, and substance abuse prevalence exist across countries, regions, and various income levels. This report also explores trends in access to mental health professionals, the geographic and demographic distribution of drug use, and the impact of health expenditure on service availability in exploring and seeking answers for the main research questions at hand.

**Research Questions**

1. How has access to mental health services (e.g., the number of mental health professionals) changed globally over time?
2. What is the relationship between the availability of mental health services and the prevalence of substance abuse across countries?
3. How does national health expenditure relate to the availability of mental health care services?

# Methodology

To answer these questions, data was collected from three trusted global sources: the World Bank (health spending), the World Health Organization (availability of mental health services), and the United Nations Office on Drugs and Crime (substance use rates).  
  
**Data Sources**

This project uses data from three well-established and publicly available global sources:

1. **World Bank – Health Expenditure (% of GDP) -** Provides national health spending as a percentage of GDP from 1960 onward.
   * URL: <https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS>
2. **World Health Organization (WHO) – Mental Health Service Availability -** Offers country-level data on mental health professionals, and service indicators.
   * URL: <https://www.who.int/data/gho/data/themes/mental-health>
3. **United Nations Office on Drugs and Crime (UNODC) – Prevalence of Drug Use -** Reports national statistics on the percentage of the population using various drugs (e.g., cannabis, opioids, cocaine), including gender and age group breakdowns.
   * URL: <https://dataunodc.un.org/>

All datasets were cleaned and reshaped using Python before importing them into Tableau. The original World Bank was in a wide format, with years spread across columns. These were transformed into long formats so that each year became a row, making it easier to analyze trends over time. Unnecessary columns like empty fields, and metadata that did not contribute to the analysis, were removed. Country-level metadata—such as World Bank region and income classification—was merged into a single dataset to allow for consistent cross-regional comparisons. Once prepared, the cleaned datasets were brought into Tableau, and relationships were created using the Country field to enable cross-source analysis using federated joins.

# Analysis

The goal of this analysis was to create a visual representation of how national health spending, mental health service access, and substance use prevalence are related.

**Dashboard 1 - Health spending and drug use trends**This dashboard addresses the relationship between the availability of mental health services and the prevalence of substance abuse across countries

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Top Chart – Time Series Trends in Investment (Health Expenditure) & Bottom Chart – Drug Use Prevalence (by region)

This chart shows that Europe & Central Asia and North America have consistently maintained the highest levels of health expenditure. These regions exhibit stable and gradually increasing investment across the timeline. In contrast, regions such as South Asia, Sub-Saharan Africa, and the Middle East & North Africa show far lower investment levels, with minimal growth over time. There is a clear and sustained disparity in health investment across regions. Higher-income regions continuously allocate more funding to health, while lower-income regions show underinvestment, which likely limits their ability to expand mental health services and infrastructure.

The second chart highlights substantial variation in drug use prevalence by region. The Europe region shows the highest and most volatile levels of drug use, peaking dramatically around 2012–2016 before gradually declining. The Americas also show high prevalence but with a steadier trend. In contrast, Africa, Asia, and South Asia maintain consistently low drug use levels throughout the timeline. High drug use prevalence exists even in regions with the greatest health investment. This indicates that increased spending alone does not necessarily reduce substance abuse. Cultural norms, law enforcement, stigma, and public health education likely play key roles in shaping substance use trends, especially in high-use regions like Europe and the Americas.

**Dashboard 2 - Are we spending enough on Mental Health?**  
This dashboard addresses whether the access to mental health services (changed globally over time and national health expenditure relation with the availability of mental health care services by comparing national health spending with mental health service availability. It helps assess whether higher investment leads to better workforce access and whether access is improving over time across different income groups and regions.

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These visualizations show a clear and consistent relationship between national health expenditure and access to mental health professionals. Countries that allocate a higher percentage of their GDP to health tend to have more mental health workers per 100,000 people. High-income countries demonstrate both higher spending and higher professional availability, while lower-income countries show limited investment and workforce presence.

The data reveals a persistent global inequality. While most regions have improved access to mental health professionals over the past two decades, the gap between high- and low-income regions remains wide. The trend lines confirm that this inequality is not narrowing at a meaningful pace.

Despite increased spending in some middle-income countries, corresponding workforce growth is not always observed, suggesting systemic inefficiencies or delays in translating investment into service delivery. The geographic distribution of health expenditure shows clear clustering of high-spending nations in North America and Europe.

Overall, countries that invest more in health consistently have better access to mental health services. However, this access remains uneven globally, and financial investment alone does not always guarantee workforce expansion. Structural and policy-related factors may influence how effectively funds are translated into care.

**Dashboard 3: Mental Health Services vs. Substance Abuse – A Global Perspective**

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This dashboard demonstrates that higher availability of mental health services does not uniformly lead to lower substance use prevalence. Several countries with high professional access also report high drug use rates, indicating that other social or behavioral factors contribute to substance use beyond access alone.

Drug use prevalence is highest for cannabis across nearly all regions, with notable regional variation in opioid and cocaine use. The hierarchy chart identifies geographic and substance-specific concentrations, showing that drug use patterns are not globally uniform.

Gender differences are significant. Males report substantially higher usage across all drug categories, regardless of region. This pattern underscores the need for gender-specific intervention strategies.

The relationship between spending and drug use is inconsistent. Some countries with high health spending also show high drug prevalence, while others report lower levels. The spatial distribution of services shows major gaps in Africa and parts of Asia, where services are extremely limited or absent.

Substance abuse is influenced by factors beyond service availability or national spending. While mental health services are critical, they must be paired with culturally appropriate, gender-sensitive, and prevention-focused strategies to reduce drug use. Service access alone is not a reliable predictor of lower substance use.

# Conclusion

This analysis explored global patterns in mental health service availability, national health expenditure, and substance use prevalence using data from the World Bank, WHO, and UNODC. Across all three research questions, the visualizations revealed meaningful trends and disparities that suggest both progress and persistent challenges in global mental health care.

The first key conclusion is that access to mental health services has improved globally but remains highly unequal. High-income countries have made significant advances in building their mental health workforce, while low-income countries still lag far behind. This disparity appears strongly linked to differences in national health expenditure, which supports the conclusion that spending capacity remains a key driver of service availability. However, some countries achieve more efficient outcomes despite limited resources, suggesting that policies, governance, and system structure also play important roles.

The second major finding is that greater availability of mental health services does not automatically reduce substance abuse prevalence. Drug patterns vary widely by region, gender, and substance type. For example, cannabis remains the most widely used drug globally, and men consistently report higher use than women across nearly all categories. These trends imply that factors such as culture, socioeconomic stress, and public health education may also influence substance use, beyond clinical service access alone.

While increased investment is associated with improved workforce metrics, the relationship is not perfectly linear, and time-lagged effects are likely. This suggests a need for longer-term studies that examine whether current investments are producing future benefits, especially in lower-income countries that are now increasing their health budgets.

Future Research Questions

Based on the patterns and gaps identified in this study, the following questions could guide future research:

1. Does increased investment in mental health care result in measurable improvements in population outcomes after a specific time lag (e.g., 5–10 years)?
2. What policies or systems enable some middle-income countries to outperform peers in mental health service delivery efficiency?
3. What is the impact of cultural stigma or legal frameworks on reported drug use prevalence across regions?

In conclusion, this project demonstrates that while health spending and service availability are crucial elements in improving mental health outcomes, they are only part of a complex system influenced by policy, culture, and economic structure. Addressing global mental health challenges will require both increased investment and smarter allocation of resources, informed by data-driven strategies and inclusive public health planning.