

DATA VISUALIZATION

Prof. Johannes Reichgelt, PhD

Final Project Report

**Security And Stability: A
Data-Driven Analysis of Military Strength,
Public Welfare, Global Threats and Peace**

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Business Analytics and Artificial intelligence

Background of the Project:

Governments across the world must make critical decisions regarding the allocation of resources between national security, public welfare, and governance transparency. Defense spending, armed forces personnel, and military strength are often considered crucial for maintaining security. However, excessive militarization might be linked to increased corruption, reduced public welfare investment, and geopolitical instability. At the same time, the rising threat of terrorism challenges nations to balance security and economic growth.

This project, critically examines the relationship between military spending, health investment, and peace indices across different nations and regions. The project's premise is based on the hypothesis that higher military expenditures might correlate with lower peace indices, suggesting that aggressive defense spending could be inversely related to a country's internal and external peace measures.

Ambitiousness of the Project:

This project sets out to tackle the complex task of examining how the allocation of resources influences peace outcomes by drawing from diverse, multidimensional datasets. It brings together information across key sectors such as defense, public health, and peace metrics to create an integrated view of the relationships and trade-offs between military expenditure and health funding. By visualizing and analyzing these connections, the work offers a fresh perspective that goes beyond traditional narratives, highlighting both the tensions and possible alignments between national security and societal well-being. Rather than isolating spending in one area, it considers the broader political, economic, and social contexts in which such decisions occur. The insights generated are designed to inform and support the efforts of researchers, decision-makers, and global stakeholders in shaping policies that prioritize lasting peace and stability. More than just an academic study, this project aspires to drive meaningful change through data-backed, practical guidance.

Research Questions:

- 1. What is the relationship between per capita military spending and a nation's peace index rating?**

This question investigates whether the amount a country spends on its military per person has any association with its peace ranking, using the Global Peace Index as a benchmark. Visual tools will help uncover patterns or correlations across countries.

- 2. How have military and health spending trends shifted over time within a single country?**

This question looks at how government priorities may change over the years by comparing time-series data on military and health expenditures within a chosen nation. The visualization will illustrate any trade-offs or shifts in funding emphasis.

- 3. How do regions differ in their Global Military Index scores?**

This explores regional disparities in the Global Military Index, seeking to identify which areas of the world show higher or lower average scores. Visual representations will highlight regional trends in military capacity and emphasis.

- 4. Is there a link between per capita health spending and military spending across countries?**

This question examines whether nations that spend more per person on health also allocate similar levels to defense, aiming to understand if there is a pattern of balanced or competing priorities. The relationship will be explored through comparative visualizations.

- 5. What percentage of the population serves in the military across various countries?**

This explores how military personnel numbers relate to the overall population in different nations, using visualization to compare the share of armed forces per capita and reveal levels of military involvement globally.

6. How does military spending influence peace levels at a regional scale?

This question assesses whether higher regional military expenditures correlate with lower or higher peace index scores. The goal is to visualize and interpret regional dynamics between defense budgets and peace stability.

7. What are the regional averages for military spending as a share of GDP?

This explores how much of their gross domestic product different world regions dedicate to military expenses, offering visual comparisons that reflect regional priorities in terms of security and defense.

8. How much do countries spend per person on healthcare?

This question compares health spending per capita among countries, using visual tools to highlight national differences in healthcare investment and the emphasis placed on public health.

9. How do per capita health and military expenditures compare across regions?

This looks at how different global regions allocate spending per individual on health and military sectors, using visuals to reveal whether there's balance or disparity in those investments and what that might indicate about regional policy choices.

10. What trends can be observed over time in the Global Military Index and Global Peace Index, and how are they connected?

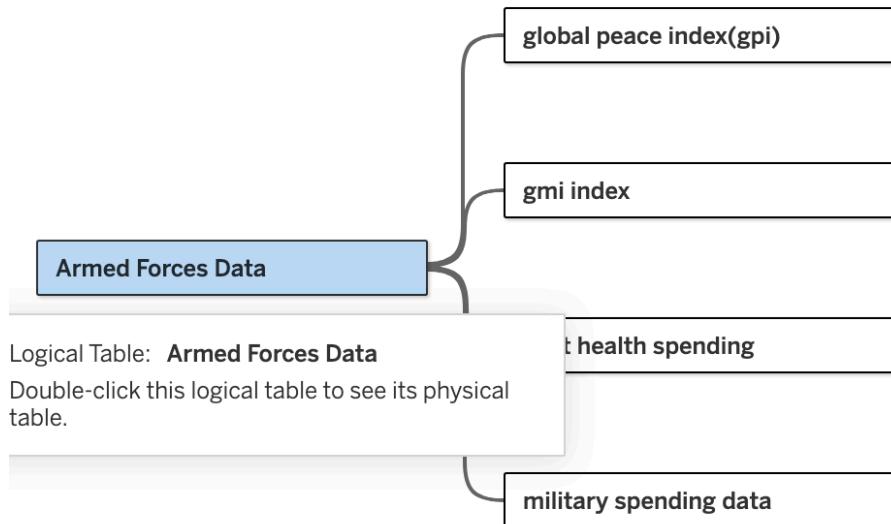
This question evaluates how the Global Military Index and Global Peace Index have changed over the years and whether their movements suggest a relationship. The visual analysis will track these trends side-by-side to uncover any notable correlations.

11. How is the global share of military personnel distributed relative to population size by country?

This question maps the proportion of military personnel in the overall population for each country, offering a global perspective through visual comparisons on how military engagement varies internationally.

Methodology

Data Source:



1. Armed Forces Personnel Dataset:

This dataset offers detailed statistics on the size of military personnel across various nations, including both the total count and the proportion relative to each country's population. It serves as a key resource for examining global patterns in military staffing and comparing how different countries maintain and deploy their armed forces over time.

Link: <https://ourworldindata.org/grapher/armed-forces-personnel>

2. Global Military Index (GMI) Rankings:

The GMI dataset ranks countries based on their military capabilities, incorporating factors such as defense budgets, manpower, and technological advancements. It provides a structured overview of national military strength, making it valuable for cross-country analysis of defense power.

Link: <https://gmi.bicc.de/ranking-table>

3. Global Peace Index (GPI):

Published yearly, this dataset evaluates the level of peace in countries and regions using a range of indicators, including conflict intensity, public safety, and the level of militarization. It's a critical tool for understanding how different forms of spending—like health and defense—may influence peace outcomes.

Link: https://prosperitydata360.worldbank.org/en/indicator/QOG+BD+gpi_gpi

4. Public Health Expenditure Data:

This dataset tracks per capita government health spending across countries, highlighting long-term trends in how public funds are allocated to healthcare. It plays a crucial role in evaluating national priorities and helps to assess the interplay between health investment and other sectors, such as defense.

Link: <https://ghdx.healthdata.org/record/ihme-data/global-health-spending-1995-2019>

5. Military Spending Records:

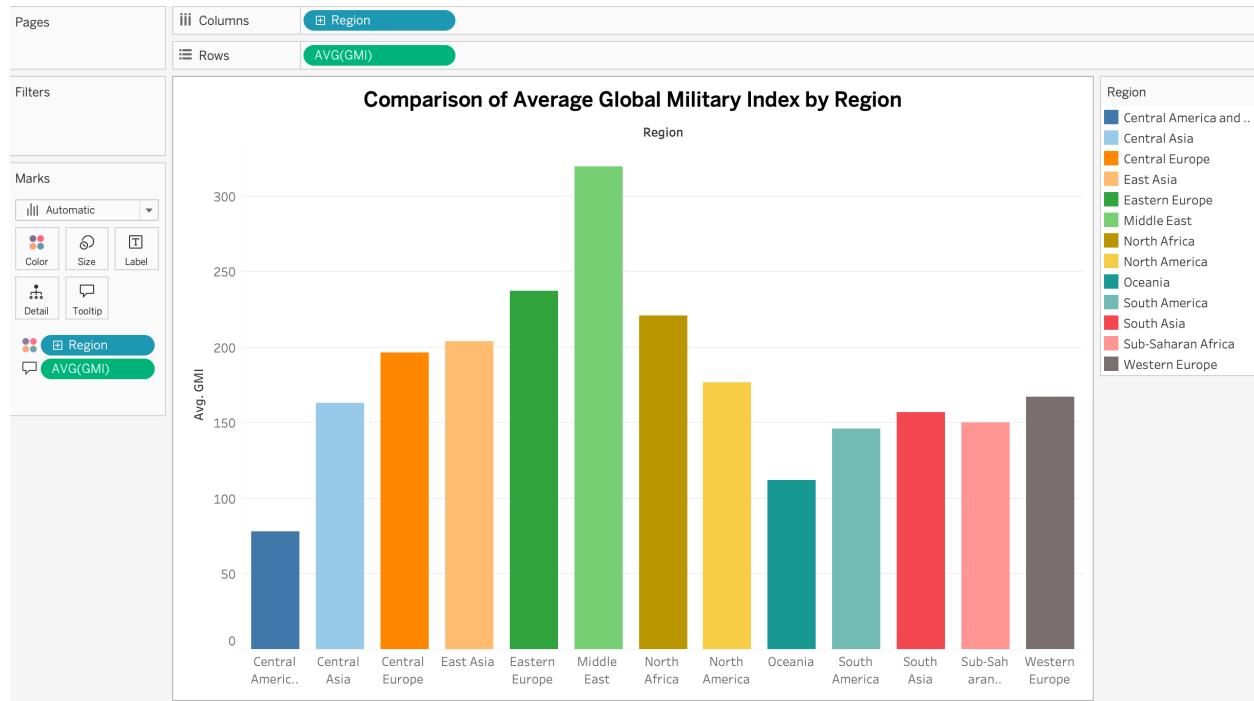
This dataset provides extensive information on how countries allocate their military budgets, with details by year, type of expenditure, and percentage of GDP. It's instrumental for understanding the scale and focus of defense investments, as well as how they evolve in response to global events and national strategies.

Link: <https://ourworldindata.org/military-personnel-spending>

Data Visualization Tools: I have used Tableau, a powerful data visualization tool, to create interactive dashboards and reports

Analysis

1. How do regions differ in their Global Military Index scores?

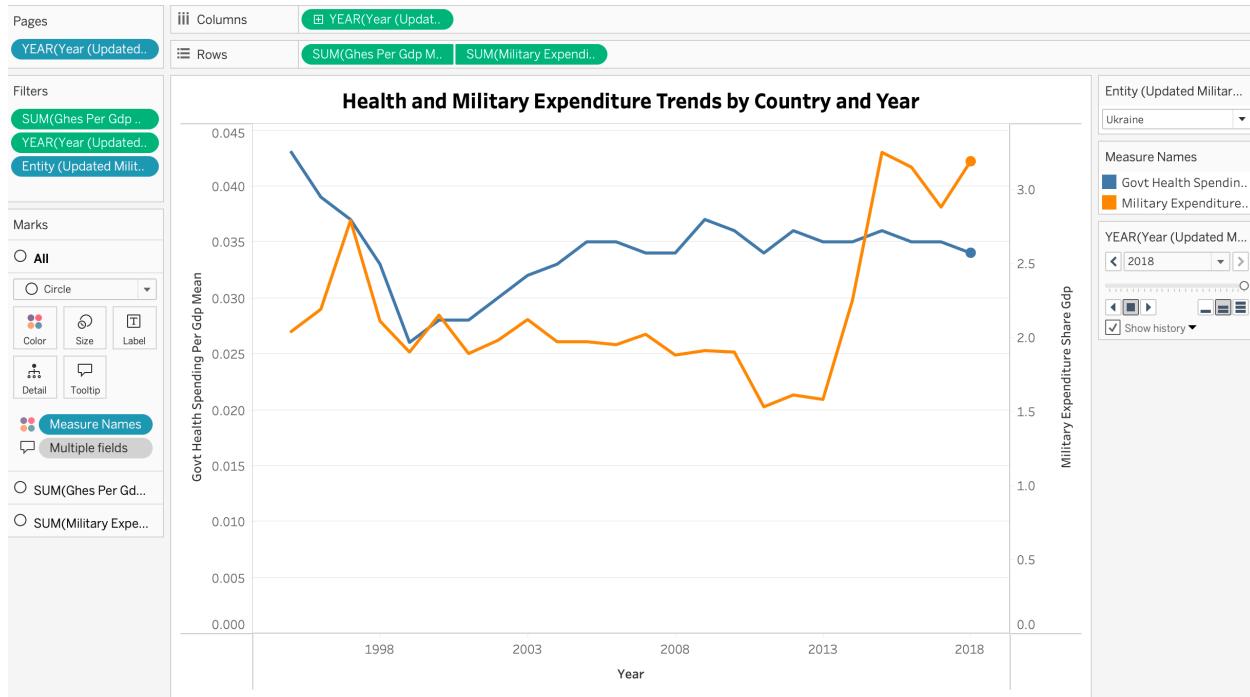


This bar chart presents a comparative view of the average Global Military Index (GMI) scores across different global regions, with each region represented by a unique color to distinguish their military strength. The Middle East emerges with the highest average GMI, reflecting substantial military capability likely shaped by persistent regional tensions. Similarly, Eastern Europe and East Asia show relatively high scores, indicating robust defense postures influenced by their respective security landscapes. On the other hand, Central America and the Caribbean exhibit the lowest average GMIs, suggesting more modest military investments aligned with their distinct security and economic contexts.

The noticeable variations in GMI across regions reveal how differently countries prioritize military preparedness and spending. Regions with elevated scores, such as the Middle East and Eastern Europe, may be responding to active conflicts or strategic threats, while those with lower scores might face different stability challenges or rely more on diplomatic and international partnerships.

Overall, the chart serves as an insightful reference for policymakers and defense analysts, offering a clear visualization of military strength by region. It supports informed decision-making in terms of strategic defense planning, resource distribution, and evaluating regional and global security concerns.

2. How have military and health spending trends shifted over time within a single country?

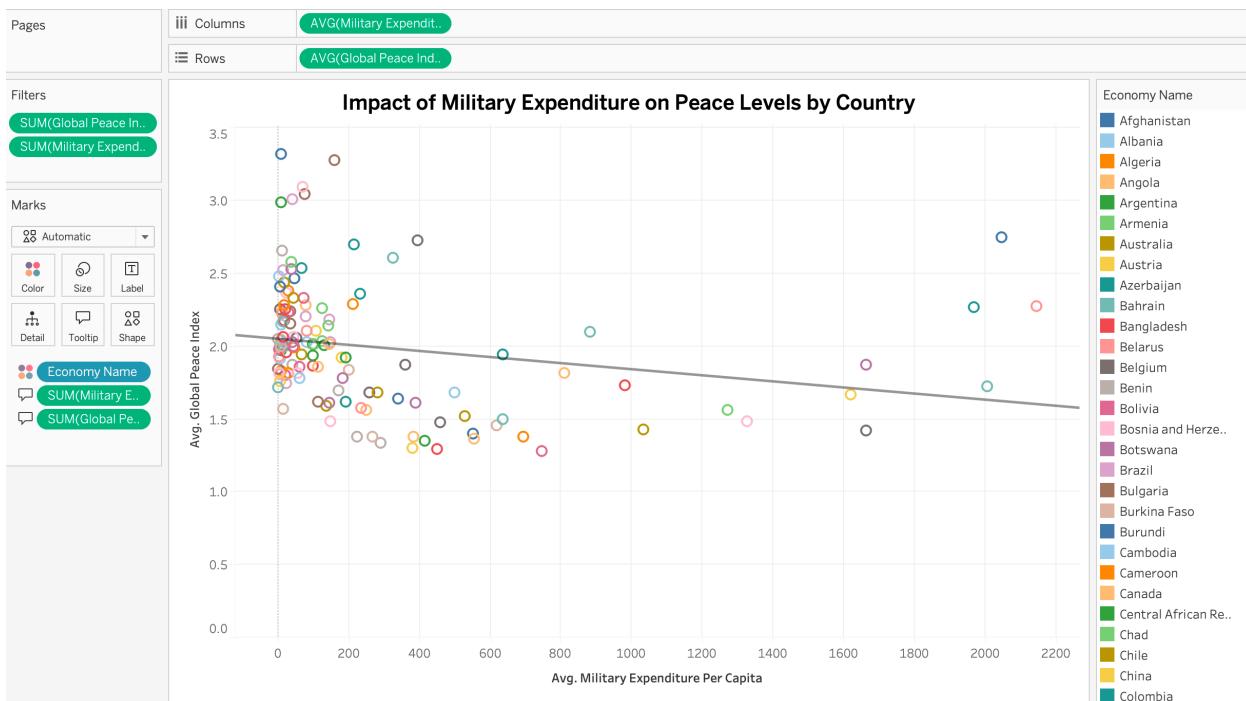


The line chart offers a side-by-side view of Ukraine's government spending on health and military sectors from 1995 to 2018. Health expenditure, illustrated by the blue line as a share of GDP, shows an initially irregular upward trend, followed by a period of stability, and then a significant rise toward the end of the timeline. Conversely, military spending—represented by the orange line—remains relatively flat with a slight downward trend until 2014, when it spikes sharply, reaching a peak in 2015, coinciding with the outbreak of conflict in Eastern Ukraine, before showing a modest decline.

This pattern highlights how fiscal priorities shift in response to internal and external pressures, particularly national security threats and healthcare demands. The notable surge in defense spending during 2014–2015 reflects the immediate response to armed conflict, while the later fluctuations may indicate recalibrated spending as the situation evolved and other sectors, like healthcare, regained importance.

In essence, the chart illustrates how geopolitical developments can significantly influence government budget allocations. It provides valuable context for understanding how nations like Ukraine adapt their spending strategies during periods of instability, offering critical insights for policymakers aiming to navigate the balance between defense and public welfare in times of crisis.

3. What is the relationship between per capita military spending and a nation's peace index rating?

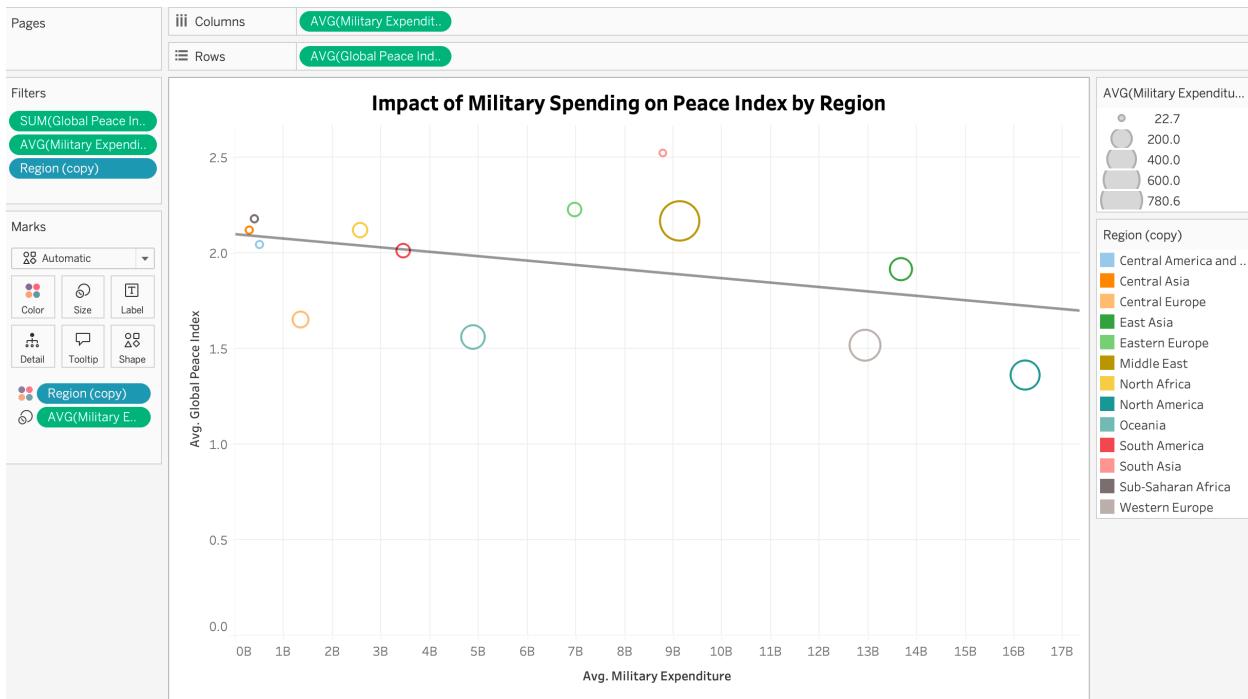


This scatter plot examines how military spending per person relates to a country's peace index score. Each point represents a country, with military expenditure per capita shown on the x-axis and the corresponding peace score on the y-axis. The chart reveals a general downward trend, indicating that nations with higher military spending tend to have lower peace scores, which may point to a link between increased defense budgets and heightened conflict or instability.

The presence of a downward-sloping trend line highlights a negative correlation between defense spending and peace levels. This challenges the assumption that greater military investment leads to enhanced security. Instead, it suggests that heavy military expenditures might come at the cost of peace, potentially by diverting funds from social programs or economic development.

Overall, the scatter plot offers a visual insight into the possible drawbacks of excessive military spending. It encourages policymakers to reflect on the broader implications of defense budgets and to strive for a more balanced approach—one that considers both security needs and investments in sectors that promote long-term peace and societal well-being.

4. How does military spending influence peace levels at a regional scale?

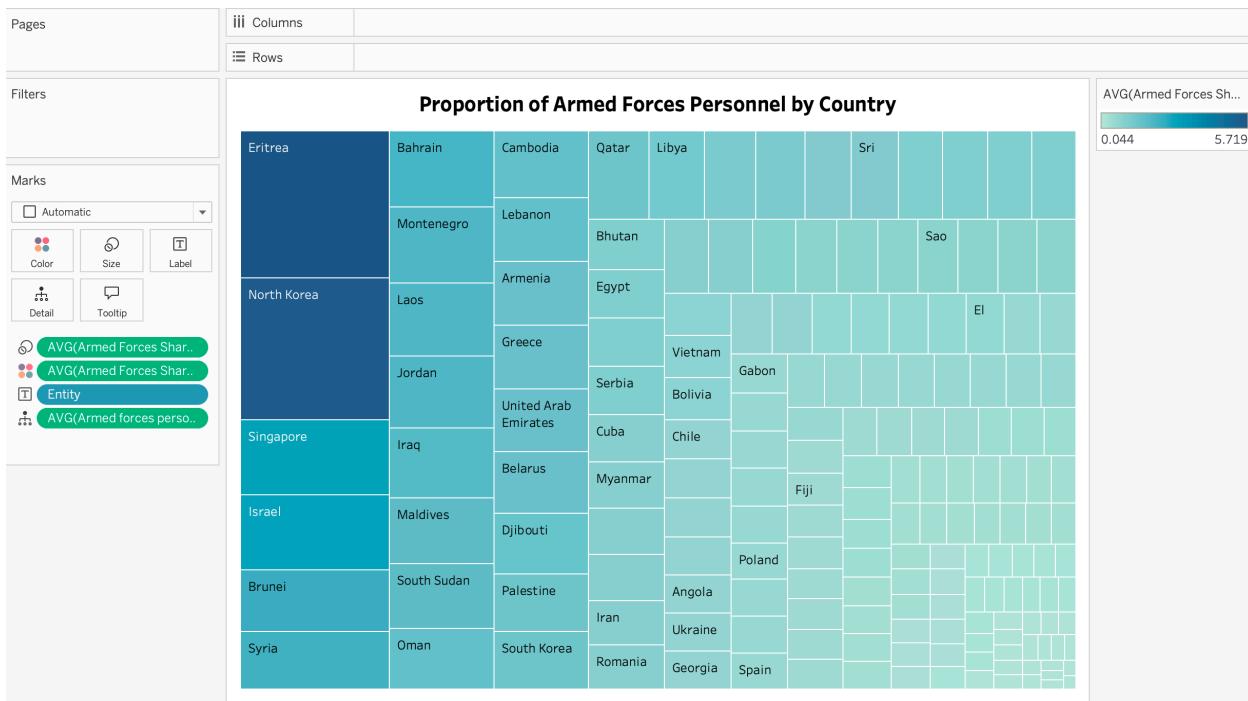


This scatter plot investigates the relationship between average military spending per capita and peace levels across different global regions. Each region is represented as a circle, with military expenditure plotted along the x-axis and the Global Peace Index on the y-axis. The inclusion of a trend line reveals a negative correlation—regions with higher defense spending generally tend to have lower peace scores, likely influenced by ongoing regional conflicts and substantial military budgets.

Regions like the Middle East and North Africa, which face persistent geopolitical instability, exhibit both elevated military expenditures and reduced peace ratings. Conversely, Western Europe demonstrates a different pattern, where lower defense spending aligns with higher peace scores, likely due to political stability and a strong emphasis on peacekeeping efforts. This visual evidence suggests that increased military spending may not contribute to greater peace and might even mirror or intensify regional unrest.

These findings are particularly valuable for decision-makers and analysts, emphasizing the importance of reassessing how military budgets affect regional stability. It points to the potential benefits of prioritizing peace-building measures and diplomacy over increased defense investments. The visualization lays a foundation for more in-depth exploration into the complex interplay between military expenditure and peace outcomes across regions.

5. What percentage of the population serves in the military across various countries?

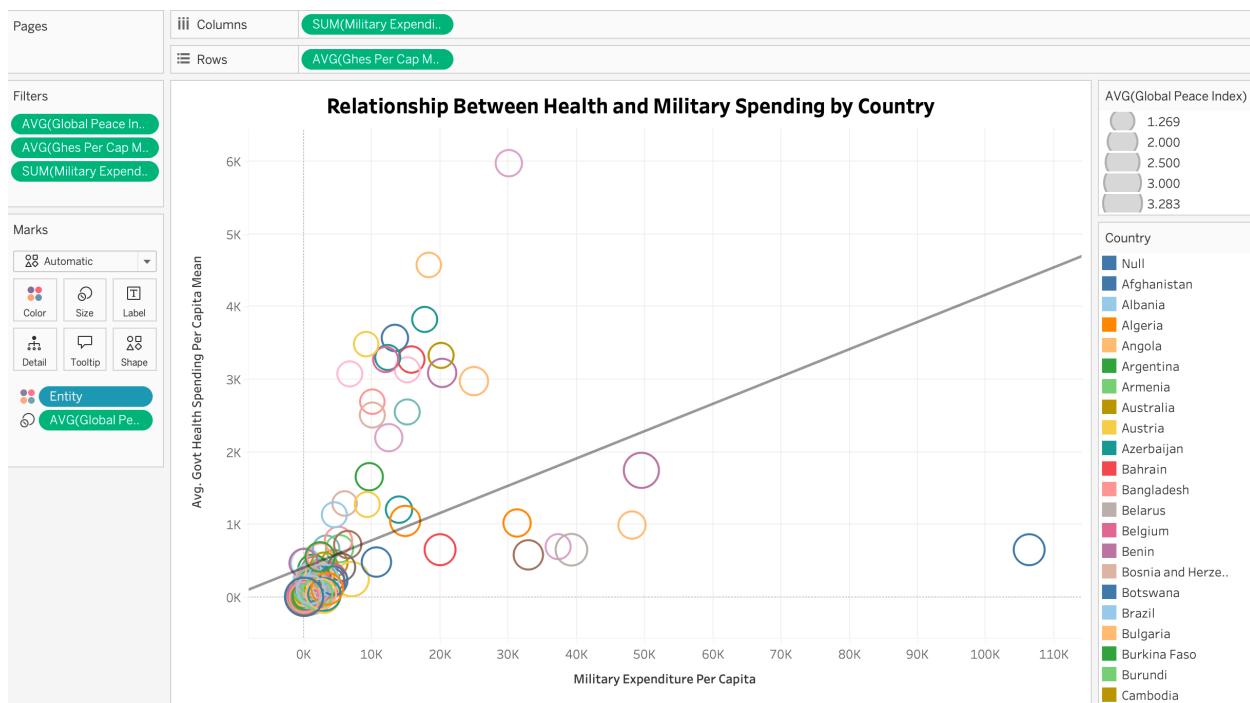


This treemap offers a clear visual comparison of the share of armed forces personnel relative to the total labor force across various countries. By utilizing differently sized and shaded blocks, the visualization effectively highlights nations with higher concentrations of military personnel. Countries like North Korea and Eritrea appear with larger, darker blocks, reflecting their substantial military ratios—often driven by compulsory service laws or heavy defense commitments.

In contrast, countries such as Iceland, Haiti, and Ghana are shown with smaller, lighter blocks, indicating a lower proportion of military personnel, which aligns with their limited military involvement or pacifist policies. The treemap provides a straightforward way to understand the global disparities in military workforce distribution, shaped by national defense priorities, historical contexts, and strategic approaches.

Beyond presenting raw data, the visualization emphasizes the significant variation in military staffing worldwide and encourages deeper exploration into how these differences influence global security dynamics. It serves as a useful tool for researchers and policymakers aiming to assess the broader effects of military personnel policies on regional stability and international peace.

6. Is there a link between per capita health spending and military spending across countries?

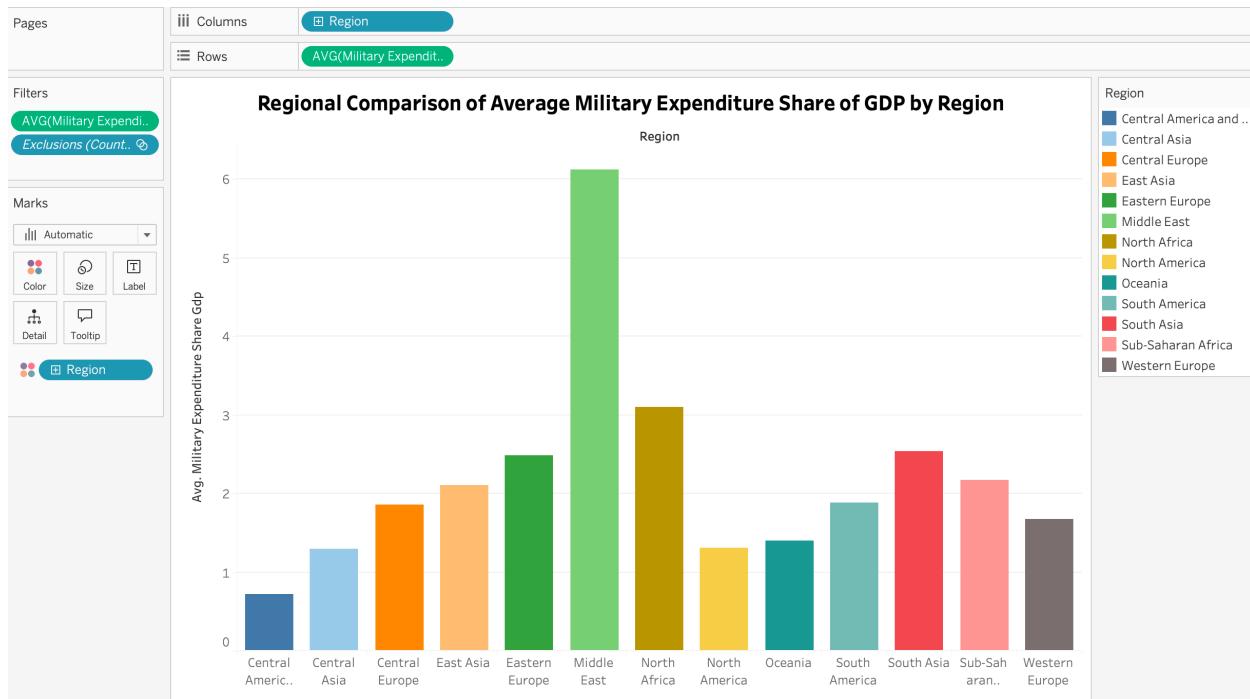


This scatter plot illustrates the association between average military spending per capita and average government health expenditure per capita across multiple countries. Each circle on the chart represents a country, positioned according to its military expenditure on the x-axis and health expenditure on the y-axis. A positively sloped trend line indicates a general pattern: countries that spend more on their military also tend to allocate more funds to healthcare.

The chart highlights a range of fiscal behaviors—some countries appear in the lower-left quadrant, indicating limited investment in both sectors, which may stem from economic limitations or differing policy priorities. In contrast, other nations cluster in the upper-right, reflecting higher spending on both military and health, possibly due to stronger economic capacity and a commitment to investing in both national security and public welfare.

This visualization provides meaningful insights for decision-makers, showcasing how countries manage the balance between defense and healthcare funding. It reinforces the idea that sustainable national development often involves strategic investment in both sectors to ensure overall stability and well-being.

7. What are the regional averages for military spending as a share of GDP?

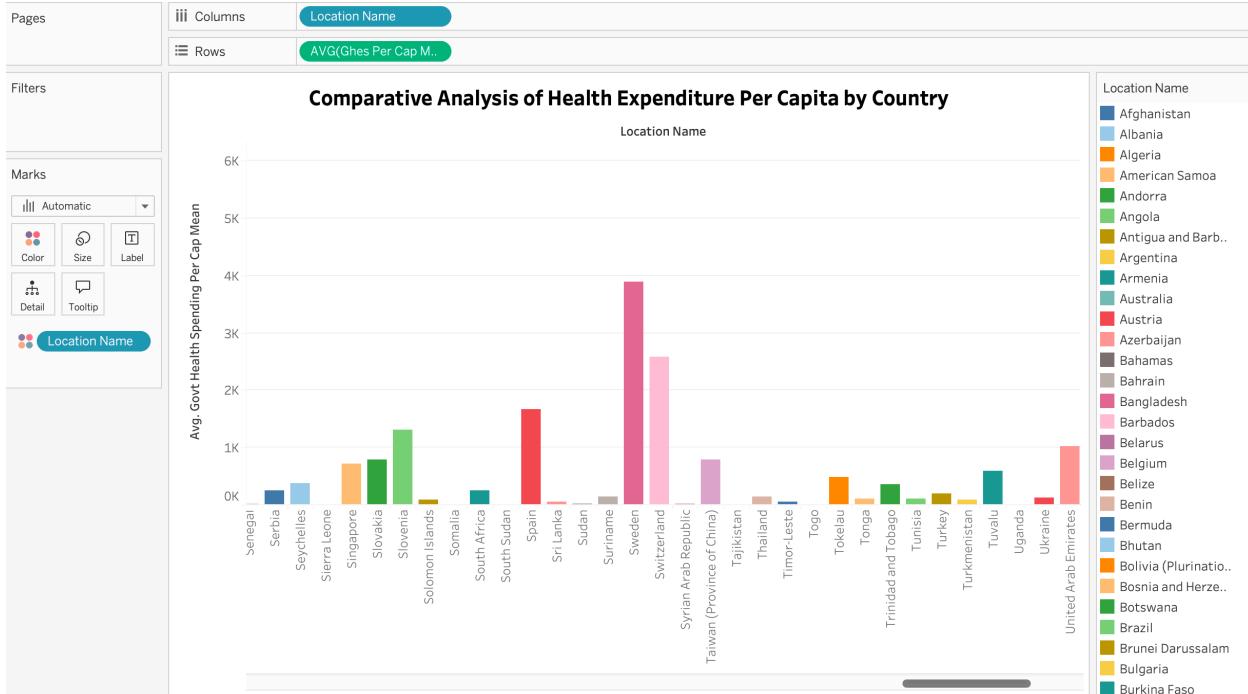
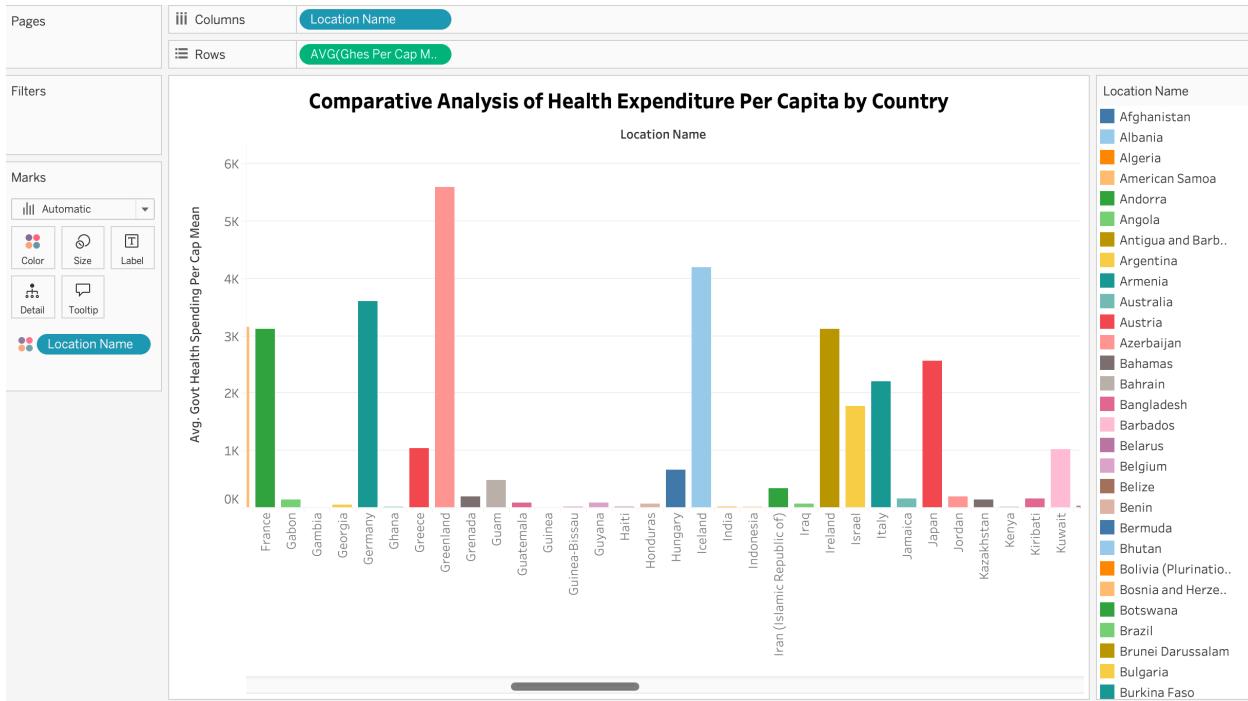


This bar chart presents a comparative view of average military expenditure as a share of GDP across various global regions, with each region represented by a uniquely colored bar. The height of each bar indicates the extent of military spending relative to economic output, providing an accessible way to evaluate defense budget allocations around the world.

The Middle East leads with the highest percentage, likely driven by persistent regional conflicts and heightened security demands. North America, largely influenced by the United States' extensive military commitments, also shows elevated spending. In contrast, Western Europe exhibits lower military expenditure, reflecting relative political stability and reliance on cooperative defense structures such as NATO. Regions like Sub-Saharan Africa and South Asia display moderate to high levels, pointing to the effect of regional instability and internal conflicts on their defense allocations.

This visual analysis is a valuable resource for policymakers and security analysts, offering insights into how regional circumstances shape military budgets. It emphasizes the need to carefully assess defense priorities alongside other critical sectors, and encourages global discussions on equitable military spending and the potential to redirect resources toward peacebuilding and sustainable development in regions with less militarization.

8. How much do countries spend per person on healthcare?

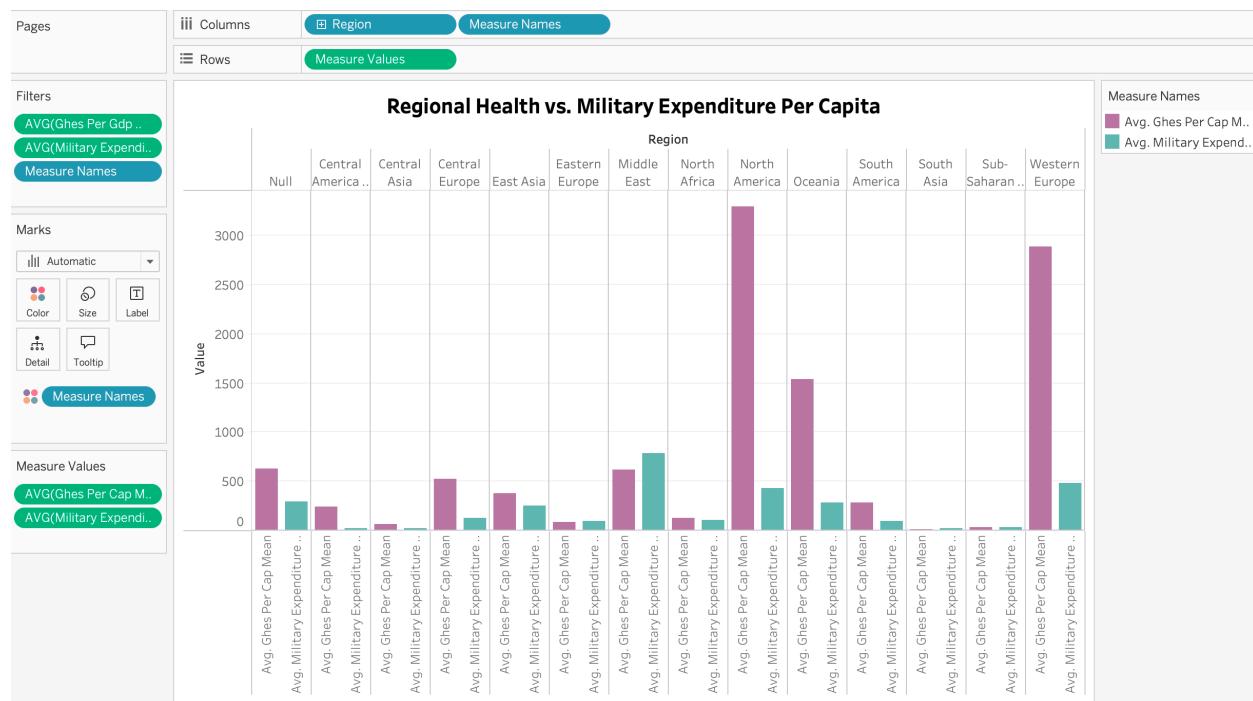


This bar chart offers a straightforward comparison of per capita government health spending across different countries, emphasizing the wide gaps in how nations invest in healthcare. Countries such as Norway, Greenland, and Luxembourg appear as top spenders, likely due to their robust healthcare systems and higher costs of living, which contribute to elevated health expenditures per person.

In contrast, nations like Pakistan and Nigeria, which face economic constraints and have less developed health infrastructures, show considerably lower spending levels. This disparity highlights the global imbalance in healthcare access and quality, shaped by each country's economic strength and policy focus.

The chart serves as a valuable reference for health policymakers and global organizations, offering a visual benchmark to identify areas where healthcare funding is lacking. By recognizing these differences, stakeholders can better target funding strategies, promote equitable access to care, and support reforms aimed at improving health outcomes in underserved regions.

9. How do per capita health and military expenditures compare across regions?



This bar chart offers a side-by-side comparison of average per capita government spending on health and the military across different global regions. Using a dual-bar design, each region is represented with two adjacent bars—purple for health spending and green for military expenditure—making it easy to visually assess the balance or imbalance between the two.

The chart reveals stark contrasts in regional spending priorities. North America and Western Europe, for example, allocate significantly more funds per person to healthcare than to defense. Conversely, the Middle East shows the opposite pattern, with military expenses exceeding health-related investments.

This visualization offers valuable insights into the economic decisions and policy directions of various regions. Higher health investment may suggest a focus on social welfare, while elevated military budgets could reflect ongoing security concerns or strategic defense postures.

Overall, this comparative analysis is an important resource for researchers, decision-makers, and policy analysts. It sheds light on how regions allocate resources between crucial sectors and encourages a dialogue around achieving a more balanced approach to national budgeting that supports both societal well-being and security objectives.

10. What trends can be observed over time in the Global Military Index and Global Peace Index, and how are they connected?

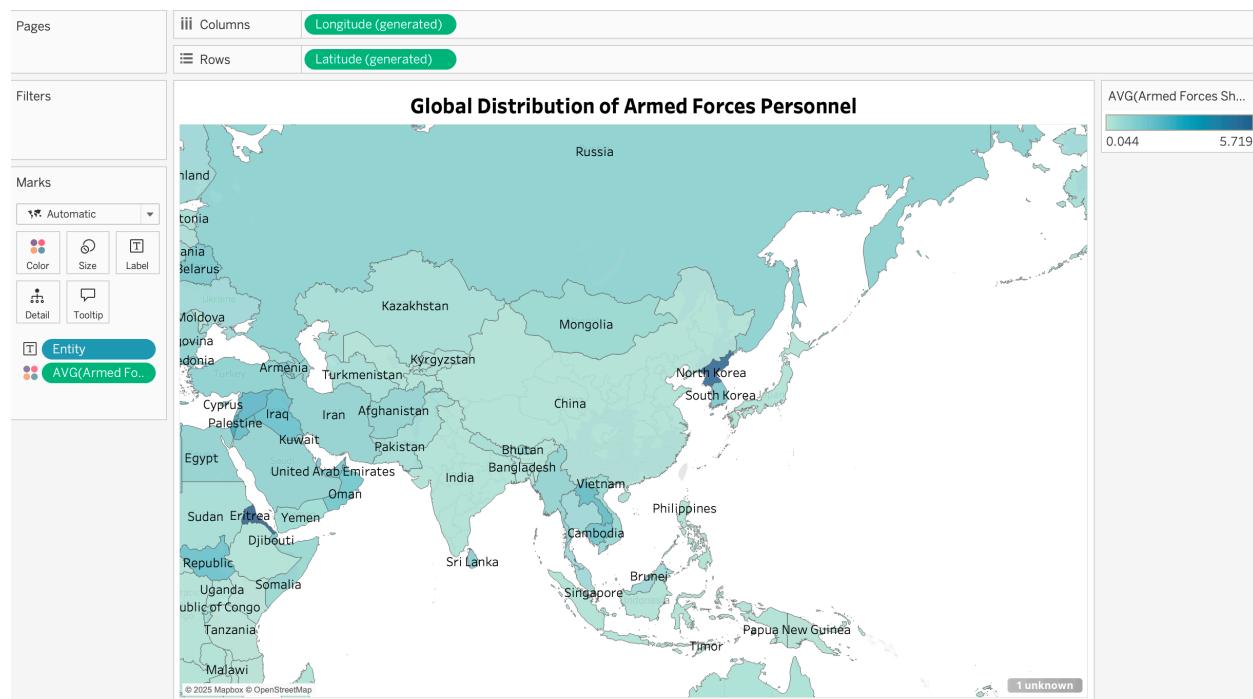


This line chart compares the trends of the Global Military Index (GMI) and the Global Peace Index (GPI) from 2007 to 2018, offering insight into global shifts in military strength and levels of peacefulness. The green line, which tracks the GMI, remains largely consistent over time, indicating that global military power has experienced minimal change. In contrast, the yellow line depicting the GPI reveals a clear downward trend after 2014, highlighting a decline in worldwide peace during that period.

The visualization underscores a potential inverse correlation between military capability and peace, implying that sustaining or increasing military strength does not inherently lead to more peaceful conditions. This pattern may reflect escalating global unrest or unresolved conflicts, despite steady military capacities. It raises questions about the effectiveness of relying solely on defense investments and points toward the importance of prioritizing peace-building and diplomatic efforts.

In conclusion, the chart illustrates the complex interplay between defense power and peacefulness, suggesting that a greater focus on diplomacy and conflict resolution could help reverse the recent decline in global peace. The data encourages policymakers to reassess security strategies and consider alternative approaches to promoting international stability.

11. How is the global share of military personnel distributed relative to population size by country?



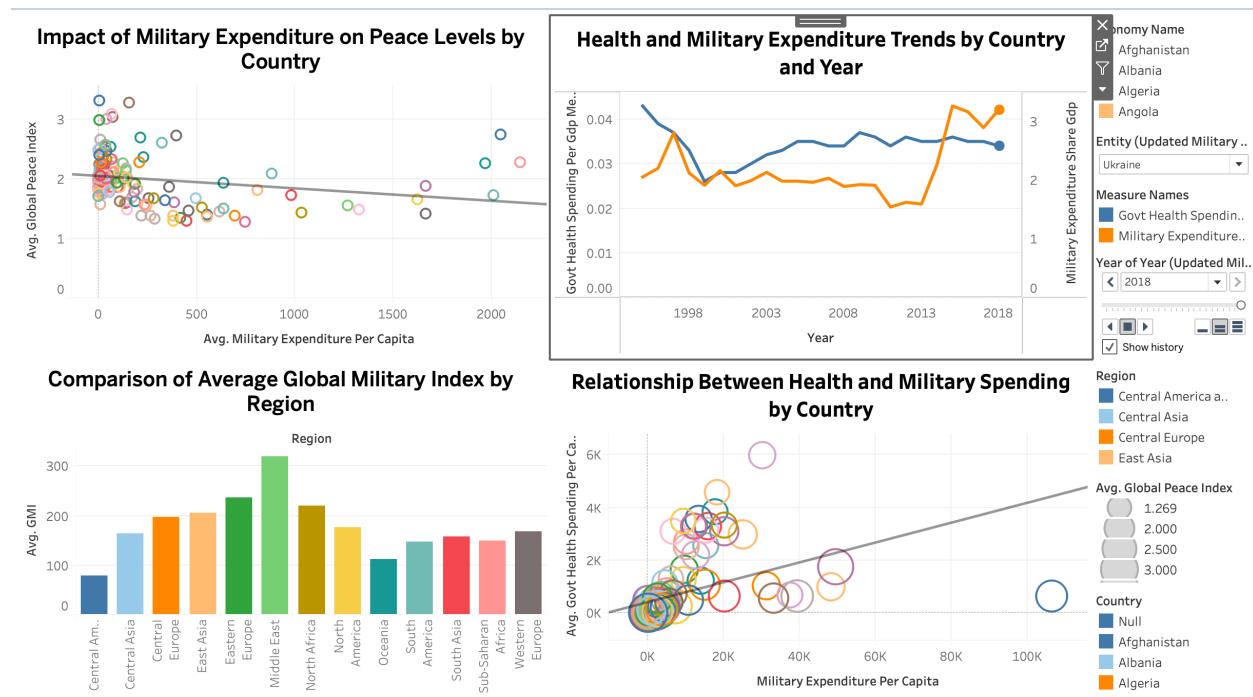
This choropleth map visually displays the global distribution of armed forces personnel as a percentage of each country's total population. Countries are shaded in varying intensities, with darker colors representing higher concentrations of military personnel. This gradient makes it easy to distinguish between nations with heavy military involvement—such as North Korea—and those with a smaller military footprint, like many countries in Europe and South America.

The use of color effectively captures the contrast in military engagement across different regions, reflecting the strategic and political priorities of each nation. It provides a compelling snapshot of how countries allocate human resources to their armed forces, revealing links between military staffing levels, economic capacity, and regional security concerns.

Ultimately, the map serves as a key resource for decision-makers, researchers, and security analysts. It enhances understanding of military presence across the globe and supports further exploration into how the concentration of armed personnel influences both regional and international peace and stability.

Dashboard 1: Global Dynamics: Military Expenditure and Health Investment Impacts on Peace"

This comprehensive dashboard showcases the multifaceted relationships between military spending, health investment, and peace levels across various regions and countries from a global perspective. The visualizations include:



1. Impact of Military Expenditure on Peace Levels by Country:

This scatter plot reveals the relationship between average military expenditure per capita and the Global Peace Index for each country, highlighting a potential inverse relationship where higher military spending might correlate with lower peace levels.

2. Health and Military Expenditure Trends by Country and Year:

A line chart tracks the trends in government health spending and military expenditure as a share of GDP over time for selected countries, illustrating how these expenditures evolve in relation to each other.

3. Comparison of Average Global Military Index by Region:

This bar chart compares the average Global Military Index across different regions, providing insight into regional variations in military capability and preparedness.

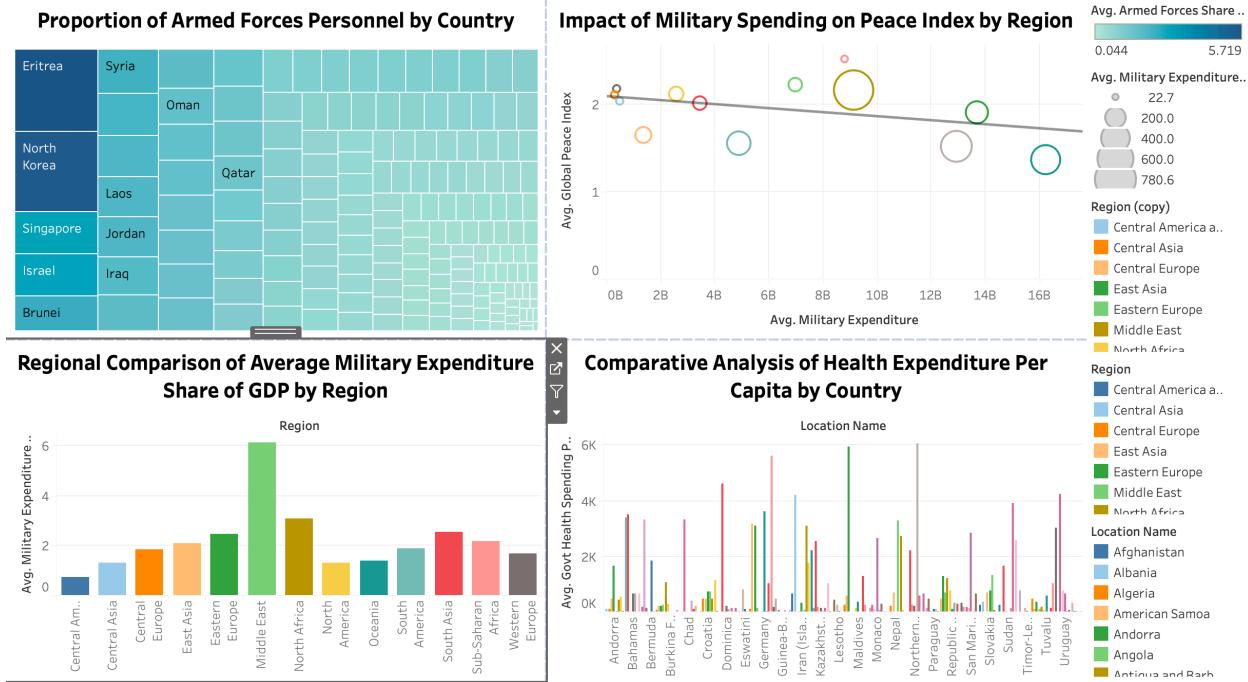
4. Relationship Between Health and Military Spending by Country:

A scatter plot that explores the correlation between government health spending per capita and military expenditure per capita, displaying a positive correlation that suggests higher health expenditure is often associated with higher military spending.

Each visualization on the dashboard integrates data-driven insights that contribute to a deeper understanding of how military and health expenditures impact global and regional peace indices, offering a critical tool for policymakers and analysts engaged in global security and health economics.

Dashboard 2: Global Security and Health Expenditures: A Comparative Analysis

This dashboard presents an in-depth examination of global military and health expenditures, emphasizing their relationship to peace indices and the proportional distribution of armed forces personnel. The included visualizations analyze data from multiple perspectives to offer insights into how these factors interact on a regional and global scale. The dashboard includes:



1. Proportion of Armed Forces Personnel by Country:

This treemap visualization highlights the proportion of armed forces personnel relative to the total labor force in various countries, showcasing which countries have a higher percentage of their population in the military.

2. Impact of Military Spending on Peace Index by Region:

A scatter plot mapping the relationship between average military expenditure and peace indices across different regions, analyzing how increased military spending could correlate with peace levels.

3. Regional Comparison of Average Military Expenditure Share of GDP:

Bar charts compare the average military expenditure as a percentage of GDP across different regions, illustrating regional priorities in defense spending.

4. Comparative Analysis of Health Expenditure Per Capita by Country:

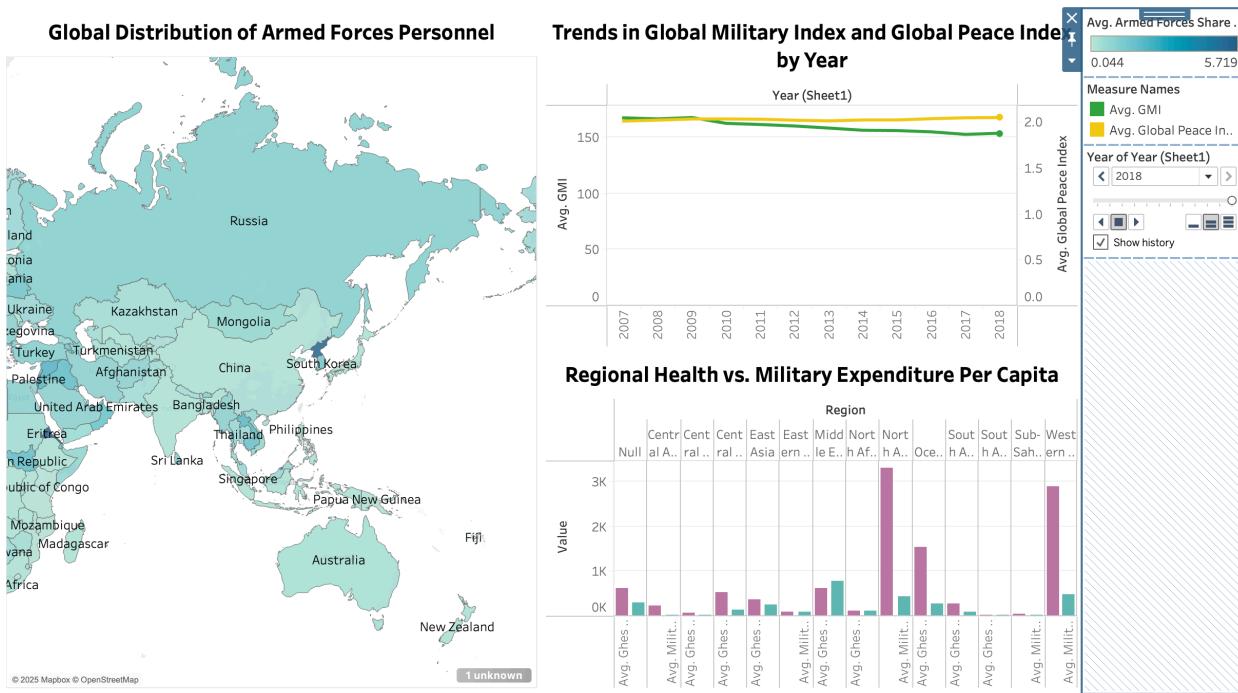
A bar chart displaying government health expenditure per capita by country, highlighting how much each country invests in health relative to its economic capacity.

This comprehensive dashboard facilitates a nuanced understanding of the dynamics between military and health spending and their potential effects on global and regional

stability, providing valuable insights for policymakers, researchers, and stakeholders interested in the intersections of security, health, and peace.

Dashboard 3: Global Dynamics of Military Strength and Health Expenditures: A Temporal and Regional Analysis

This dashboard offers a comprehensive view of the interaction between military capabilities, health spending, and peace across different regions and over time. Key components of the dashboard include:



1. Global Distribution of Armed Forces Personnel:

This map provides a visual representation of the distribution of armed forces personnel worldwide, emphasizing the proportion of the labor force engaged in military activities across different countries, which highlights the military emphasis in regions such as East Asia and the Middle East.

2. Trends in Global Military Index and Global Peace Index by Year:

A line chart tracking the stability of military capabilities as represented by the Global Military Index (GMI) alongside fluctuations in the Global Peace Index (GPI) over more than a decade. This visualization underscores the relationship between military strength and peace, offering insights into whether increased militarization correlates with peace over time.

3. Regional Health vs. Military Expenditure Per Capita:

This bar chart compares health and military spending per capita across various regions, demonstrating how different regions prioritize health and military budgets. This comparison is crucial for understanding the potential trade-offs between health and military expenditures and the broader implications for regional stability and health outcomes.

This dashboard synthesizes complex data into a format that facilitates easy understanding of how military and health expenditures impact global and regional peace and stability, making it an essential tool for policymakers, analysts, and scholars interested in the intersections of security, health, and peace.

CONCLUSION

The in-depth examination of global patterns in military and healthcare spending, along with the distribution of armed forces personnel, highlights significant regional differences and notable relationships. The analysis reveals that nations with higher military expenditure per capita often tend to have lower scores on the Global Peace Index, suggesting a possible connection between elevated defense budgets and diminished levels of peace. This association is especially evident in regions like the Middle East and North Africa, where defense spending constitutes a larger share of GDP due to persistent geopolitical unrest. The findings imply that in areas plagued by conflict, increased military spending may both reflect and contribute to instability. Overall, the results emphasize the intricate relationship between defense investment and the broader political and social landscape of a country.

Conclusion for Research Questions:

The summarized findings point to clear patterns linking military and health expenditures with broader socio-political and economic conditions. Notably, higher military spending per capita often coincides with lower peace levels, especially in regions facing persistent conflict or geopolitical instability. In contrast, countries with stable political systems tend to show more balanced growth in both military and healthcare investment. Regions like the Middle East and Eastern Europe, marked by tensions and conflict, consistently rank high in military strength and spending.

Additionally, a positive correlation exists between military and health expenditures, suggesting that countries with greater fiscal capacity can support substantial investments in both sectors. However, in nations experiencing heightened security threats, there is often a higher ratio of military personnel relative to the population. This is particularly evident in states like North Korea, where militarization is deeply embedded in governance.

Western nations, with higher GDP and health spending, generally enjoy better health outcomes, whereas many developing countries lag in healthcare investment, revealing stark inequalities. The spending priorities in various regions reflect differing national agendas—developed countries often favor health and welfare, while others may prioritize defense due to external pressures or instability.

Over the years, the Global Military Index has remained relatively steady, while the Global Peace Index has declined, reinforcing the notion that growing militarization may be linked to decreased global peace. These patterns underscore the need for more in-depth research into the policy choices behind these trends and their long-term implications for global stability and development.

Justification:

This project investigates the complex dynamics between military investment, public health expenditure, and global peace indicators across diverse regions. By leveraging comprehensive datasets and employing comparative and trend analyses, the study reveals critical patterns—most notably, the association between elevated military spending and diminished peace index scores in conflict-affected areas.

The research offers valuable insights into how governments prioritize defense and healthcare funding, and how these choices influence national and regional stability. It emphasizes the importance of striking a balance between military preparedness and investment in public welfare to promote sustainable peace.

This analysis is particularly relevant for policymakers, defense strategists, and health planners, as it highlights the broader implications of fiscal allocation on global security. The findings pave the way for future studies exploring causality and developing policy strategies that simultaneously support national security and societal well-being.

Additional Research Questions:

1. How does sustained high military spending affect a nation's long-term economic development and its relationships on the global stage?
2. In countries with significant military budgets, what impact does variation in government health spending have on public health outcomes?
3. Are there observable year-over-year trends linking fluctuations in military spending to changes in global peace index scores?
4. Is it possible to build a predictive model that forecasts a country's peace index ranking based on shifts in its military expenditure?
5. How does foreign aid influence the allocation of resources between defense and healthcare in financially constrained countries?

These questions seek to deepen the understanding of the interplay between military and health investments and their influence on national well-being, global perception, and stability.