**REPORT- Water Fluoridation Status in the United States**

Ameya Sanghvi1, Devansh Manocha1,Urmi Phanse1,Ojasvi Vacharajani1, Manogna Mutte1

1. Boston University School of Public Health

Community water fluoridation involves maintaining an optimal fluoride concentration of 0.7mg/dl in drinking water to effectively prevent tooth decay.(*CDC - MWF - About My Water’s Fluoride*, n.d.) By ensuring regular exposure to fluoride, this process plays a crucial role in preventing cavities and strengthening tooth surfaces, promoting dental strength and overall oral health. While alternative fluoride-containing products like toothpaste, mouth rinses, and dietary supplements exist, community water fluoridation stands out as the most economically efficient means of delivering fluoride. Its impact is substantial, reducing tooth decay by 25% across all age groups, including children and adults. This method ensures that fluoride benefits reach the entire community consistently. Recognized for its cost-effectiveness and widespread effectiveness, community water fluoridation remains a cornerstone in the collective effort to combat dental issues and enhance public dental well-being. (*Water Fluoridation Basics | Community Water Fluoridation | Division of Oral Health | CDC*, n.d.)

**Purpose of the dashboard:**

The purpose of the dashboard is to provide data visualization regarding water fluoridation of public water systems across different states of the U.S. over time. The Dashboard focuses on the total population across the US and state-wise subpopulation.

**Source of Data:**

The dashboard's data was sourced from the government website https://catalog.data.gov/, which provides reliable statistical information.

**Intended Audience:**

We used the data on public water systems to create dashboards in order to provide trend analysis of Key Performance Indicators along with state level breakdowns and indicator comparisons. This offers a concise and efficient way to communicate the information to stakeholders like public health experts, policymakers, researchers and health departments at state and country levels. It can be utilized for research, geo-mapping, planning public health interventions, resource allocation, and policy adjustments.

**Key Performance Indicators:**

For the dashboard we used key performance indicators like:

* **Total number of public water systems (PWS):** It indicates the total number of water systems available for public use in the US. This is derived by counting the total number of public water systems available during the years 2016, 2018 and 2020 for every state in the US.

* **Number of PWS providing fluoridated water:** It indicates the total number of public water systems in the US providing water with the recommended fluoride level. This KPI is derived by counting the total number of public water systems that have fluoride at the recommended level.

* **Percentage of the population served by fluoridated PWS:** This indicates the percentage of the US population receiving fluoride at the recommended levels from public water systems. It is calculated by dividing the total population receiving fluoridated water at the recommended level from PWS with the total US population and then multiplying by 100.

* **Percentage of population receiving fluoride below recommended level from PWS:** It indicates the percentage of population in the US receiving fluoride below recommended level from the public water systems. This is calculated by dividing the total population receiving fluoride below the recommended level from PWS with the total US population and then multiplying by 100.

A map of the united states

Description automatically generatedA map of the united states

Description automatically generated

A map of the united states of america

Description automatically generated

The dashboard (map of US) displays the percentage of the US population receiving water from PWS below the recommended level of 0.7mg/L over the years 2016, 2018 and 2020. The states with the highest percentage of population were highlighted with darker colour compared to the states that have less percentage of population receiving fluoride below recommended levels. The highest percentage to lowest percentage of population receiving fluoride from PWS below the recommended level during 2016 ranges from 88.7% to 0.1%; during 2018, it ranges from 91.2% to 0.2%; during 2020, it ranges from 91.5% to 0.1%. Over the years, there seems to be only a slight increase in the percentage of the US population receiving fluoride from PWS below the recommended level.

A screenshot of a green and yellow chart

Description automatically generated

A screenshot of a green and yellow chart

Description automatically generated

A screenshot of a graph

Description automatically generated

The dashboard of the waffle chart shows the population in the US receiving fluoridated water below recommended level. The states with the percentage above recommended level were highlighted in green whereas those with percentage below recommended level were highlighted in yellow. They show that the population in the US receiving water below the recommended level in 2016 is 27.2%, in 2018 it is 27% whereas in 2020 it is 27.3%. Over the years, there seems to be only a slight increase in the percentage of the US population receiving fluoride from PWS below the recommended level.

**A graph of blue bars

Description automatically generated with medium confidence**

The dashboard displays the top 10 states in the US with the highest number of PWS providing fluoridated water along with the total number of PWS. Texas has the highest number of fluoridated PWS and total PWS as well, followed by Illinois, Michigan,  Georgia, North Carolina, Florida, California, New York, Pennsylvania, and Washington. This dashboard depicts that though there are several PWS in these states the relative number of PWS providing fluoridated water at the recommended level are comparatively less, except for Illinois which has relatively more number of PWS providing fluoridated water than total number of PWS.

A table with numbers and a number in the middle

Description automatically generated with medium confidence

The dashboard displays the top five and least five ranking of US states along with sparklines regarding PWS during 2016, 2018 and 2020. Over these years the top 5 states were Texas, California, Washington, New York, and North Carolina whereas the least 5 states were Rhode Island, Hawaii, Delaware, Nevada, and Wyoming. From 2016 to 2020, the overall trend of the sparklines for the top 5 states seem to increase except for Washington which seems to be constant whereas for the least 5 states it seems to be constant except for Hawaii which shows a slight increase from 2016 to 2018, remaining constant till 2020.

**Updating the Dashboard:**

Overall, these dashboards provide a visual representation of the trends of fluoridated PWS, total PWS and the population in the US receiving fluoridated water over the years 2016, 2018 and 2020 across the states. As the data was collected once every 2 years from 2016 to 2020, it would be useful if the dashboards were updated every 2 years. It could be updated either through manual data entry or automated data integration to ensure both efficiency and accuracy. Subject matter experts like public health professionals, data managers, researchers and state and federal level health departments should be responsible for updating the dashboards every 2 years.

**Interpretation:**

The dashboard offers a comprehensive visualization of community water fluoridation across the United States, focusing on public water systems (PWS). It presents key performance indicators (KPIs) such as the total number of PWS, the number of PWS providing fluoridated water, and the percentage of the population served by fluoridated PWS. For instance, in 2020, the highest percentage of the population receiving water from PWS below the recommended level of 0.7mg/L was 91.5%, while the lowest was 0.1%. The dashboard also highlights the top 10 states with the highest number of fluoridated PWS, with Texas leading, followed by Illinois, Michigan, Georgia, and North Carolina. Furthermore, the waffle chart in the dashboard shows that the percentage of the US population receiving water below the recommended level was 27.2% in 2016, 27% in 2018, and 27.3% in 2020. The dashboard also includes sparklines for the top five and least five ranking states regarding PWS from 2016 to 2020, showing trends such as the consistent performance of Texas and the slight increase in Hawaii's ranking from 2016 to 2018. Intended for stakeholders in public health, policy-making, and research, the dashboard provides valuable insights for decision-making and resource allocation, with state-level breakdowns and trend analysis over time. The dashboard is recommended to be updated every two years by public health professionals and relevant health departments to ensure accuracy and relevance. Overall, the dashboard serves as a vital tool for monitoring and evaluating the effectiveness of community water fluoridation programs in the United States, contributing to informed decision-making and improvements in public health.

**References:**

*Water Fluoridation Basics* | *Community Water Fluoridation* | *Division of Oral Health* | *CDC*. (n.d.). <https://www.cdc.gov/fluoridation/basics/index.htm#:~:text=Water%20fluoridation%20prevents%20tooth%20decay,even%20rebuild%20the%20tooth%27s%20surface>

*CDC - MWF - About my water’s fluoride*. (n.d.). CDC.gov. <https://nccd.cdc.gov/doh_mwf/default/AboutMWF.aspx#:~:text=How%20Much%20Fluoride%20Is%20Needed,and%20promotes%20good%20oral%20health>