



VCU

Virginia Commonwealth University
VCU Scholars Compass

Undergraduate Research Posters

Undergraduate Research Opportunities Program

2013

Overuse of Fluoride in Public Water Systems: Stimulating Fluorosis Rather Than Preventing Dental Caries

Kaixin Chen

Virginia Commonwealth University

Follow this and additional works at: <https://scholarscompass.vcu.edu/uresposters>

© The Author(s)

Downloaded from

Chen, Kaixin, "Overuse of Fluoride in Public Water Systems: Stimulating Fluorosis Rather Than Preventing Dental Caries" (2013).
Undergraduate Research Posters. Poster 29.

<https://scholarscompass.vcu.edu/uresposters/29>

This Article is brought to you for free and open access by the Undergraduate Research Opportunities Program at VCU Scholars Compass. It has been accepted for inclusion in Undergraduate Research Posters by an authorized administrator of VCU Scholars Compass. For more information, please contact libcompass@vcu.edu.

Overuse of Fluoride in Public Water Systems: Stimulating Fluorosis Rather Than Preventing Dental Caries



Kaixin Chen

Why do we care?

There has been an ongoing debate as to whether or not water should be fluoridated. Constant exposure to fluoride in children can result in dental fluorosis, an irreversible condition caused by excessive ingestion of fluoride, which destroys enamel; however, inadequate exposure can increase the chances of developing dental caries.

Although dental fluorosis afflicts individuals of all ages, sexes, and races, due to biological susceptibility and cultural practices, African American children between the ages of zero months to eight years are more susceptible to developing dental fluorosis. Therefore, the African American populations of the predominantly African American cities with fluoridated public water systems in the United States are being overdosed with fluoride. Agencies within the United States Public Health Services and the Environmental Protection Agency should regulate the water systems in these predominantly African American cities in order to decrease the prevalence of dental fluorosis.

The Poison in the Water

The Centers for Disease Control and Prevention (CDC) initially approved the fluoridation of public water systems in the 1940s when researchers claimed that topical exposure and consumption of fluoride reduced the prevalence of dental caries. Over the course of the next few decades, public health professionals did indeed witness a decrease in the prevalence of dental caries in municipalities with fluoridated water systems; however, there was also a sharp increase in the prevalence of dental fluorosis, which is detrimental to the structure and aesthetic appearance of dentition.

A Formula for Dental Fluorosis

Reconstituted powder baby formula is one of the most common sources of nutrients for infants who are not breastfed. The fluoridated tap water that is used to reconstitute infant formula contains optimal levels of fluoride according to standards set by the EPA based on recommendations made by the CDC; however, these fluoride concentrations can often be too high for infants whose fluoride intake to body weight ratios are very high. Other sources of fluoride in infants' diets include dry cereals, processed chicken, reconstituted beverages, fluoridated dentifrices, and fluoride supplements.

Race Matters

According to reports made by the CDC, cases of dental fluorosis in the United States are more severe and more prevalent in the African American population than they are in the Hispanic American or Caucasian populations. There are factors such as biological susceptibility and greater fluoride intake that make African Americans more susceptible to dental fluorosis. The disparity in fluorosis prevalence can be attributed to the finding that African American children are more likely to consume tap water and dental supplements than Caucasian children are and less likely to consume breast milk, which has little to no fluoride. When more fluoride compounds are present in the body and oral, the duration of enamel-fluoride contact increases. In a study of metabolic processes of mice, it was suggested that metabolism of fluoride could attribute to fluorosis susceptibility due to the presence and absence of certain fluoride-related enzymes. These enzymes can correlate to certain enzymes in humans. Because genetic susceptibility cannot be altered, regulation of fluoride intake needs is pertinent to reducing dental fluorosis.

Conclusion

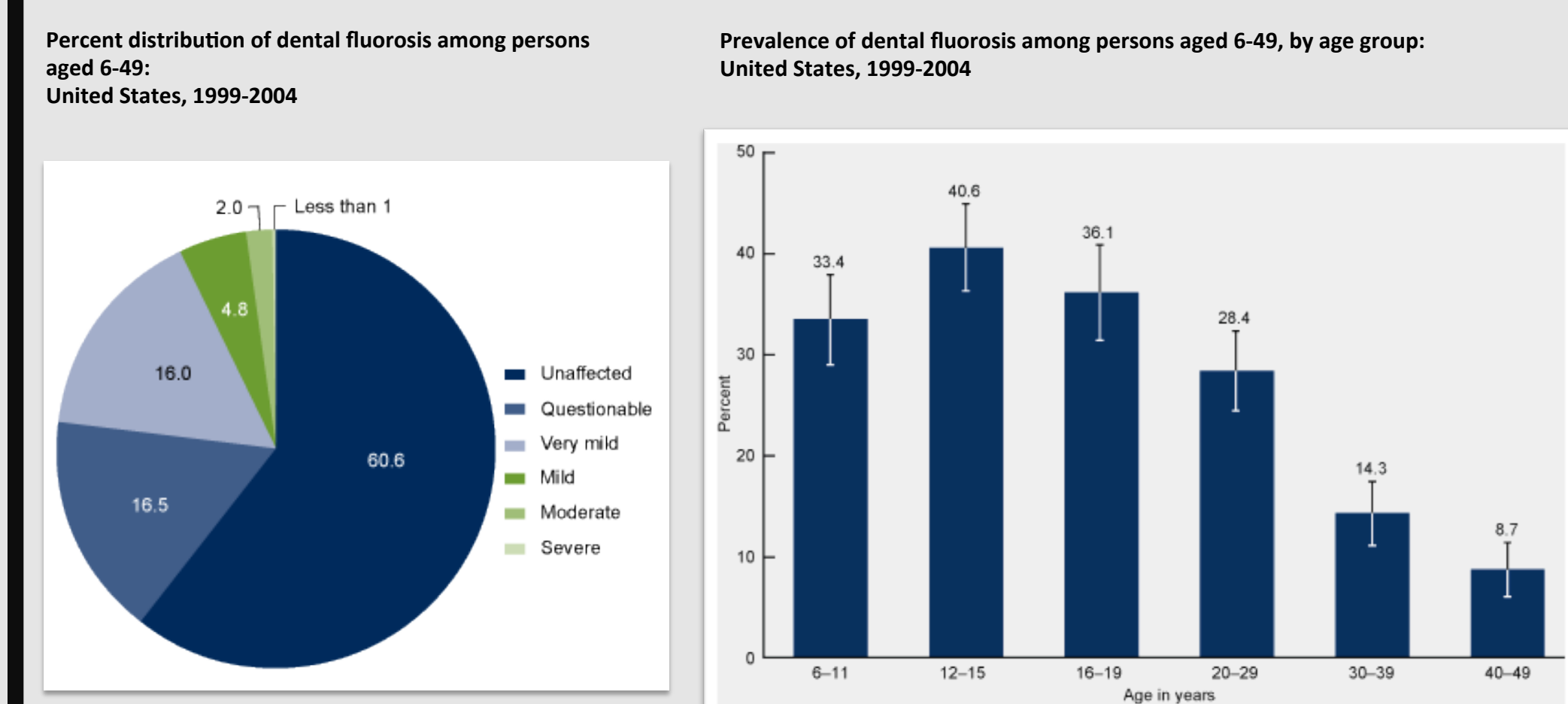
With the increase of alternative options for fluoride, many of which are not as easily utilized by children between the ages of zero months to eight years, it is only reasonable to decrease public water fluoride concentrations to a level that will be beneficial to their dental enamel development. When fluoridating water, public health officials cannot only consider the decrease of dental caries rates but also consider the increase of dental fluorosis rates, which is rarely accounted for. Because African Americans are both biologically susceptible and perform cultural practices that make them predisposed to developing dental fluorosis, public health officials in areas with high African American populations need to consider the demographic distributions of their respective municipalities and inform these African Americans of their predispositions. Until the levels of public water fluoridation can be altered, there are other options available; however it is the responsibility of health officials and dental practitioners to ensure that the public is aware of these options. A decrease in the prevalence of dental fluorosis in the African American population of the United States can be achievable; however, it will be a long process that requires financial support and the cooperation of national, state and municipal public health organizations.

Purpose

Explore dental enamel development in African American children ages zero months to eight years with unerupted teeth in relation to concentrations of fluoride in public water systems in Jackson, Mississippi and Detroit, Michigan

Find out if and how fluoride might alter enamel development in unerupted teeth resulting in dental fluorosis and varying enamel strengths

Understand how to better use fluoride to implement a system that will improve the dental health of African American individuals in the United States.



What to Consider when Adjusting Public Water Concentrations

The CDC has established a database that records the concentrations of fluoride in fluoridated water systems across the United States. This database needs to be utilized along with other databases in order to provide residents with optimal concentrations of fluoride.

According to the 2010 Census Briefs published by the U.S. Census Bureau (2011), the cities of Detroit, Michigan and Jackson, Mississippi have the highest percentage of African American residents at 84% and 80% respectively (p. 14). Jackson, Mississippi's public water system has a fluoride concentration of 0.8 mg/L (CDC, 2008b), and Detroit, Michigan's public water system has a fluoride concentration of 1.0 mg/L (CDC, 2008a). Although this range falls within the recommendations provided by the EPA, they are not optimal for children aged zero months to 8 years old who consume large quantities of water relative to their body masses.

The development of fluorosis occurs primarily before the age of eight prior to dentition eruption. Although all individuals need to consume water and fluoride, it is the most convenient for infants to get small quantities of fluoride from the water. Adults and children older than eight years old can ingest fluoride in other forms such as fluoride supplements and dentition. When considering how to fluoridate public water systems, it is the most important to consider children in the zero month to 8 year age range.

Taking Action

Public health outreach programs should educate the public so individuals will be more capable of making decisions that will optimize their fluoride concentration so children can minimize dental caries without developing dental fluorosis.

Breastfeeding should be suggested to mothers whose children's diets largely consist of fluoride. Consultations with these mothers may be required to analyze why they avoid breastfeeding and provide clarity for any misconceptions.

Although less economical, feeding infants pre-constituted formulas that are pre-labeled with fluoride concentrations and using pre-packaged non-fluoridated water to reconstitute baby formula are both options. Defluoridation filters are also available; however, they are time consuming and expensive to use. Manufacturers can also label their products with respective fluoride contents.

Guardians are responsible for monitoring fluoride consumption and general dentists should prescribe fluoride supplements or suggest modifications in fluoride consumption as necessary to monitor pre-eruptive enamel development.

The Environmental Protection Agency should implement regulations and recommendations that will result in the decrease of the fluoride concentration in water systems in municipalities with large or dense African American populations, monitor water concentrations, and work with create awareness of African Americans' increased susceptibility to fluoride.

Dean's Index for Dental Fluorosis



Acknowledgements

Thank you to Professor Mary Boyes for her support and guidance in the creation of this research paper.