

WATER FLUORIDATION EXPOSURE AMONG PATIENTS RECEIVING DENTAL TREATMENT UNDER GENERAL ANESTHESIA

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PURPOSE

The aim of this study is to compare the fluoridation of home water supplies among patients receiving comprehensive dental treatment under general anesthesia at Yale Children's Hospital. This study was drawn from retrospective chart data for all patients seen over a calendar year (from 01/01/2018—12/31/2018). Data on water fluoridation was obtained from government websites both state and local.

ABSTRACT

The positive impacts of fluoride use on oral health have been immense, yet Early Childhood Caries (ECC) continues as the most common chronic disease in children. Early Childhood Caries is largely preventable and water fluoridation is among the safest and most cost-effective interventions available. Understanding the accessibility and distribution of water fluoridation among patients with ECC is critical for optimizing the chances for improved lifelong oral health. This chart review examines all patients seen under general anesthesia during the calendar year of 2018. The patient's demographics were charted on a map and cross referenced with a map of water districts, fluoridation levels, and location of treatment center. Understanding the geographical distribution of patients can highlight areas of need as well as provide unique insight as to the most effective and appropriate interventions to address those needs. Understanding our communities and the demographics of our patients is crucial to fulfilling our role as oral health providers.

METHODS

A retrospective chart review was completed for all children receiving dental care under general anesthesia at Yale New Haven Hospital. Additional inclusion criteria included the following:

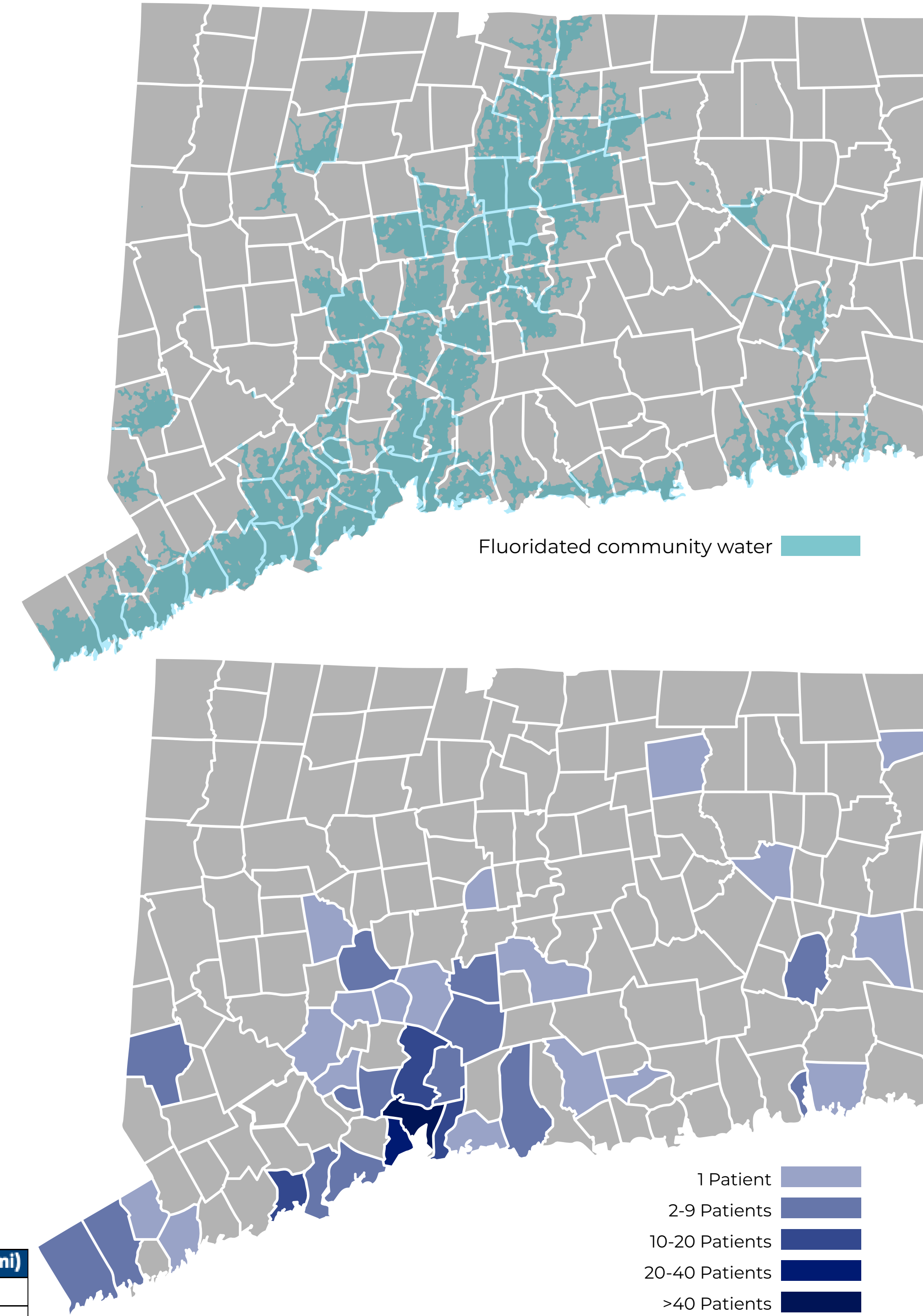
- Child < 72 months of age
- Complete documentation in the Electronic Medical Record
- Absence of Hereditary Developmental Defects of the Dentition (ex. Amelogenesis Imperfecta)
- Treated by Attendings and Residents of Yale New Haven Health Department of Pediatric Dentistry

The dmft (Decayed, Missing, Filled Teeth) score was calculated for each child and their address of residence on the date of the procedure recorded. Average dmft score were calculated for each town and correlated with their water fluoridation status as provided by data from Connecticut State's Department of Public Health. Furthermore, the distance from each community to the location of the treatment center was compiled and compared.

| Fluoridated | # of Patients | Avg DMFT | Distance (mi) |
|-------------|---------------|----------|---------------|
| Ansonia | 2 | 10 | 12 |
| Branford | 1 | 12 | 7.7 |
| Bridgeport | 10 | 8.3 | 18 |
| Cheshire | 1 | 4 | 19 |
| Danbury | 3 | 13.33 | 41 |
| East Haven | 15 | 7.93 | 4.7 |
| Greenwich | 2 | 3.5 | 45 |
| Groton | 1 | 8 | 50 |
| Guilford | 2 | 7 | 16 |
| Hamden | 19 | 11.42 | 12 |
| Meriden | 8 | 10.13 | 24 |
| Middletown | 1 | 7 | 28 |
| Millford | 5 | 9.8 | 9.5 |
| Naugatuck | 1 | 8 | 19 |
| New Britain | 1 | 4 | 35 |
| New Canaan | 1 | 8 | 36 |
| New Haven | 124 | 8.94 | 2.6 |
| New London | 2 | 11 | 48 |
| North Haven | 5 | 7 | 9.3 |
| Norwalk | 1 | 3 | 32 |
| Norwich | 2 | 10 | 56 |
| Oxford | 1 | 4 | 17 |
| Prospect | 1 | 5 | 18 |
| Seymour | 1 | 13 | 14 |
| Stamford | 5 | 7.4 | 40 |
| Stratford | 2 | 4 | 15 |
| Tolland | 1 | 0 | 57 |
| Wallingford | 4 | 8.25 | 15 |
| Waterbury | 7 | 7.29 | 38 |
| West Haven | 32 | 9.4 | 3.2 |
| Woodbridge | 2 | 9.5 | 8.6 |

| Non-Fluoridated | # of Patients | Avg DMFT | Distance (mi) |
|-----------------|---------------|----------|---------------|
| Deep River | 1 | 10 | 30 |
| Jewett City | 1 | 15 | 65 |
| Killingworth | 1 | 20 | 26 |
| Oakville | 1 | 11 | 42 |
| Putnam | 1 | 10 | 89 |
| Willimantic | 1 | 10 | 78 |

| Totals | # of Patients | Avg DMFT | St. Dev. | Distance (mi) |
|-----------------|---------------|-------------|-------------|---------------|
| Fluoridated | 263 | 8.92 | 4.14 | 24.21 |
| Non-Fluoridated | 6 | 12.67 | 4.08 | 55 |
| Total | 269 | 8.98 | 4.17 | 29.21 |



RESULTS

Community water fluoridation has been a public health policy in the state of Connecticut since 1950. The policy has adapted and changed in accordance with the recommendations and guidelines of the times as provided by the Center for Disease Control (CDC). In 1965 the state of Connecticut set forth the criteria for management of public water supplies (PWS). Specifically they stated that all PWSs serving a population > 20,000 must be in compliance with the state fluoridation plan. The most recent update to the state fluoridation plan came in 2011 following an adjustment of recommendations by the Environmental Protection Agency. This adjustment resulted in a state wide recommendation of a fluoride concentrations of 0.7m/L. (An updated map demonstrating the areas with fluoridated public water is included above.)

After completing the review there were 625 patients that received dental treatment under general anesthesia at Yale Children's Hospital within the date range of 01/01/2018—12/31/2018. 269 of these patients met our selection criteria which represents 43% of pediatric patients receiving dental treatment in the hospital.

Of the total qualifying patients 263 resided in communities with water fluoridation and 6 did not. Of those with fluoridation there was a mean dmft of 8.92 (SD = 4.14) while those without fluoride possess a mean of 12.67 (SD = 4.08). This displayed a 30% reduction in dmft scores for those with community water fluoridation. This is

synchronous with current literature which has cited a 35% reduction in dmft scores between groups receiving non-fluoridated water and those receiving community water fluoridation. There is insufficient information present in the review to determine if community water fluoridation alone is responsible for this reduced caries rate.

Of the fluoridated communities the average distance from the location of treatment was 24.2 miles. For those without fluoridation this value increased to 55 miles. This discrepancy fits the distribution of communities in Connecticut with water fluoridation. Geographically, the location of treatment is quite centrally located with respect to the state but also with respect to the main interstate highways. The communities providing fluoridated water are focused along these same interstates. The combination of fluoridated water and ease of transportation via interstate resulted in the average distance a patient of a fluoridated community traveled being less than 50% of those patients in communities without fluoride. This trend continues as we examine the state population. The vast majority of the state's populous is concentrated along the same routes and results in these communities yielding a higher percentage of patients receiving treatment. There is inadequate data available as part of this review to label distance as a determinant factor for optimal results. The presence of additional treatment centers throughout the state was not accounted for in this review.

DISCUSSION

Our review and analysis of these patients highlighted multiple aspects of our communities in Connecticut. The number of patients receiving dental care under general anesthesia that reside in communities without water fluoridation was much lower than anticipated. We are happy to see such a high percentage of our patients receiving fluoridated water, however it leads us to recognize the need for additional interventions to reach these patients. Additional efforts would be well spent here to identify, organize, and implement further public health measures. The distribution of community water fluoridation in Connecticut was unfortunately not as diverse as we anticipated, and we attribute this to the population density distribution and mandated threshold of 20,000 required for community water fluoridation compliance. Lastly the average distance from location of treatment was as expected, also due to the distribution of the general populous.

There were multiple areas in which our review could be improved:

- Confirmation of use of public water by patients. Regular use of bottled water and/or advanced filtration techniques would diminish and potentially negate the effects of community water fluoridation.
- Consideration for pre vs. post-eruptive effects of Fluoride. A history of previous addresses during early stages of life and tooth development were not available to draw data from.
- Increasing sample size and parameters would facilitate a greater insight into the challenges that are facing our patients.

CONCLUSION

Water fluoridation has been cited as one of the most cost effective, equitable, and safe public health measures available, and yet despite its use, Early Childhood Caries (ECC) remains the most common chronic disease of childhood. It is clear that this seemingly incongruous relationship is reflected in the patients treated at Yale New Haven Hospital whom possess high caries rates despite most having access to fluoridated water.

As pediatric oral health providers we cannot expect community water fluoridation alone to reach all children and provide sufficient protective measures to completely combat ECC. Additional, ideally individualized, efforts must be made to reach high risk patients and to provide support and intervention.

Potential avenues that are worth investigating include oral health screenings of expectant mothers, child-care center oral health education programs, and school-based oral health education programs. In recent literature these have shown promise in low-and middle-income countries and additional efforts to adapt these programs to higher income areas could prove productive.

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