OralHealth

In Madison County

2019

OralHealth *In Madison County*

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Overview of Oral Health

Oral health is more than healthy teeth. Oral health is essential to the general health and well-being of all individuals. A healthy mouth enables people to eat, speak and socialize without pain, discomfort or embarrassment. Maintaining one's oral health can prevent disease, affect our performance in school, attendance and productivity at work, enhance overall health and well-being, and lessen financial and social costs that significantly diminish the quality of life. Good oral health means being free of chronic oral-facial pain, oral and pharyngeal (throat) cancers, oral soft tissue lesions, birth defects such as cleft lip and palate, and conditions that affect the oral, dental and craniofacial tissues.

Over the past 50 years, safe and effective preventive strategies lead to marked improvements in oral health and, as a result, most middle-aged and younger Americans can expect to retain their natural teeth over their lifetimes without serious oral health problems. Most of the gains are a result of effective prevention and treatment efforts, such as community water fluoridation and dental sealants; however, these benefits are not available to all Americans.[1] The most vulnerable populations are those least likely to receive preventive and restorative dental services, such as the low income, the least educated, racial and ethnic minorities, immigrants, older adults, persons with HIV, the developmentally and medically disabled, and the under– and uninsured.[1]

Some of the most common diseases that impact our oral health include tooth decay (cavities), gum (periodontal) disease, and oral cancer. Oral conditions are frequently considered separate from other chronic conditions, but these are actually inter-related.

Certain conditions increase one's risk for periodontal disease including diabetes, a weakened immune system, poor oral hygiene, and family history. Poor oral health is linked to chronic disease, like heart disease. It is also linked with risk behaviors like using tobacco and eating and drinking foods and beverages high in sugar.[2]

Tooth loss is directly associated with deteriorating diet and compromised nutrition,[3] which can impair general health and exacerbate existing health conditions. Further, the mouth is often an entry point for infections, which may spread to other parts of the body.[4] There are associations between chronic oral infections and heart and lung diseases, stroke, low birth weight and premature births. Associations between periodontal disease and diabetes have also been noted.[5]

Acute dental conditions also can restrict the participation of adults in the workforce, including restricted duties and lost work days due to dental related illness.[1]

In 2016, expenditures for dental services in the U.S. were $124.4 billion, which accounted for 3.7 percent of the overall national health expenditures.[6]

Introduction

This report provides the most complete compilation of oral health data for Madison County to date, with county-specific baseline data, including oral health status, risk factors, workforce analysis, and economic burden of dental care. The report provides a glimpse into the effects of oral disease on the general health of Madison County residents.

Although we, as a nation, have made substantial gains in improving the oral health for all Americans, including Madison County residents, oral disease, which is nearly 100 percent preventable, is still a major health issue. Knowledge of baseline and trend data, and increasing awareness of the linkages between oral health and general health, are the first steps in evaluating community efforts to improve the overall health of Madison County residents.

The Impact of oral disease on Madison County residents is presented in sections with supporting data, where available. The sections address health status, behavioral risks, risk reduction, workforce, access to care, and conclude with county-wide oral health goals, objectives and key measures. This report shall serve as framework for addressing oral health in Madison County.

Demographics

Madison County is primarily a sub-urban and rural community located in central New York. The County encompasses 661 square miles and is located approximately 20 miles from the urban centers of Syracuse and Utica. Madison County contains one city, fifteen towns and ten villages. The population in Madison County is about 70,965 (2017 census estimate) with a population density of 112 persons per square mile, much less than the 240 people per square mile average for the rest of upstate NY. The County's population distribution by age is similar to the State's, but with a higher proportion of individuals over 60 years of age (25%) compared to the state (22%).

Between 2013-2017 there were 26,307 households with 2.5 people per household. The majority (95%) of the population is white with small concentrations of minorities including African-Americans (2%) and persons of Hispanic origin (2%). Eleven percent of the county's population is below the poverty level and almost one third (29.1%) are below 200 percent of the poverty level. Madison County's current economy is based primarily on agriculture. The service, wholesale, and retail trade sectors have grown in importance in the past several years

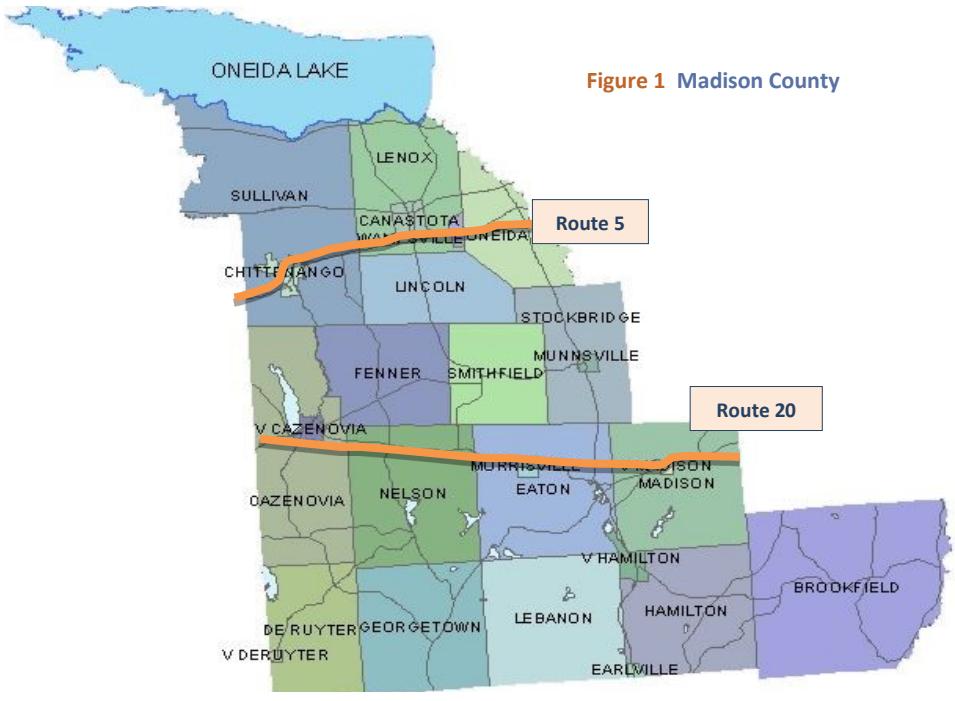


Figure 1 Madison County

and the proximity to Syracuse and Utica provide employment opportunities to Madison County residents.

Most of the county's population (49%) resides in the northern third of the county along the route 5 corridor [Figure 1].

Oral Health Conditions

Children

Children face the additional challenge of poor oral health and/or poor oral health habits having far reaching effects into their adulthood. Dental conditions in childhood can restrict children's participation in schooling and education through days lost to illness. Impaired physical appearance due to dental disease can further limit children's ability to socialize with confidence and develop social norms and relationships.

Caries (i.e., tooth decay or cavities) affect children in the United States more than any other chronic infectious disease.[7] In New York State the percentage of caries experience in children reflects a history of tooth decay and indicates that opportunities for primary prevention may have been missed. A significantly higher proportion of Madison County third-grade children (74%) have or have had a caries experience compared to the average NY state third-grader (45%). This seems counter-intuitive given that the proportion of Madison County third-graders with untreated caries, sealant applications, dental insurance, and dental visits within the last year are comparable or better than the state percentage (Table 1).

"Children residing in Madison County have a higher burden of (dental) disease compared to the rest of the state."

Children in Madison County consume a significantly higher proportion of fluoride tablets then children in the state (Table 1). This is most likely due to the fact that 32 percent

of the county's population is served by individual/private water sources (e.g., wells), and of the population on public water supply, 52 percent is served by municipal water systems that are not fluoridated. Nationally, children living in communities with fluoridated tap water have fewer cavities than children whose water is not fluoridated.[8]

Table 1: Percentage of 3rd grade children with caries experience, untreated caries, at least one sealant, dental insurance, at least one dental visit w/in last year, and regular consumption of fluoride tablets - 2010 - 2012

Indicator	Madison County (%)	NYS excluding NYC (%)
Caries experience	74.4	45.4
Untreated caries	24.6	24.0
Sealant application	71.1	41.9
Dental Insurance	93.6	81.8
At least one dental visit last year	81.2	83.4
Regular consumption of fluoride tablets	79.8	41.9

Source: NYSDOH 2009-11 Oral Health Survey of Third Grade Children

Children from low socioeconomic families tend to demonstrate higher prevalence of tooth decay compared to children from higher income schools.[7] Using free and reduced lunch eligibility as an approximate measure for socioeconomic status,[9] fourteen of twenty-six schools (54%) in Madison County would be classified as low income (i.e., greater than 50 percent eligible for free or reduced price meals) (Table 2).

Tooth decay begins early in a child's life. Rampant decay is often found among low-income toddlers and preschoolers. Head Start, serving children 5 years old and younger, in addition to pregnant women, is one program that can identify oral disease early and increase the school readiness of young children from families with low incomes.[10]

In Madison County 141 children ages 3–5 were enrolled in Head Start in 2017-2018(Figure 2). Head Start Program Performance Standards state that programs, in collaboration with parents, must determine each child's oral health status within 90 days of entry into the program. Nationally, the percent of Head Start children with a dental provider is 93 percent; whereas, in Madison County, the percentage is 76 percent.[11]

Cleft Lip/Palate

Cleft lip/palate are the most common birth defect. The CDC estimates that approximately 7,088 babies are born each year with an orofacial cleft.[12]

While dental decay is the most common oral disease in children,

Figure 2 Head Start in Madison County

Mohawk Valley Community Action Agency, Inc serves 119 children, ages 3-5, in Madison County
In the 2017-2018 school year, cumulative enrollment was 141.

Oral Health

76% of children had a dental home
35 children received preventative care (25% - 1 of every 4 children!)
32 children had a professional dental exam completed (22%)

- 12 of those children were identified as needing dental treatment (37.5%)
- Of those 12 children, at least 1 child had received dental treatment. (8.3%)

Insurance

Of the 141 students :

- 134 were enrolled in Medicaid and/or Child Health Plus (95%)
- 3-TriCare (2.1%)
- 1- State Only Funded (0.8%)
- 3 children, were without insurance (2.1%)

Source: A. DeCondo, MVCAA, personal communication, December 7, 2018

Table 2: Grades, enrollment, free and reduced lunch percentage, and School-Based Health Center-Dental Programs for public schools in Madison County*

School District (SD)	School Name	Grades Served	Children Enrolled (2016-2017)	Free & Reduced Lunch % (2016-2017)	School Based Health – Dental Program
Brookfield Central SD	Brookfield Central School	PK-12	236	58%	No
Canastota Central SD	Peterboro Street Elementary School	K-1	190	59%	No
	South Side Elementary School	2-3	204	62%	No
	Roberts Street Middle School	4-6	312	60%	No
	Canastota High School	7-12	641	53%	No
Cazenovia Central SD	Burton Street Elementary	K-4	493	24%	No
	Cazenovia Middle School	5-7	307	23%	No
	Cazenovia High School	8-12	649	19%	No
Chittenango Central SD	Bolivar Road Elementary	K-4	453	34%	No
	Bridgeport Elementary	K-4	224	56%	No
	Chittenango Middle School	5-8	626	39%	No
	Chittenango High School	9-12	608	37%	No
DeRuyter Central SD	DeRuyter Elementary School	PK-5	177	57%	Yes
	DeRuyter High School	6-12	205	52%	No
Hamilton Central SD	Hamilton Elementary School	PK-5	285	34%	No
	Hamilton Junior-Senior High School	6-12	278	29%	No
Madison CSD	Madison Central School	PK-12	459	44%	No
Morrisville-Eaton CSD	Edward R Andrews Elementary	PK-5	324	57%	No
	Morrisville-Eaton Middle-High School	6-12	351	56%	No
Oneida City SD	Durhamville School	K-5	244	53%	No
	North Broad School	K-5	239	68%	No
	Oneida Senior High School	9-12	621	41%	No
	Otto L Shortell Middle School	6-8	488	54%	No
	Seneca Street School	K-5	223	37%	No
	W F Prior Elementary School	PK-5	264	75%	No
Stockbridge Valley Central SD	Stockbridge Valley Central School	K-12	421	49%	No

*Source: 2016-2017 NYSED School Report Card data ; NYSDOH School Based Health - Dental programmatic data as of October 2018.

cleft lip/cleft palate is one of the most common and visible congenital anomalies, affecting about 4 out of every 2058 newborns in Madison County.[13] Children born with craniofacial defects, such as cleft lip and palate, require surgical treatment of these defects and extensive reconstruction that involves many health specialists. A craniofacial anomaly team is located nearby in Syracuse at Upstate Medical Hospital.

The causes of cleft lip and cleft palate are unknown. Cleft lip/palate are thought to be caused by a combination of genetics, environment factors,[14,15,16] and maternal and parental behaviors for risk taking and health. Maternal health behaviors such as smoking, alcohol use and multivitamin use affect cleft risks.[17,18,19]

Pregnancy

While oral diseases are significant in themselves, their relationship to maternal health specifically is often overlooked. There is a strong relationship between poor oral health in expectant mothers and birth outcomes including pre-term/low birth weight deliveries.[1,20,21, 22,23]

The National Institutes of Health reports that as many as 18 percent of pre-term low birth weight infants born in the U.S. may be attributed to infectious oral disease. Oral disease infections were found to stimulate uterine contraction, cervical dilation, labor and miscarriage.[24]

For various reasons, including concerns of how dental treatment may affect the unborn child on the part of both dentists and the expectant mothers, many pregnant women are not receiving needed dental care.[25]

The New York Pregnancy Risk Assessment Monitoring System (PRAMS) data from 2013 to 2015 found that, in 2013, about 18 percent of mothers experienced a dental problem during their pregnancy.[26] Between 2013 and 2015 there was a decrease in mothers having their teeth cleaned at least one year before pregnancy (62% in 2013 to 56% in 2015), having their teeth cleaned during pregnancy (57% in 2013 to 48% in 2015), and in having dental insurance coverage. (84% in 2013 to 73% in 2015).[27]

Pregnant women with gum disease who receive a thorough cleaning significantly reduce their risk for pre -term/low birth weight deliveries.[25]

According to the NYS PRAMS 70 percent of women were counseled by their prenatal provider on smoking and 70 percent were counseled on alcohol use, yet only about 58 percent spoke to a dentist or health care provider about dental care.[26]

Adults

Many adults in general suffer from unmet dental needs and may not understand that good oral health is essential to general health and well-being.

More than one in four (27%) adults in the United States have untreated tooth decay. Among adults aged 20-64 years, more than 90 percent had at least one cavity.[28] Dental caries among adults aged 35–64 was higher (94%–97%) compared with adults aged 20–34 (82%).[29] Interestingly enough, white adults and those living in families with higher incomes and more education have

had more decay.[28]

Untreated tooth decay can lead to a severe infection (abscess) under the gums, which can spread to other parts of the body and have serious, and in rare cases fatal, results. Although the prevalence of gum disease has decreased over the years, approximately half (46%) of adults over the age of 30 have signs of gum disease and about 9 percent have severe periodontal disease.[30] Currently there is no data available for adults in NYS and Madison County with respect to dental caries, untreated tooth decay, or gum disease.

In the 2016 Behavioral Risk Factor Surveillance System (BRFSS) survey administered by New York State, nearly half (47 percent) reported that they had at least one permanent tooth extracted.[31]

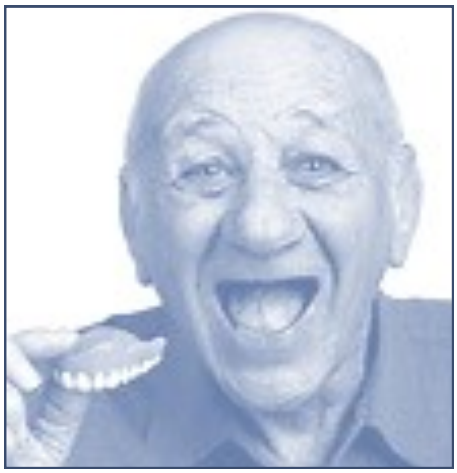
Individuals with chronic medical conditions, such as diabetes, cardiovascular disease, and tobacco-related illnesses, are at increased risk for oral disease. Moreover, some chronic conditions further aggravate oral disease.[32] Many systemic diseases, such as HIV and AIDS, have adverse oral health effects and result in greater prevalence of oral diseases.[33]

Older Adults

Older adults are at high risk for periodontal disease and tooth loss, due, in part, to lack of access to preventive measures when they were young, physical limitations that make brushing teeth difficult, lack of a perceived need for oral health care, and loss or limited dental insurance coverage.[30,34,35,36]

Nationally, as well as locally, the percent of the population age 65 years and older is increasing; therefore a greater number of persons age 65 years and older in Madison County will be in need of oral health services in the coming years.[37,38]

New York State ranks in the top fifteen states with the greatest percentage of seniors retaining their natural teeth at 88 percent.[39] However, that still leaves 12 percent of New Yorkers over age 65 who have lost all their natural teeth.

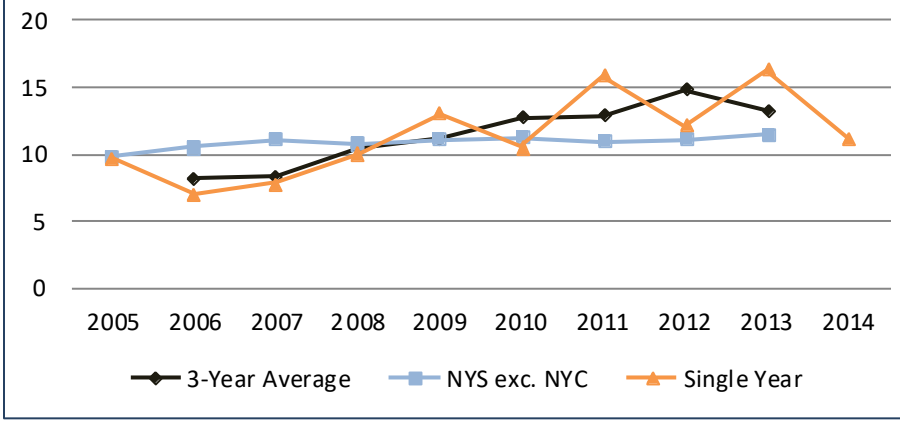


Oral cancers are most common among older adults. About 95 percent of oral cancers occur in people over 40 years of age. The average age at the time of diagnosis is about 60 years old, although oral cancer is now occurring more frequently in much younger patients. Older adults who smoke and are heavy drinkers are particularly at risk.[40]

In Madison County, from 2011 to 2015, there were 60 new cases of Oral Cavity and Pharynx cancer. Over those same years 16 people died of oral cavity and pharynx cancer in Madison County.[41] Figure 3 shows that the incidence rate (i.e. rate of new cancer cases), of oral cavity and pharynx cancer increased over the last decade and that the county's rate exceeds that of the state rate.

Many seniors remain at high risk for periodontal disease and tooth loss, due, in part, to loss of dental insurance coverage after retirement. While Americans paid out-of-pocket for approximately one-half of all dental care expenses in 2015, people age 65 and older paid more than 64 percent of their dental expenses. Only 37 percent of people 65 years of age and older have any type of dental insurance.[42]

Figure 3. Madison County Age-adjusted Lip, oral cavity and pharynx cancer incidence rate per 100,000



Source: NYSDOH. Madison County age-adjusted lip, oral cavity and pharynx cancer incidence rate per 100,000. Retrieved February 15, 2019 from https://www.health.ny.gov/statistics/chac/chai/docs/ora_25.htm.

Medicare, the primary source of medical coverage for seniors, does not cover most dental care, dental procedures, or supplies like cleanings, fillings, tooth extraction, dental plates, or other dental devices. Medicare Part A (Hospital Insurance) will pay for certain dental services that one gets in a hospital. Part A can pay for an emergency or complicated dental procedure, even though dental care isn't covered. Some Medicare Advantage Plans (Part C) offer extra benefits that original Medicare doesn't cover - like dental.[43] Medicare Advantage Plans available in Madison County vary in the type of preventive and comprehensive dental services covered as well as associated costs.[44]

The increasing number of seniors with fixed incomes and without dental insurance reduces the likelihood of accessing dental care. For low-income seniors, maintaining healthy teeth may be cost prohibitive, resulting in poor nutritional status and decreased quality of life.

Disparities

Health disparities include the disproportionate burden of oral disease that occurs among underrepresented racial and ethnic minority groups, low-income residents, older adults, migrant and seasonal farm workers, and those in rural areas. Social, economic and cultural factors affect how oral health services are delivered and how people access and utilize services.[45,46] Although the oral health status of New Yorkers mirrors national findings with respect to the disparities found among the different racial and ethnic groups, this data is not available at the county level.

Income & Education

Income and education are strong predictors of a person's future health and serve as an approximate measure for socioeconomic status. According to the NYS Department of Health, income and education levels were related to disparities in oral health, such that lower incomes and lower education levels were associated with higher poor oral health experiences. In addition, the percentage of individuals having a dental visit within the past year increased as education and income levels increased.[47] Although data at the county level is not available, we expect the conditions in Madison County to mirror those of the state.

Risk Factors

Tobacco use

Tobacco use, a known risk factor for periodontal disease and oral cancer, is higher among Madison County adults than the state average. According to the 2016 BRFSS estimates, Madison County smoking rates are higher than the states (14.1% of NYS adults were smokers versus 21.1% in Madison County).[48]

Almost all adults addicted to nicotine started smoking or using other tobacco products in their teens. Nearly 9 out of 10 adult smokers started smoking by age 18, and 99 percent started by age 26.[49]

Surveys of Madison County students grades 7-12 show that since 2003, the proportion of students who reported smoking at least 1 cigarette in the past month decreased by almost half. The most recent survey (2014), revealed that among the students who had smoked at least 1 cigarette in their lifetime, the majority say they were 13-14 years old when they smoked a whole cigarette for the first time. This is an older age than reported in the 1999-2007 surveys, when the majority said that they were 11-12 years old when they smoked a

whole cigarette for the first time.[50] Previous surveys did not ask about e-cigarette use among these students.

Throughout NYS, about 21 percent of high school students reported using e-cigarettes in 2016. This proportion has nearly doubled since they first asked the question in 2014.[51]

Smokeless tobacco (e.g., chewing tobacco) is associated with leukoplakia, oral cancer, decay and periodontal disease.[52] Smokeless tobacco use is lower in New York than in the rest of the United States. In 2015, smokeless tobacco use prevalence was 1.6 percent in New York compared with 4.4 percent in the rest of the country. Youth use of smokeless tobacco is low in New York and the United States as a whole. In 2014, 0.9 percent of New York middle school students and 3.6 percent of New York high school students reported current use of smokeless tobacco.[53]

Alcohol & Substance Use

Alcohol dependence and substance abuse are associated with increased risk for oral diseases such as caries and periodontitis.[54,55,56,57] More than half of all oral cancers are presumed to be caused due to the individual and combined effects of alcohol and smoking/chewing of tobacco.[58] Alcohol is thought to act as a solvent that facilitates the penetration of tobacco carcinogens into oral tissue.[59]

Data on alcohol and substance use in New York State, and in Madison County is limited. Nearly 19 percent of adults in NYS report excessive alcohol use in the form of either binge or heavy drinking. Binge drinking is the most common pattern of excessive use among adults in NYS. An estimated 17.5 percent of adults in NYS report binge drinking and 5.9 percent report heavy drinking. Excessive alcohol use is higher in men, adults aged 18 to 34 years, and adults with an annual household income greater than $75,000. White, non-Hispanic adults report higher rates of both binge (19.9%)

and heavy drinking (7.8%) when compared to other racial and ethnic groups. The prevalence of binge drinking reported among adults who are current smokers (30.9%) is double the prevalence reported among non-smokers (15.3%) while the prevalence of heavy drinking is almost three times greater among smokers (13.5%) as compared to non-smokers (4.7%).[60]

In Madison County, the percent of adult binge drinking (16%) is lower than the State percentage.[61] Further data on heavy drinking and association with alcohol use and drinking for adults is not available for Madison County.

For teens in Madison County, alcohol continues to be identified as the drug most frequently used with more than a third (36%) drinking alcohol. Of positive note, teen alcohol use in Madison County is decreasing; a trend that mirrors national data.[50]

Based on the New York State Office of Alcoholism and Substance Abuse Services (OASAS) 2010 estimates, approximately 12 percent of State residents age 12 and older experience a substance use disorder (addiction or abuse) annually. Statewide, over 1.9 million New Yorkers (1.77 million adults and 156,000 youth ages 12-17) have a substance abuse problem.[62]

About 22 percent of teens have tried marijuana, 4 percent methamphetamines, 6 percent inhalants, 3 percent steroids (without a doctor's prescription) and 7 percent other prescription drugs (i.e., without a doctors' prescription).[50]

Sugar sweetened beverages

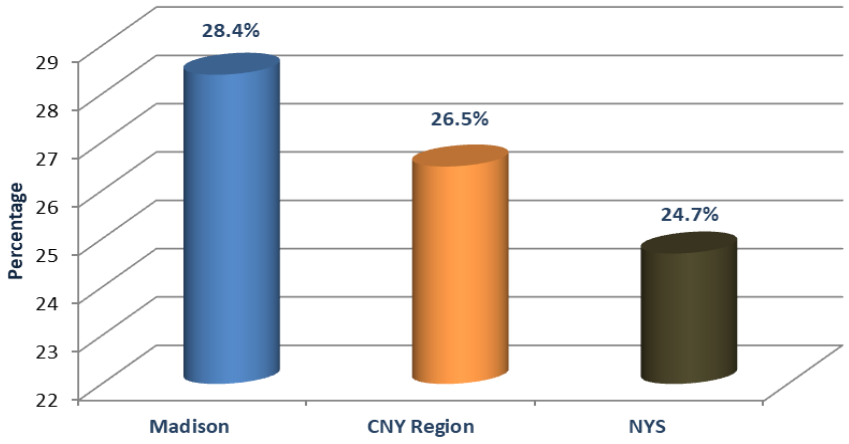
The consumption of sugar-sweetened beverages is associated with dental caries and subsequent tooth loss.[63,64] More adults in Madison County drink more sugary drinks per day than their peers in the Central New York Region and in the State. (Figure 4).[61]

Diet/nutrition

Dental caries is a multifactorial chronic disease and its severity is influenced by, among other things, one's diet. In addition to the consumption of sugary beverages, a high sugar intake from other food sources (fermentable carbohydrates) that contain non-milk extrinsic sugars (e.g, breads and cakes) comprise two-thirds of all sugars in one's diet.[65,66]

Frequent consumption of fermentable carbohydrates, especially between meals, is a greater risk to dental health than the overall amount of fermentable carbohydrates consumed. Fermentable carbohydrates are found in anything that is sweetened with sugar, high fructose corn syrup, or any one of 50 other names for sugar. The quantity of sugars seems to not have a significant impact on dental caries, but the frequency of sugars

Figure 4. Percentage of adults who consume one or more sugary drinks daily - Madison County, CNY Region, and NYS 2013-2014



intake does impact dental caries.[67,68] The mouth is full of hundreds of bacteria, many of which are beneficial to the oral ecosystem. However, certain harmful oral bacteria actually feed on the sugars a person eats to create acids that destroy the tooth enamel. Cavities are a bacterial infection created by acids, that cause teeth to experience a hole in them. Without treatment, cavities can progress past the enamel and into the deeper layers of the tooth, causing pain and possible tooth loss.

Oral hygiene - Personal

Oral hygiene is the practice of keeping the mouth clean and healthy by brushing and flossing to prevent tooth decay and gum disease. Maintaining good oral hygiene at all stages of life is essential for a person's overall health. The basic practice of brushing one's teeth reduces plaque build-up, which in turn could lead to periodontal disease and dental caries.[69] As important brushing teeth is, it is also important that one uses the proper brushing technique as well as the right type of tooth brush.[70,71]

Although tooth brushing and flossing are the most effective methods of plaque removal,[72] these mechanical means alone are insufficient to control plaque as some residual plaque is frequently left behind after brushing and flossing.[73,74,75,76] The use of plaque-inhibiting mouth washes could be beneficial in addition to brushing and flossing.[73,74] Care needs to be given in selecting an appropriate mouthwash. A variety of over-the-counter mouthwashes contain alcohol (ethanol) as an ingredient. One of its roles in mouthwashes is as a solvent for active ingredients and facilitates penetration into the dental plaque. However, its benefits appear to be negligible in terms of gingivitis and plaque control.[77] Moreover, the risk of oral cancer in smokers who use alcohol-containing mouthwashes is enhanced, as the alcohol facilitates the penetration of tobacco-based carcinogens into the oral mucosal tissue.[59]

Dental Visits

Regular dental visits are essential for the maintenance of healthy teeth and gums. Oral diseases can be prevented or improved with regular dental visits at intervals determined by the dentist.[78] In addition to professional cleaning, dentists conduct a dental examination that evaluates the health of the gums, perform a head and neck examination, and examine the mouth for any indications of oral cancer, diabetes or vitamin deficiencies.[79]

In Madison County, approximately 77 percent of adults have visited a dentist within the past year, compared to 70 percent for the State and 72 percent for the Central New York (CNY) region. However, the percentage of Madison County enrollees in Medicaid who have had a dental visit within the last year is only 29 percent.[80] For children in Madison County, approximately 81% of 3rd graders have had at least one dental visit in the last year. This compares to the State rate of 83 percent.[81]

Dental Literacy

The American Dental Association's (ADA) policy defines oral health literacy as "the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate oral health decisions. It also recognizes

that by improving health literacy, patients are better stewards of their own health."[82]

Low oral health literacy is more common among adults with less than a high school education, older adults, immigrants and refugees, racial and ethnic minorities, and low income individuals.[83,84,85]

Communication between health care providers and patients greatly impacts patient health outcomes. There is a discrepancy between patient and provider literacy levels, and high literacy demand is associated with reduced patient learning.[86] The literacy skills of individual patients are not the only important part of health literacy. Health care systems and providers must make services and information understandable for everyone; regardless of their literacy skills.[87]

Low patient literacy is associated with poor oral health outcomes.[88,89] Moreover, poor oral health in children is associated with low parental oral health literacy.[90,91] The issue of dental literacy also applies to ones understanding of what their insurance covers for dental services. For instance, only 34 percent of individuals on Medicare knew whether or not Medicare includes a dental benefit.[92]

Figure 5: READ-30 Word Comprehension Test Scores

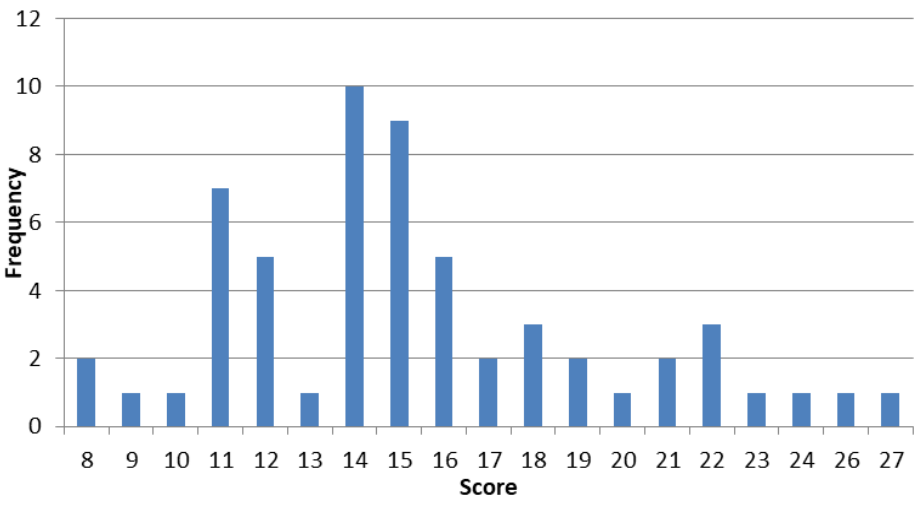
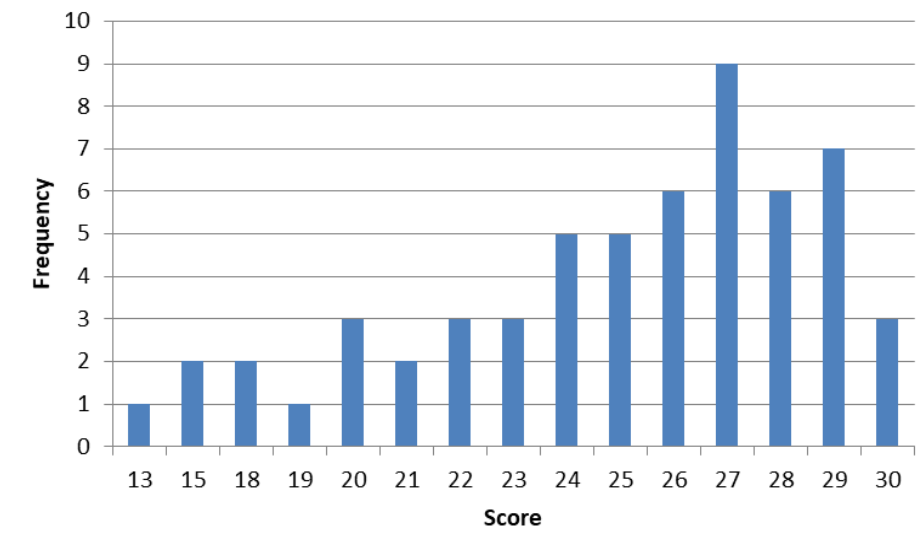


Figure 6: READ-30 Word Recognition Test Scores



Source figure 5 & 6: Madison County Department of Health, 2018.

An oral health literacy assessment conducted by the County Health Department, with adult patients at dental offices, revealed that although they scored high on recognizing dental health related terms, their understanding of these terms was lower (Figures 5 & 6).

Risk Reduction

Preventive measures for reducing dental decay include community water fluoridation, dental sealants, fluoride varnish, and enhancing dental health workforce to increase access.[93,94,95,96]

Community Water Fluoridation

Improvements in water treatment over the decades have dramatically improved the public's health. Access to healthy water can be affected by numerous factors including treatment practices like fluoridation.

Fluoridation safely and inexpensively benefits both children and adults, regardless of socioeconomic status or access to dental care.[97] Fluoridation is the adjustment of fluoride in community drinking water supplies up to the optimal level for prevention of decay (0.7 milligrams/liter).[98] Since its inception in the second half of the 20th century, fluoridation of community water supplies is responsible for major reductions in tooth decay (40–70 percent in children) and tooth loss in adults (40–60 percent).[99] Evidence shows the prevalence of dental caries is substantially lower in communities with community water fluoridation, and there is no evidence that community water fluoridation results in severe dental fluorosis.[100]

Nationally, approximately 74.4 percent of the population served by community water systems receive fluoridated water. New York State ranks 30th in the percentage of persons receiving fluoridated water via a community water system.[101]

Community water service in Madison County varies by location. Approximately 64 percent of the county's population (46,080 people) is served by community water systems. The remaining 36 percent of the population (25,920) is served by individual/private water sources (wells); this compares to 19 percent of the New York State population served by private water sources.[102]

Only 48 percent of Madison County's population is served by community water systems with optimally fluoridated water, with the remaining 52% of the population served by community water systems that are not provided with fluoridated water. For comparison, the percent of the NYS population served by optimally fluoridated community water systems is 71.1 percent; excluding NYC, it drops to 46.9 percent.[102]

Table 3 lists community water systems serving Madison County and whether or not the systems are optimally fluoridated. Unfortunately there is no data for the Towns of Lennox and Sullivan and the Villages of Canastota and Chittenango, who are served by the Onondaga County Water Authority (OCWA) as their numbers are included under Onondaga County by the NYSDOH. Regardless, the OCWA system serving these communities is fluoridated.

In the northern portion of Madison County, drinking water is supplied primarily by the Onondaga County Water Authority (OCWA) and the City of Oneida. The City of Oneida's inner district is completely served by their water district. The outer district relies on both public and private supplies. The villages are almost completely served by OCWA while the surrounding towns have between 6 to 72 percent of their housing units served by private wells.

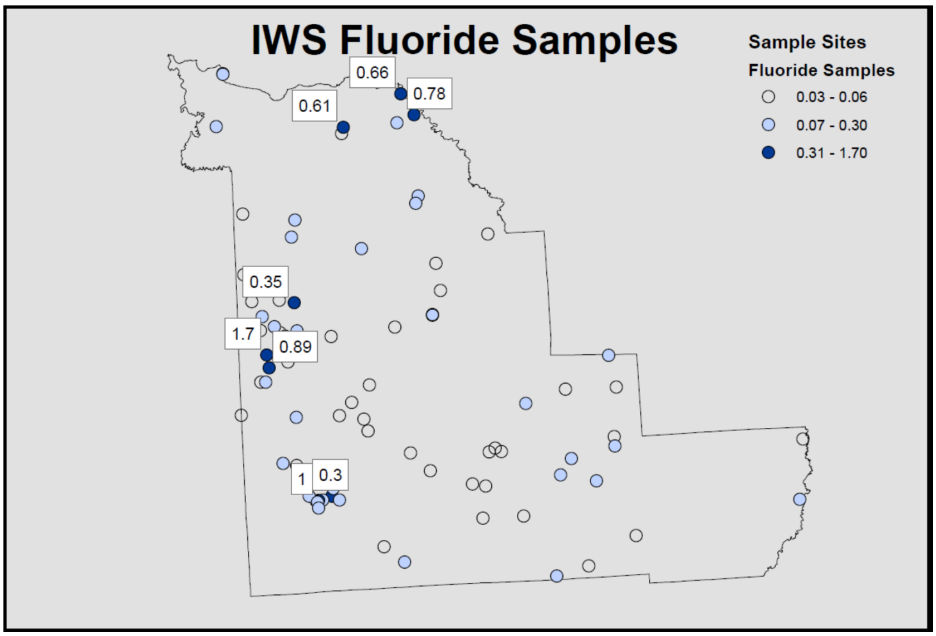
Table 3: Community Public water systems in Madison County and their fluoridation status [a]

Water system name	Water system ID	Population served	Water source	Water system type	Optimally Fluoridated
Chenango Valley Trailer Court	NY- 2600961	50	Ground	Community	No
Isbell Mobile Home Park	NY- 2600965	95	Ground	Community	No
Maple View Manor	NY- 2600966	67	Ground	Community	No
Valley Mobile Home Park	NY- 2600973	90	Ground	Community	No
Valley View Mobile Home Park	NY- 2600974	30	Ground	Community	No
White Pines Trailer Park	NY- 2600976	49	Ground	Community	No
Cazenovia Village	NY- 2602371	3,635	Ground	Community	No
DeRuyter Village	NY- 2602373	558	Ground	Community	No
Earlville Village	NY- 2602374	545	Ground	Community	No
Erieville Water Supply	NY- 2602375	150	Ground	Community	No
Georgetown W.D.	NY- 2602376	300	Ground	Community	No
Hamilton Village	NY- 2602377	4,239	Ground	Community	Yes
Madison Village	NY- 2602378	305	Ground	Community	No
Stockbridge Water District	NY- 2602379	600	Surface	Community	No
New Woodstock Water District	NY- 2602380	460	Ground	Community	No
Oneida City	NY- 2602381	11,393	Ground	Community	No
O-We-Ra Point Water Supply	NY- 2603518	100	Ground	Community	No
Morrisville Village	NY- 2603521	2,199	Ground	Community	Yes
SUNY At Morrisville	NY- 2613319	3,450	Ground	Community	No
Sleepy Hollow Subdivision	NY- 2619390	27	Ground	Community	No
Cobblefield Estates W.D.	NY- 2621115	120	Ground	Community	No
Mount Pleasant (Caz.Cntry Est)	NY- 2622401	75	Ground	Community	No
Route 8 Estates	NY- 2630002	75	Ground	Community	No
Hamilton Manor	NY- 2630059	37	Ground	Community	No

Source: Centers for Disease Control and Prevention, My Water's Fluoride as of October 2018

[a] The above table does not include the Towns of Lenox and Sullivan and Villages of Chittenango and Canastota because they are served by the Onondaga County Water Authority (OCWA), and were included in under Onondaga County in the NYS DOH's calculation.

Figure 7 Naturally Occurring Fluoride levels in Individual Water Systems Madison County, 2019



Source: MCDOH 2019. All fluoride samples =>0.3mg/l are labeled. 74 fluoride samples.

Several Madison County municipalities have their own public water supply systems that rely on groundwater. The more rural and less populated areas within Madison County rely heavily upon private wells.

Individual water supplies in Madison County, consisting of wells, springs and/or surface water sources are not fluoridated. However, some groundwater have natural background levels of fluoride.

Fluoride is a common constituent of groundwater. Natural sources are connected to various types of rocks and volcanic activity. Agricultural (use of phosphatic fertilizers) and industrial activities (clays used in ceramic industries or burning of coals) may also contribute to fluoride concentrations in groundwater.[103]

In 2018, water from seventy-four (74) individual waters systems (e.g., wells) throughout Madison County were tested for fluoride (Figure 7). Water samples collected along the western border and at the northeast corner of the county demonstrated the highest levels of fluoride (0.31 to 1.7 mg/l). Of those with the highest levels, four exceed the optimal level for prevention of decay (0.7 milligrams/liter), with two others (0.66 and 0.61 mg/l) near optimal level. The U.S. Environmental Protection Agency (EPA) currently has a non-enforceable recommended guideline for fluoride of 2.0 mg/L that is set to protect against dental fluorosis. If a home is served by a water system that has fluoride levels exceeding this recommended guideline, EPA recommends that children 8 years and younger be provided with alternative sources of drinking water. None of the samples tested exceeded the 2.0 mg/l guideline.[104]

Community water fluoridation has been shown to save money, both for families and the health care system. The return on investment for community water fluoridation varies with size of the community, increasing as the community size increases.[105]

Ongoing education of individuals, health care providers and community leaders is needed to assure continual progress in maintaining and increasing access to this preventive measure.

A New York study demonstrated that the implementation of community water fluoridation resulted in substantially reduced dental treatment costs among children and youth in the Medicaid program. The NYS Medicaid program found that the mean number of caries-related procedures per recipient was 33.4 percent higher in less

fluoridated counties than in predominantly fluoridated counties. A conservative estimate of the difference between these two groups in treatment costs per recipient (<21 yrs. old) averaged $27.60.[106]

Fluoridation benefits all residents on the community water system and is particularly important to address oral health disparities in vulnerable populations that have limited access to dental care services.

Dental Sealants

Dental sealants, a thin coating bonded into the pit and fissures of the chewing surface of permanent molars, are highly effective in preventing tooth decay.[1]

Sealants protect the chewing surfaces from cavities by covering them with a protective shield that blocks out germs and food. Once applied, sealants protect against 80 percent of cavities for 2 years and continue to protect against 50 percent of cavities for up to 4 years. Children aged 6 to 11 years without sealants have almost three times more first molar cavities than children with sealants.[107]

When properly placed and retained, dental sealants are a highly effective primary preventive measure. The

DeRuyter Central School
School Based Dental Clinic Services: 2014 - 2018

Total Students	81	**Services Received (% of students)**	
Student Age		Screening	100%
Average age	7.6 yrs.	Prophylaxis	100%
Age range	4-12 yrs.	Fluoride	87.5%
Gender		Sealant	43.8%
Male	49%	Oral Hygiene Instruction	100%
Female	51%		

Figure 8: Number of Students receiving dental services - DeRuyter School-Based Health/Dental Clinic

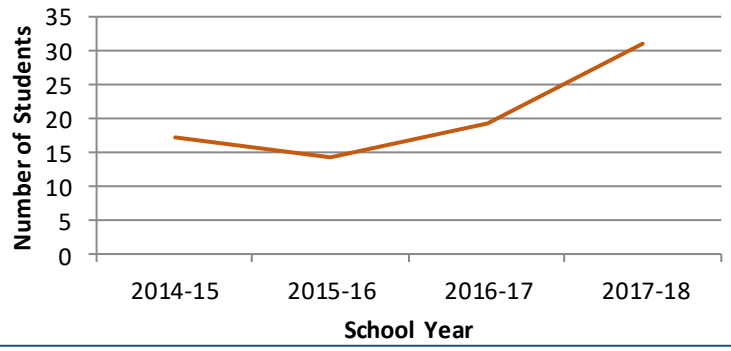
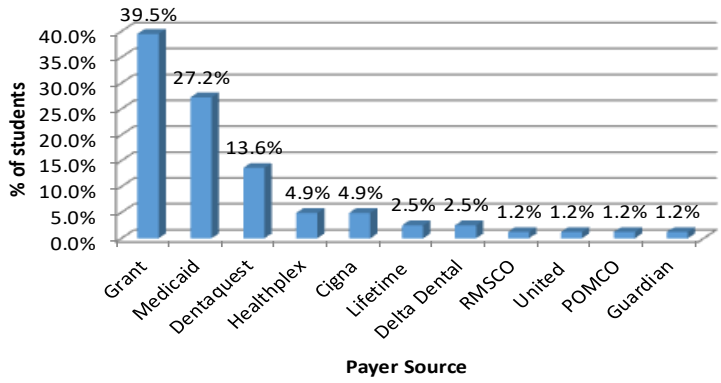


Figure 9: DeRuyter School-Based Dental Clinic - Payer Source - 2014-2018



Source: J. Argyle. Family Health Network of CNY, Inc, Personal Communication. June 5, 2018

Task Force on Community Preventive Services recommends that sealant programs be included as part of a comprehensive population-based strategy to prevent and control dental decay in communities.[107]

According to the 2009-2011 New York State Department of Health's oral health survey of third grade children, 71.1 percent of Madison County third graders had at least one sealant application compared to 41.9 percent for New York State, excluding NY City (Table 1).

The Task Force on Community Preventive Services found school-based/school-linked sealant programs to be cost effective, and that the median decrease in decay in permanent molars among children 6 –17 years of age was 60 percent, regardless of socioeconomic status and risk of decay.[107]

Currently the DeRuyter Central School District is the only school-based health/dental clinic that exists in Madison County. The school-based clinic serves the DeRuyter Elementary School students in grades Pre-K through fifth grade. Figures 8 and 9 provide a summary of dental services provided to students through the school-based dental clinic. The NYS Department of Health provides grant funds to the School through its School-Based Dental Sealant Program. Under the terms of the grant, services are provided to second and third grade students only. If services are extended to other grades, services would not be covered under grant funds, and instead would be billed through insurance.[108]

Fluoride Varnish & Supplements

In the United States, water fluoridation is not the only form of fluoride delivery that is effective in preventing tooth decay in people of all ages. Topical fluoride is applied to tooth surfaces to make them strong and resistant to tooth decay.[109] Topical fluorides include fluoride toothpaste, gels, and varnish. Fluoride supplements (tablets or drops) can be prescribed in areas where the public water supply or well water has low levels of fluoride.

Oral health professionals can apply fluoride gels and varnish to tooth surfaces. In most states, including New York State, physicians, nurse practitioners, and other health professionals can also apply topical fluoride.

Although all of these products reduce tooth decay, combined use with fluoridated water offers protection greater than any of these products used alone.[110]

Oral Health Workforce

Having a sufficient number and distribution of providers is critical to ensuring population access to needed care. Similarly, a diverse dental workforce, one able to service low-income populations, is key to addressing the unmet needs of patients in Madison County.

Trends show an increasing demand for dentists across the U.S. coupled with a projected increase in the per capita supply of dentists in the United States through 2037.[111] As to future dentists, the number of individuals applying to dental schools grew by over 24 percent between 2004-05 to 2014-15, although declining somewhat from a period of peak enrollment in 2007-08.[112]

New York State enjoys the fifth best population-to-dentist ratio in the country;[113] however, the distribution of dental professionals is uneven throughout the state and there are still rural areas where shortages of dentists and dental hygienists exist and where specialty services may not be available.[114] While NYS has substantial resources and assets including 10 dental hygiene schools, 50+ training programs in advanced dentistry, a considerable provider network and support programs for vulnerable populations,[114] there is a discouraging trend in dentists migrating out of the state. Between 2011 and 2016, NYS saw a net loss of 6.1 percent of dentists 40 years or younger leaving the state.[115]

In Madison County we saw a decrease in dental professionals over the last five years (2013-2018), except for Certified Dental Assistants (Table 4).[116] Furthermore, Madison County demonstrates the lowest

Table 4: Relative Supply of Registered Licensed Dental Health Practitioners: Madison County 2013 vs. 2018

Licensed Practitioner	2018	Ratio	2013	Ratio	Change
Dental Practitioners	116	1.57	119	1.62	⇩
Dentists	30	0.405	32	0.436	⇩
Hygienists	62	0.838	68	0.926	⇩
Certified Dental Assistants	24	0.324	19	0.259	⇧

Source: NYSED accessed on 3/7/18 at http://www.op.nysed.gov/prof/dent/dentcounts.htm

* Ratio of Practitioners per 1,000 Population.

rate of dentists in the Central New York Region (Figure 10) and fairs worse when compared to state and national rates (Figure 11).

Approximately 28 dental health professionals are located in Madison County. Of those, a little more than half (57%) actively participate in Medicaid.[117] In terms of dental specialists there are two, one pedodontist (who accepts Medicaid) and an orthodontist practice. The distribution of dentists is concentrated in the village and city centers throughout the county. (Figure 12).

HRSA's Bureau of Health Workforce (BHW) develops shortage designation criteria and uses them to decide whether or not a geographic area or population group is a Health Professional Shortage Area (HPSA), Medically Underserved Area (MUA), or Medically Underserved Population (MUP). HPSAs may have

Figure 10. CNY Region - Dentist Rate per 100,000 pop.

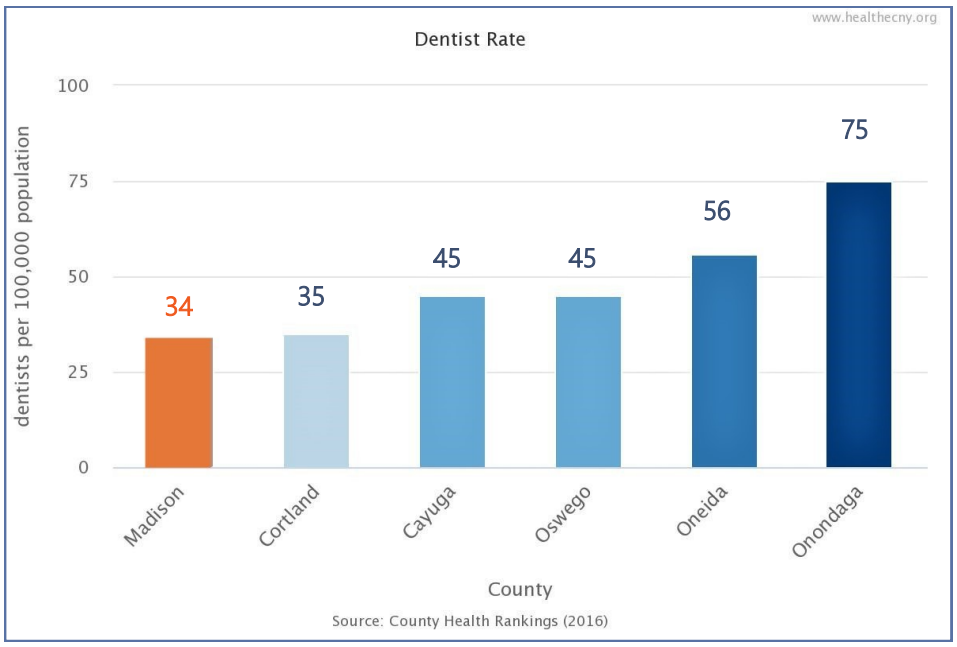


Figure 11. Dentist Rate in Madison County Compared to:

NY Counties

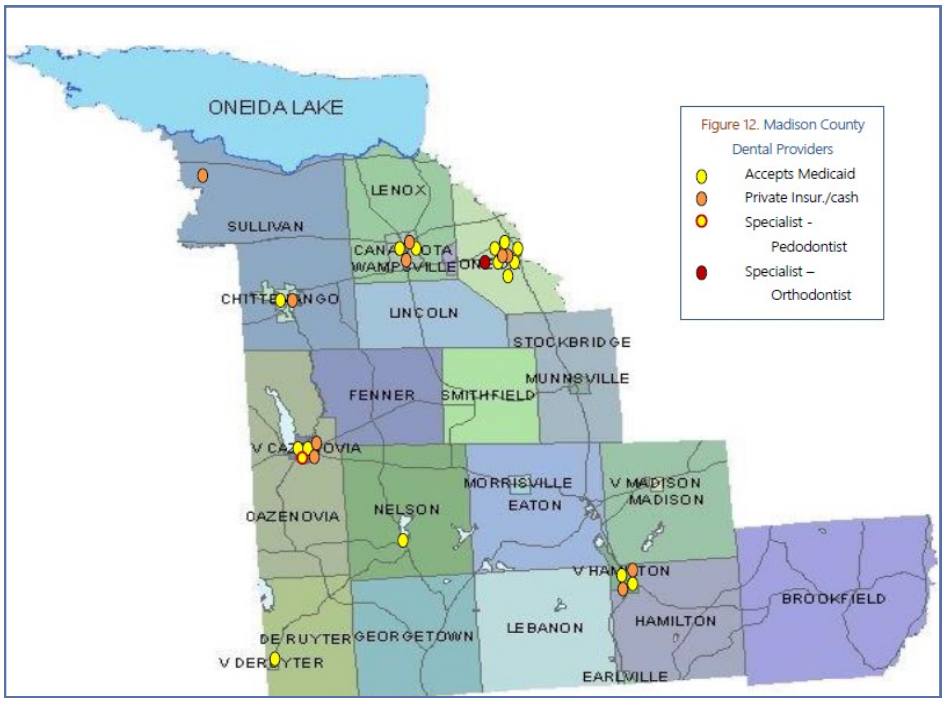
U.S. Counties

NY Value (81)

US Value (67)

shortages of primary medical care, dental, or mental health providers; may be urban or rural areas; population groups; or medical or other public facilities.[118]

The State's Center for Health Workforce Studies collaborates with the federal Division of Shortage Designation to designate counties and/or specific census tracts as dental Health Professional Shortage Areas (HPSA). In order for an area to be designated, one of the following criteria must be met: 1) a dentist-to-population ratio of 1:5,000 or greater; or 2) a dentist-to-population ratio of 1:4,000 or greater in areas with less than half the population on fluoridated water or where greater than 20 percent of the population is at 200 percent or below the federal poverty level (Figure 13).[118]



Madison County has only one designated dental health provider shortage area (Oneida Nation) that addresses a Native American population within the county. For dental

Figure 13. Dental Health HPSA Scoring

Source: Health Resources & Services Administration. Health Professional Shortage Area (HPSA) Application and Scoring Process. Retrieved March 8, 2019 from https://bhw.hrsa.gov/shortage-designation/hpsa-process

health professionals that are willing to work in underserved areas and/or serve underserved populations, there are state and federal professional incentive programs including scholarships, education loan repayment and health professional tax credit programs.[119]

According to the U.S. Department of Labor, Bureau of Labor Statistics' Occupational Outlook Handbook, an estimated 90 percent of the nation's dentists, including specialists, provide services in the private sector of the dental care delivery system. (i.e., dental offices or self employed). The remaining 10 percent provide services in the public sector, including government, offices of physicians, and outpatient care centers.[120]

Prior to July 2011, New York County Health Departments were able to provide limited dental services (e.g., dental clinics, school based sealant programs), while receiving State Aid reimbursement for this work. After July 2011, the State Department of Health changed State Aid Reimbursement requirements so that Dental Health activities were no longer a reimbursable public health activity. Up until 2007 Madison County employed a dental hygienist who provided dental health education, screening, and fluoride treatments in schools, and other settings within the county.

Fifty-eight counties, including New York City, in New York have organized health departments; However, only five health departments, provide dental health services through their local health department (Albany, Broome, Schenectady, Suffolk, and Tioga). Other counties such as Jefferson and Cortland have dental coalitions in which several agencies collaborate around dental health initiatives.

Access to Dental Services

Apart from the availability of dental providers accepting publicly funded programs, access barriers to dental services involve: the lack of dental insurance, a lack of knowledge about the importance of oral health as it relates to general health and well-being, and an underutilization of available resources.

Overall, 71 percent of Americans had dental coverage in 2015, increasing from 64 percent in 1996.[121] Although an improvement, this still leaves almost a third (29%) of the population without dental coverage. In comparison, only 9 percent of Americans were without medical insurance 2015. Dental coverage varies by age, family income, race/ethnicity, education, public vs. private insurance, and employment status.[122]

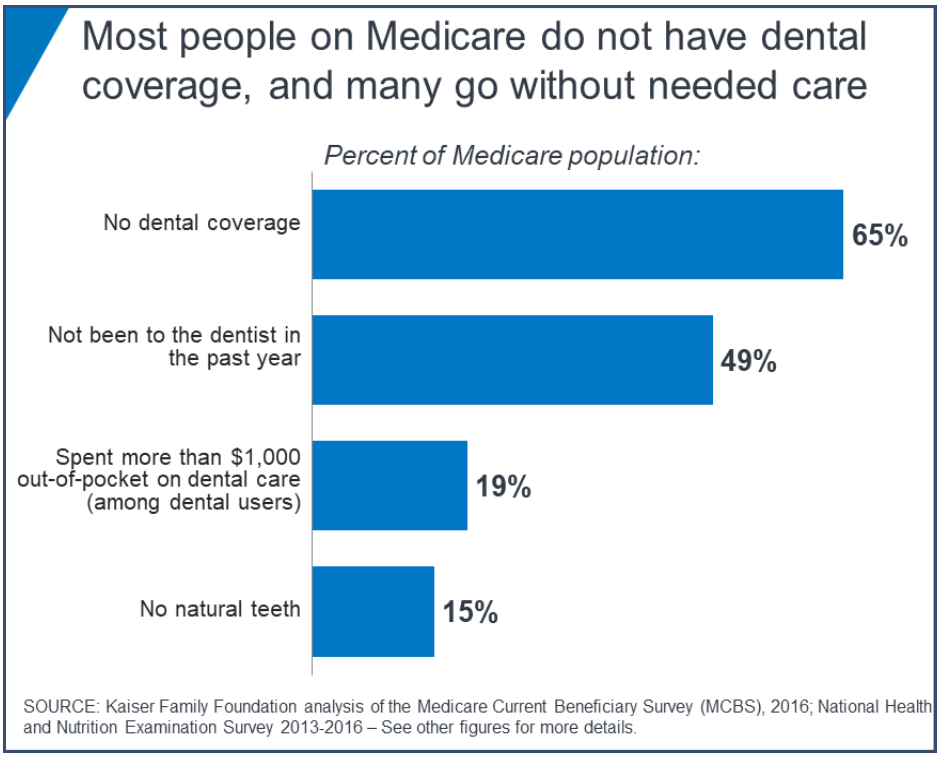
In New York State (NYS), approximately 20 percent of children did not have dental insurance in 2014.[114] This is in contrast to only about 4 percent of children in NYS are without medical insurance for the same time period.[123] Data on the percentage of NYS adults without dental coverage was not available.

Beginning in 2014, the Affordable Care Act (ACA) expanded affordable coverage through Medicaid and private insurance, and also by specifically including pediatric oral health care among the ten "essential health benefits" that all qualified health plans are required to cover for children.[124] New York State selected the Child Health Plus dental package as the standard dental benefit for the essential health benefits. Unfortunately, such adult dental benefits were not included. Adult benefits are still optional, with one implication being there are fewer regulations governing how dental benefits are offered to adults.

A few states provide coverage of non-emergency dental services for adult Medicaid enrollees. For those states that do, there was a higher use of preventive and other types of dental services and lower out-of-pocket share of dental costs.[125]

For adults 65 years and older or for people with specific disabilities, Medicare dental coverage is limited; it does not cover most routine dental care or dentures. Generally Original Medicare dental coverage is only for limited circumstances involving hospitalization. Original Medicare (Part A and B) generally doesn't cover most dental care, including cleanings, fillings, tooth extractions, dentures, and dental plates. Hospital (Part A) may pay for emergency or complicated dental procedures (e.g., jaw reconstruc-

Figure 14. Medicare Beneficiaries and Dental Coverage



tion).[126]

Dental coverage is available at low, or sometimes no cost to Medicare-eligible seniors who join a Medicare -sanctioned, state regulated fee for service plan that provides dental and medical assistance; this is known as Medicare Advantage plans, which are run nationwide by private health insurers in compliance with federal guidelines. The extent of dental coverage may vary from plan to plan. Individuals on Medicare can also shop for stand-alone private dental plan which are either preferred provider organizations (PPOs) or indemnity plans. Both plans have no-out-of-pocket maximums, which mean there is no limit on what an individual might pay with their own resources.[126]

Financing Oral Health

"Financing for oral health care greatly influences where and whether individuals receive care. At the individual level, dental coverage and socioeconomic factors play a significant role in access to oral health care. That is, individuals who have private dental coverage or can afford care, either through private insurance or through out-of-pocket expenditures, are generally able to obtain care. On the other hand, individuals who lack dental coverage, who have minimal dental coverage, and/or those of limited financial means experience significant barriers to care. Financing also has a powerful influence on providers' practice patterns. For example, low reimbursement by public programs, such as Medicaid and the Children's Health Insurance Program (CHIP), are often cited as a disincentive to providers' willingness to participate in these publicly funded programs. Finally, state and federal spending on oral health has a tremendous impact on what oral health services are available and to whom. This begins at the level of support for dental schools and continues in the form of subsidies for residency programs, reimbursement policies of public insurance programs, mandated benefits, and additional financial incentives. For example, the federal government makes considerable investments in improving the distribution of oral health care professionals in urban and rural areas while states are authorized under federal law to determine the rate of Medicaid reimbursement for oral health services provided."

Source: Institute of Medicine and National Research Council. 2011. Improving Access to Oral Health Care for Vulnerable and Underserved Populations. Washington, DC: The National Academies Press. https://doi.org/10.17226/13116.

As depicted in figure 17, most people on Medicare do not have dental coverage and spend more than $1000 of their own funds on dental care.[127,128] Such costs become an additional barrier to accessing care and have contributed to a decrease in utilization of dental services.[129, 130]

In 2016 Behavioral Risk Factor Surveillance System survey, almost a third of NY adults (30%) over the age of 18 reported that they had not visited a dentist in the previous year.[31]

In Madison County, approximately 23 percent of adults have not visited a dentist within the past year.[81] However, the percentage of Madison County enrollees in Medicaid who have not had a dental visit within the last year rises significantly to 71 percent.[80]

Approximately 81 percent of Madison County third-grade children have seen a dentist within the last year (Table 1). However, only 40 percent of Madison County Medicaid enrollees, aged 2 to 20 years have had at least one dental visit within the last year.[131,132]

Having dental insurance, even private insurance, doesn't necessarily translate to visiting a dentist. More than a third of adults between the ages of 19 and 64, with private dental insurance do not have a single dental claim within the year; even when fees paid through private dental benefits plans are significantly lower than market fees.[133] Between 2003 and 2011, dental care utilization declined steadily among working-age adults. This trend oc-

curred despite dental benefit status and income level.[134]

Dental Emergency Department (ED) visits increased between 2010 and 2012, especially among working age Medicaid-enrolled adults (21 to 64 years old).[135] This increase appears to correspond with the continued loss of private and public dental benefits coverage among adults.[136] In addition, almost 80 percent of dental ED visits were for a non-traumatic dental condition that could be diverted to a dental offices.[137]

Figures 15, 16, and 17 depict emergency room usage for dental related issues in Madison County.[133] Similar to national trends, there is higher usage of EDs for dental-related services amongst Medicaid enrollees; however, between 2013 and 2016 there is an overall decrease in use of EDs for dental related issues.

Residents in rural areas tend to use dental services less than their urban counterparts.[138] Non-utilization of dental services in rural communities is due to or further exacerbated by a shortage of dentists, economic, socio-demographic and geographic factors.[139]

Figure 15. Emergency department diagnosis of 'Disorders of Teeth and Jaw' by year, Madison County, 2012-2016

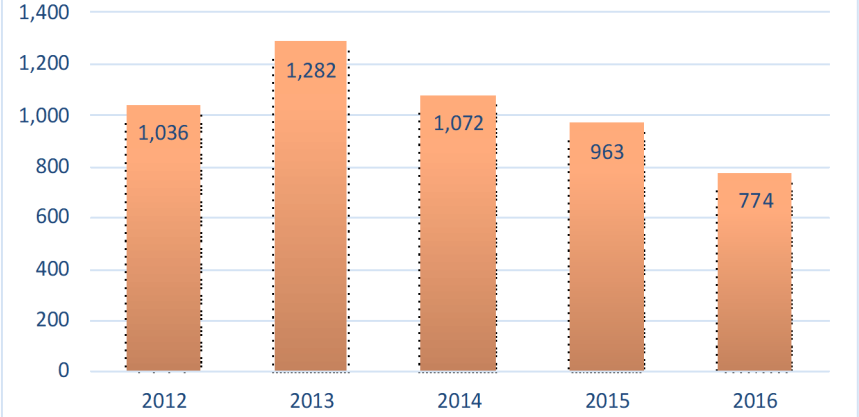


Figure 16. Emergency department diagnosis of 'Disorders of Teeth and Jaw' by age group, Madison County, 2012-2016

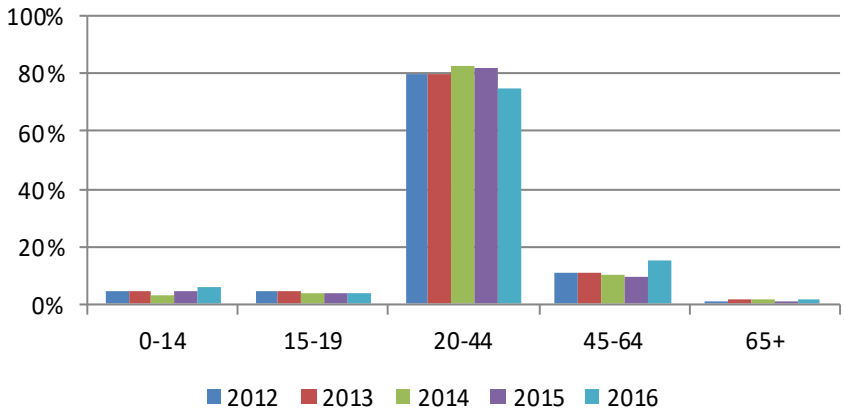
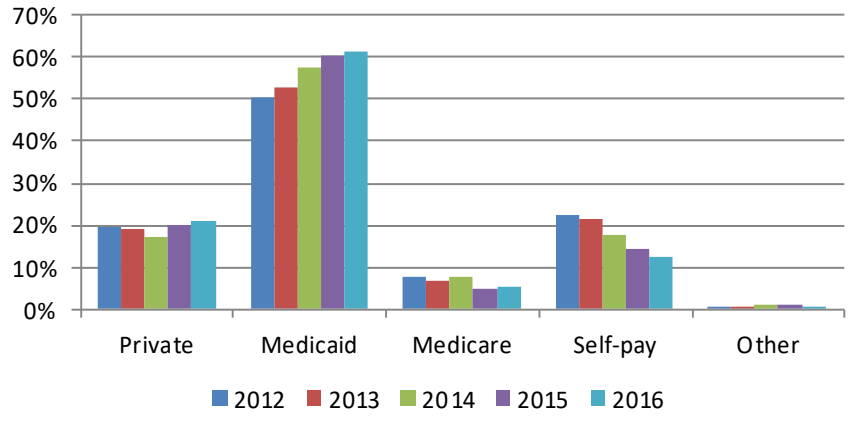


Figure 17. Emergency department diagnosis of 'Disorders of Teeth and Jaw' by payer type, Madison County, 2012-2016



Next Steps

Although we, as a nation, state, and county, have made substantial progress in improving the oral health of our residents, significant disparities remain, including access to known preventive measures, recognition of the importance of oral health as it relates to general health, knowledge of the impact of various risk behaviors on optimal oral health, utilization of benefits, and projected workforce shortages.

While the information presented here is the most comprehensive to date, it is by no means complete. There is still more to learn about Madison County resident's oral health status and behaviors; however what we do know is sufficient to guide recommendations for action.

Goals, Objectives, & Key Measures

The oral health goals and objectives presented in this report (page 27) reflect our review of the oral health conditions and factors that contribute these conditions, as well as national, state, and local trends, initiatives, and evidence based practices.

Key measures derive from Healthy People 2020, New York State's Prevention Agenda, The Community Guide, and other evidence-based best practices. The goals, objectives and key measures are outlined on the next page.

An implementation plan addressing the goals and objectives will be developed and presented in a separate report.

Key Issues—Madison County

- A large proportion of Medicaid enrollees in Madison County are not accessing dental care
- Children residing in Madison County have a higher burden of disease compared to the rest of the state
- Residents have a higher and increasing rate of oral cancer compared to the of the state
- Although people may recognize dental terms they're less likely to understand what they mean
- One third of the county's population obtains their drinking water from private wells
- Only 48% of the Madison County's population is served by community water systems with optimally fluoridated water
- Individuals on Medicare have limited access to dental care services due to costs

Madison County Health Directive

Healthy Care

Ensure access to and receipt of recommended quality, effective, evidence-based preventive and health care services and information for individuals at each stage of life.

Strategic Goal Statement

Oral Health

Prevent oral diseases and address risk factors through evidence-based interventions.

Objective 1

Reduce the prevalence of tooth decay among children and adolescents

Baseline: 74.4% of 3rd grade children with caries experience
Target: 67.0% of 3rd grade children with caries experience
Target Setting Method: 10 percent improvement
Data Source: NYSDOH 2009-2011 Bureau of Dental Health Data as of August 2012

Objective 2

Reduce incidence rate of lip, oral cavity, and pharynx cancer.

Baseline: 13.2 age-adjusted lip, oral cavity, and pharynx cancers per 100,000.
Target: 11.9 age-adjusted lip, oral cavity, and pharynx cancers per 100,000.
Target Setting Method: 10 percent improvement
Data Source: NYSDOH 2012-2014 Cancer Registry data as of July 2017

Objective 3

Increase the percentage of population with access to optimally fluoridated water.

Baseline: 64% of population served by community water systems w/ optimally fluoridated water
Target: 70% of population served by community water systems w/ optimally fluoridated water
Target Setting Method: 10 percent improvement
Data Source: NYSDOH Safe Drinking Water Information System data as of February 2017

Objective 4

Improve oral health literacy among the general public.

Baseline: Reading comprehension Mean score = 4.71
Target: Reading comprehension Mean score = 5.18
Target Setting Method: 10 percent improvement
Data Source: MCDOH Oral Health Literacy Assessment, June 2018

Objective 5

Increase the percentage of Medicaid enrollees who had a dental visit within the last year.

Baseline: 29.0% of Medicaid enrollees with at least one dental visit within the last year
Target: 31.9% of Medicaid enrollees with at least one dental visit within the last year
Target Setting Method: 10 percent improvement
Data Source: NYSDOH 2014-2016, Medicaid Program Data as of July 2017.

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