



2013

# The Burden of Oral Disease in Arkansas



# The Burden of Oral Disease in Arkansas, 2013

## **Report Prepared By:**

Abby Holt, MPH MLIS

## **Contributors and Reviewers:**

Bryan Whitaker, DDS

Carol Amerine, RDH MSDH

Wanda Simon, MS

Rupa Sharma, MSc MSPH

Lucy Im, MPH

---

# Contents

- I. INTRODUCTION ..... 4
- II. BACKGROUND ..... 5
  - The Office of Oral Health ..... 5
  - Purpose and Use of the Report..... 8
- III. ARKANSAS DEMOGRAPHICS ..... 9
- IV. NATIONAL AND STATE OBJECTIVES ON ORAL HEALTH..... 10
- V. THE BURDEN OF ORAL DISEASES ..... 15
  - Children..... 15
    - Prevalence of Disease and Unmet Needs ..... 15
    - Oral and Craniofacial Diseases..... 17
  - Adults ..... 18
    - Preventive Visits..... 18
    - Dental Caries..... 21
    - Tooth Loss ..... 21
    - Periodontal Disease..... 29
    - Oral Cancer ..... 31
  - Disparities ..... 36
    - Racial and Ethnic Groups ..... 36
    - Women’s Health ..... 36
    - People with Disabilities..... 38
  - Societal Impact of Oral Disease ..... 39
    - Socioeconomic Disparities ..... 39
    - Geographic Disparities..... 39
    - Economic Impact..... 43
    - Oral Disease and Other Health Conditions ..... 44
- VI. RISK AND PROTECTIVE FACTORS AFFECTING ORAL DISEASES..... 45
  - Community Water Fluoridation ..... 45
    - Arkansas Fluoridation Legislation ..... 46
    - Topical Fluorides and Fluoride Supplements..... 47
    - Dental Sealants ..... 47
    - Arkansas Dental Sealant Program..... 48

Screening for Oral Cancer ..... 50

Tobacco Control ..... 50

Oral Health Education ..... 56

VII. PROVISION OF DENTAL SERVICES ..... 57

    Dental Workforce and Capacity ..... 57

        Dental Workforce Diversity ..... 61

        Dental Medicaid and State Children’s Health Insurance Programs ..... 63

        ConnectCare ..... 65

VIII. CONCLUSIONS ..... 67

IX. ABBREVIATIONS ..... 68

X. REFERENCES ..... 69

---

## I. INTRODUCTION

The mouth is our primary connection to the world. It is how we take in water and nutrients to sustain life, our primary means of communication, the most visible sign of our mood, and a major part of how we appear to others. Oral health is an essential and integral component of overall health throughout life and is much more than just healthy teeth. Oral refers to the whole mouth, including the teeth, gums, hard and soft palate, linings of the mouth and throat, tongue, lips, salivary glands, chewing muscles, and upper and lower jaws. Not only does good oral health mean being free of tooth decay and gum disease, but it also means being free of chronic oral pain conditions, oral cancer, birth defects such as cleft lip and palate, and other conditions that affect the mouth and throat. Good oral health also includes the ability to carry on the most basic human functions such as chewing, swallowing, speaking, smiling, kissing, and singing.



The mouth is an integral part of human anatomy and plays a major role in our overall physiology. Thus, oral health is intimately related to the health of the rest of the body. For example, mounting evidence suggests that infections in the mouth such as periodontal (gum) diseases may increase the risk of heart disease, may put pregnant women at greater risk of premature delivery, and may complicate control of blood sugar for people living with diabetes. Conversely, changes in the mouth often are the first signs of problems elsewhere in the body, such as infectious diseases, immune disorders, nutritional deficiencies, and cancer. Oral health is an issue for persons of all ages, races, and geographic locations.

## II. BACKGROUND

### The Office of Oral Health

The Arkansas Department of Health (ADH) is a unified health department, with a main office in Little Rock and 94 local health units in each of the state's 75 counties. The Office of Oral Health (Office) was established within the Arkansas Department of Health in 1999. The vision for the ADH's Office is "Optimum oral health for every citizen of Arkansas". To that end, the Office provides resources and support for counties, communities, neighborhoods, schools, and professional groups to address oral health needs and disparities.

The mission of the Office is to allow all Arkansans to enjoy optimum oral health. Working through not only public health core functions of assessment, policy development and assurance, but also through education, prevention and access, the Office strives to improve oral health throughout the state. Programmatic activities benefit children, adults, the elderly and those with special needs.

The Office continues to collaborate with and receive strong support from the Arkansas General Assembly, the leadership and administration of the Arkansas Department of Health (ADH). Internal partnerships within the ADH include the Pregnancy Risk Assessment Monitoring System, Behavioral Risk Factor Surveillance System (BRFSS), Tobacco Prevention and Cessation Program (TCP), Infection Control Committee, Chronic Disease Forum, and the Clinician's Committee and Science Advisory Committee. The University of Arkansas for Medical Sciences (UAMS) College of Public Health has provided significant input in areas relating to epidemiology and evaluation.

External partnerships include the Arkansas Oral Health Coalition (AOHC) which includes numerous public and private organizations with interests in the oral health of the public. The Arkansas State Board of Dental Examiners (ASBDE), Arkansas State Dental Association, Arkansas Dental Hygienists' Association and UAMS Center for Dental Education have been integral to our mission.

The Office is also active on the national level with alliances among the Association of State and Territorial Dental Directors, American Association of Public Health Dentistry, Centers for Disease Control and Prevention (CDC) and Health Resources and Services Administration (HRSA).

#### Programs

##### *Community Water Fluoridation*

Community water fluoridation (CWF) is promoted through a CDC cooperative agreement. Activities include presentations on the benefits and costs of CWF internally within the ADH and externally to various governing bodies, community leaders and lay citizens through the distribution of informational packets and campaigns to include print and broadcast media. Funding for minor repairs of existing water treatment fluoride equipment has also been available. Internal partners include the ADH Section of Engineering and the Office of Communications and Marketing among others.

---

### *Sealants*

In 2007, a formalized sealant program was initiated with funding through the Daughters of Charity Foundation (DOCF). The Office was able to purchase newspaper and broadcast ads with the assistance of the ADH Office of Communications and Marketing. Clinical activities included coordination and clinical services with Arkansas Children's Hospital (ACH). In 2009, with assistance through a CDC grant, ACH became the primary provider of sealants throughout the state.

### *Family Violence Prevention*

Working with the Delta Dental Foundation (DDF) of Arkansas and utilizing HRSA funding, the Office assisted with the promotion of the Prevent Abuse and Neglect through Dental Awareness (P.A.N.D.A.) program. The program is designed to prevent family violence through the provision of lectures and in-service trainings for dentists, dental hygienists, physicians, nurses, teachers, day care workers and other interested groups.

### **Workforce**

Through a HRSA Oral Health Workforce Development grant, the Office promotes Arkansas dental careers through outreach and recruitment of prospective dental students to the profession and grants-in-aid to new dentists and dental hygienists agreeing to work in health care shortage areas across the state. Delta Dental of Arkansas Foundation (DDF) and the Community Health Centers of Arkansas (CHCA) and Partners for Inclusive Communities have all contributed to recruiting efforts. The intent of these initiatives is to increase the number of oral health care professionals returning to the state thus improving access to care for all Arkansans. The members of the AOHC have been invaluable in recruitment and incentive initiatives.

### **Funding**

In addition to state and private support, the Office has maintained and expanded capacity and programmatic activities through agreements with the CDC, HRSA, and TPCP.

### **Recent successes**

In March of 2011, three oral health bills advanced by the Office and the AOHC were passed by the Arkansas General Assembly and signed by the Governor. The new statutes guarantee access to fluoridated water for all water systems serving 5000 or more people; allows physicians and nurses to provide fluoride varnish to children's teeth, and creates a category of collaborative practice dental hygienists who can then provide hygiene services in designated public settings without the patient having first seen a dentist.

The Office maintains active and vibrant collaboration with a wide variety of Arkansas organizations and entities. These include DDF that provides all funding for fluoridation equipment in mandated water

systems and ACH with whom the Office conducts the Seal-the-State dental sealant initiative. The Healthy Connections dental clinic also provides a screening and sealant program. In addition, Children International in coordination with University of Arkansas at Little Rock maintains a sealant program along with comprehensive dental care for children at high risk. The CHCA of Arkansas assists with grants-in-aid from the Office to new dentists practicing in underserved areas.

### **Future**

In addition to the above, a significant focus for future activities includes strong collaboration between the Office and the UAMS Center for Dental Education. These will include the provision of direct clinical services, expansion of access to care and educational opportunities for dental students, residents and current practitioners.

The establishment of initiatives and pilot programs for the delivery of care to those in nursing home/long-term care facilities and home-bound patients is also a goal.

A state-wide trauma system has recently been established and hitherto not contained provisions for dental input. Protocols for the management of dental emergencies and trauma in the emergency room setting are also issues of significant concern.

Human Papillomavirus (HPV) is continuing to receive attention as a significant cause of oral cancer. Thus, in addition to preventive efforts related to tobacco use and excessive alcohol consumption, plans for educating the public about the HPV association will be explored.

With support of the many individuals and organizations with interest in health care and oral health in particular, the Office hopes to continue to play a vital role in the promotion and provision of oral health care to the citizens of Arkansas.

---

## Purpose and Use of the Report

This report summarizes the most current information available on the oral disease burden of people in Arkansas. It also highlights groups and regions in our state that are at highest risk of oral health problems and discusses strategies to prevent these conditions and to provide access to dental care. Comparisons are made with national data whenever possible and to the Healthy People 2020 objectives when appropriate. For some conditions, only national data are available at this time. It is hoped that this information will help raise awareness of the need for monitoring the oral disease burden in Arkansas and guide efforts to prevent and treat oral diseases and enhance the quality of life of Arkansas's residents. Copies of the report are available from the Office website:

<http://www.aroralhealth.com>

### III. ARKANSAS DEMOGRAPHICS

Arkansas is home to approximately 2.9 million residents, one fourth of whom are 18 years of age or younger. The population is diverse, with 15.4% being Black and 6.4% being Hispanic. The median household income in the state is \$40,150, compared to \$52,760 in the US overall. According to the 2013 Arkansas Dental Sealant Plan, approximately 60% of students enrolled in public schools are eligible for free or reduced priced meals, an indicator of poverty.

#### Arkansas Population, 2010

<b>Total Population</b>		2,915,918
<b>Gender</b>		
	Male	49.1%
	Female	50.9%
<b>Median Age</b>		37.4
<b>Age Distribution</b>		
	Under 5 years	6.8%
	5 - 9 years	6.8%
	10 -14 years	6.8%
	15 -19 years	7.0%
	20 - 44 years	32.3%
	45 - 64 years	25.9%
	65 - 84 years	12.7%
	85+ years	1.8%
<b>Race/Ethnicity</b>		
	White	77.0%
	Black	15.4%
	Hispanic (any race)	6.4%
	Asian	1.2%
	American Indian and Alaska Native	0.8%

Source: U.S. Census Bureau

---

## IV. NATIONAL AND STATE OBJECTIVES ON ORAL HEALTH

Oral health indicators were selected using the *Healthy People 2020* objectives and goals developed as a collaborative process among the U.S. Department of Health and Human Services (HHS) and other federal agencies, public stakeholders, and an advisory committee. The overall goals of the *Healthy People 2020* oral health objectives is to prevent and control oral and craniofacial diseases, conditions, and improve access to related services.

The Arkansas-specific oral health indicators and goals were selected by the Office of Oral Health and are available from the *Healthy People 2020: Arkansas's Chronic Disease Framework for Action*, a collaborative project between the Arkansas Chronic Disease Coordinating Council, the Chronic Disease programs of the ADH, and their coalitions and partners. The goal of the project was to develop a set of chronic disease objectives, with Arkansas baseline data and target goals, to be used to track progress towards *Healthy People 2020* objectives in Arkansas. The Office of Oral Health selected indicators for inclusion in the *Framework for Action* based on common objectives already addressed by the program and the Arkansas Oral Health Coalition.

The state-specific oral health indicators will be evaluated using the established *Healthy People 2020* targeted goals documented in the *Framework for Action*. The indicators will be measured periodically by the Office of Oral Health and measured in the burden report every five-years as indicated by the CDC Division of Oral Health. The *Healthy People 2020* oral health objectives and target goals for the United States and for Arkansas are illustrated in Table 4.1.

For more information, see:

- National *Healthy People 2020* Objectives and Goals for Oral Health  
<http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=32>
- *Healthy People 2020: Arkansas's Chronic Disease Framework for Action*  
<http://www.healthy.arkansas.gov/programsServices/chronicDisease/Initiatives/Documents/HP2020/ARHP2020ChDzbooklet.pdf>

Table 4.1. *Healthy People 2020* Oral Health Indicators, United States and Arkansas

<i>Healthy People 2020</i> Objective [Objective Number and Description]	National Baseline (%)	National Goal (%)	Arkansas Status (%)	HP 2020 Arkansas Framework for Action Goal*	Source & Year of Arkansas Data
<b>OH - 1) Reduce the proportion of children and adolescents who have dental caries experience in their primary or permanent teeth</b>					
1.1) Children, aged 3-5 years	33.3	30.0	DNC	DNC	DNC
1.2) Children, aged 6–9 years*	54.4%	49.0%	64.0%	57.6%	Basic Screening Survey (BSS) Third Graders, 2010
1.3) Adolescents, aged 13-15 years	53.7%	48.3%	DNC	DNC	DNC
<b>OH - 2) Reduce the proportion of children and adolescents with untreated dental decay</b>					
2.1) Children, aged 3-5 years	23.8%	21.4%	DNC	DNC	DNC
2.2) Children, aged 6–9 years*	28.8%	25.9%	29.0%	26.0%	BSS Third Graders, 2010
2.3) Adolescents, aged 13-15 years	17.0%	15.3%	DNC	DNC	DNC
<b>OH – 3) Reduce the proportion of adults with untreated dental decay</b>					
3.1) Adults, aged 35–44 years*	27.8%	25.0%	DNC	DNC	Possible Source: BRFSS
3.2) Adults, aged 65-74	17.1%	15.4%	DNC	DNC	DNC
3.3) Adults, 75 and older	37.9%	34.1%	DNC	DNC	DNC
<b>OH – 4) Reduce the proportion of adults who have ever had a permanent tooth extracted because of dental caries or periodontal disease</b>					
4.1) Adults, aged 45-64 years*	76.4%	68.8%	67.5%	48.6%	Behavioral Risk Factor Surveillance System (BRFSS), 2010
4.2) Adults, aged 65-74 who have lost all their natural teeth	24.0%	21.6%	23.3%	DNC	BRFSS, 2010 (aged 65+)
<b>OH – 5) Reduce the proportion of adults aged 45-74 years with moderate to severe periodontitis</b>	12.8%	11.5%	12.3%	DNC	Basic Screening Survey (BSS) Older Adults, aged 65+ 2013

<b>Healthy People 2020 Objective [Objective Number and Description]</b>	<b>National Baseline (%)</b>	<b>National Target (%)</b>	<b>Arkansas Status (%)</b>	<b>HP 2020 Arkansas Framework for Action Goal*</b>	<b>Source &amp; Year of Arkansas Data</b>
<b>OH - 6) Increase the proportion of oral and pharyngeal cancers detected at the earliest stage *</b>	32.5%	35.8%	5.0 per 100,000, Stage I	2.0 per 100,000, Stage I	AR Cancer Registry, 2009
<b>OH - 7) Increase the proportion of children, adolescents, and adults who used the oral health care system in the past year*</b>	44.5%	49.0%	Adults = 61.1%	Adults = 70.4%	BRFSS, 2010
<b>OH-8) Increase the proportion of low-income children and adolescents who received any preventive dental service during the past year*</b>	30.2%	33.2%	27.0%	29.7%	2008 AR Medicaid Services Report, EPSDT Dental Utilization Rates
<b>OH-9) Increase the proportion of school-based health centers with an oral health component *</b> 9.1) Dental sealants 9.2) Dental care 9.3) Topical fluoride	9.1)24.1 9.2) 10.1 9.3) 29.2	9.1)26.5 9.2) 11.1 9.3) 32.1	Arkansas has 1-school based dental clinic, Wakefield Elementary, Little Rock, provided 25,947 screenings and 3,340 children received 9,912 sealants	Increase to two school-based dental clinics	University of Arkansas at Little Rock (UALR) Children International Program, 2006 - 2010
<b>OH-10.1) Increase proportion of Federally Qualified Health Centers (FQHCs) that have an oral health program</b>	75.0%	83.0%	18 Dental Locations	DNC	Community Health Centers of Arkansas, 2012 Dental Services Fact Sheet
<b>OH-10.2) Increase the proportion of local health departments that have oral health prevention or care programs*</b>	25.8%	28.4%	DNC	DNC	DNC

<b>Healthy People 2020 Objective [Objective Number and Description]</b>	<b>National Baseline (%)</b>	<b>National Target (%)</b>	<b>Arkansas Status (%)</b>	<b>HP 2020 Arkansas Framework for Action Goal*</b>	<b>Source &amp; Year of Arkansas Data</b>
<b>OH-11) Increase the proportion of patients who receive oral health services at Federally Qualified Health Centers (FQHCs) each year*</b>	17.5%	33.3%	17.0% of all CHCA patients receive dental services.	17.3% of CHCA patients will receive dental services	Community Health Centers of Arkansas, 2012 Dental Services Fact Sheet
<b>OH-12) Increase the proportion of children and adolescents who have received dental sealants on their molar teeth</b>					
12.1) Children, aged 3-5 years (primary molar teeth)	1.4%	1.5%	DNC	DNC	DNC
12.2) Children, aged 6-9 years (permanent first molar teeth)*	25.5%	28.1%	27.0%	30.0%	BSS Third Graders, 2010
12.3) Adolescents, aged 13-15 (permanent molar teeth)	19.9%	21.9%	DNC	DNC	DNC
<b>OH-13) Increase the proportion of the U.S. population served by community water systems with optimally fluoridated water*</b>	72.4%	79.6%	67.0%	70.9%	ADH Environmental Health Branch, 2013
<b>OH-14) (Developmental) Increase the proportion of adults who receive preventive interventions in dental offices*</b> 14.1) tobacco use prevention or smoking cessation in the past year 14.2) oral and pharyngeal cancer screening 14.3) referred for glycemic control in the past year	DNC	DNC	DNC	DNC	Possible Source: BRFSS

<b>Healthy People 2020 Objective [Objective Number and Description]</b>	<b>National Baseline (%)</b>	<b>National Target (%)</b>	<b>Arkansas Status (%)</b>	<b>HP 2020 Arkansas Framework for Action Goal*</b>	<b>Source &amp; Year of Arkansas Data</b>
<b>OH-15) (Developmental) Increase the number of States and the District of Columbia that have a system for recording and referring infants and children with cleft lips and cleft palates to craniofacial anomaly rehabilitative teams*</b> 15.1) Have a system for recording cleft lips and cleft palates 15.2) Have a system for referral for cleft lip and cleft palates to rehabilitative teams	DNC	DNC	Cleft palate 6.3/10,000 births, cleft lip 12.4 per 10,000 births  Cleft Lip and Palate Program at Arkansas Children's Hospital	Continue to meet this goal	Arkansas Center for Birth Defects Research and Prevention, AR 2002-2006 birth years
<b>OH-16) Increase the number of States and the District of Columbia that have an oral and craniofacial health surveillance system*</b>	32 states	50 States and District of Columbia	Arkansas Reproductive Health Monitoring System (ARHMS)	Continue to meet this goal	ARHMS birth defects registry <a href="http://arbirthdefectsresearch.uams.edu/surveillance.htm">http://arbirthdefectsresearch.uams.edu/surveillance.htm</a>
<b>OH-17.1) Increase the proportion of States and local health agencies that serve jurisdictions of 250,000 or more persons with a dental public health program directed by a dental professional with public health training *</b>	23.4%	25.7%	ADH Office of Oral Health serves the entire state and is directed by a dental professional	Continue to meet this goal	ADH Office of Oral Health, 2013

Indicators selected based on the national *Healthy People 2020* objectives. Data for are available from, the *Healthy People 2020* objectives: <http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?to>

\*Indicators and goals selected by the ADH Office of Oral Health for the *Healthy People 2020: Arkansas's Chronic Disease Framework for Action*:

<http://www.healthy.arkansas.gov/programsServices/chronicDisease/Initiatives/Documents/HP2020/ARHP2020ChDzbooklet.pdf>

DNC = Data not collected

## V. THE BURDEN OF ORAL DISEASES

### Children

#### Prevalence of Disease and Unmet Needs

Nationally, dental caries (tooth decay) is five times more common than childhood asthma and seven times more common than allergic rhinitis (hay fever). Dental caries is a disease in which acids produced by bacteria on the teeth lead to loss of minerals from the enamel and dentin, the hard substances of teeth. Unchecked, dental caries can result in loss of tooth structure, inadequate tooth function, unsightly appearance, pain, infection, and tooth loss.

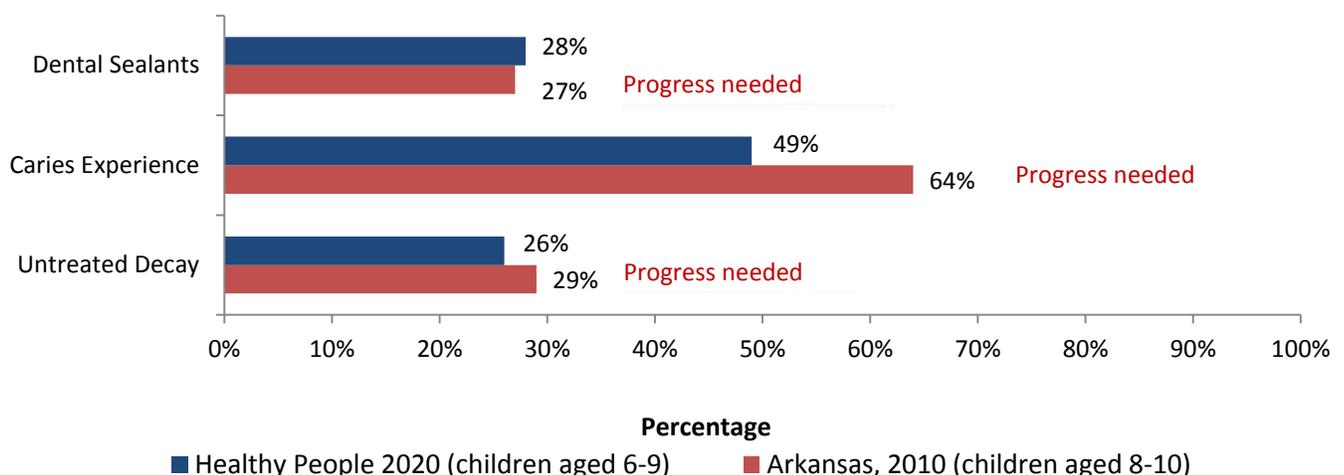
The prevalence of decay in children is measured by assessing caries experience (if they have ever had decay and now have fillings), untreated decay (active unfilled cavities), and urgent care (reported pain or a significant dental infection that requires immediate care).

Caries experience and untreated decay are monitored by the Office of Oral Health as consistent with the National Oral Health Surveillance System (NOHSS), which allows comparisons with other states and with the nation. For comparisons between Arkansas and the *Healthy People 2020* targets, see Figure 5.1.

During 2010, the Office conducted open-mouth surveys of 4,239 third graders to measure the prevalence of dental sealants, caries experience, and untreated caries in Arkansas. Schools from each of the 75 counties were included. The data were weighted to accurately represent the student population in each school.

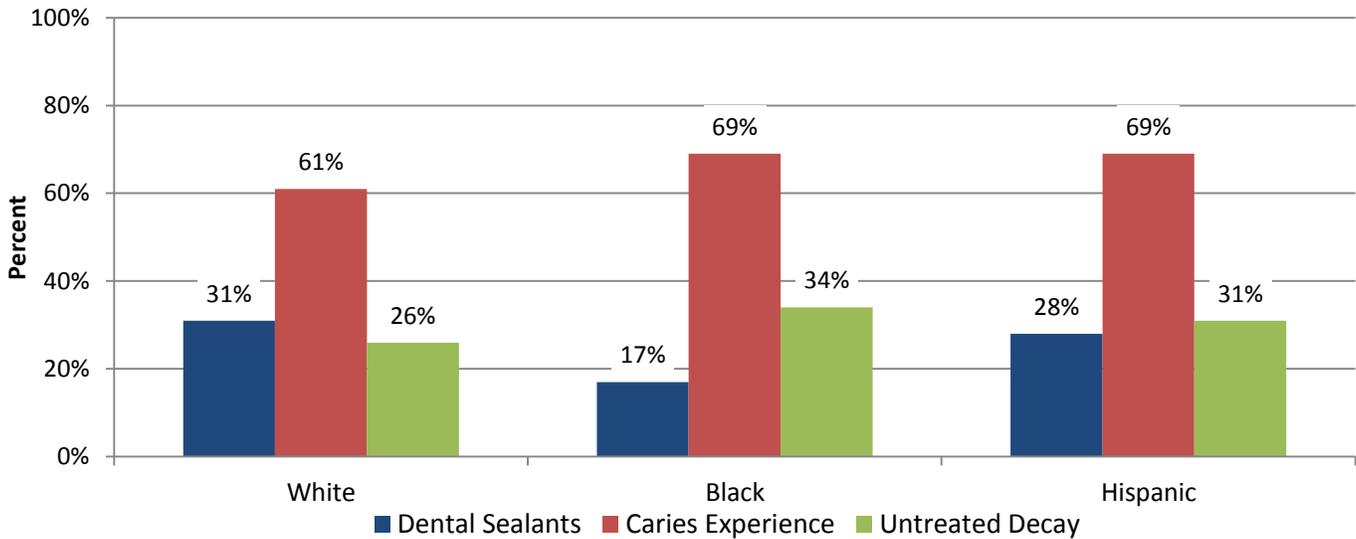
- Of those who participated, 50% were female and 50% were male.
- There was little age variation. Among the third graders screened, 42% were 8 years of age, 52% were 9 years of age, and 6% were 10 years of age.
- Among race and ethnic backgrounds reported, 64% were white, 25% were black, and 11% were Hispanic.

**Figure 5.1. Oral Health Status Among Third Graders in Arkansas Compared to Healthy People 2020 Target Goals**



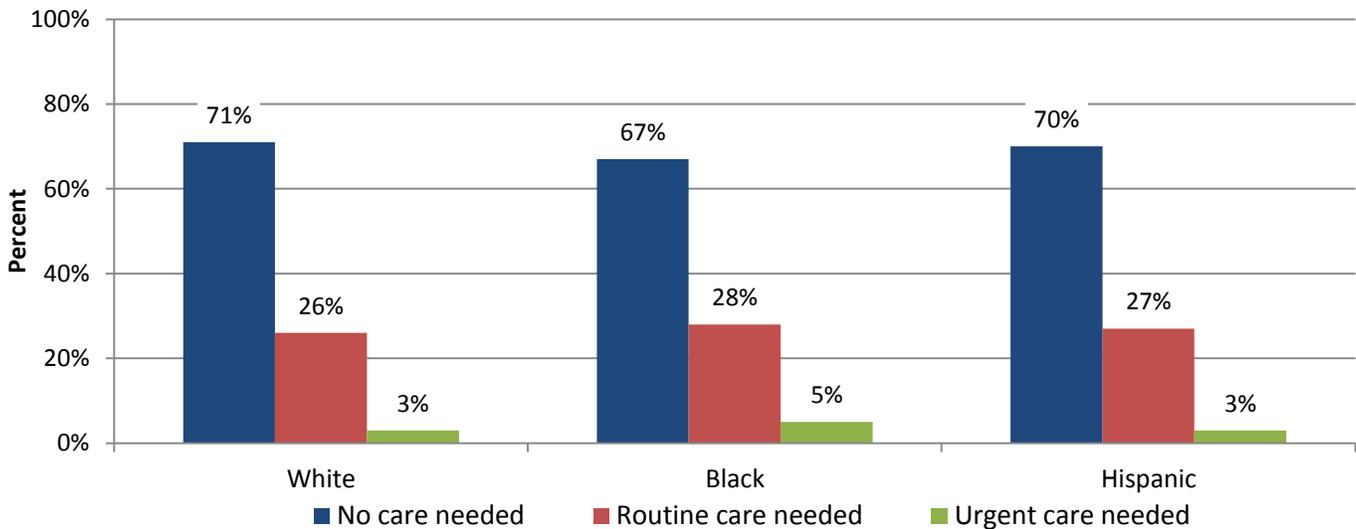
Dental caries is not uniformly distributed in the United States or in Arkansas. Some groups are more likely to experience the disease and are less likely to receive treatment. The most recent data for third grade children in Arkansas are illustrated in Figures 5.2 & 5.3.

**Figure 5.2. Percentage of Dental Sealants, Caries Experience, and Untreated Dental Decay Among 8-10 Year Old Children, by Race/Ethnicity, Arkansas, 2010**



Source: Office of Oral Health, BSS of 3<sup>rd</sup> Graders: Oral Health Screening, 2010

**Figure 5.3. Percentage of Referral for Care Among 8-10 Year Old Children, by Race/Ethnicity, Arkansas, 2010**



Source: Office of Oral Health, BSS of 3<sup>rd</sup> Graders: Oral Health Screening, 2010

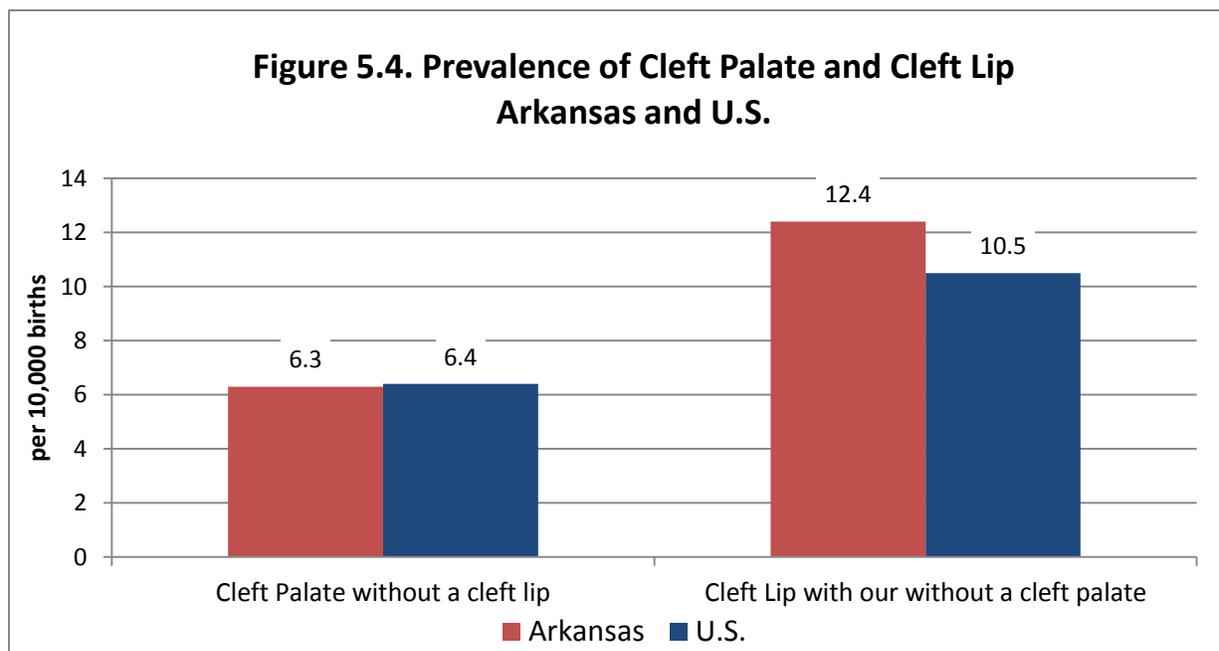
## Oral and Craniofacial Diseases

Oral and craniofacial diseases and their treatment place a burden on society in the form of lost days and years of productive work. The Craniofacial Clinic at Arkansas Children's Hospital (ACH) provides diagnosis, evaluation and treatment for children with a variety of craniofacial deformities and malformations. The Craniofacial Orthodontics Clinic provides comprehensive orthodontic services for patients with craniofacial and/or cleft lip/palate malformations.

The Arkansas Reproductive Health Monitoring System at the Arkansas Center for Birth Defects Research and Prevention monitors the prevalence of cleft lip and cleft palate in the state.

<http://arbirthdefectsresearch.uams.edu/surveillance.htm>

A cleft palate (roof of the mouth) or cleft lip defect occurs early in pregnancy and causes an opening or fissure to occur in the lip or palate. The results of these defects also cause children to have problems with their teeth and with speaking, eating, and hearing. In Arkansas, the birth prevalence of cleft lip with or without a cleft palate is slightly higher, 12.4 per 10,000 births, compared to the United States, 10.5 per 10,000 births. However, the prevalence of cleft palate without a cleft lip is essentially the same in Arkansas, 6.3 per 10,000 births, and the United States, 6.4 per 10,000 births, see Figure 5.4.



Source: Arkansas Reproductive Health Monitoring System, UAMS, [http://www.nbdpn.org/docs/AR\\_2010\\_C.pdf](http://www.nbdpn.org/docs/AR_2010_C.pdf)

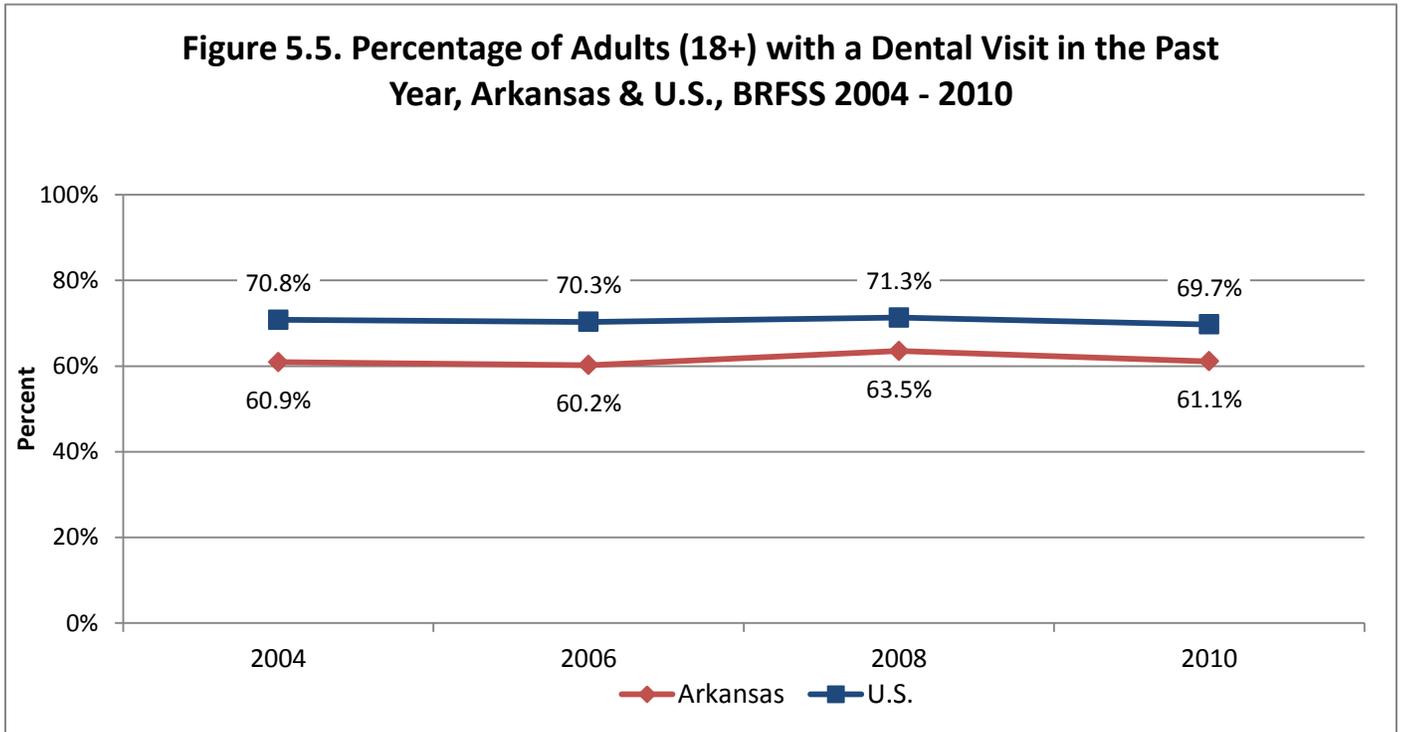
Note: Arkansas estimates based on pooled data from birth years 2002-2006. U.S. estimates based on pooled data from birth years 1999-2001

## Adults

### Preventive Visits

Regular dental visits are important to achieve good oral health. In 2010, 61.1 percent of Arkansas adults aged 18 and older reported visiting a dentist or dental clinic in the past year for any reason, much lower than that of the U.S. (69.7%).

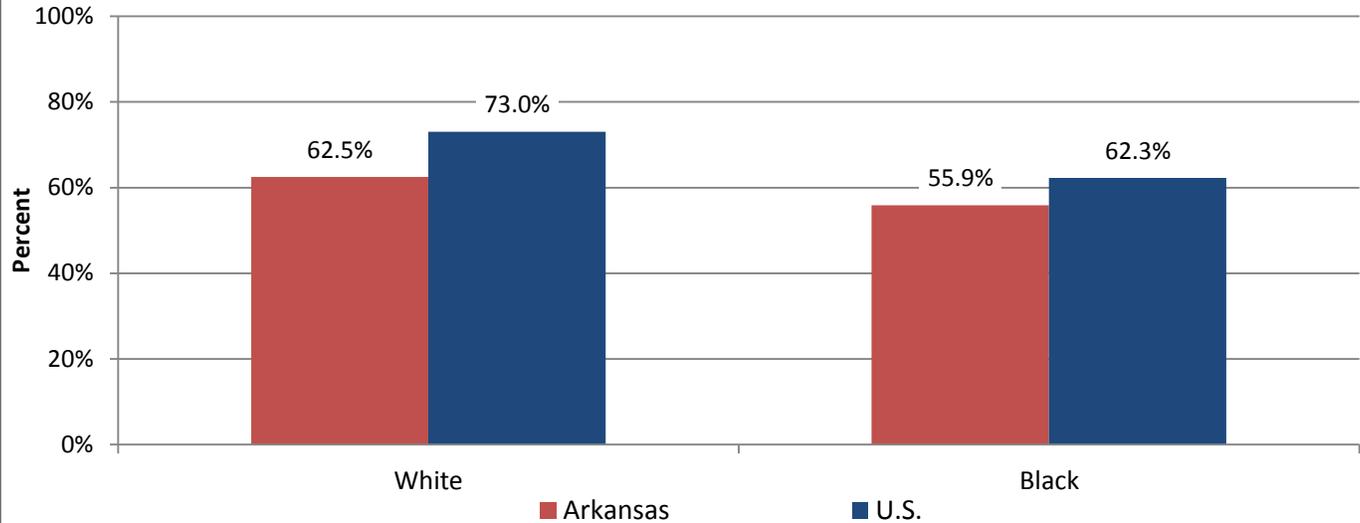
The reported dental visits in Arkansas and the United States for adults, by selected demographic groups, is illustrated in Figures 5.5 - 5.8.



Question: How long has it been since you last visited a dentist or a dental clinic for any reason? Include visits to dental specialists, such as orthodontists.

Source: CDC Behavioral Risk Factor Surveillance System (BRFSS): <http://www.cdc.gov/brfss/index.htm>

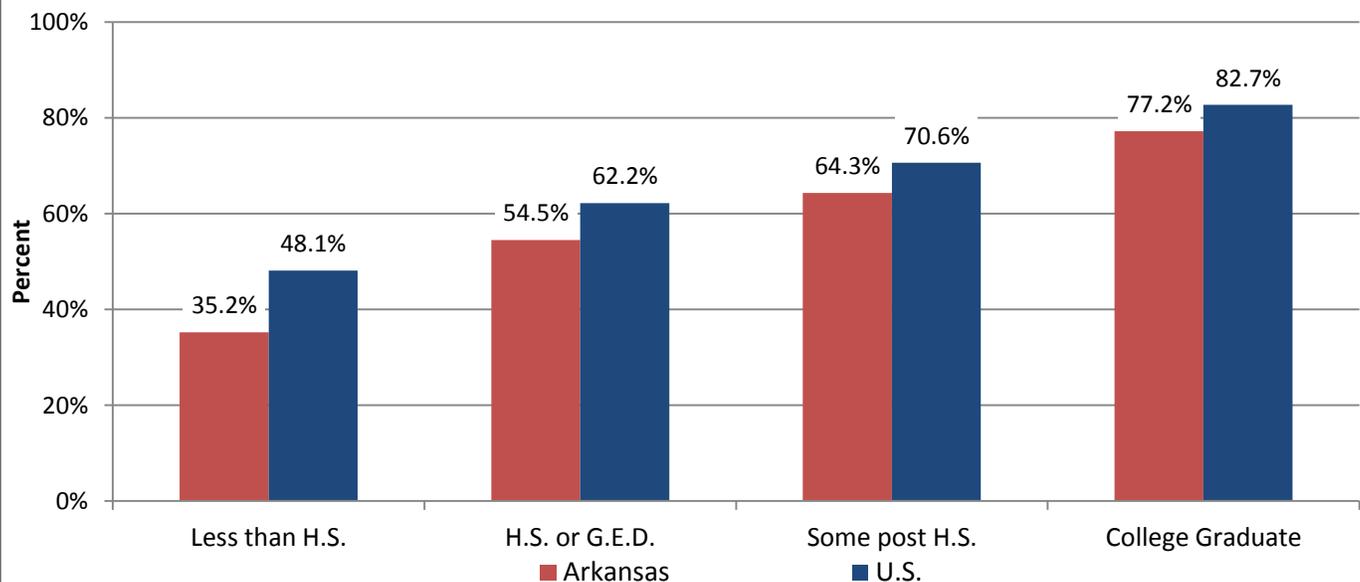
**Figure 5.6. Percentage of Adults (18+) with a Dental Visit in the Past Year, by Race, Arkansas & U.S., BRFSS 2010**



Question: How long has it been since you last visited a dentist or a dental clinic for any reason? Include visits to dental specialists, such as orthodontists.

Source: CDC Behavioral Risk Factor Surveillance System (BRFSS): <http://www.cdc.gov/brfss/index.htm>

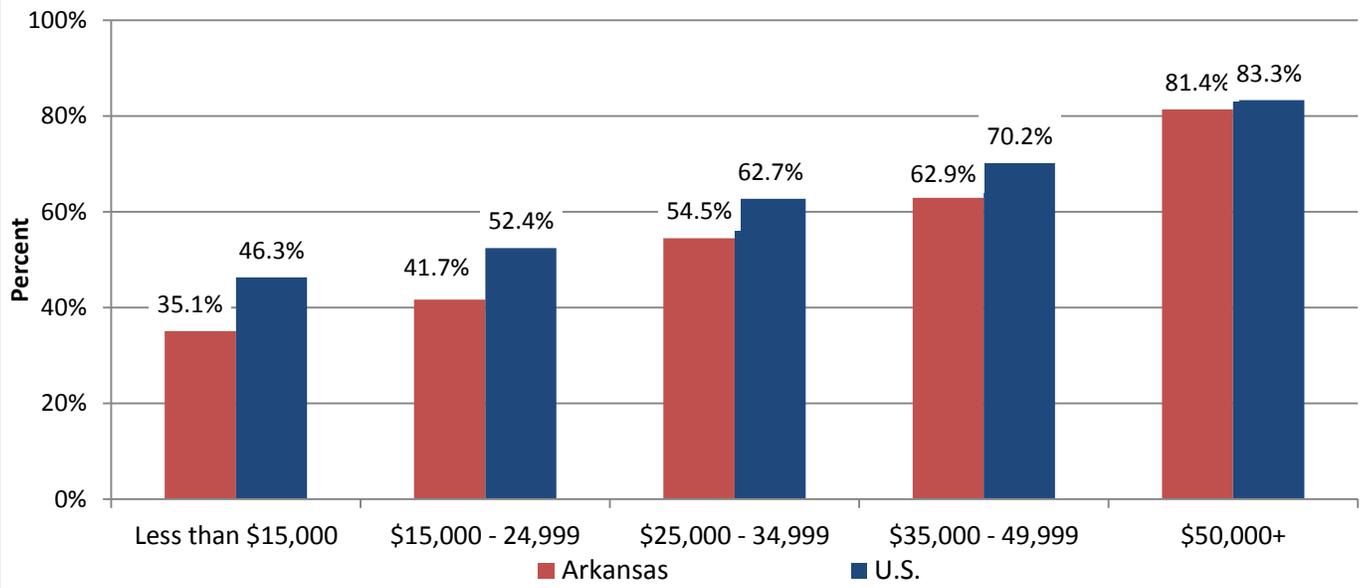
**Figure 5.7. Percentage of Adults (18+) with a Dental Visit in the Past Year, by Education, Arkansas & U.S., BRFSS 2010**



Question: How long has it been since you last visited a dentist or a dental clinic for any reason? Include visits to dental specialists, such as orthodontists.

Source: CDC Behavioral Risk Factor Surveillance System (BRFSS): <http://www.cdc.gov/brfss/index.htm>

**Figure 5.8. Percentage of Adults (18+) with a Dental Visit in the Past Year, by Income, Arkansas & U.S., BRFSS 2010**



### Dental Caries

People are susceptible to dental caries (decay) throughout their lifetime. Like children and adolescents, adults can experience new decay on the crown (enamel covered) portion of the tooth. But adults can also develop caries on the root surfaces of teeth as they become exposed to bacteria and carbohydrates as a result of gum recession. In the most recent national examination survey, 85 percent of U.S. adults had at least one tooth with decay or a filling on the crown. Root surface caries affect 50 percent of adults aged 75 years or older [USDHHS 2000a].

Not only do adults experience dental caries, but a substantial proportion of that disease is untreated at any point in time. About 28 percent of adults between the ages of 35 and 44 participating in the 2004 National Health and Nutrition Examination Survey had untreated caries [CDC 2010].

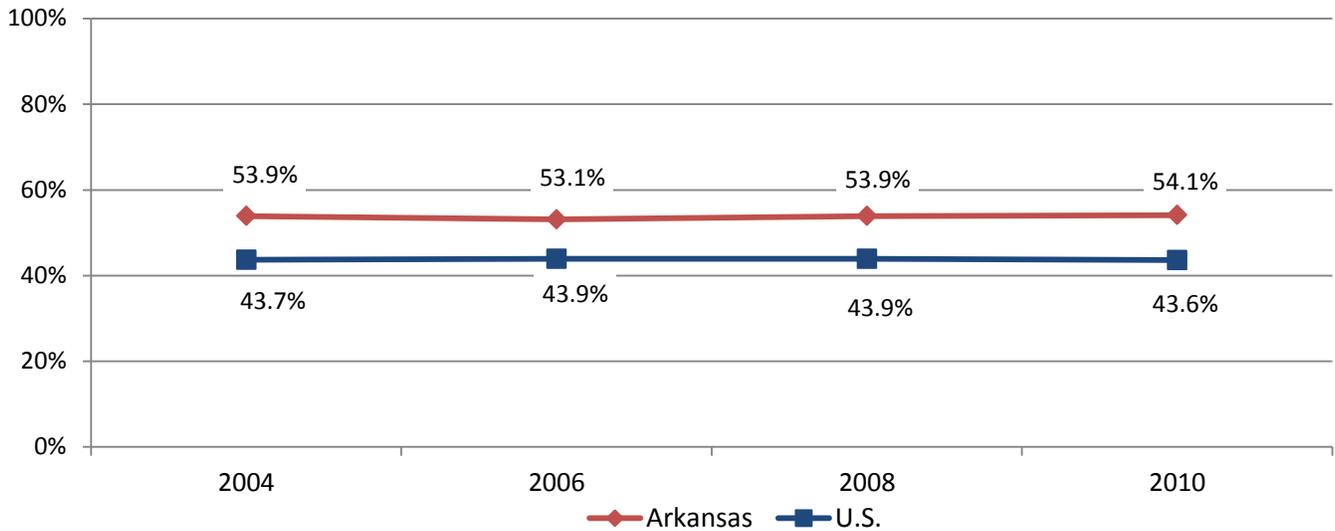
### Tooth Loss

A full dentition is defined as having 28 natural teeth, exclusive of third molars (the wisdom teeth) and teeth removed for orthodontic treatment or as a result of trauma. Most persons can keep their teeth for life with adequate personal, professional, and population-based preventive practices. As teeth are lost, a person's ability to chew and speak decreases. The most common reasons for tooth loss in adults are tooth decay and periodontal disease. Tooth loss also can result from infection (due to tooth decay), unintentional injury, and head and neck cancer treatment. In addition, certain orthodontic and prosthetic services sometimes require the removal of teeth.

Despite an overall trend toward a reduction in tooth loss in the U.S. population, not all groups have benefited to the same extent. Women tend to have more tooth loss than men of the same age group, but could in part be due to fewer visits to the dentist by male patients. Black Americans are more likely than whites to have tooth loss. Among all predisposing and enabling factors, low educational level often has been found to have the strongest and most consistent association with tooth loss.

In Arkansas, 54 percent of adults aged 18 and older had at least one tooth extracted due to decay or gum disease in 2010. This is in contrast to 44 percent of U.S. adults. The prevalence tooth loss in Arkansas and the United States for adults, by selected demographic groups, is illustrated in Figures 5.9 - 5.16.

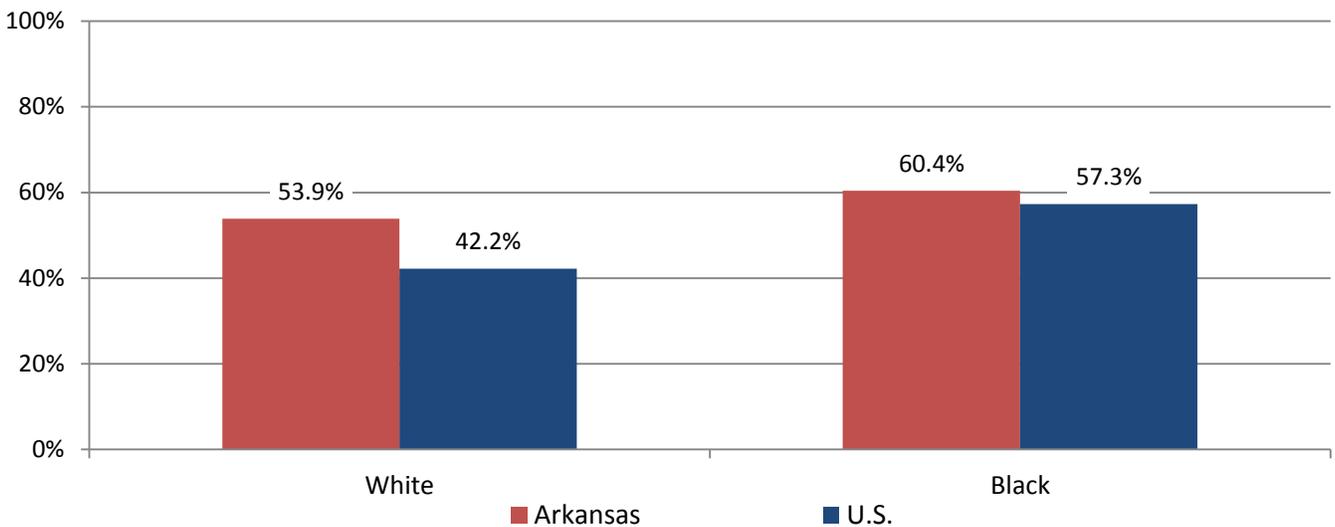
**Figure 5.9. Percentage of Adults (18+) with at Least One Tooth Extracted Due to Decay/Gum Disease, Arkansas & U.S., BRFSS 2004 - 2010**



Question: How many of your permanent teeth have been removed because of tooth decay or gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics.

Source: CDC Behavioral Risk Factor Surveillance System (BRFSS): <http://www.cdc.gov/brfss/index.htm>

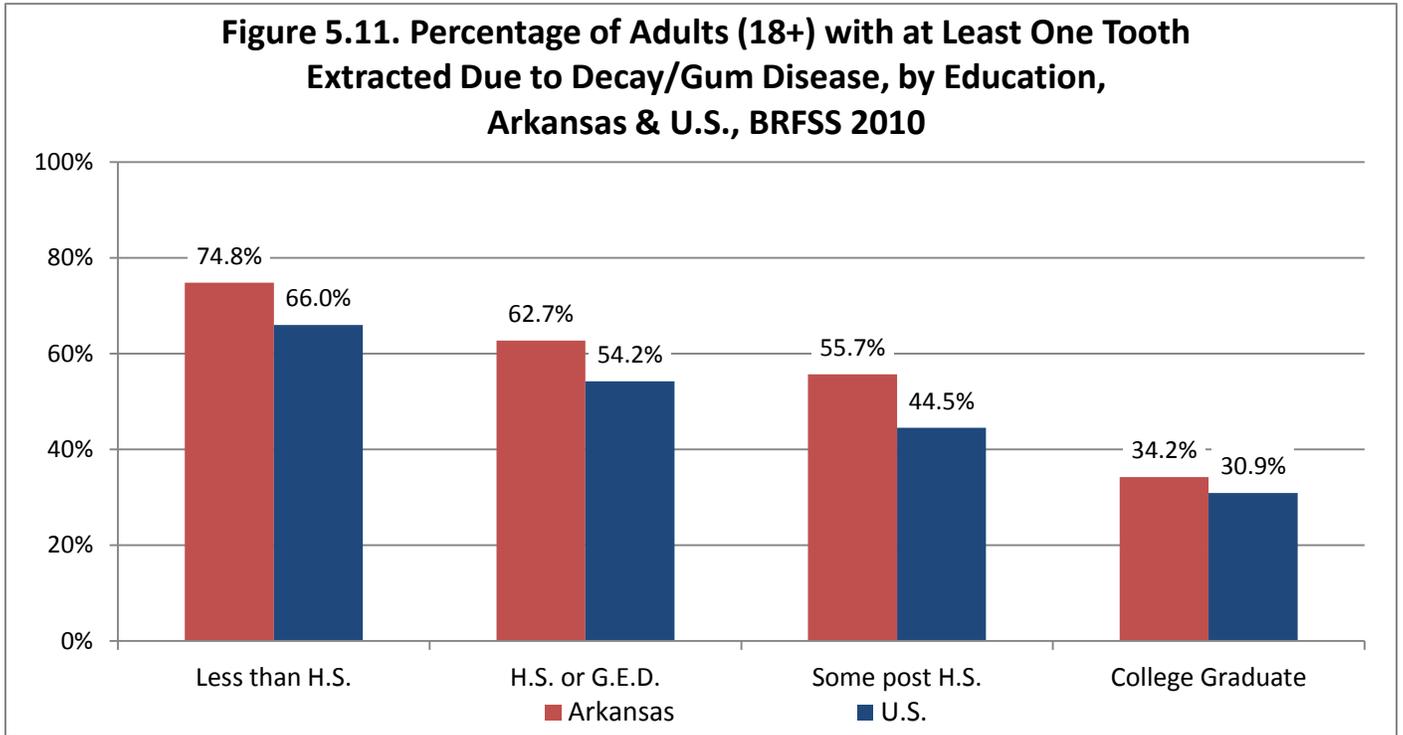
**Figure 5.10. Percentage of Adults (18+) with at Least One Tooth Extracted Due to Decay/Gum Disease, by Race, Arkansas & U.S., BRFSS 2010**



Question: How many of your permanent teeth have been removed because of tooth decay or gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics.

Source: CDC Behavioral Risk Factor Surveillance System (BRFSS): <http://www.cdc.gov/brfss/index.htm>

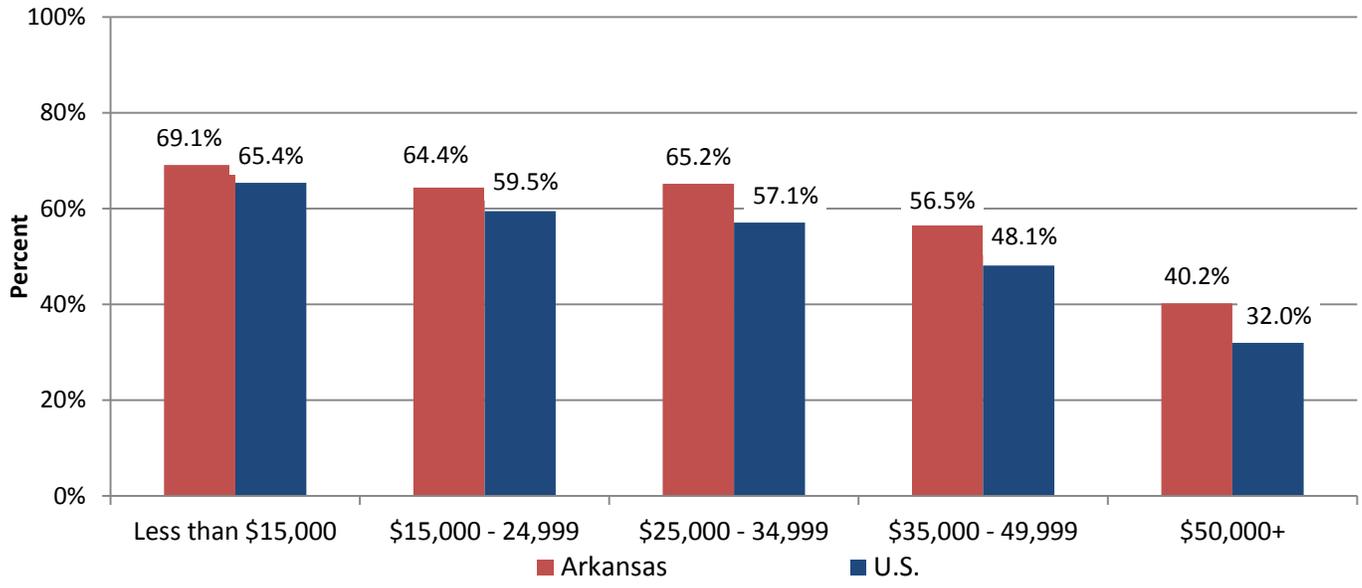
**Figure 5.11. Percentage of Adults (18+) with at Least One Tooth Extracted Due to Decay/Gum Disease, by Education, Arkansas & U.S., BRFSS 2010**



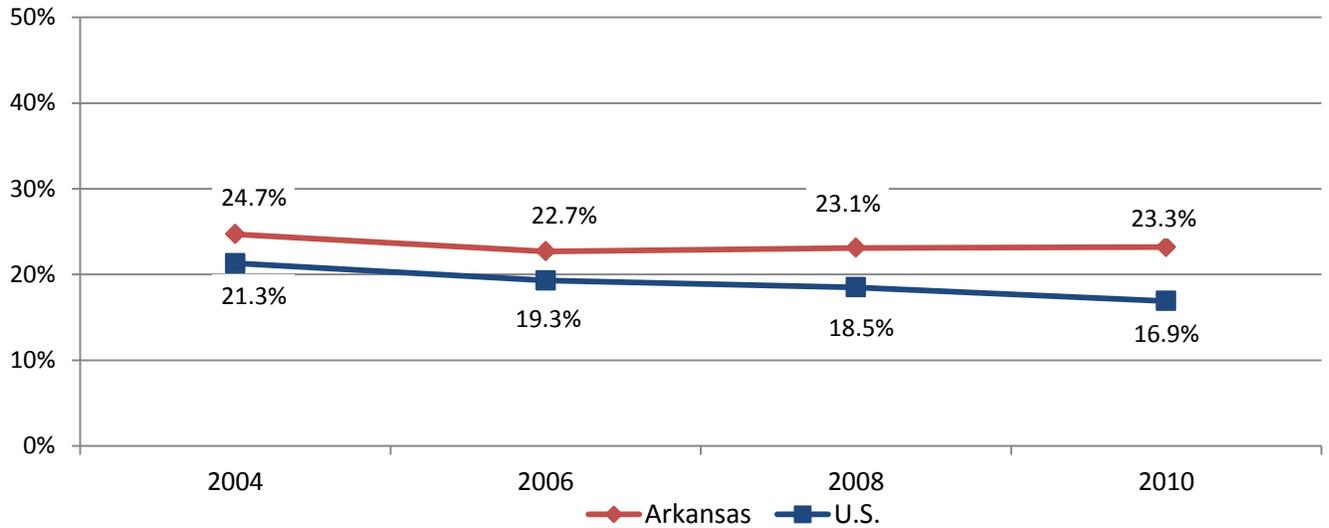
Question: How many of your permanent teeth have been removed because of tooth decay or gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics.

Source: CDC Behavioral Risk Factor Surveillance System (BRFSS): <http://www.cdc.gov/brfss/index.htm>

**Figure 5.12. Percentage of Adults (18+) with at Least One Tooth  
Extracted Due to Decay/Gum Disease, by Income,  
Arkansas & U.S., BRFSS 2010**



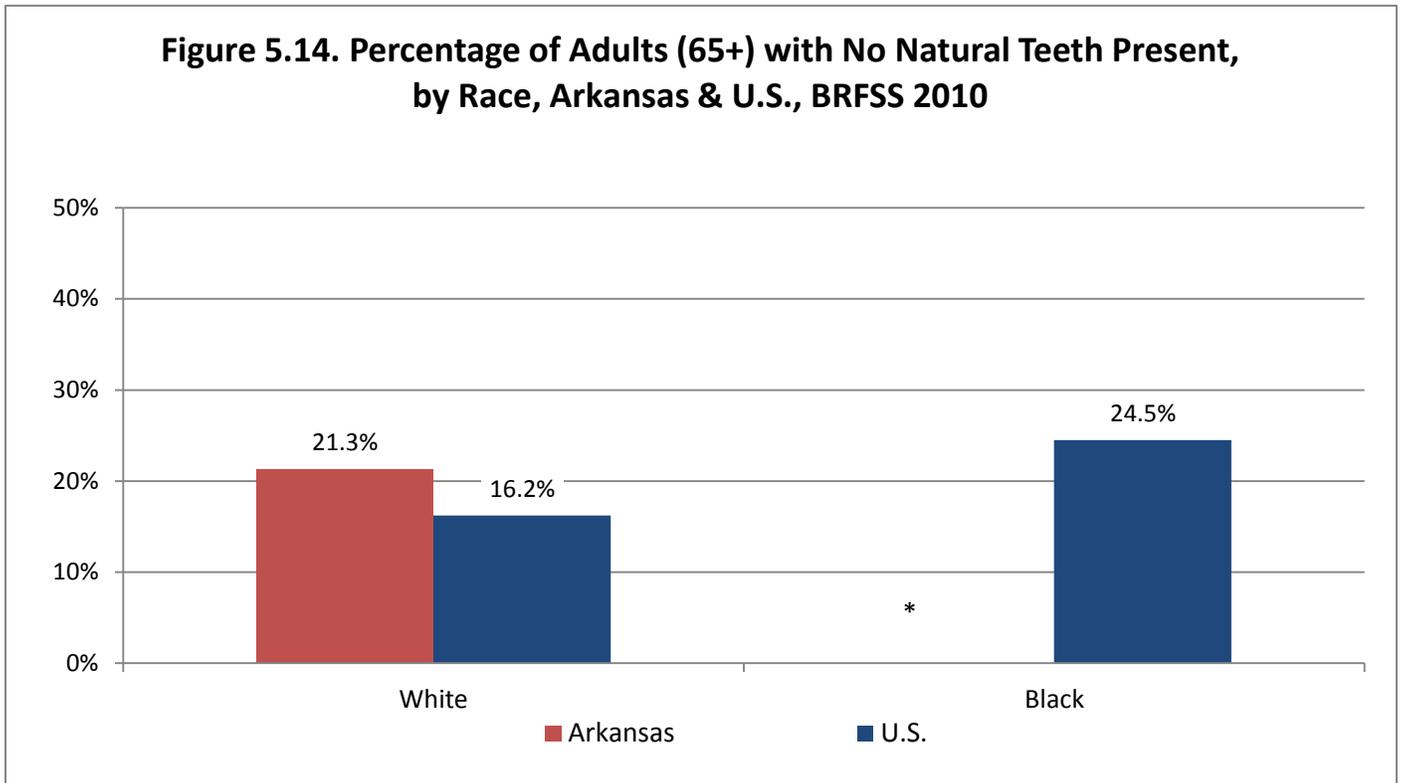
**Figure 5.13. Percentage of Adults (65+) with No Natural Teeth Present, Arkansas & U.S., BRFSS 2004 - 2010**



Question: How many of your permanent teeth have been removed because of tooth decay or gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics.

Source: CDC Behavioral Risk Factor Surveillance System (BRFSS): <http://www.cdc.gov/brfss/index.htm>

**Figure 5.14. Percentage of Adults (65+) with No Natural Teeth Present, by Race, Arkansas & U.S., BRFSS 2010**

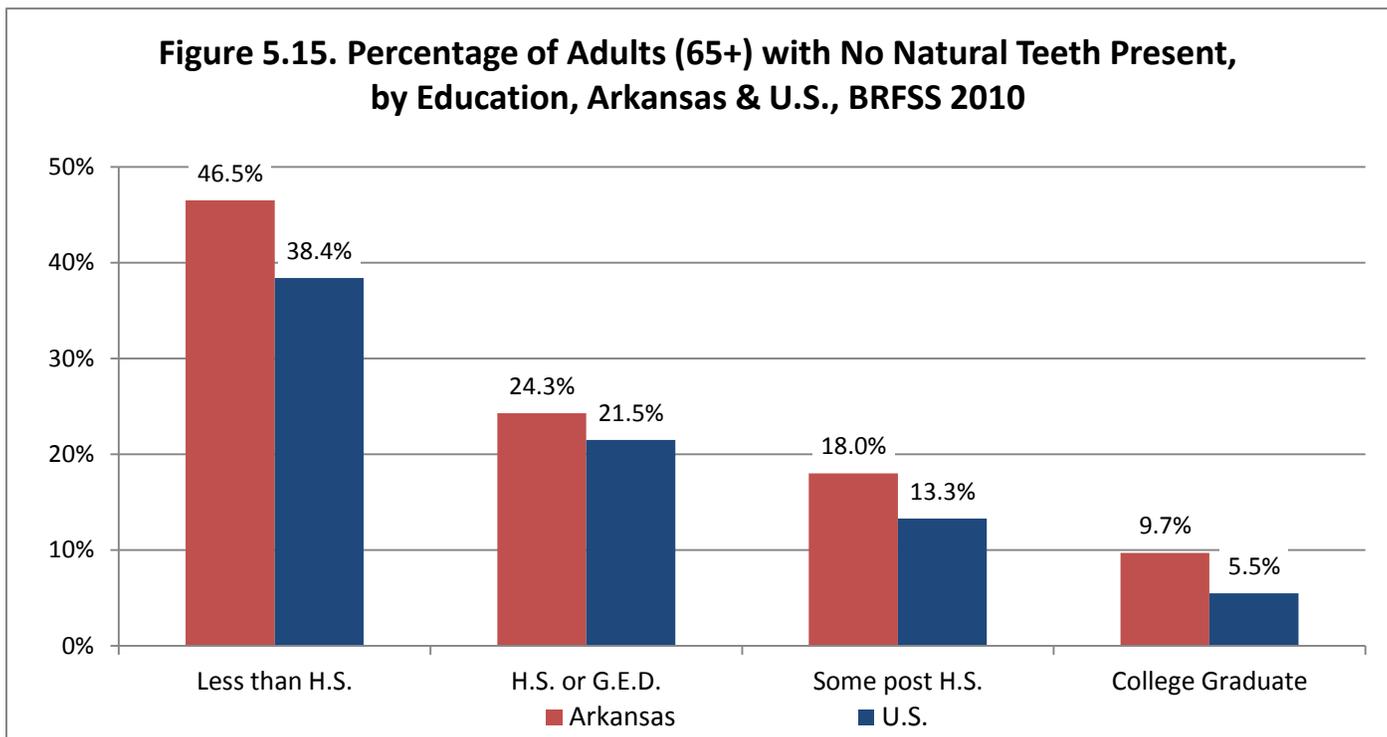


\* Arkansas data not available since the sample size for the denominator was < 50.

Question: How many of your permanent teeth have been removed because of tooth decay or gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics.

Source: CDC Behavioral Risk Factor Surveillance System (BRFSS): <http://www.cdc.gov/brfss/index.htm>

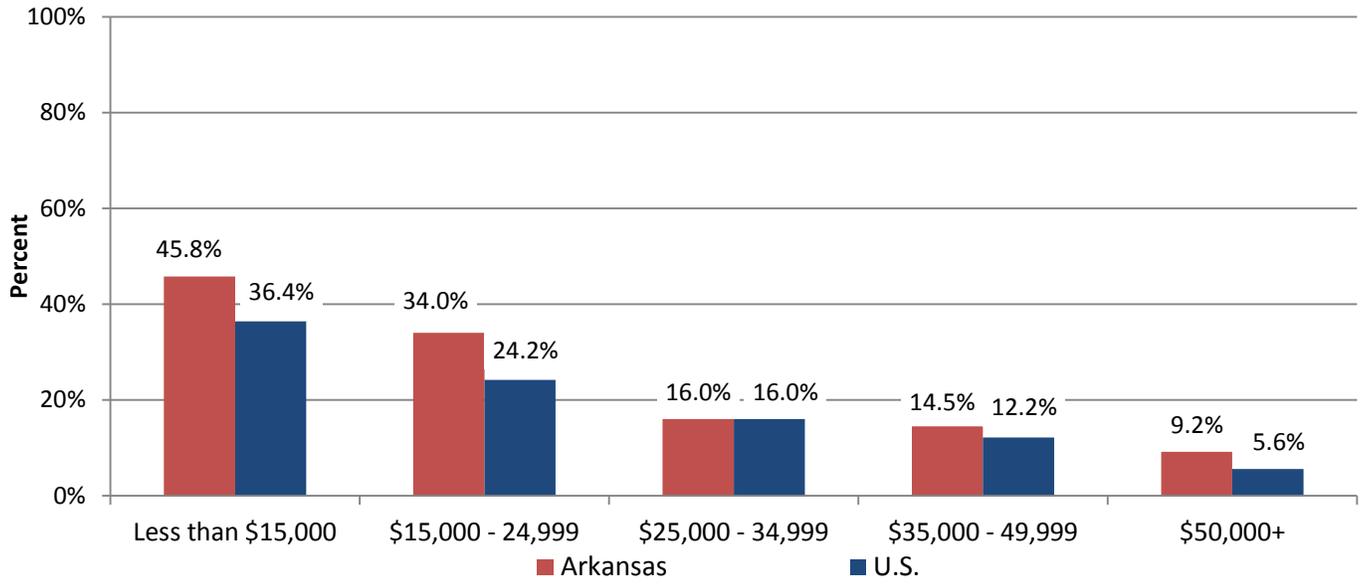
**Figure 5.15. Percentage of Adults (65+) with No Natural Teeth Present, by Education, Arkansas & U.S., BRFSS 2010**



Question: How many of your permanent teeth have been removed because of tooth decay or gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics.

Source: CDC Behavioral Risk Factor Surveillance System (BRFSS): <http://www.cdc.gov/brfss/index.htm>

**Figure 5.16. Percentage of Adults (65+) with No Natural Teeth Present, by Education, Arkansas & U.S., BRFSS 2010**



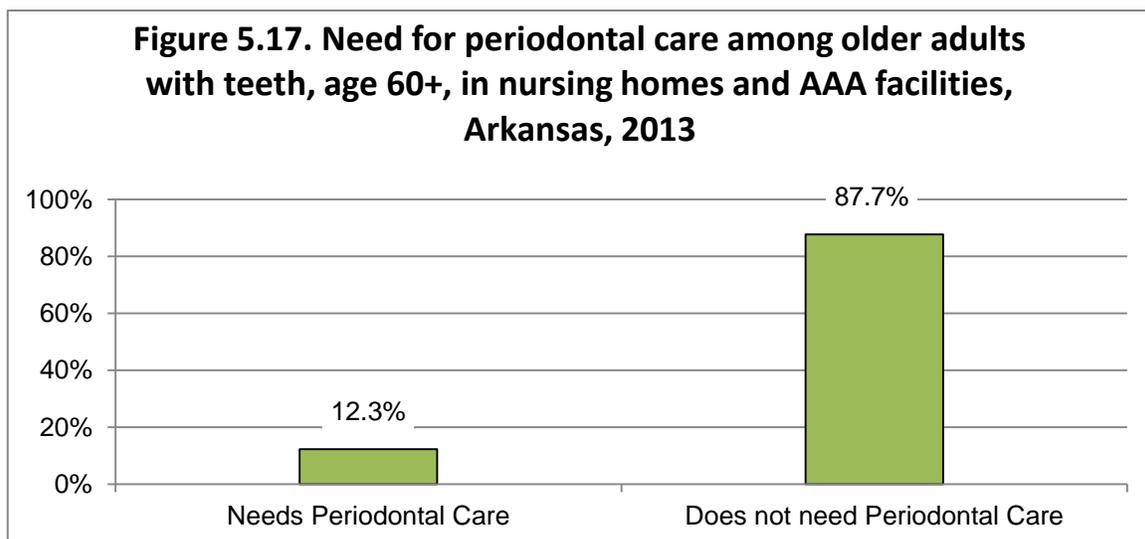
## Periodontal (Gum) Diseases

Gingivitis is characterized by localized inflammation, swelling, and bleeding gums without a loss of the bone that supports the teeth. Gingivitis is usually reversible with good oral hygiene. Daily removal of dental plaque from the teeth is extremely important to prevent gingivitis, which if untreated can progress to destructive periodontitis.

Periodontitis is characterized by the loss of the tissue and bone that support the teeth. It places a person at risk of eventual tooth loss unless appropriate treatment is provided. Among adults, periodontitis is a leading cause of bleeding, pain, infection, loose teeth, and tooth loss [Burt & Eklund 1999].

Nationally, the prevalence of gingivitis is highest among American Indians and Alaska Natives, Hispanic Americans, and adults with less than a high school education. As tooth loss from dental caries is on the decline, the periodontium will be at increased risk for inflammation (gingivitis and periodontitis) simply because more teeth are present. As one ages, the ability to maintain oral hygiene may be diminished. Coupled with the potential of medication induced inflammatory changes, cases of gingivitis and periodontitis are positioned to rise. Although not all cases of gingivitis progress to periodontal disease, all periodontal disease starts as gingivitis. The major method available to prevent destructive periodontitis, therefore, is to prevent the precursor condition of gingivitis.

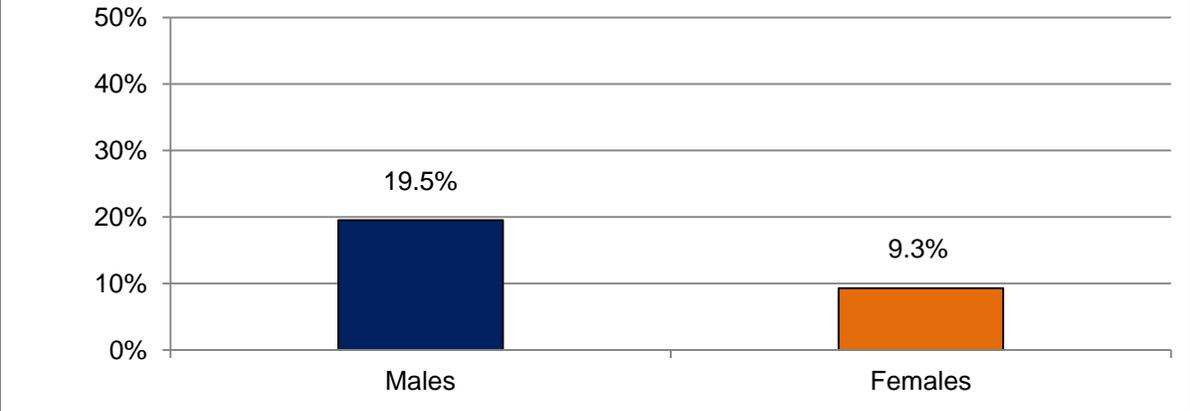
During 2012-2013, the Office conducted open-mouth screening surveys to determine the current status of oral health among older adults aged 60 and older in nursing home and Area Agency on Aging (AAA) facilities in Arkansas. Periodontal disease was one of the measures surveyed. Periodontal care was reported when a participant needed their teeth cleaned before the next regularly scheduled dental appointment, or when they needed more advanced periodontal treatment. Overall, 12.3 percent of the participants with teeth were in need of periodontal care. The prevalence of periodontal disease in Arkansas among older adults is illustrated in Figures 5.17 - 5.19.



Source: Office of Oral Health, Older Adults Survey, 2013

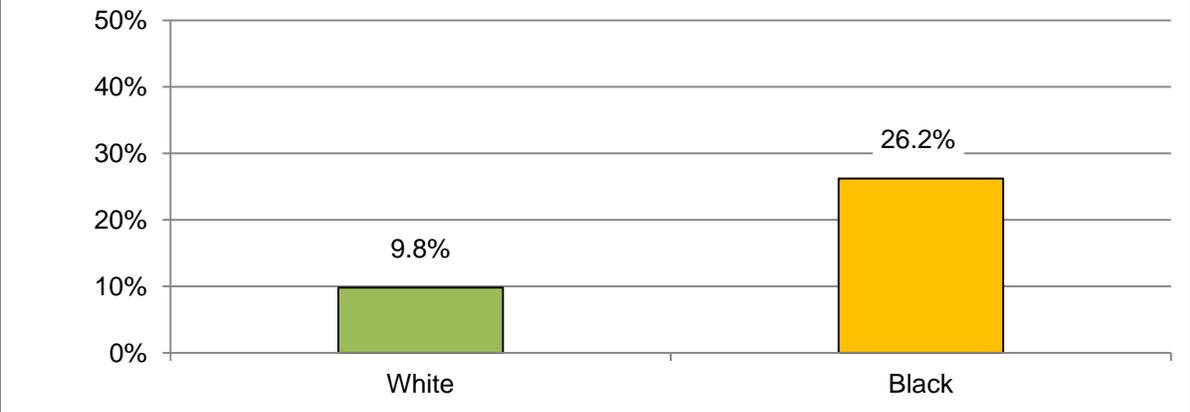


**Figure 5.18. Need for periodontal care among older adults with teeth, age 60+, in nursing homes and AAAs, by Sex, Arkansas, 2013**



Source: Office of Oral Health, Older Adults Survey, 2013

**Figure 5.19. Need for periodontal care among older adults with teeth, age 60+, in nursing homes and AAAs, by Race, Arkansas, 2013**



Source: Office of Oral Health, Older Adults Survey, 2013



## Oral Cancer

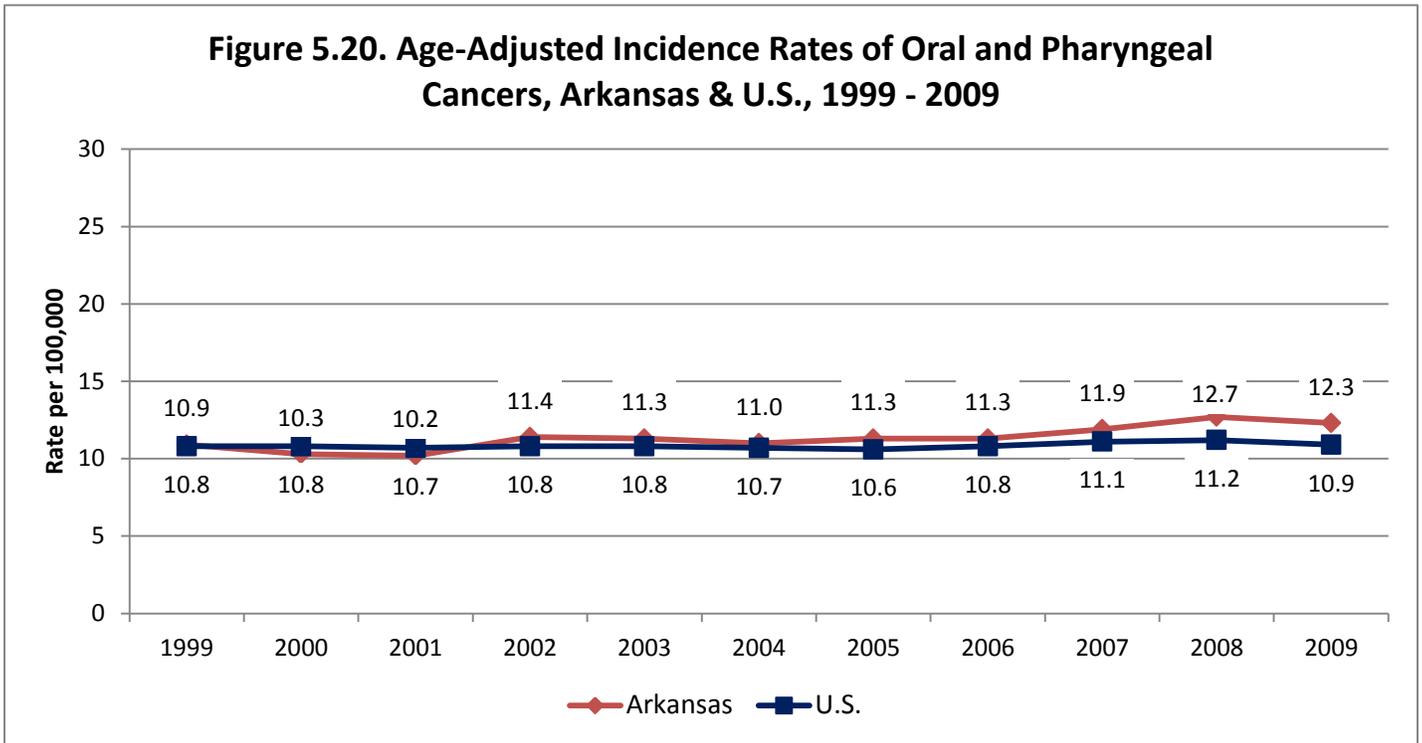
An estimated 41,380 new cases of oral cancer and 7,890 deaths from these cancers will occur in the United States in 2013. The 2009 age-adjusted (to the 2000 U.S. population) incidence rate of oral cancer in the United States was 10.9 per 100,000 persons.

Survival rates for oral cancer have not improved substantially over the past 25 years. More than 40 percent of persons diagnosed with oral cancer die within five years of diagnosis [Ries et al. 2004], although survival varies widely by stage of disease when diagnosed. The 5-year relative survival rate for persons with oral cancer diagnosed at a localized stage is 81 percent. In contrast, the 5-year survival rate is only 51 percent once the cancer has spread to regional lymph nodes at the time of diagnosis and is just 29 percent for persons with distant metastasis. Mortality is nearly twice as high in African-American males compared to white males. Methods used to treat the cancers (surgery, radiation, chemotherapy) are disfiguring and expensive.

Cigarette smoking and alcohol use are the major known risk factors for oral cancer in the United States, accounting for more than 75 percent of these cancers [Blot et al. 1988]. The use of tobacco, including smokeless tobacco [USDHHS 1986; IARC 2007] and cigars [Shanks & Burns 1998] also increases the risk of oral cancer. Dietary factors, particularly low consumption of fruit, and some types of viral infections also have been implicated as risk factors for oral cancer [McLaughlin et al. 1998; De Stefani et al. 1999; Levi 1999; Morse et al. 2000; Phelan 2003; Herrero 2003]. HPV is now thought to be the leading cause of cancer of the oropharynx (towards the back part of the mouth and throat) [Ramqvist and Dalianis 2010]. Radiation from sun exposure is a risk factor for lip cancer [Silverman et al. 1998].

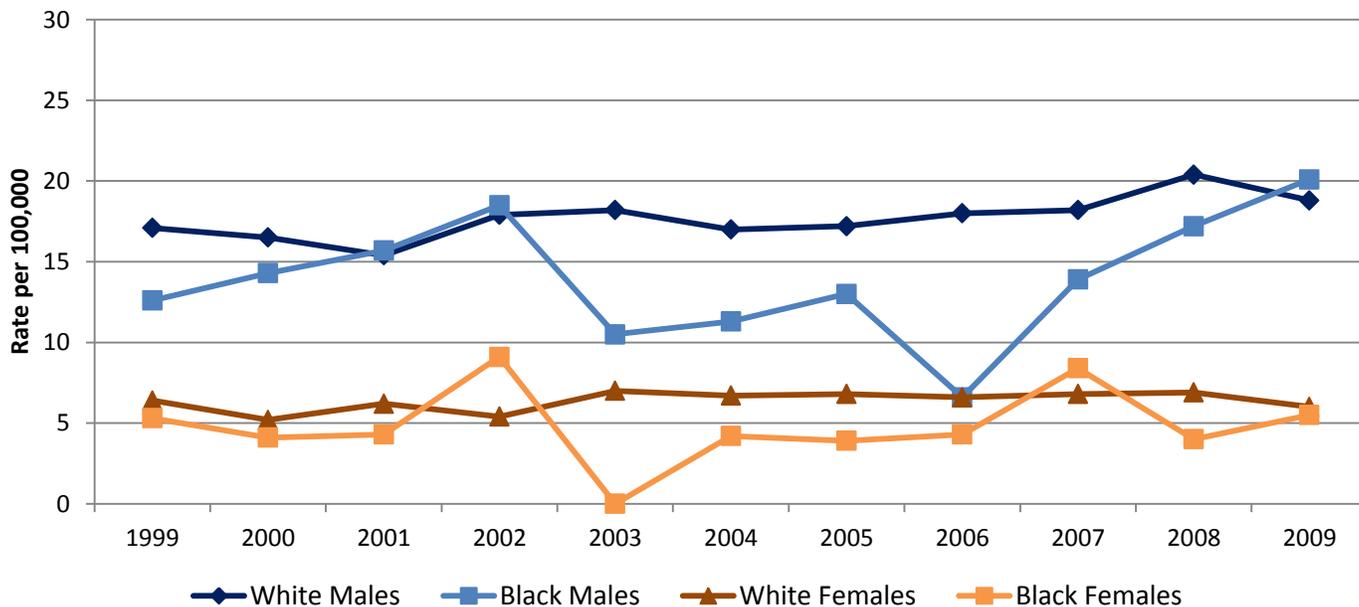
The incidence rates of cancers of the oral cavity and pharynx for Arkansas and the United States are shown in Figure 5.20. The oral cancer death rate by sex and race for Arkansas is shown in Figure 5.23. Progress is needed in Arkansas and throughout the United States overall to meet the Healthy People 2020 objective to detect oral and pharyngeal cancers at the earliest stage (35.8 percent). For oral and pharyngeal cancers diagnosed in Arkansas by stage, see Figure 5.24.

**Figure 5.20. Age-Adjusted Incidence Rates of Oral and Pharyngeal Cancers, Arkansas & U.S., 1999 - 2009**



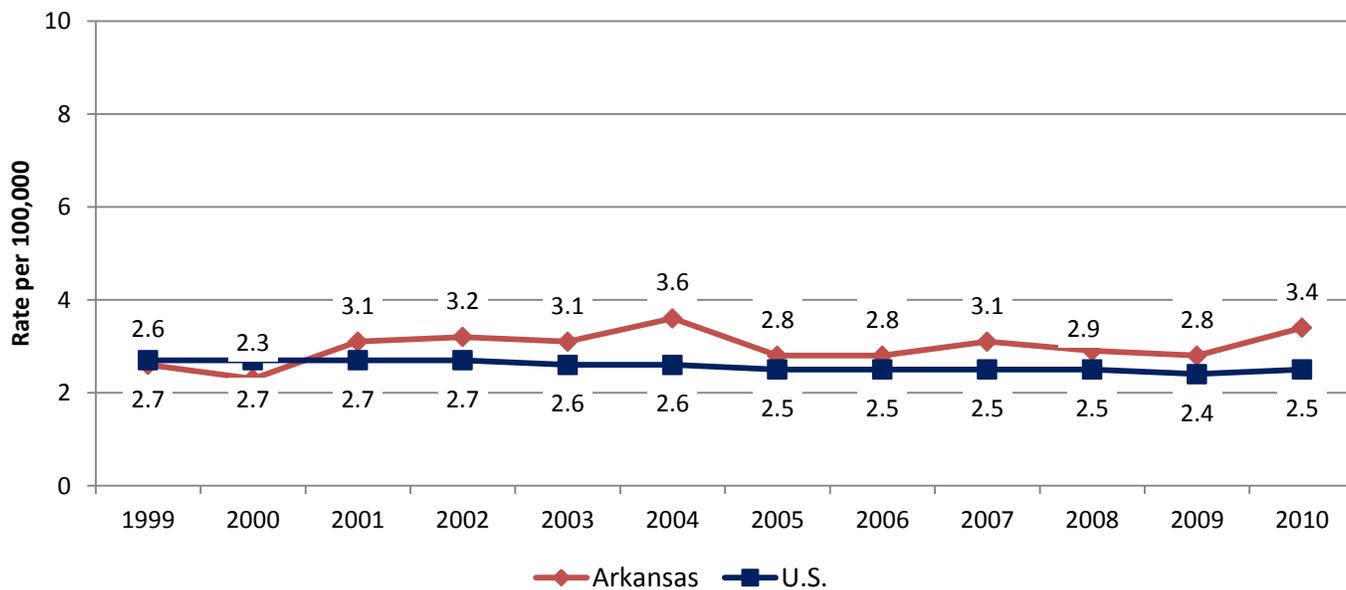
Source: Arkansas data from the Arkansas Central Cancer Registry: <http://www.cancer-rates.info/ar/index.php>  
U.S. data from CDC Wonder: <http://wonder.cdc.gov/cancer.html>

**Figure 5.21. Age-Adjusted Incidence Rates of Oral and Pharyngeal Cancers, by Sex & Race, Arkansas, 1999 - 2009**



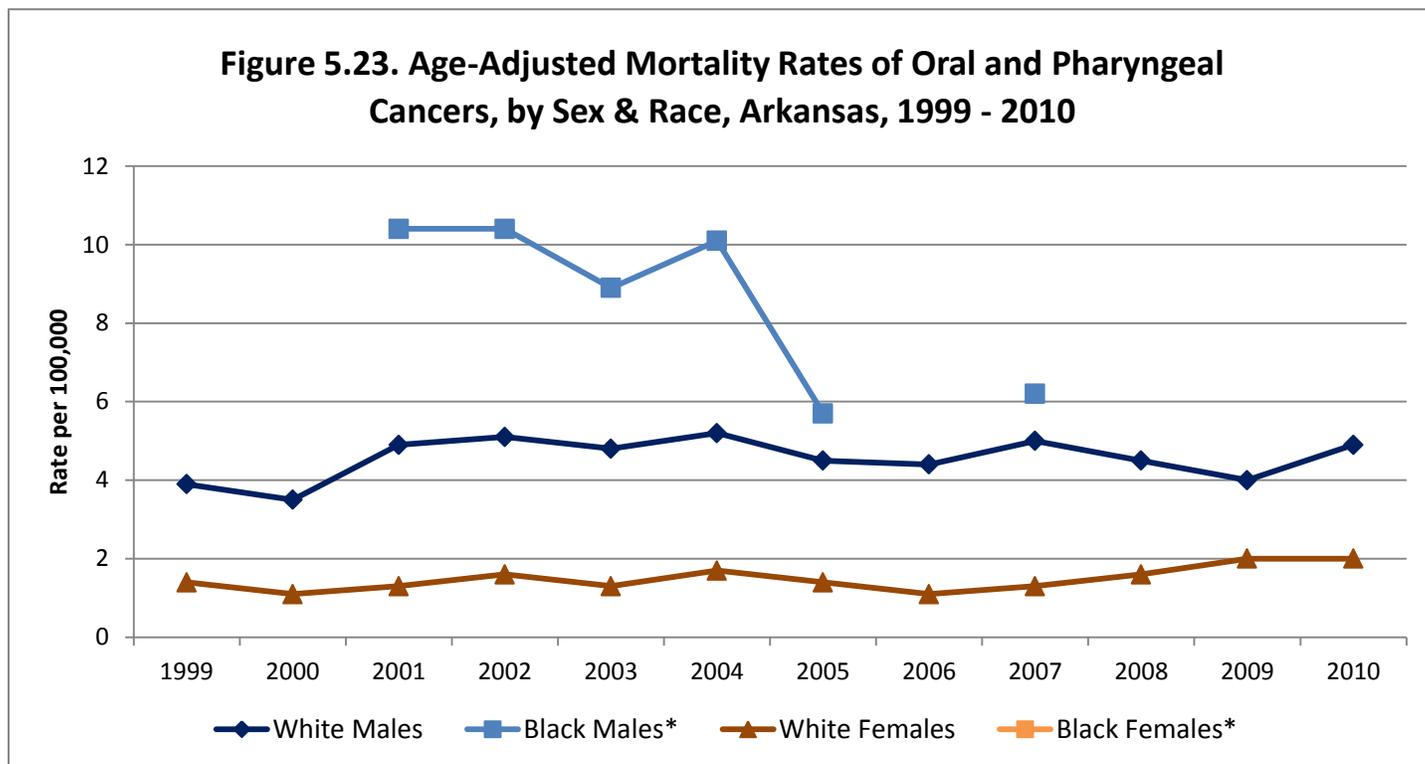
Source: Arkansas data from the Arkansas Central Cancer Registry: <http://www.cancer-rates.info/ar/index.php>  
 U.S. data from CDC Wonder: <http://wonder.cdc.gov/cancer.html>

**Figure 5.22. Age-Adjusted Mortality Rates of Oral and Pharyngeal Cancers, Arkansas & U.S., 1999 - 2010**



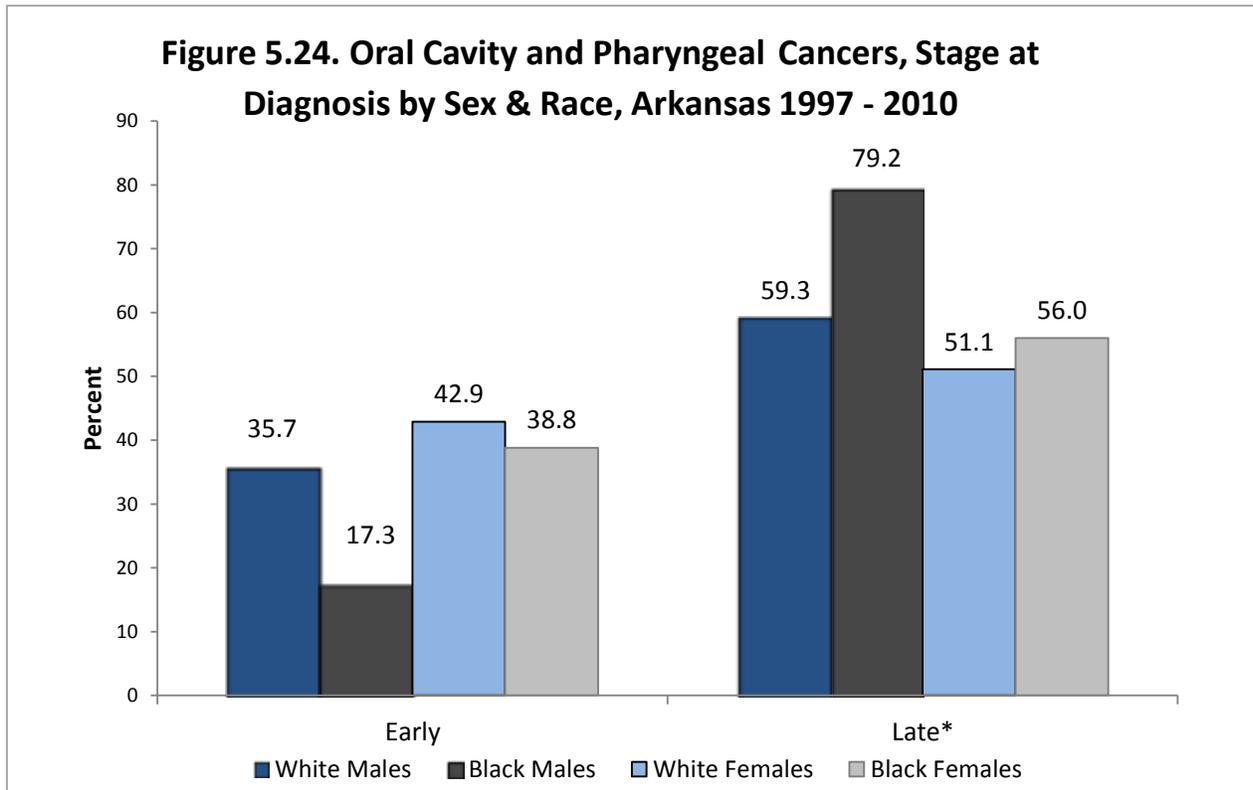
Source: CDC Wonder Compressed Mortality File: <http://wonder.cdc.gov/mortSQL.html>

**Figure 5.23. Age-Adjusted Mortality Rates of Oral and Pharyngeal Cancers, by Sex & Race, Arkansas, 1999 - 2010**



Source: CDC Wonder Compressed Mortality File: <http://wonder.cdc.gov/mortSQL.html>

\*All rates for Black females and rates for Black males for years 1999, 2000, 2006, 2008, 2009, 2010 are suppressed due to a small number of deaths.



\*Note: Late stage includes regional and distant stages of disease.  
 Source: Arkansas Central Cancer Registry, CancerCOREv2

---

## Disparities

### Racial and Ethnic Groups

Although gains in oral health status have been achieved for the population as a whole, they have not been evenly distributed across subpopulations. Non-Hispanic blacks, Hispanics, American Indians and Alaska Natives generally have the poorest oral health of any of the racial and ethnic groups in the U.S. population. As reported above, these groups tend to be more likely than non-Hispanic whites to experience dental caries in some age groups, are less likely to have received treatment for it, and have more extensive tooth loss. Black adults in each age group are more likely than other racial/ethnic groups to have gum disease.

### Women's Health

Most oral diseases and conditions are complex and are the product of interactions between genetic, socioeconomic, behavioral, environmental, and general health influences. Multiple factors may act synergistically to place some women at higher risk of oral diseases. For example, the comparative longevity of women, compromised physical status over time, and the combined effects of multiple chronic conditions and side effects from multiple medications used to treat them can result in increased risk of oral disease [Redford 1993].

Many women live in poverty, are not insured, and are the sole head of their household. For these women, obtaining needed oral health care may be difficult. In addition, gender-role expectations of women may affect their interaction with dental care providers and could affect treatment recommendations as well.

Many, but not all, statistical indicators show women to have better oral health status than do men [Redford 1993; USDHHS 2000a]. Women are less likely than men at each age group to have severe periodontal disease. Both black and white women have a substantially lower incidence rate of oral and pharyngeal cancers than do black and white men, respectively, see Figure 5.23. However, a higher proportion of women than men have orofacial pain, including pain from oral sores, jaw joints, face/cheek, and burning mouth syndrome.

**Pregnancy Risk Assessment Monitoring System (PRAMS)**

Oral health care during pregnancy is a big part of effective prenatal care. The Pregnancy Risk Assessment Monitoring System (PRAMS) is a surveillance project of the Centers for Disease Control and Prevention (CDC) and state health departments and collects state-specific, population-based data on maternal attitudes and experiences before, during, and shortly after pregnancy. The 2008 Arkansas PRAMS response to the oral health question shows disparities by race/ethnicity, see Table 5.1. Mothers receiving Medicaid coverage were less likely to have their teeth cleaned during pregnancy compared to women who were covered by non-Medicaid insurance.

**Table 5.1. 2008 PRAMS Question: During your most recent pregnancy, did you have your teeth cleaned?**

<b>Maternal Race/Ethnicity</b>	<b>Had teeth cleaned (%)</b>
White, non-Hispanic	30.9%
Black, non-Hispanic	8.4%
Hispanic	5.3%
<b>Insurance coverage</b>	
Non-Medicaid	67.1%
Medicaid (at any time)	32.9%

Source: CDC PRAMS: <http://www.cdc.gov/prams/CPONDER.htm>

---

## People with Disabilities

The oral health problems of individuals with disabilities are complex. These problems may be due to underlying congenital anomalies as well as to an inability to receive the personal and professional health care needed to maintain oral health. More than 54 million persons are defined as disabled under the Americans with Disabilities Act, including almost 1 million children under 6 years of age and 4.5 million children between 6 and 16 years of age.

No national studies have been conducted to determine the prevalence of oral and craniofacial diseases among the various populations with disabilities. Several smaller-scale studies show that the population with intellectual disability or other developmental disabilities has significantly higher rates of poor oral hygiene and needs for periodontal disease treatment than the general population. These may be due in part, to limitations in individual understanding of and physical ability to perform personal prevention practices or to obtain needed services. Caries vary widely among people with disabilities but overall their caries rates are higher than those of people without disabilities [USDHHS 2000a].

## Societal Impact of Oral Disease

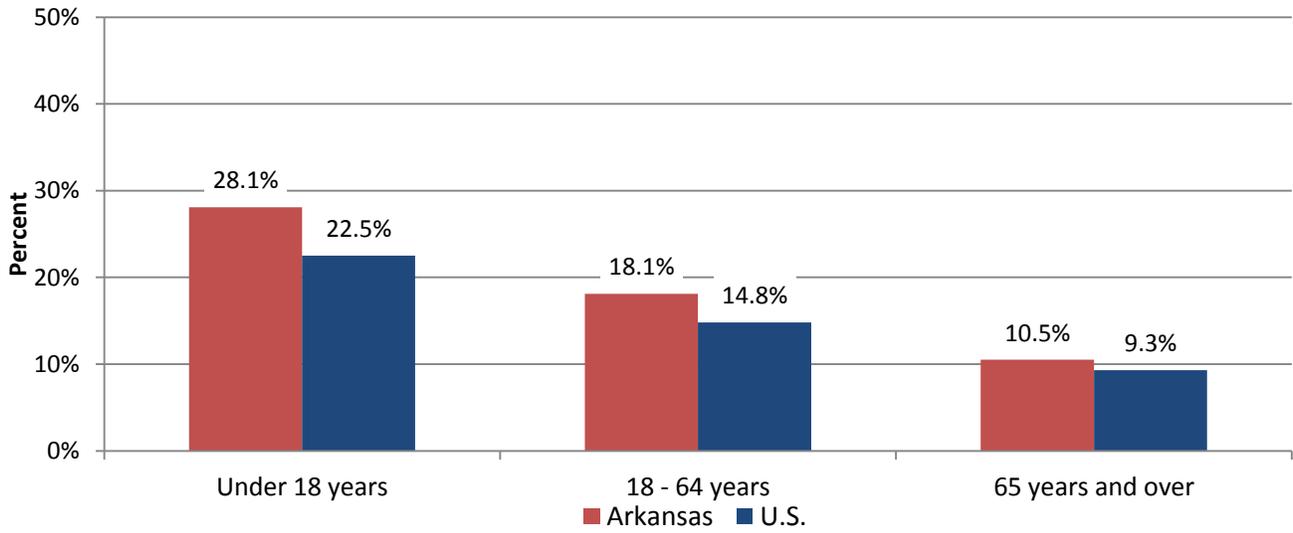
### Socioeconomic Disparities

People living in low-income families bear a disproportionate burden from oral diseases and conditions. For example, despite progress in reducing dental caries in the United States, children and adolescents in families living below the poverty level experience more dental decay than do children who are economically better off. Furthermore, the caries seen in individuals of all ages from poor families are more likely to be untreated than caries in those living above the poverty level. Nationally, 50 percent of poor children aged 2 to 11 years have one or more untreated decayed primary teeth, compared with 31 percent of non-poor children [USDHHS 2000a]. Poor adolescents aged 12 to 17 years in each racial/ethnic group have a higher percentage of untreated decay in the permanent teeth than do the corresponding non-poor adolescent group. The pattern is similar in adults, with the proportion of untreated decayed teeth being higher among the poor than the non-poor. At every age, a higher proportion of those at the lowest income level than at the higher income levels have periodontitis. Adults with some college education (15%) have 2 to 2.5 times less destructive periodontal disease than do adults with high school (28%) or with less than high school (35%) levels of education [USDHHS 2000b]. Overall, a higher percentage of Americans living below the poverty level are edentulous (have lost all their natural teeth) than are those living above [USDHHS 2000a]. People living in rural areas also have a higher disease burden. Because of difficulties in accessing preventive and treatment services, are estimated to be the main reasons. The median household income is \$40,150, compared to \$52,760 in the United States overall. Nearly one of every five residents (18%) lives in poverty, compared to 14% nationally.

### Geographic Disparities

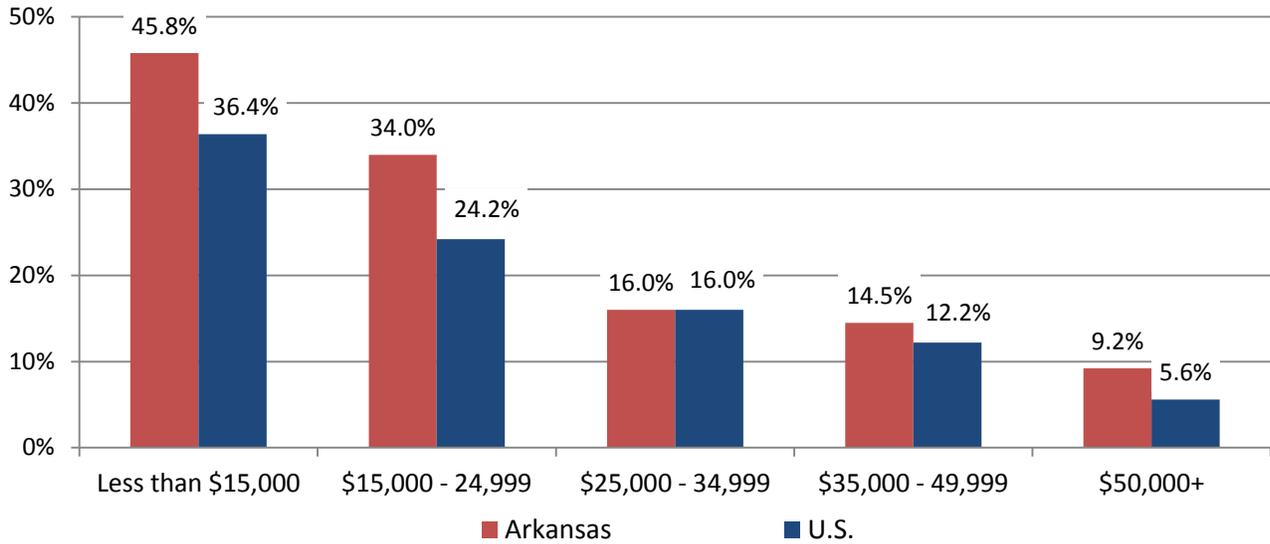
Arkansas is predominately rural. People living in rural areas often have a higher disease burden because of difficulties in accessing preventive, treatment services, and education. Some of the factors contributing to rural disparities include: geographic isolation, transportation issues, poverty, lack of providers accepting Medicaid, and large populations of elderly. Results from the 2010 oral health survey of third graders in Arkansas show outcome differences by ADH public health regions, see Figure 5.28.

**Figure 5.25. Estimated Percentage of the Population Whose Income in the Past 12 Months was Below the Poverty Level**



Source: U.S. Census Bureau, 2011 American Community Survey, 1-Year Estimates

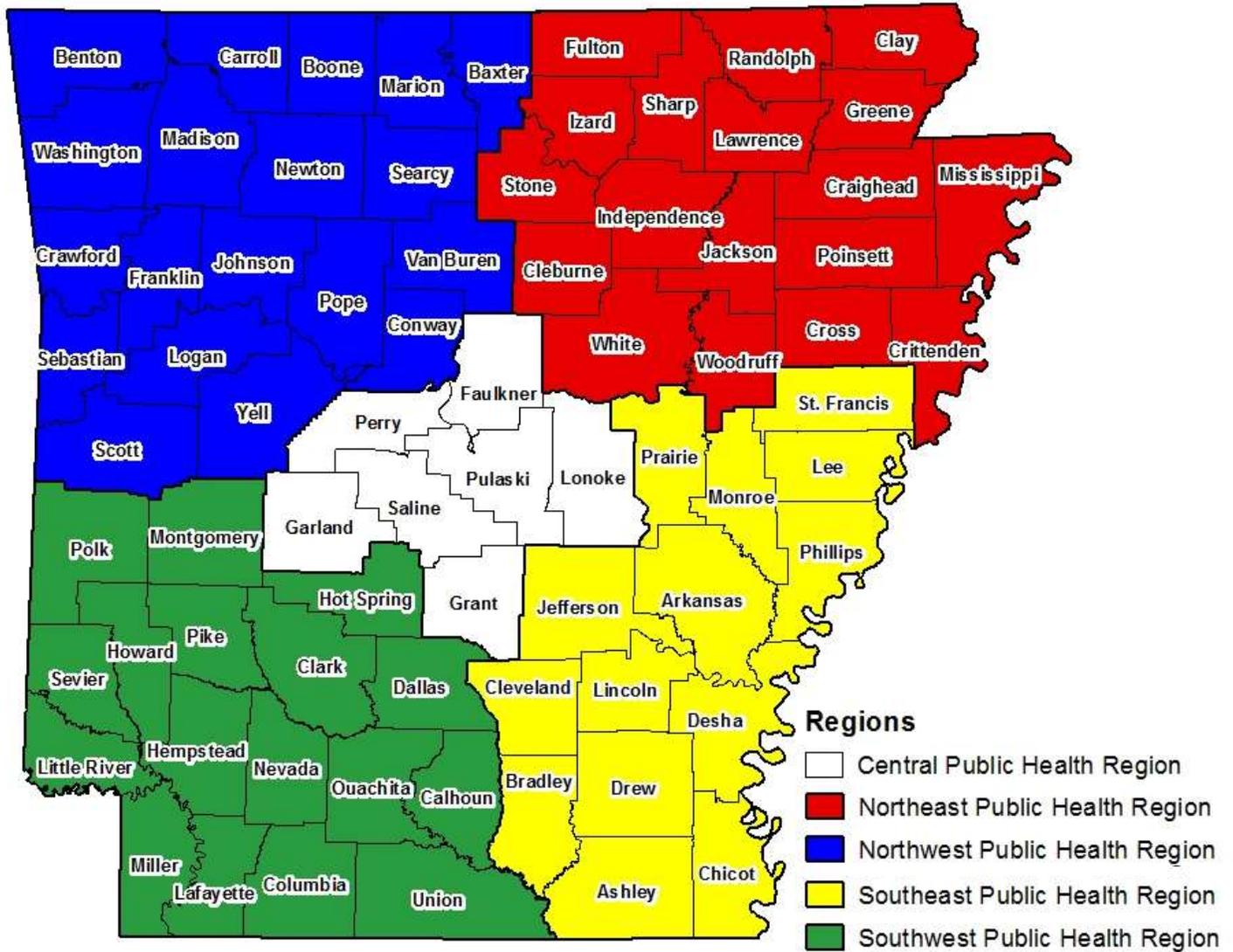
**Figure 5.26. Percentage of Adults (65+) with No Natural Teeth Present, by Income-Level, Arkansas & U.S., BRFSS 2010**



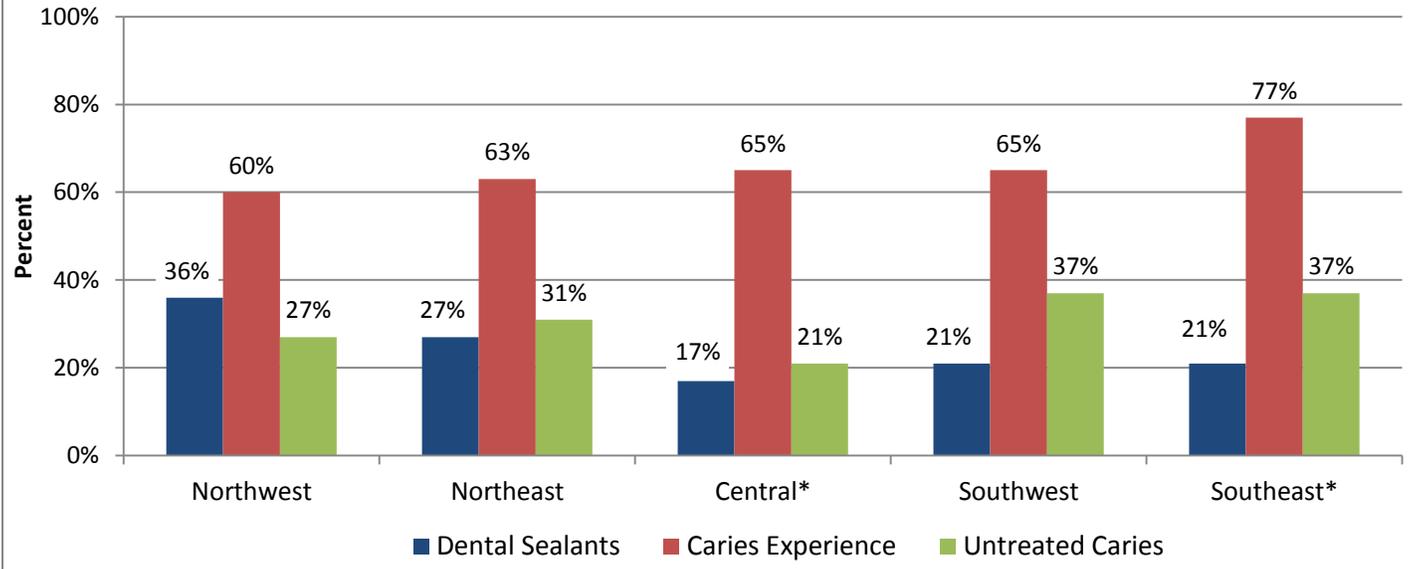
Question: How many of your permanent teeth have been removed because of tooth decay or gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics.

Source: CDC Behavioral Risk Factor Surveillance System (BRFSS): <http://www.cdc.gov/brfss/index.htm>

**Figure 5.27. ADH  
Public Health Regions**



**Figure 5.28. Distribution of Caries Experience among Third Graders  
By ADH Public Health Region, Arkansas, 2010**



Source: Office of Oral Health, BSS of 3<sup>rd</sup> Graders: Oral Health Screening, 2010

\*Although school participation rates were high, the student participation rates within the schools were low, particularly in the central and southeast public health regions. Therefore, rates for these regions may be unstable.

### Societal Impact of Oral Disease

Oral health is related to well-being and quality of life as measured along functional, psychosocial, and economic dimensions. Diet, nutrition, sleep, psychological status, social interaction, school, and work are affected by impaired oral and craniofacial health. Oral and craniofacial diseases and conditions contribute to compromised ability to bite, chew, and swallow foods; limitations in food selection; and poor nutrition. These conditions include tooth loss, diminished salivary functions, orofacial pain conditions such as temporomandibular disorders, alterations in taste, and functional limitations of prosthetic replacements. Orofacial pain, as a symptom of untreated dental and oral problems and as a condition in and of itself, is a major source of diminished quality of life. It is associated with sleep deprivation, depression, and multiple adverse psychosocial outcomes.

More than any other body part, the face bears the stamp of individual identity. Attractiveness has an important effect on psychological development and social relationships. Considering the importance of the mouth and teeth in verbal and nonverbal communication, diseases that disrupt their functions are likely to damage self-image and alter the ability to sustain and build social relationships. The social functions of individuals encompass a variety of roles, from intimate interpersonal contacts to participation in social or community activities, including employment. Dental diseases and disorders can interfere with these social roles at any or all levels. Perhaps due to social embarrassment or functional problems, people with oral conditions may avoid conversation or laughing, smiling, or other nonverbal expressions that show their mouth and teeth.

### Economic Impact

Expenditures for dental services in the United States in 2003 were \$74.3 billion, 4.4 percent of the total spent on health care that year [Centers for Medicare & Medicaid Services 2004]. A large proportion of dental care is paid out-of-pocket by patients. Nationally in 2003, 44 percent of dental care was paid out-of-pocket, 49 percent was paid by private dental insurance, and 7 percent was paid by federal or state government sources. In comparison, 10 percent of physician and clinical services was paid out-of-pocket, 50 percent was covered by private medical insurance, and 33 percent was paid by government sources (Centers for Medicare & Medicaid Services 2004).

---

## Oral Disease and Other Health Conditions

Oral health and general health are integral to each other. Many systemic diseases and conditions including diabetes, HIV, and nutritional deficiencies, have oral signs and symptoms, and these manifestations may be the initial sign of clinical disease and therefore may serve to inform health care providers and individuals of the need for further assessment. The oral cavity is a portal of entry as well as a site of disease for bacterial and viral infections that affect general health status. Recent research suggests that inflammation associated with periodontitis may increase the risk of cardiovascular diseases and lead to difficulty in the management of diabetes [Dasanayake 1998; Offenbacher et al. 2001; Davenport et al. 1998; Beck et al. 1998; Scannapieco et al. 2003; Taylor 2001]. More research is needed in these areas. The supposition that poor periodontal health could result in adverse pregnancy outcomes is not yet determined.

Acute dental conditions also were responsible for more than 2.4 million days of work loss and contributed to a range of problems for employed adults, including restricted activity and bed days [DHHS 1999]. In addition, conditions such as oral and pharyngeal cancers contribute to premature death and can be measured by years of life lost.

## VI. RISK AND PROTECTIVE FACTORS AFFECTING ORAL DISEASES

The most common oral diseases and conditions can be prevented. Safe and effective measures are available to reduce the incidence of oral disease, reduce disparities, and increase quality of life.

### Community Water Fluoridation

Community water fluoridation is the process of adjusting the natural fluoride concentration of a community's water supply to a level that is best for the prevention of dental caries. In the United States, community water fluoridation has been the basis for the primary prevention of dental caries for 60 years and has been recognized as one of 10 great achievements in public health of the 20th century [CDC 1999]. It is an ideal public health method because it is effective, eminently safe, and inexpensive. It requires no behavior change by individuals and does not depend on access or availability of professional services. Water fluoridation is equally effective in preventing dental caries among different socioeconomic, racial, and ethnic groups. Fluoridation helps to lower the cost of dental care and helps residents retain their teeth throughout life [USDHHS 2000a].

Recognizing the importance of community water fluoridation, *Healthy People 2020* Objective OH-13 is to "increase the proportion of the U.S. population served by community water systems with optimally fluoridated water to 79.6 percent". In the United States during 2002, approximately 170 million persons (67 percent of the population served by public water systems) received optimally fluoridated water. See <http://www.cdc.gov/fluoridation/statistics.htm>

Not only does community water fluoridation effectively prevent dental caries, it is one of the very few public health prevention measures that offer significant cost savings to almost all communities [Griffin et al. 2001]. It has been estimated that about every \$1 invested in community water fluoridation saves approximately \$38 in averted costs. The cost per person of instituting and maintaining a water fluoridation program in a community decreases with increasing population size.



## Topical Fluorides and Fluoride Supplements

Because frequent exposure to small amounts of fluoride each day will best reduce the risk of dental caries in all age groups, all people should drink water with an optimal fluoride concentration [CDC 2001]. For communities that do not receive fluoridated water and persons at high risk of dental caries, additional fluoride measures might be needed. Community measures include fluoride mouth rinse, which typically are conducted in schools. Individual measures include professionally applied topical fluoride gels, varnish for persons at high risk of caries, and supplemental vitamins.

## Dental Sealants

Since the early 1970s, the incidence of childhood dental caries on smooth tooth surfaces (those without pits and fissures) has declined markedly because of widespread exposure to fluorides. Most decay among school age children now occurs on tooth surfaces with pits and fissures, particularly the molar teeth.

Pit-and-fissure dental sealants—plastic coatings bonded to susceptible tooth surfaces—have been approved for use for many years and have been recommended by professional health associations and public health agencies. First permanent molars erupt into the mouth at about age 6 years. Placing sealants on these teeth shortly after their eruption protects them from the development of caries in areas of the teeth where food and bacteria are retained. It is estimated that if sealants were applied routinely to susceptible tooth surfaces in conjunction with the appropriate use of fluoride, most tooth decay in children could be prevented [USDHHS 2000b].

Second permanent molars erupt into the mouth at about age 12 to 13 years. Therefore, young teenagers need to receive dental sealants shortly after the eruption of their second permanent molars.

The *Healthy People 2020* target for dental sealants on molars for children aged 6 to 9 years is 28.1 percent. During 2010, the Office conducted an open-mouth survey of 4,239 third graders to measure the prevalence of dental sealants. Schools from each of Arkansas' 75 counties were included. Results of the survey showed among third-grade children, 27 percent had at least one sealant present when screened. Within this age group, Black Americans and Hispanic Americans were less likely than non-Hispanic whites to have sealants, see Figure 6.2.

---

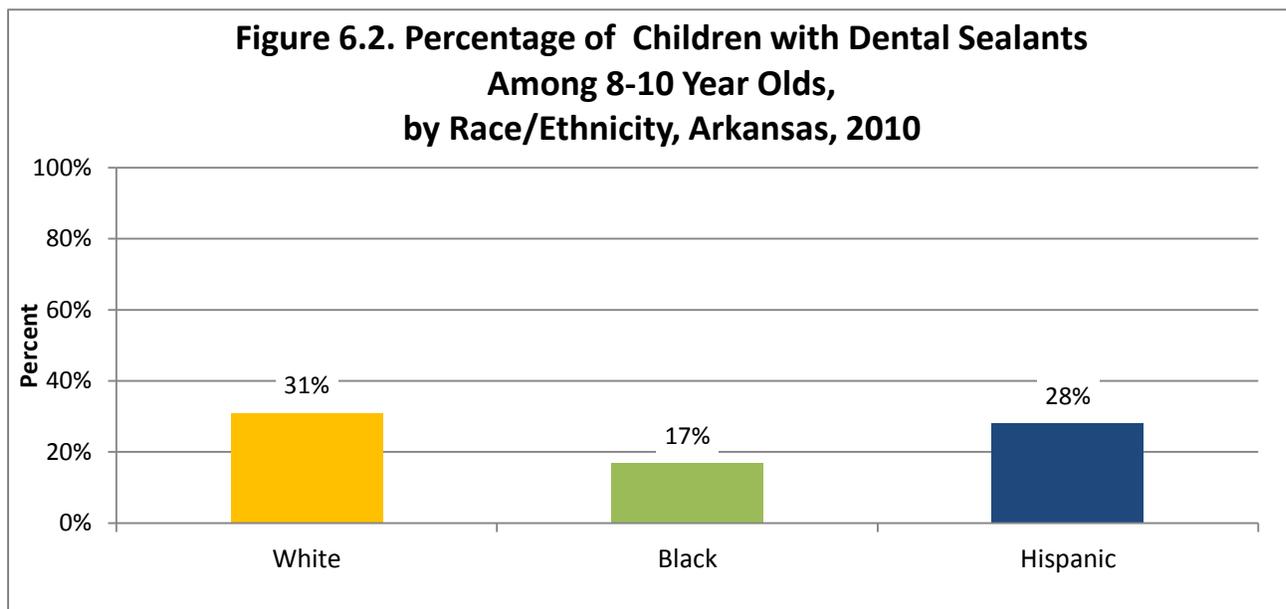
## Arkansas Dental Sealant Program

In 2007, a state sealant program was initiated with funding from the Daughters of Charity Foundation of Saint Louis, MO. The Daughters of Charity grant provided for the purchase of four complete portable dental units and support for the following three pronged program: 1) a pilot sealant program in Forrest City, Arkansas; 2) a statewide educational and dental sealant awareness campaign with informational handouts, newspaper ads and radio advertisements; and 3) direct services to approximately 2,000 children in school-based setting across the state. This initial program was begun with the following goals in mind:

- 1) Evaluate the pilot program and its relation to the state dental sealant plan, including data from the SEALS (Sealant Efficiency Assessment for Locals and States) software;
- 2) Develop and coordinate additional school-based dental sealant programs; and
- 3) Evaluate the state sealant program.

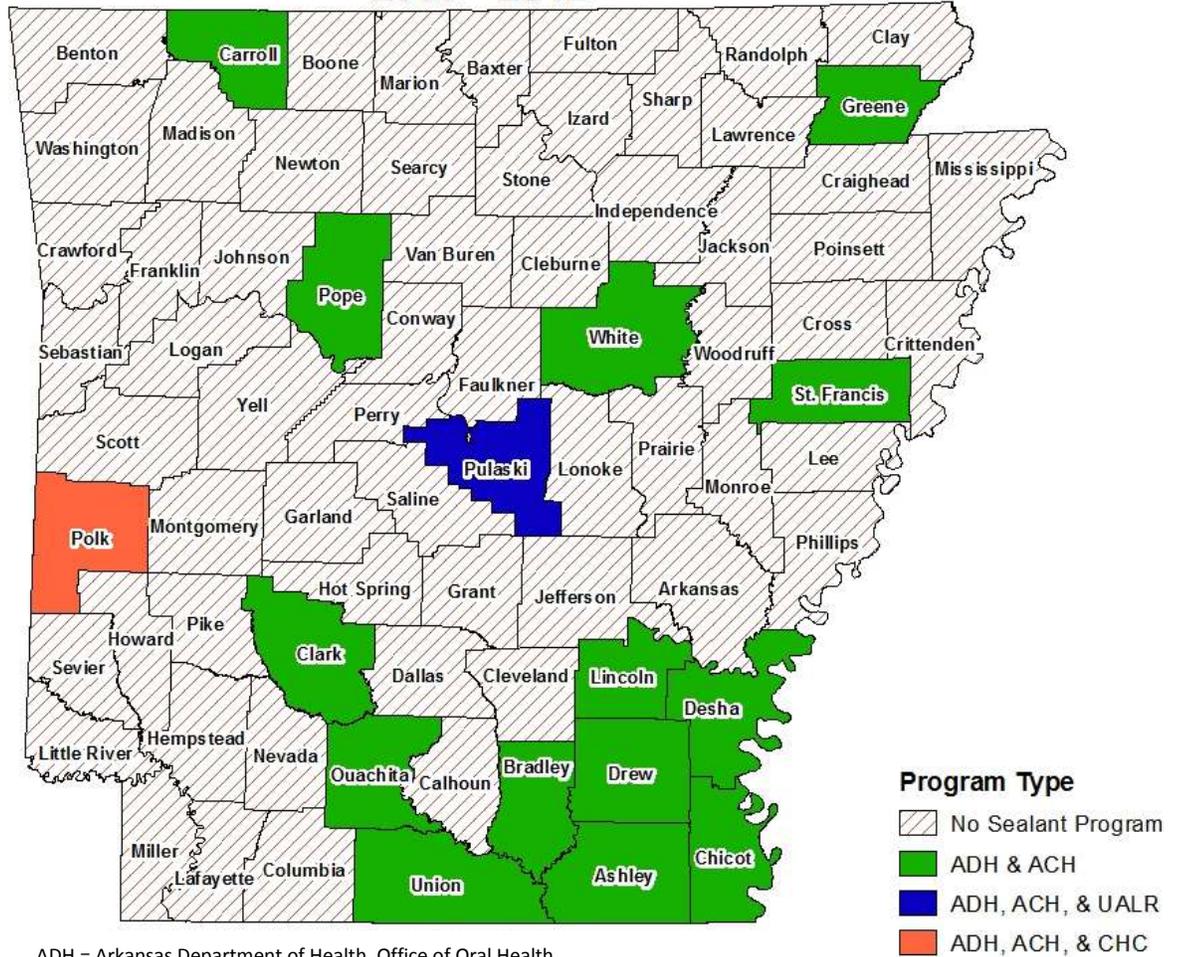
To sustain the newly established sealant program, and with a new funding source (CDC), the Office provided logistic, clinical, and data analysis support to ACH. ACH continues to grow and develop the program, bringing the preventive benefits of dental sealants to thousands of underserved children across the state.

To further implement the plan, the Office of Oral Health has worked extensively with other partners in the AOHC, both to implement the sealant program and assure its sustainability. In addition to ACH, three other partners, University of Arkansas at Little Rock (UALR) Children International Program; CHCA, Healthy Connections, in Mena, Arkansas; and the Interfaith Dental Clinic in Conway, Arkansas; have joined these efforts. Sealant activities from these four partners are evaluated and reported to the CDC Division of Oral Health annually. Currently, sealant programs have been completed in schools in the Arkansas counties shown in Figure 6.3.



Source: Office of Oral Health, BSS of 3<sup>rd</sup> Graders: Oral Health Screening, 2010

**Figure 6.3. County-Level Dental Sealant Programs  
2009 - 2012**



Date: February 6, 2013  
 Source: Arkansas Department of Health  
 Map created by: Abby Holt

ADH = Arkansas Department of Health, Office of Oral Health  
 ACH = Arkansas Children’s Hospital  
 UALR = University of Arkansas at Little Rock, Children’s International, Future Smiles Dental Clinic  
 CHC = Community Health Centers, Healthy Connections

---

## Screening for Oral Cancer

Oral cancer detection is accomplished by a thorough examination of the head and neck; an examination of the mouth including the tongue, the entire oral and pharyngeal mucosal tissues, and the lips; and palpation of the lymph nodes. Although the sensitivity and specificity of the oral cancer examination have not been established in clinical studies, most experts consider early detection and treatment of precancerous lesions and diagnosis of oral cancer at localized stages to be the major approaches for secondary prevention of these cancers [Silverman 1998; Johnson 1999; CDC 1998]. If suspicious tissues are detected during an examination, definitive diagnostic tests, such as biopsies, are needed to make a firm diagnosis.

Oral cancer is more common after the age of 60 years. Known risk factors include use of tobacco products and alcohol use. The risk of oral cancer is increased 6 to 28 times in current smokers. Alcohol consumption is an independent risk factor and, when combined with the use of tobacco products, accounts for most cases of oral cancer in the United States and elsewhere [USDHHS 2004a]. Recent data suggests that HPV is an emerging leading cause of oropharyngeal cancers. Individuals should also be advised to avoid other potential carcinogens, such as exposure to sunlight (a risk factor for lip cancer) without protection (use of lip sunscreen and hats is recommended).

Recognizing the need for dental and medical providers to examine adults for oral and pharyngeal cancer, *Healthy People 2020* Objective OH-14.2 is to increase the proportion of adults who received an oral and pharyngeal cancer screening from a dentist or dental hygienist in the past year.

There is a difference between oral health screenings and oral examinations. Oral examinations as a part of a comprehensive dental examination are more likely to detect precancerous and cancerous lesions.

## Tobacco Control

Tobacco use has a devastating effect on the health and well-being of the public. More than 400,000 Americans die each year as a direct result of cigarette smoking, making it the nation's leading preventable cause of premature mortality. Furthermore, smoking causes over \$150 billion in annual health-related economic losses [CDC 2002]. The effects of tobacco use on the public's oral health are also alarming. The use of any form of tobacco — including cigarettes, cigars, pipes, and smokeless tobacco — has been established as a major cause of oral and pharyngeal cancer [USDHHS 2004a]. The evidence is sufficient to consider smoking a contributing factor for adult periodontitis [USDHHS 2004a]; one-half of the cases of periodontal disease in this country may be attributable to cigarette smoking [Tomar & Asma 2000]. Tobacco use substantially worsens the prognosis of periodontal therapy and dental implants, impairs oral wound healing, and increases the risk of a wide range of oral soft tissue changes [Christen et al. 1991; AAP 1999].

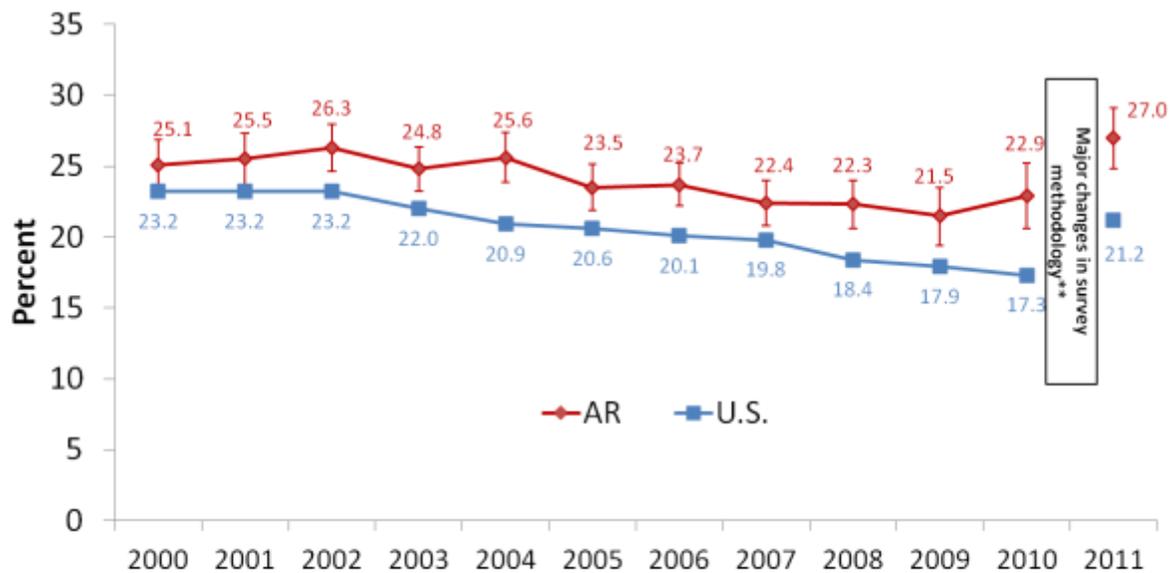
Comprehensive tobacco control should have a large impact on oral health status. The goal of comprehensive tobacco control programs is to reduce disease, disability, and death related to tobacco use by:

- Preventing the initiation of tobacco use among young people,
- Promoting cessation among young people and adults,
- Eliminating nonsmokers' exposure to secondhand tobacco smoke, and
- Identifying and eliminating the disparities related to tobacco use and its effects among different population groups.

The dental office provides an excellent venue for providing tobacco intervention services. More than one-half of adult smokers see a dentist each year [Tomar et al. 1996]. Dental patients are particularly receptive to health messages at periodic check-up visits, and oral effects of tobacco use provide visible evidence and a strong motivation for tobacco users to quit. Because dentists and dental hygienists can be effective in treating tobacco use and dependence, the identification, documentation, and treatment of every tobacco user they see should become a routine practice in every dental office and clinic [Fiore et al. 2000]. However, national data from the early 1990s indicated that just 24 percent of smokers who had seen a dentist in the past year reported that their dentist advised them to quit, and only 18 percent of smokeless tobacco users reported that their dentist *ever* advised them to quit.

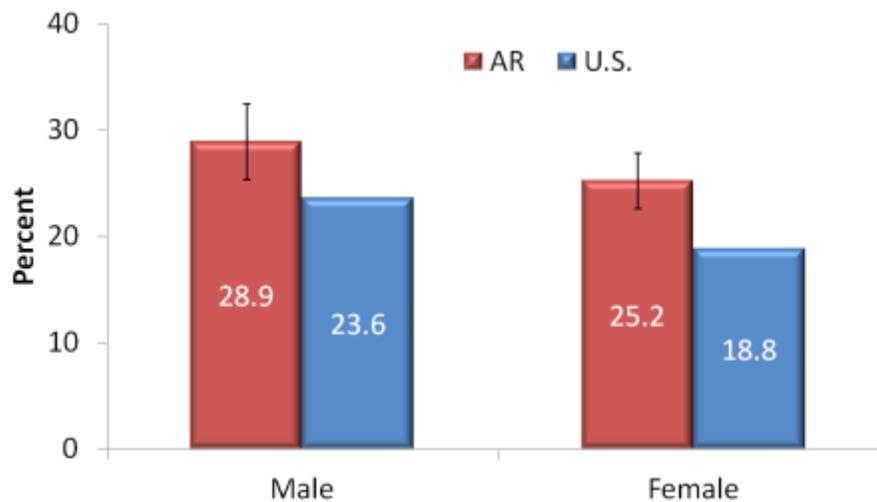
Cigarette smoking and smokeless tobacco use among adults 18 years and older is described in Figures 6.4 – 6.7. Data from on high school students who smoked or used other tobacco products are shown in Figures 6.8 – 6.10.

**Figure 6.4. Current Cigarette Smoking among Adults\*  
Arkansas & U.S. 2000-2011**



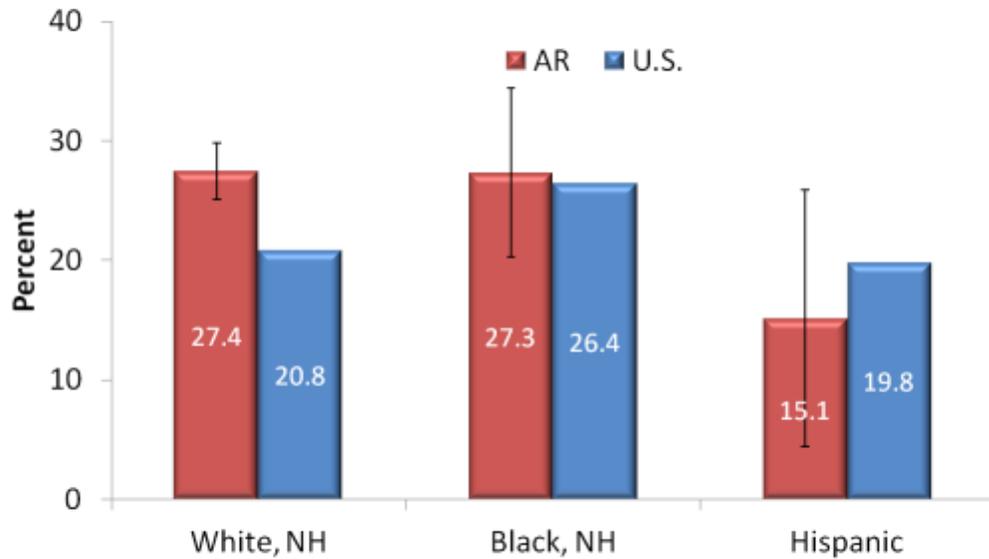
\*Respondents aged  $\geq 18$  years who report having smoked 100 cigarettes in their lifetime and are current smokers on every day or some days.  
 \*\*The 2011 BRFSS had substantial methodological changes; it is not comparable to previous years.  
 Source: Behavioral Risk Factor Surveillance System (BRFSS)

**Figure 6.5. Current Cigarette Smoking among Adults\* by Gender  
Arkansas and U.S. 2011**



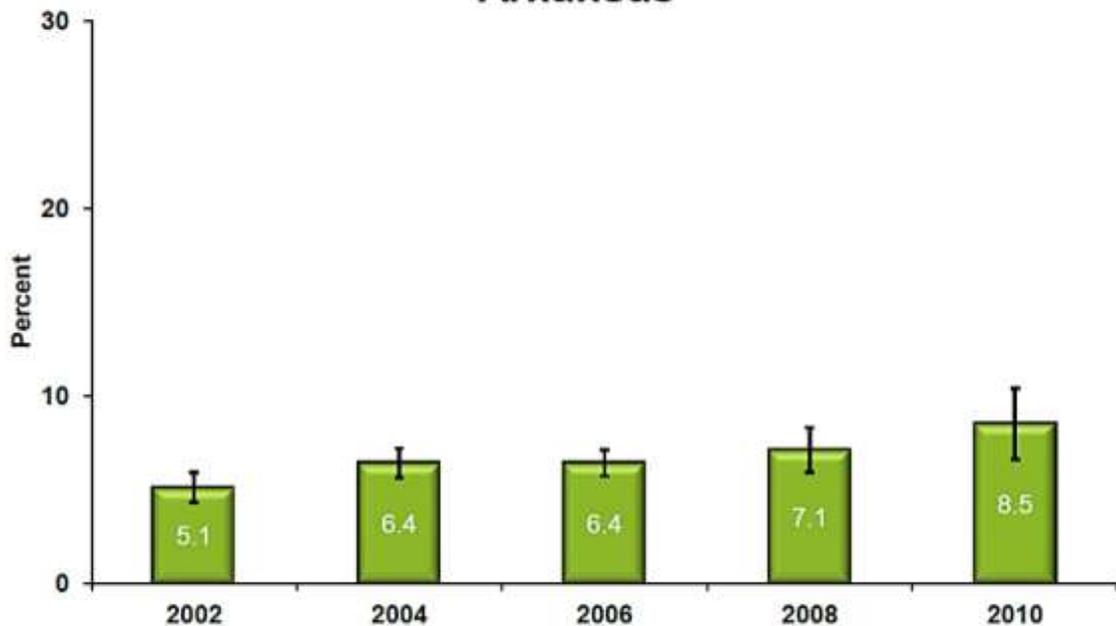
\*Respondents aged  $\geq 18$  years who report having smoked 100 cigarettes in their lifetime and are current smokers on every day or some days.  
 Source: Behavioral Risk Factor Surveillance System (BRFSS) 2011

**Figure 6.6. Current Cigarette Smoking among Adults\* by Race/Ethnicity Arkansas and U.S. 2011**



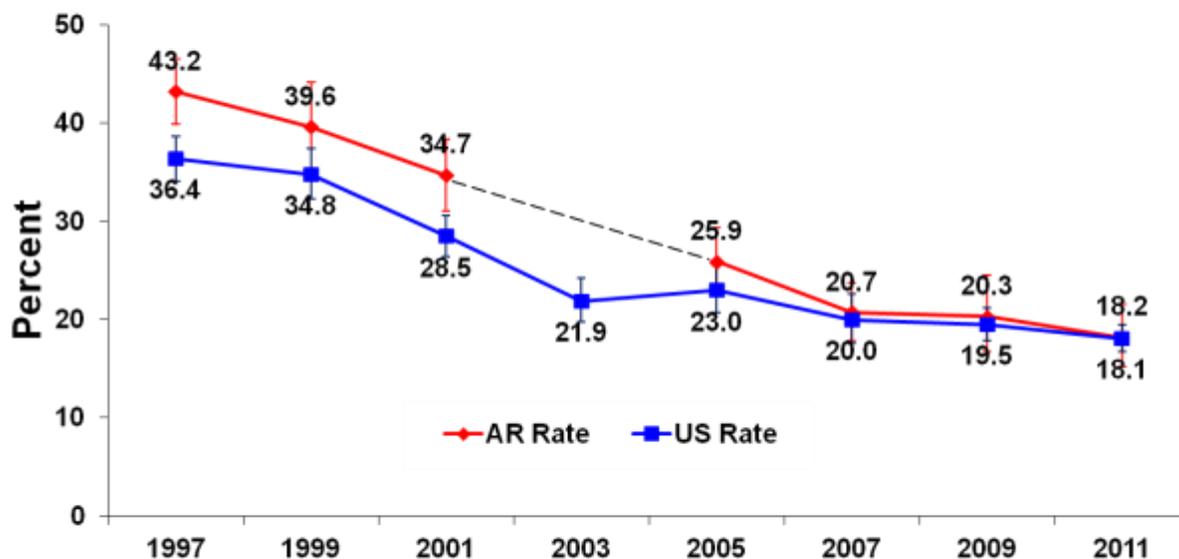
\*Respondents aged  $\geq 18$  years who report having smoked 100 cigarettes in their lifetime and are current smokers on every day or some days.  
Source: Behavioral Risk Factor Surveillance System (BRFSS) 2011

**Figure 6.7. Current Smokeless Tobacco Use among Adults\* Arkansas**



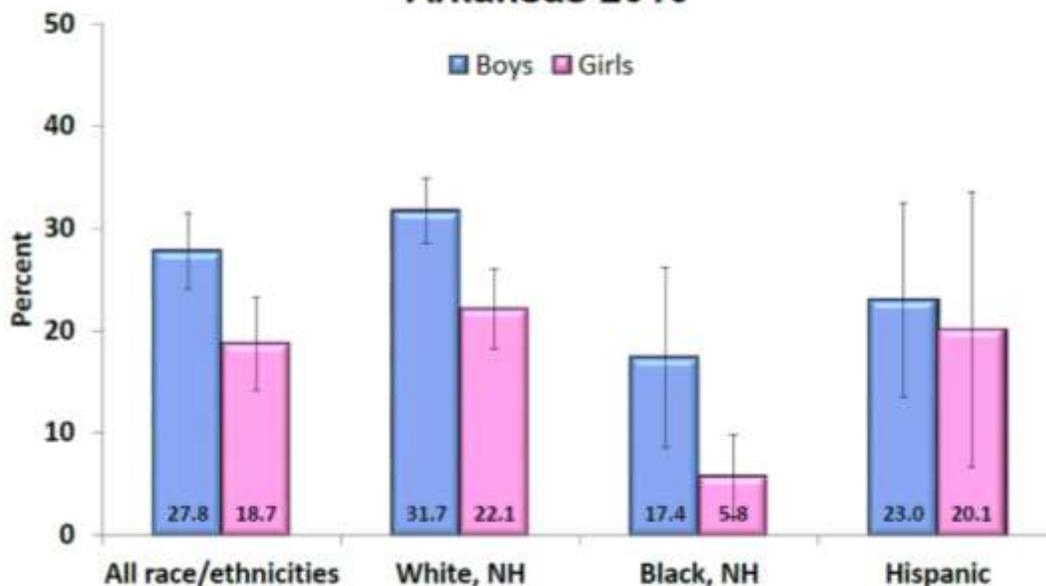
\*Respondents aged  $\geq 18$  years who are current users of chewing tobacco or snuff on every day or some days.  
Sources: Arkansas Adult Tobacco Survey (ATS) for 2002-2008  
2010 data is from the 2009-2010 National ATS

**Figure 6.8. Current Cigarette Smoking\* among High School Students  
Arkansas and U.S. 1997 - 2011**



\* Students in grades 9-12 who report having smoked cigarettes on one or more days during the previous 30 days  
Source: Youth Risk Behavior Surveillance System  
--- No data available for Arkansas in 2003

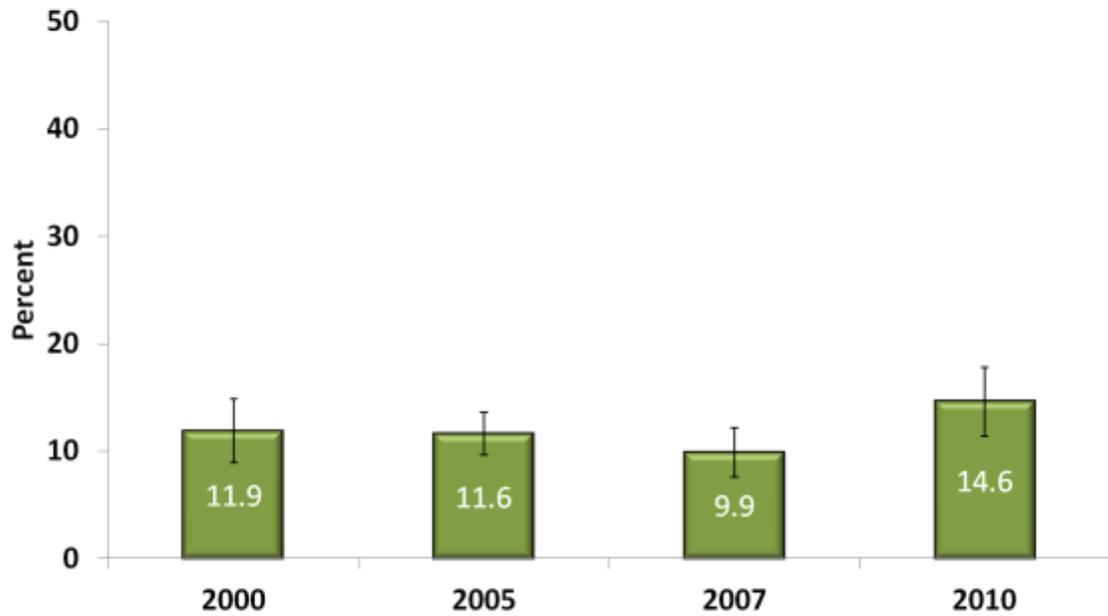
**Figure 6.9. Current Cigarette Smoking among High School Students\* by Race/Ethnicity and Gender  
Arkansas 2010**



\*Students in grades 9-12 who report having smoked cigarettes on one more days during the previous 30 days.

Source: Arkansas Youth Tobacco Survey

**Figure 6.10 Current Smokeless Tobacco Use among High School Students\*  
Arkansas 2000, 2005, 2007, & 2010**



\*Students in grades 9-12 who report having smoked cigarettes on one more days during the previous 30 days.

Source: Arkansas Youth Tobacco Survey

---

## Oral Health Education

Oral health education for the community informs, motivates, and helps people to adopt and maintain beneficial health practices and lifestyles; advocates environmental changes as needed to facilitate this goal; and conducts professional training and research to the same end [Kressin & DeSouza 2003].

The University of Arkansas for Medical Sciences (UAMS) has established a Center for Dental Education that includes an oral health clinic and has plans for postgraduate programs for dentists in advanced general dentistry, oral surgery, and geriatric dentistry.

The oral health clinic, which began accepting patients in 2012, occupies about 3,000 square feet of renovated space adjacent to the UAMS Dental Hygiene Clinic.

<http://www.uamshealth.com/News/UAMSEstablishesCenterforDentalEducation?id=5350&showBack=true&PageIndex=0&cid=4>

The UAMS Department of Dental Hygiene has a program in Little Rock on the UAMS campus and a distant location on the campus of Arkansas State University Mountain Home (ASUMH). The UAMS Department of Dental Hygiene offers both Associate of Science and Bachelor of Science degree options.

<http://www.uams.edu/chrp/dentalhygiene/>

In addition, the University of Arkansas at Fort Smith initiated a School of Dental Hygiene in the mid-1990s, which offers a Bachelor of Science in Dental Hygiene.

<http://uafs.edu/academics/dental-hygiene>

Arkansas has two Dental Assistant Programs accredited by the American Dental Association Commission on Dental Education: Pulaski Technical College in Little Rock, and Arkansas Northeastern College in Blytheville.

[http://www.pulaskitech.edu/programs\\_of\\_study/dental/dental\\_assisting.asp](http://www.pulaskitech.edu/programs_of_study/dental/dental_assisting.asp)

[http://www.anc.edu/allied\\_health/dental\\_assisting.htm](http://www.anc.edu/allied_health/dental_assisting.htm)

## VII. PROVISION OF DENTAL SERVICES

### Dental Workforce and Capacity

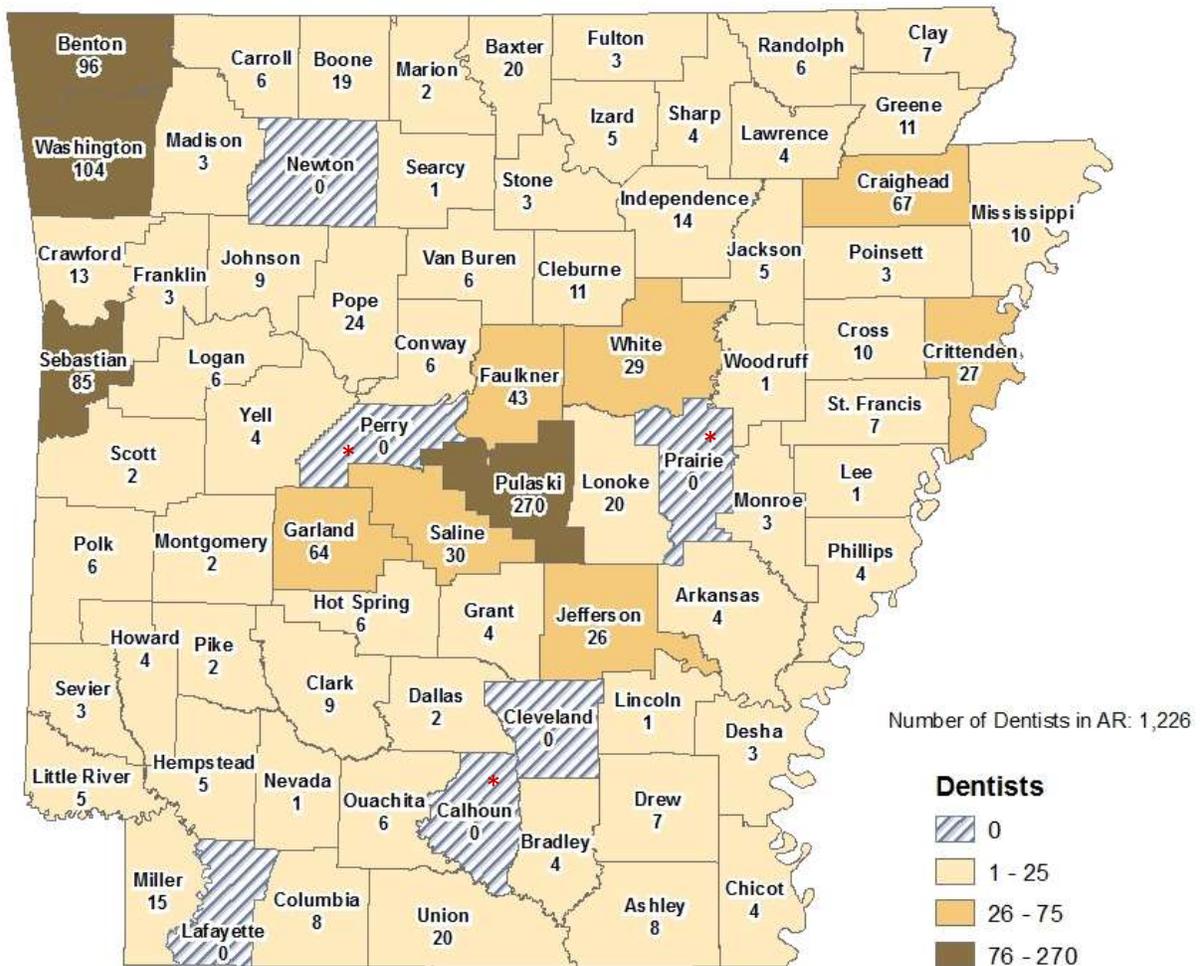


The oral health care workforce is critical to society's ability to deliver high-quality dental care in the United States. Effective health policies intended to expand access, improve quality, or constrain costs must take into consideration the supply, distribution, preparation, and utilization of the health workforce. See the following link for more information: (<http://bhpr.hrsa.gov/healthworkforce/reports/profiles>).

In Arkansas in 2011, the ASBDE licensed 5,389 providers of dental health services with mailing addresses in Arkansas, about 18.8 per 10,000 population. This total includes 1,226 dentists, 2,787 dental assistants, and 1,376 dental hygienists (See Figures 6.11 – 6.13).

In May 2004, the ASBDE approved general supervision regulations, allowing dental hygienists to practice with more autonomy under specific circumstances. In 2011, Act 89 was enacted to authorize dental hygienists to perform dental hygiene procedures for persons in public settings without the supervision of a dentist. As of 2013, the ASBDE has approved rules and regulations. The Arkansas Board of Health has rules and regulations under consideration. It is expected that these will be in place in the summer of 2013 for implementation. Additionally, dental assistants will soon be able to place sealants under the supervision of a dentist.

**Figure 6.11 Distribution of Dentists in Arkansas, 2011**



Date: March 22, 2013  
 Source: Health Statistics Branch, ADP  
 Arkansas Health Professions  
 Manpower Statistics 2011  
 Map created by: Abby Holt

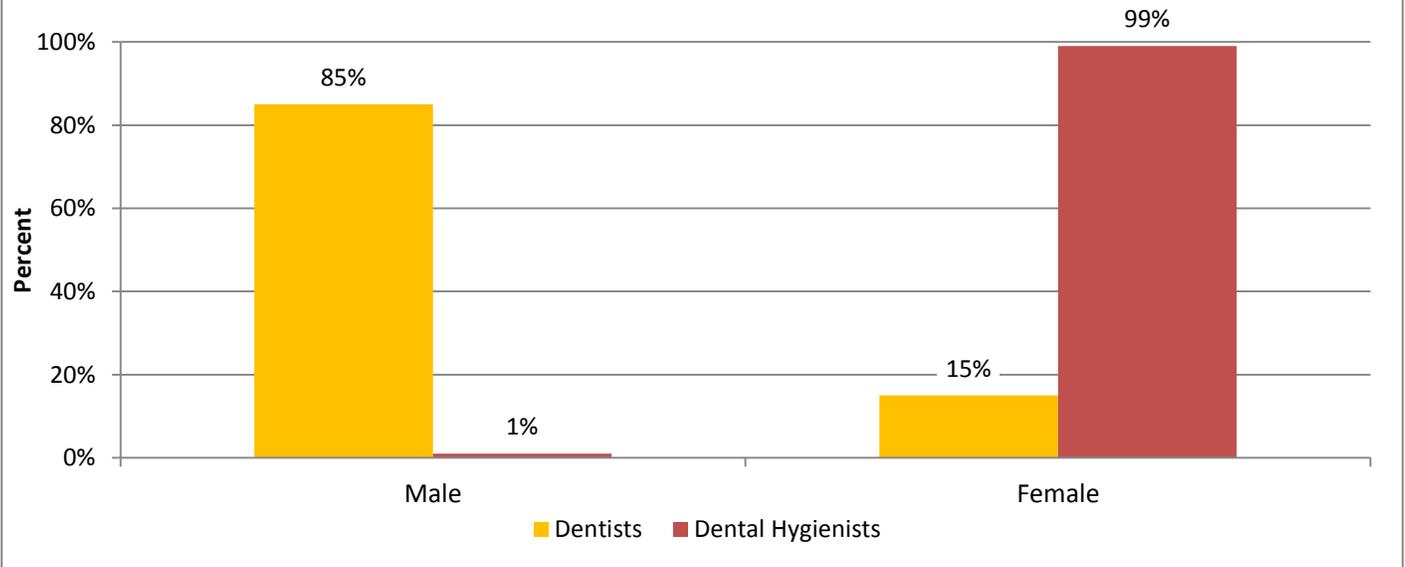
Legend Classification: Natural Breaks

\*Although not included in the ASBDE data, dental satellite offices are present in Calhoun, Perry, and Prairie Counties.

Note: Information relating to a dentist's location- address, city, county, state, etc.- meets the licensing board's need to communicate with the dentist by mail and may or may not identify the site(s) where health related services are actually performed.



**Figure 6.13. Gender Distribution of Dentists and Dental Hygienists, Arkansas, 2011**



Source: ADH Health Statistics Branch, Arkansas Health Professional Manpower Statistics

### Dental Workforce Diversity

One cause of oral health disparities is a lack of access to oral health services among under-represented minorities. Increasing the number of dental professionals from under-represented racial and ethnic groups is viewed as an integral part of the solution to improving access to care [USDHHS 2000b]. Data on the race/ethnicity of dental care providers were derived from surveys of professionally active dentists conducted by the American Dental Association [ADA 1999]. In 1997, 1.9 percent of active dentists in the United States identified themselves as black or African American, although that group constituted 12.1 percent of the U.S. population. Hispanic/Latino dentists made up 2.7 percent of U.S. dentists, compared with 10.9 percent of the U.S. population that was Hispanic/Latino.

### Additional Resources

State Health Workforce Profiles from the National Center for Health Workforce Analysis:

<http://bhpr.hrsa.gov/healthworkforce/reports/profiles/>

From the American Dental Education Association ([www.adea.org](http://www.adea.org)):

American Dental Education Association: Trends in Dental Education.

<http://www.adea.org/publications/TrendsinDentalEducation/Pages/default.aspx>

American Dental Education Association: Dental Education At A Glance

<http://www.adea.org/publications/adeadentaledataglance/Pages/default.aspx>

American Dental Education Association: Allied Professions

<http://www.adea.org/publications/TrendsinDentalEducation/AlliedDentalHealth/Pages/default.aspx>

American Dental Education Association: Annual ADEA Survey of Dental School Seniors,

<http://www.jdentaled.org/cgi/reprint/71/9/1228> and

<http://www.jdentaled.org/cgi/reprint/73/8/1009>

---

The ADH Office of Rural Health & Primary Care promotes the development of community-based health care services and systems throughout Arkansas to ensure that well managed, quality health services are available to all citizens. Activities include:

Providing consultation and technical assistance to rural communities for the purpose of developing viable health care services in their communities,

- Administering state grant programs designed to assist rural communities in maintaining local health care,
- Operating a health professional clearinghouse to assist rural and underserved areas to recruit and retain health professionals,
- Providing technical assistance and training opportunities to rural hospitals that have converted to Critical Access Hospital status (rural community hospitals that receive cost reimbursement based on defined criteria), and
- Coordinating federal, state and other efforts focusing on access to health care.

*Currently, the Office of Rural Health & Primary Care is performing a comprehensive statewide review of dental Health Professional Shortage Areas (HPSA). Results of the review are projected to be available in 2014.*

## Dental Medicaid and State Children's Health Insurance Programs

Medicaid is the primary source of health care for low-income families and disabled persons in the United States. This program became law in 1965 and is jointly funded by the federal and state governments (including the District of Columbia and the Territories) to assist states in providing medical, dental, and long-term care assistance to people who meet certain eligibility criteria. People who are not U.S. citizens can receive Medicaid only to treat a life-threatening medical emergency; eligibility is determined on the basis of state and national criteria. Dental services are a required service for most Medicaid-eligible individuals under the age of 21 years, as a required component of the Early and Periodic Screening, Diagnostic and Treatment (EPSDT) benefit. Services must include, at a minimum, relief of pain and infections, restoration of teeth, and maintenance of dental health. Dental services may not be limited to emergency services for EPSDT recipients [Centers for Medicare & Medicaid Services, 2004].

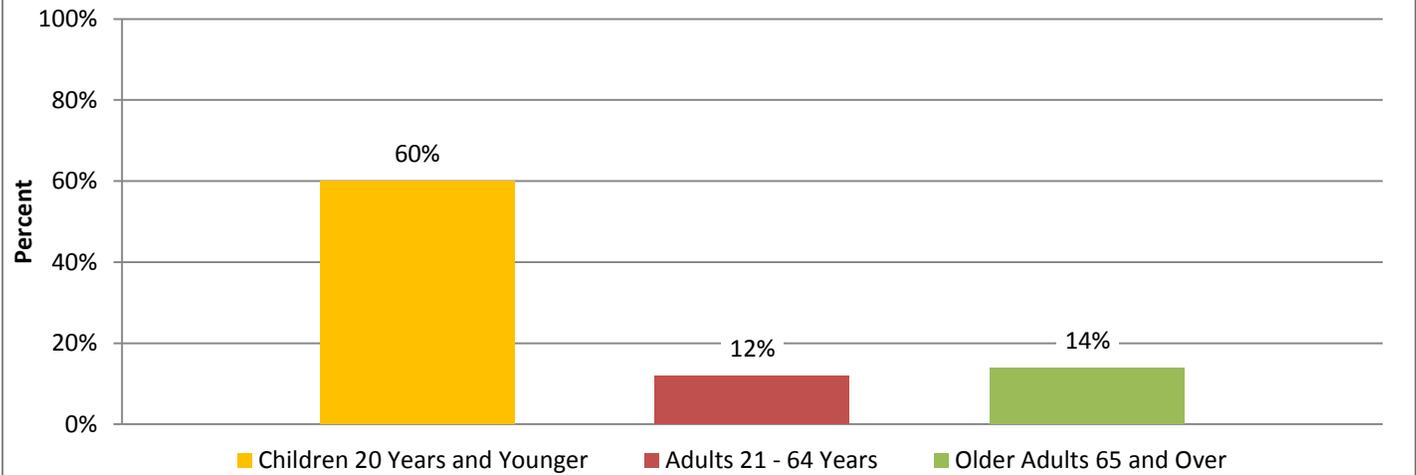
According to the 2012 Arkansas Medicaid Program Overview, Arkansas established a medical care program twenty-six (26) years before passage of the federal laws requiring health care for the underserved; Section 7 of Act 280 of 1939 and Act 416 of 1977 authorized the State of Arkansas to establish and maintain a medical care program for the underserved population. The Medicaid program was implemented in Arkansas on January 1, 1970. The Department of Human Services administers the Arkansas Medicaid program through the Division of Medical Services.

Individuals are certified as eligible for Arkansas Medicaid services through either county Human Services Offices or District Social Security Offices. Eligibility depends on age, income and assets. Most people who qualify for Arkansas Medicaid are one of the following:

- Age sixty-five (65) and older
- Under age nineteen (19)
- Blind
- Pregnant
- The parent or the relative who is the caretaker of a child with an absent, disabled, or unemployed parent
- Living in a nursing home
- Under age twenty-one (21) and in foster care
- In medical need of certain home and community-based services
- Persons with breast or cervical cancer
- Disabled, including working disabled

Arkansas funded 29.1% of Arkansas Medicaid Program-related costs in SFY 2012; the federal government funded 70.9%. The total Medicaid expenditures during SFY 12 for dental services were \$125,585,375.

**Figure 6.14. Percentage of Arkansas Population Served by Medicaid**



Source: Arkansas Medicaid Program Overview, 2012

Dental care is covered for children with ARKids First or for people with regular Medicaid.

**For children under age 21:** Dental care is covered for children with ARKids First-A and Medicaid. This includes orthodontic care such as braces, if needed for medical reasons. All orthodontic care must be approved by Medicaid before treatment. Children with ARKids First-B are eligible for some dental care, but not orthodontic care.

**For adults:** Medicaid will pay up to \$500 a year for limited dental care, from July 1 to June 30 of each year. This includes one office visit, one cleaning, one set of x-rays, and one fluoride treatment upon a dentist's recommendation, Medicaid will pay for:

- Simple tooth extractions,
- Surgical tooth extractions, (must be pre-approved) ,
- Fillings, and
- One set of dentures (must be pre-approved).

**ConnectCare**

ConnectCare is a program administrated by the ADH. The Arkansas Medicaid Program contracts with the ADH to assist Medicaid and ARKids First families find a dental home by helping them find dental care.

Dental Coordinated Care Specialists assist eligible Medicaid and ARKids recipients with locating a dentist, making appointments, arranging transportation when needed, following up on scheduled appointments and rescheduling missed appointments. Dental Coordinated Care Specialists also respond to Medicaid and ARKids recipient questions and concerns regarding dental services, give information and offer guidance on accessing dental resources. According to ConnectCare, 963 dental providers and dental groups are enrolled in Medicaid.

---

## Community Health Centers of Arkansas

The CHCA is a nonprofit organization which strives to ensure 100% access and zero health disparities through promoting and facilitating shared resources and collaborative partnerships. The CHCA also provides technical assistance, training, and resources to impact positively the expansion of affordable, quality, comprehensive, and integrated health care services in and among Arkansas communities. The CHCA represents 12 Centers and 80 CHCA locations. Currently, there are 18 CHCA dental locations throughout Arkansas.

According to the 2012 CHCA dental services fact sheet, 19 dentists, 12 dental hygienists, and 44 dental assistants, aids, and techs are employed. Out of the total patients served in 2011 by CHCA, 26,551 (17%) were dental patients.

## VIII. CONCLUSIONS

This report contains the most recent data available on the disease burden, prevention programs, risk behaviors, education, and workforce regarding oral health in Arkansas. Key findings from this report include:

- 64% of third grade students in Arkansas had caries experience,
- 29% of third grade students in Arkansas had untreated decay,
- White third grade students were nearly twice as likely (1.8) have dental sealants on a least one tooth compared to Black third grade students,
- 65% of oral/pharyngeal cancers diagnosed in males during 1997- 2009 had spread to nearby tissues or to more distant sites,
- 23% of adults aged 65 and older have no natural teeth present,
- Among adults aged 60 and older in nursing homes and Area Agency on Aging Centers in Arkansas, Black older adults were 2.6 times more likely to have periodontal disease than White older adults,
- Smokeless tobacco use has been increasing since 2002,
- The percent of smokeless tobacco use among adults in 2010 was 8.5% compared to the lower rate in 2002 of 5.1%,
- 61.1% of adults had a least one dental visit in the past year, and
- Adults with a college education were twice as likely (2.2) to have visited a dentist in the past year compared to adults with less than a high school education.

The Office will continue to monitor the oral disease burden in the state by assessing the oral health of Arkansans of all ages, race/ethnicities, and geographic locations. The ongoing activities to increase the dental workforce in the state by the recent establishment of the UAMS Center for Dental Education, policies to expand dental hygiene workforce flexibility, and the expansion of fluoridated areas to 87% will help improve oral health outcomes of residents in Arkansas.

The data in this report can be used by the dental workforce, policy-makers, community groups, and others who are working to reduce the burden of oral disease in Arkansas.

---

## X. ABBREVIATIONS

ACH – Arkansas Children’s Hospital  
ADH – Arkansas Department of Health  
AOHC – Arkansas Oral Health Coalition  
ASBDE – Arkansas State Board of Dental Examiners  
CHCA – Community Health Centers of Arkansas  
COPH – College of Public Health  
DDF – Delta Dental of Arkansas Foundation  
DOCF - Daughters of Charity Foundation  
HRSA – Health Resources and Services Administration  
Office – ADH Office of Oral Health  
TCP – ADH Tobacco Prevention & Cessation Program  
UAMS - University of Arkansas for Medical Sciences

## IX. REFERENCES

- Amar S, Chung KM. Influence of hormonal variation on the periodontium in women. *Periodontol* 2000;1994;6:79–87.
- American Academy of Periodontology. Position paper: Tobacco use and the periodontal patient. *J Periodontol* 1999;70:1419–27.
- American Dental Association. *Distribution of Dentists in the United States by Region and State*, 1997. Chicago, IL: American Dental Association Survey Center;1999.
- Bailey W, Duchon K, Barker L, Maas W. Populations receiving optimally fluoridated public drinking water – United States, 1992–2006. *MMWR* 2008; 57(27):737–741. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5727a1.htm>
- Beck JD, Offenbacher S, Williams R, Gibbs P, Garcia R. Periodontics: A risk factor for coronary heart disease? *Ann Periodontol* 1998;3(1):127–41.
- Blot WJ, McLaughlin JK, Winn DM, Austin DF, Greenberg RS, Preston-Martin S. Smoking and drinking in relation to oral and pharyngeal cancer. *Cancer Res* 1988;48(11):3282–7.
- BPHC.HRSA.gov [Internet]. Rockville, MD: The Health Center Program: What is a Health Center [last reviewed 2009 Aug 24; cited 2010 March 8th]. Available at <http://bphc.hrsa.gov/about/>.
- Brown LJ, Wagner KS, Johns B. Racial/ethnic variations of practicing dentists. *J Am Dent Assoc* 2000;131:1750–4.
- Burt BA, Eklund BA. *Dentistry, dental practice, and the community*. 5th ed. Philadelphia: WB Saunders; 1999.
- CDC.gov [Internet]. Atlanta, GA: Community Water Fluoridation: Statistics; c2010 [last reviewed 2009 Aug 24; cited 2010 March 8th]. Available at <http://www.cdc.gov/fluoridation/statistics.htm>.
- Centers for Disease Control and Prevention. Preventing and controlling oral and pharyngeal cancer. Recommendations from a national strategic planning conference. *MMWR* 1998; 47(No. RR-14):1–12. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/00054567.htm>.
- Centers for Disease Control and Prevention. Achievements in public health, 1900–1999: Fluoridation of drinking water to prevent dental caries. *MMWR* 1999;48(41):933–40. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4841a1.htm>.
- Centers for Disease Control and Prevention. Populations receiving optimally fluoridated public drinking water — United States, 2000. *MMWR* 2002;51(7): 144–7. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5107a2.htm>.

---

Centers for Disease Control and Prevention. Recommendations for using fluoride to prevent and control dental caries in the United States. *MMWR Recomm Rep* 2001;50(RR-14):1–42. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5014a1.htm>.

Centers for Disease Control and Prevention. Annual smoking-attributable mortality, years of potential life lost, and economic costs—United States, 1995–1999. *MMWR* 2002;51(14):300–3. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5114a2.htm>.

Centers for Medicare & Medicaid Services. National Health Expenditure (NHE) amounts by type of expenditure and source of funds: Calendar years 1965–2013. Updated October 2004. [Updated version: Centers for Medicare & Medicaid Services. National Health Expenditure (NHE) amounts by type of expenditure and source of funds: Calendar years 1965–2019. Available at [http://www.cms.hhs.gov/NationalHealthExpendData/03\\_NationalHealthAccountsProjected.asp#TopOfPage](http://www.cms.hhs.gov/NationalHealthExpendData/03_NationalHealthAccountsProjected.asp#TopOfPage).

Christen AG, McDonald JL, Christen JA. The impact of tobacco use and cessation on nonmalignant and precancerous oral and dental diseases and conditions. Indianapolis, IN: Indiana University School of Dentistry; 1991.

Dasanayake AP. Poor periodontal health of the pregnant woman as a risk factor for low birth weight. *Ann Periodontol* 1998;3:206–12.

Davenport ES, Williams CE, Sterne JA, Sivapathasundram V, Fearn JM, Curtis MA. The East London study of maternal chronic periodontal disease and preterm low birth weight infants: Study design and prevalence data. *Ann Periodontol* 1998;3:213–21.

De Stefani E, Deneo-Pellegrini H, Mendilaharsu M, Ronco A. Diet and risk of cancer of the upper aerodigestive tract—I. Foods. *Oral Oncol* 1999;35(1):17–21.

Fiore MC, Bailey WC, Cohen SJ, et al. Treating tobacco use and dependence. Clinical practice guideline. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service; 2000. Available at [http://www.surgeongeneral.gov/tobacco/treating\\_tobacco\\_use.pdf](http://www.surgeongeneral.gov/tobacco/treating_tobacco_use.pdf).

Gaffield ML, Gilbert BJ, Malvitz DM, Romaguera R. Oral health during pregnancy: An analysis of information collected by the pregnancy risk assessment monitoring system. *J Am Dent Assoc* 2001;132(7):1009–16. Full text available at: <http://jada.ada.org/cgi/content/full/132/7/1009>.

Genco RJ. Periodontal disease and risk for myocardial infarction and cardiovascular disease. *Cardiovasc Rev Rep* 1998;19(3):34–40.

Griffin SO, Jones K, Tomar SL. An economic evaluation of community water fluoridation. *J Public Health Dent* 2001;61(2):78–86. Abstract available at <http://www.ncbi.nlm.nih.gov/pubmed/11474918?dopt=AbstractPlus>.

Herrero R. Chapter 7: Human papillomavirus and cancer of the upper aerodigestive tract. *J Natl Cancer Inst Monogr* 2003; (31):47–51.

International Agency for Research on Cancer (IARC). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 89, Smokeless tobacco and some tobacco-specific *N*-nitrosamines. Lyon, France: World Health Organization, International Agency for Research on Cancer; 2007. Available at <http://monographs.iarc.fr/ENG/recentpub/mono89.pdf>.

Johnson NW. *Oral Cancer*. London: FDI World Press, 1999.

Komaromy M, Grumbach K, Drake M, Vranizan K, Lurie N, Keane D, Bindman AB. The role of black and Hispanic physicians in providing health care for underserved populations. *N Engl J Med* 1996;334(20):1305–10.

Kressin NR, De Souza MB. Oral health education and health promotion. In: Gluck GM, Morganstein WM (eds). *Jong's Community Dental Health*, 5th ed. St. Louis, MO: Mosby; 2003:277–328.

Levi F. Cancer prevention: Epidemiology and perspectives. *Eur J Cancer* 1999;35(14):1912–24.

McLaughlin JK, Gridley G, Block G, et al. Dietary factors in oral and pharyngeal cancer. *J Natl Cancer Inst* 1988;80(15):1237–43.

Mealey BL. Periodontal implications: medically compromised patients. *Ann Periodontol* 1996;1(1):256–321.

Morse DE, Pendry DG, Katz RV, et al. Food group intake and the risk of oral epithelial dysplasia in a United States population. *Cancer Causes Control* 2000;11(8):713–20.

Offenbacher S, Jared HL, O'Reilly PG, Wells SR, Salvi GE, Lawrence HP, et al. Potential pathogenic mechanisms of periodontitis associated pregnancy complications. *Ann Periodontol* 1998;3(1):233–50.

Offenbacher S, Lief S, Boggess KA, Murtha AP, Madianos PN, Champagne CM, et al. Maternal periodontitis and prematurity. Part I: Obstetric outcome of prematurity and growth restriction. *Ann Periodontol* 2001;6(1):164–74.

Phelan JA. Viruses and neoplastic growth. *Dent Clin North Am* 2003;47(3):533–43.

Ramqvist, T, Dalianis, T. Oropharyngeal Cancer Epidemic and Human Papillomavirus. *Emerg Infect Dis*. 2010; 16(11): 1671-7.

Redford M. Beyond pregnancy gingivitis: Bringing a new focus to women's oral health. *J Dent Educ* 1993;57(10):742–8.

Ries LAG, Eisner MP, Kosary CL, Hankey BF, Miller BA, Clegg L, et al. (Eds). SEER Cancer Statistics Review, 1975–2001, National Cancer Institute: Bethesda, MD; National Cancer Institute; 2004. Available at [http://seer.cancer.gov/csr/1975\\_2001/](http://seer.cancer.gov/csr/1975_2001/).

Scannapieco FA, Bush RB, Paju S. Periodontal disease as a risk factor for adverse pregnancy outcomes. A systematic review. *Ann Periodontol*. 2003;8(1):70–8.

---

Shanks TG, Burns DM. Disease consequences of cigar smoking. In: *Cigars: Health effects and trends. Smoking and Tobacco Control Monograph 9*. Bethesda, MD: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute, 1998.

Silverman SJ, Jr. *Oral Cancer*, 4th edition. Atlanta, GA: American Cancer Society, 1998.

Taylor GW. Bidirectional interrelationships between diabetes and periodontal diseases: An epidemiologic perspective. *Ann Periodontol* 2001;6(1):99–112.

Tomar SL, Asma S. Smoking-attributable periodontitis in the United States: Findings from NHANES III. *J Periodontol* 2000;71:743–51.

Tomar SL, Husten CG, Manley MW. Do dentists and physicians advise tobacco users to quit? *J Am Dent Assoc* 1996;127(2):259–65.

U.S. Department of Health and Human Services. *The Health Consequences of Using Smokeless Tobacco: A Report of the Advisory Committee to the Surgeon General*. Bethesda, MD: U.S. Department of Health and Human Services, Public Health Service; 1986. NIH Publication No. 86-2874.

U.S. Department of Health and Human Services. *Current Estimates from the National Health Interview Survey, 1996*. Series 10, No. 200. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 1999. DHHS Publication No. 99-1528. Available at [http://www.cdc.gov/NCHS/data/series/sr\\_10/sr10\\_200.pdf](http://www.cdc.gov/NCHS/data/series/sr_10/sr10_200.pdf).

U.S. Department of Health and Human Services. *Oral Health in America: A Report of the Surgeon General*. Rockville, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Dental and Craniofacial Research; 2000a. NIH Publication No. 00-4713.

U.S. Department of Health and Human Services. Oral Health. In: *Healthy People 2010*, 2nd edition. With Understanding and Improving Health and Objectives for Improving Health. 2 vols. Washington, DC: U.S. Government Printing Office; 2000b.

U.S. Department of Health and Human Services. *National Call to Action to Promote Oral Health*. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental and Craniofacial Research; 2003. NIH Publication No. 03-5303.

U.S. Department of Health and Human Services. *The health consequences of smoking: A report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2004a. Available at: <http://www.surgeongeneral.gov/library/smokingconsequences/>.

U.S. Department of Health and Human Services. *Healthy People 2010 progress review: Oral health*. Washington, DC: U.S. Department of Health and Human Services, Public Health Service; 2004b.

Weaver RG, Ramanna S, Haden NK, Valachovic RW. Applicants to U.S. dental schools: An analysis of the 2002 entering class. *J Dent Educ* 2004;68(8):880–900.