

Oral Health in North Carolina: Innovations, Opportunities, and Challenges

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Dental disease can have negative and lasting effects on overall health and quality of life. The Institute of Medicine of the National Academy of Sciences reported last year that close to 5 million children in the United States did not receive needed care in 2008 because of costs. Increasing use of dental care has been selected by the US Department of Health and Human Services as one of a small number of national leading health indicators, designating it as a national priority. Innovative initiatives have been undertaken in North Carolina to promote oral health, and there have been improvements in the state. For example, both the use of dental services among children and their oral health status are improving. Yet persistent and difficult challenges remain, such as ensuring an adequate workforce for the future, improving oral health literacy, maintaining existing programs, and resolving disparities in oral health and lifetime access to preventive and treatment services for all North Carolinians. This issue brief reviews some oral health initiatives and their outcomes—with a focus on youth. Commentaries in the policy forum also focus on access to oral health care; assessing, educating, and building the dental workforce; new practice models and trends; insurance innovation; and patients with special needs.

Important national publications about oral health book-end an unprecedented amount of activity in dentistry during the last decade. In 2000, *Oral Health in America: A Report of the Surgeon General*, published by the US Department of Health and Human Services, highlighted the widespread prevalence of oral diseases and their significant impact on overall health and quality of life [1]. As with other reports from the Office of the Surgeon General, starting with the 1964 report on the adverse consequences of smoking, *Oral Health in America* focused the nation's attention on an important public health issue and triggered nationwide public and private efforts to address the identified problems. The report declared dental disease to be a silent epidemic and called for everyone to share in efforts to promote oral health.

In 2011, the Institute of Medicine and the National Research Council published *Improving Access to Oral Health Care for Vulnerable and Underserved Populations* [2]. It concluded that now, a decade after publication of

Oral Health in America, millions of Americans still lacked access to basic oral health care. The report envisioned a country in which everyone has access to quality oral health care throughout life. The authors of the report considered oral health promotion and disease prevention to be essential in any strategies aimed at improving access to care, and argued that oral health is an integral part of overall health. Using these key principles as a foundation, the report concluded that, in order to ensure access for everyone, collaboration among multidisciplinary teams working across the health care system will be required.

Assessments of Oral Health Care in North Carolina

North Carolina began the last decade with its own set of policy recommendations about improving oral health, as well as a framework for action. In the late 1990s, at the request of the North Carolina General Assembly, the North Carolina Institute of Medicine (NCIOM) convened a task force to conduct a study on access to dental care for underserved and vulnerable residents of the state [3]. The resulting report by the Task Force on Dental Care Access, published in the spring 1999, found that North Carolina ranked close to the bottom among states in the supply of dentists per population and in their participation in Medicaid. Only 20% of individuals enrolled in Medicaid made a dental visit at the time. Dental caries was found to be the most prevalent chronic disease of children, and had the highest level of unmet need of any disease. Statewide, about 40% of children had experienced dental caries by the time they enrolled in kindergarten and only about half was treated.

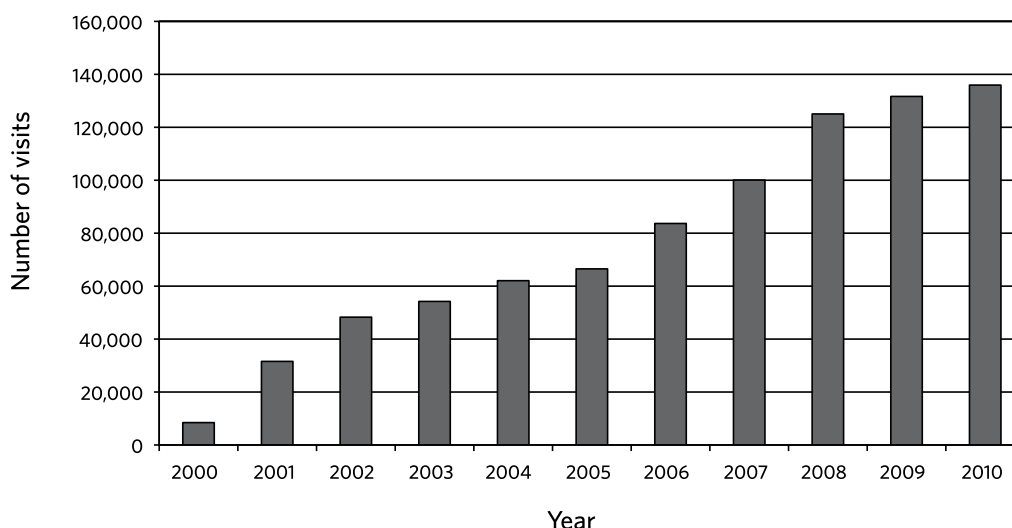
The NCIOM report contained 23 specific recommendations for improving access to care, which were organized into 5 general strategies: (1) increasing dentist participation in the Medicaid program, (2) increasing the dental workforce supply, (3) expanding access to preventive dental services for young children, (4) expanding access to special care dentistry, and (5) educating Medicaid recipients about

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FIGURE 1.
Number of Annual Preventive Dental Visits in North Carolina Medical Offices, 2000-2010



Note. Data are from the Division of Medical Assistance, North Carolina Department of Health and Human Services.

the importance of ongoing dental care and removing non-financial barriers to using dental services.

The last comprehensive assessment of progress in implementing the 23 recommendations was completed in 2005 [4]. It concluded that significant progress had been made toward improving access to dental care for underserved populations in North Carolina during the intervening 5 years. About a third of the recommendations were met, with progress being evident on many more. For example, the number of dentists participating in Medicaid had increased, as had the proportion of eligible Medicaid recipients receiving dental services, even with an increase of more than 400,000 in the number of enrollees. A large expansion of the dental care safety net also occurred, increasing from 43 clinics in 1998 to 115 in 2004.

This issue of the NCMJ provides an update on dentistry in North Carolina. It includes invited commentaries on dental education, the status of the oral health workforce, barriers to dental care, emerging dental practice models, financing, public health programs, and dentistry for special needs populations. Together, they provide a review of important trends affecting the oral health of North Carolina's population that need to be considered in planning for the future.

Progress in Meeting Children's Oral Health Needs in North Carolina

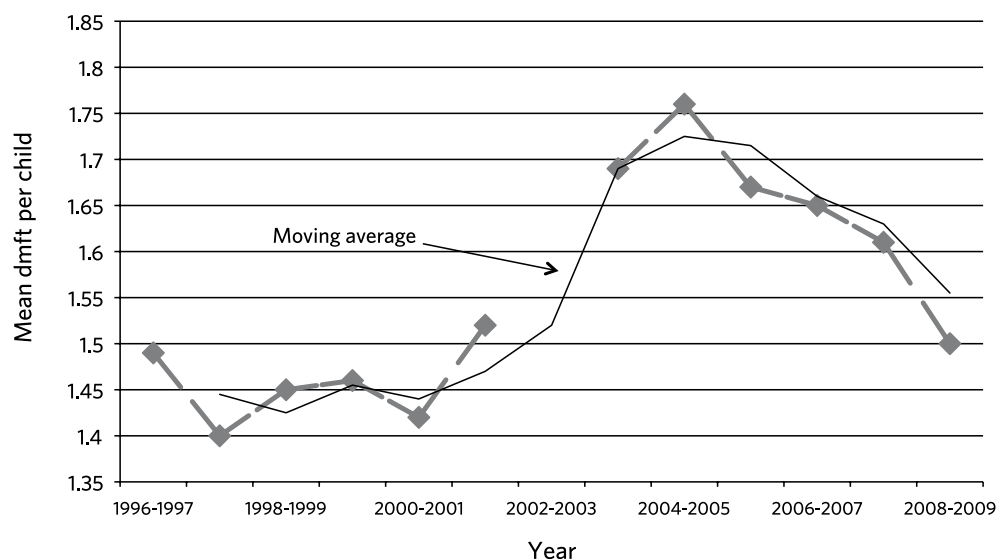
Only 22% of children enrolled in Medicaid received any dental services in 2000. By 2010 that number had more than doubled to 48%, when approximately half a million children received some type of dental care [5]. These utilization rates would approach 60% if infants without erupted teeth and children who are enrolled for only a part of the year were excluded from the denominator used in the calculation of

rates. During the past decade, Medicaid participation rates among dentists in North Carolina increased from 16% to 45%. A decade ago, as many as 40 counties lacked a Medicaid-enrolled dentist. Now, only 4 counties lack a dentist who submits claims for reimbursement to the program. According to the North Carolina Division of Medical Assistance, North Carolina ranked sixth among state Medicaid programs in 2009 for children who used preventive services and ninth for children who received any dental services—a dramatic change in ranking from 44th place in 1999 [6].

Part of the success observed in the use of preventive services is due to the innovative program, Into the Mouths of Babies (IMB), referenced in the commentary by King and Spratt [7]. One of the more difficult challenges faced by the 1999 NCIOM task force was developing recommendations for addressing the high prevalence of dental disease in preschool children and their low use of dental care. Use was only 12% among 1- to 5-year-old children enrolled in Medicaid. In 2000, the North Carolina Division of Medical Assistance, in collaboration with a number of partners, implemented IMB, a program that now reimburses medical providers for dental screenings, parent counseling, and the application of fluoride varnish in children from birth to 3.5 years of age. At the time the program was being developed, only Washington state had considered such an option.

An extensive evaluation of IMB has been conducted because of its novel aspects and the limited information available at the time of implementation about the effectiveness of the provision of dental services by non-dental providers. The results of this evaluation indicate that IMB has been highly successful in improving access to preventive oral health services for Medicaid children [8]. Visits for preventive dental services have increased every year between 2000

FIGURE 2.
Mean Number of Decayed, Missing, and Filled Primary Teeth (dmft) per Kindergarten Student in North Carolina, by Year



Note. Data are from the Oral Health Surveillance System, Division of Public Health, North Carolina Department of Health and Human Services.

and 2010 (Figure 1). In total, children have made almost a million medical visits in which they received preventive dental services. Access and use of preventive services has been extended to every county in the state where previously as many as 40 of the 100 counties had no children of this age receiving professionally-provided preventive dental services.

The IMB program has reduced dental caries-related treatments such as restorations, nerve treatments, and tooth extractions among children enrolled in Medicaid who are 6 months to 6 years of age [9]. An analysis of Medicaid reimbursement claims for the first 7 years of program implementation found that children who received 4 or more IMB visits compared to zero IMB visits when they were 6 months to 35 months of age had a statistically significant reduction in cumulative caries-related treatments of 49% at 17 months of age. By 6 years of age, the estimated cumulative reduction in the number of treatments was 17%.

Recent Enhancements to the IMB Program

The screening and referral component of IMB is being strengthened as another strategy to help improve access to care for young children. These efforts began with a project known as the Carolina Dental Home initiative under the leadership of the Oral Health Section of the North Carolina Division of Public Health, and in collaboration with the medical and dental communities in 3 counties in eastern North Carolina. The specific objectives of this demonstration project, which was completed in 2010, were to enhance the ability of medical providers participating in IMB to provide risk-based dental referrals and to increase the availability of the dental workforce to meet the dental needs of preschool-

aged children enrolled in Medicaid.

A decision support tool, known as the Priority Oral Health Risk Assessment and Referral Tool (PORRT), and associated referral guidelines were developed through consensus of local physicians and dentists to help prioritize dental referrals in medical offices in their communities where universal referral of children at 1 year of age was not possible. Adoption and implementation of PORRT and the referral guidelines resulted in an increase in referral rates, specifically for those children younger than 3 years of age who have dental caries in its early stages. Based on its success in linking physicians and dentists, the PORRT and guidelines are being tested further in other areas of the state with the ultimate goal of increasing the number of young children enrolled in North Carolina Medicaid who have a dental home. These activities are being funded through grants from the Health Resources and Services Administration and in collaboration with a quality demonstration grant specified in the Children's Health Insurance Program Reauthorization Act (CHIPRA) [10].

A Dental Public Health Crisis in Preschool-aged Children Averted

Statewide trends in dental caries experience for children enrolled in kindergarten over a 13-year period are displayed in Figure 2. These data are provided by the Oral Health Section and are based on standardized clinical assessments of about 85% of all 5-year-old children attending public schools in the state each year. Oral health surveillance for this age child is important because it can reveal effects from exposure to interventions targeting preschool-aged children

after only a few years of implementation.

The trend line for dental caries experience, or the mean of the person-level count of decayed, missing, and filled teeth (dmft) per person shows an increase between 2001-2002 and 2004-2005. A decline in dmft scores has occurred each year since the 2004-2005 school year. The absolute change in dmft is small, less than half a tooth, but amounts to a reduction of about 14% over the last 5 years.

The mean proportion of dmft that had been treated (fmt divided by dmft) per year was almost constant at about 0.49 during the first 6 years (not shown in Figure 2). The proportion treated increased in the last 5 years, reaching 0.68 in 2008-2009. Thus, during the last decade, not only has the amount of dental caries that has occurred in the first 5 years of life for children in North Carolina decreased, but the amount that is treated has increased, from slightly less than 50% to 64%.

Hypothesized reasons for these trends in dental caries and its treatment must be developed with an abundance of caution. They can be caused by a number of factors. But the downward trend in dmft in 5-year-old children starting with the 2005-2006 school year seems to correspond to the start of the IMB program when this cohort would have been 1 or 2 years of age. Training of dental students in infant and toddler oral health, increases in dentists' participation in the Medicaid program, improved public awareness about the importance of oral health in young children, or natural variation in disease and its measurement are a few of the many factors other than the IMB program that could be contributing to the observed trends. Further research can help determine the most important contributors and inform future policy and interventions.

Challenges to Further Progress in Improving Oral Health in North Carolina

Disparities in oral health and access to care. The presence of large and persistent disparities in oral diseases and

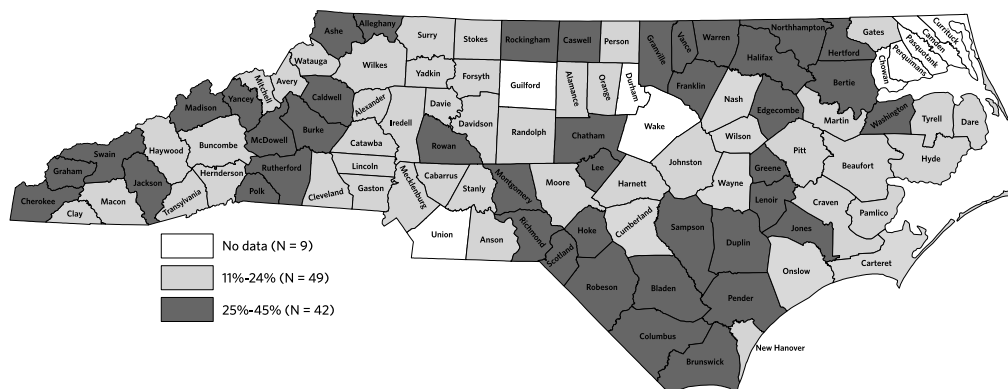
conditions by geographic areas of the state continues to be a major challenge. Where someone lives has a profound effect on their oral health. A few counties such as Duplin and Robeson still have almost two-thirds of its kindergarten children affected with dental caries. In 2003-2004, 25% or more of kindergarten students living in 42 counties (46% of the counties with data) had untreated dental caries (Figure 3A). Although the number had decreased by 2008-2009, 18 counties still had 25% or more of its kindergarten students with untreated dental caries (Figure 3B).

Counties with the most dental disease also are usually the ones that are the least healthy overall [11]. Dental diseases share many risk factors with other chronic diseases, particularly social determinants such as poverty and educational attainment. Substantial progress in preventing dental disease and eliminating oral health disparities will require a change not only in these social determinants, but also in clinical care, individual education and counseling, and the environmental context in which people live and make decisions [12]. The commentary by Lee [13] discusses access to oral health care among children, while other commentaries in the policy forum discuss aspects of access among other populations.

The oral health of underserved and vulnerable adults. The disparities in disease and treatment observed in children of our state also are present in adults. A 2006-2008 survey representative of community-dwelling adults 60 years of age and older in 2 rural counties of southeastern North Carolina found that 35% of the sample had lost all of their teeth [14]. Another publication from this same study found that a large percentage of the sample resorted to self-care behaviors such as the use of salt (50.9%) and over-the-counter dental products (84.0%) to address oral conditions such as pain, bleeding gums, or dry mouth [15]. Statewide, 21% of the population 65 years of age and older have lost all their natural teeth, while the percentage is twice that for those living in households with incomes less than \$15,000 [16]. Further,

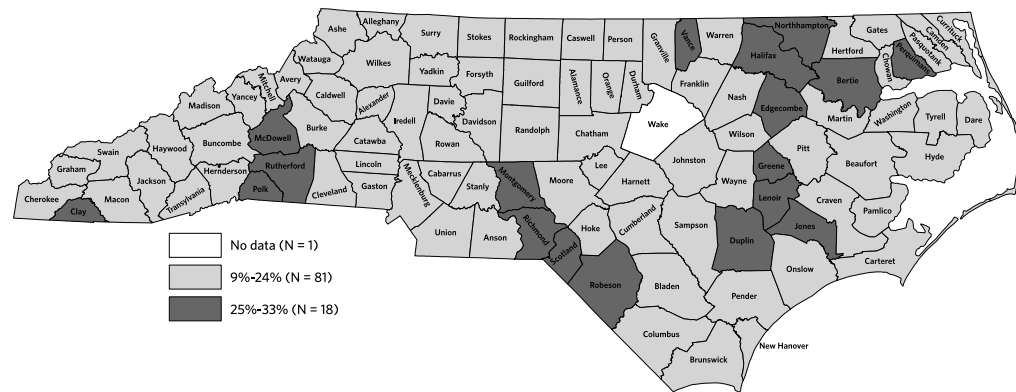
FIGURE 3A.

Percent of Kindergarten Students with Untreated Dental Caries by County, 2003-2004



Note. Data are from the Oral Health Surveillance System, Division of Public Health, North Carolina Department of Health and Human Services.

FIGURE 3B.
Percent of Kindergarten Students with Untreated Dental Caries by County, 2008-2009



Note. Data are from the Oral Health Surveillance System, Division of Public Health, North Carolina Department of Health and Human Services.

more than two-thirds of adults in the state report they visited a dentist, dental hygienist, or dental clinic in the last year. However, low-income adults are far less likely to report having a dental visit in the last year (44.5%), compared to adults with higher incomes (87.6%) [16].

Medicaid is an important dental insurance benefit for as many as 700,000 adults in North Carolina. Unlike benefits for children, however, services are optional under Title XIX of the Social Security Act. Many states have reduced adult Medicaid benefits to help balance state budgets. In his commentary, Casey [17] provides a compelling rationale for maintaining adult dental benefits at their current level in North Carolina. Not only might the oral health, general health, and quality of life of adult Medicaid beneficiaries suffer if dental benefits are eliminated, but it could also have both short- and long-term negative consequences on the costs and quality of care in primary medical care settings, emergency departments, and safety net clinics.

One specific rationale put forth by Casey for maintaining adult benefits is that adult dental treatment and improved oral health will reduce general medical problems because of the association between oral health and systemic health. This argument can be extended further. People with better oral health seem to live longer. A recent systematic review of tooth loss and mortality found that tooth loss increased the risk of death, particularly mortality from diseases of the heart and vessels [18]. The evidence linking oral health with systemic health has not gone unnoticed by Blue Cross and Blue Shield of North Carolina. Moore's [19] commentary highlights changes being made by Blue Cross and Blue Shield of North Carolina to their management systems for medical and dental claims, as well as their benefits to help integrate medical and dental care and improve both medical and dental health.

Importantly, by highlighting the different vulnerable and underserved groups that benefit from Medicaid, Casey reframes and broadens our perspective on access to den-

tal care from being primarily a problem affecting children to one affecting all age groups. Included among those who would suffer from loss of Medicaid benefits are pregnant women and adults with complicated medical problems such as HIV infection, residents of long-term care facilities, and adults with special health care needs. He argues that children might even be affected if adult benefits were eliminated because of the spillover effects the oral health of pregnant women and mothers might have on children's health.

At the request of the North Carolina General Assembly, the state released a comprehensive report on access to dental care for special needs patients in 2010 [20]. A primary conclusion of that report was that the current dental workforce is not sufficient to meet the oral health needs of the special health care needs population in North Carolina. Buchholtz and King [21] provide an update on progress in meeting the recommendations in this report. One proposal moving forward is to develop a fluoride varnish initiative that would benefit Medicaid recipients residing in long-term care facilities. Innovative strategies to provide preventive dental services in primary care and community settings such as those proposed for North Carolina have been recommended by others at the national level [22].

Dental workforce supply. Planning for future workforce supply to meet the needs of the public is difficult because of the uncertainty associated with existing projection models [23]. In his commentary, Parker [24] points out the impact of one unpredicted event, the great economic recession and its cascading, interrelated effects on the practice of dentistry and evolving new practice models.

Nevertheless, policy must be made even with uncertain information. Workforce policies, however, are often best approached with caution because of their long-term costs, the controversy associated with decisions about workforce, and because implementation of policies and programs often do not adequately resolve population needs that provided the rationale for the actions in the first place. Most of the

commentaries in this issue have implications for the dental workforce in North Carolina.

Fraher and colleagues [25] conclude that North Carolina has had an inadequate supply and geographically maldistributed dental workforce for a number of years and that it is projected to get worse. They estimate that the ratio of dentists per 10,000 population will decline from 4.4 in 2010 to 4.1 by 2020. The state seems to be mired in 47th place among states in its dentist to population ratio. Chadwick's [26] commentary examines the workforce issue by reviewing the mission of the ECU School of Dental Medicine, its philosophy of education, and its potential contributions to improving access to care. The projections by Fraher and colleagues account for ECU graduates.

Contributions in this issue present a substantial amount of evidence in support of the conclusions by Fraher and colleagues. The dentist workforce is getting older with a large percentage approaching retirement age, the retention of University of North Carolina-Chapel Hill graduates in the state is declining, and the Medicaid population is increasing rapidly. The overall population continues to grow more rapidly than the supply of dentists. The latest estimates from the US Census Bureau reveal that some areas of the state are among the fastest growing places of anywhere in the country [27].

The public health infrastructure in the state also is of some concern. The number of safety-net clinics has increased rather dramatically in the United States and in North Carolina over the last decade. Difficulties in recruitment and retention of dentists are major challenges that can reduce productivity in public health clinics for months at a time and reduce access to care in underserved areas.

Fully staffed and funded state oral health programs are

essential for the oral health of the public [2]. Yet the capacity of most state programs in the United States is limited. More than half of state dental programs operate on a total annual budget of less than \$1 million and 3 or fewer full-time equivalent staff [28]. North Carolina has a long tradition of providing core dental public health services. The paper by King and Spratt [7] provides an update on the services provided by the Oral Health Section in the North Carolina Division of Public Health. Among the cost-effective programs that reach 1,000s of North Carolina citizens each year are community water fluoridation, school-based sealants, and fluoride mouthrinse. As they point out, these programs are recommended because of evidence for their effectiveness and efficiency. The evaluation of a school-based dental sealant program in Ohio found that it eliminated disparities in the number of children with sealants [29].

The number of public health dental hygienists staffing local public health programs operated by the Oral Health Section is decreasing while the size of the school population is increasing dramatically. Currently, 39 public health hygienists are providing these services across the state. The ratio of state-employed public health dental hygienists to the elementary school population has deteriorated from 1:13,500 in the 2006-2007 school year to 1:18,000 in 2011-2012, a decrease of about 33% in the dental public health workforce available to high-need communities. These trends jeopardize the continued ability of North Carolina to meet statewide goals in oral health.

Oral health literacy. The 1999 NCIOM report on dental care access called for programs that would educate the public on the importance of dental care. This recommendation is not considered in any of the commentaries in this issue, and is yet to be addressed comprehensively in North Carolina. Limited oral health literacy is increasingly believed to be a major cause of poor oral health. The central role of health literacy was recently emphasized by Horowitz and Kleinman [30] who concluded that "...efforts to increase primary prevention, improve quality of care, reduce costs, and reduce oral health disparities cannot succeed without simultaneous improvements in oral health literacy of the public, health care providers, and policy makers...".

An estimated 43% of adult Americans have basic or below basic literacy skills that can interfere with their understanding of health information and their ability to successfully navigate the health care system [31]. North Carolina ranks 41st among states in the proportion of its adult population with basic or below basic literacy skills [32]. Studies in dentistry, many done in North Carolina, find that limited oral health literacy is associated with poorer oral health knowledge [33, 34], fewer dental care visits [34, 35], worse oral health status [36, 37], and worse oral health-related quality of life [38-40]. Nationally, only 44% of adults with less than basic health literacy skills had a dental care visit in the preceding year compared with 77% of those with proficient health literacy skills [35].

TABLE 1.
Opinions of North Carolina Parents About Restoration of Primary Teeth: Percent Who "Agree" That Cavities in Primary Teeth Do Not Need to Be Filled or "Don't Know"

Parents of:	Sample size	Overall	Hispanic	Non-Hispanic
Children 6-36 months old in 118 medical offices (2001)	781	52.4%	57.1%	52.0%
School children 5-17 years old statewide (2003-2004)	5,697	47.1%	78.2%	45.6%
Children 3 years old in 20 counties in western North Carolina (2004-2005)	954	36.2%	55.3%	35.2%
Early Head Start children 6-36 months old statewide (2006)	775	36.7%	61.5%	32.4%
Early Head Start children <19 months old in 41 counties (2010-2012)	1,206	40.8%	56.2%	35.5%

Note. Results are from an analysis of data from [42-46].

Health literacy can be a particularly important determinant of children's health. More than 21 million (29%) parents in the United States have limited health literacy skills, which can put their children's health at risk because of their caretaker role [41]. Paradoxically, many parents place a high value on the oral health of their children, but place a low value on the treatment of dental caries, particularly in primary teeth. An analysis, completed for this paper, of information collected in surveys of more than 9,000 parents in North Carolina [42-46], found that approximately one-third to one-half do not believe that primary teeth usually should be filled (Table 1). This negative opinion held by parents is particularly high among Hispanics and disadvantaged populations, and is remarkably consistent across the 5 surveys of parents done in the state.

This problem of limited health literacy has been recast nationally not only as an individual deficit to be addressed through health education of the public, as it appears to have been considered by the NCIOM Task Force on Dental Care Access in 1999, but as a community asset that needs to be improved through community interventions, and as an individual patient risk factor that needs to be considered by health care professions in providing care [47]. Underserved and vulnerable families have multiple contacts with many different types of service professionals who can provide oral health information. A continuing goal should be to integrate accurate and consistent oral health messages into all aspects of families' formal and informal social networks in ways that match their literacy skills. A statewide plan for improving oral health literacy using broad-based, coordinated strategies involving community health workers and health care professionals is needed to help improve access to dental care and oral health. Evidence for effective interventions is beginning to emerge [48, 49], and a few states are beginning statewide oral health literacy initiatives that can be used as models [30, 50].

Conclusions

Many strategies to increase access to dental services proposed by the NCIOM Task Force on Dental Care Access at the beginning of the last decade have been implemented in North Carolina. Evidence of progress toward reducing dental disease and improving access to care, particularly for young, vulnerable children is apparent in the state. Use of dental care for children enrolled in Medicaid has more than doubled, and in 2009 North Carolina ranked among the top tier of state Medicaid programs in this performance measure. Young children also have less disease and improved treatment rates. But persistent and difficult challenges remain in ensuring an adequate workforce for the future, resolving disparities in oral health and access to preventive and treatment services for children and adults, improving oral health literacy, and maintaining existing programs.

Many opportunities exist for North Carolina to continue as a leader in implementing innovative solutions for diffi-

cult challenges and to make continued progress toward oral health goals. Authors of papers in this issue of the NCMJ provide commentaries on several areas of dentistry and provide important updates on the status of existing and new strategies to improve oral health. Innovations in dental education, the integration of oral health into medicine, emerging insurance, and dental practice models—among others—are presented. Oral health policy can benefit from continued monitoring and evaluation of outcomes resulting from the state's investment in oral health, as well as planning based on these observations. NCMJ

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