

HEALTH SERVICE APPLICATION

Community-Academic Partnership to Improve the Oral Health of Underserved Schoolchildren in Rural North Carolina

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ABSTRACT

BACKGROUND: Dental caries is the most common chronic illness for children. Caries can reduce the quality of life, cause missed classroom hours, and decrease cognition. Strategies to improve children's oral health must be evidence-based, developed, and implemented in consultation with communities.

METHODS: A community-academic partnership was formed between East Carolina University School of Dental Medicine and the Bertie County Public School District to develop and implement a school-based oral health prevention program using the PRECEDE-PROCEED Model.

RESULTS: The PRECEDE component involved social, epidemiological, environmental, educational, ecological, administrative, and policy factors that informed the development of the oral health program. The PROCEED component consisted of implementation and evaluation.

CONCLUSIONS: School-based oral health programs can increase access to care for vulnerable children and improve learning. The application of the PRECEDE-PROCEED model proved to be a valuable method for developing, implementing, and evaluating a school-based oral health program.

Keywords: oral health; public health; rural; dentistry; community-academic partnerships; schoolchildren.

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Dental caries (cavities) is the most common chronic illness for children in the United States and can lead to physical and psychological disabilities in adulthood.^{1,2} About 20% of children aged 5 to 11 have untreated caries.³ This disease impacts a disproportionately high number of racial and socioeconomic groups, low-income families, and children from rural communities.²⁻⁵ Also, populations most at risk for oral disease often have the most difficult time accessing dental care.⁶ Childhood caries reduce the quality of life because it affects eating, speaking,

and learning and can lead to missed classroom hours and decreased concentration and cognition.^{7,8} Although dental disease is preventable, dental care is the most common unmet health need in children.⁹ Strategies aimed at improving children's oral health must be developed and implemented in consultation with communities, evidence-based, supported by the community, culturally competent, and sustainable.

A community-academic partnership is a collaborative approach that equitably involves academic and community partners to improve a communities'

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health. This paper describes a community-academic partnership between East Carolina University School of Dental Medicine and the Bertie County Public School District. The partnership was formed to develop and implement a school-based oral health prevention program in Bertie County, North Carolina, using the PRECEDE-PROCEED Model.¹⁰

A 7-phase plan based on the PRECEDE-PROCEED model was used to guide program planning and evaluation. The PRECEDE portion of the Model includes social, epidemiological, behavioral, and environmental assessments. The PROCEED portion focuses on program planning, implementation, and evaluation.

PHASE 1: SOCIAL ASSESSMENT

The social assessment defines the problem that is important to the community and describes community demographics. Input was solicited from school nurses, principals, teachers, administrative staff, and parents/guardians. They all stated that oral health is one of the greatest unmet needs of their community.

Bertie County is located in rural eastern North Carolina, approximately 100 miles east of Raleigh, with 21,000 residents living in 741 square miles.¹¹ The racial and ethnic distribution of students in the Bertie County School system consists of 61% non-Hispanic black, 34% non-Hispanic white, and 2% Hispanic.¹¹ In 2019, the median family income was \$33,143.¹¹ In 2020, the North Carolina Department of Commerce ranked Bertie County the sixth worse, out of 100 counties, in terms of economic distress.¹² The Health Resources and Services Administration designates Bertie County as a Health Professions Shortage Area, a Medically Underserved Community, and a Dental Health Professions Shortage Area.¹³

PHASE 2: EPIDEMIOLOGICAL AND ENVIRONMENTAL ASSESSMENT

National data show that compared with Hispanic and black children, white children have less untreated caries and are 50% more likely to have visited a dentist in the past year.^{2,14} These differences persist after controlling for family income and the education level of the primary parent/guardian. Children in rural areas experience disproportionately higher rates of dental caries and low rates of utilization of dental services compared to their urban counterparts.¹⁵

A review of secondary data sources was done to determine the oral health status of Bertie County children. The data sources included the results of oral screening examinations completed by the N.C. Department of Health and Human Services, Office of Oral Health, a Community Needs Assessment, and data from the Centers for Disease Control and Prevention. Assessments revealed 30.3% of kindergarteners and

6.5% of fifth graders had untreated decay compared to 18.8% and 4.3%, respectively, for statewide averages over the same period.^{16,17} Bertie County water systems are naturally fluoridated, and levels vary across the county.¹⁸ Among the Bertie County residents with a community water system, 7.6% receive optimally fluoridated water, and 80% receive water at a level higher than what is needed to prevent tooth decay.¹⁸ The high rate of natural fluoride places very young children at risk for mild fluorosis, a discoloration that does not affect the health of the teeth.

A high percentage of children in Bertie County participate in the federal free or reduced lunch program.¹⁹ Of the 2116 students in the county's 4 elementary, 1 middle, and 2 high schools for the 2019-2020 school year, more than 90% participated in the federal lunch program.²⁰

PHASE 3: EDUCATIONAL AND ECOLOGICAL ASSESSMENT

The educational and ecological assessment identified the predisposing, enabling, and reinforcing factors associated with an increased risk of dental disease. These factors were identified based on parent/guardian surveys, discussion with community leaders, and a literature review. Predisposing factors include the individual's and parent/guardian's knowledge, attitudes, beliefs, sociodemographic determinants such as age, sex, socioeconomic status, health literacy, and health beliefs. Reinforcing factors are the peer and social supports that serve as either positive or negative reinforcement of a behavior. Enabling factors are the resources available within a community, including insurance coverage, regular dental care sources, and transportation means.¹⁰

In this study, predisposing factors included the low median family income of \$33,143 in Bertie County compared to \$60,293 in the United States and \$52,401 in NC.¹¹ An additional predisposing factor is lower levels of health literacy often seen in vulnerable populations.²¹ The reinforcing and enabling factors influence the children to the most significant degree within their environment. More than 95% of children in Bertie County qualify for free and reduced-price meals. This federal lunch program is considered a reinforcing factor that encourages positive behaviors because the children have access to healthy foods during the school year. Enabling factors include the low dentist-to-population ratio of 0.5 dentists to 10,000 residents in Bertie County compared to 6.0 per 10,000 in the United States and 5.1 per 10,000 in N.C.^{22,23}

PHASE 4: ADMINISTRATIVE AND POLICY ASSESSMENT

This phase addresses the national, state, and local policies that serve to mitigate untreated dental decay.

Healthy People 2030 has several objectives to improve the oral health of children in the United States.²⁴ Objective OH-01: *Reduce the proportion of children and adolescents with lifetime tooth decay experience*; Objective OH-02: *Reduce the proportion of children and adolescents with active and currently untreated tooth decay*; Objective OH-09: *Increase the proportion of low-income youth who have a preventive dental visit*; and OH-10: *Increase the proportion of children and adolescents who have received dental sealants*.²⁴ The Centers for Disease Control and Prevention funds 20 states and 1 territory for implementing school-based sealant programs.²⁵ The Community Preventive Services Task Force strongly recommends using school-based sealant programs to prevent cavities among children.²⁶

PHASE 5: DEVELOPMENT AND IMPLEMENTATION

Based on the results of the PRECEDE phases, a culturally appropriate school-based oral health prevention program was proposed for all elementary and middle schools in Bertie County. School-based oral health programs reduce oral health disparities by increasing access to preventive dental services such as sealants and fluoride treatment to vulnerable children. Sealants prevent more than 80% of cavities.²⁷ Fluoride varnish reduces dental decay by approximately 40% when applied 2 to 4 times per year.²⁷

Grant funding was used to purchase equipment, supplies and to hire program staff. The program's goals are to: (1) increase children's access to preventive oral health services, (2) increase children's access to the dentist and a dental home, and (3) identify and eliminate oral health disparities within Bertie County.

Program staff includes a program director, 2 calibrated dentists, 2 public health dental hygienists, and a dental assistant. The program director provides general oversight to the program. The dentists conduct comprehensive examinations and prescribe preventive treatment to be completed by the hygienists. The hygienists and assistant provide preventive oral health services on-site, such as cleanings, radiographs (X-rays), fluoride varnish, and dental sealants. They also offer case management and oral health education. All children at the school, regardless of program enrollment status, receive oral hygiene instructions in the classroom and are given oral hygiene products, such as toothbrushes and toothpaste. Group oral hygiene instructions include videos, interactive games, and didactic instructions that are grade-level appropriate. The program bills dental insurances for the services provided. There are no out-of-pocket expenses for parents/guardians, regardless of insurance status.

The program uses portable dental equipment set up in a dedicated, secure space within each school. During the clinical examination, dentists and staff record the teeth present, existing sealants, number of decayed

teeth, and note any urgent care needs. Diagnostic radiographs are completed on most patients at the discretion of the attending dentist. Approximately twice a year, most participants will receive a dental cleaning, a topical fluoride treatment, oral hygiene instructions, and dental sealants, if indicated. The program staff works closely with school staff to minimize interruptions to the classroom activities. The total amount of time spent outside of the classroom for each child is approximately 60 minutes.

A report card is sent home with each student to inform the parent/guardian of the oral examination findings, the planned procedures, and treatment recommendations. Children that require treatment for decay are given the option to have treatment at an East Carolina University School of Dental Medicine satellite clinic, approximately 30 miles away, or another dentist of their choice. The program staff works with families to resolve barriers that affect access to dental care, including finances, transportation, and language barriers, with the ultimate goal to establish a dental home at the East Carolina University School of Dental Medicine.

PHASE 6: PROCESS EVALUATION

Process evaluation was continuously used to review and refine the program. The process evaluation included record keeping and data collection. A tracking system was used to document the numbers of consent forms returned, educational sessions conducted, carious lesions found, sealants placed, and type of restorative work done. Data from parents/guardians and school staff are collected to assess their satisfaction with the oral health program.

PHASE 7: IMPACT EVALUATION

In the initial 4 months of program implementation, 138 elementary school children were examined. Approximately 82% of the children were enrolled in Medicaid, and 35% had active dental decay, with some having urgent needs such as pain or swelling. We also assessed parent/guardian perceptions of their child's oral health by asking 86 parents/guardians to describe their child's oral health as either excellent, very good, fair, or poor and compared these perceptions to their child's clinical oral health status. Sixty percent of parents/guardians whose child had active dental disease reported their child's oral health to be excellent, very good, or good. Two percent of children had urgent dental needs, and all parents/guardians of these children reported their child's oral health status as excellent, very good, or good. Of the children with no active dental disease, 25% of parents/guardians said their child's oral health was fair or poor. These findings suggest that parent/guardian perceptions often do not

align with a child's oral health status and that strategies are needed to improve parent/guardian awareness of their child's oral health.

LESSONS LEARNED

The PRECEDE phases of the Model helped emphasize the importance of determining program goals and objectives, while the PROCEED phases underlined the importance of effective program evaluation. The community-academic partnership achieved positive outcomes by embracing a joint mission and principles of understanding and sharing responsibility and recognition. Facilitating factors included: (1) fostering and maintaining collaborations within a rural context, (2) an equitable community-academic partnership, (3) culturally relevant practices, and (4) emphasis on bi-directional learning and capacity building. Challenges faced were communication with parents/guardians, information gathering, and providing care during COVID-19.

The oral health program learned the importance of: (1) cultural competency and motivational interviewing skills are valuable tools to communicate with parents/guardians; (2) attendance at school events to answer parent/guardian questions; (3) marketing the program among schools builds trust; (4) program evaluation to meet the needs of the schools, teachers, parents/guardians, and students; (5) assuring all children receive follow-up care; and (6) insurance reimbursement, enrollment, and continued strengthening of the community-academic partnership for program sustainability.

IMPLICATIONS FOR SCHOOL HEALTH AND EQUITY

School-based oral health programs can significantly improve the oral health of vulnerable children, improving cognition, reducing missed classroom hours, and maximizing the ability of a child to reach their full academic potential. All school districts, especially those that are rural and have a significant proportion of socioeconomically disadvantaged students, should consider a school-based oral health program. School-based oral health programs can be set up in various ways, including fully equipped mobile vans or portable equipment set up inside a school. The needs and resources of a community will help determine the type of program that is right for a specific school district. For help in decision making regarding school-based oral health programs, school districts can:

- Contact the public health department or state Office of Oral Health to learn how to participate in existing school-based oral health programs or develop one in a school.
- Contact the state Office of Oral Health to identify local mobile dental program providers.
- Contact a local community health center or university dental school to determine how best to participate in oral screening programs or how to advocate for a program if one does not exist.

The COVID-19 pandemic has created special circumstances related to school-based oral health programs. Many dental procedures produce aerosols, which is the primary mechanism of the spread of this virus. Clinical areas need to have proper filtration, be isolated from non-clinical areas, and no person should enter the clinical area without the required personal protective equipment. Additionally, clinical staff should make every effort to reduce or eliminate aerosol-producing procedures. It is important that clinical staff, and school staff, understand these risks and take proper precautions to mitigate risks and maintain a safe environment for students, clinical staff, and school staff.

Human Subjects Approval Statement

The content presented in this paper is solely the responsibility of the authors and does not represent the official views of East Carolina University. Human Subjects review was provided by the East Carolina University and Medical Center IRB (#20-000864).

Conflict of Interest

All authors of this article declare they have no conflicts of interest.

REFERENCES

1. 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 Institute of Dental and Craniofacial Research, National Institutes of Health; 2000.
2. Neidell M, Shearer B, Lamster IB. Cost-effectiveness analysis of dental sealants versus fluoride varnish in a school-based setting. *Caries Res*. 2016;50(Suppl 1):78-82.
3. Dye BA, Thornton-Evans G, Li X, Iafolla TJ. Dental caries and sealant prevalence in children and adolescents in the United States, 2011-2012. *NCHS Data Brief*. 2015;191:1-8.
4. Griffin S, Naavaal S, Scherrer C, Griffin PM, Harris K, Chattopadhyay S. School-based dental sealant programs prevent cavities and are cost-effective. *Health Aff (Millwood)*. 2016;35(12):2233-2240.
5. Como DH, Stein Duker LI, Polido JC, Cermak SA. The persistence of oral health disparities for African American children: a scoping review. *Int J Environ Res Public Health*. 2019;16(5).
6. Spetz J, Pourat N, Chen X, et al. Expansion of dental care for low-income children through a mobile services program. *J Sch Health*. 2019;89(8):619-628.
7. Chaffee BW, Rodrigues PH, Kramer PF, Vítolo MR, Feldens CA. Oral health-related quality-of-life scores differ by socioeconomic status and caries experience. *Community Dent Oral Epidemiol*. 2017;45(3):216-224.

8. Guarnizo-Herreño CC, Lyu W, Wehby GL. Children's oral health and academic performance: evidence of a persisting relationship over the last decade in the United States. *J Pediatr*. 2019;209:183-189.e182.
9. Newacheck PW, Hughes DC, Hung YY, Wong S, Stoddard JJ. The unmet health needs of America's children. *Pediatrics*. 2000;105(4 Pt 2):989-997.
10. Binkley CJ, Johnson KW. Application of the PRECEDE-PROCEED planning model in designing an oral health strategy. *J Theory Pract Dent Public Health*. 2013;1(3):1-18.
11. United States Census Bureau. Bertie County, North Carolina. Available at: https://www.census.gov/quickfacts/fact/table/NC_bertiecountynorthcarolina,US/PST045219. Accessed October 8, 2020.
12. North Carolina Department of Commerce. 2020 North Carolina development tier designations. Available at: https://files.nc.gov/nccommerce/documents/files/2020-Tiers-memo_asPublished_120219.pdf. Accessed October 9, 2020.
13. Health Resources and Services Administration. Find shortage areas. Available at: <https://data.hrsa.gov/tools/shortage-area/hpsa-find>.
14. North Carolina Institute of Medicine. The North Carolina oral health action plan for children enrolled in Medicaid and N.C. Health Choice June 2013. Available at: http://nciom.org/wp-content/uploads/2017/08/ChildPrevOralHealthWeb_062813.pdf. Accessed October 9, 2020.
15. Guarnizo-Herreño CC, Wehby GL. Dentist supply and children's oral health in the United States. *Am J Public Health*. 2014;104(10):e51-e57.
16. N.C. Department of Health and Human Services. 2017-2018 North Carolina kindergarten basic screening survey. Available at: <https://publichealth.nc.gov/oralhealth/docs/NC-Kindergarten-BSS-2017-18-ae-rev022020.pdf>. Accessed May 27, 2020.
17. Albemarle Regional Health Services. Vidant Bertie Hospital's 2013 community health needs assessment. Available at: https://www.vidanthealth.com/wp-content/uploads/2020/11/2019-Bertie-County-CHNA_FINAL.pdf. Accessed October 5, 2020.
18. Centers for Disease Control and Prevention. My water's fluoride. Available at: https://nccd.cdc.gov/DOH_MWF/Default/Default.aspx. Accessed October 8, 2020.
19. Kids Count Data Center. 2018-2019. Percentage of students enrolled in free and reduced lunch in Bertie County schools. Available at: <https://datacenter.kidscount.org/data/tables/2239-percent-of-students-enrolled-in-free-and-reduced-lunch?detailed/10/5019/false/1696/any/4682>. Accessed February 4, 2021.
20. Public Schools of North Carolina. 2019. Economically disadvantaged student data. Available at: <https://childnutrition.ncpublicschools.gov/information-resources/eligibility/data-reports/data-reports>. Accessed October 11, 2020.
21. Institute of Medicine (U.S.) roundtable on health literacy. Innovations in health literacy research: workshop summary. Washington, DC: National Academies Press (U.S.); 2011. 3. The Role of Health Literacy in Health Disparities Research. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK209674/>. Accessed October 8, 2020.
22. County health rankings and roadmaps. North Carolina 2018. Available at: <https://www.countyhealthrankings.org/app/north-carolina/2020/measure/factors/65/data>. Accessed October 8, 2020.
23. American Dental Association. 2019 Health Policy Institute - Workforce. Available at: <https://www.ada.org/en/science-research/health-policy-institute/dental-statistics/workforce>. Accessed October 8, 2020.
24. Healthy People 2030. Washington, DC: U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Available at: <https://health.gov/healthypeople/objectives-and-data/browse-objectives/oral-conditions>. Accessed October 5, 2020.
25. Centers for Disease Control and Prevention. School sealant programs. Available at: https://www.cdc.gov/oralhealth/dental_sealant_program/school-sealant-programs.htm. Accessed October 10, 2020.
26. Dental caries (cavities): School-based dental sealant delivery program. Available at: <https://www.thecommunityguide.org/findings/dental-caries-cavities-school-based-dental-sealant-delivery-programs>. Accessed October 10, 2020.
27. Wright JT, Tampi MP, Graham L, et al. Sealants for preventing and arresting pit-and-fissure occlusal caries in primary and permanent molars. *Pediatr Dent*. 2016;38(4):282-308.