

Prevalence of Dental Caries and Utilization of Dental Services among WIC-participating Children: A scoping review

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ABSTRACT

Purpose Low-income children experience disproportionately high rates of dental caries and challenges in accessing dental care compared to their higher-income peers. The purpose of this scoping review was to examine the prevalence of dental caries and dental service utilization among Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) enrolled children.

Methods The literature search and review were conducted between September 2023 and February 2024. The review followed the PRISMA-ScR reporting guidelines and included three databases: PubMed, CINAHL, and Dentistry & Oral Sciences Source. The study focused on children aged one to five participating in WIC within the United States (US) and aimed to determine the prevalence of dental service utilization and dental caries in the targeted population.

Results This review includes twelve articles that are quantitative observational studies conducted from February 2001 to February 2023. Most of the studies were conducted in WIC programs in the Southern and Midwest regions of the US. Dental caries rates decreased by 61.8% from 2004 to 2016, with the highest prevalence in 2004, and the lowest prevalence in 2016. Dental service utilization among WIC children increased by 56.9% from 1992 to 2020.

Conclusion There has been an increase in dental service utilization among WIC-enrolled children, with an overall decrease in dental caries over the last two decades. However, the prevalence of dental caries remains disproportionately high for children enrolled in WIC when compared to non-participants. To develop effective dental interventions for children enrolled in WIC, it is fundamental to identify the unique determinants of dental caries in this population.

Keywords children, dental caries, health services, dental care utilization, WIC, scoping review
NDHA priority area, **Population level: Health services** (community interventions).

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INTRODUCTION

Although pediatric oral health promotion has been implemented for half a century in the United States (US), low-income children continue to experience disproportionately high rates of dental caries and challenges in accessing dental care compared to their higher-income peers.^{1,2} One promising approach to improve oral health among low-income children is through social safety net programs, such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).¹

The WIC program provides monthly food packages for eligible women, infants, and children up to age five to obtain nutritious foods such as fruits, vegetables, and whole grains and refers them to health care or other assistance programs as needed.³ In 2022, WIC enrolled around 39% of all eligible children in the US, providing significant reach and influence on low-income children by providing access to nutritional food and referral to health care.⁴ The dual enrollment in nutrition assistance programs and public insurance, such as Medicaid, can greatly improve access to oral health care.⁵ However, it is uncertain whether this increase in oral health access is improving low-income children's oral health and utilization of dental services.

The National WIC Association strongly supports efforts to improve the oral health of WIC participants.⁶ Since 1992, several WIC programs have initiated the inclusion of oral health practices within the program.^{5,7-10} One of WIC's main oral health practices is referring children for dental care.⁷ The WIC staff can assist families of eligible children in applying for the Children's Health Insurance Program (CHIP) and identify dental practices that accept public insurance.⁷ However, referrals for dental care and the availability of public insurance cannot guarantee the utilization of oral health services or the reduction in dental caries among WIC children.² Several studies have examined WIC children's oral health and dental service utilization.^{5,7-10} However, no comprehensive review has examined oral health outcomes among WIC children as of yet. Therefore, this scoping review aims to fill this gap by investigating trends in dental caries and dental service utilization among WIC-enrolled children over the past 23 years.

METHODS

A scoping review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR)¹¹ between September 2023 and February 2024. Inclusion criteria were peer-reviewed journal publications from 2000 to 2023, focusing on children aged from one to five participating in WIC within the US. Studies at national, state, and local levels were included. The targeted outcomes included the prevalence of dental caries and the prevalence of dental service utilization. All study designs were considered eligible, while exclusion criteria were studies reporting overall oral health without including the prevalence of dental caries and/or dental service utilization.

Search Strategies

One reviewer conducted the search, article selection, and data extraction. All authors reviewed and discussed the extracted data during data synthesis. Two separate searches were conducted to simultaneously observe trends in dental caries and dental service utilization and to examine any potential interaction between these outcomes. One search focused on dental caries, and the other focused on dental service utilization among WIC children. Both searches used the same databases—PubMed, CINAHL, and Dentistry & Oral Sciences Source. In each database, searches for the two outcomes were conducted on the same day.

Initial searches were conducted from September to October 2023. Each database had an assigned specific day to search for the two outcomes, followed by a week for article selection and data extraction. This was repeated for all databases. In February 2024, the searches were updated, adding only one new article on dental caries prevalence, and the review was revised accordingly. The database searches were conducted at two different points in time to enhance the consistency and reliability of the search strategy.

The keywords used to explore WIC children's participation and prevalence of dental caries were "WIC AND 'dental caries' OR 'oral health status' AND

Child OR Pediatric.” To examine WIC children’s participation and dental service utilization, the keywords used were “WIC AND ‘dental utilization’ OR ‘dental care’ AND child OR pediatric.” All articles were extracted into a reference management software program (Zotero) to conduct the initial review and check for duplicates.

Selection Process for Dental Caries Prevalence Articles

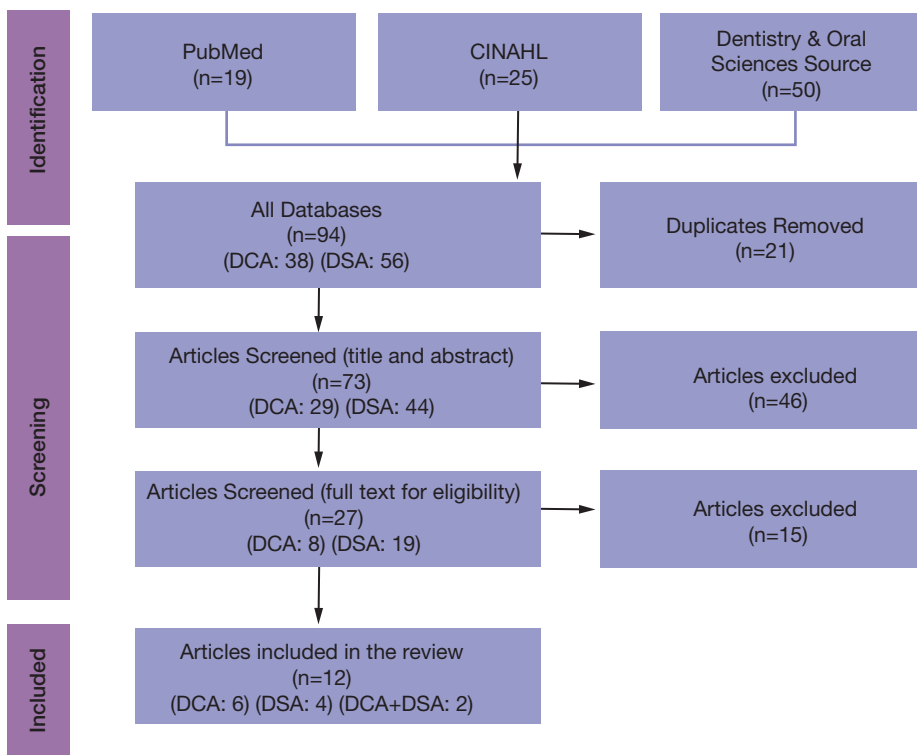
A total of 38 articles were identified after the initial search of the three databases. After removing nine duplicate records, 29 articles were left for initial review. The titles and abstracts of these articles were evaluated for relevance, and as a result, 21 articles were excluded. Articles were excluded if they did not target children or were not conducted within the WIC programs. A total of eight remaining articles met the criteria for full-text review; following the full-text review, all eight articles were included for WIC children’s dental caries prevalence.

Selection Process Dental Services Utilization Articles

A total of 56 articles were identified after the initial search in the three databases. After removing 12 duplicates, 44 articles remained for initial review. The titles and abstracts of these articles were evaluated for relevance. Following this evaluation, 25 articles were excluded. The primary reason for exclusion was that the prevalence of dental services utilization was not reported. Nineteen remaining articles met the criteria for full-text review. After the full text review, 13 articles were

excluded primarily because they were reports and non-scientific studies or reported the utilization of the caregivers. A total of six articles were included in the dental service utilization aspect of the review. The search process for the included articles is summarized in Figure 1.

Figure 1. PRISMA flow diagram of the selection process



Note: DCA: Dental Caries Articles, DSA: Dental Service Articles, n= the total number for DCA and DSA

Data Collection and Synthesis

A data extraction form was created, including the author(s) name, publication year, study period, study design, study population, study location, outcome measurement, and study results. A narrative synthesis was conducted to summarize the data from all studies, including study characteristics, prevalence of dental caries, and prevalence of dental service utilization. The result sections of all the studies were thoroughly reviewed to identify the targeted data and study outcomes. Two articles overlapped, Douglass et al.,¹² Biordi et al.,¹³ as both reported on the prevalence of dental caries and dental service utilization; each was included in both outcomes during data extraction.

RESULTS

The review included quantitative observational studies from February 2001 to February 2023 (cross-sectional, n=8; longitudinal, n=4) (Table I). While

Table I. Descriptive characteristics of the included studies (2001-2023)

Author(s)	Publication Year	Study Period	Research Design	Population	Location
Douglass et al.	2001	1994-1995	Cross-sectional	2,428 children	Arizona
Nurko et al.	2003	2001	Cross-sectional	120 children	Texas
Lee et al.	2004	1992-1997	Longitudinal	21,277 children	North Carolina
Shick et al.	2005	2003-2004	Cross-sectional	324 nutritionists	North Carolina
Weber-Gasparoni et al.	2012	Not Reported	Cross-sectional	411 children	Iowa
Biordi et al.	2015	2010 -2013	Longitudinal	4,360 children	Ohio
Gold and Tomar	2018	2013 -2016	Longitudinal	576 children	Florida
Mattheus and Cnm	2018	Not Reported	Cross-sectional	73 children	Hawaii
Mattheus et al.	2020	Not Reported	Longitudinal	176 children	Hawaii
Claiborne et al.	2022	2017-2018	Cross-sectional	10,356 children	National
Claiborne et al.	2022	2016	Cross-sectional	7,719 children	National
Sanjeevi et al.	2023	2011-2018	Cross-sectional	1,921 children	National

the majority of studies were conducted in Southern regions of the US, three studies were at the national level. The distribution of studies by states was as follows: North Carolina (n=2), Texas (n=1), Florida (n=1), Iowa (n=1), Ohio (n=1), Arizona (n=1), and Hawaii (n=2). The study participants were from two groups: WIC children (n=11) and WIC nutritionists (n=1), who reported on the oral health of WIC children. The children's ages ranged from 1 to 5 years. The outcome measures were the prevalence of dental caries (Table II) and the prevalence of dental service utilization (Table III).

Prevalence of Dental Caries

A total of eight articles discussed the prevalence of dental caries among WIC children (Table II), six cross-sectional and two longitudinal (Table I). Five studies conducted dental examinations to collect primary data on the prevalence of dental caries.¹²⁻¹⁶ However, two studies utilized secondary data from nationally representative datasets.^{1,3} One of these studies used dental examination data from the National Health and Nutrition Examination Survey (NHANES),³ while the other

used caregiver-reported data from the National Survey of Children's Health (NSCH).¹ Additionally, one study used data reported by WIC nutritionists, who were chosen due to their direct interaction with WIC children during assessments and health promotion activities.⁷

The average prevalence of dental caries among all studies was 38.16% and the range was from 10% to 71.8% (Table II). Claiborne et al. had the largest sample size of WIC enrolled children (n=7,719) and reported the lowest prevalence at 10%.¹ Shick et al. reported the highest caries rate at 71.8% from 324 WIC nutritionists.⁷ Biordi et al. conducted a longitudinal study in Ohio between 2010 and 2013 and reported a dental caries rate of 19.6%.¹³ However, Gold and Tomar conducted another longitudinal study in Florida between 2013 and 2016 and reported a higher rate of dental caries, 46%.¹⁴ Sanjeevi et al. conducted a cross-sectional study that spanned seven years (2011 to 2018).³ When comparing the average prevalence of dental caries in the Sanjeevi et al. study (29.9%)³ and the average prevalence of this review between 2012 and

Table II. WIC enrolled children's dental caries prevalence (2001-2023)

Author(s), Year	Data Collection Time	Study Tool	Prevalence of Dental Caries
Douglass et al., 2001	1994 -1995	Dental examination	25.0%
Nurko et al, 2003	2001	Dental examination	66.0%
Shick et al, 2005	2003 - 2004	Nutritionists survey	71.8%
Weber-Gasparoni et al. 2012	Not Reported	Dental examination	37.0%
Biordi et al, 2015	2010 - 2013	Dental examination	19.6%
Gold and Tomar, 2018	2013 - 2016	Dental examination	46.0%
Claiborne et al, 2022	2016	Caregiver survey	10.0%
Sanjeevi et al, 2023	2011 - 2018	Dental examination	29.9%

Table III. WIC enrolled children's dental services utilization (2001- 2022)

Author(s), Year	Data Collection Time	Study Tool	Prevalence of Dental Service Utilization
Douglass et al, 2001	1994-1995	Caregiver survey	13.0%
Lee et al, 2004	1992-1997	Medicaid claims	7.1%
Biordi et al, 2015	2010- 2013	Caregiver survey	29.9 %
Mattheus and Cnm, 2018	Not Reported	Caregiver survey	68.0%
Mattheus et al, 2020	Not Reported	Caregiver survey	64.0%
Claiborne et al, 2022	2017-2018	Caregiver survey	57.6%

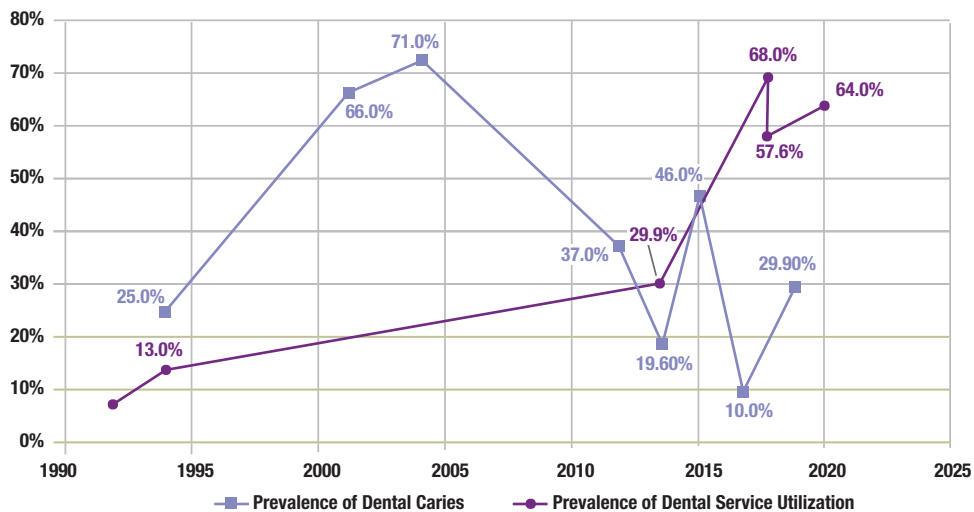
2018 (28.15%), the dental caries averages are quite similar.

The trends in the prevalence of dental caries were observed between 1994 and 2018 according to the data collection time of the review studies (Figure 2). The prevalence of dental caries increased from 1994 to 2004, then decreased from 2004 to 2013. There was a gap in the reported prevalence between 2005 and 2010; during this time, the dental caries rate dropped by roughly 52.2% from 71.8% to 19.6%. Between 2013 and 2018, the prevalence rate of dental caries fluctuated, reaching the highest point in 2015 and the lowest point in 2016. Overall, between 2004 and 2016, the prevalence rates of caries decreased by 61.8%, with the highest prevalence in 2004 and the lowest prevalence in 2016.

Prevalence of Dental Service Utilization

Six studies reported the prevalence of dental service utilization among WIC children; three were cross-sectional, and three were longitudinal. Most studies depended on the reported utilization prevalence from the caregivers; four used primary data, and one used secondary data from the National Survey of Children's Health (NSCH). Only one study, Lee et al.,⁵ used Medicaid claims between 1992 and 1997

Figure 2. Prevalence trends of dental caries and dental service utilization of WIC enrolled children (1992- 2020)



to measure the WIC children’s dental service utilization, and it was the only study to examine the impact of WIC participation on dental emergency services.

The utilization rate ranged from 7.1% to 68.0%, with an overall average of 39.9% (Table III). Claiborne et al. used nationally representative data from 2017-2018 and reported a utilization rate of 57.6%.¹⁷ Two studies conducted in Hawaii by Mattheus et al. reported the highest prevalence in this review: 68.0% in 2018 and 64.0% in 2020.^{8,18} While the researchers did not report the data collection time of both studies, and it was assumed that the data was collected in the same publication years.^{8,18} Two longitudinal studies found that children’s participation in WIC may have increased dental service utilization by 23% in North Carolina⁵ from 1992 to 1997 and by 15.5% in Ohio¹³ from 2010 to 2013. However, regardless of this increase in North Carolina, dental services utilization among WIC children was extremely low between 1992 and 1997.⁵

The trends in dental service utilization were observed according to the data collection years 1992-2020 (Figure 2). Dental service utilization increased by approximately 60.9% between 1992 and 2018. Two studies in 2018 reported the prevalence of dental service utilization, averaging 62.8%. According to this average, dental service utilization increased to 64% in 2020. There was a significant gap in the reported utilization data between 1997-2010. During this time, WIC children’s utilization rate increased by 22.8%. Overall, dental services utilization increased among WIC children by approximately 56.9% from 1992 - 2020.

Interaction of the Prevalence of Dental Caries and Dental Service Utilization

There was an upward trend between 1994-2004 in both the prevalence of dental caries and the utilization of dental services, with a 46.8% increase

in dental caries and an approximate 14.9% increase in dental services utilization (Figure 2). A shift occurred after 2004 with a sharp decline in the prevalence of dental caries; however, dental service utilization continued to increase steadily. Between 2013 and 2015, dental caries and dental services utilization simultaneously increased, reaching the same rate of approximately 45% in 2015.

From 1994 to 2013, dental service utilization was lower than the dental caries rate. In 2013, dental service utilization exceeded the dental caries rate. However, after 2015, both rates slightly fluctuated, although the prevalence of dental caries remained lower than the 2004 peak.

DISCUSSION

This scoping review examined the rates of dental caries and utilization of dental services among WIC-enrolled children from studies published from 2000 to 2023. However, the data collected in these studies ranged from 1992-2020. The review included studies from WIC programs in the Midwest, South, and West regions, but there were no studies from Northeast region. Over the past 23 years, only three national studies have been conducted on the oral health of WIC enrolled children, highlighting

the need for more national studies on this research area. Review studies have also identified significant gaps in time between data collected and the reporting of the outcomes. For instance, there was a 5-year gap in data reported on dental caries between 2005 and 2010 and an even larger gap in utilization data between 1997 and 2010. It is essential to prioritize this research area among the oral health research agenda to gain a better understanding of the oral health of low-income children participating in public assistance programs such as WIC.

Prevalence of Dental Caries

The available research on the prevalence of dental caries in WIC children is mainly based on cross-sectional studies. There is a need for longitudinal research to track the incidence of dental caries in WIC children and offer comprehensive insights into oral health in this demographic. Moreover, the reviewed studies that reported either extremely high or low rates of dental caries relied on data reported by caregivers or WIC staff. This raises concerns about potential information bias and questions about the accuracy of measuring dental caries rates reported by caregivers or WIC staff.

Over the past two decades, there has been a steady decline in the overall prevalence of dental caries in children.¹⁹ However, between 1988 and 2004, the prevalence of caries among children in the United States increased by 4%.²⁰ According to this review, WIC children had a more significant increase of 46.8% from 1994 to 2004.¹⁹ In 2000, the Surgeon General's report highlighted the increased rates of dental caries among children and the disparities observed among different groups.¹⁹ Anticipatory guidance was developed in response to the 2000 report to modify or eliminate practices and behaviors that increase the risk of caries disease among children.²¹

One major factor that contributed significantly to the reduction in caries prevalence after 2000 was implementing anticipatory guidance through the establishment of a dental home for children.²² A dental home is a long-term relationship between a dentist and a patient that implements anticipatory guidance

involving preventative care, comprehensive treatment, and referral.²¹ One study compared low-income children with a dental home to children without one.²¹ Children with a dental home had significantly lower rates of dental caries and cariogenic feeding practices.²¹ Currently, there is no information on the number of WIC children with established dental homes. The WIC programs can play a crucial role in promoting anticipatory guidance, particularly by offering oral health education to caregivers, providing nutritional counseling related to oral health, and referring children to establish a dental home by age one.²¹ This approach could help reduce the inequality in dental caries prevalence among WIC enrolled children.

Overall, children enrolled in WIC experienced higher dental caries rates than the general population.^{1,3} The unique determinants and distribution of dental caries among children enrolled in WIC need to be examined to address this continued disparity among this vulnerable population. A national surveillance system that monitors subgroups at higher risk of dental caries, such as WIC, is necessary to continually assess the prevalence of dental caries to develop targeted oral health interventions.

Prevalence of Dental Service Utilization

This review highlights a significant gap in the literature regarding the assessment of dental service utilization among WIC enrolled children using clinical data. More research based on clinical data is needed to reduce the chance of recall bias from reported data. Furthermore, the evaluation of dental emergency service use among children enrolled in WIC is significantly understudied, warranting further investigation. This scoping review identified only one study that found an association between WIC participation and the use of dental emergency services. Additionally, it is crucial to confirm a causal link between WIC activities and children's dental service utilization, including the types of dental visits.

According to this review, the utilization rate of dental services among WIC enrolled children between 1992 and 1997 was low. During this time, the average utilization rate for children enrolled in WIC was 10.0%,

which is lower than the average utilization rate of 17.3% for children in the US.²³ A steady rise was observed in the utilization of dental services by WIC enrolled children from 2010 to 2020. The increase in dental service utilization could be explained by the significant efforts made during the late 1990s and early 2000s to improve dental care access for children under Medicaid and the Children's Health Insurance Program (CHIP).²⁴ Some of these efforts were raising reimbursement rates, reforming administrative processes, and conducting outreach and education for both providers and patients.²⁴ In 2021, 77.4% of low-income children were covered by public health insurance with dental benefits.²²

The average utilization during 2010-2020 among WIC enrolled children was 54.9%, slightly higher than the national rate of 50.0%.²⁵ Even during the pandemic, children enrolled in WIC showed a higher utilization at 64.0% compared to 51.3% nationally.²⁶ Three studies in this review reported that WIC participation may increase overall dental service utilization.^{5,13,17} However, lower-income non-WIC participants were less likely to receive dental care.¹⁷ Specifically, children enrolled in WIC for a full year were approximately 1.7 times more likely to have two or more dental visits per year compared to those who never participated in WIC.⁵ In particular, those children were more likely to have preventive or restorative visits but were less likely to have emergency dental visits.⁵ This could indicate that WIC participation may help establish early oral care routines, resulting in more planned and less urgent dental care.⁵

Dental Service Utilization and Dental Caries

Results from this scoping review indicate that children enrolled in WIC had increased utilization of dental care; however, their dental caries rate is still persistently higher than that of the overall population. A recent study found that children with higher dental utilization levels had higher caries rates.¹⁹ Similarly, another study found that the high utilization of Medicaid insurance was associated with an increased risk of dental caries among children.²¹ This could indicate that with increasing dental service utilization, there is

a higher possibility of identifying and reporting dental caries. This also could reflect that dental services utilized by children are for treatment, not prevention.¹⁹ Further, the high utilization level may indicate the need for re-treatment.²¹ One study showed that low-income children had over 50% recurring caries after restorative treatment.²¹ When evaluating children's oral health, it is important to distinguish between treatment and preventive utilization. This helps to understand the effect of preventive utilization on caries rates. Combining treatment and preventive utilization makes it difficult to understand the association between dental service utilization and dental caries. Further, assessing the type and frequency of dental preventative services is key to understanding the connection between utilization and caries rates. More research is needed to explain the association between dental services utilization and dental caries rate among children enrolled in WIC.

When examining the trends of dental service utilization and dental caries together, dental service utilization showed an overall increase; however, the prevalence of dental caries does not follow a consistent trend. The higher utilization of dental services did not always reflect the lower prevalence of dental caries except between 2004 and 2013. During this time, there was a decrease in the prevalence of dental caries and an increase in the utilization of dental services. None of the review studies evaluated the impact of WIC children's dental service utilization on dental caries rates. This creates a significant gap in the literature about the correlation between the prevalence of dental caries and dental service utilization among WIC children.

Interprofessional Collaboration between WIC and Dental Professionals

Dental professionals could help develop oral health modules for WIC staff or provide oral health services directly to WIC participants.⁹ Dental professionals such as dental hygienists can assist in creating standardized, structured oral health modules for WIC staff, empowering them to provide basic oral health education, screenings, and referrals to dental care providers who accept public insurance

like Medicaid.^{9,10} Additionally, dental professionals can directly provide oral health services such as fluoride varnish applications for WIC participants. This collaborative model not only enhances the accessibility of dental care for WIC enrolled children but also fosters a comprehensive approach to health promotion that includes oral health as a critical component of overall well-being.^{10,14}

Policies have a foundational role in enabling collaboration between dental professionals and WIC programs.¹⁴ For instance, policies enabling dental hygienists to provide dental screenings and fluoride applications could potentially help reduce dental caries rates among WIC children. This approach requires policy support to further integrate dental hygienists and oral health promotion into existing WIC services.

Healthy People 2030 Oral Health Objectives and WIC

Healthy People 2030 oral health objectives include a specific aim (OH-9) for increasing the utilization of preventative services among low-income children; however, there is no specific aim to reduce caries prevalence among low-income children.²⁷ From this review, it was evident that the prevalence of dental caries is a concern among WIC enrolled children, who are typically from low-income households. The OH-9 oral health objective is to reach a 79.9% dental care utilization rate among low-income children.²⁷ According to the nationally representative studies in this review, dental service utilization among WIC-participating children would need to increase by approximately 22.3% to meet this goal.¹⁷ Additionally, the OH-02 goal is to reduce active dental caries among all children to reach 10.2%.²⁷ The prevalence of dental caries among children enrolled in WIC needs to be reduced by approximately 19.7% to meet the OH-02 target by 2030.³ It is important to align WIC goals with the oral health targets set by Healthy People 2030 and to establish a monitoring system to evaluate the oral health of WIC children to facilitate targeted interventions within the WIC program.

LIMITATIONS

There are several limitations to consider in this scoping review. Although the eligibility years were from 2000 to 2023, two studies included data from before 2000, specifically dating back to 1992. Additionally, three articles did not report the data collection time, and publication time was considered a proxy for the data collection time, which may impact the accuracy of the review results. Most of the studies reviewed were cross-sectional, providing only a prevalence of the targeted outcomes at a specific time. Thus, the specific dynamics of dental caries and service utilization over time remain unknown.

The results reported in this review may not accurately represent the WIC population due to the combination of local and national studies. One specific limitation is related to the reported dental service utilization in the study by Lee et al.⁵ The reported prevalence did not distinguish between WIC and non-WIC participants, although more than 50% of the sample were WIC participants. The utilization rate was reported as pertaining to WIC participants, which may not fully capture the prevalence of WIC enrolled children.

This review has potential biases. Some studies utilized a convenience sample of WIC programs, which might have caused selection bias and reduced the representation of children enrolled across different WIC programs. Additionally, many studies relied on reported data from caregivers or staff, which can lead to recall bias. Confounding effect is also a concern, as not all studies controlled for influential factors such as oral hygiene practices and dietary habits when examining dental caries or access to dental care when examining dental care utilization. One of the major concerns with the review studies is the high level of inconsistency in study designs and effect sizes of the oral health outcomes.

CONCLUSION

Over the last two decades, there has been an increase in dental service utilization among WIC-enrolled children, with an overall decrease in dental caries. It is unclear whether there is a correlation between dental

service utilization and dental caries. However, the prevalence of dental caries remains disproportionately high for children enrolled in WIC compared to their peers. Identifying the unique determinants of dental caries among WIC enrolled children is fundamental to developing effective dental interventions for this population. Further investigation is needed to understand the utilization of preventive services and its impact on the dental caries rate among children enrolled in WIC. Collaboration between WIC and dental professionals is crucial for promoting oral health, training WIC staff, and increasing access to oral health services. However, policy support is also necessary for successful collaboration.

DISCLOSURES

The authors have no conflicts of interest to disclose.

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