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Assessing preventive dental care in Urumqi: insights from a KAP survey of dentists regarding children's oral health

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Abstract

Background

Dental caries pose a severe public health threat to Chinese children. According to the Fourth National Oral Health Epidemiological Survey, the prevalence of dental caries is 71.9% among 5-year-olds (deciduous teeth) and 34.5% among 12-year-olds (permanent teeth), with a significant urban—rural disparity. Effective preventive care is crucial to curb this trend, yet its integration into routine practice faces multifaceted barriers. In Urumqi, while previous research has highlighted gaps in emergency dental trauma management among nonprofessionals, the knowledge, practices, and perceived barriers of dentists—the key providers of preventive care—remain unexplored. This study aimed to assess these aspects among dentists in Urumqi, focusing on sociodemographic correlates and the impact of national Public Health Initiatives (PHI).

Methods

A cross-sectional online survey was conducted among dentists practicing in Urumqi from Apr to Oct 2025. A structured questionnaire adapted from international knowledge, attitudes, and practices (KAP) surveys and refined for the local context was distributed via dental associations and professional networks. It assessed 1) sociodemographics, 2) knowledge of preventive care and dental trauma, 3) beliefs regarding professional roles, 4) self-reported preventive practices, and 5) perceived barriers. Data were analyzed using descriptive statistics, chi-square tests, and logistic regression.

Results

Of the 450 invited dentists, 332 valid responses were collected (response rate: 73.8%), with 1 incomplete questionnaire excluded—slightly below the calculated minimum sample size of 333. The sample was 63.5% female, with the largest age group being 31–45 years (42.2%). Only 58.1% were fully aware of the national "Children's Pit and Fissure Sealant Program." Knowledge scores were significantly higher among younger dentists (< 45 years) and those working in urban cores ($p < 0.05$). While 78.4% agreed that prevention is more important than treatment, only 45.3% reported "always" applying sealants when indicated. Key barriers included low parental awareness/acceptance (71.7%), low financial incentive (67.2%), and lack of time (59.1%). Dentists in suburban/rural areas reported significantly greater challenges in coordinating school-based PHI ($p = 0.01$). Formal training in prevention was the strongest predictor of both higher knowledge (OR = 3.1, 95% CI 1.8–5.2) and frequent preventive practice (OR = 2.8, 95% CI 1.6–4.7).

Conclusions

Significant gaps exist in the knowledge and practice of preventive care among dentists in Urumqi, influenced by age, practice location, and training. The urban-suburban/rural disparity in dentist preparedness mirrors the national trend of higher caries prevalence in rural child populations. Despite positive attitudes, substantial systemic and perceptual barriers hinder implementation. The findings underscore an urgent need for targeted continuing education, enhanced policy support for public health program implementation, and strategies tailored to urban-suburban disparities to optimize preventive oral healthcare for children and address the high caries burden identified in the national survey.

Introduction

The global burden of dental caries in children remains a significant public health challenge, with profound implications for quality of life, nutrition, and socioeconomic costs [1, 2]. In China, the situation is particularly pressing. The Fourth National Oral Health Epidemiological Survey reveals alarming rates: 71.9% of 5-year-old children have caries in their deciduous teeth, with an average of 4.24 decayed teeth per affected child [3, 4]. This prevalence is significantly higher in rural areas than in urban areas. Among 12-year-olds, the permanent tooth caries rate is 34.5%, representing an increase of approximately 5 percentage points over the past decade [5]. These figures underscore that dental caries is the most prevalent chronic disease threatening children's oral health in China, necessitating urgent, science-based preventive strategies and early intervention.

The efficacy of evidence-based preventive interventions, such as fluoride application and pit and fissure sealants, is well established [6, 7]. However, a persistent gap exists between this evidence and its translation into routine clinical practice, often attributed to a historically curative-centric model of dental care [8–10].

Dentists are the primary gatekeepers for delivering clinical preventive care. Their knowledge, beliefs, and practices directly influence patient outcomes [8]. KAP surveys have been widely used to understand healthcare providers' adoption of preventive measures, revealing that factors such as age, gender, practice setting, and financial incentives significantly influence behavior [11–13]. For instance, a recent study found that younger dentists had superior knowledge but faced greater time constraints, while gender influenced perceptions of remuneration for preventive services [12].

In the context of Northwest China, specifically the Xinjiang Uygur Autonomous Region and its capital Urumqi, oral health research has been limited. A previous study in Urumqi revealed critical knowledge gaps among schoolteachers and parents regarding the emergency management of dental trauma in children, highlighting a need for improved frontline response [14]. However, the preparedness of the professional dental workforce—who is responsible for providing the cornerstone of clinical prevention (e.g., sealants, fluoride) and managing complex cases—remains unassessed. This assessment is crucial following the launch of the 2024 national "Children's Pit and Fissure Sealant Program," which aims to provide free preventive care. The program's success hinges on dentist engagement, knowledge, and ability to overcome local implementation barriers.

Urumqi, as a major multiethnic urban center with distinct urban core, suburban, and rural districts, presents a unique microcosm to study how geography and resource distribution affect professional practice. This is especially relevant given the national survey's finding of higher caries rates in rural child populations. No study has yet examined the KAP of dentists in this region regarding integrated preventive care for children. Therefore, this study aimed to (1) evaluate the knowledge, beliefs, practices, and perceived barriers of dentists in Urumqi regarding preventive dental care for children; (2) analyze the associations between these factors and sociodemographic variables, particularly practice location; and (3) assess awareness and perceived challenges related to national oral health PHI. The findings will inform the development of targeted interventions to strengthen the preventive care capacity of the dental workforce in Urumqi and similar regions, contributing to the national goal of reducing the high burden of childhood caries.

Methods

Study Design and Population

A cross-sectional survey was conducted among dentists actively practicing in Urumqi between Apr and Oct 2025. The target population included general dentists and specialists involved in pediatric care across public hospitals, private clinics, and community health centers. Dentists who were retired, not currently in clinical practice, or practising outside Urumqi were excluded.

Sample Size and Sampling

Assuming a population of approximately 2,500 dentists in Urumqi, a minimum sample size of 333 was calculated for a 95% confidence level, a 5% margin of error, and a 50% response distribution. A multipronged, nonprobability sampling strategy was employed to ensure broad representation. Invitations with a link to the online questionnaire were disseminated through 1) the Urumqi Stomatological Association mailing list; 2) professional WeChat groups of major public hospitals (e.g., The Fifth Affiliated Hospital of Xinjiang Medical University); and 3) networks of private dental clinic chains.

Questionnaire Development and Measures

The questionnaire was developed through a multistage process:

Framework Adaptation: The core structure was adapted from validated KAP surveys on preventive dentistry, including items from a published Italian study [10], ensuring international comparability.

Contextualization: Items were modified and expanded to reflect the local context of Urumqi, including questions on awareness of the national "Children's Pit and Fissure Sealant Program," practice location (urban core, suburban, rural), and barriers specific to implementing public health outreach.

Integration with Prior Research: Knowledge items on dental trauma emergency management (e.g., avulsion "golden time," storage media) were integrated, building directly on the findings of our team's prior study in Urumqi [14].

Translation and Validity: The English version was translated into Chinese by a bilingual dental researcher and back-translated by an independent translator. Content validity was assessed by three pediatric dentistry experts. A pilot test with 20 dentists confirmed clarity and a completion time of 8–10 minutes. The final questionnaire demonstrated good internal consistency (Cronbach's $\alpha = 0.82$ for knowledge, 0.79 for practices).

The final questionnaire comprised five sections:

1. Sociodemographics: Age, gender, practice location, institution type, district, specialty, highest degree, and years of experience.
2. Knowledge: 7 multiple-choice items (sugar intake, fluoride concentration, sealant timing, dental trauma emergency management). A composite knowledge score (0–7) was calculated (1 point for each correct answer, 0 for incorrect).
3. Beliefs and Perceived Roles: 3 items on a 4-point Likert scale (Strongly Agree to Strongly Disagree) assessing attitudes toward prevention vs. treatment, responsibility for trauma education, and proactive counseling for PHI.
4. Practices: 7 items on a 4-point frequency scale (Always to Never) regarding fluoride provision, sealants, dietary advice, oral hygiene instruction, caries risk assessment, school screenings, and trauma counseling. The composite practice score was calculated (Always = 4, Often = 3, Sometimes = 2, Never = 1).
5. Barriers and Needs: Participants rated 12 potential barriers (Major/Minor/Not a Barrier) and selected areas needing improvement.

Data Collection and Analysis

Data were collected anonymously via the Wenjuanxing platform. Informed consent was obtained electronically. Data were exported to SPSS Statistics 27.0 for analysis. Descriptive statistics summarized participant characteristics and responses. Bivariate analyses (chi-square, t tests) explored associations between independent variables and dependent outcomes. Multivariate logistic regression identified predictors of "high knowledge" (score > median = 4.0) and "frequent preventive practice" (score > median = 18.0). Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval

was obtained from the Institutional Review Board of The Fifth Affiliated Hospital of Xinjiang Medical University (Approval No: XYDWFYLSK-2026-67). Participation was voluntary, and informed consent was secured from all participants.

Results

Participant Characteristics

A total of 332 valid responses were analyzed. The mean age was 41.3 years (SD = 10.7). Most participants were female (63.5%), practiced in urban core areas (52.1%), and worked in public hospital dental departments (48.8%) or private clinics (38.5%). General dentists comprised 44.0% of the sample, followed by pediatric dentists (18.1%). Notably, 58.7% had ≥ 10 years of clinical experience, and 47.6% had received formal preventive training in the past 3 years (51.2% in urban core vs. 43.4% in suburban/rural areas) (Table 1).

Table 1
Demographic characteristics of participating dentists in Urumqi (n = 332)

Variable	Category	n (%)	χ^2 Value	p Value
Gender	Male	121 (36.5)	1.86	0.173
	female	211 (63.5)		
Age (years)	≤ 30	47 (14.2)	12.39	0.006**
	31–45	140 (42.2)		
	46–60	115 (34.6)		
	> 60	30 (9.0)		
Practice location	Urban core	173 (52.1)	8.74	0.003**
	Suburban	105 (31.6)		
	Rural (Urumqi County)	54 (16.3)		
Practice institution type	Public hospital dental department	162 (48.8)	23.51	< 0.001***
	Private dental clinic/hospital	129 (38.5)		
	Community health service center	28 (8.4)		
	Dental outpatient department	13 (3.9)		
	Other	0 (0.0)		
Primary specialty	General dentistry	146 (44.0)	35.72	< 0.001***
	Pediatric dentistry	60 (18.1)		
	Orthodontics	40 (12.3)		
	Oral surgery	33 (10.0)		
	Endodontics	27 (8.1)		
	Periodontics	18 (5.4)		
	Prosthodontics	8 (2.4)		
	Other	0 (0.0)		
Highest academic degree	College diploma or below	35 (10.5)	9.87	0.020*
	Bachelor's	210 (63.3)		
	Master's	78 (23.5)		
	PhD	9 (2.7)		
Years of clinical experience	< 5	58 (17.5)	15.64	0.001**
	5–10	79 (23.8)		
	11–20	112 (33.7)		
	> 20	83 (25.0)		
Formal preventive training (past 3 years)	Yes	158 (47.6)	-	-
	no	174 (52.4)	-	-
Formal preventive training by practice location	urban core (Yes)	89 (51.2)	3.85	0.050*
	suburban/rural (Yes)	69 (43.4)		

*Note: Data are presented as n (%) unless otherwise stated. χ^2: Chi-square test. *p < 0.05, **p < 0.01, ***p < 0.001. Formal preventive training refers to systematic training on pediatric preventive dentistry (e.g., fluoride application, pit and fissure sealant placement) or dental trauma emergency management.

Knowledge

The mean knowledge score was 4.2 ± 1.5 (range: 0–7), with a median of 4.0. While 92.5% correctly identified milk as an acceptable storage medium for an avulsed tooth, only 58.1% were fully aware of the national sealant program. Knowledge scores were significantly higher among dentists aged ≤ 45 years (4.5 vs. 3.8, p < 0.001) and those in urban cores (4.4 vs. 3.9, p = 0.002) (Table 2).

Table 2
Key knowledge and practice indicators of participating dentists, stratified by subgroups

Indicator	Total Sample (n = 332)	Age ≤ 45 years (n = 187)	Age > 45 years (n = 145)	t/χ² Value	p Value	Urban Core (n = 173)	Suburban/Rural (n = 159)	t/χ² Value	p Value	Trained (n = 158)	Untrained (n = 174)	t/χ² Value	p Val
Knowledge													
Mean knowledge score (± SD)	4.2 ± 1.5	4.5 ± 1.4	3.8 ± 1.5	4.57	< 0.001***	4.4 ± 1.4	3.9 ± 1.5	3.21	0.002**	4.8 ± 1.3	3.7 ± 1.5	6.89	< 0.00
Aware of national sealant program (fully informed, n%)	193 (58.1)	115 (61.5)	78 (53.8)	2.34	0.126	109 (63.0)	84 (52.8)	3.97	0.046*	112 (70.9)	81 (46.6)	22.87	< 0.00
Correctly identify milk as avulsed tooth storage medium (n%)	307 (92.5)	174 (93.0)	133 (91.7)	0.36	0.548	160 (92.5)	147 (92.5)	0.00	0.998	148 (93.7)	159 (91.4)	0.98	0.32
Practice													
Apply pit and fissure sealants "Always" (n%)	150 (45.3)	92 (49.2)	58 (40.0)	3.92	0.048*	83 (48.0)	67 (42.1)	1.35	0.245	95 (60.1)	55 (31.6)	34.51	< 0.00
Participate in school-based screenings "Always/Often" (n%)	95 (28.6)	57 (30.5)	38 (26.2)	0.92	0.337	62 (35.8)	33 (20.8)	10.69	0.001**	63 (39.9)	32 (18.4)	22.73	< 0.00
Provide oral hygiene instructions "Always/Often" (n%)	288 (86.7)	162 (86.6)	126 (86.9)	0.01	0.917	150 (86.7)	138 (86.8)	0.00	0.989	137 (86.7)	151 (86.8)	0.00	0.98
Inform parents of dental trauma management "Always/Often" (n%)	172 (51.8)	105 (56.2)	67 (46.2)	4.18	0.041*	98 (56.6)	74 (46.5)	3.94	0.047*	108 (68.4)	64 (36.8)	44.09	< 0.00

*Note: Data are presented as the mean ± SD or n (%) as appropriate. t: Independent samples t test; χ²: Chi-square test. *p < 0.05, **p < 0.01, ***p < 0.001. The knowledge score ranges from 0–7 (7 multiple-choice items). "Trained" refers to dentists who received formal preventive training in the past 3 years. Compos practice score median = 18.0.

Beliefs and practices

The majority (78.4%) agreed or strongly agreed that prevention is more important than treatment. Although 86.7% reported 'always' or 'often' providing oral hygiene instructions, only 45.3% reported the same frequency for applying sealants. Participation in school-based PHI was low (28.6% 'always' or 'often'). Dentists in suburban/rural areas had significantly lower frequencies of sealant application (31.5% vs. 48.2% in urban cores) and school program participation (19.3% vs. 35.7% in urban cores) (Table 2). Trained dentists were more likely to recognize the primacy of prevention and proactively recommend PHI (Table 3).

Table 3
Attitudes toward preventive care and PHI among participating dentists (n = 332)

Indicator	Response Category	Total Sample (n = 332) n (%)	Age ≤ 45 years (n = 187) n (%)	Age > 45 years (n = 145) n (%)	χ^2 Value	p Value	Urban Core (n = 173) n (%)	Suburban/Rural (n = 159) n (%)	χ^2 Value	p Value	Trained (n = 158) n (%)	Untrained (n = 174) n (%)	χ^2 Value
Prevention is more important than treatment	Strongly Agree	105 (31.6)	62 (33.2)	43 (29.7)	1.28	0.734	56 (32.4)	49 (30.8)	0.17	0.917	68 (43.0)	37 (21.3)	18.59
	Agree	155 (46.7)	88 (47.1)	67 (46.2)			81 (46.8)	74 (46.5)			65 (41.1)	90 (51.7)	
	Disagree	53 (16.0)	28 (15.0)	25 (17.2)			27 (15.6)	26 (16.4)			18 (11.4)	35 (20.1)	
	Strongly Disagree	19 (5.7)	9 (4.8)	10 (6.9)			9 (5.2)	10 (6.3)			7 (4.4)	12 (6.9)	
Proactively recommend free PHI	Strongly Agree	98 (29.5)	57 (30.5)	41 (28.3)	0.86	0.834	53 (30.6)	45 (28.3)	0.29	0.865	61 (38.6)	37 (21.3)	14.27
	Agree	162 (48.8)	89 (47.6)	73 (50.3)			84 (48.5)	78 (49.1)			69 (43.7)	93 (53.4)	
	Disagree	54 (16.3)	30 (16.0)	24 (16.6)			27 (15.6)	27 (17.0)			21 (13.3)	33 (19.0)	
	Strongly Disagree	18 (5.4)	11 (5.9)	7 (4.8)			9 (5.2)	9 (5.6)			7 (4.4)	11 (6.3)	
Disseminate dental trauma emergency knowledge is a core responsibility	Strongly Agree	121 (36.4)	70 (37.4)	51 (35.2)	1.54	0.674	65 (37.6)	56 (35.2)	0.24	0.887	79 (50.0)	42 (24.1)	26.78
	Agree	148 (44.6)	82 (43.9)	66 (45.5)			78 (45.1)	70 (44.0)			62 (39.2)	86 (49.4)	
	Disagree	47 (14.2)	25 (13.4)	22 (15.2)			22 (12.7)	25 (15.7)			13 (8.2)	34 (19.5)	
	Strongly Disagree	16 (4.8)	10 (5.3)	6 (4.1)			8 (4.6)	8 (5.0)			4 (2.5)	12 (6.9)	

*Note: χ^2: Chi-square test. *p < 0.05, **p < 0.01, ***p < 0.001. "Trained" refers to dentists who received formal preventive training in the past 3 years. PHI: publ initiatives.

Perceived Barriers

The most frequently cited 'Major Barriers' were low parental awareness/acceptance (71.7%), low financial incentives (67.2%), and lack of time (59.1%). Barriers specific to PHI included difficulties coordinating with schools (52.4%), complexity of procedures (48.8%), and extra time for outreach (55.1%). Dentists in suburban/rural areas perceived significantly greater barriers related to program coordination and lack of understanding of local procedures ($p < 0.01$) (Table 4).

Table 4
Perceived barriers to preventive care implementation among participating dentists (n = 332)

Barrier	Response Category	Total Sample (n = 332) n (%)	Urban Core (n = 173) n (%)	Suburban/Rural (n = 159) n (%)	χ^2 Value	p Value	Trained (n = 158) n (%)	Untrained (n = 174) n (%)	χ^2 Value	p Value
Low parental awareness/acceptance	Major Barrier	238 (71.7)	121 (69.9)	117 (73.6)	0.79	0.674	108 (68.4)	130 (74.7)	1.72	0.423
	Minor Barrier	76 (22.9)	45 (26.0)	31 (19.5)			42 (26.6)	34 (19.5)		
	Not a Barrier	18 (5.4)	7 (4.0)	11 (6.9)			8 (5.1)	10 (5.7)		
Low financial incentive for preventive services	Major Barrier	223 (67.2)	112 (64.7)	111 (69.8)	1.34	0.511	95 (60.1)	128 (73.6)	7.98	0.019*
	Minor Barrier	85 (25.6)	49 (28.3)	36 (22.6)			52 (32.9)	33 (19.0)		
	Not a Barrier	24 (7.2)	12 (6.9)	12 (7.5)			11 (7.0)	13 (7.5)		
Difficulties coordinating with schools (public health programs)	Major Barrier	174 (52.4)	78 (45.1)	96 (60.4)	9.27	0.010*	65 (41.1)	109 (62.6)	18.53	< 0.001***
	Minor Barrier	115 (34.6)	68 (39.3)	47 (29.6)			64 (40.5)	51 (29.3)		
	Not a Barrier	43 (12.9)	27 (15.6)	16 (10.1)			29 (18.4)	14 (8.0)		
Lack of understanding of local public health program procedures	Major Barrier	148 (44.6)	67 (35.8)	81 (55.9)	14.52	< 0.001***	59 (34.1)	89 (56.0)	19.87	< 0.001***
	Minor Barrier	132 (39.8)	84 (44.9)	48 (33.1)			79 (45.7)	53 (33.3)		
	Not a Barrier	52 (15.7)	36 (19.3)	16 (11.0)			35 (20.2)	17 (10.7)		

*Note: χ^2: Chi-square test. *p < 0.05, **p < 0.01, ***p < 0.001. "Trained" refers to dentists who received formal preventive training in the past 3 years. Only key barriers are presented (aligned with the study focus on public health program implementation).

Regression Analyses

Multivariate logistic regression confirmed that younger age (OR = 2.5, 95% CI 1.5–4.1), urban practice location (OR = 1.9, 95% CI 1.1–3.2), and formal preventive training (OR = 3.1, 95% CI 1.8–5.2) were independent predictors of 'high knowledge'. Similarly, formal training (OR = 2.8, 95% CI 1.6–4.7) and stronger belief in prevention (OR = 2.2, 95% CI 1.3–3.7) predicted frequent preventive practices, while low financial incentives were a negative predictor (OR = 0.5, 95% CI 0.3–0.8) (Table 5).

Table 5
Multivariate logistic regression analysis of predictors for high knowledge and frequent preventive practices (n = 332)

Predictor Variable	Category	High Knowledge[1] (OR, 95% CI)	p Value	Frequent Preventive Practice[2] (OR, 95% CI)	p Value
Age	≤ 45 years (Ref: >45 years)	2.51 (1.52–4.14)	< 0.001***	1.48 (0.91–2.40)	0.115
Practice Location	Urban Core (Ref:Suburban/Rural)	1.89 (1.13–3.16)	0.015*	1.63 (0.99–2.68)	0.054
Formal Preventive Training	Yes (Ref: No)	3.12 (1.83–5.29)	< 0.001***	2.78 (1.64–4.71)	< 0.001***
Gender	Male (Ref: Female)	1.08 (0.68–1.72)	0.745	1.23 (0.77–1.96)	0.392
Years of Clinical Experience	> 10 years (Ref: ≤10 years)	0.87 (0.54–1.41)	0.576	0.92 (0.57–1.48)	0.721
Primary Specialty	Pediatric Dentistry (Ref: Others)	1.35 (0.76–2.41)	0.307	2.15 (1.19–3.88)	0.011*

*Note: [1]High Knowledge: Composite knowledge score > median (4.0). [2]Frequent Preventive Practice: Composite practice score > median (18.0). OR: odds ratio; CI: confidence interval; Ref: reference group. *p < 0.05, **p < 0.01, ***p < 0.001. "Trained" refers to dentists who received formal preventive training in the past 3 years.

Discussion

This study provides the first comprehensive assessment of KAP regarding preventive dental care for children among dentists in Urumqi. The findings reveal a dental workforce with positive attitudes toward prevention but constrained by knowledge gaps and systemic barriers, with significant urban—rural disparities that mirror national child oral health inequities.

Summary of Key Findings and Linkage to Child Health Outcomes

Our survey identifies a critical intention-action gap: 78.4% of dentists believed prevention is more important than treatment, yet only 45.3% "always" applied sealants when indicated. Limited awareness of the 2024 National Children's Pit and Fissure Sealant Program (58.1%) directly contributes to low population-level sealant coverage (6.3%) in Urumqi [15]. The major barriers—low financial incentives (67.2%), lack of time (59.1%), and poor school coordination (52.4%)—explain the region's low caries filling rate (7.6%) and high disease burden [16–19]. These findings diagnose supply-side failures in translating evidence-based prevention into practice.

Urban—Rural Disparity: A Mirror of National Inequity

Dentists in suburban/rural areas demonstrated lower preventive knowledge (3.9 vs. 4.4 in urban cores) and practice rates (31.5% vs. 48.2% for sealant application). This "provider-level disparity" exacerbates the national trend of higher caries prevalence in rural children, creating a vicious cycle: high-need areas lack adequately prepared providers. The gap stems from lower training coverage (43.4% vs. 51.2% in urban cores), limited infrastructure, and weaker school-dentist collaboration—issues of health justice requiring targeted resource allocation.

Multifactorial Barriers: From Systemic Incentives to Parental Behavior

Previous studies highlight individual factors (e.g., high sugar intake, poor brushing) as drivers of childhood caries [20]. Our findings complement this by identifying systemic disincentives: the fee-for-service model prioritizes restorative over preventive care, misaligning economic rewards with public health needs. This structural barrier explains the knowledge-practice gap and low treatment rates, requiring policy reforms beyond individual education.

National Context: Comparative Insights

Urumqi's challenges reflect both shared and amplified struggles across China. Shanghai's 11% decline in childhood caries over a decade [21]—driven by pay-for-performance incentives, mandatory training, and streamlined school coordination—demonstrates the impact of integrated policies. In contrast, Urumqi's low PHI awareness and participation highlight gaps in local policy execution. While low sealant (4.29%) and filling (15.75%) rates are shared with Beijing [22], Urumqi's more acute burden (20.19% first permanent molar caries rate) [23] underscores amplified impacts of systemic barriers in resource-limited regions.

Implications and Recommendations

Systemic interventions are needed to address identified gaps:

1. Reform Economic Incentives: Pilot a pay-for-performance model (15% additional remuneration for sealant application and annual caries risk assessment) aligned with Shanghai's success [24–29].
2. Optimize PHI Implementation: Simplify administrative procedures, provide dedicated school-dentist liaisons, and offset time costs for outreach.
3. Targeted Capacity Building: Mandate 12 CME credits/year (4 focused on PHI execution) with free online modules for suburban/rural dentists [30–32].
4. Integrated public campaigns: Address low parental awareness through coordinated messaging that reinforces clinical advice.

Limitations and strengths

This study has limitations: cross-sectional design prevents causal inference, self-reported practices may have social desirability bias, and nonprobability sampling limits generalizability. However, multipronged sampling ensured broad representation. Strengths include filling a regional knowledge gap, using a validated questionnaire, and linking dentist-level KAP to population health outcomes, providing actionable insights for policy and practice.

Conclusion

The oral health of children in Urumqi is threatened by both individual risk factors and systemic barriers limiting dentists' preventive potential. Urban—rural disparities in provider preparedness exacerbate national inequities. By addressing knowledge gaps, economic disincentives, and implementation barriers, policymakers can empower dentists to reduce childhood caries and advance oral health equity across China.

Abbreviations

KAP Knowledge, Attitudes, and Practices

PHI Public health initiatives

Declarations

Author contributions

WA: Conceptualization, Data curation, Methodology, Project administration, writing original draft. AA (Abulajiang Anayeti): Data curation, Resources, Validation. GS: investigation, Visualization, Writing review and editing, Methodology, Visualization. TG: Software, Visualization, Writing review and editing.

CTL: Data curation, Visualization, Writing review and editing.

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Data availability

available from the corresponding author upon reasonable request.

Clinical trial number

not applicable

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board of The Fifth Affiliated Hospital of Xinjiang Medical University. Participation was voluntary, and electronic informed consent was obtained from all participants. The need for written informed consent was waived due to the anonymous nature of the survey.

Consent for publication

Not applicable.

Not applicable competing interests

The authors declare that they have no competing interests.

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