e-ISSN : 2597-6052

MPPKI MEDIA PUBLIKASI PROMOSI KESEHATAN INDONESIA

Research Articles Open Access

Web-Based Caries Risk Assessment and Parental Feedback: A Cross-Sectional Implementation Study of Tegal's IDCRA School Program

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ARTICLE INFO

Manuscript Received: 30 Nov, 2025
Revised: 03 Jun, 2026
Accepted: 12 Jun, 2026
Date of Publication: 16 Jul, 2026
Volume: 9
Issue: 7
DOI: 10.56338/mppki.v9i7.9409

KEYWORDS

Dental Caries Prevention; Parental Involvement; Indonesian Digital Caries Risk Assessment (IDCRA); School-Based Dental Programs; Children's Oral Health

ABSTRACT

Introduction: Dental caries remains a major public health issue among Indonesian children, driven by poor oral hygiene and limited parental awareness. This study describes the use of the Indonesian Digital Caries Risk Assessment (IDCRA) as a web-based screening tool and parent-reporting platform.

Methods: This study employed a cross-sectional quantitative design, involving 227 students and their parents from both public and private elementary schools in Tegal, Central Java. Data were collected through dental screenings and parent feedback. Only 130 of 227 parents responded (57.3%). An analysis included descriptive statistics, validity-reliability tests, and Mann-Whitney and Chi-Square tests. Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine and Health Sciences at Universitas Muhammadiyah Yogyakarta (FKIK UMY). All participants provided informed consent to ensure their rights were protected.

Results: Private-school students had higher mean of DEF.T (Decayed, Extracted, Filled Teeth) scores compared to public school (4.91 +/- 3.6 vs 1.97 +/- 2.8; Mann-Whitney $U = 9699.500$; $p < 0.001$; $r = 0.45$). However, DMF.T scores (Decayed, Missing, Filled Teeth) did not differ significantly (1.75 +/- 2.7 vs 2.09 +/- 2.6; $U = 5824.500$; $p = 0.200$; $r = 0.09$). Among the parents, perceptions of the digital report and support for school-based oral health program were generally favorable. No statistically significant differences between school types across the questionnaire items.

Conclusion: This study demonstrates the feasibility of a locally developed IDCRA as a digital platform for school-based dental screening and communication of oral health findings to parents in the participating schools. The findings support further longitudinal and controlled evaluation of whether digital reporting leads to sustained care-seeking behavior, improved oral hygiene supervision, and reduced caries burden.

Publisher: Fakultas Kesehatan Masyarakat Universitas Muhammadiyah Palu

INTRODUCTION

Oral health is critical to children's general well-being. Dental caries is one of the most common preventable oral diseases among children, including in Indonesia, where children are particularly vulnerable due to poor dietary habits, limited access to dental care, and insufficient parental knowledge about oral hygiene. These conditions can shape children's caries risk (1,2). Since parents directly manage children's daily brushing, diet, and dental appointments, school-based oral health initiatives are more actionable when clinical results are clearly communicated. Effective management of this issue requires the active involvement of parents, who play a significant role in shaping their children's oral health behaviors (3).

Previous literature has established that caries is a public health problem, globally and in Indonesia. A survey of global caries trends in permanent teeth from 1990 to 2019 revealed that caries incidence among children aged 5-14 has remained stable at a high level, underscoring the need for more targeted interventions (4). Similarly, a Regional study in Cimahi, West Java, also confirms the high burden of caries, with 96.9% of children aged 6–8 years experiencing caries in primary teeth, and 19% already showing caries in their first permanent molars (5). School-based dental health programs, along with parental education and involvement, can support oral health promotion (3,6,7). Furthermore, parents who knowledgeable about dental hygiene are more likely to promote proper oral health practices among their children (8,9).

Digital oral health platforms may help improve communication between schools, healthcare providers, and parents by standardizing data entry, generating accessible reports, and facilitating parental feedback. The Indonesian Digital Caries Risk Assessment (IDCRA) is a web-based platform that provides digital dental screening, suitable for recording clinical conditions, calculating caries indices, and generating a digital report for parents(1,9,10). The report offers a comprehensive evaluation of oral health and provides actionable insights to parents about the necessary preventive measures. Studies have shown that when parents are better informed about their children's oral health, they are more likely to engage in practices that reduce caries risk, such as improving oral hygiene and controlling sugar intake (11). However, only a few studies have described how a locally developed digital caries-assessment platform can link school screening results with structured parental feedback in Indonesian elementary schools. Studies on school-based oral health studies mostly focused on clinical outcomes, caries prevalence, and treatment needs, leaving the implementation of digital communication and parental engagement in these programs largely limited and unaddressed. Without effective communication with parents, the screening results may not lead to preventive actions unless they receive and understand the information. Addressing these limitations, IDCRA was developed to support implementation and communication in a school dental program.

Given the gap mentioned above, this study aims to describe the implementation of IDCRA between two elementary schools in Tegal City. The DEF.T (Decayed, Extracted, and Filled Teeth) and DMF.T (Decayed, Missing, Filled Teeth) indices are compared between the two schools. Parental feedback on the Dental Examination Report is gathered and summarized. The novelty of this study lies in describing how a digital screening platform can be integrated into oral health assessments, generate reports, and collect feedback from parents within elementary schools in Indonesia. Given its cross-sectional design, the focus is on the implementation rather than on establishing causal impacts or long-term prevention.

METHOD

Research Type

This study used a descriptive, quantitative, observational design with a cross-sectional implementation approach. The design was intended to describe caries profiles and parent-reported responses at a single point in time after dental screening. The research instrument consists of a structured questionnaire specifically developed to capture parents' perspectives regarding oral health, including dental care practices, perceived usefulness of screening reports, and responses to dental examination findings. Pre- and post-behavioral change, caries incidence, or the causal effect of IDCRA on parental behavior were not measured in this study, reflecting its cross-sectional design rather than a longitudinal evaluation.

Population and Sample/Informants

The participants gathered through total sampling and included students and their guardians who were present in the school dental screening activities. A total of 227 students from selected schools were screened. The inclusion criteria included elementary school students from SD Muhammadiyah, aged 8 to 13 years. Only students whose parents or guardians provided consent and agreed to participate were included in the study. As for the exclusion criteria, it applied to students who were younger than 8 years or older than 13 years, those who did not obtain consent from parents or guardians, and those who were absent or unwilling to participate.

All of the 227 students were screened and completed the clinical data. The students' parents were invited to access the digital report and fill the feedback form. Only 130 parents or guardians submitted feedback responses, 81 from public school and 49 from the private school. Thus, the parent-feedback response rate was 57.3%.

Research Location

The study was conducted in two elementary schools, public and private, located in Tegal, Central Java. These schools provided a bounded local implementation context for comparing school types. Because only two schools were included, the setting should not be interpreted as representative of all public and private elementary schools in Tegal or Indonesia.

Instrumentation or Tool

Dental screening was conducted using the Indonesian Digital Caries Risk Assessment (IDCRA), a previously developed web-based platform designed to record dental screening and generate dental examination reports. It has been registered under property rights (HAKI) no. EC00202308933 and can be accessed through https://idcra.umy.ac.id (12). In the present study, it functioned as an electronic dental documentation tool rather than an independently evaluated predictive algorithm.

From the Figure 1 below, the platform workflow included data entry of student and school information, student's oral health behavior and contributing condition items, clinical findings, caries index data (DEF.T and DMF.T), and operator recommendations. After the examiner entered the clinical data, the system generated an individual Dental Examination Report (Figure 2). The risk classification displayed as a risk score in graph. It summarized the caries risk-related findings and preventive recommendations. In this study, the report was not evaluated as a tool for predicting caries risk.

IDCRA has previously been described and implemented in a conference publication (1). However, a formal validation study for this platform had not yet been reported in a comprehensive manner. Therefore, this study focuses on the implementation and use of the platform in school-based dental health screening activities across different settings and compares implementation outcomes between private and public schools.

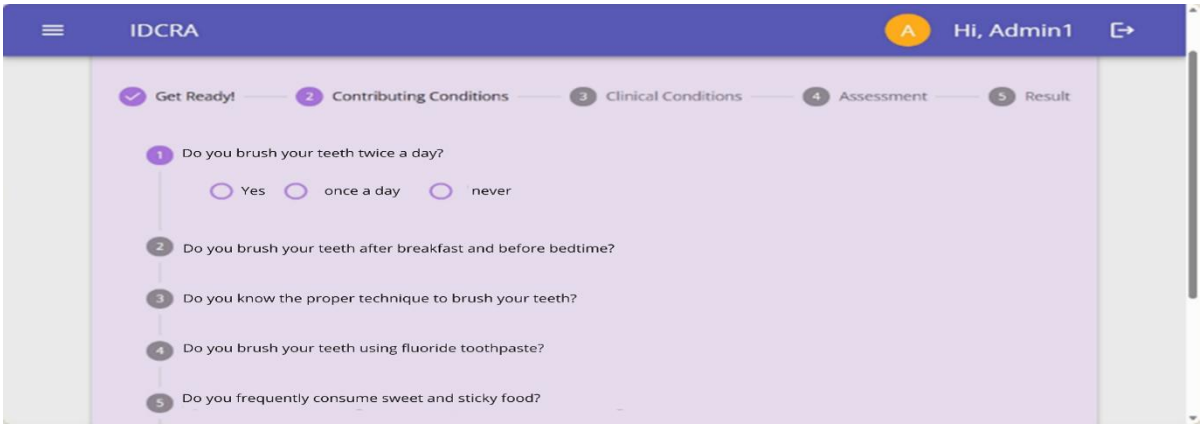

Figure 1. Indonesian Digital Caries Risk Assessment (IDCRA) website interface used for structured entry of oral-health behavior, contributing conditions, clinical findings, and caries-index data during school dental screening

Clinical assessment, digital data processing, and parental communication were treated as separate components of the implementation. Clinical screening produced the DEF.T and DMF.T. The report was generated after all data had been collected. The report was then shared with parents or guardians to support the understanding and feedback. Formal inter-examiner reliability coefficients were not available, which is acknowledged as a methodological limitation. However, standardized and consensus training were conducted prior to the study.

Following the screening, parents or guardians received an individual Dental Examination Report and a structured 10-item feedback questionnaire. The questionnaire was developed for this study to describe past dental-care behaviors, perceived usefulness of the report, feedbacks and expectations for future reporting.

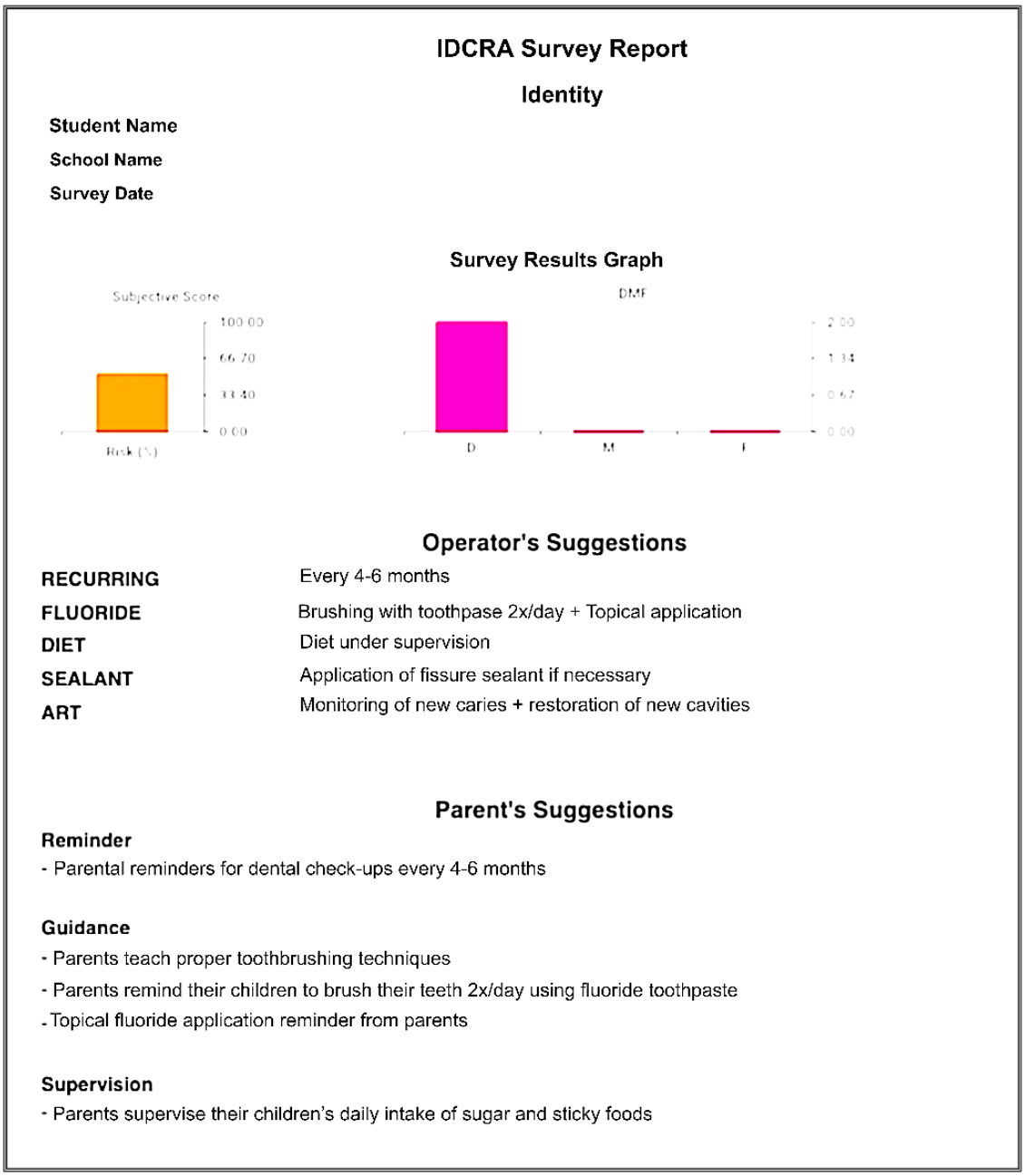

Figure 2. Example of IDCRA Dental Examination Report showing student identity, caries-screening output, operator recommendations, and parent-directed suggestions for home oral-health supervision

Table 1. Questionnaire Instruments for parents' feedback

	Instrument Components	Conceptual Domain
Q1	Have you ever taken your child for regular dental check-ups (every 6 months)?	Past Dental History & Behaviors
Q2	What types of dental treatments has your child undergone?	
Q3	What do you usually do if your child has a dental complaint?	
Q4	In your opinion, is the Dental Examination Report useful for understanding your child's dental health	Perceived Usefulness & Parental Awareness
Q5	Do you think the Dental Examination Report increases your awareness to promptly seek dental treatment for your child?	
Q6	With the Dental Examination Report, will you ensure that your child brushes their teeth as recommended? (Twice a day: in the morning after breakfast and at night before bed)	
Q7	How often should the Dental Examination Report be given to parents?	Feedback & Future Expectations
Q8	Do you agree with the implementation of free dental check-up and treatment programs at school?	
Q9	In your opinion, should dental and oral health education be provided to parents to improve their knowledge?	
Q10	What are your expectations regarding the Dental Examination Report that has been provided?	

Questions (Q1) to (Q3) describe past dental history and behaviors, including routine check-ups, previous treatments, and parental responses to dental complaints. Questions (Q4) to (Q6) describe the perceived usefulness of the Dental Examination Report for parental awareness regarding when to seek dental treatment and supervising toothbrushing habits. (Q7) asks about the preferred report frequency, while (Q8) and (Q9) gather parents' opinions on school-based dental programs and parental education. Finally, (Q10) captures expectations for future reports. Given that these items cover heterogeneous domains rather than a single validated engagement scale, they were analyzed primarily as individual, item-level parental feedback.

Data Collection Procedures

Data collection followed a two-phase approach (Figure 3). First, all participating students underwent standardized dental screenings using IDCRA. The examiners entered clinical and behavior-related information into the web. Caries indices and recommendations were also entered. Second, the generated reports were shared with parents or guardians, who were invited to complete the structured feedback form through Google Forms.

Complete-case analysis was used for parent-level questionnaire data. Among the submitted forms included in Table 7, item-level missingness was not observed. Parents who did not submit the Google Form were not included in parent-feedback analyses, and potential non-response bias is addressed in the limitations.

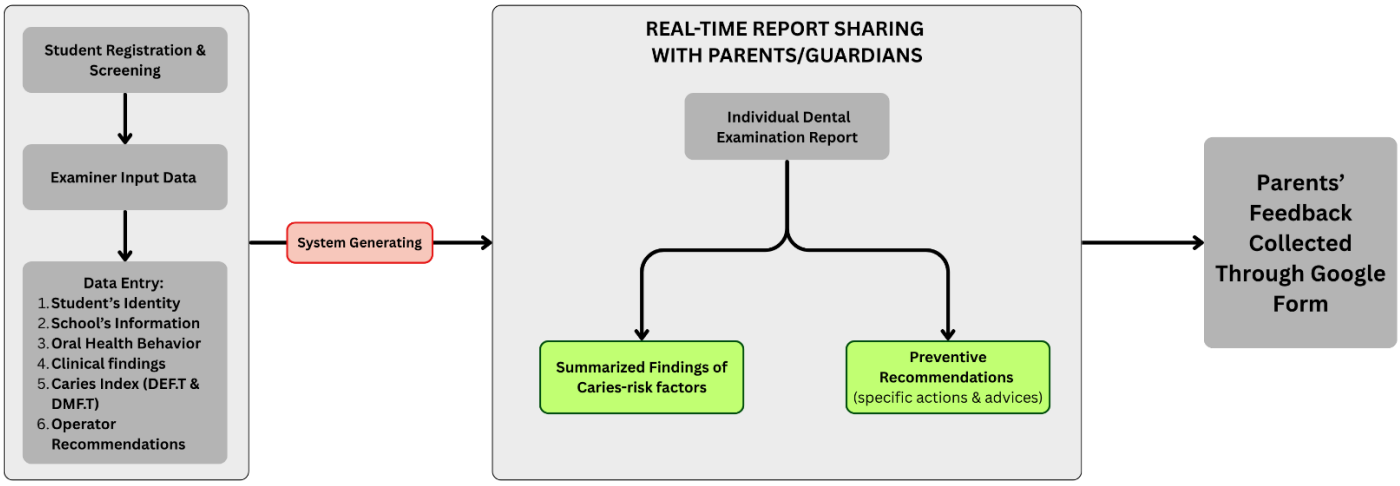

Figure 3. IDCRA School Program Workflow (Student registration, dental screening, digital report generation, parent-access, feedback collection)

Data Analysis

The data analysis in this study used descriptive analysis to summarize the students' and parents' characteristics, caries indices, and questionnaire responses. Student-level analyses used all 227 screened students, whereas parent-level analyses used the 130 complete feedback forms. Normality of DEF.T and DMF.T scores was evaluated with Kolmogorov-Smirnov and Shapiro-Wilk tests. As the data did not meet normality assumptions, non-parametric statistical tests, using the Mann-Whitney and the Chi-Square, were applied to compare caries indices between school types. Effect size (r) was calculated from the standardized test statistic, divided by the square root of the total sample size. Chi-square tests were used to explore school-type differences in questionnaire responses. Items with sparse or invariant categories were interpreted descriptively. As the study focused on exploratory bivariate analyses, multivariable adjustment for potential confounders was not conducted. Also, No formal sample-size calculation was conducted because this was a bounded school-program implementation using total sampling of available eligible participants. This limitation further acknowledged in the discussion.

Ethical Approval

This study obtained the permission of ethical clearance from the Ethics Committee of the Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, with approval number: No.161/EC-KEPK FKIK UMY/V/2025. Consent was obtained directly during the dental screening, as the students were accompanied by their guardians. For the parental feedback, the informed consent was included within the Google form.

RESULTS

The results of this study provide an overview of caries risk among elementary school children and the level of parental engagement following the implementation of the IDCRA tool. The analysis includes caries indices for primary and permanent teeth, as well as parental responses to digital feedback reports. An overview of participant demographics is provided below.

Table 2. Demographic of Screened Students and Responding Parents

	Numbers (n)	Percentage (%)	Total
School type			
Public School	106	46,7	**227**
Private School	121	53,3	
Parents' Gender*			
Public School			
Female	34	42	**81**
Male	47	58	
Private School			
Female	29	59,2	**49**
Male	20	40,8	
Parents' occupation*			
Public School			
Housewife	43	53,1	**81**
Government Employee	8	9,9	
Private Sector Employee	13	16,0	
Self-employed Worker	9	11,1	
Others	8	9,9	
Private School			
Housewife	12	24,5	**49**
Government Employee	11	22,4	
Private Sector Employee	15	30,6	
Self-employed Worker	3	6,1	
Others	8	16,3	
Children's Age			
Public School			
8-9 years	48	45,3	**106**
10-11 years	56	52,8	
12-13 years	4	3,77	
Private School			
8-9 years	51	42,1	**121**
10-11 years	70	57,9	
12-13 years	0	0	

Table 2 separates student characteristics from parent characteristics. Among the 227 screened students, 106 (46,7%) attended the public schoool and 121 (53.3%) attended the private school. The most common student age category was 10-11 years in both schools. In the public school, 56 students (52.8%) were aged 10-11 years and 48 (45.3%) were aged 8-9 years. In the private school, 70 students (57.9%) were aged 10-11 years and 51 (42.1%) were aged 8-9 years.

The demographic data was also collected from parents who completed the feedback questionnaire via Google Forms. The feedback data were available for 130 respondents. In public schools, 81 parents responded, with most fathers representing 47 responses (58%) and mothers representing 34 responses (42%). In contrast, private schools had a higher proportion of mothers participating (59.2%), than fathers (40.8%). Occupational information suggests descriptive differences in respondent background, but occupation alone should not be interpreted as a complete measure of socioeconomic status, income, health literacy, or access to care.

Table 3. Descriptive Tests

Descriptive Statistics						
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Variance**
Schools	227	1	2	1.53	.500	.250
Total DEF.T	227	0	17	3.54	3.497	12.232
Total DMF.T	227	0	12	1.89	2.758	7.606
Valid N (listwise)	227					

The descriptive analysis identified variation both in primary and permanent dentition caries indices. The overall mean score was 3.54 +/- 3.497, with a maximum value of 17, indicating substantial variation in primary teeth caries experience. In contrast, the mean DMF.T score is lower at 1.89 +/- 2.758, with a maximum value of 12. Due to the non-normal distributions, subsequent between school comparisons were interpreted using non-parametric tests.

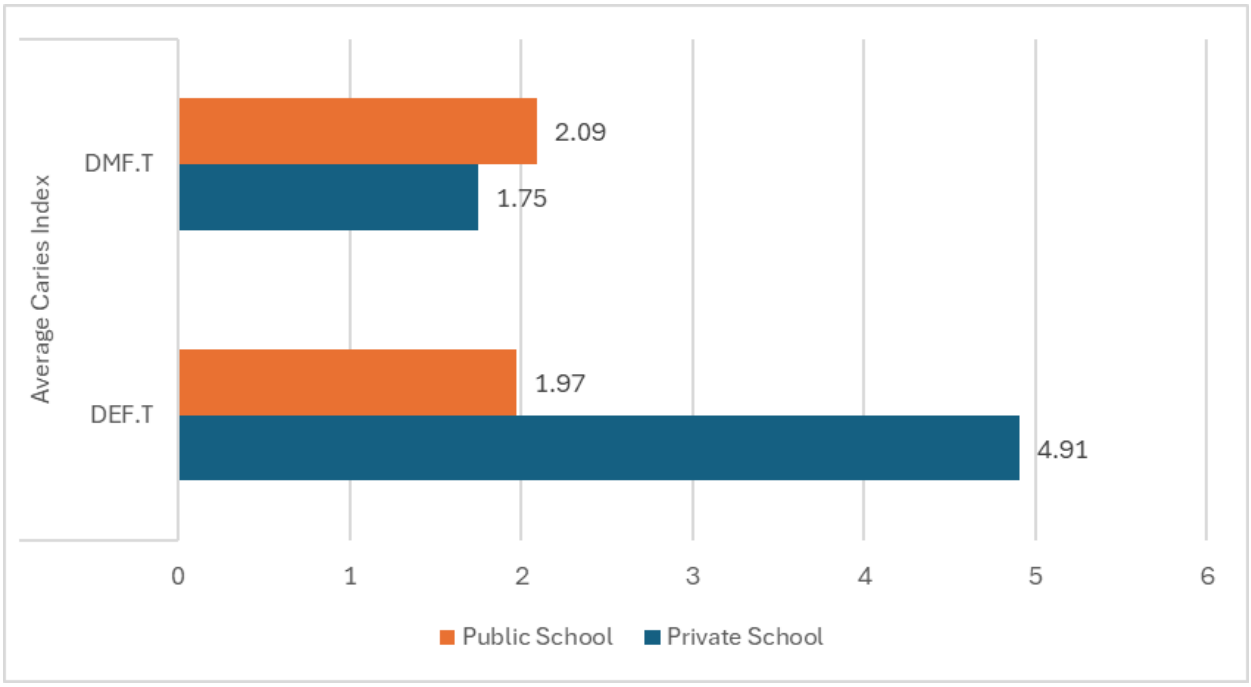

Figure 4. Mean DEF.T and DMF.T scores by school type

Figure 4 indicates that the DEF.T mean score was higher among private school students (4.91) than in public school (1.97), indicating a greater observed burden of caries experience in primary teeth in this sample. Conversely, the DMF.T mean score was slightly higher among public school students (2.09) than in private school students (1.75). As these results are derived from unadjusted descriptive analyses, they do not necessarily reflect the independent effect of school type. Differences observed may also be influenced with other factors, like age, diet, exposure to dental programs, access to dental services, and other potential confounding variables.

To assess the normality of data distribution, an assumption test was conducted to examine the differences in DEF.T and DMF.T scores between public and private elementary schools.

Table 4. Normality test

Tests of Normality							
	School	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Total DEF.T	SDN Tegalsari 1 (Public)	.317	106	.000	.728	106	.000
	SD Muhammadiyah 1 (Private)	.099	121	.006	.951	121	.000
Total DMF.T	SDN Tegalsari 1 (Public)	.272	106	.000	.782	106	.000
	SD Muhammadiyah 1 (Private)	.272	121	.000	.660	121	.000

a. Lilliefors Significance Correction

A normality assumption test was conducted to determine whether the parametric or non-parametric comparisons were appropriate. Kolmogorov-Smirnov and Shapiro-Wilk tests indicated significant deviations from normality in DMF.T and DEF.T across both schools ($p < 0.05$). As a result, this finding suggests that the next test should employ the Mann-Whitney test as a non-parametric test to compare data between schools.

Table 5. Mann-Whitney Test (DEF.T)

Independent-Samples Mann-Whitney U Test Summary (DEF.T)	
Total N	227
Mann-Whitney U	9699.500
Wilcoxon W	17080.500
Test Statistic	9699.500
Standard Error	484.791
Standardized Test Statistic	6.779
Asymptotic Sig. (2-sided test)	.000
Effect size (r)	.045

The Mann-Whitney test of the DEF.T score showed a statistically significant difference in distributions between public and private schools $U = 9699.500$; $p < 0.001$). The calculated effect size was moderate ($r= 0.45$). Consistent with the descriptive mean values, students in private schools had higher observed DEF.T, meaning that they were characterized by higher primary-dentition caries levels than those in public schools.

Table 6. Mann-Whitney Test (DMF.T)

Independent-Samples Mann-Whitney U Test Summary (DMF.T)	
Total N	227
Mann-Whitney U	5824.500
Wilcoxon W	13205.500
Test Statistic	5824.500
Standard Error	458.768
Standardized Test Statistic	-1.283
Asymptotic Sig. (2-sided test)	.200
Effect size (r)	.09

The Mann-Whitney test showed no statistically significant difference between the two schools regarding the DMF.T scores ($U = 5824.500$; $p = 0.200$). The effect size was small ($r = 0.09$), indicating the observed difference in permanent-dentition caries experience was limited in this sample.

Table 7. Descriptive Statistic Results of parental feedback related to IDCRA reports by school type

		Valid	Missing	Median	Mean	Std. Deviation	Minimum	Maximum
Q1	**Private School**	49	0	1.000	0.980	0.629	0.000	2
	Public School	81	0	1.000	0.741	0.703	0.000	2
Q2	**Private School**	49	0	1.000	0.694	0.508	0.000	2
	Public School	81	0	1.000	0.630	0.601	0.000	2
Q3	**Private School**	49	0	3.000	2.635	0.597	0.000	3
	Public School	81	0	3.000	2.605	0.701	0.000	3
Q4	**Private School**	49	0	1.000	0.959	0.200	0.000	1
	Public School	81	0	1.000	1.000	0.000	1.000	1
Q5	**Private School**	49	0	1.000	0.959	0.200	0.000	1
	Public School	81	0	1.000	1.000	0.000	1.000	1
Q6	**Private School**	49	0	2.000	1.980	0.143	1.000	2
	Public School	81	0	2.000	2.000	0.000	2.000	2
Q7	**Private School**	49	0	1.000	1.408	0.643	1.000	3
	Public School	81	0	1.000	1.370	0.715	1.000	4
Q8	**Private School**	49	0	1.000	1.000	0.000	1.000	1
	Public School	81	0	1.000	1.000	0.000	1.000	1
Q9	**Private School**	49	0	2.000	1.653	0.751	0.000	2
	Public School	81	0	2.000	1.741	0.648	0.000	2
Q10	**Private School**	49	0	1.000	0.816	0.391	0.000	1
	Public School	81	0	1.000	0.840	0.369	0.000	1

Table 8. Chi-square test analysis from parents' feedback

Questions	Chi-Square	p-Value
Q1	5,748	0,056
Q2	3,17	0,205
Q3	0,959	0,811
Q4	3,358	0,067
Q5	3,358	0,067
Q6	1,666	0,197
Q7	2,37	0,499
Q8	0	1
Q9	0,955	0,62
Q10	0,117	0,733

Questionnaire analyses indicated no statistically significant differences between public and private school across the 10 feedback items. This finding represents a descriptive comparison between respondents from public and private schools; it is not evidence that the two groups share equivalent characteristics or circumstances. Limited variation was observed for some items, particularly Q8. Thus, according to the results, the majority of parents appear to support the school-based dental check-up and parental education program

Table 9. Caries Risk Scores and Prior Dental Care Behavior Indicators by School Type

School Type	Mean ± SD		
	DEF.T (Primary Teeth)	DMF.T (Permanent Teeth)	Prior Dental-Care Behavior Indicator*
Public School (n = 106)	1.97 ± 2.8	2.09 ± 2.6	0.74 ± 0.3
Private School (n = 121)	4.91 ± 3.6	1.75 ± 2.7	0.98 ± 0.2
Total (n = 227)	3.54 ± 3.5	1.89 ± 2.8	0.86 ± 0.3

***** Prior Dental-Care Behavior Indicator, reflects prior dental-care experiences and parental responses to dental complaints (Questions 1–3).

The table shows that private school students had a higher mean of DEF.T scores, while their responding parents reported a slightly higher prior to dental-care behavior than those in public schools. Among private school students, prior dental-care behavior was also reported slightly greater (mean = 0.98) compared to those in public schools (mean = 0.74). The indicator captures prior dental-care behavior rather than direct engagement with the digital report.

DISCUSSION

Interpretation of Key Findings

This study provides baseline cross-sectional data regarding the feasibility and parental responsiveness to the IDCRA system in two elementary schools, while identifying different patterns of caries experience in primary and permanent teeth. The higher DEF.T score was observed in private school students, where the DMF.T scores did not differ significantly between school types. The parent-feedback findings indicate favorable perceptions of the Dental Examination Report among respondents, with most parents expressing support for school-based dental check-ups and parental oral health education.

Higher DEF.T scores observed in private-school students may reflect to several unmeasured mechanisms, including early-childhood dietary habits, parental involvement in children's toothbrushing, previous preventive dental care, or differences in school oral-health programs. Previous studies have reported differences in caries experience between school types. However, the extent of these differences appears to vary depending on socioeconomic conditions, access to preventive programs, and study methods (13,14). For example, other studies have suggested that public schools may benefit from more preventive measures, such as routine fluoride mouth rinses and dental sealant programs, which could contribute to lower caries among students (13). The higher primary-tooth caries experience observed in private-school students may be related to factors such as dietary habits, parental support for toothbrushing, or previous dental-care experiences. However, none of these factors were measured in the present study. Therefore, they should be viewed as potential explanations that require further investigation rather than conclusions that can be drawn from the current findings.

The absence of a significant difference in DMF.T scores may be partly related to the development of permanent teeth or the mixed-dentition phase. During this phase, the number of erupted permanent teeth varies considerably. As a result, the DMF.T index, which only includes permanent teeth, may underestimate the actual level of tooth decay until all permanent teeth have fully erupted (15). The small effect size suggests that differences in DMF.T between school types were limited in this sample.

The parent-feedback results are consistent with literature emphasizing that parents influence children's oral health behaviour through children's toothbrushing habits, food choices, access to dental care, responses to oral pain (3,16–20). This study, however, only collected parental responses through self-report after Dental Examination Report delivered to the parents. As a result, the findings mainly describe parents' perceptions and what they intended to do, rather than actual follow-up care.

From an implementation perspective, IDCRA may help organize clinical screening data and communicate the individualized report to parents in a more structured format. This potential value is relevant, especially for school program which screening alone is unlikely to achieve its full benefit when parents are not adequately informed about the results. Nevertheless, future studies are needed to determine whether receiving IDCRA reports leads to actual dental visit, improvement in children's brushing routines, changes in dietary, or a fewer caries.

Comparison with Previous Studies

Recent evidence from various countries highlights the importance of school-based oral health promotion and parental involvement. However, findings should be interpreted within their local context, as differences in study populations, methods, and socioeconomic conditions may influence the observed patterns. For instance, studies from different settings have identified a range of factors associated with children's oral health (8,21–24). A study in Egypt identified lower maternal schooling and household income as robust predictors of early childhood caries (8) and a systematic review of low- and middle-income countries reported consistent DMF.T reductions when parental components were incorporated (21). Findings from these studies suggest that oral health outcomes may be associated not only with individual and family factors, but also with the characteristics of preventive programs. For example, in Mozambique overloaded curricula prevent the integration of oral health education, resulting in inadequate promotion of dental and oral hygiene (22). Similar challenges have been reported in Ghana, where the lack of structured programs has been associated with a gap between oral health knowledge and daily practices (23). In Jordan, students were found to have basic oral health awareness but low rates of preventive dental visits when oral health education was limited (24).

Against this background, it highlights the importance of effective approaches for delivering oral health information and engaging both students and parents. The growth of digital health platforms has led to the integration of telehealth services, electronic reporting systems, and digital monitoring platforms into various preventive health programs as part of health promotion and communication initiatives (25–28). These technologies are being developed across various health sectors, including oral health. In school-based oral health programs, such platforms may facilitate the delivery of health information, support parental involvement, and provide easier access to dental screening results (29,30). In response to this need, IDCRA was developed as a digital platform that integrates caries assessment with structured reporting to parents, supporting the communication of oral health findings within school-based oral health programs.

Rather than demonstrating effectiveness, the findings align with broader implementation literature suggesting that family-school communication is a necessary component of preventive or health programs. The country-specific tudies provide contextual support for school-based strategies, but direct evidence for IDCRA's long-term clinical effect need a longitudinal or controlled designs.

Limitations and Cautions

This study faced some limitations. This study used a cross-sectional design, which restricts causal interpretation and does not permit assessment of pre-post changes in parental awareness, treatment-seeking behavior, or caries incidence. This may result in response bias. Second, only two schools in one city were included, and school selection may have introduced institutional or contextual bias. Third limitation, parent-feedback analyses were based on 130 respondents (57.3% of screened students), so non-response bias is possible because parents who completed a digital form may differ from non-respondents in digital access, health interest, education, or available time. Fourth, the questionnaire was developed for implementation feedback and was not a validated parental-engagement scale. Fifth, IDCRA was used as a digital recording and reporting platform, but independent evidence of diagnostic validity, algorithmic accuracy, and examiner reliability was not available in this dataset. Sixth, analyses were primarily bivariate and did not adjust for age, sex, diet, oral-hygiene behavior, prior dental programs, or socioeconomic variables. Finally, parental feedback may be affected by social-desirability bias because respondents may provide favorable answers to school-linked health programs. Despite these limitations, the consistent parental responses across two school types suggest that IDCRA has broad applicability and is well-received in diverse educational settings.

Recommendations for Future Research

The next future studies should consider using a longitudinal design to assess the sustained impact of how the IDCRA tool can prevent caries incidence and parental behavior over time. Comparative studies involving more schools across different regions should include sample-size calculations, respondent/non-respondents comparisons, examiner calibration, psychometric validation of parantal response instruments, and multivariate models for DEF.T dan DMF.T. Implementation studies should also assess cost, digital access, training requirements, data security, and integration with existing school health programs before broader scale-up.

CONCLUSION

This cross-sectional implementation study found that IDCRA could be used as a web-based workflow for recording school dental-screening and as communication tool with parents, using the generated Dental Examination Report in two elementary schools in Tegal. A higher DEF.T scores were observed in private school students than public school students. In contrast, DMF.T scores showed no significant difference between school types. Among parents who completed the feedback form, responses were generally favorable toward the Dental Examination Report and school-based dental programs. As the study did not include baseline measurement, longitudinal follow-up, or a non-IDCRA comparison group, the findings should be interpreted as evidence of local feasibility and positive respondents' perceptions, rather than proof of improved parental engagement or reduced caries risk. Further longitudinal and controlled research is required to evaluate behavioral follow-up, clinical outcomes, and scalability.

AUTHOR'S CONTRIBUTION STATEMENT

First author, Erma Sofiani, conducted initial draft writing, investigation, data collection, supervision, research framework design, data analysis, and manuscript review. Indri Kurniasih contribute to the investigation, data collection, research framework design, and data analysis. As for Frida Arba Martadewi and Saskia Sabrina Putri, they participated in data collection, assisted in drafting the manuscript, and performed data analysis. Cahyani contributed to the Investigation, data collection, data analysis, and interpretation. Agus Dwi Sulistyantono supported coordination between the school level, obtained permissions, and served as a liaison with partner schools.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the authors utilized generative artificial intelligence (AI) tools, including ChatGPT, to improve clarity and support content development, and Grammarly to refine language and grammar. All outputs from these tools were carefully reviewed and edited by the authors to ensure originality, and the authors take full responsibility for the final content of the publication.

SOURCE OF FUNDING STATEMENTS

This study received funding from Universitas Muhammadiyah Yogyakarta (UMY), which supported its implementation. The funding body had no role in the study design, data collection, analysis, interpretation of findings, or manuscript preparation. The authors assume full responsibility for the content and conclusions presented in this research.

ACKNOWLEDGMENTS

The authors extend their sincere appreciation to the partner schools in Tegal for their invaluable support and collaboration throughout the community engagement activities. Gratitude is also expressed to the Professional Dental Education Program and the Faculty of Dentistry, Universitas Muhammadiyah Yogyakarta, for their institutional guidance and assistance. Finally, heartfelt appreciation goes to the entire research team whose commitment and hard work made this study possible.

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