# Assessment of School health programs using oral health integrated health promoting school framework in Bengaluru (Southern India) - a cross-sectional compliance study

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**Introduction:**

Schools play a crucial role in promoting health, reaching more than one billion children worldwide and providing an ideal setting for establishing lasting health habits (1). School-age is fundamental for developing knowledge, attitudes, and behaviors related to general and oral health, making schools vital for targeted health initiatives (2,3). Given that children typically spend 6–7 hours daily in school, health interventions aimed at this demographic have the potential to substantially enhance not only their own well-being but also that of their families and the wider community (4, 5).

The World Health Organization's Global School Health Initiative emphasizes comprehensive strategies for child health promotion grounded in the Ottawa Charter for Health Promotion principles. In India, school-based programs addressing oral health issues such as dental caries and inadequate hygiene present significant opportunities to improve health outcomes for children, constituting approximately 35% of the population. These initiatives can effectively address widespread oral health challenges and establish a foundation for improving lifelong health practices. The research underscores the potential of integrating oral health into broader school health frameworks, emphasizing its impact on reducing disease burden and enhancing the quality of life globally (6-9).

The Health Promoting Schools (HPS) framework offers a holistic strategy for health promotion, striving to improve the well-being of students, educators, and community members through collaborative partnerships across sectors (4,5). Institutions that embrace the HPS model aim to establish an environment conducive to health by incorporating education, services, and policies related to health, thereby encouraging positive health-related behaviors among learners. Scholarly investigations have corroborated the effectiveness of the HPS framework in enhancing children's oral health awareness, practices, and results (6,7). Further development of this paradigm emphasizes its flexibility in diverse sociocultural and economic settings, enabling tailored interventions to meet specific community requirements. As an illustration, educational institutions implementing focused oral health initiatives within the HPS framework have observed notable decreases in dental caries incidence and enhancements in students' hygiene habits (10,11). Moreover, research indicates that integrating health policies into educational programs not only augments oral health literacy but also facilitates enduring behavioral modifications, yielding long-term advantages for public health (12,13).

This comprehensive strategy, aligned with public health goals, highlights the crucial function of schools in cultivating healthier community futures (14).

Adoption of the HPS framework is particularly pertinent in the Indian context. Epidemiological data at the national level have revealed significant potential for enhancing oral health outcomes among Indian children. According to the National Oral Health Survey conducted in 2004, dental caries affected more than half of India's 5-year-old population. Concurrently, global statistics indicate that oral diseases, including caries, are among the most prevalent noncommunicable ailments affecting children (8,9). These findings emphasize the critical need for targeted health interventions that comprehensively address the behavioral and systemic factors contributing to suboptimal oral health.

The prevalence of tobacco consumption among adolescents in India is a complex public health issue. A substantial proportion of students aged 13–15 years, specifically 14.6%, engaged in tobacco use, 4.4% utilized cigarettes, and 9% opted for smokeless tobacco products (10). Scientific investigations have elucidated the adverse consequences of environmental tobacco smoke on children's oral and systemic well-being, elevating their susceptibility to dental decay and gingival disorders (15). Furthermore, a study conducted in Western Uttar Pradesh demonstrated measurable biochemical alterations in primary school children exposed to second-hand smoke, emphasizing the critical need for comprehensive tobacco prevention education in academic institutions (16).

Sociodemographic factors, including urban-rural disparities, significantly impact oral health inequalities. Research indicates that children from rural and tribal areas in India frequently experience higher rates of dental caries and periodontal disease than their urban peers, primarily because of restricted access to dental services and health education (17). Additionally, adolescents residing in orphanages face distinct challenges as gaps in oral health knowledge and practices exacerbate poor oral health outcomes (18). These observations emphasize the importance of developing comprehensive policies within the HPS framework to address the needs of underserved populations. The integration of oral health education and tobacco prevention initiatives into the HPS model presents an opportunity for schools to contribute significantly to addressing these critical issues. Moreover, the establishment of collaborations with local healthcare providers and utilization of current public health programs can enhance the long-term viability and expandability of these interventions.

The integration of oral health into the HPS framework is widely recognized as crucial; however, a significant lacuna exists in comprehensive evaluations assessing adherence to this approach within Indian educational institutions. Although previous research has examined specific elements, such as school infrastructure, sanitation, and nutritional facilities, these studies have largely disregarded the incorporation of oral health services and health education, which are essential components of the HPS model (18,19). This oversight has impeded the formulation of comprehensive strategies that align with the core principles of the framework.

To address this disparity, a comprehensive assessment instrument was developed to evaluate the adherence of schools in Bengaluru to the HPS framework, with particular emphasis on oral health services. This novel instrument incorporates elements such as the establishment of school health committees, teacher training programs, applied nutrition initiatives, and structured counseling services. This instrument was used to conduct a cross-sectional analysis, elucidate existing capacities, and identify deficiencies in the school's health promotion infrastructure.

The findings of this study are expected to provide valuable insights for policymakers and stakeholders. By emphasizing oral health as an integral component of health promotion, this study aimed to enhance the implementation of the HPS model, ensuring that Indian schools are better equipped to foster comprehensive well-being among students. Furthermore, the results highlight the need to integrate oral health into broader health promotion initiatives, potentially facilitating more inclusive and effective educational health policies.

**Methodology:**

**Study Design and Setting**This observational cross-sectional study aimed to evaluate the extent to which schools in Bengaluru City adhere to the Health Promoting Schools (HPS) framework, with a particular focus on oral health integration (20,21). Bengaluru is administratively divided into eight zones and 198 wards and stratified into northern and southern regions to encompass a diverse educational landscape. The investigation included urban and semi-urban schools for a comprehensive analysis (22). Ethical approval was obtained from the University Ethics Committee (EC-24/04-F-RS-FDS), ensuring compliance with the research guidelines, and data were collected through interviews with school health coordinators, administrators, and representatives (23,24).

**School Participation**: Schools in Bengaluru urban were selected based on their willingness to participate and relevance to the study objectives. Data collection involved structured interactions with key stakeholders within the schools, including head teachers, health coordinators, and other representatives. Institutional records comprising textbooks, health activity logs, and event reports were systematically reviewed to verify compliance with evaluation criteria

**Development of Data Collection Tool**

The data collection instrument was developed through a comprehensive review of the literature published between 2010 and 2023, accessed via databases including PubMed, Scopus, and Google Scholar. The search terms encompassed "Health Promoting Schools," "oral health integration in schools," and "school health compliance," combined utilizing Boolean operators, e.g., ("Health Promoting Schools" AND "oral health") OR ("school health programs" AND Bengaluru). The inclusion criteria focused on studies about HPS frameworks, oral health initiatives in schools, and research conducted in urban educational settings, while studies outside the specified date range or non-school contexts were excluded. This systematic process informed the design of a structured instrument to assess compliance and ensure replicability and contextual relevance. Key insights derived from the reviewed studies enhanced the instrument's validity and application (1-3).

**Framework Integration** The instrument was developed based on the Health Promoting Schools (HPS) framework (WHO, 1996, 2003) and expanded to incorporate oral health components. Eight HPS domains (e.g., healthy school environment and health education) were augmented with oral health-specific domains (e.g., oral hygiene practices and preventive care) designated as domains 9–16.

**Item Generation** The instrument items were generated following a comprehensive literature review using PubMed and Google Scholar databases. Boolean operators and proximity searches were employed to ensure the inclusion of relevant studies. Each item was constructed to quantitatively assess compliance across the various domains.

**Face Validity** A panel of public health experts evaluated the instrument's clarity, relevance, and comprehensiveness utilizing a 4-point Likert scale. Their assessment was instrumental in refining the instrument and in enhancing its practical applicability.

**Content Validation** A cohort of 15 Subject Matter Experts (SMEs) specializing in community medicine, public health, dentistry, and pedodontics evaluated the tool using Lawshe's methodology. The items were categorized as "essential," "useful but not essential," or "not necessary." In accordance with Lawshe's guidelines, which stipulate that the critical CVR value is dependent on panel size, a threshold of 0.49 was implemented. This threshold ensures that more than half of the panel members deemed the item essential while accounting for statistical significance given the panel's dimensions. Items that exceeded this threshold were exclusively retained (25). The tool's validity and relevance were substantiated by an overall Content Validity Index (CVI) of 0.86, which demonstrated substantial agreement among experts.

**Reliability Testing** Cronbach's alpha was utilized to assess internal consistency, demonstrating robust reliability in specific domains, notably "Mental Health and Well-being" ($\alpha = 0.835$) and "Nutrition and Food Services" ($\alpha = 0.786$). Domains exhibiting lower reliability are undergoing further refinement to enhance their internal coherence

**Table 1:** Reliability assessment of tool

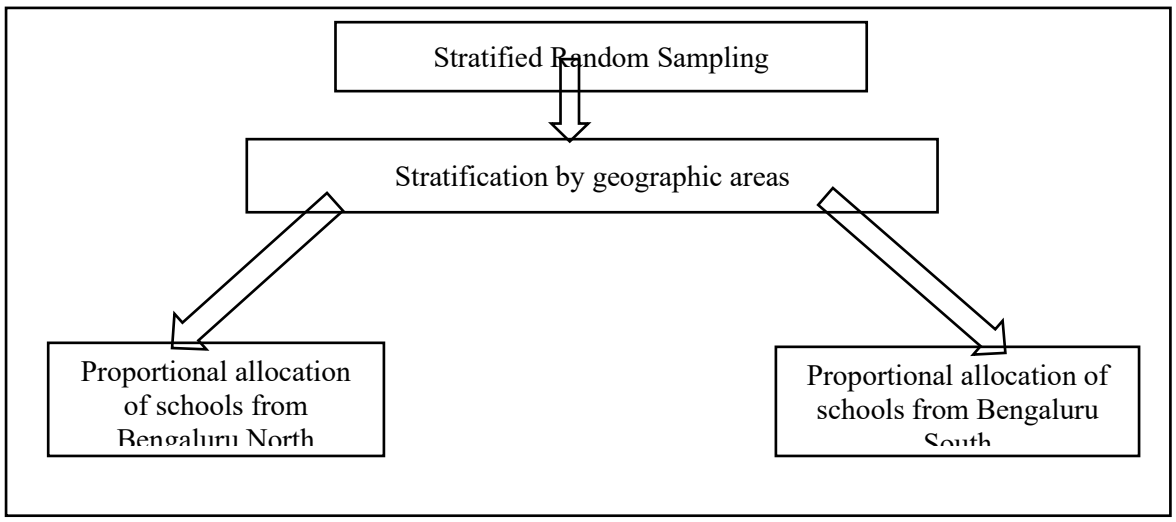
| **Domains** | **Total number of items** | **Cronbach's alpha** |
|---|---|---|
| Domain 1 - Safe school environment | 42 | 0.718 |
| Domain 2- Safe school environment | 15 | 0.659 |
| Domain 3- Nutrition and food services | 12 | 0.786 |
| Domain 4- School health education | 06 | 0.761 |
| Domain 5- Physical education and leisure activities | 05 | 0.569 |
| Domain 6- Mental health and well-being | 04 | 0.835 |
| Domain 7- health promotion for school staff | 04 | 0.578 |
| Domain 8- community collaborations and relationships | 04 | 0.659 |
| Total number of items | 92 | |

**Pilot Testing** The instrument underwent pilot testing in 29 educational institutions to evaluate the temporal feasibility, clarity, and practicality of conducting a compliance study of schools regarding oral health-integrated health promotion. Structured interviews, direct observations, and verification of school records were utilized to validate the scoring system. Feedback from institutional representatives was incorporated to refine the primary study instrument.

**Time and Feasibility Measurements** The feasibility and time efficiency of the instrument were evaluated in a pilot study involving 29 schools. The mean time required for its implementation was 46.83 minutes (SD: 11.26), with a median of 46 min and a mode of 29 min. Observations and feedback regarding the instrument's clarity, usability, and logistical aspects corroborated its feasibility. The instrument was effectively integrated into school routines with minimal disruption, demonstrating its practicality, reliability, and suitability for utilization in the main study.

**Sample size estimation**

**Figure 1:** Sample selection




**Sampling and Sample Size Estimation** Bengaluru City, administratively divided into eight zones and 198 wards by the Bruhat Bengaluru MahanagaraPalike (BBMP), was stratified into two primary regions, Bengaluru North and Bengaluru South. This stratification was implemented to account for the city's demographic and geographic diversity, ensuring representation of both urban and semi-urban

areas. Schools were categorized based on their geographic location within these regions, reflecting the proportional distribution of school clusters: 37% in Bengaluru North and 63% in Bengaluru South. A total of 88 schools were proportionally allocated, with 33 schools selected from Bengaluru North and 55 from Bengaluru South. To ensure representativeness, stratified random sampling was employed within each region, mirroring the proportional distribution of the clusters and preserving the city's geographic and demographic diversity. This technique minimizes selection bias, improves the precision of the estimates, and ensures a balanced representation. Aligning with established methodologies in public health research, this approach facilitated the evaluation of health-promoting schools (HPS) and Oral Health Integration (OHI) standards across diverse settings. It also enhances the credibility, reliability, and efficiency of the study, rendering the methodology robust and generalizable (30).

**Data Collection**

Data were collected by trained personnel who had undergone standardized training to ensure consistency. Structured interviews and observations were conducted to assess compliance with HPS and OHI components. School representatives evaluated indicators related to health services, nutrition, and oral hygiene practices (30,31).

**Data Analysis**

The data analysis process employed MS Excel and SPSS version 20 to examine compliance with the oral health-integrated Health Promoting Schools (HPS) framework across educational institutions. Data entry was conducted in MS Excel and subsequently exported to SPSS for analysis. Descriptive statistics, including chi-square tests, were used to summarize school demographic details and evaluate adherence to key HPS components categorized by domains such as School Environment, Health Services, and Nutrition. Schools were stratified by size (e.g., schools with ≥750 children vs. schools with <750 children) to assess variations in compliance. A binomial scoring system was implemented, assigning a score of "1" for affirmative responses and "0" for negative responses. Cumulative scores for each domain were computed and adherence percentages were calculated using the following formula: Percentage Adherence = (obtained core total score) × 100. Inferential statistical methods, including Pearson's correlation analysis, binary logistic regression, and chi-square tests, were applied to investigate the relationship between school characteristics and adherence to the HPS framework. This comprehensive analytical approach facilitates the identification of patterns, relationships, and compliance trends, and provides valuable insights into targeted interventions and policy recommendations for enhancing health promotion in schools (32,33).

**Results**

**Descriptive statistics**

**Demographics of schools**

**Figure 2:** Distribution of Schools and their demographic details

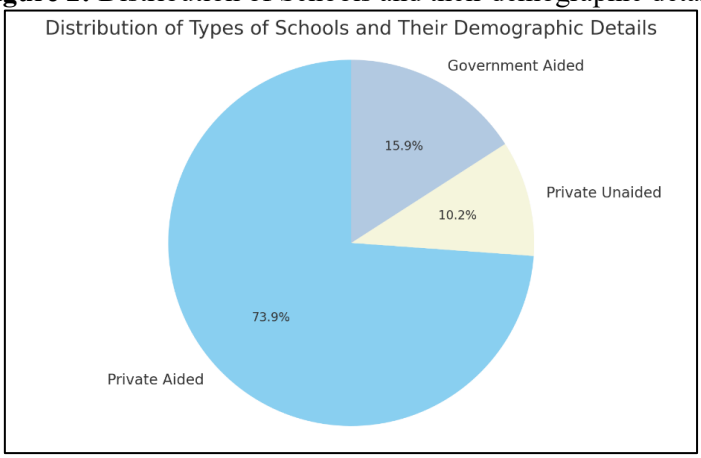


**Figure 2**The data illustrates the distribution of school types and their corresponding demographic characteristics. Among the educational institutions surveyed, 73.9% were classified as private-aided, 10.2% as private unaided, and 15.9% as government-aided, indicating a predominant representation of private-aided institutions within the sample.

**Frequency of compliance and non-compliance of schools**

**Table 1 (a):** Domains 1 to 4

| Component | Category | Frequency (%) |
|---|---|---|
| **1.1 Safe school environment** | | |
| 1.1a. School Proximal Zone | Up to 500 meters | 61 (69.3) |
| | Not present | 27 (30.7) |
| | | |
| 1.1b. School Access Zone | Extends fully to 100 metres | 49 (55.7) |
| | Not Compliant | 39 (44.3) |
| | | |
| 1.1c. School Transition Zone | Up to 70 metres | 43 (48.9) |
| | 2 | 45 (51.1) |
| | | |
| 1.1d. Fenced/Walled | Has proper compound wall | 4 (4.5) |
| | There is no compound wall, but it is a temporary fence | 51 (58.0) |
| | The compound wall was completely absent | 33 (37.5) |
| **1.2. School area, the design of the school buildings and the infrastructure of classrooms** | | |
| 1.2a. Primary School Details | More than 2000 square feet | 27 (30.7) |
| | Up to 2000 Square feet | 61 (69.3) |
| | | |
| 1.2b. Building preferences | On Ground floor | 72 (81.8) |
| | Not on the Ground floor | 16 (18.2) |
| | | |
| 1.2c. Higher Elementary School | Compliant | 25 (28.4) |
| | Non-compliant | 24 (27.3) |
| | 2 | 39 (44.3) |
| | | |
| Single storied and Primary School Building | Compliant | 31 (35.2) |
| | Non-compliant | 18 (20.5) |
| | 9 | 39 (44.3) |
| | | |
| 1.2d. RCC building Architecture design | Compliant | 69 (78.4) |
| | Non-compliant | 19 (21.6) |
| | | |
| 1.2e. Student Teacher Ratio | >1:40 | 29 (33.0) |
| | <1:40 | 59 (67.0) |
| | | |
| 1.2f. Student: Classroom ratio | <30:1 | 88 (100.0) |

| | | |
|---|---|---|
| | | |
| 1.2g. No. of students per desk | 2 | 21 (23.9) |
| | 3 | 48 (54.5) |
| | 4 | 13 (14.8) |
| | 5 | 6 (6.8) |
| | | |
| 1.2h. Chairs | Compliant | 81 (92.0) |
| | Non-compliant | 7 (8.0) |
| | | |
| 1.2i. Windows | Compliant | 67 (76.1) |
| | Non-compliant | 21 (23.9) |
| | | |
| 1.2j. Color of classroom | Compliant | 52 (59.1) |
| | Non-compliant | 36 (40.9) |
| | | |
| 1.2k. Whitewash | Compliant | 6 (6.8) |
| | Non-compliant | 82 (93.2) |
| | | |
| 1.2l. Natural Light | Compliant | 71 (80.7) |
| | Non-compliant | 17 (19.3) |
| | | |
| **1.3. Water supply** | | |
| 1.3a. Adequate water supply | Compliant | 77 (87.5) |
| | Non-compliant | 11 (12.5) |
| | | |
| 1.3b. Separate water supply | Compliant | 39 (44.3) |
| | Non-compliant | 49 (55.7) |
| | | |
| 1.3c. Disinfection | Compliant | 76 (86.4) |
| | Non-compliant | 12 (13.6) |
| | | |
| 1.3d. Water filters | Compliant | 64 (72.7) |
| | Non-compliant | 24 (27.3) |
| | | |
| 1.3e. Drinking water container | Compliant | 55 (62.5) |
| | Non-compliant | 33 (37.5) |
| | | |
| 1.3f. Disposable glasses | Compliant | 55 (62.5) |
| | Non-compliant | 33 (37.5) |
| | | |
| **1.4. Toilet facilities** | | |
| 1.4a. Washrooms present | Compliant | 52 (59.1) |
| | Non-compliant | 36 (40.9) |
| 1.4b. Separate washrooms for boys and girls | Compliant | 53 (60.2) |
| | Non-compliant | 35 (39.8) |
| | | |
| 1.4c. One urinal for 20 children | Compliant | 52 (59.1) |
| | Non-compliant | 36 (40.9) |
| | | |

| | | |
|---|---|---|
| 1.4d. 1 latrine for 40 children | Compliant | 60 (68.2) |
| | Non-compliant | 28 (31.8) |
| | | |
| 1.4e. Separate water supply for washroom | Compliant | 42 (47.7) |
| | Non-compliant | 46 (52.3) |
| | | |
| 1.4f. Soaps available in the washrooms for hand washing | Compliant | 42 (47.7) |
| | Non-compliant | 46 (52.3) |
| | | |
| 1.4g. Washrooms cleaned daily | Compliant | 42 (47.7) |
| | Non-compliant | 46 (52.3) |
| | | |
| **1.5 Availability of unhealthy foods around the school campus** | | |
| 1.5a. Unauthorized vendors | Compliant | 73 (83.0) |
| | Non-compliant | 15 (17.0) |
| 1.5b. Carbonated drinks | Compliant | 61 (69.3) |
| | Non-compliant | 27 (30.7) |
| 1.5c. Tobacco sales | Compliant | 1 (1.1) |
| | Non-compliant | 86 (97.7) |

| | | |
|---|---|---|
| **2.1 School Health Services** | | |
| 2.1a. Major health concerns of children | Compliant | 7 (8.0) |
| | Non-compliant | 81 (92.0) |
| 2.1b. Provisions for emergency | Compliant | 70 (79.5) |
| | Non-compliant | 18 (20.5) |
| 2.1c. Screening & Referral | Compliant | 83 (94.3) |
| | Non-compliant | 5 (5.7) |
| 2.1d. Frequency of services | Half-yearly | 81 (92.0) |
| | Yearly | 7 (8.0) |
| 2.1e. Maintenance of general health and oral health records of School Children | Present | 79 (89.8) |
| | Absent | 9 (10.2) |
| 2.1f. Provision of sanitary napkins for schoolchildren | Compliant | 49 (55.7) |
| | Non-compliant | 39 (44.3) |
| 2.1g. Provision for Age-appropriate vaccination for School Children (1 for 10-16 years old) | Compliant | 88 (100.0) |
| 2.1h. Health record for each School child | Compliant | 88 (100.0) |
| **3.1 Nutrition and Food Services** | | |
| 3.1a. Food cooked on the school campus or Mid-day meal program | Compliant | 52 (59.1) |
| | Non-compliant | 36 (40.9) |
| 3.1b. Separate room for serving mid-day meals (if coded 1 or 2 | Compliant | 52 (59.1) |

| | | |
|---|---|---|
| in the previous question or skip to next question) | | |
| | Non-compliant | 36 (40.9) |
| 3.1c. Classes have an increased focus on nutrition | Compliant | 81 (92.0) |
| | Non-compliant | 7 (8.0) |
| **4. School Health Education** | | |
| 4.1a. General health education fully incorporated into the curriculum | Fully into the curriculum as a chapter content | 35 (39.8) |
| 4.1b. Partially integrated | Individual lessons or activities | 45 (51.1) |
| 4.1c. Not integrated | Not part of the curriculum | 8 (9.1) |

Table 1 (a) indicates that the majority of schools (69.3%) had a school proximal zone within 500 m, whereas only 4.5% possessed an adequate compound wall. Although classrooms predominantly met the standards for natural light (80.7%) and student-teacher ratios (67.0%), compliance with whitewashing was notably low (6.8%). Sufficient water supply was observed in 87.5% of the schools; however, over half lacked separate washroom water supplies (52.3%), and hygiene measures, such as soap availability and daily cleaning, were compliant in only 47.7%. Controls for unhealthy food were robust, with high compliance rates for unauthorized vendors (83.0%) and carbonated drink restrictions (69.3%), although tobacco sales remained a significant concern (97.7% noncompliance). School health services demonstrated excellence in vaccination (100%) and health records (89.8%) but lacked provisions for addressing major health concerns (92.0% non-compliance). Nutrition services exhibited 59.1% compliance with mid-day meals and 92.0% compliance with nutrition-focused classes. Health education was fully integrated into the curriculum in 39.8% of the schools.

**Table 1(b):**Domains 5 to 8

| **Component** | **Category** | **Frequency (%)** |
|---|---|---|
| **5. Physical and Leisure activities** | | |
| 5.1 Playgrounds available in the schools | Separate playground available | 55 (56.8) |
| | The nearby public park is used as a playground | 25 (28.4) |
| | The playground is completely absent | 8 (14.8) |
| 5.2 Mouthguards are used to prevent injuries during high-risk contact sports to protect teeth | Compliant | 40 (45.5) |
| | Non-compliant | 48 (54.4) |
| **6. Mental Health & Well-being** | | |
| 6.1 Internal counselling and support services | Compliant | 46 (52.3) |
| | Non-compliant | 42 (47.7) |
| 6.2 External counselling and support services | Compliant | 46 (52.3) |
| | Non-compliant | 42 (47.7) |
| 6.3 Previous records of counselling available in the | Compliant | 46 (47.7) |

| | | |
|---|---|---|
| school | | |
| | Non-compliant | 42 (52.3) |
| **7. Health promotion for school staff** | | |
| 7.1 Health education training for school teachers | Compliant | 24 (27.3) |
| | Non-compliant | 64 (72.7) |
| 7.2 Education regarding emergency care or first aid for school teachers | Compliant | 18 (20.5) |
| | Non-compliant | 70 (79.5) |
| 7.3 Communication methods are available to school children/school staff/parents to get help quickly in an emergency | Compliant | 11 (12.5) |
| | Non-compliant | 77 (87.5) |
| **8. Relationships and Collaboration between the school and community** | | |
| 8.1 Regular parent-teacher meetings are organized in the schools | Compliant | 4 (4.5) |
| | Non-compliant | 29 (33.0) |
| 8.2 Presence of the school health team | Compliant | 39 (44.3) |
| | Non-compliant | 49 (55.7) |

Table 1(b) illustrates the distribution of playground facilities in schools, indicating that 56.8% possessed dedicated playgrounds, 28.4% used nearby public parks, and 14.8% lacked playground facilities. Regarding mental health and well-being services, 52.3% of schools offered internal and external counselling services, although only 47.7% maintained counselling records. Health promotion initiatives for school staff demonstrated low adherence, with 27.3% providing health education training and merely 20.5% offering emergency care or first-aid education. Communication protocols for emergencies were present in only 12.5% of the schools. Concerning school-community collaboration, regular parent-teacher meetings occur in only 4.5% of schools, while 44.3% have established school health teams.

**Table 1(c):** Domains 9 to 12

| **Component** | **Category** | **Frequency (%)** |
|---|---|---|
| **9. Healthy school environment** | | |
| 9.1a. To what extent is the school environment conducive to oral health? | Compliant | 23 (26.1) |
| | Non-compliant | 65 (73.9) |
| 9.1b. Purchase of oral health teaching aids, and tooth models | Compliant | 55 (62.5) |
| | Non-compliant | 33 (37.5) |
| 9.1c. Develops tooth brushing media, posters, and videos for School children, teachers, and parents | Compliant | 44 (50.0) |
| | Non-compliant | 44 (50.0) |

| | | |
|---|---|---|
| 9.1d. Psychosocial environment | Compliant | 30 (34.1) |
| | Non-compliant | 58 (65.9) |
| 9.1e. The school has a supportive system to train seed teachers and student peer leaders to become role models for oral health | Compliant | 43 (48.9) |
| | Non-compliant | 45 (51.1) |
| 9.1f. The school teachers' duties include supervising the correctness of children's toothbrushing after meals, checking the suitability of toothbrushing tools, and reminding parents to require children to brush their teeth before going to bed and change their cleaning tools regularly. | Compliant | 39 (44.3) |
| | Non-compliant | 49 (55.7) |
| 9.1g. Parents reminding their children to brush their teeth and change their dental cleaning tools before going to bed | Compliant | 37 (42.0) |
| | Non-compliant | 51 (58.0) |
| **10.1. School Oral Health Education** | | |
| 10.1a Oral health education for School children in class | Compliant | 30 (34.1) |
| | Non-compliant | 58 (65.9) |
| 10.1b. Conducts Teacher training programs on School Oral health education and promotion | Compliant | 42 (47.7) |
| | Non-compliant | 46 (52.3) |
| 10.1c. Hosts oral health lectures for parents and school children | Compliant | 53 (60.2) |
| | Non-compliant | 35 (39.8) |
| 10.1d. Oral health is integrated into the school curriculum? | Compliant | 39 (44.3) |
| | Non-compliant | 49 (55.7) |
| **11.1 School Oral Health Services** | | |
| 11.1a. Major Oral health problems affecting the well-being of school children? | Compliant | 82 (93.2) |
| | Non-compliant | 6 (6.8) |
| 11.1b. Provision for screening and referral for oral diseases | Compliant | 68 (77.3) |
| | Non-compliant | 22 (22.7) |

| | | |
|---|---|---|
| 11.1c. Oral health status of school children and its comparison with the local community or national data? | Compliant | 64 (72.7) |
| | Non-compliant | 24 (27.3) |
| 11.1d. Provisions for emergency care or first aid for Oral Health | Compliant | 35 (39.8) |
| | Non-compliant | 53 (60.2) |
| 11.1e. Provision for appropriate basic oral health services, e.g. annual examination, sealant/Fluoride application, and restoration of teeth | Compliant | 54 (61.4) |
| | Non-compliant | 34 (38.6) |
| 11.1f. Types and extent of oral health services provided? | Compliant | 71 (80.7) |
| | Non-compliant | 17 (19.3) |
| 11.1g. Working closely with central or local oral health service providers | Compliant | 47 (53.4) |
| | Non-compliant | 41 (46.6) |
| 11.1h. Monitoring of oral health-related complaints and absenteeism | Compliant | 64 (67.3) |
| | Non-compliant | 31 (32.6) |
| **12.1. Nutrition and Food Services** | | |
| 12.1a. The school has a healthy snack or 0 sugar policy to support healthy eating behaviors | Compliant | 78 (88.6) |
| | Non-compliant | 10 (11.4) |
| 12.1b. Oral health activities are included as part of the assessment and monitoring of nutritional status within schools | Compliant | 80 (90.9) |
| | Non-compliant | 8 (9.1) |
| 12.1c. The school has Oral health integrated into healthy nutrition interventions | Compliant | 83 (94.3) |
| | Non-compliant | 5 (5.7) |
| 12.1d. Food service providers are aware of the role of promoting oral health? | Compliant | 75 (85.2) |
| | Non-compliant | 13 (14.8) |

Table 1 (c) shows the status of oral health and health-related practices in the educational institutions. A mere 26.1% of schools provided an environment conducive to oral health, with 62.5% procuring teaching aids and 50.0% developing educational media. Psychosocial support is available in 34.1% of

schools and 48.9% of schools train educators and peer leaders as role models. Oral health education is offered in 34.1% of schools, and 44.3% integrate it into the curriculum. Screening and referral services were available in 77.3% of schools, and 61.4% provided basic oral health services. Among the schools, 53.4% reported collaboration with health providers, while 67.3% monitored oral health complaints. Regarding nutrition, 88.6% enforced a healthy snack policy, and 85.2% ensured that food service providers promoted oral health. Counselling services were available in 52.3% of schools, but emergency communication protocols existed in only 12.5% of schools. Parent-teacher meetings occurred in 4.5% of the schools, and 44.3% had school health teams, indicating moderate community collaboration.

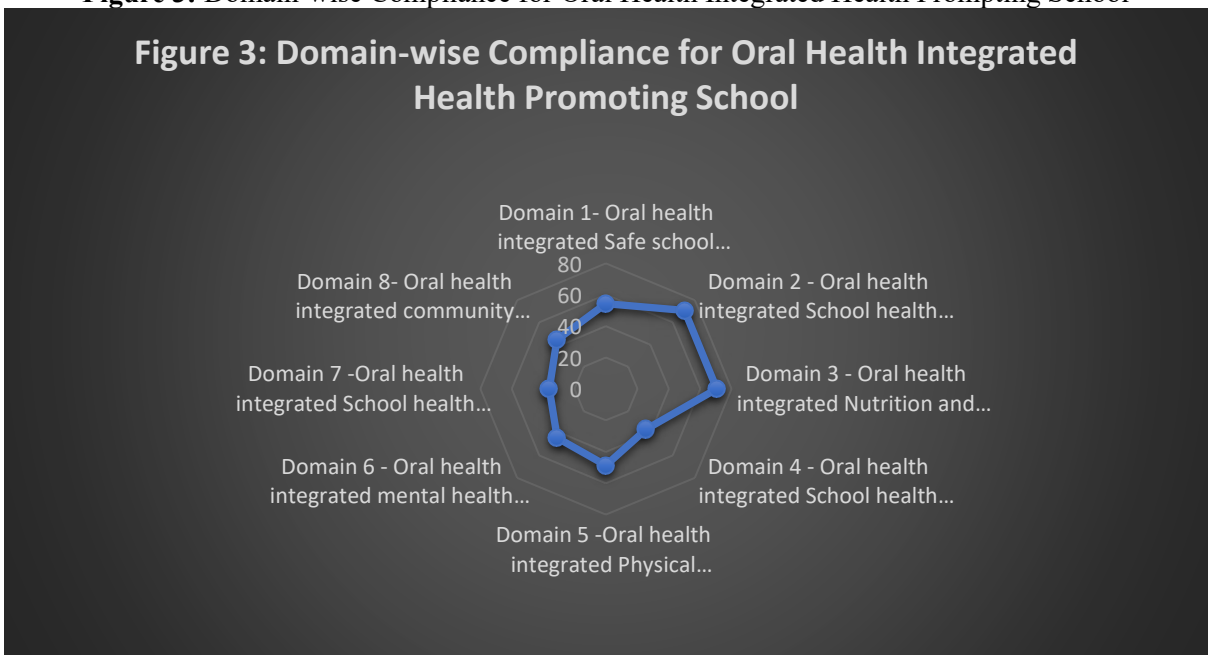
**Table 1 (d):** Domains 13 to 16

| Component | Category | Frequency (%) |
|---|---|---|
| **13.1. Physical education and sports** | | |
| 13.1a. The school supports the use of protection to prevent head and face injuries | Compliant | 34 (38.6) |
| | Non-compliant | 54 (61.4) |
| 13.1b. The school supports limited or 0 usage of sports drinks to prevent dental erosion | Compliant | 52 (59.1) |
| | Non-compliant | 36 (40.9) |
| 13.1c. Physical exercises and Oral health promotion are adequately co-ordinated, for example Demonstration of tooth brushing | Compliant | 5 (5.7) |
| | Non-compliant | 83 (94.3) |
| **14.1 Oral health integrated mental health and well-being** | | |
| 14.1a. Are oral health issues considered in promoting mental health and well-being? | Compliant | 2 (2.3) |
| | Non-compliant | 86 (97.7) |
| **15.1 Oral health integrated Health promotion for school staff** | | |
| 15.1a. There is tailor made oral health promotion programs for teachers | Compliant | 5 (6.02) |
| | Non-compliant | 78 (93.9) |
| **16.1 School and community relationships and collaboration** | | |
| 16.1a. Community involves in interventions for oral health promotion | Compliant | 32 (31.4) |
| | Non-compliant | 69 (67.6) |
| 16.1b. The school provides oral health training programs for parents and other community members | Compliant | 19 (17.6) |
| | Non-compliant | 89 (82.4) |

Table 1 (d) reveals the significant deficiencies in oral health integration across school programs. Only 38.6% of schools implemented protective measures for head and face injuries, while 59.1% restricted sports drinks to mitigate dental erosion. Coordination between physical exercise and oral health was notably insufficient, with only 5.7% compliance. Similarly, oral health is incorporated into mental health programs in only 2.3% of schools, whereas tailored health promotion for staff is provided in only 6.02%. Community involvement in oral health initiatives was moderate at 31.4%; however, only

17.6% offered training for parents and community members, indicating the necessity for expanded engagement and program enhancement.

**Figure 3:** Domain-wise Compliance for Oral Health Integrated Health Prompting School




The radar graph illustrates the varying levels of compliance across the eight domains of the Oral Health Integrated Health Promoting School Framework. Domain 1, which focused on a safe school environment, demonstrated moderate compliance at 54.33%, indicating partial success in establishing oral health-friendly environments. Domains 2 and 3, addressing school health services and nutrition/food services, exhibit relatively higher compliance at 70.83% and 70.55%, respectively, suggesting effective implementation of health services and dietary practices conducive to oral health. However, Domain 4, which encompasses school health education, exhibits a substantially lower compliance rate of 36.17%, reflecting a significant deficiency in oral health education for students. Similarly, Domains 5 (physical education and leisure activities), 6 (mental health and well-being), and 8 (community collaborations) demonstrated compliance levels ranging from 44.03% to 48.64%, indicating moderate integration of oral health within these areas. Domain 7, focused on health promotion for school staff, exhibited one of the lowest compliance levels at 36.08%, underscoring the necessity for enhanced efforts to engage staff in oral health initiatives. Collectively, the findings suggest the need to prioritize interventions in education, staff engagement, and mental health, while continuing to strengthen successful strategies in health services and nutrition.

**Assessment of compliance with Health Promotion domains and their association with school sizes and school types**

**Table 2 (a): Cross-tabulation between compliance of schools with oral health HPS components, and their size and type (Domains 1-4)**

| **Oral Health Integrated Domains** | Category | Compliance (Count & %) | Non-compliance (Count & %) | Total (Count & %) | p-value | Cramer's V |
|---|---|---|---|---|---|---|
| **Domain 1: Healthy School Environment** | School Size ≤ 750 | 24 (27.3%) | 33 (37.5%) | 57 (64.8%) | 0.448 | 0.503 |
| | School Size 750+ | 13 (14.8%) | 18 (20.5%) | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Private Aided | 32 (36.4%) | 33 (37.5%) | 65 (73.9%) | 0.534 | 0.119 |
| | Private Unaided | 3 (3.4%) | 6 (6.8%) | 9 (10.2%) | | |
| | Government Aided | 8 (9.1%) | 6 (6.8%) | 14 (15.9%) | | |
| **Domain 2: School Health Services** | School Size ≤ 750 | 16 (18.2%) | 41 (46.6%) | 57 (64.8%) | 0.433 | 0.109 |
| | School Size 750+ | 12 (13.6%) | 19 (21.6%) | 31 (35.2%) | | |
| | Private Aided | 21 (23.9%) | 44 (50.0%) | 65 (73.9%) | 0.078 | 0.241 |
| | Private Unaided | 3 (3.4%) | 6 (6.8%) | 9 (10.2%) | | |
| | Government Aided | 9 (10.2%) | 5 (5.7%) | 14 (15.9%) | | |
| **Domain 3: Nutrition and Food Services** | School Size ≤ 750 | 27 (30.7%) | 30 (34.1%) | 57 (64.8%) | 0.578 | 0.083 |
| | School Size 750+ | 12 (13.6%) | 19 (21.6%) | 31 (35.2%) | | |
| | Private Aided | 28 (31.8%) | 37 (42.0%) | 65 (73.9%) | 0.418 | 0.141 |
| | Private Unaided | 5 (5.7%) | 4 (4.5%) | 9 (10.2%) | | |
| | Government Aided | | | | | |
| **Domain 4: General Health Education** | School Size ≤ 750 | 25 (28.4%) | 32 (36.4%) | 57 (64.8%) | 1.000 | 0.013 |
| | School Size 750+ | 14 (15.9%) | 17 (19.3%) | 31 (35.2%) | | |
| | Private Aided | 65 (73.9%) | 0 (0.0%) | 65 (73.9%) | 5.346 | 0.246 |
| | Private Unaided | 9 (10.2%) | 0 (0.0%) | 9 (10.2%) | | |
| | Government Aided | 13 (14.8%) | 1 (1.1%) | 14 (15.9%) | | |

Table 2a presents Cross-tabulation between school compliance with oral health health-promoting school (HPS) components and their size/type reveals domain-specific trends.

Domain 1: Healthy School Environment: Schools with a size ≤750 students exhibited a higher percentage of both compliance (27.3%) and non-compliance (37.5%) than larger schools with 750+ students (14.8% compliance, 20.5% non-compliance). Among school types, private-aided schools demonstrated the highest overall participation (36.4% compliant, 37.5% non-compliant), whereas Private Unaided schools exhibited the least involvement (3.4% compliant, 6.8% non-compliant). The p-value (0.448) and Cramer's V (0.503) suggested no significant association between school characteristics and compliance in this domain.Domain 2: School Health Services: Compliance was generally low, with smaller schools (≤750) demonstrating 18.2% compliance and 46.6% noncompliance. Larger schools (750+) had slightly lower compliance (13.6%), but comparable non-compliance (21.6%). Private Aided schools had the highest representation (23.9% compliant, 50%

non-compliant), while Private Unaided schools had minimal participation. The p-value (0.078) approaches significance, and moderate Cramer's V (0.241) indicates some association, potentially reflecting structural disparities in health service implementation.Domain 3: Nutrition and Food Services: Compliance was relatively higher in smaller schools (30.7% compliant and 34.1% non-compliant) than in larger schools (13.6% compliant and 21.6% non-compliant). Private Aided schools again had the highest participation, with 31.8% compliance and 42% non-compliance. Government-aided schools lack data on this domain. The p-value (0.578) and Cramer's V (0.083) suggested no significant relationship between school size/type and compliance.Domain 4: General Health Education:General health education demonstrated better compliance among schools with ≤750 students (28.4%) than among larger schools (15.9%). Among the school types, private-aided schools demonstrated full compliance (73.9%), with no non-compliant schools, whereas government-aided schools had 14.8% compliance and 1.1% non-compliance. The significant p-value (5.346) and moderate Cramer's V (0.246) suggest a notable association between school type and compliance, indicating that privately aided schools lead to the implementation of general health education.Hence, Smaller schools generally exhibit higher compliance rates across domains than larger schools, potentially due to the enhanced manageability of health programs. Private-aided schools consistently demonstrate higher compliance, particularly in General Health Education (100%), whereas private unaided and government-aided schools show limited participation and higher non-compliance. Statistically significant associations were observed in domain 4, emphasizing the role of school type in compliance. However, most domains lacked strong associations (high p-values), indicating systemic issues in oral health HPS implementation across varying school types and sizes.

**Table 2 (b): Cross-tabulation between compliance of schools with oral health HPS components, and their size and type (Domains 5-8)**

| **Oral Health Integrated Domains** | Category | Compliance (Count & %) | Non-compliance (Count & %) | Total (Count & %) | p-value | Cramer's V |
|---|---|---|---|---|---|---|
| **Domain 5: Physical and Leisure Activities** | School Size ≤ 750 | 37 (42.0%) | 20 (22.7%) | 57 (64.8%) | 0.018 | 0.252 |
| | School Size 750+ | 12 (13.6%) | 19 (21.6%) | 31 (35.2%) | | |
| | Private Aided | 6 (6.8%) | 59 (67.0%) | 65 (73.9%) | 1.359 | 0.124 |
| | Private Unaided | 0 (0.0%) | 9 (10.2%) | 9 (10.2%) | | |
| **Domain 6: Mental Health and Well-being** | School Size ≤ 750 | 31 (35.2%) | 26 (29.5%) | 57 (64.8%) | 0.532 | 0.067 |
| | School Size 750+ | 19 (21.6%) | 12 (13.6%) | 31 (35.2%) | | |
| | Private Aided | 35 (39.8%) | 30 (34.1%) | 65 (73.9%) | 6.174 | 0.265 |
| | Private Unaided | 8 (9.1%) | 1 (1.1%) | 9 (10.2%) | | |
| | Government Aided | 11 (12.5%) | 3 (3.4%) | 14 (15.9%) | | |
| **Domain 7: Health Promotion for** | School Size ≤ 750 | 55 (62.5%) | 2 (2.3%) | 57 (64.8%) | 0.944 | 0.007 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **School Staff** | | | | | | |
| | School Size 750+ | 30 (34.1%) | 1 (1.1%) | 31 (35.2%) | | |
| | Private Aided | 62 (70.5%) | 3 (3.4%) | 65 (73.9%) | 0.647 | 0.086 |
| | Private Unaided | 9 (10.2%) | 0 (0.0%) | 9 (10.2%) | | |
| | Government Aided | 13 (14.8%) | 1 (1.1%) | 14 (15.9%) | | |
| **Domain 8: Relationships and Collaboration** | School Size ≤ 750 | 40 (45.5%) | 17 (19.3%) | 57 (64.8%) | 0.466 | 0.078 |
| | School Size 750+ | 24 (27.3%) | 7 (8.0%) | 31 (35.2%) | | |

Table 2b represents Cross-tabulation between school compliance with oral health : Health Promoting School (HPS) components (Domains 5–8) and their size/type reveals varying adherence levels to health-promoting activities. Domain 5: Physical and Leisure Activities Schools with ≤750 students showed higher compliance (42%) compared to larger schools (13.6%), with a statistically significant p-value of 0.018. Private Aided schools had minimal compliance (6.8%) and high non-compliance (67%), while Private Unaided schools had no compliance. The Cramer's V value (0.252) indicates a moderate association between school size and compliance; however, compliance is generally low, especially in unaided and aided schools. Domain 6: Mental Health and Well-being Smaller schools had higher compliance (35.2%) compared to larger schools (21.6%), but this was not statistically significant (p-value = 0.532). Private Aided schools had the highest compliance (39.8%), while Private Unaided schools had lower compliance (9.1%). Government Aided schools showed moderate compliance (12.5%). The p-value for school type (6.174) and Cramer's V (0.265) indicate a moderate association, with Private Aided schools showing the strongest adherence. Domain 7: Health Promotion for School Staff High compliance was noted across both school sizes, with smaller schools at 62.5% and larger schools at 34.1%. Private Aided schools had the highest compliance (70.5%), and Private Unaided schools showed 100% compliance, while Government Aided schools also performed well (14.8%). The p-value (0.944) and negligible Cramer's V (0.007) indicate no statistically significant differences in compliance between sizes or types, likely due to high adherence in this domain. Domain 8: Relationships and Collaboration Smaller institutions had higher compliance (45.5%) compared to larger ones (27.3%), though this was not statistically significant (p-value = 0.466). Private Aided schools had the highest participation but also notable non-compliance (45.5% compliant, 19.3% non-compliant). The Cramer's V value (0.078) indicates weak associations between institutional characteristics and compliance in this domain. Hence, Compliance varied across domains, with Health Promotion for School Staff showing the highest adherence (up to 70.5% in Private Aided schools) and Physical and Leisure Activities showing the lowest, particularly in larger and unaided institutions. Statistical significance in Domain 5 highlights institutional size's influence on adherence rates. Private Aided schools consistently led in compliance but showed disparities in domains like Physical Activities and Relationships/Collaboration. Overall, smaller institutions generally exhibited better compliance, suggesting that size is a key determinant of successful HPS implementation.

**Inferential statistics**

*Pearson's Correlation Constant*

**Table 3 (a):** Pearson's Correlation Test for Domains 1 to 4

| Variable Pair | Pearson Correlation (r) | Significance (p-value) | Interpretation |
|---|---|---|---|
| OH& Safe School Environment | 0.372 | <0.001 | Moderate positive |
| Domain 1 & Domain 1+9 (OH Integrated Scores) | 0.968 | <0.001 | Strong positive |
| Domain 9 & Domain 1+9 (OH Integrated Scores) | 0.594 | <0.001 | Moderate positive |
| Domain 9 & Year of Establishment | -0.210 | 0.050 | Weak negative |
| Domain 2 & Domain 11 (Health Services) | -0.289 | 0.006 | Moderate negative |
| Integrated Scores (Domain 2 & 11) | 0.246 | 0.021 | Weak positive |
| OH Integrated Scores (Domain 2 & 11) | 0.856 | <0.001 | Strong positive |
| Nutrition Services (Domain 3 & 12) | 0.368 | <0.001 | Moderate positive |
| OH Integrated Scores for Nutrition Services (Domain 3) | 0.874 | <0.001 | Very strong positive |
| Age of School & Domain 10 (Oral Health Education) | -0.214 | 0.045 | Weak negative |
| OH Integrated Scores (Domain 4 & Domain 10) | 0.960 | <0.001 | Strong positive |

Table 3 (a) shows the varying degrees of correlation between oral health integration and school health domains. A moderate positive correlation ($\rho = 0.372$, $p < 0.001$) was observed between Oral Health and a Safe School Environment, suggesting a direct association between safer environments and better oral health practices. Similarly, a strong positive correlation ($\rho = 0.968$, $p < 0.001$) between Domain 1 and Domain 1+9 (OH Integrated Scores) highlights the alignment of comprehensive health measures with school safety. Integrated scores for Nutrition Services (Domain 3 & 12) demonstrated a very strong positive correlation ($\rho = 0.874$, $p < 0.001$), emphasizing the role of nutrition in oral health outcomes. In contrast, weak negative correlations were noted between Domain 9 cumulative scores and Year of Establishment ($\rho = -0.210$, $p = 0.050$), indicating challenges older schools face in implementing integrated health strategies. Moderate and weak correlations were found in specific health services. Domain 2 and Domain 11 (Health Services) showed a moderate negative correlation ($\rho = -0.289$, $p = 0.006$) but a strong positive correlation ($\rho = 0.856$, $p < 0.001$) for integrated scores, reflecting the benefits of joint services. A weak negative correlation ($\rho = -0.214$, $p = 0.045$) between the Age of School and Domain 10 (Oral Health Education) suggests that older institutions may require updated programs to align with contemporary standards. Meanwhile, integrated scores between Domain 4 (School Health Education) and Domain 10 demonstrated a strong positive correlation ($\rho = 0.960$, $p < 0.001$), underscoring the effectiveness of combined educational initiatives.

**Table 3 (b):** Pearson's Correlation Test for Domain 5 to 8

| Variable Pair | Pearson Correlation (r) | Significance (p-value) | Interpretation |
|---|---|---|---|
| Total Children & Domain 5 (Physical Activities) | -0.239 | 0.025 | Weak negative |
| OH Integrated Physical Activity Scores | 0.976 | <0.001 | Very strong positive |
| Mental Health (Domain 6) & Well-being (Domain 14) | 0.453 | <0.001 | Moderate positive |
| OH Integrated Scores for Mental Health (Domain 6 & 14) | 0.968 | <0.001 | Strong positive |
| Health Promotion (Domain 7) & Staff Outcomes (Domain 15) | 1.000 | <0.001 | Perfect positive |
| Age of School & Community Collaboration (Domain 16) | -0.223 | 0.037 | Weak negative |
| OH Integrated Community Relationship Scores | 0.848 | <0.001 | Strong positive |

Table 3 (b) reveals significant correlations across the various school health domains. An inverse relationship of weak magnitude ($\rho = -0.239$, $p = 0.025$) was identified between Total Children and Domain 5 (Physical Activities), suggesting potential resource limitations in larger educational institutions. Conversely, the integrated physical activity scores demonstrated a robust positive association ($\rho = 0.976$, $p < 0.001$), validating the effectiveness of the comprehensive approaches. A moderate positive correlation ($\rho = 0.453$, $p < 0.001$) was observed between Mental Health (domain 6) and well-being (domain 14), with integrated scores exhibiting strong congruence ($\rho = 0.968$, $p < 0.001$), highlighting the pivotal role of mental health initiatives. Remarkably, Health Promotion for Staff (Domain 7) and Staff Outcomes (Domain 15) exhibited a perfect positive correlation ($\rho = 1.000$, $p < 0.001$), indicating complete alignment and integration within these areas. Community Collaboration (Domains 8 and 16) showed a weak negative association with school-age ($\rho = -0.223$, $p = 0.037$), implying that older educational institutions may experience difficulties in cultivating community relationships. Nevertheless, the OH Integrated Community Relationship scores revealed a strong positive correlation ($\rho = 0.848$, $p < 0.001$), indicating the importance of collaborative partnerships in achieving comprehensive health integration.

***Binary Logistic Regression***

Binary logistic regression was employed to evaluate the probability of compliance with various school health domains while controlling for school size, to elucidate the influence of subdomains, such as Healthy School Environment, Integrated Oral Health, and School Health Services.

**Table 4:** Binary Logistic Regression for all domains

| **Domain** | **p-value (Sig.)** | **Odds Ratio (OR)** | **95% Confidence Interval (CI)** |
|---|---|---|---|
| Domain 1 & 9 (Healthy School Environment) | 0.936 | 0.885 | 0.044–17.665 |
| Domain 2 & 11 (School Health Services) | 0.389 | 0.644 | 0.237–1.753 |
| Domain 3 & 12 (Nutrition and Food Services) | 0.368 | 2.023 | 0.436–9.396 |
| Domain 4 (School Health Education) | 0.870 | 1.057 | 0.544–2.052 |
| Domain 5 & 13 (Physical and Leisure Activities) | 0.001 | 0.073 | 0.017–0.325 |
| Domain 6 & 14 (Mental Health & Well-being) | 0.228 | 0.203 | 0.015–2.719 |
| Domain 7 & 15 (Health Promotion for Teachers) | 0.376 | 1.721 | 0.037–5.406 |
| Domain 8 & 16 (Community Interactions) | 0.860 | 1.136 | 0.275–4.469 |

The binary logistic regression analysis explainsthe association between school size and various domains of school health services, both individually and in integrated forms. The analysis demonstrated statistical significance exclusively for Domains 5 and 13 (Physical and Leisure Activities integrated with Oral Health), with a p-value of 0.001 and odds ratio (OR) of 0.073, indicating a robust inverse relationship. This finding suggests that smaller schools are significantly less likely to have integrated physical and leisure activities with oral health services than larger schools. For the other domains, the p-values exceeded the threshold for significance ($p > 0.05$), implying insufficient evidence of an association between school size and the respective domains. However, the ORs for certain domains, such as Domains 3 and 12 (OR = 2.023), suggest a potential trend toward higher likelihood, although not statistically significant in this sample. The wide

confidence intervals in numerous cases indicate variability and potential limitations in sample size or data precision, necessitating further research to explain these relationships.

**Discussion:**

**Descriptive Data Analysis**

Descriptive data analysis revealed significant compliance patterns across various domains of school health services. Private-aided institutions, which comprised 73.9% of the sample, exhibited higher compliance rates in most areas. Notably, adherence to an adequate water supply (87.5%) and natural light in classrooms (80.7%) indicated a relatively high-quality infrastructure. However, certain aspects required attention, such as the widespread lack of whitewashing (93.2% non-compliance) and the complete absence of compound walls in 37.5% of the cases. These findings resonate with a local Bengaluru study, which reported comparable trends of private-aided schools outperforming government institutions in infrastructural and hygiene parameters (37). On a national scale, the Swachh Vidyalaya Abhiyan report (2020) emphasized substantial disparities between private and government schools in water and sanitation facilities throughout India, aligning with the observed non-compliance rates for soap availability (52.3%) and separate washroom water supply (52.3%) (38). In a global context, UNICEF's 2021 report on school hygiene revealed that 56% of schools in low-income countries lacked basic sanitation services, illustrating parallels between local deficiencies and worldwide challenges (39).

Nutrition and food services demonstrated moderate compliance, with 59.1% adherence to mid-day meal provisions and 92% inclusion of nutrition-focused classes. However, 40.9% of non-compliance with designated dining spaces reflects ongoing infrastructural challenges. Locally, a study in Tamil Nadu found that schools implementing mid-day meal programs showed improved nutritional outcomes but faced similar challenges in dining infrastructure (23, 40-43). International comparisons, such as those from the United Kingdom's Healthy Schools Program, show higher compliance with dining space standards, suggesting that Indian schools need targeted investments to match global benchmarks (47, 48).

**Correlation Data Analysis**

Pearson correlation analysis revealed significant interrelationships among domains, notably the strong correlation between cumulative Domain 1 and Domain 9 scores ($r = 0.968$, $p < 0.001$). This finding underscores the interconnected nature of a safe school environment and oral health integration. Furthermore, the moderate correlation between domain 9 cumulative scores and oral health integration ($r = 0.594$, $p < 0.001$) substantiates the critical role of oral health-focused initiatives within a comprehensive health-promoting framework. In a comparative local context, studies conducted in Maharashtra have demonstrated similar associations between environmental safety measures and health outcomes, particularly oral health (49-52). At the national level, research by the Indian Public Health Standards has emphasized the importance of environmental and oral health synergies in mitigating health disparities among schoolchildren (53, 54). From a global perspective, the World Health Organization's Health Promoting Schools framework has consistently emphasized the role of safe environments in achieving sustainable health outcomes, aligning with the findings of this study (55-57).

The weak negative correlation between domain 9 cumulative scores and the year of establishment ($r = -0.210$, $p = 0.050$) indicates that older educational institutions encounter difficulties in implementing contemporary health-promoting standards. Local data from Bengaluru schools substantiate this trend, with established institutions frequently contending with legacy infrastructure and outdated policies (58, 59). In an international context, a comparable study in sub-Saharan Africa identified infrastructural limitations in older schools as an impediment to the implementation of modern health promotion strategies, underscoring a shared challenge across low- and middle-income countries (60).

Binary Logistic Regression Analysis The binary logistic regression results provided nuanced insights into the association between school size and compliance across health domains. The statistically

significant finding for Domains 5 and 13 (Physical and Leisure Activities integrated with Oral Health) indicated that smaller schools were significantly less likely to comply with integrated physical and oral health activities ($p = 0.001$, OR = 0.073). This inverse relationship elucidates the challenges that smaller institutions encounter when implementing resource-intensive programs.

Local studies in Bengaluru corroborate this finding, demonstrating that smaller schools frequently lack dedicated playgrounds and resources for oral health promotion (61). At the national level, Fit India Movement data indicate that larger schools are more likely to incorporate physical and oral health programs because of their superior resource allocation (62). Comparatively, international evidence from the United States Coordinated School Health Program demonstrates higher compliance in larger schools, emphasizing the significance of resource availability in facilitating health-promoting activities (63, 64). For other domains, while p-values exceeded the significance threshold, the ORs revealed noteworthy trends. For instance, domains 3 and 12 (Nutrition and Food Services) exhibited an OR of 2.023, suggesting a potentially higher likelihood of compliance in larger schools, albeit not statistically significant. This aligns with the national data from the Mid-Day Meal Scheme, where larger schools demonstrate superior adherence to food service standards (65). Internationally, Australia's National Healthy School Canteens initiative reports similar trends, with larger schools benefiting from economies of scale in implementing nutritional policies (66, 67).

Wide confidence intervals observed in numerous domains, such as Domains 6 and 14 (Mental Health & Well-being; OR = 0.203, 95% CI: 0.015–2.719), indicated substantial variability and potential limitations in the data. This observation underscores the need for additional research with larger sample sizes to elucidate these associations. On a global scale, the integration of mental health services in educational institutions remains a significant challenge, as evidenced by UNICEF's 2021 report, which demonstrates limited mental health services in resource-constrained settings, aligning with the findings of this study (68, 69). Furthermore, the absence of statistical significance in domains 7 and 15 (Health Promotion for Teachers) and domains 8 and 16 (Community Interactions) suggests a systemic deficiency in these areas. Regional studies conducted in Karnataka revealed comparable challenges, with health promotion initiatives focused on teachers and community engagement frequently deprioritized due to financial constraints (70-73). At the national level, the National Education Policy 2020 emphasizes the imperative for enhanced teacher engagement and community collaboration in health programs, corresponding to the identified gaps (74). In the international context, Finland's model of incorporating teacher wellness into school health programs serves as a benchmark for addressing these deficiencies (75-79).

**Limitations and future research recommendations:**

The study primarily relied on checklist-based compliance assessments, which may have overlooked the nuanced perspectives of key stakeholders such as school administrators, teachers, parents, and students. Future research should adopt a qualitative approach, including in-depth interviews or focus group discussions with these stakeholders, to capture subjective experiences and identify barriers and enablers to compliance with the Health Promoting Schools (HPS) framework. Such methods would provide rich, context-specific insights, allowing for the development of tailored intervention strategies that address the unique challenges and opportunities within diverse school settings.

**Conclusion**

The present investigation highlights the pivotal role of integrating oral health within the Health Promoting School (HPS) framework to address the multifaceted health requirements of students in Bengaluru. The analysis revealed substantial variations in compliance across different domains, with notable shortcomings in community engagement, educator training, and infrastructural elements despite relative achievements in areas such as health services and nutrition. Although private-aided institutions exhibited higher levels of adherence, systemic challenges remained, indicating that resource allocation alone is insufficient to resolve the broader policy and operational inefficiencies

identified. These observations underscore the need to address both the structural and the programmatic dimensions of the School health promotional activities with the HPS framework as a reference.

Furthermore, this study explains the interconnected nature of health promotion domains, as evidenced by the robust correlations between safe educational environments and oral health integration. These findings emphasize the merits of comprehensive and integrated approaches to enhance health outcomes and underscore the need for capacity-building initiatives targeting educators, administrators, and policymakers. By cultivating cross-sector collaborations, prioritizing underserved educational institutions, and implementing best practices from global health-promoting school models, policymakers can bridge the existing gaps. These strategies will facilitate a more effective alignment of schools with HPS objectives, thereby enhancing the overall health and academic achievements of the student population.

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