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Advancing Sustainable Dentistry in Saudi Arabia: A Cross-Sectional Study of Dentists' Knowledge, Attitudes, Practices and Perceived Barriers

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Abstract **Background:** Sustainable dentistry aims to reduce the environmental impact of oral healthcare while maintaining patient safety and quality of care. Understanding dental professionals' awareness, attitudes and implementation needs can inform efforts to promote environmentally responsible practice. **Aim:** To assess knowledge, attitudes, practices, perceived barriers and willingness to adopt sustainable dentistry among dental professionals in Saudi Arabia. **Methods:** A cross-sectional online survey recruited 306 dental professionals through social media platforms and professional dental societies. A structured, self-administered questionnaire assessed demographic characteristics, sustainability awareness, attitudes, reported practices, perceived barriers and willingness to adopt sustainable measures. Descriptive statistics summarized participants' responses. **Results:** Awareness regarding sustainable dentistry concept was reported by 79.7% of participants. Positive attitudes were common: 87.6% agreed or strongly agreed that sustainable dentistry should be prioritized, 91.2% supported incorporating sustainability training into dental curricula and 82.0% believed sustainable practices could be implemented without compromising patient care. Willingness to invest in eco-friendly equipment and materials despite higher costs was reported by 61.8%. Overall, 78.8% expressed willingness to participate in sustainability training and 86.0% indicated that financial incentives would encourage adoption. However, only 48.4% reported existing workplace support for sustainability initiatives. **Conclusion:** Respondents reported substantial familiarity with sustainable dentistry, favorable attitudes and strong willingness to undertake training. Integrating sustainability into dental education and continuing professional development, alongside financial and institutional support, may help translate this willingness into routine practice.

Key Words Sustainability, Eco-Friendly Dentistry, Knowledge, Attitude, Practice

INTRODUCTION

The increasing global concern regarding environmental sustainability has extended to the healthcare sector, where dentistry is recognized as a contributor to environmental impact through significant resource consumption, waste generation and energy use [1]. Dental practices require substantial amounts of materials, water and energy, while producing various forms of waste, including plastics, chemical by-products and hazardous materials, all of which contribute to environmental degradation and necessitate more sustainable approaches in oral healthcare delivery [1,2].

Sustainable dentistry, also referred to as green or eco-friendly dentistry, focuses on the responsible use of resources while maintaining high standards of patient care. It is based on principles such as reducing waste, conserving energy and minimizing pollution, while ensuring that current healthcare needs are met without compromising future generations [2,3]. Within this framework, dental professionals are encouraged to adopt environmentally responsible practices as both a professional and ethical obligation [4].

The integration of sustainability into dentistry aligns with global initiatives such as the United Nations Sustainable Development Goals (SDGs), which promote environmental protection, social equity and economic sustainability. In oral healthcare, these goals emphasize preventive care, efficient resource utilization and reduction of environmental burden associated with clinical procedures [5]. International organizations such as the World Dental Federation (FDI) advocate for embedding sustainability principles into dental education and practice to reduce the ecological footprint of oral healthcare [3].

Despite growing awareness, the implementation of sustainable practices in dentistry remains inconsistent. Evidence indicates that dental professionals and students often demonstrate limited knowledge regarding environmental sustainability, although their attitudes toward its importance are generally positive [6,7]. A cross-sectional study conducted across dental schools in Saudi Arabia reported that a large proportion of students and faculty lacked fundamental knowledge of environmental sustainability, despite recognizing its importance and supporting its inclusion in dental curricula [6]. Similarly, another study found that dentists exhibited poor knowledge but relatively favorable attitudes toward eco-friendly dental practices, suggesting a gap between awareness and implementation [7]. Understanding the educational and organizational needs of dental professionals across different Saudi populations and regions is important, as variations in institutional policies, available resources and budgets may contribute to differences in study findings and influence efforts to strengthen sustainable oral healthcare.

Barriers to adopting sustainable dentistry include insufficient education, lack of training resources, financial constraints and limited integration of sustainability concepts within dental curricula [8].

Additionally, the absence of structured educational content and institutional support limits the preparedness of dental professionals to implement environmentally responsible practices effectively [8].

In Saudi Arabia, sustainability has become a national priority under initiatives aligned with Saudi Vision 2030, which emphasize environmental responsibility and sustainable development across sectors, including healthcare [2]. However, research exploring sustainability within dental practice in the Saudi context remains limited. Existing evidence suggests that although awareness and attitudes toward sustainable dentistry are improving, significant gaps persist in knowledge, education and practical implementation [2,5].

Given the environmental impact of dental practice and the national emphasis on sustainability, there is a need to assess the current level of knowledge, attitudes and perceived barriers among dental professionals in Saudi Arabia. This understanding is essential for informing policy, improving education and promoting the adoption of environmentally sustainable practices in oral healthcare.

The literature underscores the urgent need for Saudi-specific policies and education to align dental practices with national sustainability goals. Future research should explore effective interventions, such as subsidies for eco-friendly materials and mandatory sustainability training, to bridge the gap between awareness and action in the Saudi dental community.

This study aims to evaluate the knowledge and attitudes of Saudi dentists regarding sustainable dental practices, identify barriers to their implementation in clinical settings and assess practitioners' readiness to adopt environmentally sustainable approaches.

METHODS

This study adopted a cross-sectional design using a structured, self-administered online questionnaire to evaluate the knowledge, attitudes and perceived barriers related to the implementation of sustainable dental practices among dentists in Saudi Arabia. The target population included licensed dentists practicing within the Kingdom, encompassing general practitioners, specialists and academic faculty members. Participation was open to dentists currently engaged in clinical or academic practice who were recruited through different social media platforms and professional dental societies.

The minimum sample size was estimated for a population survey using an expected proportion of 50% (the conservative assumption producing the largest sample), 5% absolute precision and a 90% confidence level, yielding approximately 271 participants. Recruitment continued until 306 complete responses were obtained. A formal non-response adjustment could not be applied because the open-link recruitment strategy did not provide a denominator.

Ethical approval was obtained from Umm Al-Qura. Institutional Review Board (HAPO-02-K-012-2025-05-2702). All participants provided informed consent electronically prior to participation. Anonymity and confidentiality were strictly maintained and participation was entirely voluntary in accordance with established ethical research standards.

Data were collected using a structured online Google forms questionnaire adapted from previously validated instruments, including the Knowledge, Attitude and Practices survey and the Attitude toward Sustainability in Dentistry scale ensuring relevance and applicability to the study context [2,7]. Content validity was evaluated by a panel of associate professors in dental public health and face validity was subsequently assessed to evaluate clarity, grammar, syntax, logical flow, and comprehensibility before distribution. The questionnaire comprised of the following main components: demographic information (age, gender, qualifications and years of experience), a knowledge assessment section consisting of items addressing eco-friendly dental practices, waste management and energy conservation, an attitude assessment measured using a five-point Likert scale ranging from "strongly agree" to "strongly disagree," and a section exploring barriers and current practices through both multiple-choice and open-ended questions. All five attitude response categories were retained in the tables, with "agree" and "strongly agree" combined when reporting overall agreement in the text. As participants could select more than one barrier, percentages for barrier items could exceed 100% in total.

Data were analyzed using IBM SPSS Statistics. Continuous variables were summarized as means and standard deviations and categorical variables as frequencies and percentages. Chi-square tests were used to examine associations between demographic characteristics and responses to individual knowledge and attitude items.

RESULTS

The study sample comprised 306 participants and there demographics are presented in (Table 1). Majority of the participants were male respondents (64.4%), majority of the participants (62.7%) had less than five years of clinical experience, indicating a relatively young professional cohort. Participants were almost evenly distributed between private (52.9%) and government (47.1%) sectors, enhancing the representativeness of different clinical settings. This balanced distribution strengthens the external validity of the findings across diverse practice environments.

Participants demonstrated a generally moderate- high level of awareness regarding sustainable dentistry, where the overall knowledge score (Mean = 65.4% SD± 14.5) indicates a moderate overall level of knowledge regarding sustainable dentistry among the study population. Focusing on individual items, 79.7% of participants reported familiarity with the concept (Table 2). Knowledge related to environmental hazards associated with dental materials, particularly amalgam waste, was also relatively high (74.5%), suggesting good awareness of environmental risks in clinical practice.

However, knowledge was less consistent in more specialized domains. Only 65.7% of participants identified digital dentistry as an environmentally sustainable alternative, the role of energy-efficient technologies such as LED lighting indicating a moderate level of understanding regarding technological contributions to sustainability. More notably, awareness of the different roles of dentists, institutions, government and patients in sustainable dentistry practices in addition to sustainability guidelines issued by the FDI World Dental Federation was limited to 51.0% of participants, representing a substantial knowledge gap in policy and regulatory frameworks.

The results in (Table 3) indicate overwhelmingly positive attitudes toward sustainable dentistry among participants. A substantial majority (87.6%) agreed that sustainability should be prioritized within Saudi dental practice, demonstrating strong recognition of its importance. Furthermore, 91.2% supported the integration of sustainability into dental education, highlighting a clear demand for curricular reform.

Confidence in the feasibility of implementing sustainable practices was also high, with 82.0% agreeing that such practices can be adopted without compromising patient care.

However, willingness to invest in eco-friendly materials and technologies was comparatively lower (61.8%), with a notable proportion of participants expressing neutrality (19.0%) or disagreement (19.3%).

The adoption of sustainable practices varied across different domains of clinical activity (Table 4). Waste management practices were relatively well implemented, with 69.3% of participants reporting appropriate separation of hazardous dental waste.

Table 1: Participant Characteristics

Variable	Category	N = 306	Percentage
Gender	Male	197	64.4
	Female	109	35.6
Experience	<5 years	192	62.7
	5-10 years	47	15.4
	>10 years	67	21.9
Work setting	Private	162	52.9
	Government	144	47.1

Table 2: Knowledge and Awareness of Sustainable Dentistry

Question	Response	Number	Percentage
Are you familiar with the concept of sustainable dentistry?	Yes	244	79.7
	No	62	20.3
Does dental amalgam waste contribute significantly to mercury pollution in water?	Yes	228	74.5
	No	78	25.5
Compared to traditional methods, do you believe that digital dentistry (e.g., scans, radiography) is more environmentally sustainable?	Yes	201	65.7
	No	105	34.3
Are you aware of energy-saving dental technologies, such as LED lighting and the relevance of the Saudi Green Initiative to sustainable dentistry?	Yes	201	65.7
	No	105	34.3
Are you aware of the different roles of dentists, institutions, government and patients in sustainable dentistry practices?	Yes	156	51
	No	150	49
Are you aware of FDI World Dental Federation sustainability guidelines for dentistry?	Yes	156	51
	No	150	49

Table 3: Attitudes Toward Sustainable Dentistry

Statement	Strongly Agree (n (%))	Agree (n (%))	Neutral (n (%))	Disagree (n (%))	Strongly Disagree (n (%))
Sustainable dentistry should be a priority in Saudi dental practice	134 (43.8)	134 (43.8)	25 (8.2)	7 (2.3)	6 (2.0)
I believe sustainable practices can be implemented without compromising patient care	126 (41.2)	125 (40.8)	34 (11.1)	11 (3.6)	10 (3.3)
I would be willing to invest in eco-friendly equipment/materials, even at higher cost	95 (31.0)	94 (30.7)	58 (19.0)	30 (9.8)	29 (9.5)
Dental schools should include sustainability training in the curriculum	140 (45.8)	139 (45.4)	18 (5.9)	5 (1.6)	4 (1.3)

Table 4: Current Sustainable Practices

Practice	Response	Number	Percentage
Do you separate hazardous dental waste (e.g., amalgam, sharps) for proper disposal?	Yes	212	69.3
	No	94	30.7
Have you reduced single-use plastics in your clinic (e.g., disposable cups, packaging)?	Yes	167	54.6
	No	139	45.4
Do you use digital dentistry (e.g., scans, digital radiography)?	Yes	198	64.7
	No	108	35.3
Do you use teledentistry (remote consultations) to reduce patient travel emissions?	Yes	121	39.5
	No	185	60.5

Table 5: Barriers to Sustainable Dentistry (Choose all Answers that Applies)

Barrier	Number	Percentage
High cost of sustainable materials/equipment	233	76.1
Lack of training or education in sustainability	211	69
Lack of institutional policies or support	186	60.8
Time constraints in clinical practice	142	46.4
Other barriers such as patient acceptance and cooperation	10	3.3
Limited availability of eco-friendly products	225	73.5

Table 6: Willingness and Enabling Factors

Variable	Response	Number	Percentage
Would you participate in sustainability training if available?	Yes	241	78.8
	No	65	21.2
Would financial incentives encourage adoption of sustainable practices?	Yes	263	86
	No	43	14
Does your workplace currently support sustainability initiatives?	Yes	148	48.4
	No	158	51.6

Moderate adoption was observed for digital dentistry (64.7%) and reduction of single-use plastics (54.6%), suggesting partial integration of environmentally conscious practices into routine workflows. The lowest level of adoption was observed for teledentistry (39.5%).

There are some barriers that may delay or prevent dentists from practicing sustainable dentistry (Table 5). Financial constraints emerged as the most significant barrier, reported by 76.1% of participants, indicating that cost remains the primary obstacle to adopting sustainable practices. Limited availability of eco-friendly products was reported by 225 participants (73.5%), making it the second most frequently reported barrier.

Educational barriers were also prominent, with 69.0% of participants identifying lack of training as a key limitation. Institutional factors, including absence of policies and organizational support, were reported by 60.8% of participants, suggesting that systemic changes are required to facilitate widespread adoption. Time constraints were also identified by nearly half of respondents (46.4%), reflecting operational challenges in busy clinical environments.

Most participants expressed willingness to attend sustainability training (78.8%) and 86.0% indicated that financial incentives would encourage the adoption of sustainable practices. However, fewer than half (48.4%) reported that their workplace currently supported sustainability initiatives (Table 6).

In contrast, only 48.4% of participants indicated that their workplace currently supports sustainability initiatives, revealing a significant gap in institutional engagement.

Gender and years of experience were associated with several awareness, practice and barrier measures (Table 7). Female respondents more frequently reported familiarity with sustainable dentistry, reduced single-use plastics and teledentistry use. Limited product availability was more commonly reported by females, whereas time constraints and lack of institutional support were more commonly reported by males (all $p< 0.05$). Across experience groups, differences were observed in five of the six awareness measures, digital records/radiographs, plastic reduction, teledentistry and the barriers of product availability, lack of knowledge/training and lack of institutional support (all $p<0.05$). Pearson chi-square tests were used.

DISCUSSION

The present study explored dentists' knowledge, attitudes and practices toward sustainable dentistry within the context of Saudi Arabia and the findings demonstrate a moderate-to-high level of knowledge accompanied by highly positive attitudes; however, practical implementation remains inconsistent. This pattern reflects a transitional stage in the adoption of sustainable dentistry, where awareness is established but systemic integration remains incomplete.

The observed overall knowledge score in this study (65.4%) is consistent with recent Saudi and international studies reporting moderate awareness among dental professionals and students [2-5]. A national Saudi study by Haque *et al.* [2] found that although participants demonstrated general awareness of sustainability concepts, there were notable gaps in understanding formal guidelines and structured frameworks. Similarly, research across Saudi dental schools revealed that despite strong interest in sustainability, more than 80% of participants lacked fundamental knowledge of environmentally sustainable dentistry concepts, particularly in curricular and policy domains [6].

Table 7: Awareness Practices and Barriers by Gender and Experience

Measure and response counted	Male (n = 197)	Female (n = 109)	Gender p-value	<5 years (n = 192)	5-10 years (n = 47)	>10 years (n = 67)	Experience p-value
Awareness and knowledge							
Familiar with sustainable dentistry	146 (74.1)	98 (89.9)	<0.001	136 (70.8)	42 (89.4)	66 (98.5)	<0.001
Amalgam waste contributes to mercury pollution:True	127 (64.5)	89 (81.7)	0.002	127 (66.1)	25 (53.2)	64 (95.5)	<0.001
Digital dentistry is more environmentally friendlyTrue	112 (56.9)	48 (44.0)	0.032	111 (57.8)	12 (25.5)	37 (55.2)	<0.001
FDI has sustainability guidelines: True	105 (53.3)	51 (46.8)	0.023	63 (32.8)	33 (70.2)	60 (89.6)	<0.001
Aware of Saudi Green Initiative relevance that LED lights consume less energy than halogen lights:True	146 (74.1)	77 (70.6)	0.513	136 (70.8)	32 (68.1)	55 (82.1)	0.147
Practices							
Uses digital records/radiographs	109 (55.3)	64 (58.7)	0.567	101 (52.6)	21 (44.7)	51 (76.1)	<0.001
Always separates hazardous dental waste	146 (74.1)	83 (76.1)	0.694	136 (70.8)	36 (76.6)	57 (85.1)	0.066
Reduced single-use plastics significantly or somewhat	77 (39.1)	99 (90.8)	0.33	63 (32.8)	46 (97.9)	67 (100.0)	0.005
Uses teledentistry regularly or occasionally	28 (14.2)	93 (85.3)	0.023	23 (12.0)	42 (89.4)	56 (83.6)	0.029
Barriers							
Limited availability of eco-friendly products	131 (66.5)	94 (86.2)	<0.001	126 (65.6)	39 (83.0)	60 (89.6)	<0.001
Lack of knowledge/training	136 (69.0)	79 (72.5)	0.528	142 (74.0)	25 (53.2)	48 (71.6)	0.020
High costs	124 (62.9)	109 (100)	0.097	150 (78.1)	47 (100.0)	36 (53.7)	0.540
Time constraints	107 (54.3)	45 (41.3)	0.029	86 (44.8)	28 (59.6)	38 (56.7)	0.082
No institutional support/policies	136 (69.0)	50 (45.9)	<0.001	140 (72.9)	37 (78.7)	9 (13.4)	0.020
Other barriers	5 (2.5)	5 (4.6)	0.165	5 (2.6)	5(10.6)	0 (0.0)	0.423

*Values are n (%correct answers or agreement within subgroup). Gender and experience describe the same 306 supplied response rows

The overwhelmingly positive attitudes reported in this study particularly the strong support for integrating sustainability into dental curricula (91.2%) are highly consistent with both national and international literature [5,6,8]. Previous studies have emphasized that dental professionals increasingly recognize sustainability as an ethical responsibility aligned with modern healthcare delivery [8]. This aligns directly with the strategic direction of Saudi Vision 2030, which emphasizes environmental sustainability, efficient resource utilization and healthcare transformation. The FDI World Dental Federation has similarly highlighted that sustainable dentistry must balance environmental impact reduction with the maintenance of high-quality oral healthcare, reinforcing the dual objective addressed in this study [6].

Despite strong attitudes, the present findings reveal a clear knowledge-practice gap. While practices such as hazardous waste management and digital dentistry showed moderate adoption, other strategies particularly tele dentistry and reduction of single-use materials were less frequently implemented. This discrepancy is widely reported in the literature, where sustainable practices are often limited to those that are either mandated or economically feasible [9-11]. For instance, international studies have shown that dentists tend to adopt environmentally friendly practices selectively, with financial and operational feasibility being key determinants [9]. The relatively low adoption of tele dentistry in this study is notable, given its recognized role in reducing carbon emissions associated with patient transportation and improving access to care [10,11].

Financial constraints emerged as the most significant barrier (76.1%), followed by lack of training and institutional support. These findings are strongly supported by both Saudi and international evidence, which consistently identifies cost as the primary obstacle to implementing sustainable dental practices [2,9,8]. Importantly, the lower willingness to invest in eco-friendly materials observed in this study further reinforces the influence of economic considerations. This highlights the need for policy-driven solutions, including financial incentives and governmental support.

The high willingness to participate in sustainability training (78.8%) observed in this study represents a critical opportunity for intervention. Similar findings have been reported in Saudi populations, where participants expressed strong interest in education and training related to sustainable practices [5,6]. These findings emphasize that educational reform is a key driver for bridging the gap between awareness and implementation. Integrating sustainability into undergraduate curricula and continuing professional development programs may significantly enhance practical adoption.

Interestingly, demographic variables showed minimal influence on knowledge and attitudes, consistent with previous studies indicating that sustainability awareness is broadly distributed across professional groups [9]. However, the observed association between gender and practice suggests that behavioral implementation may be influenced by factors beyond knowledge alone, including workplace environment, access to resources and organizational or cultural factors. This finding aligns with the bio-psychosocial and systems based understanding of behavioral change in healthcare practice. Similarly, existing literature reports limited influence of most demographic characteristics on attitudes toward sustainable dentistry, although minor differences have been observed. A British study found no significant association between most demographic variables and attitudes; however, females demonstrated slightly more positive attitudes than males, while the stage of training showed no significant effect [12].

The current findings demonstrate a moderate level of awareness regarding stakeholder roles in sustainable

dentistry and the FDI guidelines is particularly concerning, given their role in providing an internationally recognized framework for sustainable oral healthcare practice, with only 51% of participants recognizing the responsibilities of dentists, institutions, government and patients and an identical proportion aware of the FDI World Dental Federation sustainability guidelines [3]. This limited awareness highlights a critical knowledge gap that may hinder coordinated implementation of sustainable practices. Dentists are expected to lead clinical-level changes through preventive, minimally invasive and resource-efficient care; however, their effectiveness is contingent upon institutional support and regulatory frameworks [13,14].

Academic institutions play a foundational role in embedding sustainability principles into dental curricula, which has been shown to significantly influence professional attitudes and long-term behavioral adoption [15-17]. Meanwhile, governmental bodies are responsible for establishing policies, regulations and financial incentives that facilitate environmentally sustainable healthcare systems which is considered a reported barrier to implement sustainable dentistry globally [18,19].

Furthermore, patient engagement remains a crucial yet often under recognized component [20,21], as informed patients can contribute to sustainability through preventive behaviors and acceptance of eco- friendly treatment alternatives. Collectively, these findings suggest that improving awareness alone is insufficient; rather, a multi-level, stakeholder-driven approach is required to translate knowledge into meaningful and sustained practice.

A multi-level, stakeholder is conceptualized and illustrated by the author in Figure 1 which presents a framework for sustainable dental care, adapted from the FDI World Dental Federation's Sustainability in Dentistry policy, that emphasizes prevention-focused, high-quality care while minimizing environmental impact [3,14]. It illustrates a framework where governmental bodies provide regulation, funding and national awareness; dentists implement eco- friendly clinical practices and patient education; institutions support sustainability through curriculum reform, research and green infrastructure; and patients contribute through preventive care and responsible resource use. The integration of these interconnected roles is essential to achieving environmentally sustainable dental care while maintaining clinical quality.

The associations observed in this study suggest that sustainability initiatives should address differences in professional experience and perceived barriers. Female respondents more frequently reported familiarity with sustainable dentistry, plastic reduction and teledentistry use but also greater difficulty accessing eco-friendly products, whereas males more frequently reported time constraints and insufficient institutional support. Across experience groups, respondents with more than ten years of practice reported the highest familiarity and use of digital records, although differences across other measures did not consistently follow an increasing pattern with experience. These findings suggest that awareness alone may be insufficient to support implementation, consistent with Martin *et al.* [14], who identified educational gaps and material-related challenges as barriers to sustainable dentistry. Accordingly, practical training should be accompanied by accessible sustainable products and supportive workplace policies. However, these exploratory, unadjusted associations should not be interpreted as independent effects of gender or experience.

From a broader perspective, this study supports the concept that sustainable dentistry is not merely an environmental initiative but a core component of modern, high-quality healthcare delivery. This directly aligns with

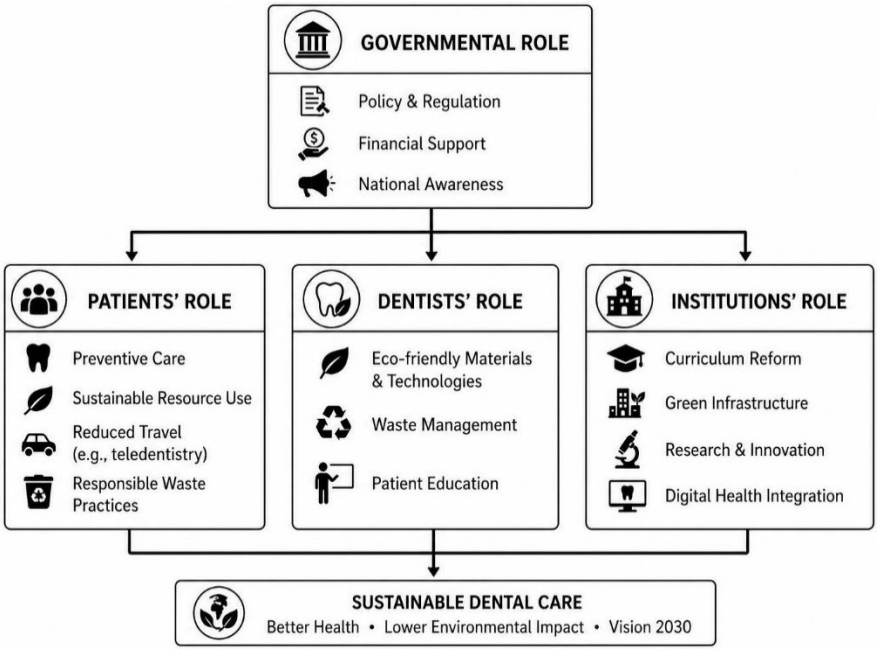


Figure 1: Proposed Framework of Stakeholder Roles in Sustainable Dentistry

the goals of Saudi Vision 2030 and FDI, which seeks to enhance healthcare quality while promoting environmental responsibility. However, this study has several limitations that should be considered. The cross-sectional design limits the ability to establish causal relationships between knowledge, attitudes and practices. Data were collected using self-reported questionnaires, which may introduce response and social desirability bias, potentially leading to overestimation of positive behaviors. Although participants were recruited from both private and government sectors using multiple social media platforms, the study was limited to a specific region, which may affect the generalizability of the findings across Saudi Arabia. Additionally, the assessment relied on subjective reporting rather than objective evaluation of clinical practices.

Despite these limitations, the study highlights important opportunities for improving sustainable dentistry. Integrating sustainability into dental education and continuous professional training is strongly recommended to bridge the gap between knowledge and practice. Policymakers should develop clear national guidelines and provide financial incentives to support the adoption of eco-friendly materials and technologies. At the institutional level, stronger support through policies and infrastructure is needed to facilitate implementation.

CONCLUSIONS

Participants demonstrated awareness and positive attitudes toward sustainable dentistry, alongside strong willingness to undertake further training; however, implementation varied. Integrating sustainability into dental curricula and continuing professional development, improving access to affordable eco-friendly products and strengthening institutional support may help translate positive attitudes into routine practice. Future longitudinal and multicentre studies incorporating objective assessments of clinical practices are needed to strengthen the evidence base and guide effective sustainability initiatives.

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