Natural Resources for Human Health
eISSN: 2583-1194

Original Research

Received 18 May 2026
Revised 15 June 2026
Accepted 01 July 2026

Natural Resources for Human Health 2026, Vol. 6 (4s): 40–51

KEYWORDS:
sustainable dentistry; green dentistry; environmental sustainability; dental education; knowledge; attitudes; practices.

Knowledge, Attitudes and Practices toward Sustainable Dentistry among Dental Students

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ABSTRACT:

Background: Environmental sustainability is increasingly important in dentistry because dental care involves substantial consumption of water, energy and materials and generates diverse clinical and non-clinical waste. Assessing students' knowledge, attitudes and practices (KAP) can identify gaps that may be addressed through dental education.

Objective: To assess knowledge, attitudes and practices related to sustainable dentistry among dental students and determine the associations between KAP scores and selected demographic and educational characteristics.

Materials and Methods: A cross-sectional KAP analysis was conducted using a dataset of 150 dental students. A structured questionnaire assessed 10 knowledge items, 8 attitude statements and 8 practice items. Knowledge scores ranged from 0–10, while attitude and practice scores ranged from 8–40. Descriptive statistics, independent-samples comparisons, one-way analysis of variance, chi-square tests and Pearson correlation analysis were performed, with statistical significance set at $p < 0.05$.

Results: The mean knowledge, attitude and practice scores were 6.43 ± 2.24, 32.71 ± 4.78 and 24.87 ± 5.64, respectively. Good knowledge was observed in 54 (36.0%) participants, positive attitudes in 112 (74.7%), and good sustainable practices in 31 (20.7%). Knowledge was significantly correlated with attitude ($r = 0.696$, $p < 0.001$) and practice ($r = 0.622$, $p < 0.001$), while attitude demonstrated the strongest correlation with practice ($r = 0.798$, $p < 0.001$). Significant differences in knowledge, attitude and practice

scores were observed across academic years. Prior sustainability education was not significantly associated with overall KAP scores.

Conclusion: Dental students demonstrated generally favorable attitudes toward sustainable dentistry, but this positive orientation was not consistently translated into sustainable practices. Integrating sustainability longitudinally into dental curricula, together with practical training and institution-level environmental policies, may help reduce the knowledge-to-practice gap.

1. INTRODUCTION

Sustainable development requires health systems to protect human health while reducing unnecessary consumption of natural resources and environmental damage. The relationship between environmental degradation and human health has become increasingly important because climate change, pollution, resource depletion and ecosystem disruption can directly and indirectly influence disease patterns and population well-being. Healthcare itself also contributes to environmental pressures through energy consumption, procurement, transportation, water use and waste generation (Lenzen et al., 2020). Sustainable healthcare therefore requires a transition from a model focused solely on immediate clinical outcomes toward one that simultaneously considers environmental, social and economic consequences.

Dentistry is an important component of this transition. Dental practices require electricity-intensive equipment, water, sterilization systems, disposable materials, personal protective equipment, chemicals, radiographic materials and numerous manufactured products. The environmental consequences of dental care extend from procurement and transportation to clinical use and final waste disposal (Hiltz, 2007; Mulimani, 2017). Dental amalgam is particularly relevant because mercury-containing waste requires appropriate handling and disposal, while conventional radiography may generate chemical waste that can be reduced through digital imaging.

The carbon footprint of dentistry is not restricted to direct energy consumption. An assessment of NHS primary dental care in England estimated a total carbon footprint of approximately 675 kilotonnes of CO_2-equivalent, with travel, procurement and energy representing major contributors (Duane et al., 2017). Subsequent life-cycle assessments have reinforced the importance of travel, procurement, waste and water in the environmental footprint of dental practices (Duane et al., 2019; Suresh et al., 2024).

The concept of "green dentistry" has consequently developed as a practical framework for reducing environmental burden while maintaining clinical quality and patient safety. The frequently described four-R approach—reduce, reuse, recycle and rethink—encourages dental professionals to minimize unnecessary consumption, select sustainable alternatives, avoid avoidable waste and reconsider conventional workflows (Pockrass and Pockrass, 2008). More recent sustainability frameworks have expanded this approach to include prevention, low-carbon care pathways, sustainable procurement, responsible waste management, energy efficiency and water conservation. FDI emphasizes that sustainable dentistry should combine high-quality oral healthcare with responsible use of materials, energy, water, equipment and other resources.

Evidence suggests that dental professionals generally recognize the importance of environmental sustainability, but implementation remains less consistent. Zia et al. (2024) reported that dental practitioners generally demonstrated favorable knowledge and attitudes but inadequate implementation of environmentally sustainable practices. Similarly, studies involving dental students have identified considerable interest in sustainability despite limited formal curricular exposure. In a multicenter US survey, 83% of students considered environmental sustainability important, whereas 75% reported little or no knowledge and only 5% reported receiving sustainability content within dental education (Gershberg et al., 2022).

Recent evidence has further highlighted the importance of education. Dixon et al. (2025) demonstrated that longitudinal integration of environmental sustainability into an undergraduate dental curriculum improved students' awareness, attitudes and knowledge. More recent studies among dental students in Malaysia, Egypt, Pakistan and Türkiye similarly indicate that education, training and year of study can influence sustainability-related knowledge and behavior.

Although the literature on sustainable dentistry is expanding, relatively few studies simultaneously examine knowledge, attitudes and actual practices using a unified scoring framework. The distinction is important because favorable attitudes do not

necessarily result in sustainable behavior. A student may support environmental protection while continuing to use paper records, unnecessary printing, disposable plastics or inefficient water and energy practices.

The present study therefore assessed the knowledge, attitudes and practices related to sustainable dentistry among dental students and examined the relationships between these domains and selected demographic and educational characteristics. The central hypothesis was that higher knowledge and more favorable attitudes would be associated with better sustainable practices.

2. MATERIALS AND METHODS

2.1 Study design and dataset

A cross-sectional KAP study design was used. The supplied dataset contained records for 150 dental students and included demographic characteristics, sustainability-related knowledge items, attitude items and practice items.

Data provenance: The supplied workbook labels the dataset as **simulated sample data**. Consequently, the present analysis should be considered a statistical research model based on simulated observations. It should not be represented as a completed human-subject study until replaced by an ethically approved dataset obtained from actual participants.

2.2 Participants and variables

The dataset contained 150 anonymous participant records. Recorded demographic variables included age, gender, year of study and prior sustainability education.

The gender distribution was 92 females (61.3%), 57 males (38.0%) and 1 participant (0.7%) who preferred not to disclose gender. The mean age was 20.4 years.

Participants were distributed across first year, second year, third year, fourth year, final year and internship. Prior sustainability education was reported by 56 participants (37.3%), whereas 94 (62.7%) reported no prior sustainability education.

2.3 Assessment of knowledge

Knowledge was evaluated using 10 binary items. Each correct or environmentally appropriate response received one point, while an incorrect or unaware response received zero points. The maximum knowledge score was therefore 10.

The knowledge domains included:

1. the concept of sustainable dentistry;
2. appropriate disposal of dental amalgam and mercury-containing waste;
3. environmental advantages of digital radiography;
4. dental single-use plastic waste;
5. the four-R framework;
6. water and energy conservation;
7. the carbon footprint of dental care;
8. clinical waste segregation;
9. environmentally preferable dental materials; and
10. professional sustainability guidelines.

Knowledge was classified as poor (0–4), moderate (5–7) or good (8–10).

2.4 Assessment of attitudes

Attitudes were measured using eight statements scored on a five-point Likert scale from 1, strongly disagree, to 5, strongly agree. Items assessed support for sustainability within the dental curriculum, professional responsibility, willingness to consider environmentally preferable materials, compatibility of sustainability with patient care, paperless records, water and energy conservation, interest in additional sustainability education and the leadership role of dentistry in environmental protection.

The total possible score ranged from 8 to 40. Scores were categorized as negative (8–18), neutral (19–29) or positive (30–40).

2.5 Assessment of practices

Sustainable practices were evaluated using eight items scored from 1, never, to 5, always. Items assessed clinical waste segregation, use of digital records, switching off equipment and lights, reduction of single-use plastics, avoidance of unnecessary printing, water-efficient practices, recycling and sustainability considerations during product selection.

Total practice scores ranged from 8 to 40 and were categorized as poor (8–18), moderate (19–29) or good (30–40).

2.6 Statistical analysis

Descriptive statistics were calculated for demographic variables and KAP scores. Continuous variables were summarized as mean and standard deviation, while categorical variables were summarized as frequency and percentage.

Independent-samples comparisons were used to evaluate differences between two-category variables, while one-way analysis of variance was used for variables with more than two groups. Pearson correlation coefficients were calculated to examine relationships between knowledge, attitude and practice scores.

Categorical associations between prior sustainability education and KAP categories were examined using the chi-square test. Statistical significance was established at $p < 0.05$.

2.7 Ethical considerations

Because the supplied workbook contains simulated observations rather than identifiable human-subject research data, no genuine participant-level ethical approval can be claimed from the dataset. For a real submission, the authors must provide the name of the approving institutional ethics committee, approval number, informed-consent procedure and study registration details where applicable. NRFHH specifically requires ethics approval information for studies involving human participants.

3. RESULTS AND DISCUSSION

3.1 Participant characteristics

The analysis included 150 simulated dental-student records. The mean age was 20.4 years. Females constituted 61.3% of the sample, males 38.0%, and 0.7% preferred not to disclose gender. Prior sustainability education was reported by 37.3% of participants, indicating that almost two-thirds had not previously received formal education or training specifically related to sustainability.

The distribution of participants across academic years allowed examination of whether sustainability-related knowledge and behaviors varied according to educational progression. This is relevant because environmental sustainability is increasingly being considered as a longitudinal educational competency rather than a single-topic component of dental education. Recent curriculum-based research indicates that sustainability teaching can improve awareness, knowledge and attitudes across multiple years of undergraduate dental training (Dixon et al., 2025).

Table 1. Participant characteristics

Characteristic	**n (%)**
Gender	
Female	92 (61.3)
Male	57 (38.0)
Prefer not to say	1 (0.7)
Prior sustainability education	
Yes	56 (37.3)
No	94 (62.7)
Age	
Mean age	20.4 years

3.2 Knowledge of sustainable dentistry

The mean knowledge score was **6.43 ± 2.24 out of 10**, indicating an overall moderate level of sustainability-related knowledge.

Twenty-eight participants (18.7%) demonstrated poor knowledge, 68 (45.3%) demonstrated moderate knowledge and 54 (36.0%) demonstrated good knowledge.

Table 2. Distribution of participants according to knowledge level

Knowledge level	n (%)
Poor	28 (18.7)
Moderate	68 (45.3)
Good	54 (36.0)
Total	**150 (100)**

The predominance of moderate knowledge is consistent with the broader literature showing that sustainability awareness among dental students is developing but remains incomplete. Fisal et al. (2026) reported poor overall knowledge among Malaysian undergraduate dental students, while Gershberg et al. (2022) found that most US dental students considered sustainability important despite reporting limited knowledge and minimal curricular exposure.

The present distribution suggests that sustainability may be recognized conceptually without being consistently developed as a formal competency. The knowledge items in the present instrument covered clinically relevant areas including amalgam management, radiographic waste, plastic use, waste segregation and conservation of water and energy. These domains correspond closely with the environmental components repeatedly identified in the sustainability literature (Zia et al., 2024; Martin et al., 2021).

The moderate knowledge level is particularly relevant because environmental sustainability in dentistry is not limited to recycling. It encompasses the entire care pathway, including disease prevention, procurement, transportation, clinical decision-making, material selection, equipment utilization, infection control and waste management. Life-cycle assessments indicate that environmental impact is distributed across several stages rather than being attributable to one isolated dental procedure (Suresh et al., 2024).

3.3 Attitudes toward sustainable dentistry

The mean attitude score was **32.71 ± 4.78 out of 40**, demonstrating a generally favorable attitudinal orientation.

One participant (0.7%) demonstrated a negative attitude, 37 (24.7%) had neutral attitudes and 112 (74.7%) demonstrated positive attitudes.

Table 3. Distribution according to attitude level

Attitude level	n (%)
Negative	1 (0.7)
Neutral	37 (24.7)
Positive	112 (74.7)
Total	**150 (100)**

The strong positive attitude observed in this analysis is encouraging because acceptance of sustainability principles is an essential prerequisite for curricular and institutional change. Similar positive attitudes have been reported among dental students and practitioners in several countries. Gershberg et al. (2022) found that 83% of surveyed US dental students regarded environmental sustainability as quite or extremely important. Fisal et al. (2026) likewise reported that integrating green dentistry into dental education is necessary to promote sustainable practice.

The high attitude score also supports the proposition that sustainability may be an educational area in which students are receptive to change. Students may not require persuasion regarding the importance of environmental protection; rather, they may need structured opportunities to convert this favorable orientation into specific behaviors.

Importantly, positive attitudes alone should not be interpreted as evidence of sustainable clinical performance. The substantial difference between the proportion with positive attitudes (74.7%) and the proportion with good practices (20.7%) illustrates this distinction.

3.4 Sustainable practices

The mean practice score was **24.87 ± 5.64 out of 40**.

Twenty-three participants (15.3%) demonstrated poor sustainable practices, 96 (64.0%) demonstrated moderate practices and only 31 (20.7%) demonstrated good practices.

Table 4. Distribution according to practice level

Practice level	**n (%)**
Poor	23 (15.3)
Moderate	96 (64.0)
Good	31 (20.7)
Total	**150 (100)**

The comparatively lower practice scores constitute the most important finding of the analysis. While almost three-quarters of students demonstrated positive attitudes, only approximately one-fifth demonstrated good sustainable practices.

This knowledge-to-practice gap has been repeatedly described in sustainable dentistry. Zia et al. (2024) concluded that dental professionals generally possess favorable knowledge and attitudes but that practical implementation remains inadequate. Similarly, recent studies among dental students and dental school personnel have demonstrated that awareness may be relatively established while actual implementation remains inconsistent.

Several factors may explain this discrepancy. Students may have limited authority over procurement, waste-management infrastructure, sterilization systems, water-saving technologies and energy policies. Consequently, even a highly motivated student may be unable to implement a sustainable practice if the institution does not provide appropriate bins, recycling systems, digital documentation infrastructure or environmentally preferable products.

The practice findings therefore reinforce the importance of distinguishing individual behavior from system-level sustainability. Sustainable dentistry cannot depend exclusively on individual motivation. Institutional procurement policies, waste segregation systems, digital workflows, energy-efficient equipment and staff training can either facilitate or constrain sustainable behavior.

3.5 Relationships among knowledge, attitudes and practices

A strong positive correlation was identified between knowledge and attitude scores (**$r = 0.696$, $p < 0.001$**). Knowledge was also positively correlated with practice scores (**$r = 0.622$, $p < 0.001$**).

The strongest relationship was observed between attitude and practice scores (**$r = 0.798$, $p < 0.001$**).

Table 5. Correlations among KAP domains

Relationship	**Pearson r**	**p-value**
Knowledge–attitude	0.696	<0.001
Knowledge–practice	0.622	<0.001
Attitude–practice	0.798	<0.001

These relationships indicate that sustainability-related knowledge and attitudes are interconnected and that both may contribute to sustainable behavior. However, the stronger association between attitude and practice suggests that willingness and perceived professional responsibility may be particularly important determinants of behavior.

Recent evidence from Türkiye similarly found positive relationships among knowledge, attitudes and sustainable clinical behavior, with attitudes showing an important association with behavior (Buldur et al., 2026). The findings are also compatible with curriculum intervention studies showing that education can modify sustainability-related knowledge and attitudes, although environmental behavior ultimately requires practical opportunities and supportive infrastructure.

The present results should nevertheless not be interpreted causally because of the cross-sectional design. A positive correlation does not establish that increasing knowledge alone will produce improved practice. Longitudinal intervention studies are required to determine whether educational exposure causes durable behavioral change.

3.6 Influence of academic year

Significant differences were observed across academic years for knowledge (**p = 0.021**), attitude (**p = 0.003**) and practice (**p = 0.010**) scores.

This finding suggests that progression through dental education may be associated with sustainability-related development. Greater exposure to clinical environments may provide students with more opportunities to encounter waste segregation, digital documentation, energy-consuming equipment, infection-control procedures and material selection.

The finding is consistent with longitudinal educational evidence. Dixon et al. (2025) demonstrated that embedding sustainability education throughout an undergraduate dental curriculum produced significant improvements in sustainability awareness, attitudes and knowledge. Other recent student studies have similarly reported associations between educational progression and sustainability-related awareness.

However, the academic-year association should not automatically be interpreted as evidence that conventional dental education naturally produces sustainability competence. The difference may reflect age, clinical exposure, self-selection or other unmeasured factors. A longitudinal cohort study would be more appropriate for determining the direction and magnitude of educational effects.

3.7 Gender and sustainability scores

Gender was not significantly associated with knowledge (**p = 0.616**) or attitude scores (**p = 0.253**). A statistically significant difference was observed for practice scores (**p = 0.038**).

The finding should be interpreted cautiously because gender was substantially imbalanced and only one participant selected "prefer not to say." The observed practice difference may therefore reflect sample composition or contextual factors rather than a true gender-dependent effect.

Environmental sustainability education should consequently be designed as a universal competency rather than targeted primarily according to demographic characteristics.

3.8 Prior sustainability education

Fifty-six participants (37.3%) reported prior sustainability education, whereas 94 (62.7%) reported no prior exposure.

Despite the apparent educational difference, prior sustainability education was not significantly associated with knowledge, attitude or practice total scores. The corresponding p-values were 0.471, 0.215 and 0.072, respectively.

This finding deserves particular consideration. The absence of statistical significance does not necessarily demonstrate that sustainability education is ineffective. The dataset does not provide information regarding the intensity, duration, quality or timing of previous educational exposure. A single lecture or informal exposure may not be equivalent to a longitudinal, competency-based sustainability curriculum.

Recent interventional evidence supports this distinction. Educational programs specifically designed around environmentally sustainable dentistry have demonstrated improvements in knowledge and practice among dental students and interns (Fakhry et al., 2025; recent Egyptian educational intervention studies).

Therefore, future educational interventions should emphasize active learning, practical demonstrations, audits, sustainability projects, waste-management exercises and feedback rather than relying solely on didactic teaching.

3.9 Implications for dental education

The findings support a transition from awareness-based sustainability education toward competency-based sustainability education.

A curriculum designed around sustainable dentistry should include at least five interconnected domains:

First, resource conservation. Students should learn to minimize unnecessary water and energy consumption. Dental equipment should be switched off when not required, and students should understand the environmental consequences of equipment use.

Second, waste minimization and segregation. Students should understand the distinction between infectious, hazardous, recyclable and general waste. This is particularly important because dental clinics generate several waste streams requiring different disposal routes. Dental waste can contain metals, chemicals, plastics and biomedical materials capable of producing environmental and public-health hazards if improperly managed (Hiltz, 2007; Boukhris et al., 2025).

Third, sustainable procurement. Students should understand life-cycle thinking when selecting materials and equipment. Sustainable procurement requires consideration of manufacturing, transportation, packaging, use, reuse, recyclability and final disposal rather than simply purchase price.

Fourth, digital transformation. Digital radiography and electronic records may reduce certain forms of chemical and paper waste, although their environmental benefits should be considered within the broader energy and equipment life cycle.

Fifth, prevention-focused dentistry. Prevention may represent one of the most important forms of sustainable oral healthcare because preventing disease reduces the need for future resource-intensive interventions. FDI emphasizes prevention and high-quality care as central components of sustainable dentistry.

3.10 Institutional implications

The relatively low proportion of students with good practice scores suggests that educational institutions should complement curriculum changes with operational changes.

Dental schools could establish sustainability committees, conduct annual environmental audits, introduce waste segregation monitoring, expand digital documentation, optimize water use, reduce unnecessary printing, implement energy-saving policies and incorporate environmental criteria into procurement.

Life-cycle research supports such interventions. Suresh et al. (2024) demonstrated that implementing recommendations addressing procurement, waste and water can reduce the carbon footprint of dental care. Similarly, dental-practice carbon assessments have demonstrated substantial contributions from patient and staff travel, energy, procurement and waste.

Consequently, sustainable dentistry should not be viewed merely as a personal lifestyle preference. It should become an institutional quality-improvement objective.

3.11 Comparison with previous research

The current findings broadly agree with the international literature showing a recurring pattern of **moderate knowledge, favorable attitudes and weaker implementation**.

Zia et al. (2024) reported that dental professionals generally understood environmentally friendly dentistry and supported environmental conservation, but practical implementation remained inadequate. Gershberg et al. (2022) found strong perceived importance of sustainability among US dental students but limited knowledge and curricular exposure. Thakar et al. (2023), studying dental students and practitioners in West India, reported limited awareness and identified lack of information as an important barrier to implementation. Fisal et al. (2026) similarly found inadequate green-dentistry knowledge among Malaysian undergraduate students and identified associations between training, awareness and practice.

Buldur et al. (2026) reported significant associations between sustainability knowledge, attitudes and clinical behavior among dental students and dentists in Türkiye, with attitudes showing a particularly important relationship with behavior. The present dataset therefore reproduces an important pattern observed in contemporary sustainability research: attitudinal acceptance is progressing faster than behavioral implementation.

3.12 Relevance to natural resources and human health

The subject is directly relevant to the broader concept of natural resources and human health because dental healthcare depends on natural resources while simultaneously generating environmental outputs capable of affecting human health. Water conservation is particularly relevant because healthcare facilities consume substantial volumes of water. Energy use contributes indirectly to greenhouse-gas emissions depending on the energy source. Procurement requires extraction of raw materials, manufacturing and transportation. Waste disposal can release pollutants when hazardous materials are inadequately managed. Therefore, environmentally sustainable dentistry represents a practical intersection between healthcare delivery, resource conservation and preventive public health. The objective is not to reduce resources at the expense of patient care, but to eliminate unnecessary consumption while maintaining or improving clinical outcomes.

3.13 Limitations

Several limitations should be considered. First, the supplied dataset is explicitly identified as simulated data. Consequently, the findings cannot be interpreted as evidence of the actual sustainability status of a real dental student population. Second, the cross-sectional design does not permit causal inference. Third, the questionnaire scores were supplied with the dataset, but independent psychometric validation information such as Cronbach's alpha, test–retest reliability and construct validity was not available.

Fourth, practices were self-reported rather than directly observed. Self-reported sustainability behaviors may be affected by social desirability bias. Fifth, the dataset did not contain detailed information regarding the institution, geographical setting, socioeconomic background, access to sustainability infrastructure or the specific nature of prior sustainability education. Sixth, the sample size of 150 limits the precision of subgroup comparisons.

Finally, the practice score should not be interpreted as a direct measurement of environmental impact. A higher practice score does not necessarily correspond to a quantified reduction in CO_2-equivalent emissions, water consumption or waste generation. Future studies should therefore combine KAP questionnaires with objective environmental audits, life-cycle assessment, waste measurements and energy/water monitoring.

4. CONCLUSION

This cross-sectional analysis demonstrated a clear discrepancy between sustainability-related attitudes and reported sustainable practices among dental students. Knowledge was predominantly moderate, attitudes were strongly positive and practical implementation was largely moderate, with only one-fifth of participants reaching the predefined good-practice category. Knowledge was positively associated with attitudes and practices, while the strongest relationship was observed between attitudes and practices. Significant differences across academic years suggest that educational progression may influence sustainability-related competencies, although prior sustainability education as recorded in the dataset was not independently associated with total KAP scores.

The findings support the integration of sustainability throughout dental education rather than treating it as an isolated topic. Curriculum reform should be accompanied by institutional policies addressing waste segregation, procurement, energy, water, digital workflows and prevention-focused care. Future research should use real, ethically approved student populations and longitudinal intervention designs incorporating objective environmental outcomes.

5. Recommendations

1. Environmental sustainability should be incorporated longitudinally throughout undergraduate dental education.
2. Practical sustainability competencies should accompany theoretical teaching.
3. Dental schools should establish formal waste-segregation and recycling systems.
4. Energy- and water-saving practices should be incorporated into clinical protocols.

5. Digital documentation and radiography should be encouraged where clinically appropriate.
6. Sustainable procurement criteria should be incorporated into dental-school purchasing policies.
7. Students should participate in environmental audits and sustainability quality-improvement projects.
8. Future studies should combine KAP assessment with objective carbon, water, energy and waste measurements.
9. Longitudinal educational studies should determine whether sustainability teaching produces persistent behavioral changes.
10. Sustainability should be integrated with prevention-oriented oral healthcare to reduce avoidable treatment-related resource consumption.

6. DATA AVAILABILITY STATEMENT

The supplied workbook contains a simulated dataset used for development and statistical demonstration of this manuscript. The dataset should not be represented as a real participant dataset. For a genuine submission, the authors should provide the de-identified research dataset and associated questionnaire/codebook in accordance with the journal's data-transparency requirements. NRFHH specifically emphasizes accessibility of datasets associated with submitted research.

7. FUNDING

No external funding was associated with the supplied simulated dataset.

8. ACKNOWLEDGEMENTS

None.

9. AUTHOR CONTRIBUTIONS

To be completed according to the actual contributions of the investigators before submission.

10. CONFLICT OF INTEREST

The authors should complete the journal's required conflict-of-interest disclosure. No conflict of interest is identifiable from the supplied simulated dataset.

11. ETHICS STATEMENT

For the present simulated dataset: Not applicable because the supplied workbook is explicitly labeled as simulated data.

For submission based on actual human participants: This section must be replaced with the authentic institutional ethics committee name, approval number and informed-consent statement. NRFHH requires ethics information for human studies.

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