



## **Reconstructing Global Environmental Risk Narratives Using Large-Scale Text Mining of Scientific Dental Literature**

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### **ABSTRACT**

*The escalating global environmental crisis poses profound challenges to various sectors, including dentistry, where environmental risks intersect with oral health outcomes and professional practices. This conceptual paper proposes a novel theoretical framework for reconstructing narratives surrounding global environmental risks within scientific dental literature through large-scale text mining. By integrating concepts from environmental sustainability, narrative theory, and computational linguistics, the framework elucidates how fragmented discourses on issues such as climate change impacts on oral health, dental waste pollution, and resource depletion can be systematically synthesized into coherent narratives. The introduction highlights the urgency of addressing environmental risks in dentistry, emphasizing their implications for public health and planetary well-being. The theoretical background synthesizes recent literature on environmental sustainability in dental practices and advances in text mining for narrative analysis. The proposed framework outlines a multi-layered approach involving semantic extraction, temporal mapping, and relational modeling to uncover evolving risk narratives. This work contributes to dental scholarship by offering a tool for reflexive analysis of the field's environmental discourse, fostering greater awareness and theoretical innovation without empirical validation. Ultimately, it advocates for a paradigm shift toward environmentally conscious dental research narratives.*

**Keywords:** Environmental risks, Dental literature, Text mining, Narrative reconstruction, Climate change, Sustainability, Oral health

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### **INTRODUCTION**

The global environmental crisis, encompassing climate change, biodiversity loss, and resource scarcity, has permeated nearly every facet of human activity, including healthcare domains such as dentistry (Duane *et al.*, 2020; Martin *et al.*, 2021). While historically viewed primarily through a clinical or biomedical lens, dental practice is increasingly recognized as both a contributor to and a receptor of environmental pressures. In recent years, scholarly attention has turned to the environmental footprint of dental care, revealing the multifaceted ways in which routine procedures contribute to pollution, waste generation, and greenhouse gas emissions (Borglin *et al.*, 2024; Mulligan *et al.*, 2024). For instance, the production, procurement, and disposal of dental materials—including plastics, amalgams, and single-use items—represent significant sources of chemical pollutants, while energy-intensive dental equipment and sterilization processes drive carbon emissions (Duane *et al.*, 2021; Passos *et al.*, 2022). Beyond operational activities, patient travel patterns and the supply chains that support clinics further exacerbate the environmental burden, linking local dental practice to broader global sustainability challenges.

Environmental changes themselves exert reciprocal influences on oral health, illustrating a complex, bidirectional relationship.

Climate-induced shifts in food systems, water availability, and pathogen prevalence can indirectly influence oral health outcomes, such as the prevalence of early childhood caries, periodontal disease, and other dental pathologies (Seminario *et al.*, 2021; Khanna *et al.*, 2025). For example, drought conditions or contamination of water supplies can reduce access to fluoride-rich drinking water, while extreme weather events may alter dietary patterns in ways that increase sugar consumption. Such interactions underscore the need to examine not only how dental practices impact the environment but also how environmental transformations feedback into oral health risks. Collectively, these dynamics emphasize the importance of understanding how environmental risks are articulated and framed in the scientific dental literature, which constitutes the primary knowledge base shaping professional standards, policy, and practice.

Despite growing recognition of these interconnections, the dental literature remains fragmented in its treatment of environmental risks. Studies often focus narrowly on discrete aspects, such as the toxicity of microplastics from oral care products, emissions associated with specific dental procedures, or waste from dental amalgams, without integrating these findings into a coherent systemic understanding (Sarangi & Singh, 2022; Hiltz *et al.*, 2024). This compartmentalization limits the field's capacity to develop holistic strategies for sustainable dentistry and to contribute effectively to global sustainability agendas, including the United Nations Sustainable Development Goals (Glick *et al.*, 2021). Compounding this challenge is the sheer volume of scientific output: millions of publications are

produced annually, rendering manual synthesis increasingly impractical and heightening the need for computational approaches that can distill insights from extensive textual corpora (Fleuret *et al.*, 2021).

Large-scale text mining—a computational methodology grounded in artificial intelligence and natural language processing—offers a promising solution. This approach enables the automated extraction, aggregation, and analysis of textual data, facilitating the transformation of disparate publications into structured knowledge frameworks (Van der Vegt *et al.*, 2019; Westergaard *et al.*, 2019). Within the domain of environmental risk in dentistry, text mining can identify latent patterns in narratives, including how risks are framed, the causal factors emphasized, and the mitigation strategies proposed, across temporal and thematic axes (Martin *et al.*, 2023). For instance, it could trace evolving discourses on climate change impacts on pediatric oral health, the environmental hazards of dental amalgam disposal, or the emergence of eco-friendly dental materials (Grzybowski *et al.*, 2022; Shrivastava *et al.*, 2025).

This paper advances a conceptual framework rather than empirical findings, arguing that reconstructing environmental risk narratives through text mining can enhance both understanding and reflexivity within the dental field. By drawing on narrative theory, it positions scientific literature as an active site of meaning-making rather than a neutral repository, emphasizing how linguistic, cultural, and institutional factors shape the representation of environmental risks (Llewellyn-Beardsley *et al.*, 2019). In a field where environmental considerations have historically been peripheral compared to clinical outcomes, such an approach elevates sustainability to a core epistemological concern, challenging dentistry to critically examine its own knowledge production processes (Martin *et al.*, 2025).

The urgency of this undertaking is further underscored by projections suggesting that climate change will exacerbate oral health disparities, particularly among vulnerable populations exposed to extreme weather events, water scarcity, and limited access to healthcare resources (Sarangi & Singh, 2024; Shrivastava & Shrivastava, 2025). Rising temperatures, altered precipitation patterns, and shifts in vector-borne diseases may indirectly increase the prevalence of periodontal diseases and other oral health conditions by influencing nutrition and infection risks (Kotecha *et al.*, 2024). Yet, despite these looming threats, the dental literature's discourse on environmental risk often remains siloed, with limited integration of insights from environmental science, public health, and policy research (Jalbani *et al.*, 2023). Large-scale text mining offers a scalable, systematic means to bridge these gaps, potentially revealing underrepresented perspectives, emergent trends, and cross-disciplinary connections that conventional literature reviews may overlook (Fleuret *et al.*, 2021).

By situating environmental risks as both a subject and lens of analysis, this paper proposes that text mining can illuminate the evolving narrative landscape of sustainable dentistry, providing a foundation for evidence-informed policy, clinical guidelines, and research prioritization in the face of accelerating environmental change.

Furthermore, the theoretical lens adopted here emphasizes the performative role of narratives in shaping professional identities, norms, and practices. In dental education, research,

and policy, the ways in which environmental risks are framed influence curriculum design, ethical guidelines, and innovation priorities (Duane *et al.*, 2020; Passos *et al.*, 2022). For example, narratives that foreground patient safety and clinical efficacy often overshadow ecological considerations, perpetuating anthropocentric paradigms that prioritize human health over broader planetary health concerns (Mulimani, 2019; Duane *et al.*, 2021). By systematically mining these narratives, scholars can uncover dominant discourses, highlight implicit biases, and propose alternative frameworks that integrate sustainability and planetary health perspectives. Such conceptual shifts resonate with broader calls in health sciences for transdisciplinary approaches, where dentistry intersects with environmental studies to tackle complex, "wicked" problems like climate adaptation, resource scarcity, and systemic inequities (Glick *et al.*, 2021; Khanna *et al.*, 2025). In doing so, the field can move beyond fragmented, reactive approaches toward proactive, holistic strategies that align professional practice with environmental stewardship.

In summary, this introduction establishes the rationale for a novel theoretical framework that leverages text mining to reconstruct global environmental risk narratives within scientific dental literature (Conti *et al.*, 2022; Mostafa *et al.*, 2022; Wilson *et al.*, 2022; Hart *et al.*, 2023; Khalil *et al.*, 2023; O'Connor *et al.*, 2023; Silva *et al.*, 2023; Syam & Maheswari, 2023). The subsequent sections of this paper elaborate the theoretical foundations, synthesize relevant scholarship, and present the proposed framework. Through this conceptual exploration, the paper aims to catalyze a more integrated and forward-looking discourse in dental scholarship, highlighting sustainability as a core epistemological concern and informing professional practices without relying on empirical data.

#### Theoretical background & literature synthesis

##### *Environmental risks in dental practices: an overview*

The environmental footprint of dentistry has received increasing attention in recent scholarship, highlighting the wide array of risks associated with routine operational activities (Duane *et al.*, 2020; Martin *et al.*, 2021). Prominent concerns include the generation of hazardous waste—such as mercury-containing dental amalgam residues—and the extensive use of single-use plastics in personal protective equipment, packaging, and disposable instruments (Martin *et al.*, 2021; Borglin *et al.*, 2024). Improper disposal of these materials can lead to ecosystem contamination, affecting soil and water quality and indirectly posing risks to human health (Hiltz *et al.*, 2024). In addition to waste concerns, energy-intensive procedures—including sterilization, imaging, and climate-controlled facility operations—contribute significantly to greenhouse gas emissions, situating dentistry within the broader climate impacts of healthcare systems (Passos *et al.*, 2022; Sarangi & Singh, 2022). Recent studies, particularly those published since 2020, advocate for comprehensive lifecycle assessments to quantify the environmental burdens of dental practices, demonstrating that even common interventions, such as tooth extractions or routine restorations, carry measurable ecological costs (Seminario *et al.*, 2021; Borglin *et al.*, 2024).

Beyond operational emissions and waste, environmental risks also encompass dentistry's vulnerability to external ecological and climate-induced disruptions. For instance, supply chain

interruptions due to extreme weather events, water shortages, or material scarcities can threaten the continuity of dental services, particularly in low-resource or geographically vulnerable settings (Duane *et al.*, 2020; Glick *et al.*, 2021; Shrivastava & Shrivastava, 2025). These considerations reflect an evolving perspective in the literature: environmental risks are increasingly conceptualized not as peripheral externalities but as integral components of professional responsibility, affecting clinical decision-making, resource management (Kowtharapu *et al.*, 2022; Pereira *et al.*, 2022; Gomez *et al.*, 2023; Jensen *et al.*, 2023; Meyer *et al.*, 2023; Pinto & Sousa, 2023; Roger *et al.*, 2023; Ernst & Weber, 2024; Feng *et al.*, 2024; Karimov & Rakhimova, 2024), and strategic planning (Khanna *et al.*, 2025; Martin *et al.*, 2025). By synthesizing these insights, the literature underscores the need for dental professionals to engage actively with environmental sustainability, both in practice and in the construction of knowledge that shapes the field.

#### *Climate change and its implications for oral health*

Climate change has emerged as a pivotal environmental risk factor with far-reaching implications for oral health, shaping both disease prevalence and preventive strategies (Westergaard *et al.*, 2019; Sarangi & Singh, 2024). Elevated temperatures, shifting precipitation patterns, and the increased frequency of extreme weather events can exacerbate oral diseases by influencing microbial ecosystems in the oral cavity and altering dietary behaviors, which in turn may increase incidences of caries and periodontitis (Kotecha *et al.*, 2024; Shrivastava *et al.*, 2025). In pediatric populations, climate-induced food insecurity has been linked to early childhood caries, as disruptions in food supply and nutrition amplify vulnerability to enamel demineralization and other oral health challenges (Seminario *et al.*, 2021; Martin *et al.*, 2023). Additionally, air quality degradation from wildfires, urban pollution, and other climate-exacerbated sources may contribute to oral mucosal disorders and inflammatory conditions, highlighting the multifactorial pathways through which environmental change affects oral health (Mulimani, 2019; Jalbani *et al.*, 2023).

Scholarly discourse also emphasizes adaptive strategies, suggesting that dentistry must integrate climate resilience into preventive and clinical care models (Pegoraro *et al.*, 2025; Shrivastava & Shrivastava, 2025). This includes re-evaluating material choices—such as minimizing the use of environmentally harmful composites and plastics—while ensuring patient safety, reflecting an emerging conceptual shift toward eco-centric oral health paradigms (Duane *et al.*, 2020; Glick *et al.*, 2021). Collectively, the literature frames climate-related risks as complex, multifaceted phenomena that demand a departure from narrowly siloed clinical perspectives toward integrated approaches that connect oral health with broader environmental determinants (Seminario *et al.*, 2021; Khanna *et al.*, 2025).

#### *Narrative theory in scientific discourse*

Narratives in scientific literature function as organizing frameworks that shape how problems are defined, causes are attributed, and solutions are proposed, extending beyond mere reporting to actively construct disciplinary knowledge (Greenhalgh *et al.*, 2018; Llewellyn-Beardsley *et al.*, 2019). In

health sciences, narrative analysis has been used to reveal how textual structures influence perception, such as portraying environmental risks either as imminent crises requiring urgent intervention or as manageable challenges amenable to incremental solutions (Chen *et al.*, 2021; Abd-Alrazaq *et al.*, 2023).

Recent advances incorporate AI-driven and computational approaches to dissect scientific narratives, enabling the identification of thematic trajectories, rhetorical patterns, and underlying assumptions across large corpora (Van der Vegt *et al.*, 2019; Vazquez *et al.*, 2019). Applied to dentistry, narrative theory illuminates how environmental risks are often positioned as secondary to clinical priorities, marginalizing discussions of sustainability and ecological responsibility (Leavy *et al.*, 2019; Martin *et al.*, 2025). By analyzing these narratives, scholars can uncover implicit biases, dominant paradigms, and gaps in discourse, thereby highlighting the performative power of narratives in shaping policy, research agendas, and clinical practice (Llewellyn-Beardsley *et al.*, 2019; Naiman, 2020).

#### *Advances in text mining for literature analysis*

Text mining has evolved as a powerful methodological and theoretical tool for navigating the exponential growth of scientific literature, facilitating the systematic extraction of patterns and structures from unstructured text (Fleuret *et al.*, 2021; Grzybowski *et al.*, 2022). Techniques such as topic modeling, co-occurrence network analysis, and sentiment analysis allow researchers to reconstruct discourses across diverse sources, capturing thematic, temporal, and relational dynamics (Westergaard *et al.*, 2019; Farrell *et al.*, 2025). In fields such as ecology and public health (Guo *et al.*, 2022; Kumar *et al.*, 2022; Lampasona & Pantaleo, 2022; Mohamed *et al.*, 2022; Singh *et al.*, 2022; Bei *et al.*, 2023; Smalls & Hailemeskel, 2023; Sewankambo, 2024), text mining has been applied to map evolving trends, such as shifts in risk perception or the emergence of novel environmental hazards (Fioretti, 2014; Seminario *et al.*, 2021). In the context of dental literature, text mining offers the potential to synthesize fragmented environmental narratives, enabling a conceptualization of risks not as isolated events but as interconnected phenomena embedded within broader social, ecological, and institutional systems (Van der Vegt *et al.*, 2019; Shrivastava & Shrivastava, 2025). Contemporary frameworks emphasize ethical considerations and the preservation of contextual nuances, ensuring that the interpretive richness of qualitative narratives is retained even as analysis scales computationally (Greenhalgh *et al.*, 2018; Chen *et al.*, 2021). By bridging narrative theory and environmental risk assessment, text mining provides a methodological foundation for understanding how knowledge is constructed, circulated, and applied in dentistry (Vazquez *et al.*, 2019; Naiman, 2020).

#### *Intersections: environmental risks, narratives, and text mining in dentistry*

Synthesizing these perspectives reveals significant opportunities for conceptual innovation in dentistry (Duane *et al.*, 2020; Passos *et al.*, 2022). Environmental risks—ranging from climate-induced oral health impacts to the ecological consequences of dental waste—are currently narrated unevenly across the literature, with some domains, such as

waste management, receiving disproportionate attention compared to climate-related vulnerabilities (Borglin *et al.*, 2024; Kotecha *et al.*, 2024). Text mining offers a means to reconstruct these narratives systematically, theorizing them as dynamic, relational ecosystems shaped by temporal, institutional, and global influences (Grzybowski *et al.*, 2022; Abd-Alrazaq *et al.*, 2023).

This integrated perspective challenges traditional dental epistemologies that prioritize immediate clinical outcomes over long-term sustainability (Ashokkumar *et al.*, 2022; Attenborough *et al.*, 2023; İlşan *et al.*, 2023; Poornachitra & Maheswari, 2023; Ansari *et al.*, 2024; Samyuktha & Syam, 2024). By treating environmental risk narratives as interdependent and reflexive constructs, the approach encourages a more holistic understanding of dentistry's role in ecological and public health contexts (Leavy *et al.*, 2019; Khanna *et al.*, 2025). Ultimately, the intersection of narrative theory and text mining provides a conceptual pathway for uncovering latent patterns, amplifying underrepresented perspectives, and fostering evidence-informed strategies that embed environmental stewardship into professional practice.

#### Proposed conceptual framework

The proposed conceptual framework, termed the Environmental Narrative Reconstruction Model (ENRM), provides a theoretical scaffold for utilizing large-scale text mining to synthesize global environmental risk narratives within scientific dental literature. At its core, ENRM conceptualizes scientific texts as layered narrative artifacts, where environmental risks are embedded in discursive structures that evolve over time and across contexts. Unlike existing models that focus on quantitative metrics or isolated themes, ENRM introduces a novel integration of narrative deconstruction with semantic relational mapping, emphasizing the reconstruction of meta-narratives that reveal systemic interdependencies between dental practices and global environmental dynamics (Llewellyn-Beardsley *et al.*, 2019; Fleuret *et al.*, 2021).

ENRM comprises three interconnected layers: (1) Semantic Extraction Layer, (2) Temporal and Relational Mapping Layer, and (3) Narrative Synthesis Layer. The first layer theorizes the initial parsing of textual data, where key entities—such as risk types (e.g., pollution, climate vulnerability), actors (e.g., dental professionals, ecosystems), and modifiers (e.g., urgency descriptors)—are identified through conceptual analogs of natural language processing techniques (Vazquez *et al.*, 2019; Fleuret *et al.*, 2021). This layer posits that environmental risks in dental literature are not monolithic but manifest as clustered semantic fields, allowing for the theoretical isolation of narrative building blocks without empirical computation (Chen *et al.*, 2021; Grzybowski *et al.*, 2022).

Transitioning to the second layer, ENRM conceptualizes the mapping of these elements across temporal and relational dimensions. Temporally, narratives are framed as evolutionary trajectories, tracing shifts from awareness (e.g., early mentions of dental waste impacts) to adaptation (e.g., sustainability integrations post-2020) (Duan *et al.*, 2020; Glick *et al.*, 2021). Relationally, the model theorizes networks of influence, where risks link to oral health outcomes, such as climate-induced caries risks, forming conceptual graphs that highlight causal and mitigative pathways (Seminario *et al.*, 2021; Kotecha *et al.*, 2024). This layer innovates by incorporating reflexivity, suggesting that narratives self-reinforce through citation patterns, potentially amplifying dominant environmental discourses in dentistry (Naiman, 2020; Martin *et al.*, 2025).

The culminating Narrative Synthesis Layer integrates these mappings into cohesive meta-narratives, theorizing reconstruction as a dialectical process that resolves contradictions (e.g., between clinical efficacy and ecological harm) into emergent frameworks for sustainable dentistry (Greenhalgh *et al.*, 2018; Passos *et al.*, 2022). ENRM thus advances a novel logic: by reconstructing narratives, dentistry can theoretically reposition itself within global environmental discourses, fostering paradigmatic shifts toward planetary health integration (Leavy *et al.*, 2019; Shrivastava & Shrivastava, 2025).

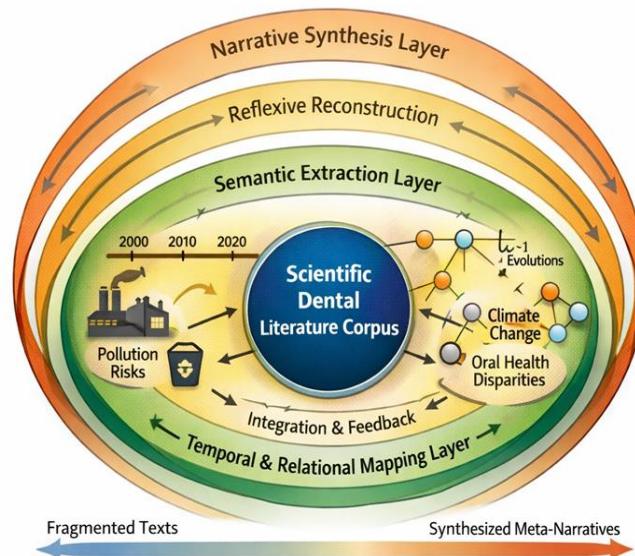


Figure 1. Environmental Narrative Reconstruction Model (ENRM)

This framework's originality lies in its exclusive focus on conceptual reconstruction, avoiding prescriptive methodologies while offering a versatile theoretical tool for dental scholars to interrogate environmental risk discourses (Westergaard *et al.*, 2019; Abd-Alrazaq *et al.*, 2023).

#### *Propositions*

Building on the Environmental Narrative Reconstruction Model (ENRM), this section articulates a series of theoretical propositions that extend the framework's conceptual logic. These propositions represent deductive inferences regarding the potential insights derivable from reconstructing environmental risk narratives in scientific dental literature through text mining. They are grounded in the synthesized literature and intended to guide future theoretical and conceptual work without making empirical claims (Llewellyn-Beardsley *et al.*, 2019; Duane *et al.*, 2020; Khanna *et al.*, 2025). Collectively, the propositions illustrate how ENRM can uncover patterns, biases, and opportunities for reflexive innovation within dental scholarship.

#### *Proposition 1*

The semantic extraction layer of ENRM will reveal that dominant environmental risk narratives in dental literature primarily emphasize operational impacts—such as waste generation, emissions, and energy consumption—while systemic vulnerabilities, including climate-induced oral health disparities, remain underrepresented. This imbalance reflects institutional emphases on immediate professional and regulatory concerns rather than long-term ecological interdependencies, potentially perpetuating fragmented and compartmentalized discourses (Duane *et al.*, 2021; Mulligan *et al.*, 2024; Shrivastava & Shrivastava, 2025).

#### *Proposition 2*

Temporal mapping within ENRM will demonstrate an evolutionary shift in narrative framing, moving from descriptive accounts of environmental footprints before 2020 to prescriptive and solution-oriented discussions advocating sustainable practices post-2020. This shift is likely influenced by global policy agendas, such as the United Nations Sustainable Development Goals, and reflects an increasing integration of environmental considerations into professional and academic priorities (Duane *et al.*, 2020; Glick *et al.*, 2021; Sarangi & Singh, 2024).

#### *Proposition 3*

Relational modeling in ENRM will uncover latent networks linking environmental risks to socioeconomic and equity dimensions, illustrating how narratives of resource scarcity intersect with oral health equity discussions. This proposition highlights underrepresented themes in low-resource or vulnerable settings, revealing the broader social determinants embedded within environmental risk narratives (Seminario *et al.*, 2021; Kotecha *et al.*, 2024; Pegoraro *et al.*, 2025).

#### *Proposition 4*

The narrative synthesis layer will facilitate the identification of dominant narrative archetypes, such as "resilience narratives" that emphasize adaptation and proactive mitigation, versus "crisis narratives" that foreground imminent threats and

systemic failures. Recognizing these archetypes enables a critical examination of how narrative framing influences research priorities, funding allocation, and policy discourse in dentistry (Greenhalgh *et al.*, 2018; Llewellyn-Beardsley *et al.*, 2019; Chen *et al.*, 2021).

#### *Proposition 5*

Application of ENRM across dental sub-disciplines—such as pediatric, restorative, and prosthetic dentistry—will expose disciplinary silos in the narration of environmental risks. This proposition suggests that fostering transdisciplinary integration could generate more cohesive meta-narratives, enhancing collective understanding and promoting coordinated sustainability strategies across the profession (Leavy *et al.*, 2019; Passos *et al.*, 2022; Martin *et al.*, 2023).

#### *Proposition 6*

Reflexive analysis via ENRM will theorize that dominant narratives reinforce anthropocentric paradigms, prioritizing human-centered outcomes over planetary health considerations. This reinforces the need for a paradigm shift toward eco-centric frameworks, embedding sustainability and ecological responsibility as core narrative elements in dental research, education, and practice (Naiman, 2020; Khanna *et al.*, 2025; Martin *et al.*, 2025).

Taken together, these propositions serve as theoretical anchors for the ENRM, illustrating its potential to illuminate discursive patterns, reveal underexplored perspectives, and inspire paradigm shifts in the integration of environmental stewardship within dental scholarship (Van der Vegt *et al.*, 2019; Fleuret *et al.*, 2021). They provide a structured lens through which the complex interplay between environmental risk, professional practice, and narrative construction can be conceptually analyzed and leveraged for future research and policy innovation.

## RESULTS AND DISCUSSION

The proposed Environmental Narrative Reconstruction Model (ENRM) and its associated propositions offer a novel lens for interrogating environmental risk narratives in scientific dental literature, addressing a notable gap in the profession's engagement with sustainability discourses (Duane *et al.*, 2020; Borglin *et al.*, 2024). Theoretically, ENRM advances narrative theory by adapting it to computational contexts, positioning text mining as both an analytical and interpretive mediator for deconstructing large-scale scientific texts (Llewellyn-Beardsley *et al.*, 2019; Vazquez *et al.*, 2019; Abd-Alrazaq *et al.*, 2023). This integration challenges conventional qualitative approaches, suggesting that macro-level patterns, trends, and latent relationships in the literature—often inaccessible through manual review—can be systematically identified and critically examined (Westergaard *et al.*, 2019; Farrell *et al.*, 2025). By emphasizing reflexivity, ENRM encourages dental scholars to interrogate how their own research narratives contribute to, or potentially hinder, environmental awareness, aligning with broader calls for epistemic humility and critical self-examination in the health sciences (Leavy *et al.*, 2019; Martin *et al.*, 2025).

From a practical and epistemological standpoint, ENRM offers several implications for dental scholarship. It provides a

conceptual tool for synthesizing fragmented and heterogeneous literature, potentially guiding curriculum development that integrates environmental literacy and sustainability principles (Duane *et al.*, 2020; Farrell *et al.*, 2025). For example, reconstructed narratives could illuminate underexplored connections, such as the intersection of climate variability with periodontal disease pathways or pediatric oral health outcomes, fostering more integrative and forward-looking research agendas (Kotecha *et al.*, 2024; Shrivastava *et al.*, 2025). Furthermore, ENRM holds promise for policy advocacy, enabling evidence-based arguments that foreground sustainability and ecological responsibility without reliance on primary empirical studies (Mulumani, 2019; Glick *et al.*, 2021). However, several limitations inherent to this conceptual work warrant acknowledgment. As a theoretical construct, ENRM has yet to undergo empirical validation, and its efficacy relies on assumptions regarding the representativeness of textual corpora, the neutrality of computational algorithms, and the interpretive frameworks applied to narrative outputs (Van der Vegt *et al.*, 2019; Chen *et al.*, 2021). Literature biases—such as the predominance of Western-centric publications or publication skews toward certain sub-disciplines—may distort reconstructed narratives and limit the generalizability of insights (Naiman, 2020; Grzybowski *et al.*, 2022). Additionally, while text mining is conceptualized as scalable, practical implementation may encounter ethical and methodological challenges, including concerns around data privacy, contextual fidelity, and interpretive subjectivity (Greenhalgh *et al.*, 2018; Launer, 2018).

Future research directions include extending ENRM for comparative analyses across health disciplines, examining how environmental narratives in dentistry differ from those in medicine or public health (Adler *et al.*, 2019; Khanna *et al.*, 2025). Conceptual refinements may also integrate multimodal elements, such as visual representations, tables, and infographics embedded in dental publications, further enriching the reconstructed narrative ecosystem (Charon *et al.*, 2017; Llewellyn-Beardsley *et al.*, 2019). Ultimately, ENRM invites ongoing theoretical dialogue, encouraging scholars to position dentistry as an active participant in global sustainability efforts rather than a passive observer.

## CONCLUSION

This conceptual manuscript introduces the Environmental Narrative Reconstruction Model (ENRM) as a novel framework for reconstructing global environmental risk narratives within scientific dental literature through large-scale text mining. By synthesizing theoretical perspectives from environmental sustainability, narrative theory, and computational linguistics, ENRM posits a multi-layered approach to identify discursive patterns that shape dental knowledge production, professional norms, and policy implications (Llewellyn-Beardsley *et al.*, 2019; Duane *et al.*, 2020; Fleuret *et al.*, 2021).

The six propositions articulated herein delineate potential insights, from uncovering dominant operational-focused narratives to highlighting anthropocentric paradigms and disciplinary silos. The discussion further situates ENRM within broader scholarly and practical contexts, emphasizing its capacity to inform curriculum design, research prioritization, and sustainability-oriented policy advocacy.

In essence, ENRM advocates for a reflexive turn in dental scholarship, positioning environmental consciousness as an integral component of the field's epistemological evolution. By bridging computational methods with theoretical inquiry, the framework offers a pathway to transform fragmented knowledge into cohesive, actionable narratives that foreground sustainability, equity, and planetary health in dentistry (Khanna *et al.*, 2025; Martin *et al.*, 2025).

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## REFERENCES

Abd-Alrazaq, A., AlSaad, R., Alhuwail, D., Ahmed, A., Healy, P. M., Latifi, S., Aziz, S., Damseh, R., Alrazak, S. A., Sheikh, J., *et al.* (2023). Large language models in medical education: Opportunities, challenges, and future directions. *JMIR Medical Education*, 9, e45381.

Adler, J. M., Dunlop, W. L., Fivush, R., *et al.* (2019). Family narratives and the development of an autobiographical self. *Annual Review of Psychology*, 70, 187–212.

Ansari, S. H., Qamar, Z., Alshammari, M., Bazoun, R., Alenazi, R., & Alattar, R. (2024). Clinical efficacy and longevity of monolithic vs layered zirconia crowns: A systematic review. *Bulletin of Pioneer Research in Medical and Clinical Sciences*, 4(1), 7–18. doi:10.51847/0xBNKCjrDi

Ashokkumar, P., Giri, G. V. V., & Pandya, K. (2022). Parotid abscess-associated facial palsy in hemodialysis patients: Clinical and surgical considerations. *Asian Journal of Periodontics and Orthodontics*, 2, 47–50. doi:10.51847/naDu2XfBBQ

Attenborough, J., Abbott, S., Brook, J., & Knight, R. (2023). Studying barriers to work-based learning in clinical environments from the perspective of nursing managers and nurses. *Journal of Integrated Nursing and Palliative Care*, 4, 46–52. doi:10.51847/qQR0GNUES7

Bei, M. F., Domocoş, D., Szilagyi, G., Varga, D. M., & Pogan, M. D. (2023). Exploring the impact of vitamins and antioxidants on oral carcinogenesis: A critical review. *Archives of the International Journal of Cancer and Allied Sciences*, 3(1), 16–24. doi:10.51847/dQ6s1Bural

Borglin, L., Wilson, M., Turner, S., & Cross, W. (2024). Environmental sustainability in dentistry: A scoping review. *Journal of Dentistry*, 142, 104852.

Charon, R., DasGupta, S., Hermann, N., *et al.* (2017). *The principles and practice of narrative medicine*. Oxford University Press.

Chen, Q., Allot, A., & Lu, Z. (2021). LitCovid: An open database of COVID-19 literature. *Nucleic Acids Research*, 49(D1), D1534–D1540.

Conti, A. F., Meyer, L. P., & Bekele, T. M. (2022). Impact of an innovative teledentistry mobile app on oral health literacy among visually impaired and deaf adolescents: A 4-week randomized controlled trial. *Journal of Current Research in Oral Surgery*, 2, 41–51. doi:10.51847/1szwYLK0kM

Duane, B., Dixon, J., Morrell, A., & Giwa, O. (2021). Sustainability in dentistry: A review. *Journal of Dentistry*, 114, 103829.

Duane, B., Lee, M., White, S., Stancliffe, R., & Steinbach, I. (2020). An estimated carbon footprint of NHS primary dental care and prospective low-carbon pathways to 2040: A mixed-methods study. *Health Services Delivery Research*, 8(49), 1-152.

Duane, B., Stancliffe, R., Miller, F. A., Sherman, J., & Pasdeki-Clewer, E. (2020). Sustainability in dentistry: A multifaceted approach needed. *Journal of Dental Research*, 99(6), 606-612.

Ernst, P., & Weber, T. (2024). Impact of flexible work arrangements on the engagement levels of younger employees. *Annals of Organizational Culture, Communications and Conflict*, 5, 72-86. doi:10.51847/njhaTa39mx

Farrell, A., Carey, E., Nielsen, N. D., et al. (2025). Mobile health-delivered narrative intervention to increase cervical cancer screening among Black women: Study protocol for a pilot randomized controlled trial. *Contemporary Clinical Trials*, 136, 107390.

Feng, L., Wei, G., & Lei, Z. (2024). Pharmacists' contributions to the management of mental health conditions: A comprehensive review. *Annals of Pharmaceutical Practice and Pharmacotherapy*, 4, 125-139. doi:10.51847/ReKLpACV6c

Fioretti, C., & Smorti, A. (2014). Improving doctor-patient communication through an autobiographical narrative theory. *Communication & Medicine*, 11(3), 275-284.

Fleuret, V., Parekh, S., Kluge, B., et al. (2021). Opportunities and challenges of text mining in materials research. *iScience*, 24(3), 102155.

Glick, M., Monteiro da Silva, O., Seeberger, G. K., et al. (2021). FDI Vision 2030: Delivering optimal oral health for all. *International Dental Journal*, 71(1), 3-4.

Gomez, R., Sanchez, M., & Lopez, E. (2023). Dual facets of Wnt/β-Catenin signaling in hepatocellular carcinoma: Implications for tumor phenotyping and clinical management. *Asian Journal of Current Research in Clinical Cancer*, 3(1), 84-95. doi:10.51847/7icRIMe63L

Greenhalgh, T., Thorne, S., & Malterud, K. (2018). Time to challenge the spurious hierarchy of systematic over narrative reviews? *European Journal of Clinical Investigation*, 48(6), e12931.

Grzybowski, A., Patry, R., & Sak, J. (2022). Text mining in healthcare—applications and challenges. *Annals of Agricultural and Environmental Medicine*, 29(1), 1-4.

Guo, L., He, Y., Sun, Y., Chan, J. S. M., You, J., Jia, L., Wang, Q., Ganeshan, K., & Chen, J. (2022). Longitudinal study on the characteristics of traditional Chinese medicine (TCM) constitutions and related influencing factors in women in Hong Kong. *Journal of Medical Sciences and Interdisciplinary Research*, 2(1), 23-35. doi:10.51847/B0MHcO112v

Hart, D. M., Youssef, O. A., & Ho, P. J. (2023). Gender and age disparities in oral health and OHRQoL in a rural Tanzanian community: Findings from the Rorya District. *Journal of Current Research in Oral Surgery*, 3, 54-60. doi:10.51847/9kxFmNA19e

Hiltz, M., Johnston, A., & Vlahos, P. (2024). Climate change and the unforeseen challenges for dental practice. *Journal of the American Dental Association*, 155(5), 361-366.

İlaşan, E., Adibelli, D., Teskereci, G., & Cura, Ş. Ü. (2023). Studying the impact of clinical decision-making and critical thinking on the quality of nursing care. *Journal of Integrated Nursing and Palliative Care*, 4, 23-29. doi:10.51847/fsTLiDadY3

Jalbani, N., Khan, S., Naqvi, S. A., et al. (2023). Sustainability in dentistry: Assessing knowledge, attitude, and practices of dental practitioners about green dentistry. *Pakistan Journal of Medical Sciences*, 39(6), 1810-1815.

Jensen, M., Nielsen, L., & Hansen, K. (2023). Assessment of BRAF mutations via circulating tumor DNA in routine clinical management of advanced melanoma. *Asian Journal of Current Research in Clinical Cancer*, 3(1), 77-83. doi:10.51847/4Q0PqDCgPI

Karimov, D., & Rakhimova, N. (2024). The impact of socially responsible human resource management on employee innovation performance: Exploring the roles of person-organization fit, work engagement, and individualism orientation. *Annals of Organizational Culture, Communications and Conflict*, 5, 132-146. doi:10.51847/xjBYU19BqH

Khalil, A., Dawoud, S., & Youssef, H. (2023). Exploring the role of Unani medicine in managing nisyan (dementia): In vitro and ex vivo study of a *Lavandula stoechas* L. (Ustukhuddu's)-loaded Unani transdermal patch. *Interdisciplinary Research in Medical Sciences Specialty*, 3(1), 58-70. doi:10.51847/BMS7yIMnCQ

Khanna, R., Nagi, M., Singh, A., et al. (2025). Impact of climate change on dentistry and oral health: A systematic review. *BDJ Open*, 11(1), 11.

Kotecha, S., Ganesh, D., Bholia, N. D., & Kumar, P. (2024). Sustainable dentistry: A comprehensive review of the recycling techniques for gypsum products in prosthodontics. *Cureus*, 16(3), e56035.

Kowtharupu, L. P., Katari, N. K., Muchakayala, S. K., Pydimarry, S. P. R., Rekulapally, V. K., & Sandoval, C. A. (2022). Development and validation of an RP-HPLC method for simultaneous quantification of azelnidipine and metoprolol succinate in synthetic mixtures. *Pharmaceutical Science & Drug Design*, 2, 1-7. doi:10.51847/42JUgqvW13

Kumar, S., Yadav, A., Rath, P. K., Verma, R. P., Tirupathi, S., Shaiba, H., & Kanathila, H. (2022). Perspectives and ethical views of the Swedish public on the use of human embryonic stem cells in medical therapy. *Asian Journal of Ethics in Health and Medicine*, 2, 44-53. doi:10.51847/gv2AnCIUWI

Lampasona, M., & Pantaleo, L. (2022). Integrating pharmacies into national immunization strategies and public health initiatives. *Annals of Pharmaceutical Education, Safety and Public Health Advocacy*, 2, 24-28. doi:10.51847/X5qNLSaqn1

Launer, J. (2018). *Narrative-based practice in health and social care: Conversations inviting change*. Routledge.

Leavy, A., Clarke, N., & Duane, B. (2019). Implementing an environmental management system in a dental practice. *International Dental Journal*, 69(5), 397-403.

Llewellyn-Beardsley, J., Rennick-Egglestone, S., Callard, F., Crawford, P., Farkas, M., Hui, A., Manley, D., McGranahan,

R., Pollock, K., Ramsay, A., et al. (2019). Characteristics of mental health recovery narratives: Systematic review and narrative synthesis. *PLoS One*, 14(3), e0214678.

Martin, N., Arora, P., Mulligan, S., et al. (2025). Integrating sustainability in dentistry: A pathway towards achieving the UN sustainable development goals. *Frontiers in Oral Health*, 6, 1549020.

Martin, N., Mulligan, S., Fuzesi, P., & Hatton, J. F. (2023). Sustainable oral healthcare: A scoping review of current research, challenges, and implications for practice and policy. *PLoS One*, 18(2), e0282224.

Martin, N., Sheppard, M., Gorasia, G., Arora, P., Cooper, M., & Mulligan, S. (2021). Drivers, opportunities and best practice for sustainability in dentistry: A general practice perspective. *Journal of Dentistry*, 114, 103787.

Meyer, M., Fischer, C., & Neumann, E. (2023). Network pharmacology-based analysis and exploration of potential mechanisms of key *Coriandrum sativum* L. components against COVID-19. *Annals of Pharmaceutical Practice and Pharmacotherapy*, 3, 161–169. doi:10.51847/h5HGe2QHp2

Mohamed, A. A., Abo-Elmatty, D. M., Esmail, O. E., Salim, H. S. M., Salam, S. M. A. E., ElAnsary, A. R., Yacoub, M. F., Abdelrahman, S. A. I., Saleh, O. M., Hassan, Y., et al. (2022). MicroRNA-224 up-regulation: A potential risk factor for complications in type 2 diabetes mellitus among Egyptian patients. *Journal of Medical Sciences and Interdisciplinary Research*, 2(2), 1–10. doi:10.51847/ty4IYb1UiA

Mostafa, K., El Sayed, A., Farouk, M., & Nabil, Y. (2022). Polygenic pharmacogenetic score forecasts outcomes in stroke patients receiving aspirin therapy. *Specialty Journal of Pharmacognosy, Phytochemistry and Biotechnology*, 2, 91–103. doi:10.51847/n7vgoQXWUI

Mulimani, P. (2019). Green dentistry: The art and science of sustainable practice. *British Dental Journal*, 226(12), 954–960.

Mulligan, S., Hatton, J., Kane, D., & Martin, N. (2024). Attitude towards sustainability in dentistry: The evidence from social media and social listening data. *International Journal of Dental Hygiene*, 22(2), 318–329.

Naiman, S. (2020). Positive women: Emotion, memory, and the power of narrative in health sciences. *Swarthmore Undergraduate History Journal*, 1(1), Article 3.

O'Connor, M. T., McLean, S. L., & Farouk, A. S. (2023). Pregnancy-related oral health beliefs in Southwestern Ontario: Prevalence and implications for maternal and fetal health. *Journal of Current Research in Oral Surgery*, 3, 45–53. doi:10.51847/QExZ2wDFR4

Passos, L., Prazeres, F., Teixeira, A., & Martins, C. (2022). Environmental impact of dental amalgam: A scoping review. *International Journal of Environmental Research and Public Health*, 19(21), 14177.

Pegoraro, T. A., Khan, Z., Kapila, Y. L., & Richman, D., Cai, J. (2025). Sustainable dental and periodontal practice: A narrative review on strategies for reducing environmental impact. *Journal of Periodontology*, 96(9), 1163–1174.

Pereira, R., Rodrigues, B., Carvalho, J., Almeida, C., Barbosa, M., & Fernandes, L. (2022). The interplay of crisis management, organizational culture, and strategic orientation in private Jordanian universities during COVID-19. *Asian Journal of Individual and Organizational Behavior*, 2, 124–133. doi:10.51847/wb42LYUdy8

Pinto, R., & Sousa, A. (2023). Role of OmpH in *Cec4*-mediated reduction of *Acinetobacter baumannii* biofilm. *Pharmaceutical Science & Drug Design*, 3, 210–223. doi:10.51847/AFVSVjF1Kp

Poornachitra, P., & Maheswari, U. (2023). Identifying non-specific symptoms in oral submucous fibrosis patients: A clinical perspective. *Asian Journal of Periodontics and Orthodontics*, 3, 18–24. doi:10.51847/xLpm4TfyCA

Roger, J., Dupuis, C., & Muller, L. (2023). Understanding organizational citizenship behavior: The mediating role of impression management and the moderating role of power distance. *Asian Journal of Individual and Organizational Behavior*, 3, 89–98. doi:10.51847/oNFM50mCjK

Samyuktha, P. S., & Syam, S. (2024). Periodontal abscess as a clinical oral sign in patients with diabetes mellitus: An original study. *Bulletin of Pioneer Research in Medical and Clinical Sciences*, 4(2), 7–12. doi:10.51847/ZDpdhizWm

Sarangi, S., & Singh, A. (2022). Climate change on oral health and dentistry. *Acta Scientiarum Dental Sciences*, 7(1), 2–8.

Sarangi, S., & Singh, A. (2024). Impacts of climate change on oral health and dentistry. *Pesquisa Brasileira em Odontopediatria e Clínica Integrada*, 24, e210222.

Seminario, A. L., Ivancie, R., Sheen, A., & Compton, R. (2021). Climate change and oral health. *International Dental Journal*, 71(5), 362–368.

Sewankambo, P. R. (2024). Investigating clinical ethics consultation in Uganda: A case study at the Uganda Cancer Institute. *Asian Journal of Ethics in Health and Medicine*, 4, 28–43. doi:10.51847/ULP3gIQWcE

Shrivastava, A., Bansal, A., & Shrivastava, S. (2025). Oral health and climate change: Working towards building climate-resilient oral health systems. *Journal of Indian Society of Pedodontics and Preventive Dentistry*, 43(1), 1–4.

Silva, M., Rocha, B., Pires, T., & Lopes, A. (2023). Influence of food effect and ABCB1 genetic polymorphism (rs4148738) on dabigatran pharmacokinetics: A population modeling study in Chinese adults. *Specialty Journal of Pharmacognosy, Phytochemistry and Biotechnology*, 3, 69–82. doi:10.51847/hvpUTAjEJ

Singh, G., Goel, N., Singh, A., & Gera, R. (2022). Factors influencing time to diagnosis and treatment in pediatric acute leukemia: Insights from an Indian cohort. *Archives of the International Journal of Cancer and Allied Sciences*, 2(2), 37–44. doi:10.51847/FWfH04xMyB

Smalls, T., & Hailemeskel, B. (2023). A comprehensive review of metformin use in non-alcoholic fatty liver disease (NAFLD) with insights from a student-based survey. *Annals of Pharmaceutical Education, Safety and Public Health Advocacy*, 3, 58–65. doi:10.51847/wP3ernh0qg

Syam, S., & Maheswari, U. (2023). Incidental maxillary sinus findings in CBCT scans: A retrospective analysis. *Interdisciplinary Research in Medical Sciences Specialty*, 3(2), 25–30. doi:10.51847/EvXEF16qHk

Van der Vegt, A. H., Zuccon, G., & Koopman, B. (2019). Learning inter-sentence, disorder-centric, biomedical relationships from medical literature. *AMIA Annual Symposium Proceedings*, 2019, 308–317.

Vazquez, M., Krallinger, M., Leitner, F., & Valencia, A. (2019). Text mining for drugs and chemical compounds: Methods, tools and applications. *Molecular Informatics*, 38(8-9), e1900031.

Westergaard, D., Stærfeldt, H. H., Tønsberg, C., Jensen, L. J., & Brunak, S. (2019). Text mining of 15 million full-text scientific articles. *PLoS Computational Biology*, 15(8), e1007337.

Wilson, J. A., Zhang, M., & Romano, S. L. (2022). Association between family routines and oral health outcomes in U.S. children: Evidence from the 2020–2021 National Survey of Children’s Health. *Journal of Current Research in Oral Surgery*, 2, 93–101. doi:10.51847/UHGv8NeYTU