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Letter to Editor

Artificial Intelligence in Pediatric Dentistry: Unlocking New Pathways for Research Policies and Priorities

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As a passionate pediatric dentist, dedicated researcher, and vice-chancellor for research at a prestigious dental school, I have immersed myself in a diverse range of topics, including innovative materials (1-3), cutting-edge procedures (4), epidemiology (5), prevention strategies (4,6,7), and treatment modalities (8) within the field of pediatric dentistry (PD) over the years. However, one of the most significant challenges I have faced is identifying the "hot topic" research areas (such as caries risk assessment in generation Alpha)[1] and evidence-based PD, that could revolutionize pediatric dental care.

However, everything changed with the advent of artificial intelligence (AI). This revolutionary advancement will likely change every dimension of our professional practices, substantially affecting dental care and treatment methods. Experts predict that AI will become a key advancement in healthcare over the next decade, opening doors to new possibilities we have yet to imagine (9,10).

In my view, one of the most transformative contributions of AI is its ability to comprehensively analyze and assess past research literature. AI can identify key areas for further research and reveal opportunities for meaningful improvements in PD.

To take full advantage of this opportunity, we must promptly implement AI tools to examine the research at hand, allowing us to fully grasp what has already been done. We must rapidly deploy AI tools to sift through existing research, giving us a holistic understanding of what has been achieved. Also, collaborating with a panel of experts will be crucial in charting a course for the future of PD research. Recently, a colleague of mine, an epidemiologist and fellow vice-chancellor for research at our dental school, proposed developing a structured process to identify high-impact research areas.

We have laid the framework for a roadmap to reach our shared vision through engaging in discussions in our consecutive meetings and synthesizing diverse ideas. We expect this effort will enrich the field of PD by integrating diverse expertise and innovative methodologies. Moreover, we invite any stakeholders – including researchers, practitioners, and policymakers – to critique our framework; in this way, we can enrich our collaborative ecosystem that emphasizes shared learnings and best practices, significantly impacting community health. Our framework has five steps, as presented below:

Step 1: Data collection

Literature mining

- Use AI-powered literature mining, including text mining tools, natural language processing (NLP) (11), NLTK (Natural Language Toolkit) (12), domain-specific static word vectors, and generic dynamic word vectors (13) techniques to extract the latest research articles, journals, and conference proceedings in PD.
- Platforms like PubMed, Scopus, and Google Scholar can be sources for gathering a substantial amount of relevant literature.
- Educational topic: Introduction to NLP
- Example: Using NLP tools like NLTK to extract keywords and abstracts from research articles in PD databases.

Social media and online platforms

- Monitor discussions and publications from platforms like ResearchGate, Twitter, and LinkedIn, where researchers often share emerging trends and findings. AI algorithms can analyze sentiment and engagement levels on these platforms.
- Educational topic: Sentiment analysis in text data (14).
- Example: Using tools like VADER (Valence Aware

Dictionary and Sentiment Reasoner) (15) to analyze sentiment from tweets related to the latest pediatric dental research findings.

Patent analysis

- Review recent patents in pediatric dental technologies and treatments to identify areas where innovation occurs. AI can help filter and categorize relevant patents.
- Educational Topic: The Importance of Patents in Innovation
- Example: Studying recent patents in dental materials to identify new technologies for treating dental issues in children.

Step 2: Trend analysis

Keyword extraction

- Utilize AI-based NLP techniques to extract and categorize keywords and phrases from the collected literature to identify frequently occurring terms related to new treatments, technologies, or methodologies.
- Educational Topic: Techniques for Keyword Extraction
- Example: Utilizing the term frequency-inverse document frequency (TF-IDF) algorithm (16), to identify main keywords in contemporary articles about innovative dental treatments.

Citation analysis

- Perform citation analysis to determine which papers are being widely cited. VADER (15) can indicate hot topics of significant interest and impact.
- Educational Topic: Evaluating the impact of scientific papers
- Example: Analyzing papers with a high citation count in Scopus to find influential studies driving new trends in PD.

Research gap identification

- Use AI to explore systematic reviews and meta-analyses to discover gaps in existing research. This could involve clustering related studies and finding under-researched areas.
- Educational topic: Methods for identifying research gaps
- Example: Conducting a meta-analysis of existing papers to discover under-researched treatment areas in PD.

Step 3: Impact assessment

AI models for predictive analytics

- Implement machine learning models to predict the potential impact of emerging research topics based on current funding patterns, citation frequency, and media coverage.
- Educational topic: Machine learning for trend prediction
- Example: Using regression models to forecast the clinical success of new dental treatments based on current research trends.

Collaboration networks

- Analyze collaboration networks using AI to identify influential researchers or leading institutions working in specific areas. Strongly connected researchers often indicate hot topics due to active discussions and collaborations.
- Educational topic: The importance of collaboration in research
- Example: Gephi (17), (is an open-source network visualization and analysis software that allows users to explore and visualize large amounts of data in networks or graphs) to analyze the communication networks between different researchers to identify thought leaders in PD.

Survey and feedback

- Administer surveys to gather feedback from pediatric dentists, researchers, and other stakeholders about the topics they believe are emerging or have had a significant impact.
- Educational topic: Designing effective surveys
- Example: Creating and distributing an online questionnaire using Google Forms to collect opinions about new pediatric dental treatments.

Step 4: Continuous monitoring

Dynamic research dashboards

- Create an AI-based dashboard that continuously monitors new publications, trends, citation counts, and media coverage in PD. This dashboard can be designed to alert you when a significant shift occurs, indicating new hot topics.
- Educational Topic: Designing Analytical Dashboards
- Example: Using Tableau (18) (a powerful data visualization tool widely used for business intelligence and data analysis) to design a dashboard that displays data on the latest articles and patents in PD.

Regular reporting

- Set up a system for generating regular reports on the findings, summarizing the hot topics detected, key researchers, potential impacts, and trends. This helps one stay updated and make informed decisions about research focus areas.
- Educational Topic: Writing scientific reports
- Example: Preparing quarterly reports summarizing detected trends and presenting them to the local scientific community.

Step 5: Community engagement

Engagement with the research community

1. Participate in or organize workshops, seminars, or webinars where findings can be discussed with experts and practitioners. This facilitates the interchange of perspectives and might stimulate research areas in emergent hot topics.
2. Educational topic: Communication skills in research
3. Example: Organizing an online seminar to present new findings in pediatric dental treatments and encouraging discussion and feedback.

Although the application of AI algorithms in PD is still in its infancy, it has already started to contribute to a richer and more sophisticated understanding of the subject, which includes procedures, materials, prevention strategies, and treatment methodologies. Now is the time to apply these sophisticated algorithms to further enhance our comprehension of PD.

There is still much to learn and explore, and we believe that this discourse captures the essence of our field, catalyzing future innovations and significant advancements. We invite all researchers and policymakers in the field of medical and health research to engage in further discussions about this proposed process and collaborate towards creating a comprehensive platform that encompasses all disciplines, including PD.

We believe that with a centralized and unified program, we will be able to address the important challenge of finding the best research areas. Engaging policymakers and stakeholders can make significant progress in PD and enhance the health care for our young patients. We would like to emphasize the specialized applications of this tool across various fields, including education, telemedicine, mental health, etc. We believe incorporating these insights will provide a more comprehensive understanding of the tool's impact and relevance in contemporary practice. We invite researchers, policymakers, and stakeholders to adapt this approach for application across all fields of medicine and healthcare.

Authors' Contribution

Conceptualization: Fatemeh Jahanimoghadam, Amir Hossein Nekouei.
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Competing Interests

The authors declare that they do not have any conflict of interest.

Ethical Approval

Not applicable.

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Endnotes

[1] Generation Alpha: children born between 2010 and 2025.

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