JMIR Publications
The Leading eHealth Publisher

Generative AI: A Promising, but Cautious, Ally in Children's Mental Health

Muhammad Mahbubur Rahman

Submitted to: JMIR Mental Health
on: May 07, 2024

Preprint
JMIR Publications

Disclaimer: © The authors. All rights reserved. This is a privileged document currently under peer-review/community review. Authors have provided JMIR Publications with an exclusive license to publish this preprint on it's website for review purposes only. While the final peer-reviewed paper may be licensed under a CC BY license on publication, at this stage authors and publisher expressively prohibit redistribution of this draft paper other than for review purposes.

Table of Contents

Preprint
JMIR Publications

Generative AI: A Promising, but Cautious, Ally in Children's Mental Health

Muhammad Mahbubur Rahman[1] PhD

[1]Children's National Hospital Washington DC US

Corresponding Author:
Muhammad Mahbubur Rahman PhD
Children's National Hospital
111 Michigan Avenue NW
Washington DC
US

Abstract

Generative artificial intelligence (AI), a powerful subfield of AI, is rapidly gaining momentum in both private and public sectors, demonstrating its applicability across diverse domains. The healthcare system is no exception, with researchers enthusiastically embracing its potential to provide valuable support across various healthcare domains. This article explores the transformative potential of Generative AI in addressing children's mental health, considering its promises, challenges, and ethical implications. By highlighting the applications of Generative AI models in detection and support, the article emphasizes the need for cautious implementation due to risks such as bias, hallucination, and privacy concerns. Emphasizing a collaborative approach involving clinicians and robust governance, the article concludes by advocating for responsible integration, acknowledging Generative AI as an augmentation, not a replacement, for human expertise in the realm of children's mental health.

(JMIR Preprints 07/05/2024:60321)
DOI: https://doi.org/10.2196/preprints.60321

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**
Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.
Only make the preprint title and abstract visible.
No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).
Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain v

✓ **Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <a h**

Original Manuscript

Preprint
JMIR Publications

Generative AI: A Promising, but Cautious, Ally in Children's Mental Health

Muhammad Mahbubur Rahman, PhD
Assistant professor, Center for Translational Research at Children's National Hospital,
Assistant professor, Pediatrics & of Biostatistics and Bioinformatics at George Washington University
1 Inventa Place, Silver Spring, MD 20910 | Phone: 240-531-6587 (O)
mmrahman@childrensnational.org

Abstract
Generative artificial intelligence (AI), a powerful subfield of AI, is rapidly gaining momentum in both private and public sectors, demonstrating its applicability across diverse domains. The healthcare system is no exception, with researchers enthusiastically embracing its potential to provide valuable support across various healthcare domains. This article explores the transformative potential of Generative AI in addressing children's mental health, considering its promises, challenges, and ethical implications. By highlighting the applications of Generative AI models in detection and support, the article emphasizes the need for cautious implementation due to risks such as bias, hallucination, and privacy concerns. Emphasizing a collaborative approach involving clinicians and robust governance, the article concludes by advocating for responsible integration, acknowledging Generative AI as an augmentation, not a replacement, for human expertise in the realm of children's mental health.

Introduction

According to the World Health Organization, mental health is characterized as the mental well-being of an individual, enabling them to understand their capabilities, handle normal life stresses, and contribute to their community. This complicated aspect of life encompasses an individual's mind, body and social surroundings. Children's mental health is more complex due to associated factors like developmental elements, the impact of early life experiences and limited communication skills. AI, particularly Generative AI (GenAI), has the potential to improve children's mental health. GenAI, a subset of AI, can generate new content such as text, images, speech, videos, and complex patterns by learning from vast datasets sourced from public and private channels. This technology could mimic human behavior and offer innovative avenues for supporting children's mental health. However, like any technological advancement, GenAI has both positive and negative aspects, contingent on its ethical application. This paper explores the promises of GenAI and describes potential challenges it may pose in the context of children's mental health.

Promises

AI technologies, such as deep learning (DL), machine learning (ML), and natural language processing (NLP), have been widely applied in addressing children's mental health. DL approaches is used for detecting conditions like Attention-Deficit/Hyperactivity Disorder[1,2] while ML has successfully identified depression and anxiety in children[3,4] and mid-adolescents[5]. NLP is used in identification of suicidal behavior using electronic health record (EHR)[6,7]. To date, there's been no research on children's mental health utilizing GenAI. However, we see significant promise for GenAI in this domain.

Large Language Model (LLM), a type of GenAI, has significant potential in advancing mental health support for children. For instance, an LLM-powered chatbot could be designed as an interactive storytelling tool, assisting manage anxiety and depression by diverting children from negative thoughts. Through immersive narratives, it can deliver hopeful messages and educate coping skills in the form of a story. It could also provide 24/7 non-emergency assistance to parents dealing with their children's mental health challenges.

LLM can extract mental health concepts from multiple sources like social media, EHR, and publications for parents, teachers, and clinicians. It can efficiently summarize clinical notes, thereby

saving valuable time for clinicians when reviewing patient charts. As a mood monitoring tool, LLM can analyze children's day-to-day activities such as social media interactions to identify children's emotions, strengths, and weaknesses, and can assist in managing their conditions.

LLM can analyze EHR to understand symptoms and the entire health trajectory, aiding early detection of potential mental illness and development of personalized treatment plans. Additionally, it can generate educational content tailored for children to better understand symptoms, risks, and effective strategies for their mental well-being.

GenAI, beyond LLM, can understand images and videos to generate new realistic visuals. This capability can create supportive tools for clinicians by interpreting images and videos, such as fMRI scans, X-rays, EEG data, and video recordings of CBT sessions. Such tools have the potential to assist clinicians, allowing them to be more deeply engaged in supporting children and providing personalized care.

Children struggling with social-emotional learning may face increased risk of developing behavioral issues and psychiatric disorders[8]. GenAI has the potential to assist these children in cultivating self-awareness, coping mechanisms, and interpersonal skills through personalized interactive games, educational videos, and activities tailored to their specific needs and developmental requirements.

Challenges

While GenAI holds promise for addressing children's mental illness, it is not without its limitations. GenAI Models like Gemini, ChatGPT, DALL-E, and Sora are trained on extensive datasets that may contain disinformation, biased data, hateful content and discriminatory narratives. This raises concerns about inaccurate and violent content generation, biased treatment suggestions and hallucination - the generation of irrelevant content. Such outcomes pose a considerable risk for children's well-being. To mitigate risks, combining strategies such as regulations, fact-checking by clinicians-in-the-loop integration, fine-tuning the models using high-quality data, and providing clear prompts are essential for responsible GenAI use in children's mental health support.

Ensuring children's privacy and confidentiality is very important. Healthcare providers must uphold confidentiality and transparency with legal guardians regarding children's personal health information (PHI). GenAI models trained on patient data raises concerns about potential PHI leaks, violating HIPAA regulations. When curating children's data for training, strict adherence to HIPAA compliance is crucial. Establishing robust data governance is essential to minimize patient data exposure during both training and use. Rather than training GenAI models with all-encompassing children's data, a recommended approach involves fine-tuning large models using de-identified data. This ensures minimal exposure of children's PHI to the models, promoting both privacy and regulatory compliance. Additionally, a synthetic data generation tailored to children's mental health data can be used.

Another challenge with GenAI lies in their inherent technological complexity. Teams engaged in developing GenAI applications must possess a thorough understanding of the approach and appropriate usage. Inadequate understanding or poorly designed applications could worsen health conditions, particularly considering the rapid pace of children's mental, emotional, and social development.

Last but not least, a fundamental challenge with GenAI lies in its substantial computing demands for training on vast datasets. This requires accelerated computing, sizable storage, and large GPU memories, commonly facilitated through cloud computing platforms such as AWS and Google Cloud. Ensuring secure data storage on public clouds requires careful security configuration by institutions. Transparent communication with legal guardians regarding the storage of their children's data in the cloud is necessary. The institutional data governance body should play a key role in upholding the security and transparency of children's data throughout this process.

Conclusion

The potential impact of GenAI on children's mental health is significant. However, the adoption of this technology presents challenges. While agencies, such as FDA and NIST, work on regulations to address bias and enhance trust in GenAI, it is essential to establish robust institutional governance for both data and technology to minimize potential harm and foster trustworthiness.

It is important to note that GenAI is not intended to replace human but to assist them in providing enhanced care. Involving clinicians-in-the-loop and incorporating their feedback into model training can enhance trust and reduce bias.

Acknowledgements

The authors have declared that they have no competing or potential conflicts of interest.

Reference:

1. Chen H, Song Y, Li X. A deep learning framework for identifying children with ADHD using an EEG-based brain network. *Neurocomputing*. 2019;356:83-96.
2. Vahid A, Bluschke A, Roessner V, Stober S, Beste C. Deep learning based on event-related EEG differentiates children with ADHD from healthy controls. *J Clin Med*. 2019;8(7):1055.
3. Haque UM, Kabir E, Khanam R. Detection of child depression using machine learning methods. *PLoS One*. 2021;16(12):e0261131.
4. Qasrawi R, Polo SPV, Al-Halawa DA, Hallaq S, Abdeen Z, others. Assessment and prediction of depression and anxiety risk factors in schoolchildren: machine learning techniques performance analysis. *JMIR Form Res*. 2022;6(8):e32736.
5. Hawes MT, Schwartz HA, Son Y, Klein DN. Predicting adolescent depression and anxiety from multi-wave longitudinal data using machine learning. *Psychol Med*. 2023;53(13):6205-6211.
6. Ohno-Machado L, Séroussi B. Identifying suicidal adolescents from mental health records using natural language processing. *MedInfo*. Published online 2019:413.
7. Carson NJ, Mullin B, Sanchez MJ, et al. Identification of suicidal behavior among psychiatrically hospitalized adolescents using natural language processing and machine learning of electronic health records. *PLoS One*. 2019;14(2):e0211116.
8. Briggs-Gowan MJ, Carter AS. Social-emotional screening status in early childhood predicts elementary school outcomes. *Pediatrics*. 2008;121(5):957-962.