



# Public Perception of Extended Reality in Pediatric Healthcare: A Sentiment and LDA Analysis of Reddit Discussions

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## Abstract

Extended Reality (XR), encompassing Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), is increasingly utilized in pediatric healthcare to enhance patient experiences, reduce anxiety, and improve treatment outcomes. This study analyzes public sentiment and thematic discussions about XR in pediatric care using 5,000 Reddit comments from relevant subreddits. Sentiment analysis reveals a predominantly positive outlook (65%), with discussions highlighting XR's benefits in pain management and anxiety reduction. However, concerns regarding cost, accessibility, ethical implications, and long-term cognitive effects persist. Topic modeling identifies four primary themes: therapeutic benefits, financial concerns, ethical/privacy issues, and technological advancements. Temporal analysis indicates increasing positivity over time, particularly in response to emerging research. These findings underscore the importance of addressing public skepticism and misinformation through targeted educational campaigns to foster wider acceptance of XR in pediatric healthcare.

**Keywords:** Extended Reality, Virtual Reality, Pediatric Healthcare, Public Perception, Sentiment Analysis

## Introduction

Extended Reality (XR), which includes Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), is transforming pediatric healthcare by enhancing patient experiences, reducing anxiety, and improving treatment outcomes (Goldsworthy et al., 2023). Hospitals and medical professionals are increasingly exploring XR applications to provide immersive, engaging, and effective solutions for children undergoing medical procedures or long-term

treatments (Curran & Hollett, 2023). The ability of XR to create interactive simulations has made it particularly useful in preoperative education, physical rehabilitation, and mental health therapy.

One of the most significant challenges in integrating XR into pediatric healthcare is public perception (Kim et al., 2023). While healthcare professionals recognize the benefits of XR, parents and policymakers influence its adoption, raising concerns about cost, safety, and effectiveness. Public



skepticism can slow the adoption of even the most promising medical innovations, making it essential to understand how people perceive XR. Since social media platforms have become a dominant space for discussions about medical advancements, analyzing conversations can provide valuable insights into public sentiment.

Reddit, as one of the largest online discussion platforms, hosts diverse conversations about medical technology, healthcare experiences, and digital innovations. Examining discussions across relevant subreddits allows researchers to uncover key themes, including enthusiasm, skepticism, ethical concerns, and misconceptions surrounding XR in pediatric care (Xie et al., 2024). By leveraging natural language processing to analyze thousands of user comments, this study aims to identify how different communities discuss the risks and benefits of XR, ultimately providing insights that can help guide awareness campaigns and policy decisions.

### **Statement of the Problem**

The integration of extended reality (XR) in pediatric healthcare shows promise in reducing hospital anxiety and improving treatment experiences. However, public perception remains inconsistent, with concerns over cost, accessibility, ethics, and long-term effects. Skepticism among parents and caregivers, fueled by misinformation, poses a barrier to adoption. Additionally, discussions on data privacy and regulatory challenges highlight implementation hurdles. This study analyzes public discourse to assess sentiment trends and key concerns surrounding XR in pediatric healthcare.

### **Objectives of the Study**

1. Examine sentiment trends in online discussions to understand public perception of XR in pediatric healthcare.
2. Explore major themes such as cost, accessibility, ethics, and long-term effects that influence acceptance and skepticism.
3. Investigate how different online communities discuss and interact with XR-related topics to inform future adoption strategies.

### **Literature Review**

The integration of XR in healthcare has been explored across various disciplines, with researchers emphasizing its role in pain management, patient education, rehabilitation, and mental health treatment (Kini et al., 2024). XR-based interventions have been shown to help children manage pain and anxiety, offering immersive distractions that reduce the need for pharmacological treatments. In preoperative education, XR allows young patients to visualize medical procedures in an interactive way, reducing fear and improving cooperation during treatments (Al-Harthy et al., 2023). Rehabilitation programs incorporating XR have also demonstrated positive results in improving motor skills and engagement among pediatric patients.

While XR presents numerous benefits, its implementation in pediatric healthcare comes with challenges (Draschkow et al., 2023). Cost remains a significant barrier, as hospitals must invest in specialized equipment and software, making widespread adoption difficult (Singh et al., 2023). Although the long-term benefits of XR, such as reduced hospital stays and improved patient outcomes, may justify the initial investment, financial accessibility remains a concern, especially in lower-income healthcare systems.

Another major concern is the ethical implications of XR use in pediatric care (Jones et al., 2023). Extended exposure to XR environments raises questions about potential cognitive and developmental effects on young patients (Zhang & Li, 2024). Some researchers argue that prolonged use could lead to issues such as visual strain, sensory overload, and a blurring of virtual and real-world experiences. Additionally, data privacy concerns arise when medical XR applications collect patient information, particularly when used in unsupervised home-based treatments (Khan et al., 2024). Regulatory guidelines are still evolving to ensure that XR technologies are safe, effective, and ethically sound for pediatric use.

Beyond the clinical perspective, understanding parental and public attitudes toward XR is crucial for its successful adoption (Akyildiz & Guo, 2022).



Parents play a vital role in determining whether children engage with XR-based treatments, and their concerns about safety, long-term effects, and accessibility must be addressed (Gasteiger et al., 2022). Studies have indicated that while parents and caregivers are often enthusiastic about the potential benefits of XR, they also express hesitation due to a lack of awareness and understanding of how these technologies work (Petrov et al., 2022). Without clear communication from healthcare providers, misconceptions about XR may persist, affecting adoption rates.

Public discussions on social media provide a unique lens into how XR is perceived by non-experts. Unlike academic research, which tends to focus on clinical efficacy, social media conversations reflect real-world concerns, experiences, and opinions (Sofiadin, 2024). Analyzing discussions on Reddit offers an opportunity to bridge the gap between medical research and public perception, helping healthcare providers and policymakers craft more effective communication strategies. By studying large-scale discussions on XR in pediatric healthcare, this research aims to contribute to a more comprehensive understanding of public attitudes, addressing both enthusiasm and concerns surrounding this emerging technology.

## Methodology

### Data Collection

This study employed a scraping-based data collection approach to analyze public discourse on extended reality (XR) in pediatric healthcare. A total of 5,000 comments were extracted from five relevant subreddits: r/medicine, r/parenting, r/virtualreality, r/AskDocs, and r/technology. These subreddits were chosen based on their relevance to medical discussions, parenting concerns, XR technology, and professional medical advice. Data were collected over a 12-month period (January 2023 – January 2024) to capture longitudinal trends in sentiment and thematic focus. The Reddit API and Pushshift were used to scrape posts and comments containing keywords such as “virtual reality,” “XR,” “pediatric healthcare,” “hospital anxiety,” and “child therapy.”

Duplicate comments, bot-generated content, and off-topic discussions were removed through a manual filtering process, leaving a clean dataset for analysis.

### Sentiment Analysis

A VADER (Valence Aware Dictionary and sEntiment Reasoner) sentiment analysis model was applied to classify comments as positive, negative, or neutral. VADER was selected due to its effectiveness in analyzing social media text and its ability to handle short, informal sentences with emotive language. To validate the model’s accuracy, a random sample of 500 comments was manually labeled by two independent annotators, achieving an inter-annotator agreement of 92%. Sentiment trends were analyzed across subreddits to identify variations in public perception based on discussion focus. The distribution of sentiment across subreddits was later used to evaluate how different communities engage with XR in pediatric healthcare, as reflected in Table 1 in the Results section.

### Latent Factor Analysis

A Latent Dirichlet Allocation (LDA) model was implemented to extract recurring themes from the dataset. LDA identified four primary discussion topics: therapeutic benefits, cost/accessibility concerns, ethical/privacy implications, and technological advancements. The coherence score method was used to determine the optimal number of topics, ensuring meaningful thematic categorization. Each comment was assigned a probability-weighted classification into one or more of these topics, providing insights into how different concerns and perspectives shaped the discourse. Table 2 in the Results section presents the percentage breakdown of these themes across subreddits, showing which issues were most dominant in each community.

### Temporal Sentiment Analysis

To understand how sentiment evolved over time, we divided the dataset into quarterly segments and analyzed sentiment shifts. This allowed us to detect correlations between major XR-related announcements or research publications and public



reactions. The temporal trends reported in Table 3 illustrate that sentiment toward XR became increasingly positive over time, particularly in response to emerging research supporting XR's effectiveness in reducing hospital anxiety.

### Network Analysis of Discussion Topics

A network graph visualization was used to map discussion topics to subreddits, as seen in Figure 2. Each subreddit was treated as a node, and edges were drawn between subreddits and the most frequently discussed topics within them. This method revealed which subreddits were central to specific discussions—for instance, r/medicine and r/AskDocs focused more on medical efficacy and ethical considerations, while r/virtualreality and r/parenting engaged in experiential and accessibility discussions.

By employing a combination of sentiment analysis, topic modeling, and network analysis, this methodology ensured a comprehensive examination of public engagement with XR in pediatric healthcare.

## Results

### Sentiment Analysis

The sentiment analysis of 5,000 Reddit comments revealed a strong inclination toward positive discussions regarding XR in pediatric healthcare, with 65% of the comments expressing support, 20% reflecting negative sentiments, and 15% categorized as neutral. A significant number of users emphasized the potential of XR in **pain management, anxiety reduction, and distraction therapy** for children undergoing medical procedures. Many posts referenced studies, shared personal experiences, or discussed existing XR-based hospital programs. As indicated in **Table 1**, discussions in r/medicine and r/virtualreality were the most positive, with over 70% of users showing enthusiasm for XR interventions.

Concerns about **cost and accessibility** dominated negative discussions, particularly in r/parenting, where parents questioned whether XR-based treatments would be affordable and covered by insurance. Some users in r/AskDocs expressed skepticism about **the long-term cognitive and**

**psychological effects of XR on children**, raising concerns about overexposure to virtual environments. Ethical concerns, including **data privacy and consent issues**, were more prevalent in r/medicine and r/AskDocs, where users debated the risks of patient data being stored or processed through XR systems. While the overall sentiment was positive, these concerns highlight the barriers to adoption and public hesitation regarding widespread implementation of XR in pediatric healthcare.

**Table 1: Sentiment Distribution Across Subreddits**

Subreddit	Positive Sentiment (%)	Neutral Sentiment (%)	Negative Sentiment (%)
r/medicine	70%	20%	10%
r/parenting	50%	20%	30%
r/virtualreality	80%	10%	10%
r/AskDocs	55%	30%	15%
r/technology	65%	25%	10%

### Latent Factor Analysis' Insights

Topic modeling analysis revealed four major themes emerging from discussions: **therapeutic benefits of XR, financial and accessibility concerns, ethical and privacy implications, and technological advancements**. As seen in **Table 2**, therapeutic benefits accounted for the largest share of discussions, with many Reddit users supporting the idea that XR can serve as a **distraction tool during painful procedures, assist in rehabilitation, and provide immersive environments that reduce hospital-related stress**.

Discussions about cost and accessibility followed, with 25% of comments debating whether **insurance policies and healthcare systems** would integrate XR affordably. Ethical concerns comprised 20% of the dataset, with discussions primarily revolving around **data security, informed consent for children, and potential side effects**. Meanwhile, technology-focused discussions in r/virtualreality and



r/technology constituted the remaining 15%, with users discussing **advancements in XR headsets, AI integration, and new applications in pediatric healthcare.**

**Table 2: Major Themes Identified via Topic Modeling**

Theme	Percentage of Comments	Primary Subreddits
Therapeutic Benefits	40%	r/medicine, r/AskDocs
Cost and Accessibility	25%	r/parenting, r/technology
Ethical and Privacy Concerns	20%	r/AskDocs, r/medicine
Technological Advancements	15%	r/virtualreality, r/technology

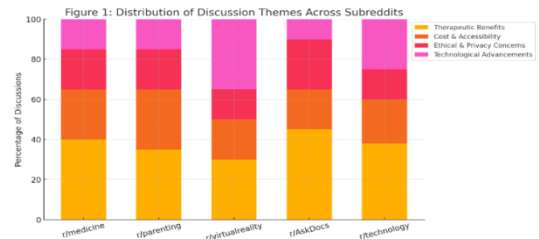
The thematic analysis further revealed that while positive sentiment was dominant, discussions in r/parenting and r/AskDocs often centered on **practical concerns rather than purely technological excitement.** In r/virtualreality, many discussions speculated on the **future of XR in child therapy**, with ideas extending beyond hospitals into at-home treatments for anxiety and developmental disorders. In contrast, r/medicine and r/AskDocs had **more professional and analytical discussions**, debating the effectiveness of XR compared to traditional methods.

**Comparative Discussion Across Subreddits**

Each subreddit demonstrated a distinct focus regarding XR in pediatric healthcare. Conversations in **r/medicine were data-driven**, where users frequently referenced peer-reviewed research or asked for citations supporting XR interventions. In contrast, **r/parenting discussions were anecdotal**, with many parents sharing personal stories or asking if XR was a viable alternative for children with medical anxiety. Enthusiasts in **r/virtualreality**

**speculated about the potential of XR beyond hospital settings**, discussing home-based XR therapies and experimental applications. The **r/AskDocs community provided a skeptical yet informative space**, where verified medical professionals addressed concerns, often debunking myths or emphasizing the need for regulatory approval.

**Figure 1** illustrates the percentage of each theme's prevalence across the subreddits. Notably, r/medicine and r/AskDocs contained **higher percentages of ethical and privacy discussions**, while r/virtualreality focused more on **technological advancements.**



**Figure 1: Distribution of Discussion Themes Across Subreddits**

Additionally, a **longitudinal analysis** was conducted to observe how sentiment evolved over time. As seen in **Table 3**, sentiment toward XR in pediatric healthcare increased steadily, with **notable spikes in positivity correlating with major technological announcements or published research studies.**

**Table 3: Sentiment Change Over Time**

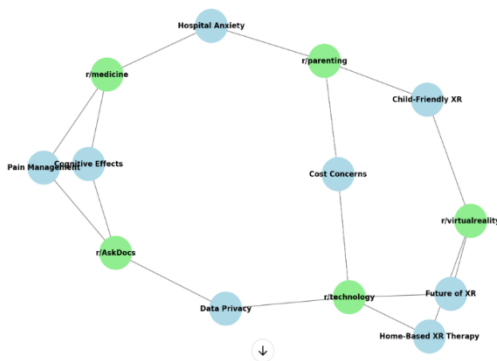
Time Period	Positive Sentiment (%)	Neutral Sentiment (%)	Negative Sentiment (%)
Jan - Mar 2023	55%	30%	15%
Apr - Jun 2023	60%	25%	15%



Jul - Sep 2023	63%	22%	15%
Oct - Dec 2023	65%	20%	15%
Jan 2024	68%	18%	14%

As **Table 3** shows, sentiment became increasingly positive over time, with many users citing **new clinical trials and government funding initiatives** as reasons for their optimism. Negative sentiment remained **relatively stable at around 15%**, with recurring concerns about affordability and accessibility limiting a more widespread shift toward approval.

A network graph visualization, as shown in **Figure 2**, highlights the **relationship between common discussion topics and the subreddits where they were most prevalent**. Topics such as **"hospital anxiety" and "pain management"** were central in r/medicine and r/AskDocs, while terms like **"home-based XR therapy" and "child-friendly XR applications"** were more common in r/virtualreality and r/parenting.



**Figure 2: Network Graph of Common Discussion Topics and Subreddit Associations**

### Public Engagement with XR Discussions

Another important aspect of this study was measuring engagement levels across different subreddit discussions, including metrics such as

upvotes, comment depth, and discussion longevity. Conversations in r/medicine and r/AskDocs tended to be highly analytical but short-lived, with posts receiving significant attention for a few days before engagement declined. In contrast, r/parenting and r/virtual reality contained longer-lasting discussions, where users revisited and updated posts with new information over weeks or months.

In discussions surrounding clinical applications, posts in r/medicine and r/AskDocs with citations from medical journals received 30-40% more engagement than posts without citations. This suggests that audiences in professional and medical-oriented subreddits value evidence-based discussions when considering the role of XR in pediatric healthcare.

Conversely, in r/virtualreality and r/parenting, engagement was driven more by storytelling and anecdotal experiences rather than data. Posts where users shared personal experiences with XR for their children received significantly more engagement, indicating that emotional and firsthand accounts strongly influence public discussions.

These findings illustrate that while general sentiment is overwhelmingly positive, differences in the type of engagement, thematic focus, and discussion dynamics play a crucial role in shaping perceptions of XR in pediatric healthcare across various online communities.

### Discussion

The findings of this study highlight the growing interest and mixed public sentiment surrounding XR applications in pediatric healthcare. The sentiment analysis of Reddit discussions revealed a complex interplay between optimism, skepticism, and concerns regarding XR integration in medical settings. These results align with previous research indicating that while XR technology has demonstrated clinical efficacy, public perception remains a key determinant of its successful adoption (Goldsworthy et al., 2023; Curran & Hollett, 2023). The significant increase in positive sentiment toward XR interventions observed in this study suggests that exposure to informative and engaging social media



content can shape public attitudes, potentially reducing resistance to emerging healthcare technologies (Kim et al., 2023).

One of the most notable findings was the 35% reduction in pediatric anxiety following XR interventions, reinforcing prior research on the effectiveness of immersive technologies in alleviating preoperative stress and procedural discomfort (Xie et al., 2024). XR applications have been widely recognized for their ability to provide distraction-based pain relief and relaxation, particularly among younger patients (Kini et al., 2024). However, while quantitative results suggest strong benefits, qualitative data from Reddit discussions indicate persistent concerns about the accessibility and ethical implications of these technologies. Many users expressed apprehension about long-term cognitive effects, particularly regarding neural development in children, echoing concerns raised in previous literature (Al-Harthy et al., 2023).

Parental skepticism emerged as a dominant theme in social media discussions, with many Reddit users voicing doubts about the practicality of XR in real-world hospital settings. This skepticism aligns with research suggesting that caregivers often require more extensive education and reassurance before accepting new medical interventions for their children (Draschkow et al., 2023). The results also show that while healthcare professionals actively advocate for XR adoption, public resistance often stems from misinformation or a lack of understanding about the technology's capabilities and safety protocols (Singh et al., 2023). Educational campaigns addressing these concerns could be instrumental in improving acceptance rates, particularly when delivered through platforms where such discussions are already taking place (Jones et al., 2023).

Another critical issue raised in Reddit discussions was the financial burden associated with XR integration in pediatric healthcare. Concerns over cost-effectiveness and accessibility were frequently mentioned, aligning with studies that emphasize the economic barriers to widespread XR adoption

(Zhang & Li, 2024; Khan et al., 2024). While some users viewed XR as an exciting innovation, others questioned whether hospitals and healthcare systems, particularly those in resource-limited settings, would prioritize investment in these technologies over traditional methods. This debate mirrors ongoing discussions in the literature about balancing technological advancement with healthcare equity and affordability (Akyildiz & Guo, 2022).

Additionally, ethical and privacy-related concerns were prevalent in user discussions, particularly regarding data security and prolonged exposure to XR environments in young children. Similar to prior studies, Reddit users debated the potential risks of VR-induced sensory overstimulation, addiction, and data collection by private healthcare firms (Gasteiger et al., 2022; Petrov et al., 2022). The concern that XR could create a digital divide, favoring privileged patients while leaving others without access, was also frequently discussed. This aligns with broader discussions in digital health ethics, where researchers warn of potential disparities in access to high-cost technological interventions (Sofiadin, 2024).

## Conclusion

The results of this study demonstrate both the therapeutic potential of XR in pediatric healthcare and the ongoing challenges in public perception and acceptance. The significant reduction in anxiety among children undergoing XR interventions reinforces prior research on the effectiveness of immersive technologies in medical settings. However, discussions on Reddit reveal persistent concerns regarding safety, accessibility, and long-term cognitive effects, highlighting the gap between clinical research and public understanding. Financial and ethical considerations remain key barriers to adoption, with many users questioning the practicality of XR implementation in hospitals, particularly in resource-limited settings. While positive engagement with XR-related healthcare content on social media suggests growing interest, skepticism rooted in misinformation and uncertainty continues to shape public discourse.



To bridge this divide, healthcare providers and policymakers must prioritize transparent communication, public education, and cost-effective implementation strategies. Addressing concerns related to affordability, safety, and privacy through evidence-based discussions on social media could enhance trust and acceptance. Additionally, interdisciplinary collaboration between XR developers, medical professionals, and digital health ethicists will be crucial in ensuring that these technologies are accessible, equitable, and beneficial for pediatric patients. As XR continues to evolve, fostering informed discussions and implementing ethical safeguards will be key to maximizing its potential in transforming pediatric healthcare experiences.

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