

Big Data Applications in Online Psychological Counseling: A Systematic Literature Review

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Abstract: The development of digital technology has transformed mental health services, including online psychological counseling. The increasing use of digital platforms generates large volumes of psychological and behavioral data that can be analyzed through Big Data approaches to support assessment, intervention, monitoring, and decision-making processes. This study aims to systematically review the application of Big Data in online psychological counseling by examining its implementation approaches, supporting technologies, benefits, challenges, and future research directions. A Systematic Literature Review (SLR) was conducted following PRISMA 2020 guidelines. Literature searches were performed in Scopus, ScienceDirect, PubMed, SpringerLink, and Google Scholar, resulting in 20 eligible studies published between 2016 and 2026 for qualitative synthesis. The findings indicate that Big Data has been applied in data integration, behavioral analysis, counseling conversation analysis, clinical decision support, and digital intervention development. Key enabling technologies include Natural Language Processing, Machine Learning, social media analytics, conversational agents, and Large Language Models. The reviewed studies highlight several benefits, including personalized mental health services, early identification of mental health risks, improved accessibility, and enhanced scalability of counseling support. However, important challenges remain, particularly regarding data privacy, informed consent, algorithmic bias, transparency, fairness, and the generalizability of computational models. Future research should focus on integrating heterogeneous data sources, developing explainable artificial intelligence systems, strengthening ethical governance frameworks, and evaluating long-term effectiveness in real-world counseling settings. Overall, Big Data demonstrates considerable potential to support more effective, ethical, and evidence-based digital mental health services.

Keywords: Big Data; Online Psychological Counseling; Digital Mental Health; Machine Learning; Natural Language Processing

INTRODUCTION

The development of digital technology has transformed the delivery of mental health services. Psychological counseling, which was previously dominated by face-to-face interactions, has evolved into online services through mobile applications, web-based platforms, and telehealth systems. This transformation continuously generates large volumes of digital information, including counseling session records, psychological assessment results, user interaction logs, and behavioral data collected throughout the therapeutic process. The accumulation of these heterogeneous data across multiple digital platforms provides a foundation for large-scale computational analysis in mental health services [24], [2].

Big Data is commonly defined as large-scale datasets characterized by the core attributes of volume, velocity, and variety, requiring advanced computational techniques for efficient storage, processing, and analysis [24]. From a technological perspective, it relies on distributed computing systems, machine learning algorithms, and data integration

frameworks to manage heterogeneous and rapidly generated data streams originating from diverse digital sources, including electronic health records, social media platforms, mobile applications, wearable sensors, and online counseling systems, thereby enabling large-scale computational analysis of psychological and behavioral patterns in healthcare and mental health contexts [2]. In online psychological counseling, Big Data extends beyond the storage of client information by supporting the integration, management, and analysis of large-scale heterogeneous psychological data from multiple digital sources, which facilitate evidence-based clinical decision-making through the identification of behavioral patterns, prediction of psychological risks, and development of data-driven decision support systems for mental health professionals [2]. Furthermore, insights generated through Big Data analytics contribute to the design of more personalized, accessible, and effective digital mental health interventions, ultimately enhancing the quality and continuity of online psychological services [18].

Recent studies indicate a growing adoption of computational and data-driven approaches in mental health research, with systematic reviews showing that digital data sources such as social media platforms, counseling systems, and mobile health applications are increasingly utilized for large-scale analyses of psychological conditions and behavioral patterns [21], [12]. These developments reflect the expanding role of Big Data-driven methodologies in complementing traditional mental health research through large-scale computational analyses of language and behavior. However, existing studies also emphasize several critical challenges associated with the application of Big Data in mental health contexts, including concerns regarding data privacy, ethical issues, algorithmic bias, and limitations in model validity and generalizability across different populations [10], [9]. Nevertheless, digital mental health interventions have demonstrated promising outcomes in enhancing psychological well-being, reducing symptoms of depression and anxiety, and improving access to mental health services [18], indicating that although Big Data-driven approaches contribute significantly to the advancement of mental health care, their implementation requires careful consideration of technical, ethical, and methodological constraints.

Although the potential of Big Data in mental health services is substantial, most existing studies tend to focus on specific artificial intelligence applications such as machine learning models, conversational agents, and large language models in online mental health contexts, rather than examining broader data-driven approaches within a unified Big Data framework [14], [21]. Moreover, the existing literature remains fragmented across disciplines, with limited integration of findings across different stages of the data lifecycle in digital mental health research, including data generation, processing, analysis, and application. Furthermore, the use of psychological and behavioral data in digital mental health systems raises significant ethical and regulatory concerns, particularly related to data privacy, informed consent, fairness, and the ethical use of algorithmic systems in healthcare contexts [10], [9]. These challenges become increasingly critical as Big Data-driven systems scale across platforms and populations, highlighting the need for robust governance frameworks to ensure responsible and ethical implementation in online psychological counseling services.

Therefore, this study aims to systematically review the application of Big Data in online psychological counseling by synthesizing current evidence on its implementation approaches, functional roles, benefits, challenges, and ethical considerations. Furthermore, this review seeks to identify existing research gaps and future directions to support the development of more effective, ethical, and evidence-based online counseling services.

RESEARCH METHOD

This study employed a Systematic Literature Review (SLR) approach to synthesize existing evidence regarding the application of Big Data in online psychological counseling. The review was conducted following PRISMA 2020 guidelines to ensure a transparent, systematic, and replicable review process [17]. The SLR approach was selected because it enables researchers to identify, evaluate, and integrate findings from multiple studies, thereby providing a comprehensive understanding of current developments, challenges, and future directions in the application of Big Data within online psychological counseling services.

1. Research Questions

To guide the review process and ensure alignment with the study objectives, the following research questions (RQs) were formulated:

- RQ1: How has Big Data been applied in online psychological counseling and digital mental health services?
- RQ2: What technologies and analytical approaches are commonly used to support Big Data implementation in online psychological counseling?
- RQ3: What benefits and opportunities are associated with the use of Big Data in online psychological counseling?
- RQ4: What challenges, limitations, and ethical issues are reported in the implementation of Big Data within online psychological counseling systems?
- RQ5: What future research directions have been identified for advancing Big Data-driven online psychological counseling services?

2. Data Sources and Search Strategy

The literature search was conducted using several academic databases, including Scopus, ScienceDirect, PubMed, SpringerLink, and Google Scholar. These databases were selected because they provide extensive coverage of interdisciplinary research in psychology, mental health, computer science, artificial intelligence, and health informatics.

The search process focused on studies published between 2016 and 2026, reflecting the period during which Big Data analytics, machine learning, natural language processing, and artificial intelligence became increasingly integrated into digital mental health services. To identify relevant studies, combinations of keywords and Boolean operators were used, including: "Big Data" AND "Online Psychological Counseling"; "Big Data" AND "Online Counseling"; "Big Data" AND "Mental Health Counseling"; "Big Data" AND "Digital Mental Health"; "Data Analytics" AND "Online Psychological Counseling"; "Data-Driven" AND "Mental Health Services"; "Big Data" AND "Machine Learning" AND "Mental Health"; "Big Data" AND "Natural Language Processing" AND "Mental Health"; "Big Data" AND "Artificial Intelligence" AND "Online Counseling"; "Big Data" AND "Chatbot" AND "Mental Health", and "Big Data" AND "Large Language Model" AND "Mental Health Counseling".

3. Inclusion and Exclusion Criteria

To ensure the relevance and quality of the selected studies, predefined inclusion and exclusion criteria were applied.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Studies published between 2016 and 2026	Studies published before 2016

Inclusion Criteria	Exclusion Criteria
Peer-reviewed journal articles, review papers, or conference proceedings	Editorials, commentaries, book reviews, and non-academic publications
Studies related to Big Data, data-driven approaches, artificial intelligence, machine learning, natural language processing, or digital technologies in mental health and online psychological counselling	Studies unrelated to mental health, psychological counseling, or digital mental health services
Studies written in English	Articles without accessible full-text versions
Full-text articles available for review	Duplicate publications identified across databases

Following the screening and eligibility assessment stages, 20 studies met the inclusion criteria and were included in the final synthesis.

4. Data Extraction
- Data extraction was performed systematically using a structured extraction form. Information collected from each study included: author(s) and publication year; research objective; study design and methodology; Big Data component or technological approach; application domain within online psychological counseling or mental health services; key findings; benefits and opportunities; challenges and limitations, and ethical and governance considerations.
5. PRISMA Flow Summary
- The following table summarizes the review process:

Table 2. PRISMA Flow Summary

PRISMA Stage	Number of Records
Records identified through database searching	134
Duplicate records removed	24
Records screened (title and abstract)	110
Records excluded during screening	68
Full-text articles assessed for eligibility	42
Full-text articles excluded	22
Studies included in the final qualitative synthesis	20

Five additional references were retained as supporting literature for conceptual, technological, and ethical discussions; however, these studies were not included in the final synthesis process.

RESULT AND DISCUSSION

Following the PRISMA 2020 selection process, a total of 20 studies were included in the final qualitative synthesis. The selected studies were published between 2016 and 2026 and represent interdisciplinary research spanning mental health, psychology, health informatics, artificial intelligence, natural language processing, and digital health

technologies. The literature demonstrates the growing integration of Big Data–driven approaches within digital mental health services and online psychological counseling.

To facilitate analysis, the selected studies were categorized into five thematic groups based on their primary research focus: (1) Big Data and Computational Mental Health; (2) Natural Language Processing and Machine Learning; (3) Artificial Intelligence, Large Language Models and Chatbot-Based Counseling; (4) Digital Mental Health Systems and Infrastructure; and (5) Ethics, Governance, and Data Challenges. This thematic classification enabled a structured synthesis of how Big Data has been applied, the technologies involved, the benefits generated, the challenges encountered, and future directions for research and practice.

Some studies contributed to more than one thematic category because of their interdisciplinary nature. Therefore, the total number across categories exceeds the 20 studies included in the review.

1. Applications of Big Data in Online Psychological Counseling (RQ1)

The reviewed literature indicates that Big Data has been applied in various aspects of online psychological counseling and digital mental health services, including data collection, data integration, behavioral analysis, clinical decision support, and intervention development [2], [18]. One major application of Big Data involves the collection and integration of heterogeneous data from multiple digital sources including online counseling conversations, social media interactions, electronic health records, mobile mental health applications, and wearable devices. The integration of these diverse data streams enables large-scale analysis of mental health trends and individual behavioral patterns that would be difficult to identify through traditional clinical approaches alone [2], [24].

Another important application concerns the analysis of counseling interactions and psychological communication. Althoff et al. (2016) demonstrated how large-scale counseling conversation datasets can be analyzed using computational techniques to identify communication patterns associated with effective counseling outcomes. Such approaches provide valuable insights into counselor-client interactions and factors associated with successful counseling outcomes [3]. The reviewed studies also show that Big Data has become a foundation for computational mental health research. Schindler and Domahidi (2023) reported a growing reliance on digital data sources and computational methods to investigate psychological conditions and behavioral dynamics [21]. Similarly, Guntuku et al. (2017) highlighted the increasing use of large-scale online behavioral data for understanding mental health indicators and predicting psychological outcomes [12].

Overall, the findings suggest that Big Data serves not only as a repository of psychological information but also as a strategic resource that enables large-scale analysis, clinical insight generation, and data-driven innovation within online psychological counseling systems.

2. Technologies and Analytical Approaches Supporting Big Data Implementation (RQ2)

The reviewed studies reveal that the implementation of Big Data in online psychological counseling is supported by a combination of computational

technologies and analytical approaches [15], [16], [13], [14]. The most frequently reported technologies include Natural Language Processing (NLP), Machine Learning (ML), social media analytics, conversational agents, and Large Language Models (LLMs). Natural Language Processing represents one of the most widely used approaches for analyzing psychological text data. NLP techniques enable the extraction of meaningful information from counseling conversations, social media posts, and digital communication records. Le Glaz et al. (2021) identified NLP as a central methodological approach in computational mental health research, particularly for detecting emotional states, psychological symptoms, and behavioral indicators [15]. Machine learning algorithms are also commonly employed to identify patterns and generate predictive insights from large-scale psychological datasets. Studies by Shen et al. (2017), Eichstaedt et al. (2018), and Reece and Danforth (2017) demonstrated the ability of machine learning models to predict depressive symptoms using data derived from social media content, language use, and visual information [23], [7], [20]. These findings suggest that machine learning may support the early identification of individuals at risk for mental health problems.

Recent developments have introduced transformer-based architectures and Large Language Models into mental health applications. The introduction of BERT by Devlin et al. (2019) significantly improved natural language understanding capabilities and provided a foundation for subsequent NLP applications in various domains, including mental health research [6]. More recent reviews by Hua et al. (2024), Guo et al. (2024), and Cho et al. (2026) indicate growing interest in the use of LLMs and agentic AI systems for mental health counseling, assessment, and support services [13], [11], [5].

In addition, conversational agents and chatbot technologies have emerged as practical tools for delivering scalable mental health interventions. Laranjo et al. (2018), Vaidyam et al. (2019), and Abd-Alrazaq et al. (2020) reported increasing adoption of AI-powered conversational systems that can provide psychoeducation, emotional support, and self-management assistance for mental health concerns [14], [25], [1]. The findings suggest that Big Data implementation in online psychological counseling is supported by an evolving technological ecosystem in which NLP, machine learning, and generative AI technologies play complementary roles in analyzing large-scale psychological data and supporting data-driven mental health services.

3. **Benefits and Opportunities of Big Data in Online Psychological Counseling (RQ3)**
The reviewed literature identifies numerous benefits associated with the application of Big Data in online psychological counseling. These benefits primarily relate to personalization, accessibility, scalability, and predictive capabilities [2], [18], [1], [25]. One of the most significant advantages is the ability to provide personalized mental health services. By analyzing large volumes of behavioral and clinical data, digital mental health systems can support more personalized approaches to mental

health assessment and intervention. Ahmed et al. (2022) highlighted the role of Big Data analytics in supporting personalized mental health care through continuous monitoring and data-driven decision support [2]. Big Data also facilitates early detection and prediction of mental health risks. Studies employing machine learning and social media analytics have demonstrated the potential to identify digital indicators associated with depression and other mental health conditions. Research conducted by Eichstaedt et al. (2018), Reece and Danforth (2017), and Shen et al. (2017) illustrates how digital behavioral data can serve as predictive markers for mental health conditions [7], [20], [23]. Another important benefit involves increased accessibility to mental health services. Digital mental health interventions can expand access to mental health services by enabling remote and technology-mediated forms of care delivery. Philippe et al. (2022) found that digital mental health interventions contribute to improved service accessibility and expanded mental health support opportunities [18].

Furthermore, digital mental health technologies supported by data-driven systems can enhance scalability and service efficiency. Automated systems such as chatbots and conversational agents can provide support to large populations simultaneously, reducing service bottlenecks and extending the reach of mental health resources [14], [25], [1]. This capability is particularly valuable in contexts where demand for mental health services exceeds the availability of professional counselors.

4. Challenges, Limitations, and Ethical Issues of Big Data in Online Psychological Counseling (RQ4)

The reviewed literature identifies several challenges and limitations associated with the implementation of Big Data in online psychological counseling. These challenges encompass technical, methodological, ethical, and regulatory dimensions that may affect the reliability, fairness, and responsible use of data-driven mental health systems [1], [10], [9], [22], [4]. One of the most frequently discussed concerns involves data privacy and confidentiality. Online psychological counseling systems routinely collect highly sensitive personal information, including emotional disclosures, psychological assessments, behavioral patterns, and digital interaction records. Gooding et al. (2021) emphasized that the collection and analysis of such data raise significant concerns regarding privacy protection, informed consent, and compliance with ethical and legal standards in mental health care [10]. Another important challenge relates to algorithmic bias and fairness. Machine learning models are highly dependent on the quality and representativeness of training data. When datasets contain demographic imbalances or limited population diversity, algorithmic outputs may produce biased predictions or unequal performance across different groups. Floridi et al. (2018) highlighted fairness, transparency, and accountability as essential principles for the responsible development and deployment of artificial intelligence systems [9].

The reviewed studies also report methodological limitations associated with the use of digital behavioral data. Schindler and Domahidi (2023) noted that many

computational mental health studies rely on data obtained from specific digital platforms, which may limit the generalizability of findings to broader populations [21]. Similarly, social media-based studies may not accurately represent individuals who do not actively engage with online platforms, creating potential sampling biases in mental health research.

In addition, challenges related to data quality and interpretation remain significant. Psychological states are complex and context-dependent, whereas computational models often rely on observable digital traces such as language patterns, online activities, or interaction histories. As a result, computational predictions may not fully capture the complexity of psychological experiences and should therefore be interpreted alongside broader clinical and contextual information [15], [16].

Furthermore, the increasing adoption of advanced artificial intelligence technologies, including large language models and conversational agents, introduces additional concerns regarding transparency, explainability, accountability, and the potential dissemination of inaccurate or misleading information. Recent reviews have highlighted the importance of rigorous evaluation, safety monitoring, and appropriate human involvement when deploying AI-driven mental health applications in practice [11], [13].

Overall, the findings indicate that the successful implementation of Big Data in online psychological counseling depends not only on technological capabilities but also on the establishment of robust ethical, legal, and governance frameworks that ensure responsible, transparent, and trustworthy use of psychological data [10], [9], [22].

5. Future Research Directions for Big Data-Driven Online Psychological Counseling (RQ5)

The reviewed literature suggests several directions for future research aimed at enhancing the effectiveness, reliability, and ethical implementation of Big Data in online psychological counseling [2], [4], [10], [11].

First, future studies should focus on improving the integration of heterogeneous data sources. Existing research frequently examines individual data streams, such as social media content, counseling conversations, electronic health records, or mobile health applications, in isolation. Greater integration of these diverse data sources may enable more comprehensive and accurate representations of psychological conditions and behavioral patterns [2], [24]. Second, there is a need for the development of more explainable and transparent artificial intelligence systems. As machine learning models and large language models become increasingly integrated into mental health services. Future research should further explore approaches that enhance the transparency and explainability of AI systems used in mental health [9], [11].

Third, additional empirical research is required to evaluate the effectiveness of Big Data-driven interventions in real-world counseling settings. Although many studies demonstrate promising technological capabilities, evidence regarding long-term

clinical outcomes, implementation effectiveness, and user acceptance remains limited. Future longitudinal and experimental studies may provide stronger evidence regarding the practical impact of data-driven mental health services [18], [4]. Another important direction involves strengthening ethical governance and data protection mechanisms. Future research should investigate approaches for balancing innovation with privacy protection, informed consent, fairness, and responsible data governance. These issues are expected to become increasingly important as mental health systems continue to generate and utilize large-scale psychological datasets [10], [22]. Finally, the diversity of challenges identified in the reviewed studies suggests the value of interdisciplinary collaboration involving psychology, counseling, computer science, data science, health informatics, and ethics. Such collaboration may facilitate the development of more comprehensive Big Data frameworks that connect technological innovation with clinical effectiveness and ethical responsibility in online psychological counseling. Overall, the reviewed literature indicates that future developments may benefit from moving beyond isolated technological applications toward more integrated, evidence-based, and ethically governed Big Data ecosystems that support online psychological counseling and digital mental health services.

6. Limitations of the Review

Several limitations should be considered when interpreting the findings of this review. First, the review focused on studies published between 2016 and 2026, which may have excluded earlier research relevant to the development of Big Data applications in mental health services. Second, only English-language publications were included, potentially limiting the representation of findings reported in other languages and regional contexts.

Third, although multiple databases were searched, including Scopus, ScienceDirect, PubMed, SpringerLink, and Google Scholar, it is possible that some relevant studies were not identified due to differences in indexing practices, search algorithms, or keyword selection. Fourth, the reviewed literature consisted of diverse study designs, including systematic reviews, scoping reviews, review articles, empirical studies, and conference proceedings. This heterogeneity limited the possibility of conducting quantitative comparisons or meta-analytic synthesis across studies. Finally, the field of Big Data, artificial intelligence, and digital mental health is evolving rapidly. Consequently, new technologies, applications, and regulatory developments may emerge after the completion of this review, potentially influencing the relevance of some findings over time. Despite these limitations, the review provides a comprehensive synthesis of current evidence regarding the application of Big Data in online psychological counseling and identifies important directions for future research and practice.

CONCLUSION

This study systematically reviewed the application of Big Data in online psychological counseling by synthesizing evidence from 20 selected studies published between 2016 and

2026. The findings indicate that Big Data has become an important component of digital mental health services, supporting various functions including data collection, integration of heterogeneous psychological data, behavioral analysis, clinical decision support, and the development of digital interventions. The increasing availability of data from online counseling platforms, social media, mobile applications, and other digital sources has expanded opportunities for large-scale analysis of mental health conditions and counseling processes. The review further revealed that the implementation of Big Data in online psychological counseling is supported by a range of computational technologies, particularly Natural Language Processing, Machine Learning, social media analytics, conversational agents, and Large Language Models. These technologies enable the analysis of large-scale psychological data and support data-driven mental health services. In addition, the literature highlights several potential benefits, including personalized mental health support, early identification of mental health risks, improved accessibility to counseling services, and enhanced scalability of digital mental health interventions.

Despite these opportunities, the reviewed studies also identified important challenges and limitations. Concerns related to data privacy, informed consent, algorithmic bias, transparency, fairness, and the generalizability of computational models remain significant barriers to the responsible implementation of Big Data-driven mental health systems. The findings suggest that technological advancement alone is insufficient and must be accompanied by appropriate ethical, legal, and governance frameworks to ensure the safe and trustworthy use of psychological and behavioral data.

Finally, the literature indicates several directions for future research, including the integration of heterogeneous data sources, the development of explainable artificial intelligence systems, the evaluation of long-term effectiveness in real-world counseling settings, and the strengthening of ethical governance mechanisms. Future progress will require interdisciplinary collaboration among psychology, counseling, computer science, data science, health informatics, and ethics. Overall, Big Data demonstrates considerable potential to support the advancement of online psychological counseling, provided that technological innovation is balanced with clinical effectiveness, ethical responsibility, and user protection.

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