REUFPI
Revista de Enfermagem da UFPI
ISSN 2238-7234

Revisão

Big data and machine learning in predicting suicidal ideation: an integrative review

Big data e machine learning na previsão de ideação suicida: revisão integrativa

Big data y machine learning en la predicción de la ideación suicida: una revisión integradora

Giovanna Vitória Aragão de Almeida Santos[1]
ORCID: 0000-0002-7499-2749
Lidya Tolstenko Nogueira[1]
ORCID: 0000-0003-4918-6531
Fernando José Guedes da Silva Júnior[1]
ORCID: 0000-0001-5731-632X
Belquior Gomes de Aguiar Filho[2]
ORCID: 0000-0002-5069-5344
Álvaro Sepúlveda Carvalho Rocha[1]
ORCID: 0000-0002-7968-9597
Jefferson Abraão Caetano Lira[1]
ORCID: 0000-0002-7582-4157

[1]Universidade Federal do Piauí. Teresina, Piauí, Brasil.
[2]Centro Universitário Uninovafapi. Teresina, Piauí, Brasil.

Corresponding author:
Giovanna Vitória Aragão de Almeida Santos
E-mail:
giovannavitoriasantos@gmail.com

Abstract

Objective: To analyze, in literature, the application of Machine Learning and Big Data techniques to predict suicidal ideation in different populations. **Methods:** An integrative review, conducted according to the model proposed by Whittemore and Knafl in October 2024. Two independent reviewers performed the search in the MEDLINE/PubMed, Web of Science and PsycINFO databases. Primary studies that addressed the use of Big Data and Machine Learning in predicting suicidal ideation were included, with no restrictions regarding language or publication date. The presentation of results followed the PRISMA protocol guidelines. **Results:** Ten studies were selected to compose this review, which demonstrated the potential of Big Data and Machine Learning in identifying risk patterns for suicidal ideation in various groups, such as sexual and gender minorities, students, psychiatric patients, patients who have suffered a stroke, workers and the general population, with high predictive accuracy. Conducted in Asia and North America, the studies employed varied collection and analysis methods, with random forest standing out as a recurring and potentially effective technique. **Conclusion:** The use of Big Data and Machine Learning in mental health offers significant advances in predicting suicidal ideation.

Descriptors: Big Data; Machine Learning; Suicidal Ideation; Mental Health.

Whats is already known on this?
Current literature indicates that Big Data and Machine Learning are potential tools for predicting suicidal ideation.

What this study adds?
The study highlights a synthesis of the application of Machine Learning and Big Data techniques to predict suicidal ideation in different populations.

How to cite this article: Santos GVAA, Nogueira LT, Silva Júnior FJGS, Aguiar Filho BG, Rocha ASC, Lira JAC. Big data and machine learning in predicting suicidal ideation: an integrative review. Rev. enferm. UFPI. [internet] 2025 [Cited: ano mês abreviado dia];14:e6249. DOI: 10.26694/reufpi.v14i1.6249

Resumo

Objetivo: *Analisar, na literatura, a aplicação de técnicas de Machine Learning e Big Data para predição da ideação suicida em diferentes populações.* ***Métodos****: Revisão integrativa, conduzida conforme o modelo proposto por Whittemore e Knafl, no mês de outubro de 2024. Dois revisores independentes realizaram a busca nas bases de dados MEDLINE/PubMed, Web of Science e PsycINFO. Foram incluídos estudos primários que abordaram o uso de Big Data e Machine Learning na previsão da ideação suicida, sem restrições quanto ao idioma ou à data de publicação. A apresentação dos resultados seguiu as diretrizes do protocolo PRISMA.* ***Resultados:*** *Foram selecionados dez estudos para compor esta revisão, que demonstraram o potencial de Big Data e Machine Learning na identificação de padrões de risco para ideação suicida em diversos grupos, como minorias sexuais e de gênero, estudantes, pacientes psiquiátricos, pacientes que sofreram acidente vascular cerebral, trabalhadores e a população em geral, com alta precisão preditiva. Realizados na Ásia e América do Norte, os estudos empregaram métodos variados de coleta e análise, destacando-se a random forest como técnica recorrente e potencialmente eficaz.* ***Conclusão:*** *O uso de Big Data e Machine Learning na saúde mental oferece avanços significativos na predição da ideação suicida.*

Descritores: *Big Data; Aprendizado de Máquina; Ideação Suicida; Saúde Mental.*

Resumén

Objetivo: *Analizar, en la literatura, la aplicación de técnicas de Machine Learning y Big Data para predecir la ideación suicida en diferentes poblaciones.* ***Métodos:*** *Revisión integradora, realizada según el modelo propuesto por Whittemore y Knafl en octubre de 2024. Dos revisores independientes realizaron la búsqueda en las bases de datos MEDLINE/PubMed, Web of Science y PsycINFO. Se incluyeron estudios primarios que abordaron el uso de Big Data y Machine Learning para predecir la ideación suicida, sin restricciones de idioma o fecha de publicación. La presentación de resultados siguió las pautas del protocolo PRISMA.* ***Resultados:*** *Se seleccionaron diez estudios para componer esta revisión, que demostraron el potencial del Big Data y Machine Learning en la identificación de patrones de riesgo de ideación suicida en diferentes grupos, como minorías sexuales y de género, estudiantes, pacientes psiquiátricos, pacientes que han sufrido un accidente cerebrovascular, trabajadores y la población en general, con alta precisión predictiva. Los estudios, realizados en Asia y América del Norte, emplearon diversos métodos de recopilación y análisis, entre los que el bosque aleatorio se destacó como una técnica recurrente y potencialmente eficaz.* ***Conclusión:*** *El uso de Big Data y Machine Learning en salud mental ofrece avances significativos en la predicción de la ideación suicida.*

Descriptores: *Macrodatos; Aprendizaje Automático; Ideación Suicida; Salud Mental.*

INTRODUCTION

Suicide is a complex and multifaceted phenomenon, influenced by a variety of causes that can affect people of different backgrounds, social classes, ages, sexual orientations and gender identities. However, scientific advances have made it possible to identify signs that can help prevent this act. Today, suicide is considered a serious public health problem that affects people all over the world.[1]

In this context, suicidal ideation refers to thoughts and plans related to attempted suicide, involving fleeting reflections on the decision to live or die. The increased risk of death requires careful assessment of suicidal ideation, plans and attempts, since the presence of thoughts about one's own death indicates a significant and imminent risk. Therefore, the implementation of strategies for early identification is essential in suicide prevention, allowing for interventions targeted at individuals.[2]

According to the World Health Organization, suicide is one of the leading causes of death on a global scale, surpassing the numbers related to acquired immunodeficiency syndrome, malaria, breast cancer as well as armed conflicts and homicides. In 2019, more than 700,000 people took their own lives, which is equivalent to one in every 100 deaths recorded worldwide. In the same year, the suicide rates recorded in the African (11.2 per 100,000), European (10.5 per 100,000) and Southeast Asian (10.2 per 100,000) regions exceeded the global average, which was 9 per 100,000 inhabitants.[3]

Furthermore, Brazil has been facing an increase in the number of suicides, which worsens an already critical scenario. Between 2011 and 2022, the suicide rate among young people showed an annual increase of 6% while, in the general population, the increase was 3.7% per year.[4] According to data from 2021, more than 15,500 suicides were recorded, which is equivalent to one death every 34 minutes. This worrying rate makes suicide the 27th leading cause of death in the country and the third leading cause among young people, especially among older men and adolescent girls aged 15 to 19.[5]

In the current scenario, the increasing use of social networks and online forums, where many people share feelings and experiences related to suicidal thoughts, offers new opportunities for detecting this phenomenon. Information and Communication Technologies, including apps, show promise, especially considering that most young people have access to cell phones and many older people have already adapted to this new reality.[6]

Finally, technology stands out by offering new perspectives for analyzing large volumes of data, known as Big Data, allowing the identification of patterns or signals through Machine Learning (ML) techniques. These approaches have the potential to become significant alternatives in identifying suicidal ideation, especially in the current scenario of technological development. Moreover, the integration of artificial intelligence into mental health applications can facilitate the monitoring of users' feelings and behaviors, enabling early interventions.[7]

Thus, given that this is an emerging and highly relevant topic for mental health, and considering the relevance and potential of these tools to improve suicide prevention strategies, this study aimed to analyze the evidence available in literature on the application of ML and Big Data techniques to predict suicidal ideation in different populations.

METHODS

This is an integrative literature review, a method that allows for a comprehensive and in-depth analysis of complex topics, theories and issues in health. By encompassing a diversity of samples and objectives, the integrative review provides a broad and detailed view of the topic addressed. To conduct the review, the five-stage model proposed by Whittemore and Knafl was followed: problem definition; bibliographic survey; data assessment; analysis of results; and presentation of conclusions.[8]

The first stage, which consisted of formulating the research question, was based on the acronym PICo, in which P represents Problem (suicidal ideation), I, Interest (use of Big Data and ML), and Co, Context (patterns or predictors of suicidal ideation in different populations). Thus, the following guiding question was formulated: what evidence is available in literature on the application of ML and Big Data techniques to predict suicidal ideation in different populations?

To answer this question, only primary studies that investigated the use of Big Data and ML in predicting suicidal ideation with no restrictions on language or publication date were included. Editorials, case studies, letters to the editor, coursework, preprints, gray literature, incomplete studies, and studies that did not address the proposed question were excluded.

Bibliographic search was carried out by accessing the Federated Academic Community via theCoordination for the Improvement of Higher Education Personnel portal, using the following databases: Medical Literature Analysis and Retrieval System Online/PubMed (MEDLINE); Web of Science (WoS); and PsycINFO of the American Psychological Association (APA).

To ensure accuracy and comprehensiveness, controlled descriptors indexed in the respective databases were selected through the Medical Subject Headings (MeSH Terms) (Big Data; Machine Learning; Suicidal Ideation) and APA Thesaurus (Big Data; Machine Learning; Suicidal Ideation). The combination of these descriptors with the Boolean operators AND and OR aimed to ensure the expansion of search strategy, as detailed in Chart 1.

Chart 1. Search strategy in the databases researched. Teresina, PI, Brazil, 2024

DATABASE	SEARCH STRATEGY
MEDLINE/PubMed	(("big data"[MeSH Terms]) OR ("machine learning"[MeSH Terms])) AND ("suicidal ideation"[MeSH Terms])
Web of Science	((ALL=("Big Data")) OR ALL=("Machine Learning")) AND (ALL=("Suicidal Ideation"))
PsycINFO	(Any Field: "Big Data" OR Any Field: "Machine Learning") AND Any Field: "Suicidal Ideation"

Source: authors, 2024.

After literature search, the articles were exported to the bibliographic software EndNote (https://www.myendnoteweb.com/) in order to identify and remove duplicates. Subsequently, the studies were exported to the Rayyan platform (https://www.rayyan.ai/), in which the study screening process was carried out.

The selection of studies involved the participation of two reviewers who worked independently throughout October 2024. Any disagreements were resolved through discussions involving a third reviewer. The results obtained were organized and presented according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart guidelines.[9]

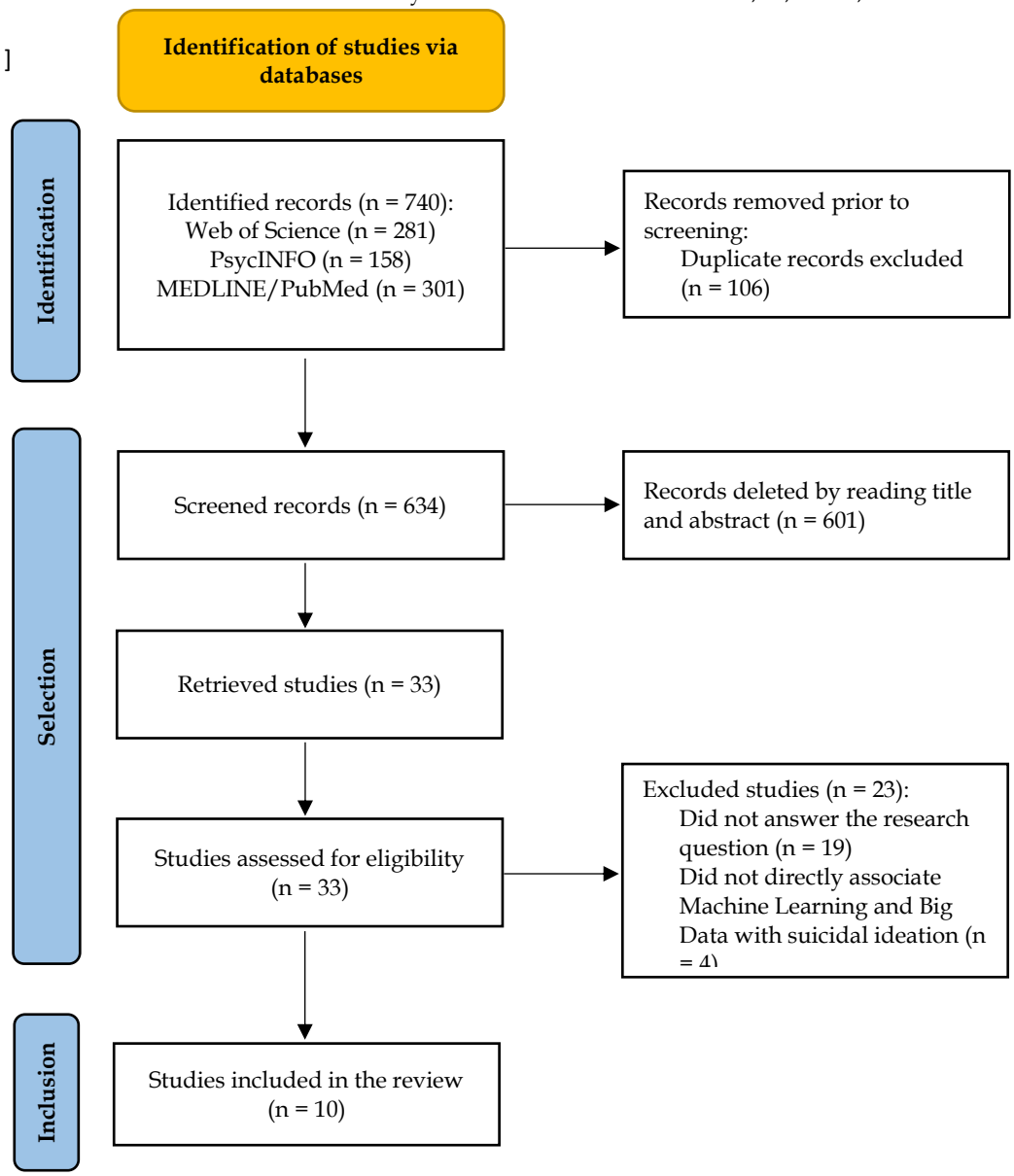
Data extraction was performed and organized in a Microsoft Word® instrument, developed by the authors, in which the extracted information was about authorship, year of publication, country, sample,

data collection, objective and main results of each study. Then, a synthesis and descriptive analysis of selected articles were performed, ensuring a structured and detailed view of the findings included in this review.

RESULTS

The search in the databases resulted in 740 studies. Of these, 106 were identified as duplicates and, after their removal, 634 articles remained for reading of titles and abstracts. Of these, 33 were selected for further analysis according to the eligibility criteria, 19 of which did not address the research question and four did not present a direct association between ML and Big Data with suicidal ideation. Thus, at the end of the selection process, ten studies constituted the final sample of this review. The systematization of this selection process is shown in Figure 1.

Figure 1. Systematization of study selection according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses recommendation.[9] Teresina, PI, Brazil, 2024.



Source: adapted by the authors, 2024.

Chart 2 provides a comprehensive overview of the studies included in this review, highlighting the importance of the intersection between technology, mental health and data.

Chart 2. Characterization of included studies. Teresina, PI, Brazil, 2024

Authorship (year of publication, country)	Sample	Data collection	Objective	Main results
Lei C, Qu D, Liu K, Chen R (2023; China)[10]	103 participants who self-identified as a sexual and gender minority	Messages, via cell phone, with questionnaires	Test the extent to which mood fluctuations and contextual stressful events experienced by sexual and gender minority individuals can predict subsequent suicidal ideation in the short and long term.	The study demonstrated that data from the Ecological Momentary Assessment approach, which incorporated mood fluctuations and stressful events as predictors, showed a stronger predictive effect for short-term (1 month) suicidal ideation in sexual and gender minority individuals.
Shin S, Kim K (2023; South Korea)[11]	24,540 students	Big Data collected for approximately 4 years (from 2017 to 2020) by the National Youth Policy Institute's Korean Child and Adolescent Human Rights Survey	Present a data-driven analysis method to quickly and effectively predict suicidal thoughts and suggest countermeasures against the causes of suicidal thoughts.	Using convolutional neural networks, suicidal ideation was predicted with an accuracy of approximately 90%. Experiencing sadness and depression increased suicidal ideation by more than 25 times, and experiencing anxiety, loneliness, and swearing by more than seven times.
Kim S, Lee K (2022; South Korea)[12]	7,994 participants	Directly applied questionnaires	Investigate the influence of suicidal ideation prediction, whether the assessment of social isolation and depression combined can effectively predict suicide, and the accuracy of suicidal ideation was predicted using three ML techniques.	The RF technique was the most effective ML method in predicting suicidal ideation, and when considering social isolation in addition to depressive symptoms, diagnostic accuracy was improved.
Bozzay ML, Hughes CD, Eickhoff C, Schatten H, Armey MF (2024; United States)[13]	257 psychiatric patients hospitalized	Clinical interviews	Examine whether the classification accuracy of ML models varies as a function of the type of training data or characteristics of suicidal ideation.	The study showed that RF models outperformed other modeling approaches in most metrics (accuracy, precision, specificity, negative predictive value, and AUC), indicating better false positive and true positive rates. The results support the use of ML approaches for accurate identification of suicidal ideation features.
Li TMH, Chen J, Law FOC, Li CT, Chan NY, Chan JWY, et al. (2023; China)[14]	305 participants	Clinical interviews	Determine whether suicidal ideation can be detected through language features in clinical interviews for depression using	RF models demonstrated that text analysis of responses was effective in identifying individuals at high risk of suicide (AUC 0.76–0.89; P < 0.001) and in detecting overall

			natural language processing and ML.	suicide risk, including low and high suicide risk (AUC 0.83–0.92; P < 0.001).
Roy A, Nikolitch K, McGinn R, Jinah S, Klement W, Kaminsky ZA (2020; Canada)[15]	512,526 tweets from 283 suicidal ideation cases and 3,518,494 tweets from 2,655 controls	Tweets	Generate an algorithm capable of predicting future risk of suicidal thoughts by analyzing publicly available Twitter® data.	The authors trained an RF model using neural network outputs to predict binary suicidal ideation status. The model predicted N = 830 suicidal ideation events derived from an independent set of 277 suicidal ideators, relative to N = 3,159 control events in all individuals without suicidal ideation with an AUC of 0.88 (95% CI 0.86–0.90).
Hwanjin P, Lee K (2022; South Korea)[16]	12,816 salaried participants	Korean National Health and Nutrition Examination Survey data	Investigate whether the suicide risk of workers could be efficiently predicted using ML techniques based on work environments and emotional factors.	It was pointed out that when cases of suicidal ideation were predicted using 23 variables related to work, life and emotion, using RF, 98.9% of the cases were predicted and 97.4% could be predicted using only work-related variables.
Lee J, Pak TY (2022; South Korea)[17]	3,780 data	Korea Welfare Panel Study data	Develop ML algorithms for screening Korean adults at risk of suicidal ideation and suicide planning or attempt.	Four ML classifiers (logistic regression, RF, support vector machine, and extreme gradient boosting) were fine-tuned and cross-validated, and all demonstrated satisfactory classification performance in predicting suicidal ideation (sensitivity 0.808–0.853, accuracy 0.843–0.863). The most important predictors were depressive symptoms, self-esteem, income, consumption, and life satisfaction.
Lekkas D, Klein RJ, Jacobson NC (2021; United States)[18]	52 participants	Public Instagram® user data and post content, and interview via Instagram Messenger®	Leverage a consensus ensemble ML model to predict acute suicidal ideation on Instagram® using textual and user engagement metadata.	ML model introspection showed a higher proportion of predictors derived from online social networks having an impact on predicting suicidal ideation, compared to linguistic predictors from structured interviews.
Song SI, Hong HT, Lee C, Lee SB (2022; South Korea)[19]	385 patients diagnosed with stroke	Patient clinical data	Develop and validate a ML model for predicting suicidal ideation using clinical data and identified	The prediction model (Xgboost, CatBoost and Light GBM) of suicidal ideation can be used to classify stroke patients

			suicidal ideation predictors.	into low and high risk groups based on routinely collected medical data and self-report questions.

Note: RF - random forest; AUC - area under the curve; ML - Machine Learning.
Source: authors, 2024.

The articles were published between 2020 and 2024, and reflect a growing interest in applying ML and Big Data techniques to understand and predict suicidal ideation in diverse populations. The study samples varied significantly, ranging from 52 participants in a study that analyzed data from Instagram®[18] to 4,031,020 tweets.[15] This diversity allows for a broad representation of populations affected by suicidal ideation, including sexual and gender minorities, students, psychiatric patients, stroke patients, workers, and the general population.[10-19]

The studies reviewed were conducted mostly in countries in Asia and North America, with emphasis on South Korea.[11,12,16,17,19] Regarding data collection methods, the studies used clinical interviews and questionnaires, as well as strategies such as social network analysis, mobile phone messages, national databases and text mining algorithms. Techniques such as random forest (RF), convolutional neural networks and models such as XGBoost, CatBoost and LightGBM were used, with emphasis on RF, which has proven to be recurrent and effective in various contexts.[10-19]

DISCUSSION

ML algorithms, especially RF models, have demonstrated consistent performance in predicting suicidal ideation, with high accuracy and sensitivity in different contexts. Studies in this review highlight RF as one of the most effective models, demonstrating its robustness in the face of complex and varied data.[12-17] This result is supported by literature, which recognizes RF as one of the most efficient algorithms in classification tasks with a high number of variables and non-linear interactions.[20, 21]

A central point that emerges from the studies is the importance of contextual factors, especially for individuals belonging to sexual and gender minorities. In one study, ML was used to predict suicidal ideation among these groups, identifying stressors associated with the work environment, finances, fidelity, and marriage as strong influences in predicting suicidal ideation. The use of ML, therefore, shows promise for identifying individuals at risk and supporting the development of personalized early prevention programs.[10]

In their contributions on predicting suicidal thoughts in children and adolescents, researchers highlight the importance of applying ML technologies to all age groups, thus expanding the capacity to respond to the suicide crisis that affects different demographics. Using convolutional neural networks, an ML method, the study achieved an accuracy of about 90% in predicting suicidal ideation.[11]

Research investigated the effectiveness of ML techniques to predict suicidal ideation, using symptoms of depression and social isolation as the main variables. The results confirmed that the use of these techniques based on depression and social isolation can be a highly effective method for predicting suicidal ideation. With high specificity, these methods show promise as a useful tool to identify and confirm suicide risk in populations with a high prevalence of this behavior, strengthening the potential of ML to assist targeted interventions and prevent crises in vulnerable groups.[12]

Another study highlights that both baseline and momentary characteristics offer valuable information for the appropriate classification and differentiation of individual profiles related to suicidal ideation. Using ML, the results reinforce the effectiveness of these approaches in accurately identifying characteristics associated with suicidal ideation, in addition to emphasizing the importance of understanding the factors that distinguish and influence these profiles among different individuals.[13]

Furthermore, the use of natural language processing, combined with ML, has great potential to open up new possibilities for automated detection of suicidal ideation, offering more precise and specific markers for this identification. The analysis of texts derived from clinical interviews can generate more reliable indicators, with the potential to transform the screening process by enabling the introduction of online chatbots for continuous assessment.[14]

Another aspect present in the studies analyzed is the use of data from social networks such as Instagram® and Twitter® to detect suicidal ideation based on metadata, language and engagement patterns. Studies show that digital platforms can provide important information about users' emotional state,

anticipating risks that, in many cases, would not be detected by traditional methods.[15,18] This approach, however, raises ethical questions about privacy, consent and digital surveillance, which need to be carefully debated by the scientific community and regulatory bodies.[22]

Innovation in algorithmic approaches, such as the Suicide Artificial Intelligence Prediction Heuristic model, highlights the potential of ML to more accurately identify future risk of suicidal ideation. This model can not only be adapted as a clinical decision support tool, but also provides a basis for ongoing tracking and monitoring of suicidal ideation risk, integrating with technologies that are already part of current clinical practice.[15]

Furthermore, two studies confirm that applying ML techniques based on contextual variables, such as work environments and mental and socioeconomic characteristics, can effectively predict the risk of suicidal ideation. The ability to identify more than 80% of cases of suicidal ideation suggests that implementing rapid screening tools in primary care could facilitate early interventions, thus addressing a critical need in the mental health field.[16,17]

Another significant contribution is the possibility of identifying stroke patients at high risk of suicidal ideation. Researchers have developed an ML model to predict the risk of suicidal ideation in stroke patients based on clinical and psychological characteristics. Furthermore, the model can function as a decision tool to help healthcare professionals identify the risk of suicidal ideation early.[19]

The applicability of ML-based predictive models by healthcare professionals has the potential to improve health outcomes, reduce healthcare costs, and promote clinical research. However, for their implementation to be effective, professionals must be properly trained in the interpretation of results, as the integration of models with clinical expertise is essential to ensure that predictive data is used ethically and sensitively.[23,24]

The limitations of this review are significant, especially considering that this is a new research topic. The exploration of Big Data and ML in predicting suicidal ideation is still a recent field, resulting in a restricted selection of articles, since the number of available studies remains limited. In addition to this, the heterogeneity in the data and variables analyzed may reflect this new area of research, making it difficult to formulate definitive conclusions.

Added to this is the wide variation between study samples, which limits comparability between results and may affect the generalizability of findings. Finally, although ML models show high predictive performance in experimental and controlled contexts, there is still a need for further discussion about their practical applicability in real clinical settings, where factors such as technological infrastructure, ethics, data privacy, and professional training can directly influence their implementation and effectiveness.

CONCLUSION

The analysis of selected studies allowed us to conclude that ML techniques, applied to data from different sources, have demonstrated strong potential to identify patterns associated with suicidal ideation with a high degree of accuracy, sensitivity and specificity. The findings reveal that psychosocial, behavioral and linguistic variables, when processed by algorithms such as RF, have the potential to predict suicidal ideation. These results point to the ability of computational models to not only predict risk, but also to contribute to more effective prevention strategies.

Although the field is expanding, the consolidation of these tools still requires progress until they can be safely and effectively integrated into the daily routine of mental healthcare services. The guiding question of this study can therefore be answered based on the available evidence: there is a growing body of research demonstrating the effectiveness of using Big Data and ML algorithms in predicting suicidal ideation, but this effectiveness still depends on contextual, methodological and ethical factors that need to be carefully considered.

In view of this, it is suggested that future research should further evaluate the effectiveness of these models in real clinical settings and with diverse populations. It is also essential to invest in interdisciplinary approaches that involve healthcare professionals, data scientists, bioethicists and service users, in order to build technological solutions that are not only technically robust, but also humanized, inclusive and ethically sustainable.

Finally, this review contributes to broadening the understanding of how technology can be a strategic ally in suicide prevention, especially when used as a complement to clinical decision-making. At the same time, it reinforces the need for caution, criticality and responsibility in the use of these tools, reaffirming that suicide prevention requires, above all, listening, care and collective commitment.

CONTRIBUITIONS

Contributed to the conception or design of the study/research: Santos, G. V. A. D.; Nogueira, L. T.; Aguiar Filho, B. G.; Rocha, A. S. C.; Lira, J. A. C.; Silva Júnior, F. J. G. Contributed to data collection: Santos, G. V. A. D.; Nogueira, L. T.; Aguiar Filho, B. G.; Rocha, A. S. C.; Lira, J. A. C.; Silva Júnior, F. J. G. Contributed to the analysis and/or interpretation of data: Santos, G. V. A. D.; Nogueira, L. T.; Aguiar Filho, B. G.; Rocha, A. S. C.; Lira, J. A. C.; Silva Júnior, F. J. G. Contributed to article writing or critical review: Santos, G. V. A. D.; Nogueira, L. T.; Aguiar Filho, B. G.; Rocha, A. S. C.; Lira, J. A. C.; Silva Júnior, F. J. G. Final approval of the version to be published: Santos, G. V. A. D.; Nogueira, L. T.; Aguiar Filho, B. G.; Rocha, A. S. C.; Lira, J. A. C.; Silva Júnior, F. J. G.

REFERENCES

1. Ministério da Saúde (BR). Suicídio (Prevenção). Brasília: Ministério da Saúde; 2024. Available from: https://www.gov.br/saude/pt-br/assuntos/saude-de-a-a-z/s/suicidio-prevencao.

2. Santos J, Pimentel FO, Méa CPD, Patias ND. Ideação suicida na adolescência e fatores associados. Arquivos Brasileiros de Psicologia. 2022; 74:e024. Doi:10.36482/1809-5267.ARBP-2022v74.19801

3. World Health Organization. Suicide worldwide in 2019: global health estimates. Geneva: World Health Organization; 2021. ISBN: 9789240026643.

4. Alves FJO, Fialho E, Araújo JAP, Naslund JA, Barreto ML, Patel V, Machado DB. The rising trends of self-harm in Brazil: an ecological analysis of notifications, hospitalisations, and mortality between 2011 and 2022. Lancet Reg Health Am. 2024;31:100691. DOI: 10.1016/j.lana.2024.100691.

5. Ministério da Saúde (BR). Boletim epidemiológico. Panorama dos suicídios e lesões autoprovocadas no Brasil de 2010 a 2021. Brasília: Ministério da Saúde, Secretaria de Vigilância em Saúde e Ambiente; 2024. Available from: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/edicoes/2024/boletim-epidemiologico-volume-55-no-04.pdf.

6. Barbosa SS, Rodrigues J, Guimarães GF, Lopes SMB. Aplicativos de celular na prevenção do comportamento suicida. SMAD, Rev Eletrônica Saúde Mental Álcool Drog. 2020;16(4):100-8. Doi: 10.11606/issn.1806-6976.smad.2020.167062

7. Oliveira LM de, Fernandes Junior LCC. Aplicabilidade da inteligência artificial na psiquiatria: uma revisão de ensaios clínicos. Debates em Psiquiatria [Internet]. 2020;10(1):14-25. DOI: 10.25118/2236-918X-10-1-2

8. Whittemore R, Knafl K. The integrative review: updated methodology. J Adv Nurs. 2005;52(5):546-553. Doi:10.1111/j.1365-2648.2005.03621.x

9. Page MJ, McKenzie JE, Bossuyt PM, *et al*. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ. 202;372(71). DOI: 10.1136/bmj.n71

10. Lei C, Qu D, Liu K, Chen R. Ecological Momentary Assessment and Machine Learning for Predicting Suicidal Ideation Among Sexual and Gender Minority Individuals. JAMA Netw Open. 2023;6(9):e2333164. doi:10.1001/jamanetworkopen.2023.33164

11. Shin S, Kim K. Prediction of suicidal ideation in children and adolescents using machine learning and deep learning algorithm: A case study in South Korea where suicide is the leading cause of death. Asian J Psychiatr. 2023;88:103725. doi:10.1016/j.ajp.2023.103725

12. Kim S, Lee K. The Effectiveness of Predicting Suicidal Ideation through Depressive Symptoms and Social Isolation Using Machine Learning Techniques. J Pers Med. 2022;12(4):516. Published 2022 Mar 22. doi:10.3390/jpm12040516

13. Bozzay ML, Hughes CD, Eickhoff C, Schatten H, Armey MF. Identifying momentary suicidal ideation using machine learning in patients at high-risk for suicide. J Affect Disord. 2024;364:57-64. doi:10.1016/j.jad.2024.08.038

14. Li TMH, Chen J, Law FOC, Li CT, Chan NY, Chan JWY, *et al*. Detection of Suicidal Ideation in Clinical Interviews for Depression Using Natural Language Processing and Machine Learning: Cross-Sectional Study. JMIR Med Inform. 2023;11:e50221. doi:10.2196/50221

15. Roy A, Nikolitch K, McGinn R, Jinah S, Klement W, Kaminsky ZA. A machine learning approach predicts future risk to suicidal ideation from social media data. NPJ Digit Med. 2020;3:78. Published 2020 May 26. doi:10.1038/s41746-020-0287-6

16. Hwanjin P, Lee K. A Machine Learning Approach for Predicting Wage Workers' Suicidal Ideation. J Pers Med. 2022;12(6):945. doi:10.3390/jpm12060945

17. Lee J, Pak TY. Machine learning prediction of suicidal ideation, planning, and attempt among Korean adults: A population-based study. SSM Popul Health. 2022;19:101231. doi:10.1016/j.ssmph.2022.101231

18. Lekkas D, Klein RJ, Jacobson NC. Predicting acute suicidal ideation on Instagram using ensemble machine learning models. Internet Interv. 2021;25:100424. doi:10.1016/j.invent.2021.100424

19. Song SI, Hong HT, Lee C, Lee SB. A machine learning approach for predicting suicidal ideation in post stroke patients. Sci Rep. 2022;12(1):15906. doi:10.1038/s41598-022-19828-8

20. Couronné R, Probst P, Boulesteix AL. Random forest versus logistic regression: a large-scale benchmark experiment. BMC Bioinformatics. 2018;19(1):270. doi: 10.1186/s12859-018-2264-5.

21. Ignatenko V, Surkov A, Koltcov S. Random forests with parametric entropy-based information gains for classification and regression problems. PeerJ Comput Sci. 2024 Jan 3;10:e1775. doi: 10.7717/peerj-cs.1775.

22. Gremsl T, Hödl E. Emotional AI: legal and ethical challenges. Information Polity. 2022;27(2):163-174.

23. Waring J, Lindvall C, Umeton R. Automated machine learning: Review of the state-of-the-art and opportunities for healthcare. Artif Intell Med. 2020 Apr;104:101822. doi: 10.1016/j.artmed.2020.101822.

24. Habehh H, Gohel S. Machine Learning in Healthcare. Curr Genomics. 2021 Dec 16;22(4):291-300. doi: 10.2174/1389202922666210705124359.

Conflicts of interest: No
Submission: 2024/10/31
Revised: 2025/03/18
Accepted: 2025/04/25
Publication: 2025/06/18

Editor in Chief or Scientific: Raylane da Silva Machado
Associate Editor: Larissa Alves de Araujo Lima