

Emerging Mental Health Challenges in Construction Industry through Web Crawling

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Abstract: The construction industry faces a mental health crisis, with rates of suicide and substance abuse that outstrip those in other sectors and significantly contrast with the improvements seen in general worker safety. While prior studies have documented the prevalence of mental health issues in construction, little is known about whether the industry itself recognizes and addresses these issues. To this end, this study aims to examine how mental health is represented within recent construction industry discourse. This goal is achieved through an analysis of 6,280 Engineering News-Record (ENR) articles published between 2017 and 2024, employing topic modeling to identify trends in language and thematic evolution. Findings reveal a notable increase in mental health mentions post-2020, likely influenced by the COVID-19 pandemic, with discussions often framed around crisis terms such as “stigma,” “substance abuse,” and “suicide prevention.” Language promoting preventive and resilience-building measures, however, remains scarce. These patterns suggest the need for a revised safety protocol within the construction industry, one that formally integrates mental health support with physical safety protocols, advancing a more comprehensive approach to worker well-being.

Keywords: mental health, construction industry, workplace safety, substance abuse, topic modeling, occupational health.

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1. Introduction

Behind the rugged image of construction lies an industry vulnerable to mental health challenges. According to the Centers for Disease Control and Prevention (CDC), the suicide rate in the construction industry has increased by 33% among the U.S. working-age population over the past two decades (Sussell et al., 2023). Moreover, male construction workers face one of the highest suicide rates among major industry groups, with their risk of suicide nearly four times greater than that of the general population (National Institute of Mental Health [NIMH], 2024). In fact, the suicide rate for males in construction is 56 per 100,000, compared to approximately 13.5 per 100,000 for the general population in 2020 (Sussell et al., 2023; NIMH, 2024). These figures provide a broad snapshot of the pervasive mental health crisis within the construction industry. Yet, mental health issues frequently co-occur with substance use disorders, revealing a larger scope for concern. A national survey on drug use and health, conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA), found that the construction industry has some of the highest rates of substance abuse, with 16.5% of full-time construction workers reporting heavy alcohol use in the past month (SAMHSA, 2018). Furthermore, 15% of all workplace overdose deaths occur in the construction sector, even though construction workers make up only about 7% of the entire workforce in the U.S. (Tiesman et al., 2019; The Center for Construction Research and Training, 2018). Such patterns suggest that substance abuse in construction may serve as both a symptom and facilitator of the mental health crisis.

While the construction sector has made substantial advancements in physical safety, mental health concerns remain largely unaddressed (Le et al., 2023). Cultural norms within the industry, such as the glorification of stoicism, masculinity,

and the reluctance to seek help, not only reflect this neglect but actively worsen the mental health challenges faced by workers (Hanna et al., 2020). Additionally, construction industry-specific factors, including overtime, harsh working conditions, and fast-paced, risky tasks, further elevate workers' stress levels (Lim et al., 2017). Consequently, many construction workers find themselves wrestling with untreated mental health issues. These struggles are compounded by high-pressure, precarious work environments.

The severity of the mental health crisis in construction is further compounded by a disconnect between awareness and action (Gruttadaro and Beyer, 2021). While most construction workers recognize the importance of mental health, few openly discuss these struggles with supervisors (Gruttadaro and Beyer, 2021). This gap highlights a systemic issue: a deeply rooted culture of silence where mental health is acknowledged in principle but largely ignored in practice. The reluctance to engage in candid conversations about mental well-being points to deep-seated barriers that counteract progress, even as awareness is growing. Addressing this issue requires a fundamental swing in how construction workers' well-being is understood—one that considers psychological as well as physical risks. Further, as the construction industry continues to shape the built environment, the mental health of those who labor within it needs to be treated with the seriousness it demands. In this context, the overarching goal of this study is to investigate the construction industry's engagement with mental health-related narratives and evaluate how they are represented in discourse.

2. Literature Review

A growing body of research addresses the severity and persistence of mental health challenges faced by construction workers. Dong et al. (2022) presented findings from a large-scale analysis involving over 12,000 U.S. construction workers, revealing that nearly one-third of male workers experience psychological distress, with 2.5% contemplating suicide. The wide breadth of this study lent undeniable weight to the pervasiveness of mental health issues in the construction industry (Dong et al., 2022). Mehany et al. (2024) added further weight to this concern, noting an increase in psychological difficulties among construction workers since the onset of the COVID-19 pandemic, signaling potential long-term consequences that are yet to be understood. Turning to individual characteristics, Liu et al. (2023) explored Australian construction sites and showed how Type A behavior, marked by competitiveness, ambition, and a constant sense of urgency, can interact with workplace stressors to influence and impair mental health outcomes.

At the organizational level, workplace culture and structure become key operators in exacerbating mental health risks in the construction industry. Golzad et al. (2023) positioned organizational culture as a major force behind stress levels, indicating that the values, norms, and leadership styles prevalent in construction firms often dictate workers' psychological experiences. These environments are further destabilized by ineffective communication channels, lack of supervisory support, and relentless pressures that Gómez-Salgado et al. (2023) argued worsen anxiety and stress for those in the field. Nwaogu et al. (2023) added to this by identifying the combined pressures of work overload, accelerated task demands, and insufficient leadership as critical stressors that directly impact mental health status. In addition to these factors, the European Agency for Safety and Health at Work (EU-OSHA) highlighted broader structural barriers to progress, such as the fragmentation of employment due to subcontracting and the dominance of small and medium-sized firms, which often lack the resources to implement proactive mental health measures. As such, these findings collectively argued that mental health struggles in construction are not confined to individual burdens but are fitted into the highest levels of the industry (EU-OSHA, 2024).

While mental health awareness has gained traction within the construction industry, this acknowledgment often fails to translate into meaningful action. Gruttadaro and Beyer (2021) conducted a pulse survey of 1,175 industry participants, revealing a disconnect between recognition and response—93% of participants acknowledged the importance of mental health, yet only 17% believed workers would feel comfortable discussing their struggles with supervisors. This gap between knowledge and behavior points to a deeper issue within the culture of construction, where mental health challenges, though recognized, remain unspoken. Kotera et al. (2019) suggested that mental health shame plays a significant role in this silence, further preventing workers from seeking help. Kotera et al. (2019) also observed that this shame is not necessarily tied to traditional masculine identity, as one might expect, but rather operates independently, driven by internalized, society-wide stigma around mental health.

In response to the ongoing mental health challenges in the construction industry, many leading construction firms have put forth a range of solutions, though implementation remains inconsistent. Progressive efforts have begun to take shape, with STO Building Group's mental health program under its Safety 360° framework offering Employee Assistance Programs (EAPs), mental health signage, and training sessions to reduce stigma and encourage open conversations (STO Building Group, 2022). Kiewit's Under the Hat™ program similarly provides confidential mental health services, integrating mental health into everyday safety routines (Kiewit, 2024). Bechtel's partnership with the American Foundation for Suicide Prevention (AFSP), involving a \$7 million commitment, aims to support 500,000 construction workers over five years (Phillips, 2024). Internationally, the MATES in Construction initiative in Australia and New Zealand stands out as a prominent example of an industry-based mental health and suicide prevention program. Sayers et al. (2019) evaluated its impact on help-seeking behaviors in the coal mining sector, finding sustained improvements over time. Similarly, a systematic review by Gullestrup et al. (2023) confirmed the program's effectiveness, mentioning consistent reductions in suicide risk and increased helping behaviors across multiple studies.

While these company-led initiatives mark significant progress, there is still a question of whether the construction industry as a whole is adequately aware of and responsive to broader mental health trends (Blake et al., 2023). This gap is largely attributed to the limited amount of scholarly work on effective, evidence-based interventions and the disparity between research findings and their application. Moreover, as construction practices evolve with technological headways and changing work dynamics, one must consider how the nature and impact of mental health stressors may shift accordingly. At the same time, public awareness of mental health issues has seen a significant rise, with surveys indicating

that over 87% of Americans now normalize the existence and acceptance of mental health disorders (American Psychological Association, 2019). This shift in perception prompts the need to examine whether construction industries are similarly evolving in their awareness and approach to these issues. Considering this, we have analyzed a decade's worth of Engineering News-Record (ENR) articles, seeking to answer the following questions:

1. How has the discourse on mental health in the construction industry evolved over the past decade?
2. What are the primary themes and trends in how mental health is discussed within the construction industry?

The overarching goal of this study is to analyze the themes, trends, and linguistic evolution of mental health and associated terminology within industry-specific media. By tracing shifts in how these issues are understood, discussed, and addressed, we aim to reveal how the construction industry engages with mental health challenges and assess the extent to which its narratives reflect and support evolving approaches to the construction workplace.

3. Methodology

To achieve the goals of this study, articles from ENR were selected as the primary data source. As illustrated in Fig. 1, the research process was divided into three main phases. Phase 1 involved the extraction and cleaning of ENR articles to produce a refined dataset suitable for analysis. In Phase 2, the cleaned textual data underwent a series of preprocessing steps followed by topic modeling to identify co-occurring terms associated with “mental health.” Finally, in Phase 3, keyword frequency trends were tracked over time using temporal analysis, and visualizations were generated to interpret the discourse patterns emerging from the construction industry's engagement with mental health topics. This study was conducted predominantly using Python 3.10.12, with the majority of development carried out within the Jupyter Notebook integrated development environment (IDE). Various packages were further utilized for distinct functions within the study: *Gensim* facilitated topic modeling and keyword selection; *Pandas* served for data wrangling and cleaning; the *Natural Language Toolkit* (NLTK) and *Spacy* were used for advanced NLP tasks. Visualization was accomplished using *pyLDAvis* for topic modeling and *Matplotlib* for data representation.

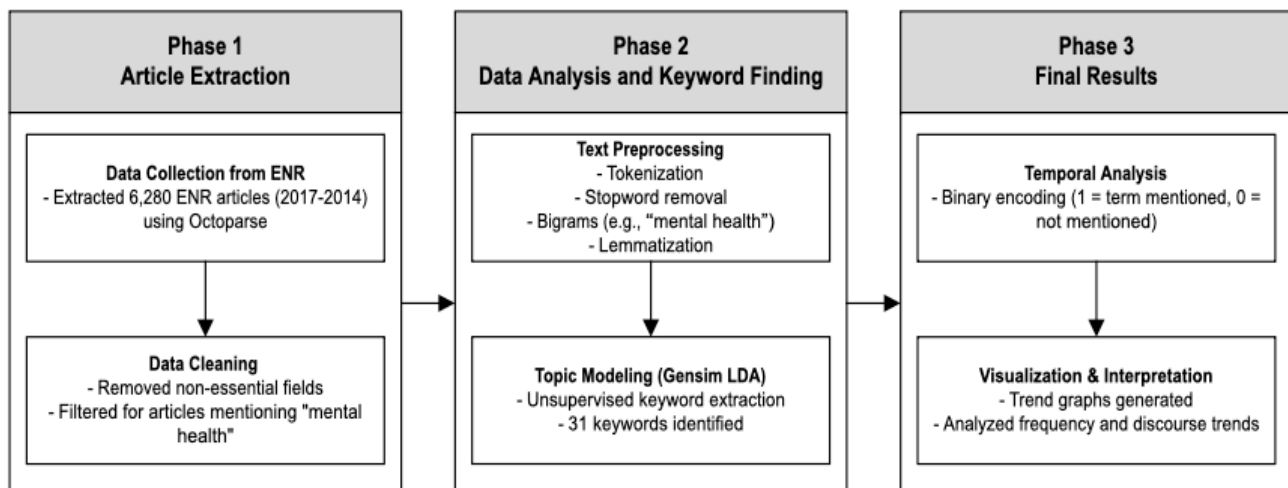


Fig. 1. Overview of the research process

The articles were retrieved using *Octoparse*, a graphical user interface (GUI)-based web crawler, specifically designed to extract web content based on identifiable patterns. Once the data extraction was completed, it underwent a cleaning process, where non-essential elements, such as headers, CSV-related delimiters, and extraneous information, were removed through the manipulation of *Pandas DataFrames*. Although *Octoparse* was user-friendly, it occasionally failed to structure the data logically, leading to the generation of numerous unwanted headers. Given that only the textual content of the articles, their publication dates, and the article titles were pertinent, all other fields were excluded. The dataset comprised 6,280 articles, spanning from 2017 to 2024.

Several preprocessing steps were required to ensure the data's compatibility with natural language processing (NLP) models. First, extraneous whitespaces were removed to standardize word representations, followed by tokenizing the text into numerical values. This conversion to numeric data is essential for NLP models, as it allows the mathematical processing and analysis of textual data. Additionally, common English stop words, such as “the,” “a,” and “an,” were excluded from the dataset, as they offer minimal insight into the semantic content and structure of the articles. Following these steps, bigrams were generated to capture commonly paired words that represent a single concept, such as “mental health.” While each word holds meaning individually, together they convey a distinct idea that warrants treatment as a unified term. Finally, the text corpus was lemmatized, converting words to their base forms, or lemmas. For example, variations of the verb “talk,” such as “talking” or “talked,” were standardized to the root form “talk,” ensuring consistency in analysis.

Intending to assess the impact of mental health on the construction sector over these seven years, a temporal analysis was conducted. This involved tracking the occurrences of the term “mental health” within the articles over time. Each article was coded with a binary value: a ‘1’ if the term appeared at least once, and a ‘0’ if it did not. The data was then resampled at three-month intervals to aggregate the frequency of articles mentioning “mental health.”

To address the research question “What are the primary themes and trends in how mental health is discussed within the construction industry?”, topic modeling was employed using the *Gensim* library. Topic modeling is an unsupervised NLP technique that aims to discern common patterns or themes within a collection of documents (Zhou et al., 2023). This method clusters frequently occurring words into a pre-specified number of topics to extract the overarching semantic meaning from the corpus (Blei et al., 2009). The development of topic modeling was driven by the need to handle growing volumes of unstructured data, particularly as digital archives expanded rapidly (Boyd-Graber et al., 2017). There arose a need to summarize such corpora without prior knowledge of their content, pushing forward a shift from manual to automated analysis. This demand spurred the development of models capable of extracting latent themes, offering computational clarity amid information overloads. Thus, topic modeling transformed textual analysis, which had positive implications for both qualitative and quantitative research. It has since been widely adopted in various fields, including the examination of construction management literature (Jagannathan et al., 2022).

Topic modeling begins with the assumption that each document in a corpus is structured around N latent topics. Each topic comprises a group of words that the model initially does not associate with any specific meaning. For example, terms like “therapy,” “drugs,” and “mental health,” which often appear together, may be categorized under a common topic. In topic modeling, each document is represented as a vector V_k , sized according to the predetermined number of topics N to be identified. Each element within V_k corresponds to a specific topic, reflecting the degree to which the document relates to it. As documents draw on topics to varying extents, an increase in a particular element of V_k suggests a stronger association with that topic. For example, within a corpus focused on computational methods, consider two documents: one addressing code optimization, represented as V_{co} , and another on neural network parameter tuning, denoted V_{nn} . In both vectors, elements representing an “optimization” topic would likely register high values; however, topics associated with “compilers” would be markedly prominent in V_{co} and nearly absent in V_{nn} .

It is essential to recognize, however, that topic modeling does not itself identify or label the themes within the topics it generates. Instead, the model organizes words into clusters based on their co-occurrence, leaving the task of interpreting and assigning meaning to these clusters to the researcher. The *Gensim* library was used for topic modeling, as it had pre-built functionalities and a helpful tutorial. The library provides an *LdaModel* that can perform topic modeling. There are several hyperparameters that *Gensim* provides that control how topic modeling is performed. Most default values were chosen, but any that were set explicitly are listed below in Table 1.

Table 1. Selected hyperparameters for topic modeling

Hyperparameter	Description	Chosen value
Num_topics	Specifies the number of latent topics to be extracted from the training corpus	20
Update_every	Defines the interval of documents iterated through for each update. Setting this to 0 enables batch learning, while values greater than 1 activate online iterative learning	1
Chunksize	Indicates the number of documents included in each training chunk	100
Passes	Refers to the number of times the model iterates over the corpus during training	10

4. Results

This study aimed to explore the evolution of mental health awareness within the construction industry, focusing on its representation in ENR articles over a seven year timeframe. Derived from a systematic analysis of ENR articles, the findings shed light on significant trends and themes, offering a comprehensive view of how mental health has been prioritized and framed in the construction sector.

Fig. 2 illustrates the frequency of mentions of the seed keyword “Mental Health” in ENR articles from 2017 to 2024, aggregated over three-month intervals. The findings reveal significant trends in the industry’s attention to mental health over time and a discernible upward trend in the mentions of mental health topics post-2020. During the earlier years, mentions of mental health were minimal or absent, indicating limited recognition of its importance within the industry. A noticeable uptick is observed around 2020, which may correlate with the onset of the COVID-19 pandemic. This period likely heightened awareness of mental health challenges due to the pandemic’s impact on the workforce, including increased stress, isolation, and uncertainty. The findings underscore the increasing importance of mental health as a critical issue requiring continuous industry-wide dialogue and action. Table 2 presents a list of 31 keywords generated through topic modeling, in which “Mental Health” was used as a seed term to identify co-occurring terms that frequently appeared in the same topic cluster. These keywords were selected based on their frequent co-occurrence with “Mental Health” within the same article or sentence. To enhance interpretability, these keywords were grouped into four overarching categories: (1) mental health challenges, (2) resources and interventions, (3) societal and contextual influences, and (4) awareness and advocacy. The *mental health challenge* category includes keywords, such as “Mental Health,” “Addiction,” “Depression,” “Disorder,” “Overdose,” “Pain,” “Substance Abuse,” “Opioid,” and “Drug,” reflecting both acute and chronic mental health conditions faced by construction workers. These terms highlight workplace stressors, substance dependency, and psychological disorders on workforce well-being. In the *resources and interventions* category, terms like “Counseling,” “Recovery,” “Treatment,” “Suicide Prevention,” “Clinic,” and “Program” suggest that the industry is beginning to focus on addressing mental health through structured interventions and programs. These keywords highlight an emphasis on providing support systems, promoting recovery, and preventing severe outcomes like suicide. The *societal and contextual* category, including “Pandemic,” “Veteran,” “Gun,” “Insurance,” “Hospital,” “Medical,” “Prescription,” and “Drinking,” points to external

factors influencing mental health in construction. Aligning with Fig. 2, the “Pandemic” underscores the heightened focus on mental health during COVID-19. “Veteran” reflects the industry’s recognition of military veterans in the workforce, often linked to unique mental health challenges like post-traumatic stress disorder (PTSD). Terms like “Insurance,” “Medical,” and “Prescription” highlight the role of systemic access to healthcare and financial resources in managing mental health. Finally, the *awareness and advocacy* category includes “Awareness,” “Stigma,” “Compassion,” “Safety,” “Help,” “Attempt,” and “Suicide,” signaling growing attention to workplace culture, stigma reduction, and psychological safety. The findings provide insights into the linguistic patterns and thematic focus surrounding mental health within the construction industry.

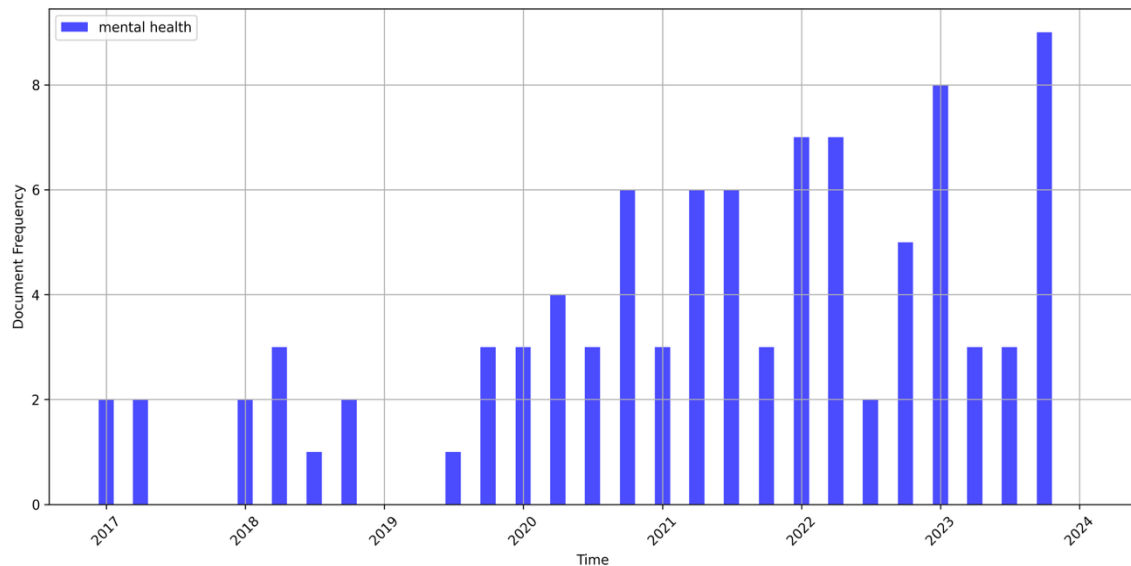


Fig. 2. Mentions of the seed keyword "Mental Health" over time

Table 2. List of generated keywords, including the seed keyword “Mental Health”

Category	Keywords
Mental health challenges	Mental health, addiction, depression, disorder, overdose, pain, substance abuse, opioid, drug
Resources and interventions	Counseling, recovery, treatment, suicide prevention, clinic, program, provide
Societal and contextual influences	Pandemic, veteran, gun, insurance, hospital, medical, prescription, drinking
Awareness and advocacy	Awareness, stigma, compassion, safety, help, attempt, suicide

After keyword generation, data visualization was performed as the last step. Fig. 3 illustrates the cumulative mentions of all 31 keywords over time, offering insights into how mental health-related terminology has been addressed in ENR articles from 2017 to 2024. In the initial period from 2017 to 2019, the graph shows very few mentions of the keywords during this time, indicating minimal attention to mental health in the construction industry. A noticeable increase occurred in 2020, marked by sharp upward trends in both the 3-month divides and the rolling sum. This coincides with the onset of the COVID-19 pandemic, a pivotal event that heightened awareness of mental health challenges across industries, including construction. From 2021 onwards, the graph shows regular peaks and troughs in the mentions of keywords. The findings highlight the increasing integration of mental health into industry narratives over time, aligning with societal trends and external pressures like the pandemic. In addition, these fluctuations suggest that while mental health gained sustained attention, the level of engagement varied, potentially influenced by specific events, campaigns, or industry reports.

Figure 4 illustrates the trends in mentions of the top three keywords—“Mental Health,” “Provide,” and “Program”—over time, along with their cumulative occurrences in ENR articles. The cumulative mentions, represented by the dashed blue line, show a steady increase starting around 2020, with notable spikes in 2021 and 2022. As already shown in Fig. 2, the keyword “Mental Health,” shown by the orange line, displays a consistent upward trend starting in 2020. Mentions of “Provide,” depicted by the green line, show periodic increases that often align with discussions about access to mental health resources and the industry’s responsibility to support workers. The steady mentions of this keyword suggest an ongoing emphasis on ensuring tangible resources and interventions are available to the workforce. The keyword “Program,” represented by the red line, follows a similar trajectory to “Provide,” indicating the industry’s focus on implementing structured initiatives to address mental health challenges. These three keywords were selected based on their frequency and their centrality to proactive and resource-oriented themes identified during the topic modeling process. Overall, these trends emphasize the growing awareness of mental health issues in the construction industry, as well as efforts to provide resources and implement programs to address them. The fluctuations and recent declines underscore the need for sustained attention to mental health as a priority within the industry’s discourse and practices.

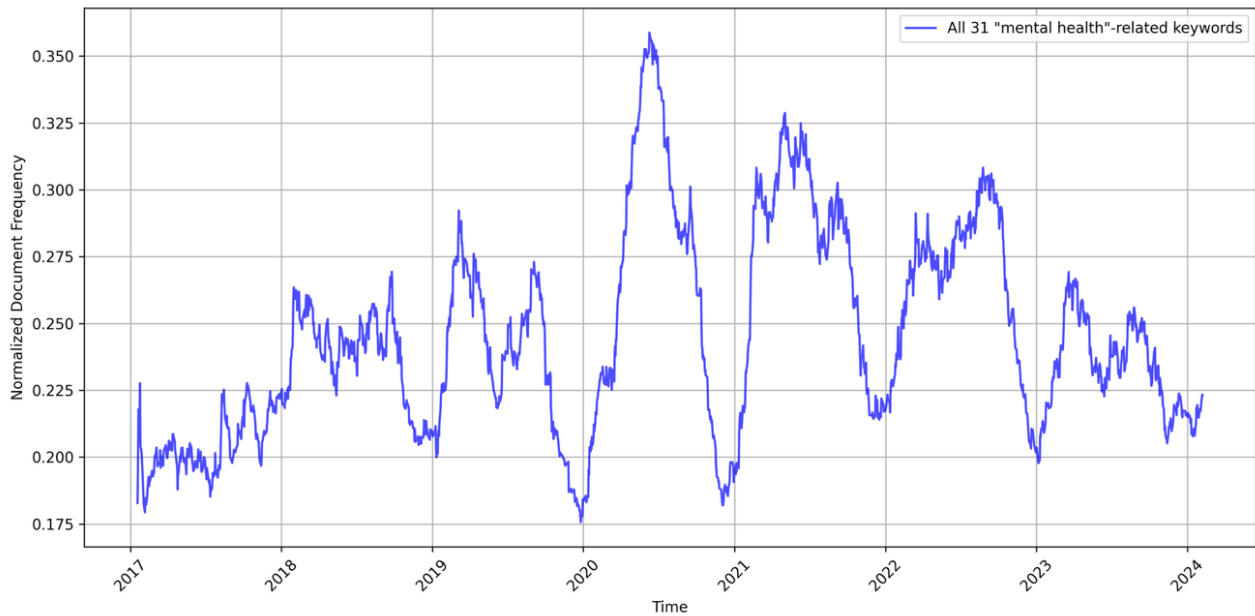


Fig. 3. Cumulative mentions of all 31 keywords per article over time

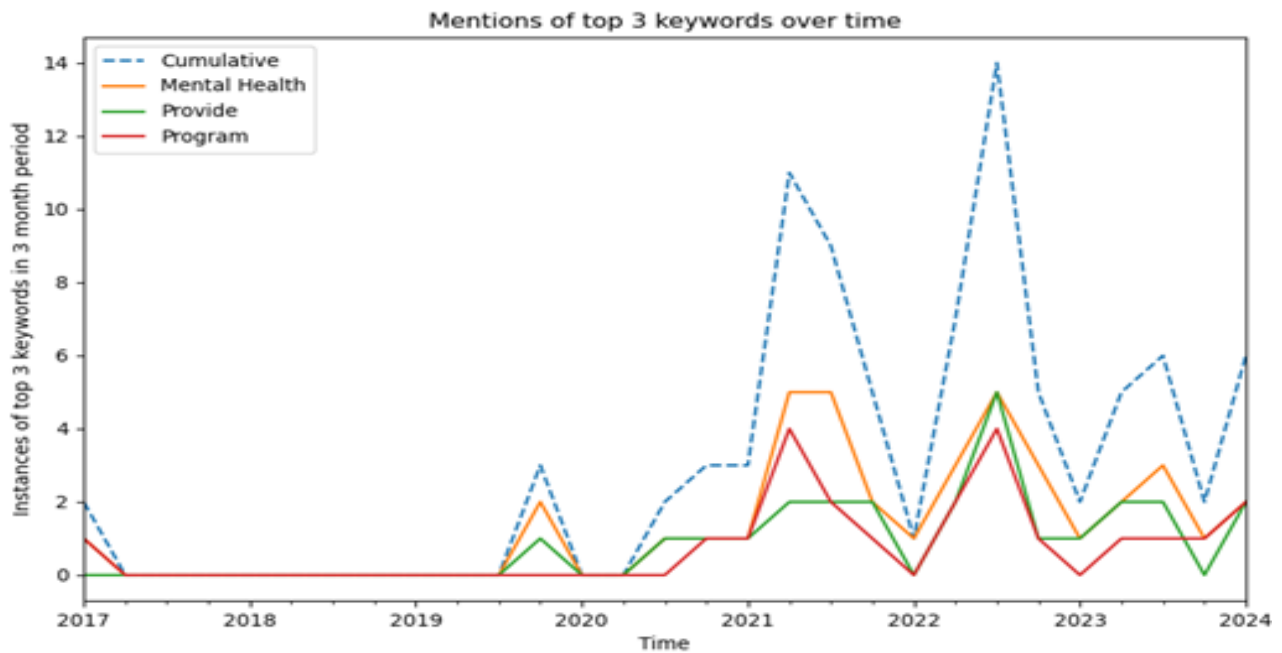


Fig. 4. Mentions over time of top keywords: “Mental Health,” “Provide,” and “Program”

5. Discussion

Our findings reveal an evident shift in the construction industry’s discourse on mental health, reflected by the intermittent spikes of related terms in ENR articles, particularly post-2020. When viewed on a year-by-year basis, there is a clear upward trend in mentions, suggesting that mental health has become a more prominent topic within the industry, particularly in response to external factors like the COVID-19 pandemic. This aligns closely with Sherratt and Dainty’s (2023) observation that the pandemic has spurred calls for systemic reform within the construction sector, emphasizing the need to prioritize psychological well-being over traditional production-centric paradigms. Additionally, while the data shows a slight downturn as 2024 approaches, this can be attributed to the data cut-off mid-2024, meaning the year’s complete publication cycle was not captured in the dataset. Therefore, this apparent decline should not be interpreted as a decrease in focus but rather because of incomplete data coverage for that year.

A closer look at keyword associations reveals how the construction industry frames mental health issues, with cumulative frequency data showing that “mental health” often appears alongside specific clusters of related terms (as shown in Table 2). The repeated association of “mental health” with terms like “stigma,” “substance abuse,” and “opioid” signals a recognition of the compounded risks of mental health issues and substance use. This mirrors the conclusions of Eyllon et al. (2020), who identified stigma as a significant force driving poor mental health within the construction sector, often in conjunction with the hyper-masculine culture that prevails. Similarly, Duckworth et al. (2022) noted the close interconnection between substance use, especially alcohol and opioids, and mental health issues, pointing out how the stigma surrounding both

domains creates a deterrent to support-seeking in construction. The repeated co-occurrence of terms like “addition,” “substance abuse,” and “suicide” suggests that the industry discourse often frames mental health through a crisis-oriented lens. While these keywords point to recognition of acute struggles, the relative absence of preventive and resilience-building terms indicates that supportive frameworks remain less prominent in industry narratives.

The analysis of the top three keywords, “Mental Health,” “Provide,” and “Program,” mirrors this trend (Fig. 4). There are clear spikes in these keywords, especially around 2021 and 2022, signaling moments of intensified discourse. This observation aligns with findings from King et al. (2018), who emphasized the need for mental health interventions to evolve alongside the language used to discuss these issues. Their research on suicide prevention in construction highlights the importance of transitioning from generic programs to context-specific approaches that better resonate with the workforce. However, while cumulative mentions of all 31 keywords (Fig. 3) show a comparable spike in 2023, the top three keywords do not follow this pattern. This discrepancy suggests that while mental health remained a topic of interest, the focus may have shifted toward different or more nuanced terminology, with terms beyond the established “Mental Health,” “Provide,” and “Program” becoming more relevant within the discourse. However, the recent initiatives introduced by the construction industry reflect a growing commitment, with leading firms expanding their efforts through tailored EAPs (STO Building Group, 2022; Kiewit, 2024).

The abovementioned shift in language may indicate a maturation in the industry’s conversation around mental health. As awareness grows, the language used to discuss mental health challenges likely becomes more specific, reflecting an evolving understanding of the complexity of mental health issues in high-stress environments. By 2023, the industry may have started adopting new or expanded terms that address the underlying causes, prevention strategies, or specialized support mechanisms, rather than solely relying on more general terms such as “Program” or “Mental Health.” Indeed, while not yet fully actionable, many initiatives are increasingly acknowledging the need for more nuanced mental health measures in construction. The Princeton Construction Wellbeing Initiative, for instance, has founded a comprehensive framework of interventions to improve the construction workplace’s mental health, anticipating a future where mental health becomes a fundamental component of industry safety standards (Princeton University, 2023).

6. Conclusion

Despite significant advances in physical safety measures, this study suggests that mental health challenges remain an under-addressed area within the construction industry. Through a text-mining analysis of ENR articles over the past seven years, the findings reveal a gradual narrative shift toward recognizing mental health as an important component of workforce well-being. Notably, the frequency of mental health-related keywords has increased since 2020, often appearing alongside terms such as “stigma,” “substance abuse,” and “suicide prevention.” However, this increased attention tends to emphasize reactive, crisis-driven responses. The consistent clustering of “mental health” with crisis-oriented terms may indicate a prevailing focus on acute issues, while references to proactive or resilience-building strategies appear more limited. Rather than reflecting a balanced discourse, encompassing both risks and preventive support mechanisms, the data highlights an industry conversation that remains largely shaped by immediate challenges.

These findings underscore the importance of developing a more comprehensive approach to safety that integrates mental health alongside physical protection. Continued efforts toward policy-informed strategies that incorporate both crisis response and preventive mental health initiatives may help the industry foster a work environment where mental and emotional well-being are actively supported. Future research could expand the scope of this research by incorporating academic literature from peer-reviewed journals and conference proceedings in databases, such as Scopus or Web of Science. This would enable a comparative analysis between industry discourse and academic framing of mental health in construction.

Author Contributions

Zehra Atay contributed to the draft preparation of the entire manuscript. Athena Morrisett was responsible for data collection, data analysis, and development of the research methodology and findings. Jiho Noh guided the research methodology, data collection, and analysis. Anne Anderson reviewed the manuscript and contributed to the manuscript editing. Jung Hyun Lee contributed to conceptualization, methodology development, data collection, and manuscript editing. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

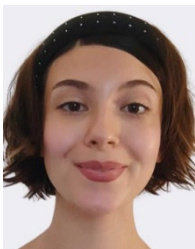
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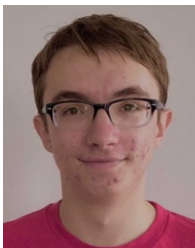
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