

The Role of Health Literacy in Vulnerability to Fentanyl Use and Dependence

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Abstract

Fentanyl, a synthetic opioid approximately 100 times more potent than morphine, has become a major factor in the current opioid crisis, responsible for a sharp increase in addiction and overdose deaths, particularly in North America. Its exceptional pharmacodynamics, the variability of its concentration on illicit markets, and barriers to accessing care significantly increase the risks for users. This literature review examines the role of health literacy in vulnerability to fentanyl addiction and in the effectiveness of prevention and management strategies. Studies indicate that high health literacy promotes more appropriate use of treatments, reduces misuse behaviors, and increases the use of risk reduction measures. Conversely, insufficient literacy is associated with dosing errors, misinterpretation of dangers, limited access to services, and an increased likelihood of dependence and overdose. Despite its importance, opioid-specific health literacy remains a largely unexplored field, particularly among the most at-risk populations. The findings highlight the need to strengthen health literacy through culturally appropriate educational interventions, more accessible communication within healthcare systems, and targeted strategies to reduce inequalities in the context of the fentanyl crisis.

Keywords: Addiction, Health Literacy, Fentanyl, Opioids, Drugs

1. Introduction

Fentanyl is a synthetic opioid 100 times more potent than morphine and has become a major global public health issue. Designed to relieve severe pain in hospitals, it is now responsible for many addictions and overdose deaths, particularly in North America. Its potency and rapid onset of action promote severe addiction, even after controlled medical use. Diverted and manufactured illegally, it now fuels a particularly deadly street market. This paradox between therapeutic tool and deadly drug sums up the complexity of the “fentanyl problem.” [1,2].

Fentanyl is widely used in hospitals as a painkiller. However, it poses a high risk of addiction for users. Numerous studies have shown that those who used it for medical reasons ultimately became addicted to this single drug. This opioid has negative effects on neurobiological levels, altering the prefrontal cortex and leading to compulsive behavior and loss of control. Furthermore, on a

clinical level, studies are mixed, with some showing no difference compared to other opioids and others showing that fentanyl is more effective than other opioids. Because of this public health crisis, researchers are looking to implement alternatives to reduce this dependence, such as programs and anti-fentanyl vaccines to prevent and reduce consumption [3-7].

In this context, this review examines the role of health literacy on fentanyl addiction. Specifically, we seek to determine how health literacy influences both the onset of addiction and the effectiveness of treatment interventions. At the systemic level, we investigate how health literacy shapes access to healthcare, engagement with addiction services, and the overall quality of prevention and treatment pathways. At the individual level, we assess whether higher or lower literacy affects the severity of their fentanyl use whether higher or lower literacy is associated with consuming more, less, or not at all. Overall, this study proposes to clarify the

impact of health literacy on fentanyl addiction and to explore how improving health literacy could support more effective prevention and intervention strategies.

To meet these objectives, this study is based on a literature review of the existing scientific literature. We examined a variety of sources, including peer-reviewed articles, systematic reviews, qualitative studies and public health reports related to health literacy, opioid use, and fentanyl addiction. Our goal is to bring together what is currently known, identify common findings and highlight the gaps that remain. We also pay particular attention to vulnerable groups, differences between medical and street contexts, and the factors that influence access to care. This approach allows us to build an overall understanding of how health literacy may shape the pathways that lead to fentanyl use, dependence and prevention.

To best carry out this work, the first part will define an important concept, which is health literacy. This will be followed by a discussion on fentanyl addiction, and finally, the last part will highlight the link between these two concepts.

2. Health Literacy

2.1. Origin, Definition, and Evolution of Health Literacy

The concept of health literacy emerged in the 1970s, at a time when researchers highlighted the link between reading skills and health behaviors (Institute of Medicine, 2004). The basic idea was that being able to read and understand medical documents, such as prescriptions or brochures, led to better health decisions (American Medical Association, 1999). However, this reading-centered approach proved insufficient to describe the complexity of individuals' relationships with medical information.

It was in this context that Nutbeam (2000, 2008) proposed a more comprehensive definition, distinguishing three levels: functional literacy, corresponding to basic reading and comprehension skills; interactive or communicative literacy, which includes the ability to communicate with health professionals and apply the advice received; and critical literacy, which refers to the ability to evaluate information and use it to influence the social determinants of health. This model marks a major turning point, introducing the concept of empowerment into the field of public health.

This approach was further developed by, who incorporated more than a dozen existing definitions to propose a multidimensional conceptual model. According to them, health literacy corresponds to the knowledge, motivation, and skills necessary to access, understand, evaluate, and use health information in the areas of care, prevention, and health promotion. Finally, updated this vision by emphasizing the contextual and systemic dimension of the concept: literacy depends not only on individuals, but also on the social and institutional structures in which they evolve [8].

2.2. Dimension of Health Literacy

Health literacy is generally approached from four main dimensions: functional literacy, communicative literacy, critical literacy and digital literacy. The first, functional literacy, corresponds to a

basic understanding of medical information. For example, showed that patients with heart failure who had limited functional literacy were more likely to be hospitalized or die prematurely. The second dimension, interactive or communicative literacy, involves the ability to communicate effectively with healthcare professionals. observed that this skill promoted better self-management of chronic diseases, particularly diabetes. The third dimension, critical literacy, refers to the ability to analyze and evaluate the reliability of information, there by fostering an active and responsible approach to health decisions. Finally, digital health literacy has emerged more recently with the widespread use of the Internet. define this skill as the ability to search for, understand, evaluate, and use health information available online. The work of showed that, during the COVID-19 pandemic, students with good digital literacy were better able to identify reliable sources and adopt protective behaviors [9-11].

2.3. Health Literacy: An Individual and Systemic Phenomenon

Health literacy does not depend solely on personal abilities: it is influenced by a combination of individual and environmental factors. The most cited determinants are age, education level, income, and health status. Older adults, people with low incomes, and those living with multiple chronic conditions are often more vulnerable. Cultural and religious factors also play a role: Koduah (2021) points out that spiritual beliefs can influence how individuals perceive health and interpret medical messages [12].

Health literacy is not just an individual issue. point out that healthcare structures themselves can be barriers if they use overly complex language or have administrative procedures that are difficult to access. Thus, the responsibility for good health literacy is shared between citizens, professionals, and institutions. This systemic view is consistent with the idea put forward by that literacy is a social and contextual process, influenced by health policies, the organization of care, and socioeconomic inequalities [13].

2.4. Impact of Health Literacy on Physical and Mental Health

Low health literacy has a direct impact on physical and mental health showed that patients with chronic conditions, such as diabetes or kidney disease, had better health outcomes and self-management when they had sufficient literacy. Conversely, limited understanding increases morbidity, hospitalizations, and mortality [14,15].

Literacy also influences quality of life. Song (2024) observed that people with chronic diseases who had adequate literacy had fewer mobility problems, anxiety, and depression. Finally, health literacy acts as a lever for equity. Indeed, according to and, it reduces social inequalities by promoting access to information and individual autonomy. Thus, developing health literacy also means strengthening social justice and citizen participation in health [16].

Psychologists play a central role in developing and sustaining health literacy, particularly in populations facing linguistic, cognitive, or cultural barriers. In transcultural clinical settings, for example,

a psychologist with a migrant background reported that mistrust toward healthcare professionals, shaped by language difficulties, discrimination, and limited understanding of the health system, often leads patients to misinterpret or reject health information by adapting communication, acknowledging cultural contexts, and building trust, psychologists help transform health information into something usable and meaningful for patients. A similar dynamic appears in severe mental illness: despite low general literacy levels, individuals with schizophrenia can achieve adequate health literacy when supported through psychoeducation, coordinated follow-up, and psychosocial rehabilitation interventions in which psychologists are key actors. In youth mental health, web-based programs may increase knowledge but do not reliably change attitudes or behaviors, suggesting that psychologists remain essential for turning information into real help-seeking and reduced stigma. Across these contexts, psychologists are crucial not only for transmitting knowledge but for enabling patients to understand, trust, and apply health information in their daily lives [17,18].

2.5. Towards Shared Health Literacy

Health literacy is a dynamic and relational process. It goes far beyond simply understanding medical texts to encompass the ability to interact, judge, and act within an often-complex healthcare system. It relies as much on individual skills as it does on the clarity and accessibility of institutions. Promoting health literacy, therefore, means strengthening the dialogue between patients, professionals, and public decision-makers. In a world where health crises and misinformation are on the rise, health literacy represents an essential pillar of modern, equitable, and sustainable public health. It helps people understand risks, make safer decisions, and navigate healthcare systems with more confidence. This becomes even more important when societies face complex and dangerous substances whose effects are not always well understood. Fentanyl is one of the clearest examples of this challenge, showing how limited knowledge and misunderstanding can increase vulnerability and lead to severe consequences.

2.6. Fentanyl Addiction: Between Medical Use and Street Crises

3. Definition of Addiction and Fentanyl

Addiction, described by the World Health Organization as a “cluster of behavioral, cognitive, and physiological phenomena” in which substance use becomes progressively prioritized over previously valued activities (WHO, ICD-10, 1992), is particularly relevant when examining fentanyl due to its extreme potency and rapid addictive potential.

Fentanyl is a synthetic opioid developed in the 1960s, primarily to treat severe pain in cancer patients or those requiring anesthesia. Its potency, approximately 100 times greater than that of morphine, makes it a particularly effective drug, but also extremely dangerous when diverted from its medical use. Since the early 2010s, an explosion in cases of addiction and overdose has transformed this therapeutic molecule into one of the most striking

symbols of the global opioid crisis, due to its rapid proliferation on international illegal markets and its involvement in rising overdose deaths worldwide. Fentanyl addiction is now observed in two very different contexts: in hospitals, where the product is still prescribed under medical supervision but can lead to iatrogenic dependence, and on the streets, where its illicit use is causing an unprecedented health crisis.

3.1. Fentanyl Addiction in A Hospital Context

Fentanyl works by binding to mu-opioid receptors (MOR) located in the central nervous system, resulting in rapid and intense analgesia. Used in anesthesia, intensive care, and to relieve severe cancer pain, it remains an essential tool in modern pharmacology. However, its pharmacological potency and short half-life significantly increase the risk of dependence. Studies have shown that 40% of people addicted to opioids report having used fentanyl intentionally, often in an initial medical context. The COVID-19 pandemic has exacerbated this trend, increasing prescriptions for patients with acute respiratory distress, causing complications such as respiratory depression and cerebral hemorrhage [19].

In terms of brain function, fentanyl addiction is based on two types of reinforcement: positive reinforcement, linked to euphoria, and negative reinforcement, which drives consumption to avoid withdrawal. These distinct processes are mediated by different neural networks in the dopaminergic circuits. In animals, repeated exposure leads to compulsive seeking and escalating consumption, replicating the criteria for addiction observed in humans.

These mechanisms are exacerbated by lasting changes in the prefrontal cortex, which are involved in loss of control and relapse. By altering these structures, fentanyl perpetuates a vicious cycle of dependence and tolerance. The use of fentanyl in hospitals must therefore be strictly regulated. A study by on mechanically ventilated intensive care patients shows that fentanyl does not provide any clinical benefits over other opioids, while exposing patients to an equivalent risk of dependence. In addition, substitution treatments such as buprenorphine show variable efficacy in patients addicted to fentanyl.

Considering these limitations, new approaches are emerging: transdermal microneedles provide faster and better-controlled relief, while an anti-fentanyl vaccine, still in the preclinical stage, aims to neutralize the molecule before it reaches the brain. These innovations illustrate the search for a balance between medical efficacy and addiction prevention.

3.2. Fentanyl Addiction in A Street Context

Since the 2010s, street fentanyl has become a global scourge. Produced in clandestine laboratories, often in China or Mexico, it is sold alone or mixed with other substances (heroin, cocaine, methamphetamine, or fake medicines). Its high potency and low cost explain its rapid spread on the black market.

Drug users seek fentanyl for its intense and immediate effects, but the margin between a euphoric dose and a lethal dose is extremely

narrow. This factor contributes to the explosion of overdoses, which are responsible for tens of thousands of deaths each year in the United States.

Illegal fentanyl users are predominantly young men, often homeless, living in precarious conditions, and poly-drug users. Their use is motivated by the potency of the product and its availability, but also by underlying mental health issues. Research has shown that these users have a low perception of risk, frequently suffer from anxiety or depressive disorders, and live in marked social isolation. These psychosocial factors increase vulnerability to addiction and complicate therapeutic management [20,21].

Overdoses linked to street fentanyl are often difficult to treat, as the product's rapid action sometimes renders naloxone, the usual opioid antidote, not sufficient, requiring repeated administration. Injecting, inhaling, and poly-drug use increase the risk of infection, respiratory depression, and death.

In response to this crisis, several risk reduction strategies are being deployed: naloxone distribution, needle exchange programs, supervised consumption rooms, and psychological support. The CA Bridge program in California is a statewide initiative that aims to treat substance use disorders and improve access to treatment. It exemplifies an integrated approach by initiating buprenorphine therapy directly in the emergency department. However, these initiatives remain insufficient given the scale of the global crisis.

Fentanyl illustrates the duality of contemporary pharmaceutical advances: capable of relieving the most extreme pain, but also of causing devastating addiction. In hospitals, addiction often results from prolonged or poorly supervised use, while on the streets, it is fueled by social precariousness and the search for immediate relief.

4. Health Literacy Applies to Addiction to Opioids

4.1. Higher Health Literacy: A Protective Factor Against Opioid Use and Addiction

Studies of people with chronic pain show that those with higher health literacy experience less pain intensity, less pain-related disability, and a reduced likelihood of opioid dependence. A good understanding of treatments, including limitations, risks of dependence, side effects, and dosage concepts, enables more appropriate use of medications [22].

People with high Health Literacy are also more likely to incorporate non-pharmacological pain management strategies, thereby reducing the systematic use of opioids. Conversely, low Health Literacy is associated with difficulties in interpreting prescriptions, dosing errors, or an inability to identify the early signs of emerging dependence.

High Health Literacy also improves the ability to identify the dangers associated with fentanyl, including its potency, dosage variability, and the frequency of contamination in illicit drugs. In a qualitative study conducted in rural areas, participants who were

better informed adopted more risk reduction strategies, such as using fentanyl test strips, consuming in the presence of others, or using small initial doses. These behaviors demonstrate an ability to understand the risks and adjust consumption accordingly to it.

Health Literacy also promotes navigation of the health care system and access to prevention services. The VOICES study, conducted using an anonymous telephone survey with a large sample of adults considered at high risk of opioid overdose in several U.S. states, set aimed to better understand how these individuals interact with health and harm-reduction services. The survey combined questions on service use, previous attempts to seek help, and participants knowledge of available programs, offering a clearer picture of the practical and informational challenges they face. Its findings show that the most common barriers to accessing treatment or tools such as naloxone are largely related to a lack of information and awareness of existing services and uncertainty about where or how to seek support (Bandara et al., 2024). Thus, higher Health Literacy contributes to better use of care, increased participation in harm reduction programs, and a greater ability to seek help.

Regarding the difficulties identified, several authors emphasize the urgent need to implement educational programs specifically focused on opioids, including practical tools, clear information, community interventions, and comprehensive training for healthcare professionals. The goal would be to improve understanding of the risks, promote overdose prevention, and facilitate access to harm reduction resources.

4.2. Health Literacy Regarding Opioids: A Largely Under-Documented Area

Despite its importance, Health Literacy applied to opioids is still an emerging field. Most research focuses on patient-physician communication or chronic diseases, while studies directly examining the link between Health Literacy and opioid use remain rare. While several studies show a clear relationship between low health literacy and opioid misuse, other findings are less clear, particularly regarding the ability of health literacy to effectively change consumption behaviors. Furthermore, explanatory models remain incomplete: for example, some studies suggest that Health Literacy may play a mediating role between post-traumatic stress disorder (PTSD), chronic pain, and opioid dependence, but empirical data remain limited.

Furthermore, the most vulnerable populations appear to be underrepresented in studies. Several groups that are particularly exposed to the opioid crisis are significantly understudied, namely, Latin American communities, rural populations, young women, people suffering from anxiety or depression, and patients exposed to opioids in hospitals. For example, a review of interventions targeting Latin American communities shows that very few of them incorporate cultural adaptation or specific educational resources [23,24].

In light of the gaps identified, several authors have examined

this issue emphasize the urgent need to implement educational programs specifically focused on opioids, including practical tools, clear information, community interventions, and increased training for healthcare professionals. Their conclusion aligns with our position, as we similarly support the development of structured educational strategies to improve risk awareness, promote overdose prevention, and facilitate access to harm-reduction resources [25,26].

Health literacy appears to be a major protective factor in the fight against opioid and fentanyl addiction. It influences understanding of pain, treatment management, the ability to recognize risks, the use of harm reduction tools, and access to care. Individuals with high Health Literacy are less likely to misuse drugs, become addicted, or suffer from overdoses. However, health literacy as it applies to opioids remains a very unexplored field. Research is sparse, often limited to specific subgroups, and struggles to describe the real influence of Health Literacy on addiction trajectories. Developing a genuine health literacy strategy focused on opioids, including fentanyl, is therefore a major priority to respond effectively to the current crisis[27-35].

5. Conclusion

Fentanyl is one of the biggest challenges in today's opioid crisis. Its high potency and rapid spread on the illegal market have led to high levels of dependence and overdose. In hospitals, fentanyl represents a real risk of addiction because of neurobiological mechanisms that reinforce use and reduce self-control.

This study explored how health literacy influences fentanyl addiction. The literature shows that people with higher health literacy understand treatments better, make fewer errors, and identify risks more easily. They also use more harm-reduction strategies [36-38].

However, health literacy linked specifically to opioids is understudied, and many vulnerable groups are rarely included. Several authors call for clearer information, practical tools, and better training for professionals.

This work suggests that health literacy can play a protective role, but limits remain. Most studies focus on opioids in general, not fentanyl specifically, and information alone is not enough to change high-risk behaviors, especially among people facing poverty, stigma, or limited access to care [39,40].

Future studies should explore how different forms of health literacy affect fentanyl use, develop culturally adapted interventions, and make healthcare systems easier to understand. Improving health literacy appears to be a key tool for better prevention, better care, and a more equitable response to the fentanyl crisis.

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