# Adverse Childhood Experiences and Health Outcomes: A 20-Year Real-World Study

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*Article*

# Adverse Childhood Experiences and Health Outcomes: A 20-Year Real-World Study

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**Abstract:** Adverse childhood experiences (ACEs) refer to traumatic life events in childhood that comprise abuse (e.g., psychological, physical, sexual), neglect (psychological and physical), indirect violence or household dysfunctions. Studies have found ACEs to be related to severe short-, medium- and long-term consequences in victims' health. The current work consists of a real-world, multicentric, prevalence study of health outcomes in children <16 years suspected of ACEs by physicians. It relies on electronic health records and healthcare registries from a Portuguese local healthcare unit between January 2001 and December 2021 ($N$ = 40,536). Three health outcome groups were analyzed: (1) traumatic injuries and intoxications (2) mental health disorders, and (3) physical disorders. Keywords and ICD-9, ICD-10, and ICPC-2 codes from were employed. Children suspected of ACEs represent 2% (n = 918). Social problems, injuries and intoxications, mental health disorders, and physical disorders arise in higher percentages in suspected victims than in non-suspected individuals. Findings uncover that child victims of ACEs may be underdiagnosed. Given the severe consequences for their current and future health, this should be taken as a critical warning for healthcare professionals. Detection and reports in health units are fundamental for early treatment, aiming to avoid an escalation of damage and prevent re-victimization.

**Keywords:** adverse childhood experiences; suspected victims; health outcomes; traumatic injuries; intoxications; mental health disorders; physical disorders

## 1. Introduction

The World Health Organization (WHO) describes violence against children as any form of violence targeting people under 18 years of age, perpetrated by a stranger or someone they know [1]. Adverse childhood experiences (ACEs), as a concept, is a much broader concept than violence against children, because it encompasses potentially traumatic life events occurred in childhood (0–17 years) [2,3]. In a pioneering study in the 90s, Felitti et al. enumerated various life events conceivable as ACEs, such as abuse (psychological, physical, and sexual), neglect (psychological and physical), and household dysfunction (exposure to domestic violence, parental separation, substance abuse, mental illness, incarcerated relative, and divorce) [4]. Yet, other experiences, such as traumatic losses (e.g., by suicide or suicide attempt of someone close) or violence in the community, are considered [2], extending to terrorism, war, torture, living in refugee camps, extreme poverty and homelessness [2,4,5].

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ACEs are not exclusive of specific households, social strata or settings. Home, school, foster care institutions, and the internet are a few examples of where violence may emerge and impact children [3]. Perpetrators may range from family members, neighbours, or peers, to perfect strangers or unfamiliar individuals [8].

Despite the rising concern about this issue over the last few years, with an ever-growing body of literature, climaxing in an expectation of a more conscious society, ACEs remain vastly underreported by families, by professionals who work with children (e.g., health care, education), and the general community. Frequently, victims are too young to acknowledge some types of abuse or too vulnerable to disclose about them. For instance, corporal punishment masked as a form of child education is still socially accepted in several regions around the world [1,9] and emotional neglect is not always perceived as abusive.

Globally, it is estimated that half the children aged 2 to 17-year experience physical, emotional, or sexual violence or neglect every year [10]. The WHO reports that 300 million 2- to 4-year-olds are victims of corporal punishment and/or psychological violence, perpetrated by parents or other caregivers [11]. This organization also declares that one in 5 women and one in 13 men stated having been sexually abused before turning 18 [9,11].

Infancy and adolescence are exceptionally relevant chapters for the development of a healthy foundation from which each person builds their life. This places children in a vulnerable position when faced with adverse experiences and environmental risk factors as it will shape their future as human beings.

ACEs are a worldwide social problem with short-, medium-, and long-term health consequences and ripple effects on children's lives. During these crucial years, ACEs can result in trauma and intoxications [12–15], mental health disorders [16–19], physical disorders [20–23], and even epigenetic changes [24] as short-term outcomes that may reflect on their adult life. Moreover, worst-case scenarios can result in death [4,6,9].

The outcomes mentioned above have a cumulative effect, increasing with the severity and one's simultaneous experience of multiple types of violence [2,25]. In their first ACE study, Felitti et al. explained that exposure to four or more ACEs increased the risk of several mental health and physical disorders [4] which was supported by results of subsequent studies [6,17,20,23].

Healthcare professionals hold a privileged position regarding the ability to identify suspected victims and report the cases to authorities. When violence occurs, victims often are taken to emergency rooms, even if they or the accompanying person do not disclose the reason behind the injuries. A study revealed that only 0.6% of occurrences in a Portuguese pediatric emergency room proceed from violence [26], while the WHO reports that in Europe, just on the subject of physical abuse, there are 22.9% of children victims [27]. Additionally, another Portuguese study, conducted in a similar geographical area to ours, reported a prevalence of 42.8% of physical abuse at school and 18.5% at home, based on answers to self-administered questionnaires [28].

Likewise, primary health care plays an indispensable role in this matter, with physicians having the opportunity to develop a unique doctor-patient dynamic and assess more insidious and recurrent suspected violence situations.

This study aims to analyze the prevalence of health outcomes in children under 16 years of age in cases of ACEs suspicion by physicians at a local healthcare unit in Portugal. The specific objectives are to characterize different health outcomes: (a) traumatic injuries and intoxications; (b) mental health disorders; and (c) physical disorders.

## 2. Materials and Methods

### *2.1. Study Design and Setting*

The present study analyzed complementary data from electronic health records and healthcare registries generated as the patient is being interviewed. It followed a real-world, retrospective, observational, cross-sectional, and multicentric study approach. Data was extracted from a Portuguese local healthcare unit (LHUM), currently tending approximately 172,557 individuals [29],

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40,536 (23.5%) of which are aged 15 years or younger. Located in the North of Portugal, it comprises one hospital and 14 primary healthcare units (12 family healthcare units and 2 personalized healthcare units). The option for a local healthcare unit is because it includes the services that most victims seek for healthcare. The LHUM is the oldest of the eight Portuguese local healthcare units, matches the geographical area of work of the research team, and has an available and well-catalogued database.

Regarding the eligible population's size, informed consent is applicable, therefore we allude to subparagraphs i) and j) of Article 9th of the European Union's General Data Protection Regulation 2016/679 as strong grounds for this study.

Data access was approved by the LHUM Health Ethics Committee and Local Information Protection and Security Committee through approval codes No. 91/CES/JAS on October 14, 2022 (original) and No. 71/CLPSI/2022 on December 21, 2022 (original). Data collection was performed by the LHUM Information Technology Department. Data processing and analysis were executed by analytic programs, created solely with this intent, on LHUM servers, implying that no data were extracted outside the LHUM and that the researchers did not have direct access. Moreover, the LHUM Information Technology Department de-identified all processed data prior to the analytic code execution to meet the Health Insurance Portability and Accountability Act (HIPAA) safe harbour criteria. The last data lock point was February 26, 2023.

### *2.2. Participants*

Children were included if they fulfilled the four following criteria: (a) to be part of the population served by LHUM; (b) to have had at least one appointment at a LHUM primary healthcare unit; (c) to be suspected of being a victim of violence by a LHUM clinician; (d) to be aged under 16 years old at the time of the event; we chose this cut-off age since other kinds of violence are likely to arise after it, namely dating violence, which was already investigated in another similar study [25].

### *2.3. Variables*

We studied the subsequent variables: (a) sex; (b) age; (c) social conditions; (d) traumatic injuries and intoxications; (e) mental health disorders; and (f) physical disorders. To accomplish the account of these variables, through words and expressions commonly used to describe them, we created a set of keywords and categorized them using the International Classification of Diseases (ICD-9 and ICD-10) and the International Classification of Primary Care (ICPC-2).

All data for the current study purposes were drawn from codes and clinical notes in electronic registries. All categorical variables herein addressed are described in the results, except for those not included due to insufficient data (e.g. sleep disorders, sexually transmitted infections, pregnancy, or hypertension).

### *2.4. Data Sources/Measurements*

Electronic health records and healthcare registries at LHUM were the sources of all data collected from January 1, 2001, to December 31, 2021. Everyone who met the inclusion criteria was enrolled, and no sample was drawn since records from all eligible patients were analyzed.

### *2.5. Bias*

Children and/or accompanying people often do not disclose they are being subjected to violence due to not being able to or not recognizing maltreatment. Additionally, not all physicians describe or code suspected cases of violence in electronic health records and healthcare registries. Therefore, omission bias represents a real risk in this study given that there might be a prevalence underestimation. To minimize this bias, we applied broad inclusion criteria, and no exclusion criteria, and used the aforementioned set of keywords relevant to this context and all pertinent ICPC-2, ICD-9, and ICD-10 codes.

No other potential sources of bias were identified by the authors.

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*2.6. Statistical Methods*

We opted for a descriptive analysis of the results, reporting absolute and relative frequencies for all variables. No inferential methods were used.

## 3. Results

Physicians registered a suspicion of ACEs in 2.3% of cases (n = 918) from a total population of 40 536 children. Most suspected victims were male (n = 552; 60.1%) and the mean age was 9 years (respectively, 52.5% and 8 years for the total population).

The number of suspected victims tends to increase with age, as seen in Table 1, in which the last two groups (aged 10–15 years) represent 47% of all victims. There is a reference to unspecified social problems in 1.5% (n = 14) of cases, contrasting with 0.4% (n = 142) within the total population.

**Table 1.** Total population and suspected victims of ACEs' age distribution.

| AGE GROUPS (years) | Total population n (%) | Suspected ACEs n (%) |
|---|---|---|
| 0–3 | 7264 (17.9) | 160 (17.4) |
| 4–6 | 8598 (21.2) | 165 (18.0) |
| 7–9 | 7813 (19.3) | 162 (17.7) |
| 10–12 | 8627 (21.3) | 201 (21.9) |
| 13–15 | 8234 (20.3) | 230 (25.1) |
| Total | 40,536 (100.0) | 918 (2.3) |

Table 2 lists the children's history of traumatic injuries and intoxications, mental health disorders, and psychotropic medication use, as well as some physical disorders.

**Table 2.** Health disorders, injuries and intoxications.

| | | | Total population n (%) | Suspected ACEs n (%) | Ratio (suspected/total) |
|---|---|---|---|---|---|
| Mental health disorders | Major psychiatric disorder | | 1360 (3.4) | 161 (17.5) | 5.1 |
| | Attention deficit hyperactivity disorder | | 106 (0.3) | 29 (3.2) | 10.7 |
| | Social deprivation | | 185 (0.5) | 19 (2.1) | 4.2 |
| | Psychosocial stress | | 308 (0.8) | 19 (2.1) | 1.6 |
| | Unspecified disorders with onset in childhood and adolescence | | 52 (0.1) | 19 (2.1) | 21 |
| | Medication | Anxiolytics | 3 134 (7.7) | 128 (13.9) | 1.8 |
| | | Antipsychotics | 414 (1.0) | 70 (7.6) | 7.6 |
| | | Sedatives | 432 (1.1) | 48 (5.2) | 4.7 |
| | | Antidepressants | 183 (0.5) | 26 (2.8) | 5.6 |
| Physical disorders | Metabolic syndrome | | 3086 (7.6) | 110 (12.0) | 1.6 |
| | Obesity | | 2512 (6.2) | 62 (6.8) | 1.1 |
| | Type 2 diabetes | | 569 (1.4) | 37 (4.0) | 2.9 |
| | Hypercholesterolemia | | 656 (1.6)) | 30 (3.3) | 2.1 |
| | Asthma | | 1 189 (2.9) | 51 (5.6) | 1.9 |
| | Urinary tract infection | | 431 (1.1) | 19 (2.1) | 1.9 |
| | Cancer | | 252 (0.6) | 11 (1.2) | 2 |
| | Unspecified illness | | 265 (0.6) | 10 (1.1) | 1.8 |
| Traumatic injuries | Bone fracture | | 6652 (16.4) | 218 (23.8) | 1.5 |
| | Open wound | | 2260 (5.6) | 88 (9.6) | 1.7 |
| | Bone dislocation | | 1034 (2.6) | 46 (5.0) | 1.9 |

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| | | | | |
|---|---|---|---|---|
| and | Superficial injury | 688 (1.7) | 33 (3.6) | 2.1 |
| intoxications | Intoxications | 1192 (2.9) | 46 (5.0) | 1.7 |

## 4. Discussion

Our study examined the health issues present in children whom physicians registered a suspicion of ACEs. Out of the total child population, 2.3% (n = 918) had documented suspicions, traumatic injuries, and intoxications, and mental and physical disorders were more common in this group compared to the overall study population.

The underlying physiological mechanism for this phenomenon is likely to be linked to the chronic stress caused by ACEs, a framework that leads to maladaptive responses, and to the disruption of both the hypothalamic-pituitary-adrenal axis and the functioning of the entire neuro-endocrine-immune network [31,32]. This disruption is associated with higher rates of diseases related to inflammation and hormonal dysfunctions [32,33], as well as changes in the brain structure, such as fewer synapses and dysfunction in crucial areas like the prefrontal cortex, amygdala, and hippocampus, which are important for cognition and behavior [7,33,34]. Additionally, some children may experience epigenetic modifications due to DNA methylation changes [24] and telomere shortening [35], among others.

### *4.1. Demographics*

The total studied population was composed of similar percentages of female and male children. However, males made up 60.1% of the suspected victims, indicating that they are more frequently victimized. Corporal punishment is one of the most common ACEs (Adverse Childhood Experiences) in Portugal, with boys being more likely to be punished [28,36].

Almost half (47%) of the suspected victims were aged between 10-15 years, consistent with another Portuguese study that found most child abuse cases occur in children aged 10-14 years [26].

Social adversities include financial hardship, lack of access to water, food, transportation, or education, poor living conditions, sociocultural problems, and the death of family members [37]. Some of these are intrinsically associated with poverty, a problem that has been previously described as increasing an individual's odds of becoming a victim of ACEs [37,38]. Our results showed that 1.5% of suspected victims had unspecified social problems, 3.8 times higher than in the total population. It's possible that some cases were coded or described in the clinical notes incorrectly and should have been categorized as "specific social problems." Nevertheless, it's important to note that, although ACEs affect people from all socioeconomic groups [39], higher-income families may have less visibility in this setting due to prioritizing private healthcare services.

### *4.2. Traumatic Injuries and Intoxications*

When abuse is suspected, a differential diagnosis is required to determine its medicolegal aetiology, which may consist of [40]: (a) trauma (accidental or inflicted by a third person, self-inflicted, or iatrogenic), (b) pathology, or (c) morphological condition.

Most child traumatic injuries in ambulatory are considered accidental [41]. However, physicians need to keep their eyes open to the possibility of an abusive nature and the many possible abuse indicators, such as [40]: (a) unexplained injury based on the patient's history (mechanism and/or time of wound occurrence), (b) unusual injury location for an accidental cause, (c) patterned injuries, (d) symmetric injuries, (e) multiple injuries at different stages of healing, and (f) delayed search for healthcare.

Abusive injuries often manifest as skin injuries, with bruises being the most common, affecting up to 90% of physical abuse victims [12]. Physical abuse is on the basis of 12-20% of all fractures in young children [13]. However, our findings showed that superficial injuries were observed in only 3.6% of suspected victims, and lower when compared to rates for open wounds, bone fractures, and dislocations (See Table 2). This may occur because physicians prioritize coding and describing severe

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injuries over minor or less explicit ones. Additionally, it must be noted that children with a history of ACEs are at higher risk of intoxication [14] and self-inflicted injuries [15].

During our study, we found that bone fractures, dislocations, open wounds, superficial injuries, and intoxications were more frequently observed in suspected cases of ACEs compared to the overall population (1.5, 1.9, 1.7, 2.1, and 1.7 times higher, respectively) – as shown in Table 2. This suggests that many of these injuries may have been intentional rather than accidental. However, based on our results, we were unable to confirm the medicolegal aetiology of these outcomes, which prevents us from making further progress in this regard.

### *4.3. Mental Health Disorders*

The following findings have been reported regarding the prevalence of some challenging behaviors and disorders in children who have experienced ACEs. Externalizing and internalizing behaviours, attention deficit hyperactivity disorder (ADHD), and the use of psychotropic medication appear to be more common in the ACEs group compared to the general population [42–44]. Additionally, there is a significant association between ACEs, particularly sexual abuse, and the lifetime diagnosis of various mental health disorders such as anxiety disorders, depression, eating disorders, posttraumatic stress disorder, sleep disorders, and suicide attempts (17). Depression and anxiety disorders have also been linked to ACEs based on a similar study population (6).

Our research revealed that higher percentages of suspected ACEs victims are associated with mental health disorders and psychotropic medication use, particularly for ADHD and antipsychotic consumption, with rates 10.7 and 7.6 times higher, respectively, compared to the general population (Table 2).

Although data for major depressive disorder were insufficient, suspected victims were found to use antidepressants 5.8 times more frequently than the total population. These disparities may be due to underreporting and the fact that antidepressants are prescribed for indications other than major depressive disorder. It also appears that physicians tend to categorize diagnoses broadly as major psychiatric disorders or psychosocial stress, which may encompass many cases of depressive and anxiety disorders.

### *4.4. Physical Disorders*

The results of our study showed that type-2 diabetes and hypercholesterolemia were the two most prominent physical disorders among the suspected victims compared to the total population, being 2.9 and 2.1 times higher, respectively (see Table 2). Other conditions studied also had higher rates, consistent with several other studies that have demonstrated a connection between ACEs and diabetes [6,7,20,45,47], cancer [7,20,22,47], hypercholesterolemia [6], asthma [48], and urinary tract infections [49].

In the case of obesity, which has also been linked to ACEs [7,20,48], a study has investigated the role of food addiction in the relationship between childhood trauma and obesity [48]. It was suggested that it might potentially account for up to 50% of cases, particularly when overeating becomes a coping mechanism. However, in our study, obesity rates in the total and suspected populations are very similar, possibly due to a significant prevalence of obesity in Portuguese children (15.3% in 2008 and 11.9% in 2019) [49].

It is important to note that our study did not include data on other physical disorders such as hypertension and stroke since there data was insufficient to draw conclusions (hypertension, n = 1; stroke, n = 3).

### *4.5. The Role of Healthcare Professionals Regarding ACEs Suspicion*

The Portuguese healthcare system is designed to provide the best possible by the implementing electronic health records, healthcare registries, and coding systems. Local healthcare units offer a wide range of services, including emergency rooms and primary health care, seeking to increase the likelihood of patients receiving the care they need.

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These services are typically free of charge to reduce access barriers for those with fewer financial resources. Healthcare professionals, considering their education and training, are expected to hold the required specific knowledge to identify victims, especially those in close contact with children, which is of paramount importance for an early detection of abuse, neglect and other adversities.

For physical abuse alone, the global known rates are 22.6%, [45] and 22.9% in Europe [27]. However, the current study found only 2.3% of children assisted at LHUM with suspected ACEs registered by physicians. It is essential to investigate why healthcare professionals may be failing to suspect, record their suspicions, or report abuses.

This failure to recognize, register suspicions, and report cases of child abuse may be due to the following conceivable reasons: (a) lack of knowledge about indicators of maltreatment and about differentiating them from accidents, self-inflicted injuries, iatrogenic injuries, specific pathological lesions, and other conditions, (b) unawareness of their legal duty to report child abuse or neglect, (c) unawareness of the impact of abuse on the child's safety and health, (d) insufficient training on how to make a report, (e) fear of making an erroneous diagnosis, (f) fear of involvement with the justice system, (g) fear of jeopardizing the doctor-patient trust-based relationship and breaking medical confidentiality duties.

It's crucial not to overlook that these children are at a heightened risk of being victimized again [24,43] and self-harming [13–16], as well as increasingly developing health problems and dying prematurely [15,47,48]. The absence of records and reports from health to child protection services and/or legal authorities will delay or even impede access of the child victim to the support systems (medical, psychological, social, security, and justice-related).

Reporting child abuse cases is mandatory for government employees and physicians according to the Law for the Protection of Children and Adolescents in Danger (Law No. 147/99, September 1, updated version - Law No. 26/2018, 05/07), criminal law (Article 242º of the Portuguese Penal Procedure Code), and the Medical Deontology Regulation of the Portuguese Medical Association (DR, 2ª serie, nº 139, 2016). Following the report, the public prosecutor's office will initiate criminal proceedings as child maltreatment has been considered a public crime since 2001.

### *4.6. Study Limitations and Further Research*

The reading of our results must take into consideration the following shortcomings: (a) omission bias, already anticipated, possibly due to the victim's inability and/or fear of disclosure, to family's secrecy, and the possible under-detection by physicians in the face of less explicit signs of traumatic events (it is possible that suspicion notes are concealed in confidential clinical information); (b) non-measurement of the number of ACEs per person, which might provide an important person-based perspective, considering the dose-response relationship between ACEs and health outcomes (unavailable information); (c) absence of health risk behaviors assessment as ACEs outcomes (e.g., substance use), due to insufficient data possibly caused by a misinterpretation of medical confidentiality; and (d) impossibility to determine the medico-legal aetiology of traumatic injuries and intoxications, preventing us from concluding whether or not they had a violent source.

Future research should involve other Portuguese healthcare facilities and European research groups to achieve a better understanding of the phenomenon and reach more definitive conclusions.

## 5. Conclusions

The following conclusions may be drawn from our study:

Children with ACEs accounted for 2.3% of the total child patient population (n = 40,536). This raises concerns about potential concealment of abuse or neglect cases by the child or accompanying person, as well as underdetection and underreporting by physicians.

Health challenges impact children with ACEs more than those without such experiences, as the current results point to:

- Higher likelihood of traumatic injuries in children with ACEs: bone fractures, open wounds, bone dislocations, and superficial injuries are 1.5, 1.7, 1.9, and 2.1 times more common, respectively.

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- Intoxications being 1.7 times more likely to be found in a child with ACEs.
- Higher likelihood of major psychiatric disorders, ADHD, social deprivation, psychosocial stress, and unspecified childhood and adolescent onset disorders, at 5.1, 10.7, 4.2, 1.6- and 21-times higher rates, respectively.
- Use of psychotropic medication such as antipsychotics, antidepressants, sedatives, and anxiolytics being 7.6, 5.6, 4.7, and 1.8 more likely.
- Somatic disorders (metabolic syndrome, obesity, type-2 diabetes, hypercholesterolemia, asthma, urinary tract infections, cancer, and unspecified illnesses) being considerably more likely.

This scenario may be both overwhelming and stimulating, if it means moving towards improvement of child victims' advocacy in healthcare. Laying a strong foundation for children to thrive can be achieved by acting on key areas: (a) promoting positive childhood experiences, with trustworthy adults, and empowering children with age-appropriate information about body safety and other important issues at school, kindergarten and healthcare; (b) advocating for social norms that protect children from adversity and promote resilience by providing systemic support to families; (c) ensuring more training and awareness for professionals working with children, especially in healthcare settings, towards a better detection and report of suspected cases; and (d) establishing and benchmarking a comprehensive national intervention system for suspected cases in countries that lack holistic approaches.

**Author Contributions:** For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, B.M. and T.M.; methodology, T.T.-G. and T.M..; software, T.T.-G.; validation, J.B. and M.J.V.-A.; formal analysis, T.T.-G.; investigation, B.M., J.B. and T.T.-G..; resources, T.M. and M.J.V.-A.; data curation, T.T.-G. and J.B.; writing—original draft preparation, B.M., and T.M.; writing—review and editing, M.J.V.-A..; visualization, M.J.V.-A.; supervision, T.M.; project administration, T.M. and T.T.-G. All authors have read and agreed to the published version of the manuscript.

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**Informed Consent Statement:** Patient consent was waived since data processing and analysis were executed by analytic programs, created solely with this intent, on the local health unit servers, and no data were extracted outside it. Moreover, Information Technology Department de-identified all processed data prior to the analytic code execution to meet the Health Insurance Portability and Accountability Act (HIPAA) safe harbour criteria.

**Data Availability Statement:** No data was extracted from servers. As such no new data was created, and information used is unavailable due to privacy or ethical restrictions.

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**Conflicts of Interest:** The authors declare no conflicts of interest.

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