Original Paper

Health Impact of Suspected Interpersonal Violence Against Adults: Retrospective Cohort Study

Rui Barbosa[1], MD; Rita Lopes[2], MD; Tiago Taveira-Gomes[2,3,4,5,6], MD, PhD; Carla Ponte[7], MD; Teresa Magalhães[1,2,3,8], MD, PhD

[1]Department of Public Health and Forensic Sciences, and Medical Education, Faculty of Medicine, University of Porto, Porto, Portugal

[2]MTG Research and Development Lab, Porto, Portugal

[3]Center for Health Technology and Services Research (CINTESIS@RISE), Porto, Portugal

[4]Department of Community Medicine, Information and Decision in Health, Faculty of Medicine, University of Porto, Porto, Portugal

[5]Faculty of Health Sciences, University Fernando Pessoa (FCS-UFP), Porto, Portugal

[6]SIGIL Scientific Enterprises, Dubai, United Arab Emirates

[7]USF Porta do Sol - ULS Matosinhos, Senhora da Hora, Portugal

[8]TOXRUN–Toxicology Research Unit, University Institute of Health Sciences, Advanced Polytechnic and University Cooperative (CESPU), Gandra, Portugal

Corresponding Author:
Rita Lopes, MD
MTG Research and Development Lab
Rua Professor Joaquim Bastos 102 2A
Porto, 4200-604
Portugal
Phone: 351 911729305
Email: rita.lopes@mtg.pt

Abstract

Background: Interpersonal violence (IV) has an extensive and profound impact on health, representing a public health concern. Different health outcomes have been identified based on the characteristics of the survivor and the abuser, their relationship, the type of violence perpetrated, and the cumulative effect of multiple violent experiences.

Objective: The main objective of this study was to estimate the likelihood of negative health outcomes, such as substance abuse, mental health, and somatic disorders, occurring in adults presenting a clinical suspicion of IV.

Methods: We performed a retrospective, observational cohort study, using secondary data from electronic health records of adult patients of the Local Health Unit of Matosinhos (ULSM). The control cohort included all patients aged between 18 and 59 years followed at ULSM between January 1, 2008, and May 9, 2024, while the violence cohort included patients within the same age range who were suspected survivors of IV within the same time period. Exposure was defined by the presence of one or more of the IV text expressions or codes in the patient's electronic health record. Data regarding violence suspicion, comorbidities, and health outcomes were obtained by conducting a text search on clinical notes, as well as *ICD-9* (*International Classification of Diseases, Ninth Revision*) and *ICD-10* (*International Statistical Classification of Diseases, Tenth Revision*) and International Classification of Primary Care 2 codes. The follow-up period was 10 years. To estimate the risk of developing health outcomes, we constructed a cohort model using a Cox proportional hazards model adjusted at baseline for age and sex.

Results: The control cohort included 154,145 patients, and the violence cohort included 36,835 patients. Suspected survivors of IV had a higher hazard ratio of developing alcohol abuse (3.05, 95% CI 2.87-3.24), drug abuse (6.03, 95% CI 4.5-8.06), suicidal ideation (5.50, 95% CI 4.78-6.32), major psychiatric disorder (4.46, 95% CI 4.38-4.53), chronic pain (3.70, 95% CI 3.60-3.81), sleep disorders (3.57, 95% CI 3.46-3.68), use of antidepressants (3.57, 95% CI 3.51-3.64), use of anxiolytics (2.98, 95% CI 2.93-3.03), and eating disorder (2.72, 95% CI 2.06-3.59). Regarding somatic health conditions, suspected violence exposure was linked to a higher hazard ratio for metabolic dysfunction–associated steatotic liver disease (6.91, 95% CI 6.37-7.50), chronic immune inflammatory disorder (3.68, 95% CI 3.93-3.44), asthma (2.64, 95% CI 2.53-2.74), chronic kidney disease (2.49, 95% CI 2.39-2.59), hypercholesterolemia (2.16, 95% CI 2.12-2.20), and early heart disease (2.01, 95% CI 1.93-2.10).

Conclusions: Exposure to violence was linked to a higher likelihood of developing adverse events related to substance abuse, mental, and somatic health. Our findings lead to a deeper understanding of the complex burden of violence on health, uncovering new relationships between IV and health outcomes while validating those already explored.

Introduction

The World Health Organization (WHO) defines violence as "the intentional use of physical force or power, threatened or current, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment, or deprivation." Thus, it includes active and passive behaviors, mostly of a repetitive nature. It is present across every stage of life, regardless of sex, and in different sociocultural contexts and forms [1].

In Portugal, data from the National Institute of Statistics from 2023 shows that 20.1% of people aged between 18 and 74 years have been survivors of physical or sexual violence in adulthood. Women are primarily affected in the context of intimacy, while men are more often survivors of violence from nonpartners [2].

Interpersonal violence (IV) is no longer regarded only as a criminal justice matter. Its impact on health is extensive and profound, and it is recognized as a significant public health problem, which requires the attention of health care providers [1,3]. Overall, IV has short-, medium-, and long-term effects. In fact, they are not limited to immediate physical trauma but include physiological changes, psychological consequences, and coping strategies that may increase the risk of negative health outcomes, years or decades following the primary exposure [4-7]. There are several mechanisms behind these transformations, some happening in the first years of life [5,8-11]: (1) changes in the brain's white and grey matter, its volume and functional connective; (2) altered neurotransmitter metabolism; (3) changes in the neuroendocrine stress response; (4) chronic inflammation; (5) impaired glucose metabolism; (6) changes in the microbiome in response to stress; and (7) epigenetic mechanisms through DNA methylation. Many of these alterations seem related to the hypothalamic-pituitary-adrenal (HPA) axis, which integrates and coordinates the central and peripheral aspects of the mammalian stress response. Thus, violence exposure acts as a trigger and places survivors at high risk for the development of physical and mental health illnesses, as well as latent and genetically programmed diseases [5,7].

Several studies describe different health outcomes according to the survivor's and abuser's personal characteristics and their relationship, as well as the type of violence perpetrated. Intimate partner violence is shown to be related, for example, with mental health disorders (where genetics have a significant preponderance [11]), substance consumption, and somatic diseases, as obesity, metabolic syndrome, type 2 diabetes (T2D; due to increased cortisol levels and suppressed insulin levels [10]), hypertension (as a result of chronic activation of HPA axis, and autonomic nervous system [9]) among others [6,7,9-13]. Bullying and cyberbullying seem to be associated with depression, anxiety, and somatization symptoms [6]. Sexual abuse is found to be mainly related to depression, anxiety, suicide attempts, substance abuse, sleep disorders, gastrointestinal disorders, or nonepileptiform seizures [5,6,14]. Economic abuse is considered associated with increased depression, anxiety, suicidal ideation, and posttraumatic stress disorder [15].

Furthermore, it must be outlined that survivors of IV frequently experience multiple forms of it [6,16]. Experiencing or being exposed to one type of violence increases the risk of becoming a survivor of other types of violence or inflicting harm on others [17,18]. The association of different types of IV or its reiteration may result in different and potentially more severe negative impacts on health consequences [18,19]. This way, to understand the full burden of IV health outcomes, we should look to the cumulative effect of the multiple experiences of violence during the lifespan [18].

Ultimately, there are still associations to be unveiled and better understood that may revolutionize the approach to survivors. The better we understand the possible long-term outcomes of IV, the more capable doctors are to minimize the burden of violence on survivors' development and well-being.

The main objective of this study was to estimate the likelihood of negative health outcomes, such as substance abuse, mental health, and somatic disorders, occurring in adults presenting a clinical suspicion of IV. The study also aimed to establish the incidence of individuals with suspected exposure to violence followed in the Local Health Unit of Matosinhos (Unidade Local de Saúde de Matosinhos [ULSM]) and to characterize this population both demographically and according to prior clinical history.

Methods

Study Design and Setting

A real-world, retrospective, observational, and analytical cohort study was performed using data from electronic health records (EHR) of adult users of ULSM.

ULSM is a health unit that provides primary, secondary, and tertiary health care, being composed of 1 hospital and 14 primary care centers, serving a population of around 176.774 inhabitants.

The study's inclusion criteria for the violence cohort were: (1) patients aged between 18 and 59 years; (2) sought the ULSM service between January 1, 2008, and May 9, 2024; (3) having text expressions (according to predefined keywords, described

in Table 1) related to IV documented in the clinical notes or codes or at least one *ICD-9* (*International Classification of Diseases, Ninth Revision*) or *ICD-10* (*International Statistical Classification of Diseases, Tenth Revision*) or an International Classification of Primary Care 2 (ICPC-2) IV-related code occurring after the age of 18 years (Table 1); and (4) having at least one appointment at ULSM in the 365 days before the index date. This last criterion was established to ensure the capturing of a population regularly followed at ULSM and to exclude sporadic visitors, such as tourists, thus increasing accuracy in the characterization of the local population.

The control cohort consisted of an incident population from ULSM, between 18 and 59 years old, who sought the ULSM service between January 1, 2008, and May 9, 2024, and had at least one appointment at ULSM in the previous 365 days before the index date.

No exclusion criteria were used in this investigation other than not meeting the inclusion criteria. Formal sample size calculations were not conducted, as the sample consisted of all the patients eligible according to the inclusion criteria.

The two study cohorts were not mutually exclusive; therefore, the same patient could enter the two cohorts at different times during the study period.

The index data corresponded to the date when each patient met all the cohort criteria. The patients' medical history, also described as prior outcomes, was evaluated using all records available in the preindex period. The follow-up period was 10 years (3650 days).

Table 1. Codes and text expressions used to define interpersonal violence suspicion in the study[a].

Classification	Code
ICD-9[b]	995.80 Adult maltreatment, unspecified 995.81 Adult physical abuse 995.82 Adult emotional or psychological abuse 995.83 Adult sexual abuse 995.84 Adult neglect (nutritional) 995.85 Other adult abuse and neglect
ICD-10[c]	- T74 Adult and child abuse, neglect, and other maltreatment, confirmed - T74.01 Adult neglect or abandonment, confirmed - T74.11 Adult physical abuse, confirmed - T74.21 Adult sexual abuse, confirmed - T74.31 Adult psychological abuse, confirmed - T74.51 Adult forced sexual exploitation, confirmed - T74.61 Adult forced labor exploitation, confirmed - T74.91 Unspecified adult maltreatment, confirmed - T74.A1 Adult financial abuse, confirmed - T76 Adult and child abuse, neglect, and other maltreatment, suspected - T76.01 Adult neglect or abandonment, suspected - T76.11 Adult physical abuse, suspected - T76.21 Adult sexual abuse, suspected - T76.31 Adult psychological abuse, suspected - T76.51 Adult forced sexual exploitation, suspected - T76.61 Adult forced labor exploitation, suspected - T76.91 Unspecified adult maltreatment, suspected - T76.A1 Adult financial abuse, suspected
ICPC-2[d]	- Z12 Relational problem with partner - Z13 Partner behavioral problem - Z25 Violent act or event
Text expressions	[Aa]bandon [Aa]gred [Aa]gress [Aa]mea[çc]a [Aa]pert[ãa]o [Aa]pert[õo]es [Bb]alead [Bb]at[ei] [Bb]ofet [Cc]hapad [Dd]estru [Dd]ispar [Ee]mpurr [Es]sfaquead [Ee]sgana [Ee]stalad [Ee]strang [Ff]acad [Hh]umilh [Ii]nsult [Mm]urr [Oo]brigada a [Pp]ancad [Pp]aulad [Pp]r[aá]tica[s]* sex [Pp]edrad [Pp]erseg [Pp]ontap [Ss]apatad [Ss]oco [Ss]ufoc

[a]Patients aged between 18 and 59 years followed in the Local Health Unit of Matosinhos should have at least one of the codes or text expressions to qualify for the violence cohort.

^bICD-9: International Classification of Diseases, Ninth Revision.

^cICD-10: International Statistical Classification of Diseases, Tenth Revision.

^dICPC-2: International Classification of Primary Care, 2nd edition.

Exposure and Outcome Definitions

Exposure was defined by the presence of one or more of the IV text-expressions or *ICD-9*, *ICD-10*, or ICPC-2 codes in the patient's EHRs described in Table 1.

Study Variables

The variable categories included in the study were (1) sex, (2) age, (3) health risk behaviors, (4) mental health disorders, and (5) somatic health conditions.

The health risk behaviors category included the following variables: (1) alcohol abuse and (2) drug abuse.

Mental health disorders encompassed (1) major psychiatric disorders, (2) posttraumatic stress disorder, (3) suicidal ideation, (4) chronic pain, (5) headache, (6) sleep disorders, (7) memory disorders, (8) eating disorders, and (9) psychotropic drug use (sedatives, antidepressants, anxiolytics, and antipsychotics).

Within the somatic health conditions category, the included variables were (1) T2D, (2) hypercholesterolemia, (3) metabolic dysfunction–associated steatotic liver disease (MASLD), (4) hypertension, (5) chronic kidney disease, (6) early heart disease, (7) asthma, (8) chronic inflammatory disorder, (9) cancer, and (10) unspecified illness.

All variables described above were used for cohort characterization, using all information available in the preindex period, within study dates.

The events used to estimate hazard ratios (HRs) included all of the health outcomes included in the categories "health risk behaviors," "mental health disorders," or "somatic health conditions" occurring up to 3650 days after the index date.

Statistical Analysis

Analysis was conducted through local execution of analytical programs developed using VERO technology that were compiled for ULSM target data infrastructure built upon Apache Spark Framework version 3.2.1 and source data harmonized according to the OMOP CDM 5.4 standard. The package implements a complete data engineering pipeline to transform the source data into the final dataset, as well as the execution of statistical analysis and the generation of results reports. Continuous variables were described using the average and SD, while categorical variables were expressed by absolute and relative frequencies. Age was analyzed as a continuous and a categorical variable. Patients were stratified into 10-year age categories in order to better characterize the age distribution of the study's population. To estimate the risk of developing health outcomes, we constructed a cohort model using a Cox proportional hazards model adjusted at baseline for age and sex. HRs were calculated with 95% CIs. Time at risk was calculated from the index date until the development of the outcome of interest. Patients were censored in case of leaving the database. Missing data were not imputed for any variables. Analysis was performed using only the available data.

Ethical Considerations

The Health Ethics Committee and Data Protection Officer of ULSM authorized the use of the database for this study, under approval codes 14/CES/JAS of 02-11-2022 and 04/CLPSI/2022 of 03-02-2022. Data processing and analysis were performed using analytical programs developed for this purpose that were sent for execution at ULSM servers. Researchers did not have access to patient-level data. Only aggregated data were shared with the researchers. No data extraction took place in the context of this study. Informed consent was waived by the institution, invoking public health and research interests, following the General Data Protection Regulation. No type of compensation was given to participants.

Results

Baseline Characteristics of Incident Population

The baseline characteristics of the control and suspected IV cohorts are described in Table 2.

The population on both cohorts was mostly female (83,636/154,145, 54.3% in the control and 23,521/36,835, 63.9% in the suspected IV cohort), average age was 32.7 (SD 23.6) in the control and 42.6 (SD 19.6) in the IV cohort.

Regarding patients' clinical history, there was a higher prevalence of both drug and alcohol abuse in the suspected IV cohort. The same was true for the major psychiatric disorders, chronic pain, sleep disorders, and the use of psychotropic drugs.

Regarding somatic health conditions, there was a higher prevalence of all studied conditions in the suspected IV cohort when compared to the control, with the biggest differences concerning cancer (1723/154,145, 1.1% in the control; 5704/36,835, 15.5% in the suspected IV cohort), hypertension (7131/154,145, 4.6% vs 13,343/36,835, 36.2%), and hypercholesterolemia (8401/154,145, 5.5% vs 13,819/36,835, 37.5%).

Table 2. Baseline characteristics of control and suspected violence cohorts[a].

	Control group (n=154,145)	Suspected IV[b] group (n=36,835)
Sex, n (%)		
Female	83,636 (54.3)	23,521 (63.9)
Male	70,509 (45.7)	13,314 (36.1)
Age (years)		
Mean (SD)	32.7 (23.6)	42.6 (19.6)
Range, n (%)		
10-19	31,275 (20.3)	1746 (4.7)
20-29	36,792 (23.9)	5906 (16)
30-39	31,892 (20.7)	8334 (22.6)
40-49	29,015 (18.8)	9739 (26.4)
50-59	25,171 (16.3)	11,110 (30.2)
Cohort components, n (%)		
Violence codes	108 (0.1)	1909 (5.2)
Violence registries	4665 (3)	34,985 (95)
Prior outcomes		
Health risk behaviors , n (%)		
Alcohol abuse	180 (0.1)	1001 (2.7)
Drug abuse	9 (0.1)	43 (0.1)
Mental health disorders , n (%)		
Major psychiatric disorder	4765 (3.1)	16,378 (44.5)
Posttraumatic stress disorder	22 (0.1)	69 (0.2)
Suicidal ideation	41 (0.1)	211 (0.6)
Chronic pain	493 (0.3)	4178 (11.3)
Headache	1640 (1.1)	2793 (7.6)
Sleep disorders	706 (0.5)	3884 (10.5)
Memory disorders	92 (0.1)	368 (1)
Eating disorders	71 (0.1)	79 (0.2)
Psychotropic drug use		
Sedatives	4399 (2.9)	9365 (25.4)
Antidepressants	3320 (2.2)	15,065 (40.9)
Anxiolytics	7987 (5.2)	22,304 (60.6)
Antipsychotics	1170 (0.8)	4154 (11.3)
Somatic health conditions , n (%)		
Type 2 diabetes mellitus	2983 (1.9)	1803 (4.9)
Hypercholesterolemia	8401 (5.5)	13,819 (37.5)
Metabolic dysfunction–associated steatotic liver disease	20 (0.1)	254 (0.7)
Hypertension	7131 (4.6)	13,343 (36.2)
Chronic kidney disease	398 (0.3)	653 (1.8)
Early heart disease	2538 (1.6)	1324 (3.6)
Asthma	2603 (1.7)	2393 (6.5)
Chronic immune inflammatory disorder	213 (0.1)	668 (1.8)

	Control group (n=154,145)	Suspected IV[b] group (n=36,835)
Cancer	1723 (1.1)	5704 (15.5)
Unspecified illness	1472 (1)	2986 (8.1)

[a]All patients were followed at the Local Health Unit of Matosinhos between January 1, 2008, and May 9, 2024, and aged between 18 and 59 years.

[b]IV: interpersonal violence.

## Health Outcomes 10 Years After the Episode of Suspected Violence

The results obtained from the 3650-day follow-up after the index date are represented in Figure 1 and Table 3.

For every outcome studied, the follow-up period for adult survivors of IV was consistently shorter compared to other adults. The shortest follow-up periods were observed for the use of anxiolytics (mean 1064, SD 1151), major psychiatric disorder (mean 1227, SD 1257), and hypercholesterolemia (mean 1241, SD 1171).

Health outcomes did come up earlier in survivors of IV, compared to adults who were not survivors of IV. The shortest times to event occurred in early heart disease (mean 43, SD 127), T2D (mean 123, SD 294), and hypertension (mean 381, SD 532).

The violence cohort had a higher HR of developing the outcomes studied, except for T2D (0.80, 95% CI 0.76-0.83). The outcomes that stood out, as they presented the highest HR values, were fatty liver disease (6.91, 95% CI 6.37-7.50), drug abuse (6.03, 95% CI 4.5-8.06), suicidal ideation (5.50, 95% CI 4.78-6.32), and major psychiatric disorder (4.46, 95% CI 4.38-4.53).

Figure 1. Health outcomes up to 3650 days postindex in the suspected violence cohort. All patients were followed at the Local Health Unit of Matosinhos between January 1, 2008, and May 9, 2024, and were aged between 18 and 59 years.
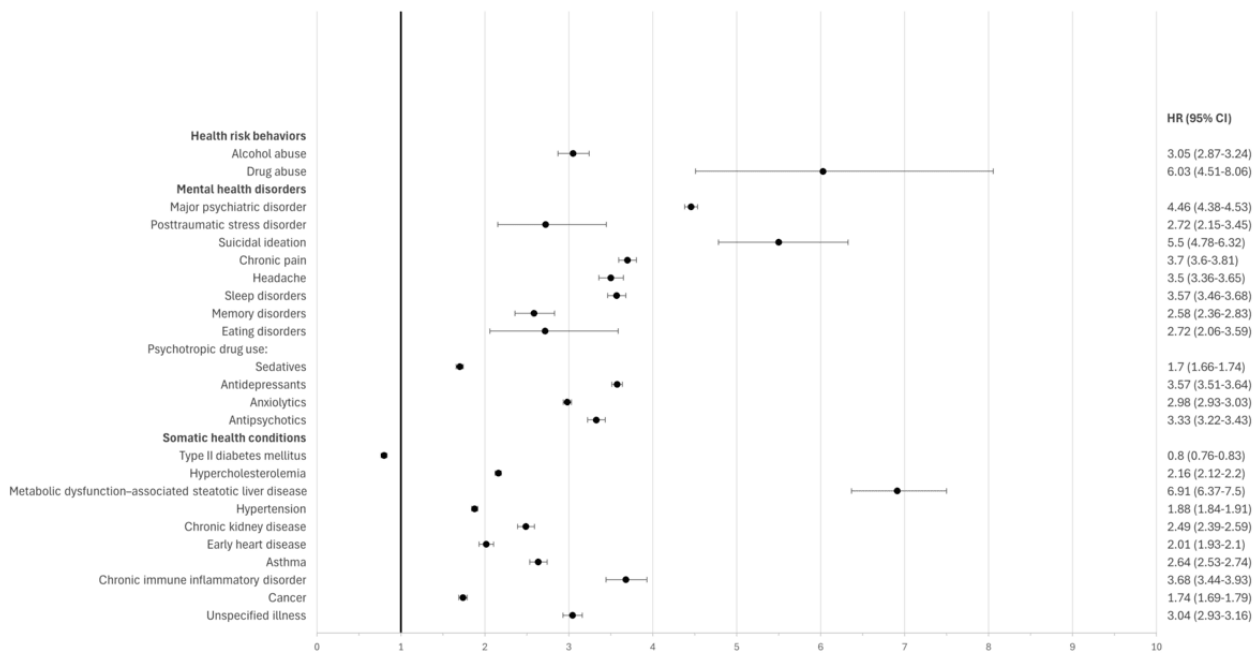
Table 3. Health outcomes after a suspected experience of IV in adults up to 10 years of follow-up[a].

	Ev/100PY[b]	Follow-up (days), mean (SD)	Time to event, mean (SD)	HR[c] (95% CI)
Health risk behaviors				
Alcohol abuse	0.53	2244 (1285)	1055 (941)	3.05 (2.87-3.24)
Drug abuse	0.03	2294 (1273)	1412 (1046)	6.03 (4.05-8.06)
Mental health disorders				
Major psychiatric disorder	16.34	1227 (1257)	642 (836)	4.46 (4.38-4.53)
Posttraumatic stress disorder	0.04	2293 (1274)	948 (931)	2.72 (2.15-3.45)
Suicidal ideation	0.11	2285 (1275)	1055 (990)	5.50 (4.78-6.32)
Chronic pain	3.25	2007 (1291)	1295 (1014)	3.70 (3.60-3.81)
Headache	1.25	2177 (1283)	1378 (989)	3.50 (3.36-3.65)
Sleep disorders	2.75	2048 (1292)	1274 (994)	3.57 (3.46-3.68)
Memory disorders	0.26	2273 (1275)	1554 (1062)	2.58 (2.36-2.83)
Eating disorders	0.02	2294 (1273)	981 (945)	2.72 (2.06-3.59)
Psychotropic drug use				
Sedatives	3.72	1924 (1318)	976 (970)	1.70 (1.66-1.74)
Antidepressants	13.36	1331 (1288)	672 (862)	3.57 (3.51-3.64)
Anxiolytics	20.95	1064 (1151)	646 (808)	2.98 (2.93-3.03)
Antipsychotics	2.56	2056 (1337)	900 (1017)	3.33 (3.22-3.43)
Somatic health conditions				
Type 2 diabetes mellitus	0.84	2174 (1328)	123 (294)	0.80 (0.76-0.83)
Hypercholesterolemia	16.00	1241 (1171)	808 (814)	2.16 (2.12-2.20)
Metabolic dysfunction–associated steatotic liver disease	0.45	2256 (1288)	996 (1092)	6.91 (6.37-7.50)
Hypertension	11.11	1342 (1325)	381 (532)	1.88 (1.84-1.91)
Chronic kidney disease	1.42	2174 (1298)	1176 (1121)	2.49 (2.39-2.59)
Early heart disease	0.60	2201 (1320)	43(127)	2.01 (1.93-2.10)
Asthma	1.20	2168 (1311)	844 (933)	2.64 (2.53-2.74)
Chronic immune inflammatory disorder	0.49	2245 (1288)	961 (1015)	3.68 (3.44-3.93)
Cancer	2.79	2026 (1324)	915 (997)	1.74 (1.69-1.79)
Unspecified illness	1.59	2133 (1291)	1242 (1003)	3.04 (2.93-3.16)

[a]All patients were followed at the Local Health Unit of Matosinhos between January 1, 2008, and May 9, 2024, and aged between 18 and 59 years.

[b]Ev/100PY: event rate per person-year.

[c]HR: hazard ratio.

Discussion

Principal Findings

The analysis of EHR data from adult users of ULSM revealed that patients who were suspected survivors of IV were more likely to develop negative outcomes when compared to the control cohort. This was true for the different health outcomes regarding health risk behaviors, mental health, and somatic conditions studied, except for T2D. In addition to reinforcing existing literature on the subject, we advanced a potential link between the experience of violence and the onset of MASLD.

We found that adult suspected survivors of IV were more likely to develop drug and alcohol abuse, respectively. This goes according to Rivara et al [6], Stubbs and Szoeke [12], Kyle [20], and Colaprico et al [21], which describe a relation between different types of IV and alcohol and substance use. Health risk behaviors, as substance abuse and alcohol abuse, may work as coping mechanisms to violence exposure [6,20,21], but it is important to note that this relationship is bidirectional. Substance abuse and worsened mental health may result in a higher risk of being a survivor of violence or inflicting harm on others [20].

According to WHO, "a mental disorder is characterized by a clinically significant disturbance in an individual's cognition,

emotional regulation, or behavior" [22]. In this study, adult suspected survivors of IV were more likely to develop each of the mental disorders studied. This goes according to other studies, such as Rivara et al [6], which summarizes the relation between intimate partner violence and depression, posttraumatic stress disorder, suicidal ideation, and chronic mental illness. Kyle [20] and Stubbs and Szoeke [12] describe similar findings, adding anxiety disorders and eating disorders, respectively. In this study, suspected survivors of IV were more likely to develop memory disorders, which is consistent with findings described by Campbell et al [23].

Sexual abuse is also related to depression, anxiety, sleep disorders, suicide, eating disorders, and posttraumatic stress disorders, according to Rivara et al [6]. Bullying and cyberbullying in the youth and children population seem to be linked to depression, anxiety, self-esteem, posttraumatic stress disorder, sleep disturbances, and headache [6]. Colaprico et al [21] described a relation between workplace bullying in adults and disorders as anxiety, depression, suicidal tendencies, and headache.

Another finding of this study was the higher likelihood of the use of psychotropic drugs. This finding seems to be directly related to the type of mental health disorders developed and their comorbidities, as these drugs may be part of a treatment strategy to respond to them.

Literature describes correlations between IV in adults and various health issues, including cardiovascular diseases, hypertension, elevated cortisol levels, cancer, sexually transmitted infections, a higher risk of developing cancer, gastrointestinal disorders, such as irritable bowel syndrome, and asthma [5-7,12].

Lin et al [24] found that children exposed to adverse childhood experiences had higher risks of dyslipidemia, asthma, liver disease, kidney disease, and arthritis, similar to our findings in the adult population.

We found a potential link between adult IV and MASLD. This possible correlation with violence has not yet been described in the literature for the adult population. However, a recent cross-sectional study found a moderate risk in men for specific forms of child maltreatment [25]. Recent studies have focused on the relation between NALFD and mental health disorders. Shea et al [26] described in their systematic review a high prevalence of depression, anxiety, and stress among adults with MASLD. Kang et al [27] concluded that higher perceived stress was independently associated with an increased prevalence of MASLD. Soto-Angona et al [28] have also come to the conclusion that MASLD is part of a complex system of mental and noncommunicable somatic disorders, with a shared underlying pathogenesis. This is based on common lifestyle and environmental risk factors, mediated by dysregulation of inflammation, oxidative stress pathways, and mitochondrial function.

This study found an inverse correlation between the experience of IV and T2D. Some studies have found a link between intimate partner violence and T2D [7,10,12]. Studies performed on adverse childhood experiences also correlate these experiences to the higher prevalence of T2D in childhood [29,30] This way, the lower HR of developing T2D in the IV cohort may be explained by a higher prevalence of the disease in children exposed to violence—a higher baseline prevalence could lead to lower incidence in adulthood as a bigger percentage of the cohort could have developed the disease prior to index date [30]. In this study, 4.9% of the IV cohort had T2D at the index date compared to only 1.9% of the control cohort.

Survivors of violence may be more susceptible to losing follow-up due to instability in their lives, which can result in missed appointments, relocation, or increased mortality, for example.

As previously said, the association between IV and negative health outcomes may be partially explained by the impact of chronic stress on various systems that regulate body homeostasis, particularly the HPA axis [5,8,16,31,32]. Hyperactivation of the HPA axis leads to neuroendocrine and immune disruption and altered systemic cortisol production [5,8,31]. Survivors of violence are at a higher risk of resurvivorization across their lifespan, exposing them to chronic and cumulative stress. This snowball effect may result in the negative outcomes explored in this study [16,32]. In fact, violence may even start before birth (intrauterine violence), in cases of violence against pregnant women, perpetuating through every phase of life, having a cumulative effect with tremendous consequences [16].

Even though it seems clear that violence is deleterious, we are still not able to comprehend the full extent of its consequences. Studies tend to address IV within each subtype of violence or a specific subgroup of the population, overlooking the intricate relation between different forms of violence and recurrent experiences of it. This limits our capacity to draw conclusions and compare patterns across diverse populations. A lot of studies have been done on children, trying to understand the direct impact of violence on health during childhood, but also its long-term consequences through their adult life [4,8,29-31,33-35]. There is also a great amount of literature regarding intimate partner violence, particularly among women [7,12,15,20,23,36-38]. However, there is limited research on other subtypes of IV. The body of research regarding men's health and violence is less robust than that for women [18], creating barriers in understanding the true burden in this sex and whether there are significant differences in response to violence between sexes.

Since multiple experiences of violence across a person's lifespan are common, we will only understand the full impact of IV by considering the co-occurrence and interconnections of the multiple experiences of it. Violence must be conceptualized from a dose-response perspective, considering the accumulation of exposure over time and across multiple domains [19]. Scott-Storey et al [32] propose an approach aligned with this. They developed a cumulative lifetime violence severity scale reflecting dimensions of type, focus (target or perpetrator), timing (childhood or adulthood), context, frequency, and degree of distress. This tool was designed only for men. Similar tools could be developed for both sexes, adjusting to each population,

allowing a profound understanding of violence's negative impact on health.

In this study, we chose to have a global approach to IV in adults, as we could not develop a dose-response perspective or differentiate each type of violence in each patient, due to the poor codification on this matter and the broad vocabulary used to describe it in EHR.

Our results underscore the significant burden of IV, which affects multiple facets of survivors' lives. Health consequences have their own repercussions that substantially diminish survivors' quality of life, affecting other spheres of life, such as job loss and career abandonment, or increased health care costs [1,15]. Violence is therefore conceptualized as a structural determinant of health. Its presence negatively impacts patients' health outcomes and self-development. Moreover, distinct patterns of cumulative lifetime exposure to violence result in varying degrees of symptom severity [13].

Violence screening represents a cost-effective prevention strategy that should be standard practice [39]. Several barriers prevent an effective detection of the cases: (1) survivors may struggle with disclosure due to shame, fear of being judged, of not being believed [40], or of violence escalation; (2) health care practitioners may face challenges such as insufficient time and skills to identify cases, discomfort, confidentiality concerns, or their own experiences with IV [39,40]; and (3) clinical-level factors may include inadequate information, lack of screening protocols, and insufficient support [39,40]. These constraints may lead to a misdiagnosis of cases. Furthermore, due to medical privacy and doubts associated with the case complexity, some situations might only be recorded in confidential registers, which may contribute to an apparent underidentification of IV cases, making it difficult to understand the full extent of the problem.

Since almost all clinicians across their practice will encounter patients who were survivors of IV, they should be trained with the necessary skills to identify and report these situations and respond appropriately, reducing their harmful consequences and preventing reoccurrence [37,39,40]. Public institutions must have a direct role in the prevention of violence, addressing underlying causes, and creating appropriate measures and programs that can give the needed support to survivors and their families.

A deeper understanding of the long-term consequences of IV enables an improvement in the approach to survivors in medical practice. By identifying the negative health outcomes that may arise from exposure to violence, clinicians can develop a proactive and targeted follow-up of survivors. An early detection of these pathologies and an understanding of the complex and multifaceted needs of survivors contribute to a more personalized, preventive, and effective medical care.

Limitations

Omission bias is possible due to certain aspects of this study. Physicians might not document or code all suspected IV cases they detect in the EHR. Additionally, they may choose to record these cases only in confidential health registers.

Given that the identification of suspected cases of IV was done through data from the EHR of adult users, we implemented comprehensive selection criteria and used a dual approach that integrates all relevant ICPC-2, *ICD-9*, and *ICD-10* codes, as well as all relevant clinical notes at every intervention point for any health care professional.

While we tried to include pertinent and broad terminology used by physicians to describe violence scenarios in clinical notes, it is not possible to account for the all variety of possible expressions that may have been used to describe a context of violence; as such, there may be a potential subestimation of violence-exposed patients in the respective cohort.

Furthermore, the variability in coding and terminology used to describe violence between countries and institutions may compromise the comparability and reproducibility of our findings when applied to different clinical settings.

Another potential limitation of this study is the reporting bias that may be associated with patients who are suspected of IV, as health care professionals may have a stronger tendency to report health care outcomes, especially those connected with mental health, regarding these patients.

In addition, given the fact that there is no methodical registration of variables as socioeconomic status, race or ethnicity, and educational level, it was not possible to adjust the data for these possible confounders; therefore, confounding bias may be present.

By including all the patients who met the inclusion criteria, without any additional exclusion criteria, we minimized selection bias and enhanced the detection of patients exposed to violence. Our comprehensive approach, encompassing all the eligible population at ULSM during the study period, resulted in a large and diverse sample, which strengthens the validity and generalizability of our findings.

A validation study of these data should be carried out. We intend to extend the study to other regions of Portugal and collaborate with research groups in other countries, which would allow us to assemble larger cohorts, conduct robust statistical analyses, and gain a deeper understanding of violence to improve prevention, intervention, and treatment. The use of real-world data is recommended as it provides the possibility of analyzing larger patient populations over longer timelines [41]. We also intend to compare the effects of IV between sexes and to develop study designs that incorporate the cumulative impact of violence across multiple domains and stages of life, while characterizing the studied populations with further socioeconomic demographic data such as profession, employment situation, level of education, and family structure.

Conclusions

This research has demonstrated that adults suspected to be survivors of IV are more likely to develop negative health outcomes than the general population. This was true for health risk behaviors, as well as for mental health and somatic conditions. Notably, this study introduces a novel perspective on the matter, suggesting that violence is linked with the development of MASLD.

Furthermore, adults suspected to be survivors of IV developed health outcomes earlier and had a shorter period of follow-up, compared to the adults with no exposure to violence. These findings highlight the complex impact of violence on health, underscoring the urgent need to address this endemic problem in society. Health providers play a crucial role in the early detection of cases, follow-up, and treatment of survivors of IV.

Future multicentric research (including international research groups) should focus on validating these findings, trying to have a dose-response perspective. Such efforts will enable more robust statistical analyses and a deeper understanding of violence's consequences, ultimately contributing to improved prevention, detection, and treatment strategies.

Data Availability

Data sharing is not applicable to this article as no datasets were generated during this study. Patient-level data used in this study are not publicly available, as the Zero Trust model was used. Researchers accessed only aggregated and anonymized results, ensuring full compliance with data protection, ethical, and privacy standards. This article incorporates all the available statistical results.

Conflicts of Interest

None declared.

References

1. Krug EG. World Report on Violence and Health. Geneva, Switzerland. World Health Organization; 2002.
2. Inquérito sobre segurança no espaço público e privado [Survey on safety in public and private spaces]. Instituto Nacional de Estatística. 2023. URL: https://ec.europa.eu/eurostat/web/products-statistical-reports/w/ks-ft-22-005 [accessed 2025-09-25]
3. Ziaei S, Hammarström A. The relationship between interpersonal violence in adulthood and mental health: a longitudinal study based on the Northern Swedish Cohort. BMC Public Health. 2023;23(1):637. [FREE Full text] [doi: 10.1186/s12889-023-15525-x] [Medline: 37013550]
4. Strathearn L, Giannotti M, Mills R, Kisely S, Najman J, Abajobir A. Long-term cognitive, psychological, and health outcomes associated with child abuse and neglect. Pediatrics. 2020;146(4):e20200438. [FREE Full text] [doi: 10.1542/peds.2020-0438] [Medline: 32943535]
5. Keeshin BR, Cronholm PF, Strawn JR. Physiologic changes associated with violence and abuse exposure: an examination of related medical conditions. Trauma Violence Abuse. 2012;13(1):41-56. [doi: 10.1177/1524838011426152] [Medline: 22186168]
6. Rivara F, Adhia A, Lyons V, Massey A, Mills B, Morgan E, et al. The effects of violence on health. Health Aff (Millwood). 2019;38(10):1622-1629. [doi: 10.1377/hlthaff.2019.00480] [Medline: 31589529]
7. Clemente-Teixeira M, Magalhães T, Barrocas J, Dinis-Oliveira RJ, Taveira-Gomes T. Health outcomes in women victims of intimate partner violence: a 20-year real-world study. Int J Environ Res Public Health. 2022;19(24):17035. [FREE Full text] [doi: 10.3390/ijerph192417035] [Medline: 36554916]
8. Neves I, Dinis-Oliveira RJ, Magalhães T. Epigenomic mediation after adverse childhood experiences: a systematic review and meta-analysis. Forensic Sci Res. 2021;6(2):103-114. [FREE Full text] [doi: 10.1080/20961790.2019.1641954] [Medline: 34377567]
9. Nguyen KA, Abrahams N, Jewkes R, Mhlongo S, Seedat S, Myers B, et al. The associations of intimate partner violence and non-partner sexual violence with hypertension in South African women. Int J Environ Res Public Health. 2022;19(7):4026. [doi: 10.3390/ijerph19074026] [Medline: 35409715]
10. Sanderson M, Cook M, Brown LL, Mallett V, Coker AL. Lifetime interpersonal violence or abuse and diabetes rates by sex and race. Am J Prev Med. 2023;65(5):783-791. [FREE Full text] [doi: 10.1016/j.amepre.2023.06.007] [Medline: 37302511]
11. Daníelsdóttir HB, Aspelund T, Shen Q, Halldorsdottir T, Jakobsdóttir J, Song H, et al. Adverse childhood experiences and adult mental health outcomes. JAMA Psychiatry. 2024;81(6):586-594. [doi: 10.1001/jamapsychiatry.2024.0039] [Medline: 38446452]
12. Stubbs A, Szoeke C. The effect of intimate partner violence on the physical health and health-related behaviors of women: a systematic review of the literature. Trauma Violence Abuse. 2022;23(4):1157-1172. [doi: 10.1177/1524838020985541] [Medline: 33541243]
13. Scott-Storey K, O'Donnell S, Perrin N, Wuest J. Cumulative lifetime violence, gender, social determinants of health and mental health in Canadian men: a latent class analysis. J Fam Violence. 2024;39(4):665-680. [FREE Full text] [doi: 10.1007/s10896-023-00502-0] [Medline: 38644980]

14. Csoboth CT, Birkás E, Purebl G. Living in fear of experiencing physical and sexual abuse is associated with severe depressive symptomatology among young women. J Womens Health (Larchmt). 2005;14(5):441-448. [doi: 10.1089/jwh.2005.14.441] [Medline: 15989417]

15. Johnson L, Chen Y, Stylianou A, Arnold A. Examining the impact of economic abuse on survivors of intimate partner violence: a scoping review. BMC Public Health. 2022;22(1):1014. [FREE Full text] [doi: 10.1186/s12889-022-13297-4] [Medline: 35590302]

16. Graça H, Frazão SL, Magalhães T, Vieira-Pinto P, Gomes J, Taveira-Gomes T. Health conditions in older adults suspected of being maltreated: a 20-year real-world study. J Clin Med. 2023;12(16):5247. [FREE Full text] [doi: 10.3390/jcm12165247] [Medline: 37629290]

17. Wilkins N, Myers L, Kuehl T, Bauman A, Hertz M. Connecting the dots: state health department approaches to addressing shared risk and protective factors across multiple forms of violence. J Public Health Manage Pract. 2018:S32-S41. [FREE Full text] [doi: 10.1097/PHH.0000000000000669] [Medline: 29189502]

18. Scott-Storey K, O'Donnell S, Busolo D, DiTommaso E, Malcolm J, Taylor P, et al. Cumulative lifetime violence severity, social determinants and anxiety in a national sample of Canadian men. BMC Psychiatry. 2022;22(1):265. [FREE Full text] [doi: 10.1186/s12888-022-03865-8] [Medline: 35421946]

19. Margolin G, Vickerman KA, Oliver PH, Gordis EB. Violence exposure in multiple interpersonal domains: cumulative and differential effects. J Adolesc Health. 2010;47(2):198-205. [FREE Full text] [doi: 10.1016/j.jadohealth.2010.01.020] [Medline: 20638013]

20. Kyle J. Intimate partner violence. Med Clin North Am. 2023;107(2):385-395. [doi: 10.1016/j.mcna.2022.10.012] [Medline: 36759104]

21. Colaprico C, Grima D, Shaholli D, Imperiale I, La Torre G. Workplace bullying in Italy: a systematic review and meta-analysis. Med Lav. 2023;114(6):e2023049. [FREE Full text] [doi: 10.23749/mdl.v114i6.14673] [Medline: 38060211]

22. Mental disorders. World Health Organization. 2024. URL: https://www.who.int/news-room/fact-sheets/detail/mental-disorders [accessed 2024-07-01]

23. Campbell JC, Anderson JC, McFadgion A, Gill J, Zink E, Patch M, et al. The effects of intimate partner violence and probable traumatic brain injury on central nervous system symptoms. J Womens Health (Larchmt). 2018;27(6):761-767. [FREE Full text] [doi: 10.1089/jwh.2016.6311] [Medline: 29083256]

24. Lin L, Wang HH, Lu C, Chen W, Guo VY. Adverse childhood experiences and subsequent chronic diseases among middle-aged or older adults in China and associations with demographic and socioeconomic characteristics. JAMA Netw Open. 2021;4(10):e2130143. [FREE Full text] [doi: 10.1001/jamanetworkopen.2021.30143] [Medline: 34694390]

25. Siewert-Markus U, Ittermann T, Klinger-König J, Grabe HJ, Stracke S, Völzke H, et al. Childhood maltreatment and risk of metabolic dysfunction-associated steatotic liver disease—evidence of sex-specific associations in the general population. J Psychosom Res. 2024;183:111829. [FREE Full text] [doi: 10.1016/j.jpsychores.2024.111829] [Medline: 38896985]

26. Shea S, Lionis C, Kite C, Lagojda L, Uthman O, Dallaway A, et al. Non-alcoholic fatty liver disease and coexisting depression, anxiety and/or stress in adults: a systematic review and meta-analysis. Front Endocrinol (Lausanne). 2024;15:1357664. [FREE Full text] [doi: 10.3389/fendo.2024.1357664] [Medline: 38689730]

27. Kang D, Zhao D, Ryu S, Guallar E, Cho J, Lazo M, et al. Perceived stress and non-alcoholic fatty liver disease in apparently healthy men and women. Sci Rep. 2020;10(1):38. [FREE Full text] [doi: 10.1038/s41598-019-57036-z] [Medline: 31913326]

28. Soto-Angona, Anmella G, Valdés-Florido MJ, De Uribe-Viloria N, Carvalho AF, Penninx BWJH, et al. Non-alcoholic fatty liver disease (NAFLD) as a neglected metabolic companion of psychiatric disorders: common pathways and future approaches. BMC Med. 2020;18(1):261. [FREE Full text] [doi: 10.1186/s12916-020-01713-8] [Medline: 32998725]

29. Hughes K, Bellis MA, Hardcastle KA, Sethi D, Butchart A, Mikton C, et al. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. Lancet Public Health. 2017;2(8):e356-e366. [FREE Full text] [doi: 10.1016/S2468-2667(17)30118-4] [Medline: 29253477]

30. Martins B. Adverse childhood experiences and health outcomes: a 20-year real-world study. 2023. URL: https://repositorio-aberto.up.pt/handle/10216/150662 [accessed 2024-06-28]

31. Novais M, Henriques T, Vidal-Alves M, Magalhães T. When problems only get bigger: the impact of adverse childhood experience on adult health. Front Psychol. 2021;12:693420. [FREE Full text] [doi: 10.3389/fpsyg.2021.693420] [Medline: 34335410]

32. Scott-Storey K, O'Donnell S, Wuest J, MacIntosh J, Merritt-Gray M. Cumulative lifetime violence severity scale: development and initial testing among men. BMC Public Health. 2020;20(1):418. [FREE Full text] [doi: 10.1186/s12889-020-08551-6] [Medline: 32228553]

33. Oberth C, Goulter N, McMahon RJ. The comparative and cumulative impact of different forms of violence exposure during childhood and adolescence on long-term adult outcomes. Dev Psychopathol. 2022;34(4):1313-1328. [doi: 10.1017/S0954579420002254] [Medline: 33779534]

34. Wiens K, Gillis J, Nicolau I, Wade TJ. Capturing risk associated with childhood adversity: independent, cumulative, and multiplicative effects of physical abuse, sexual abuse, and family violence on mental disorders and suicidality. Perm J. 2020;24. [FREE Full text] [doi: 10.7812/TPP/19.079] [Medline: 32240085]

35. Webster EM. The impact of adverse childhood experiences on health and development in young children. Global Pediatr Health. 2022;9:2333794X221078708. [FREE Full text] [doi: 10.1177/2333794X221078708] [Medline: 35237713]

36. Dicola D, Spaar E. Intimate partner violence. Am Fam Physician. 2016. URL: https://www.aafp.org/pubs/afp/issues/2016/1015/p646.html [accessed 2024-06-23]

37. Miller CJ, Adjognon OL, Brady JE, Dichter ME, Iverson KM. Screening for intimate partner violence in healthcare settings: an implementation-oriented systematic review. Implement Res Pract. 2021;2. [doi: 10.1177/26334895211039894] [Medline: 36712586]

38. Kifle ME, Aychiluhm SB, Anbesu EW. Global prevalence of intimate partner violence during the COVID-19 pandemic among women: systematic review and meta-analysis. BMC Womens Health. 2024;24(1):127. [FREE Full text] [doi: 10.1186/s12905-023-02845-8] [Medline: 38368323]

39. Jiang L, Sutherland MA, Hutchinson MK, Si B. A multi-center structural equation modeling approach to investigate interpersonal violence screening for public health promotion. Front Public Health. 2021;9:637222. [FREE Full text] [doi: 10.3389/fpubh.2021.637222] [Medline: 34178912]

40. Hegarty K, McKibbin G, Hameed M, Koziol-McLain J, Feder G, Tarzia L, et al. Health practitioners' readiness to address domestic violence and abuse: a qualitative meta-synthesis. PLoS One. 2020;15(6):e0234067. [FREE Full text] [doi: 10.1371/journal.pone.0234067] [Medline: 32544160]

41. Magalhães T, Dinis-Oliveira RJ, Taveira-Gomes T. Digital health and big data analytics: implications of real-world evidence for clinicians and policymakers. Int J Environ Res Public Health. 2022;19(14):8364. [FREE Full text] [doi: 10.3390/ijerph19148364] [Medline: 35886214]

Abbreviations

EHR: electronic health record
HPA: hypothalamic-pituitary-adrenal
HR: hazard ratios
ICD-9: International Classification of Diseases, Ninth Revision
ICD-10: International Statistical Classification of Diseases, Tenth Revision
ICPC-2: International Classification of Primary Care, 2nd edition
IV: interpersonal violence
MASLD: metabolic dysfunction–associated steatotic liver disease
T2D: type 2 diabetes mellitus
ULSM: Unidade Local de Saúde de Matosinhos
WHO: World Health Organization

XSL•FO
RenderX