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Health-Related Costs of Intimate Partner Violence: Using Linked Police and Health Registers

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Abstract

This study aims to estimate direct health-related costs for victims of intimate partner violence (IPV) using nationwide linked data based on police reports and two healthcare registers in Finland from 2015 to 2020 ($N = 21{,}073$). We used a unique register dataset to identify IPV victims from the data based on police reports and estimated the attributable costs by applying econometric models to individual-level data. We used exact matching to create a reference group who had not been exposed to IPV. The mean, unadjusted, attributable healthcare cost for victims of IPV was €6,910 per individual over the 5-year period after being first identified as a victim. When adjusting for gender, age, education, occupation, and mental-health- and pregnancy-related diagnoses, the mean attributable health-related cost for

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the 5 years was €3,280. The annual attributable costs of the victims were consistently higher than those for nonvictims during the entire study period. Thus, our results suggest that the adverse health consequences of IPV persist and are associated with excess health service use for 5 years after exposure to IPV. Most victims of IPV were women, but men were also exposed to IPV, although the estimates were statistically significant only for female victims. Victims of IPV were over-represented among individuals outside the labor force and lower among those who were educated. The total healthcare costs of victims of IPV varied according to the socioeconomic factors. This study highlights the need for using linked register data to understand the characteristics of IPV and to assess its healthcare costs. The study results suggest that there is a significant socioeconomic gradient in victimization, which could also be useful to address future IPV prevention and resource allocation.

Keywords
intimate partner violence, healthcare costs, public health, register-based approach

Intimate partner violence (IPV) is a serious preventable public health issue associated with both short- and long-term negative health consequences among the victims (Campbell, 2002; Krug et al., 2002). The prevalence of violence among women in Finland is one of the highest among EU countries. According to a survey, approximately 30% of women over the age of 15 have experienced physical or sexual violence by their current or ex-partner during their lifetime (European Union: European Agency for Fundamental Rights, 2014; Humbert et al., 2021).

A wide range of interdisciplinary literature has shown an association between exposure to violence and mental illness or other health conditions (Bacchus et al., 2018; Dillon et al., 2013; Trevillion et al., 2012). According to a Finnish population-based health survey, 7.6% of women had been exposed to violence in the previous year, which negatively influenced their quality of life and psychological well-being (Hisasue et al., 2020). Although the longitudinal research on the health consequences of IPV is limited, IPV victims are more likely to use health services, due to physical and mental health problems or comorbid health conditions, compared to those who have not been exposed to violence (Bonomi et al., 2009; Kruse et al., 2011; Rivara et al., 2007). This often leads to increased total healthcare costs.

Therefore, estimating excess direct healthcare costs of IPV is crucial for understanding the economic impact of both short- and long-term health consequences of IPV and for providing evidence to inform development of health policy for IPV victims.

Previous Research on IPV Costs

The issue of "costs" frequently emerges when assessing the burden of IPV or developing polices to combat it. Cost-of-illness (COI) is an economic analysis method often applied in violence research (Corso, 2009) with the aim to identify and estimate the costs of a particular disease or condition and to estimate the economic burden of a particular disease on society (Tarricone, 2006). COI usually includes two types of costs: direct and indirect costs. Direct costs refer to the amount that public sectors spend on services related to prevention and intervention against IPV, such as healthcare costs and costs of social or legal services. Indirect costs refer to productivity costs and immeasurable costs related to emotional and long-term effects on victims of violence (Chan & Cho, 2010). However, the research that included both direct costs and indirect costs of IPV remains limited (Corso et al., 2007; Peterson et al., 2017).

Violence is considered as a sensitive topic, and research is challenged by underreporting and lack of data in this field (Fraga, 2016). Thus, it is highly likely that previous studies or reports have underestimated IPV costs due to difficulties in including all related costs (European Institute for Gender Equality et al., 2015; Waters et al., 2004). Furthermore, health systems differ across countries, and salient topics such as unit costs, types of healthcare coverage, availability, and accessibility of healthcare also differ. These differences render it difficult to conduct international comparisons of IPV costs. In Finland, the total annual costs of domestic violence (DV) against women were estimated at approximately €50 million in 1998 (equivalent to €68 million in 2020), and healthcare (including both institutional and noninstitutional care) accounted for approximately 7% of these costs (Piispa & Heiskanen, 2001).

Theoretical Framework

The demand-for-health model by Grossman (1972) has been widely applied in the field of health economics. According to this model, individuals invest in their own health according to their own preferences. However, existing studies have rarely applied the Grossman model to mental health (Cronin et al., 2017) or violence research (Papageorge et al.,

2021). Some reasons for this gap are a lack of data, the measurement difficulties between the diagnosis of mental illness and the impact of treatment, or stigma (Cronin et al., 2017). For a victim of IPV, staying in a violent relationship can be considered as demand for mental health with a very short time preference, while seeking treatment within mental healthcare, and leaving the violent partner, could, in the context of the Grossman model, be regarded as a more long-term investment in health and safety. Furthermore, better health can positively affect future productivity. This could potentially incentivize violence victims to use health services. The Grossman model can be useful when analyzing the decision to stay with a violent partner, report, or seek treatment. However, for the complex associations between violence exposure and healthcare utilization, it should be supplemented by other theories.

Another theoretical framework is offered by the Anderson healthcare utilization model, which was developed by Anderson in 1995, and the expanded model aims at understanding factors related to the use of health services (Bradley et al., 2002). The model includes three stages: predisposing factors, enabling factors, and need. Predisposing factors including demographic characteristics such as age, or gender or cultural beliefs. Enabling factors include the availability of care or financial resources. Need associates with how individuals perceive their own health and functional state. The three factors above are relevant to DV research, since women seem more likely to suffer from IPV and more likely to have lower socioeconomic status, which may affect access to services (Yakubovich et al., 2018). In addition, IPV victims might not perceive their health problems and these factors affect service utilization.

Our hypothesis is that violence victims use health services to improve their expected health based on the Grossman model. The Anderson model was used as a point of reference when choosing variables to be included in the analysis.

Methodological Considerations

Despite considerable evidence indicating adverse health outcomes of IPV, economic evidence remains scarce. Cost studies have often applied different methodologies to estimate IPV costs, such as the top-down approach or econometric approach (Brown et al., 2008; Chan & Cho, 2010). The top-down approach is used to estimate IPV costs by multiplying the total health costs available from figures of IPV victims. In contrast, the econometric approach is used to quantify the excess healthcare costs of IPV from an individual perspective. Previous studies using econometric approaches have

mainly been conducted in the United States. These studies found that women who had been exposed to IPV had higher costs than nonvictims for a short term (up to 5 years) (Bonomi et al., 2009; Jones et al., 2006; Rivara et al., 2007). These U.S.-based studies employed surveys or interviews, whereas a Danish study used populationwide linked registers, including police and emergency room data, to identify victims of violence and estimate attributable costs (Kruse et al., 2011).

Use of Linked Register Data for IPV Research

There has been little empirical cost estimation research using multiple linked registers, although IPV victims can be identified from a variety of registers. Previous research on health service utilization tended to identify IPV victims from health registers, such as medical records or registers recording the use of emergency services (Hackenberg et al., 2017; Hinsliff-Smith & McGarry, 2017; Jónasdóttir et al., 2021; Kothari et al., 2015; Siltala et al., 2020; Singhal et al., 2021). However, healthcare system features determining whether victims of violence can disclose their experience of IPV to health professionals and receive appropriate care also need to be considered (Husso et al., 2021). Furthermore, IPV is often not well captured in healthcare settings because the primary focus is to provide treatment for physical injuries, and healthcare settings may lack the ability to collect information about perpetrators or the context of the violence (Nesca et al., 2021), resulting in underestimated IPV costs. For example, recent Finnish studies have indicated that IPV incidents are poorly documented or contain numerous missing codes in health records (Kivelä et al., 2019; Siltala, 2021).

IPV victims have different demographic characteristics or patterns of service use from linked criminal and health registers (Kruse et al., 2010; Nesca et al., 2021; Orr et al., 2022). A Canadian population-based study found that IPV victims who were identified from the criminal justice system were four times more likely to subsequently experience intentional injuries or violent deaths compared to nonvictims (Nesca et al., 2021). An Australian study revealed that mothers who were identified as victims of family violence and DV from linked health and police data had higher levels of socioeconomic deprivation than the national average (Orr et al., 2022). Hence, IPV victims who are identified in criminal registers might have specific demographic or clinical characteristics and patterns of health service use. In addition, using nationwide data based on police reports, high-risk groups or more serious IPV victims than general population surveys can be captured.

Contribution of the Current Study

The aim of this study is to address the methodological gap by estimating the attributable direct healthcare costs of IPV victims in Finland for up to 5 years after the initial violence event using individual-level data based on police reports linked with health registers and applying econometric analyses.

The main contributions of this study are as follows. First, we develop an identification method to estimate the direct health-related costs of IPV victims using a dataset based on police reports linked with national healthcare registers, where previous studies tended to use a single health data source. Second, we apply the bottom-up econometric methods, which involves primary care, secondary care outpatient visits, and hospital admissions. Finally, we investigate the impact of the social demographics and health-related factors of IPV victims.

Methods

Study Population

The IPV victims were identified from the police-reported crime register maintained by Statistics Finland. We included all individuals who lived in Finland at any point in time from January 1, 2015 to December 31, 2020 and possessed a personal identity (ID) code. IPV victims with more than one report of violence were only counted once per year, anchored to the first occurrence. The initial police records did not include information about the specific relationships between the suspects and the victims. Statistics Finland enabled linking of the data with other background information for both victims and suspects from other registers. Thus, this classification is not in accordance with the police's perception of IPV. In this paper, we use the term "perpetrator" instead of "suspect"; however, this term does not imply that a conviction has already taken place.

IPV victims were defined according to the relationships between the victims and the perpetrators: (a) spouse or cohabiting partner, (b) former spouse or former cohabiting partner, or (c) the victim and perpetrator having a common child. Statistics Finland created primary categories according to the victim–perpetrator relationships (e.g., if they were currently married/cohabiting or had been married/living together for the last 5 years). Only if the first two categories did not apply was having a "common child" checked. Thus, the three categories were mutually exclusive. We included all personal offences, such as assaults, petty assaults, rapes, robberies, deprivations of personal liberty, menaces, and persecutions toward an intimate partner, as IPV.

The study population was compared with a five times larger reference population selected using exact matching by age, gender, and year, derived from the Digital and Population Data Services Agency. The individuals matched in the reference group had not been reported to the police as IPV victims from 2015 to 2020.

Our original research plan was to use the data between 2010 and 2020 and link it with other register data. However, due to complex regulatory processes, it was difficult and time-consuming to obtain all relevant research permits from all necessary institutions. Therefore, we changed our original plan and used the data from the period between 2015 and 2020.

Healthcare Costs

We linked the main data based on police reports at the individual level with patient records in two nationwide healthcare registers in Finland. Healthcare costs were estimated using two healthcare registers: one covering specialized or secondary healthcare and the other covering primary healthcare.

Secondary Healthcare Costs

The Care Register for Healthcare includes all public sector inpatient care, specialist outpatient care, and day surgery (Sund, 2012). The costs of secondary healthcare were estimated using the Diagnosis-Related Groups (DRG) classification system with the cost values obtained from the Finnish Institute for Health and Welfare (THL). However, the DRG cost values for psychiatric visits are not available; in these cases, we used unit costs instead of the cost values.

Primary Healthcare Costs

The Register of Primary Healthcare visits contains information on all public primary care services provided in Finland since 2011 and includes health centers, school and student healthcare, maternity clinics, mental health services, physiotherapy, oral healthcare, substance abuse services, and home care. A large population of employees has access to privately produced outpatient primary healthcare services through the occupational healthcare system (Holster et al., 2022). Part of the private occupational healthcare service use was only included in 2020.

The costs for each visit were typically estimated using three different pieces of information: (a) service type, (b) occupational category, and (c) communication method (Mäklin & Kokko, 2017). If the service type was not

available, we applied a unit cost for a comparable service type. When the occupation could not be found from the source of the unit costs, we applied the unit cost for a similar occupation category, according to the occupation list in the relevant publication by Statistics Finland (2011).

Explanatory Variables

Socioeconomic and Sociodemographic Factors. We selected explanatory variables as predisposing factors according to the Anderson health utilization model (Bradley et al., 2002). Based on Yakubovich et al.'s (2018) study, we selected education and occupational status as the socioeconomic factors. Women are more likely to be exposed to violence, report health problems, and seek health services due to IPV (Bonomi et al., 2009; Ford-Gilboe et al., 2015). In contrast, the utilization of health services among male IPV victims has rarely received attention (Moore, 2021). Hence, it is useful to assess how healthcare costs differ between men and women. For victims, we used the values of age from the year of their first reported incident to the police from 2015 to 2020, and for those in the reference group, we used their age in the respective year.

Education was categorized into five groups, in line with the classification of Statistics Finland. Basic education means 9 years of education, which is the duration of mandatory basic education in Finland. Upper secondary level education means spending 11 to 12 years in basic education. Further education lasts 2 to 3 years after upper secondary education, for example, in specialist vocational education, but this definition excludes polytechnic degrees. Lower degree-level tertiary education means undergraduate degrees. Higher degree-level tertiary education comprises education with a duration of at least 5 to 6 years after upper secondary education and leading to master's degrees or higher degrees. Statistics Finland does not provide information about individuals with less than upper secondary education for research purposes and codes them as "missing."

Occupational status was classified into the following seven groups in accordance with Statistics Finland: manual workers, lower white-collar workers, upper white-collar workers, entrepreneurs, students, pensioners, and long-term unemployed. In addition, we kept observations in the "unknown" category if the personal ID codes matched with the primary police data, because foreigners who are outside the official labor force might belong to this category.

We found more mismatched cases of personal ID codes for both education and occupation data in the reference group (1.0% in the IPV victim group vs. 14.8% in the reference group). The main reason for the mismatched personal

ID codes was that we obtained the data on the reference group from a different data source. When we could not find personal ID codes in the primary data based on the police reports, we excluded them from further analyses.

Health-Related Factors. Based on the previous literature, we selected two health-related factors: pregnancy-related and mental health diagnoses (Bacchus et al., 2018; Dillon et al., 2013). In addition, violence-related International Classification of Disease (ICD-10) and its corresponding International Classification of Primary Care-2 (ICPC-2) diagnosis codes were assessed.

Our study population (19–54 years) included women of reproductive age (19–49 years). We assumed that healthcare costs are affected by age- and pregnancy-related conditions rather than disease or injury, as pregnancy and delivery could be the main reason for the hospitalization of women within the reproductive age group. To account for this, we created a dummy variable for any healthcare costs within ICD-10-chapter XV (O00-O99) from 2015 to 2020.

Mental health service use is one of the main cost drivers of IPV (Bonomi et al., 2009; Kruse et al., 2011). Because of the nature of IPV, we defined mental health service users from a broader perspective, as the victims might have used primary healthcare. Mental healthcare use was defined as having any contact within the previous year with secondary care psychiatric inpatient or outpatient services, or with primary care, with a diagnosis of any mental disorder [ICD-10-chapter V (F00-F99), ICPC-2-chapter P] or ICD-10 codes R45.0, R45.2, and R45.3, which correspond to ICPC-2-chapter P.

Statistical Analysis

We applied both descriptive and econometric approaches. According to Brown et al. (2008), the econometric method is a three-step process starting with the identification of IPV victims, followed by the estimation of attributable costs from individual-level health utilization data and the application of various multivariate analyses.

First, we estimated annual attributable costs from individual-level health register data at the entire population. Healthcare costs were aggregated into annual costs per individual and year. The total costs were the sum of secondary and primary healthcare costs. When estimating attributable healthcare costs, we compared the mean costs in each category for victims and the reference group. Attributable healthcare costs of IPV are defined as all healthcare costs among IPV victims minus the similar measure for the reference group. Second, we estimated attributable healthcare costs for up to 5 years among IPV victims who were first identified in 2016 and their matched reference

population. The rationale for using the 2016 identification year was that we could include the effects of previous mental health service use in 2015 and estimate the most prolonged period within our study period. We also compared the attributable costs between the entire sample and for the 99% quantile excluding the 1% of each group that used the services the most.

Healthcare costs are non-negative and right skewed with an excess number of zero costs. We applied generalized linear modeling (GLM) with a gamma link function, thus avoiding the need to transform the data because of the non-normal distribution of healthcare utilization (Manning & Mullahy, 2001). We also tested whether two-part models, where nonzero cost is modeled using GLM with a gamma link function, yielded different results. Cost estimates for each year were converted to 2020 prices, and the most appropriate health sector inflation index was used. All analyses were conducted using Stata BE (version 17; StataCorp LLC, College Station, Texas).

Sensitivity Analyses

We conducted four sensitivity analyses. First, acknowledging that healthcare service users may be different from nonusers, we excluded nonusers from the sample before computing healthcare costs. Second, we conducted a subgroup analysis by dividing the sample by gender. Third, we conducted another subgroup analysis by dividing the sample into previous mental health service users and nonusers. Finally, we excluded individuals who had violence-related health diagnoses among the reference group from 2015 to 2020, as these people seemed to have some types of violence experience and had contacts with health services.

Results

Sample Characteristics

During the study period from 2015 to 2020, we identified 21,073 IPV victims from the data based on police reports. In total, of the sample, 4,210 users (20.0%) were followed for all years after the first reports of IPV victims in 2015, 3,808 (18.1%) were observed for 5 years, 3,305 (15.7%) for 4 years, 3,294 (15.6%) for 3 years, 3,287 (15.6%) for 2 years, and 3,169 (15.0%) for 1 year.

Table 1 shows the distribution of the characteristics of IPV victims and the reference population. The mean age was 35.2 years [standard deviation (*SD*) 9.5 years], the majority of IPV victims (77.7%) were women and approximately 60% of the perpetrators were current spouses or cohabiting partners.

Table 1. Characteristics of Victims of IPV Who Were Reported to Police From 2015 to 2020.

Variable	IPV victims		Reference	
	N = 21,073	%	*N* = 105,171	%
Gender				
Men	4,708	22.3	23,540	22.4
Women	16,365	77.7	81,631	77.6
Age at the first report from 2015 to2020				
19–29	6,796	32.3	34,038	32.4
30–39	7,188	34.1	35,692	33.9
40–54	7,089	33.6	35,441	33.7
Cohabitation status				
Same household-dwelling unit	9,749	46.4		
Different household-dwelling unit	11,324	53.6		
Relationships with perpetrator				
Current spouse or cohabiting partner	12,383	58.8		
Former spouse or cohabiting partner	7,081	33.6		
The victim and perpetrator having a common child	1,609	7.6		
Types of violence				
Sex offences	433	2.1		
Homicide and bodily injury	17,977	85.3		
Offences against personal liberty	5,257	25.0		
Robbery and extortion	100	0.5		

(continued)

Table 1. (continued)

Variable	IPV victims *N* = 21,073	%	Reference *N* = 105,171	%
Reports between 2015 and 2020				
Once	16,544	78.5		
More than once throughout the entire period	4,529	21.5		
Education[a]				
Basic level	6,208	29.6	9,583	10.7
Upper secondary level	10,508	50.1	38,183	42.6
Short-cycle tertiary (further)	1,091	5.2	6,365	7.1
Lower degree-level tertiary	1,939	9.3	19,673	22.0
Higher degree-level tertiary	1,226	5.9	15,815	17.7
Occupation[b]				
Entrepreneur	819	4.6	4,600	6.0
Upper white-collar worker	1,114	6.3	13,446	17.6
Lower white-collar worker	4,020	22.6	25,842	33.9
Blue-collar worker	3,253	18.3	13,435	17.6
Student	1,647	9.3	6,155	8.1
Pensioner	907	5.1	2,263	3.0
Long-term unemployed	4,174	23.4	6,792	8.9
Unknown	1,879	10.6	3,795	5.0

Note. IPV = intimate partner violence.
[a]2015 to 2020 victims: *N* = 20,972, reference group: *N* = 89,619 (victims = 99%, reference group = 85%).
[b]2015 to 2019 victims: *N* = 17,813, reference group: *N* = 76,328.

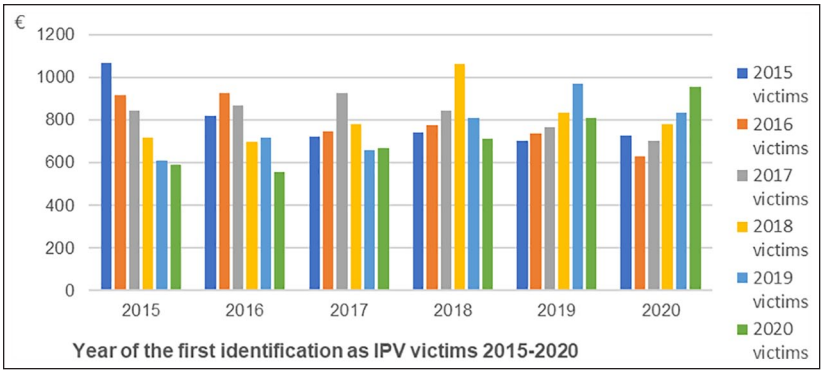

Figure 1. Mean annual attributable healthcare costs from 2015 to 2020 for the truncated population (excluding the top percentile).

Almost all IPV victims were found in either the chapter "homicide and bodily injury" (85.3%), mainly under "assault" or "petty assault," or the chapter "offences against personal liberty" (25.0%), mainly under "menace." Some of them were found in both chapters. The proportion of victims found in the chapter of "sexual offences in IPV" was approximately 2%.

One-fifth of the victims appeared more than once from 2015 to 2020. Compared to the reference group, IPV victims had lower educational attainment ($p < .001$). Regarding occupational status, the greatest difference between victims and the reference group was in terms of long-term unemployment (23.4% vs. 8.9%). The victims were more likely to be outside the labor force, students (9.3% vs. 8.1%), and pensioners or long-term unemployed (28.5% vs. 11.9%). Approximately 40% of the victims had a previous mental-health-related diagnosis before the first report of IPV from 2015 to 2020. Just over one-fifth of the victims had violence-related diagnoses, and approximately 1.4% of the reference group had violence-related diagnoses from 2015 to 2020.

Figure 1 shows the unadjusted attributable healthcare costs per year for IPV victims from 2015 to 2020 for the truncated population (excluding the top percentile of each group). The annual attributable costs for IPV victims were consistently higher than those for the nonvictims during the entire study period, also before the actual violence occurred. The mean attributable costs were the highest in the first identification year and then fell gradually in subsequent years.

Table 2 presents the results of GLM for victims who were identified in 2016 for the full and truncated populations. For the entire 5-year period

Table 2. Average Attributable Costs per IPV Victim for the 5 Years After IPV Events in 2016, for the Whole Population and Truncated Population, Euros-2020 Prices.

	The whole population		Top percentile excluded	
	N = 20,022		*N* = 19,822	
Variable	Attributable costs [95% CI]		Attributable costs [95% CI]	
Base: The reference group				
IPV unadjusted	6,910**	[2,010; 11,800]	5,620***	[5,060; 6,180]
IPV adjusted	3,280**	[1,280; 5,290]	2,850***	[2,360; 3,340]
Demographic variables				
Gender				
Base: Male				
Women	2,730***	[1,250; 4,200]	1,780***	[1,450; 2,110]
Age				
Base:19–29				
30–39	1,160	[−440; 2,760]	750***	[400; 1,110]
40–54	1,690	[−120; 3,500]	2,020***	[1,580; 2,460]
Education				
Base: Basic level				
Upper secondary	1,610	[−560; 3,770]	−230	[−760; 300]
Further	−760	[−3,720; 2,210]	−730	[−1,480; 22]
Lower degree-level tertiary	−2,050	[−4,330; 240]	−1,910***	[−2,480; 1,330]
Higher degree-level tertiary	−2,390	[−4,930; 140]	−2,420***	[−3,040; −1,810]

(continued)

Table 2. (continued)

	The whole population		Top percentile excluded	
	N = 20,022		*N* = 19,822	
Variable	Attributable costs [95% CI]		Attributable costs [95% CI]	
Occupation				
Base: Blue-worker				
Entrepreneur	200	[−1,920; 2,310]	−350	[−950; 240]
Upper white-collar worker	1,450	[−660; 3,550]	35	[−510; 580]
Lower white-collar worker	1,030	[−410; 2,460]	540*	[130; 950]
Student	4,900**	[2,110; 7,700]	1,620***	[960; 2,270]
Pensioner	32,920***	[18,760; 47,090]	6,500***	[4,890; 8,110]
Long-term unemployed	4,290***	[2,120; 6,460]	2,140***	[1,570; 2,720]
Unknown	3,310*	[560; 6,060]	560	[−90; 1,220]
Health-related variables				
Base: No mental-health-related diagnosis in 2015				
Mental-health-related diagnosis in 2015	12,370***	[9,610; 15,140]	5,980***	[5,430; 6,530]
Base: No Pregnancy-related diagnosis (2015–2020)				
Pregnancy-related diagnosis (2015–2020)	6,510***	[4,520; 8,500]	6,430***	[5,790; 7,070]

Note. IPV = intimate partner violence; 95% CI = 95% confidence interval.
*$p < .05$. **$p < .01$. ***$p < .001$.

after the initial violence event, the mean attributable cost was €6,910 per victim after the first reported events of IPV for the entire population. When we excluded the top percentile of the population, the mean attributable cost decreased to €5,620 per victim. After adjusting for age, gender, education, occupational status, and previous mental-health- and pregnancy-related service use from 2015 to 2020, the mean attributable cost of IPV decreased to €3,280 for the entire population and €2,850 for the truncated population. In the latter, women, older population, outside the labor force (students, pensioners, and long-term unemployed), and previous mental-health- and pregnancy-related service users had higher attributable costs. These results remained consistent when we used a broader definition of mental health service use (ICD-10 and ICPC-2) or a narrower definition (ICD-10) (results not shown).

As shown in Table 3, we conducted all analyses separately for men and women; the mean attributable costs for 5 years after the first violence report remained statistically significant for female victims but not for male victims. When we excluded individuals who had mental-health-related diagnoses from 2015 to 2020, the attributable costs were much lower, and the estimate remained statistically significant. In contrast, when we only included individuals who had mental-health-related diagnoses from 2015 to 2020, the mean attributable costs were much higher but not statistically significant. When we excluded individuals who had violence-related health diagnoses among the reference group from 2015 to 2020, the mean attributable costs remained statistically significant. In the data for 2016, there was a relatively low number of zero observations (1.1% for the IPV victim group and 5.2% for the reference group), and the results of the two-part models were similar to those obtained using GLM (results not shown).

Discussion

In this nationwide linked police and health register dataset, we found significantly higher direct healthcare costs among IPV victims compared to the reference population, who had not been exposed to violence, even after adjusting for the potential confounders (unadjusted cost: €6,910, adjusted cost: €3,280). The large difference between the adjusted and unadjusted costs further elucidated that individuals outside the labor force, individuals with lower level of education, and those with high mental-health-related diagnoses were overrepresented among the IPV victims, which were associated with increased total health costs. Most IPV victims were women, but men were also exposed to IPV, even though the estimates were statistically significant only for female victims. To our knowledge, this is the first Finnish study on this topic to use

Table 3. Subgroup Analyses of Attributable Costs per IPV Victim for the 5 Years after IPV Events in 2016, Euros, 2020-Prices.

Variable	Attributable costs	[95% CI]
1. Only women		
Base: reference group		
IPV unadjusted	7,600*	[1,600; 13,610]
IPV adjusted[a]	3,610**	[1,240; 5,980]
2. Only men		
Base: reference group		
IPV unadjusted	4,560	[−2,160, 11,290]
IPV adjusted[b]	2,310	[−400; 5,020]
3. Individuals who had mental-health-related diagnosis (2015–2020)		
Base: reference group		
IPV unadjusted	1,830	[−5,500; 9,170]
IPV adjusted[c]	3,670	[−570; 7,910]
4. Exclude individuals who have mental-health-related diagnosis (2015–2020)		
Base: reference group		
IPV unadjusted	1,390*	[52; 2,730]
IPV adjusted[d]	1,200*	[23; 2,390]

Note. GLM with a gamma link function. 95% CI = 95% confidence interval; GLM = generalized linear modeling; IPV = intimate partner violence.
[a]Adjusted for age, education, occupation, pregnancy- and mental-health-related diagnoses.
[b]Adjusted for age, education, occupation, mental-health-related diagnosis.
[c]Adjusted for age, education, occupation, pregnancy-related diagnosis.
[d]Adjusted for age, education, occupation, pregnancy-related diagnosis.
*$p < .05$. **$p < .01$.

a unique linked register dataset at the individual level and to facilitate an understanding of the extent and characteristics of IPV victims.

Our study highlighted that negative health consequences persist for 5 years after IPV events, which is in line with earlier research (Bonomi et al., 2009). This is an important finding because previous cost studies tended to use a single source of health utilization data or survey data, and the use of longitudinal data was rather limited. Self-report surveys are useful for capturing unreported IPV cases in registers or investigating nonserious IPV in the general population. However, conceptualizations of violence, nonresponse, or recall bias may affect the results. In a Swedish study, nonresponse bias was found for differences between the sample and sociodemographic characteristics (Simmons & Swahnberg, 2019). Our study population differed from the general population as it included serious physical violence. Nevertheless, substantial direct health-related costs were associated with the over-represented lower

socioeconomic characteristics among IPV victims. As health data already exist, our study design also reduced the recall bias. Hence, combining the two registers facilitates an understanding of the extent and characteristics of IPV.

The mean attributable costs were highest in the first identification year, which is in line with previous studies (Bonomi et al., 2009; Kruse et al., 2011). In our study, we used the calendar year, rather than the actual event dates of the IPV, to estimate costs. The rationale for this decision is that the reference group did not have an actual date, so for comparison purposes we chose to regard the entire year. Furthermore, some IPV victims might not use health services or report to the police immediately after violent events. An earlier study that linked health and criminal data found that 9% of injury hospitalizations and 26% of deaths happened within 1 week of the IPV incident date, whereas most injuries happened 1 year after the IPV incident (Nesca et al., 2021). We have individual-level data from 2015 to 2020; thus, even though we cannot be sure about earlier events, we could estimate healthcare costs before and after the latest violent events recorded in our data.

The attributable healthcare costs of IPV were observed even before the first report of IPV. A current Australian study of lifetime costs of IPV also reported that significant excess cost was observed before exposure to IPV; the study suggested delayed reporting of IPV (William et al., 2022). IPV is often described as a hidden crime; IPV victims in this population might have exposure to nonphysical violence or less severe physical violence before they report to the police. Furthermore, a Finnish study indicated that some incidents of IPV remain unrecorded in police reports (Fagerlund et al., 2017).

The estimation of total healthcare costs is not straightforward because of the asymmetry of the distribution and a high proportion of zero costs. A previous methodological study indicated that GLM with gamma link performed well for the estimation of population means of healthcare costs in most conditions (Malehi et al., 2015). However, the model choice also depends on the characteristics of the data (e.g., types of costs, age, or types of disease). We used GLM and compared it with the standard ordinary-least-squares-based model. Based on the model fit and a graphical illustration of the cost distribution, we selected GLM with a gamma link function as the best estimation of the mean healthcare costs in our data. Our data included a relatively small portion of zero costs; also, the results of the two-part model were similar to those of the GLM model. Therefore, we presented the results, including individuals with zero costs. We also presented the truncated population that excluded the top percentile of each group. In the latter analyses, we found lower attributable costs than those for the entire population. This finding indicates that there are a few costly outliers among the IPV victims in our data.

When we adjusted for the socioeconomic factors and health status, the attributable costs decreased. Healthcare costs generally increase with age. In addition, hospital delivery could be the main reason for the hospitalization of women of reproductive age. Therefore, adjusting for age- and pregnancy-related factors may render more reliable estimates of IPV costs because they capture these potential confounding factors.

Regarding socioeconomic factors, note that individuals in better socioeconomic positions have access to private primary healthcare services through the occupational healthcare system in Finland (Holster et al., 2022). As the present study included only part of the privately produced healthcare service use in 2020, it is difficult to assess the extent to which those in higher socioeconomic groups have used privately produced primary health services due to IPV. In contrast, a recent Finnish study showed that individuals in lower socioeconomic positions are less likely to use any healthcare service (Blomgren & Virta, 2020). Our study did not include information on the severity of health problems among IPV victims or patterns of primary and secondary healthcare use. We found that there was still an effect of violence on healthcare costs among IPV victims after adjusting for the socioeconomic factors.

Our study demonstrates that the healthcare costs for people with a history of mental health diagnoses are much higher than those for people without such diagnoses. The healthcare costs attributable to IPV also reduce when mental-health-related healthcare visits are excluded, which is in line with earlier research (Kruse et al., 2011). In addition, the causality between violence exposure and mental health outcomes is complicated; previous mental health diagnoses were associated with IPV, and vice versa (Devries et al., 2013). Thus, establishing whether there is a causal effect of violence exposure on mental illness is challenging due to the possible endogeneity. This study focuses on estimating total attributable costs rather than assessing causality.

Societal Implications

We identified more than 20,000 IPV victims from nationwide registers based on police reports from 2015 to 2020. However, register-based data have some limitations due to the potential underreporting or miscoding of IPV victims. Using national databases for health visits, we found that only approximately 20% of IPV victims had at least one violence-related health diagnosis in their health records during the study period. Hence, our study provides insights into a challenging area: the need to utilize linked register data to understand the characteristics of IPV and estimate its healthcare costs. As exposure to IPV negatively impacts health and well-being among victims and increases healthcare costs for society, utilization of existing registers can facilitate the

understanding of the characteristics of victims at high risk and provide salient information for the development of IPV policies and evaluation of implemented IPV-prevention strategies.

Multidisciplinary cooperation is required to understand the characteristics of both victims and perpetrators of IPV and to develop different types of IPV interventions, particularly for socially disadvantaged groups. Socioeconomic factors impact the risk of IPV exposure (Yakubovich et al., 2018), as substantiated by our study; we found a significant socioeconomic gradient among IPV victims. Socioeconomic factors are considered as predisposing factors in the expanded the Anderson's healthcare utilization model. However, our study did not include some important sociodemographic information, such as nationality or region, and the study period was relatively short. Other unobservable factors, that may impact on time preferences and demand for health, such as victims' cultural beliefs, attitudes toward seeking help, or health literacy among violence victims, might be barriers to accessing timely healthcare utilization.

In addition, we found more pregnancy-related diagnosis codes among IPV victims. Exposure to IPV may be associated with adverse health consequences among children. Therefore, knowledge of direct healthcare costs and the link between socioeconomic characteristics and IPV from multiple data sources is central for developing targeted prevention policies and prioritizing resource allocation. Further research could be directed toward investigating perpetrators' socioeconomic backgrounds or information about the children of IPV victims using national registers.

Strengths and Limitations

The main strength of the present study is that it provides a newer comprehensive view of IPV costs than could be investigated through a health register or self-report survey data alone. Finnish health registers are considered comprehensive, high-coverage national-level data (Sund, 2012).

However, our study has some limitations related to the register-based approach. First, we only assessed the data from 2015 to 2020. This population might have been exposed to IPV or had previous mental-health-related diagnoses before 2015, rendering any assessments of incidence or causality unfeasible. Second, although we successfully identified IPV victims from the data based on police reports linked with health data, we did not capture all IPV victims due to their potential underreporting or miscoding. No register has been primarily designed to identify IPV victims, police records also focus on perpetrators rather than victims; therefore, the data quality may not be optimal for the purpose of researching IPV. Finally, we matched the reference group by age, gender, and year but found that people with lower education

and out of the labor force had a higher occurrence of IPV than the reference group, meaning that the match could have been improved by including occupational status and education. However, the many missing values for occupation (10.6%) in the victim group would have been a challenge. These numerous missing values are attributable to the fact that foreigners may not be sufficiently registered in these registers.

Conclusion

Our study demonstrated that the IPV victims identified in the register based on police reports had significantly higher healthcare costs than those not exposed to IPV over a 5-year period after the initial violence event. Health-related costs attributable to IPV were substantial in the year of identification as IPV victims. IPV includes both individuals suffering from physical and psychological threats and costs for society. Our study also highlighted the strengths of using multiple linked registers to understand the characteristics of IPV and quantify the associated healthcare costs. The results of our study indicate a significant socioeconomic gradient in victimization, which could also be addressed in future early intervention and prioritizing prevention policy efforts toward IPV. Furthermore, IPV continues to impose an economic burden on society; evidence about violence victims in lower socioeconomic positions or who have pre-existing mental health disorders and incur high health-related costs can help policymakers to allocate resource effectively.

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Data Availability Statement

The datasets used in this study are not publicly available due to the confidential nature of the healthcare data involved; this restriction has been determined by GDPR and Finnish legislation.

Declaration of Conflicting Interests

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Compliance With Ethical Standards

Since our data are based entirely on register data, Tampere University and THL suggested that ethical review is not required. All authorities (National Police Board, THL, and Statistics Finland) have processed the application and approved the use of the register data underlying this study, THL (THL/6621/6.02.00/2020), the National Police Board (POL-2019-70247), and Statistics Finland (TK/2496/07.03.00/2021). All methods were conducted in accordance with relevant guidelines and regulations.

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