The Costs of External Deaths*

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October 29, 2026

Abstract

Nearly 5 million people die from external causes every year worldwide. This paper quantifies the causal effects of these deaths on surviving family members in a region of the world where they are most prevalent. Using administrative data from Colombia, I find that an external death raises survivors' probability of mental health diagnosis by 90%, spending on mental health services by 25%, and mortality risk triples. Effects are larger than those following a natural death, indicating that the consequences extend beyond bereavement. The additional healthcare spending caused by each death amounts to 2.5% of a health insurer's annual per-capita revenue.

Keywords: External-cause deaths, Bereavement, Mental health, Healthcare spending.

JEL codes: I10, I12, I14.

*In loving memory of Andrés Felipe Serna Borrero. Contact information: Stanford University, Department of Health Policy, nserna@stanford.edu. I thank the Colombian Ministry of Health and Social Protection for providing access to the data. I also thank Maria Polyakova for encouraging me to write this paper. The findings do not reflect the views of any institution involved.

1 Introduction

Every year there are approximately 5 million external-cause deaths (homicides, suicides, and accidents) around the world (World Health Organization, 2024), concentrated in Latin America, Africa, and the East Mediterranean (World Health Organization, 2026). Each death leaves behind numerous grieving family members who may suffer both short and long-term impacts as a result of these traumatic events. Most causal evidence linking deaths to the health and economic outcomes of surviving relatives has focused predominantly on high-income countries (Martikainen and Valkonen, 1996; Van den Berg et al., 2017; Bharadwaj et al., 2021; Fadlon and Nielsen, 2021; Fadlon et al., 2026a; Jensen and Zhang, 2026; Cabral et al., 2026), missing regions of the world where external-cause ("external" for short) deaths are more prevalent.

This paper addresses the gap in the literature by quantifying the consequences of external deaths on surviving family members' outcomes focusing on a country where these deaths are highly prevalent, Colombia (World Health Organization, 2026). Colombia has rich administrative data to conduct this study, linking individual-level health insurance enrollment, health claims, death certificates, and labor market outcomes for nearly 25 million people. These data allow me to characterize the health and economic impacts of external deaths on surviving relatives, and measure the costs that these deaths impose on the health system as a whole.

Colombia has a universal health insurance system organized around two regimes: contributory and subsidized. The contributory regime covers workers who make payroll contributions, along with their dependents, and accounts for roughly half of the population. The subsidized regime, fully funded by the government, covers low-income households and accounts for the other half. The data for this study come from the contributory regime, whose enrollment records link dependents to contributors and thereby allow me to identify families.

My empirical design leverages the quasi-random (and staggered) timing of external deaths across families. I estimate event studies comparing surviving family members who experience a relative's external death at different points in time, following each

individual over the years surrounding the death. The outcomes span four domains: enrollment in the contributory regime; mental health, including the likelihood of a mental health diagnosis, spending on mental healthcare, and use of psychotropic medications; economic circumstances, measured by days worked; and, the survivors' own mortality.

I find that a relative's external death impacts survivors' access to health insurance. The probability of remaining in the contributory regime falls by 30 percentage points (p.p.) on average, and the decline is larger when the decedent was the family's contributor. This pattern is consistent with the demographics of external deaths: relative to those who die of natural causes, external-cause decedents are disproportionately young men and the household's contributor.

The death also produces an immediate deterioration in survivors' mental health. Over the three years following the death, the probability of receiving a mental health diagnosis rises by 2.2 p.p. on average, a 90% increase over the pre-death mean. The increase is concentrated in mood disorders and in anxiety and stress-related disorders, with no change in diagnosed substance use. Mental healthcare spending rises by roughly 25%, driven by the extensive margin of new diagnoses and by a doubling of anxiolytic prescriptions but, conditional on receiving a diagnosis, the price of care is constant.

Beyond mental health, a relative's external death raises survivors' own mortality. Relative to matched survivors of natural deaths, the annual probability of dying triples from a baseline of 0.1% and treatment effects are increasing over time. The labor market consequences are also meaningful: the surviving contributor's days worked fall by 19 in the year of the death and by 10 in the following year. The fact that the effect persists into the second year suggests that the response goes beyond the time taken for funeral arrangements and other affairs, and reflects spells out of formal employment.

The effects listed above are not just the result of bereavement, but external deaths impose an additional burden on families. Natural deaths also worsen survivors' mental health but the effects of external deaths are two to five times larger. For example, while natural deaths increase mental healthcare spending by 10% relative to the pre-death mean, external deaths increase it by 25%. Similarly, the likelihood of being diagnosed with an anxiety and stress-related disorder increases 0.5 p.p. following a natural death and 1.2

p.p. following a external one. These findings are consistent with the clinical literature on traumatic loss, in which suddenness of a death compound grief (Kristensen et al., 2012).

Within external deaths, suicides produce the largest and most persistent responses per death, followed by accidents and then homicides. In the year after the death, for instance, the likelihood of a mental health diagnosis rises by 5 p.p. following a relative's suicide (roughly double the pre-death mean) compared with 3 p.p. after an accidental death and 1.6 p.p. after a homicide.

The burden of external deaths is unevenly shared within families. Mental health effects are stronger among female survivors than male ones. Women's probability of a mood disorder diagnosis rises three times as much as men's. Because women are more likely to seek care for mental health conditions at baseline, this difference may reflect larger underlying effects, differential care-seeking, or both. Estimates also suggest that the mental health response is concentrated among older family members, which are likely parents of the young individuals that external deaths tend to strike. Effects are otherwise stable across the deceased's own characteristics, indicating that who is lost matters less for survivors' mental health than who survives.

Extrapolating my estimates to the population, the additional mental healthcare spending induced by external deaths amounts to 4.5% of an affected household's monthly income and roughly 2.5% of the risk-adjusted capitation payment that insurers receive per enrollee. These figures likely understate the true mental health burden, since they capture only the care survivors actually receive. Unmet mental healthcare need is probably substantial, since mental illness still carries considerable stigma in Colombia (Campo-Arias et al., 2014). The costs of an external death therefore do not end with the victim but persist in the health and finances of the family left behind.

My paper relates most directly to the literature on the family spillovers of death and severe health shocks (Van den Berg et al., 2017). A long line of work documents excess mortality and morbidity among bereaved spouses, also known as the "widowhood effect" (Rees and Lutkins, 1967; Martikainen and Valkonen, 1996; Christakis and Allison, 2006; Espinosa and Evans, 2008). Recent studies using administrative data trace the consequences of a relative's death or illness for survivors' health, labor supply, and household finances

(Cas et al., 2014; Heinesen and Kolodziejczyk, 2013; Fadlon and Nielsen, 2021; Stephens and Toohey, 2022; Biasi et al., 2023; Liu et al., 2023; Arteaga et al., 2025; Altındağ et al., 2026; Fadlon et al., 2026a,b; Jensen and Zhang, 2026). Nearly all of this evidence comes from high-income countries where external-cause deaths are rare, so the deaths studied are overwhelmingly due to illness and old age and tend to over-represent parental deaths. I extend this literature in two ways: first, I study bereavement in a middle-income country with one of the world's highest burdens of external deaths, and second, I exploit family links in insurance enrollment to examine effects on the full family unit rather than spouses alone.

A second literature examines the consequences of exposure to violence. Existing causal evidence focuses on either survivors of discrete mass-violence events in high-income settings (such as mass shootings (Bharadwaj et al., 2021) and school shootings (Cabral et al., 2026)) or on in-utero and intergenerational effects of stress, grief, and conflict (Black et al., 2016; Persson and Rossin-Slater, 2018; Currie et al., 2022; Akresh et al., 2023; Akbulut-Yuksel et al., 2025). A large clinical literature suggests that external deaths are unique in their effects: bereavement following homicide, suicide, or accident is associated with more severe and prolonged grief and higher rates of post-traumatic stress disorder and depression than natural-death bereavement (Kaltman and Bonanno, 2003; Krug et al., 2002; Rivara et al., 2019). This evidence, however, comes from small, self-selected survey samples with self-reported outcomes and in many cases there is no longitudinal design, leaving open whether the manner of death causally shapes survivors' trajectories. To my knowledge, no study has estimated the effects of external deaths on surviving family members at the population level, in the context in which most of the world's lethal violence and accidents occur nor its consequences on health systems.

My paper makes three contributions to this end. First, I provide causal, population-level estimates of the effect of a relative's external death on survivors using administrative data covering millions of Colombian families. Second, by estimating identical event study designs for external and natural deaths, I show directly that the manner of death matters. Specifically, mental health effects are substantially larger following external deaths, consistent with the trauma of sudden, unanticipated loss rather than bereavement

per se. Third, I provide this evidence from a region of the world where these deaths are concentrated. Colombia is a middle-income country where homicide is a leading cause of death among working-age adults, followed by accidents (Acosta and Romero-Prieto, 2014). Beyond quantifying a largely invisible component of the social cost of violence, these estimates speak to the design of victim-support policies and to the burden that violence poses on health systems as a whole.

2 Background

Deaths from external causes have been a persistent feature of Colombia's recent history. During the 1990s and early 2000s, violence drove this mortality burden. Homicide rates exceeded 50 per 100,000 residents and reached approximately 80 per 100,000 at the 2002 peak, roughly 32,000 homicides in that year alone (Figure 1, Panel A). Although homicides have declined markedly since, Colombia recorded 13,496 homicides in 2024, a rate of 25.7 per 100,000 residents, and still among the highest in Latin America.[1] The country is also distinctive for the prevalence of targeted killings, including contract homicides (*sicariato*) and the selective assassination of social leaders, ex-combatants, and union members, which grew by 40% between 2015 and 2024.[2] Because these killings follow victims rather than territory, homicides are not confined to peripheral rural areas with guerrilla or paramilitary group presence but occur across the national territory (Figure 1, Panel B).

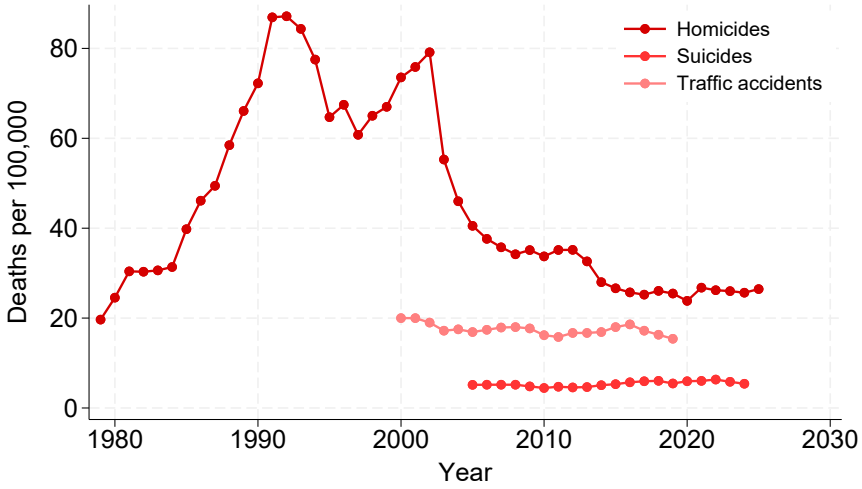
Homicides, however, account for only half of Colombia's toll of external-cause deaths. Traffic accidents claim roughly 8,000 lives per year (World Bank, 2026), and nowadays approaches two-thirds of the homicide count. Suicides add approximately 3,000 deaths annually, with rates increasing steadily since the mid-2010s. Together with fatal falls, drownings, and poisonings, these causes mean that in any given year, as many Colombians die from non-violent external causes as from homicide.

[1] Chile's homicide rate was 5.5 and Brazil's 21.1 in 2024 (InSight Crime, 2025).

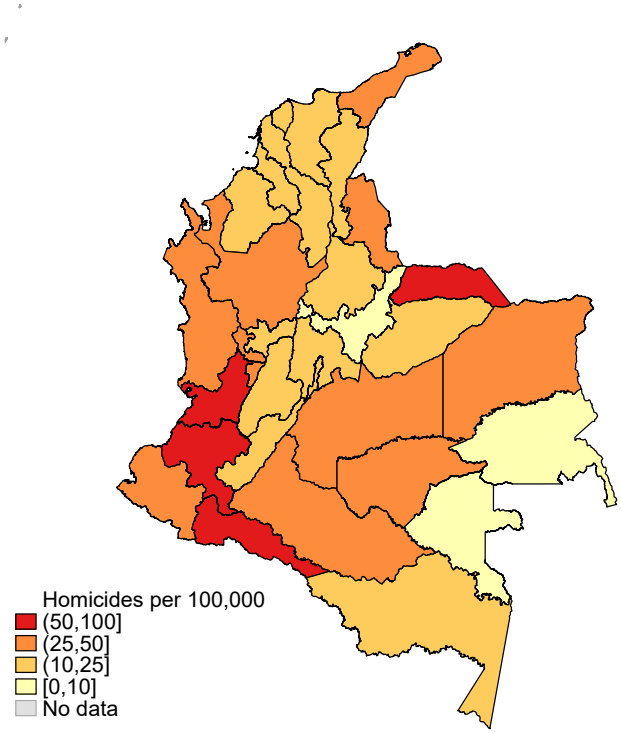
[2] El Tiempo https://www.eltiempo.com/justicia/delitos/colombia-se-encuentra-ante-un-nuevo-ciclo-de-violencia-homicida-analisis-de-hugo-acero-3524835.

FIGURE 1: Trends and Geographic Distribution of Violent Mortality in Colombia

(A) Mortality rate by manner of death



(B) 2018 homicide rate per department



Note: Panel A shows the trend in homicides, suicides, and deaths due to traffic accidents by 100,000 people in Colombia. Homicide information comes from the *Policía Nacional*, suicides from https://www.asivamosensalud.org/indicadores/salud-mental/tasa-de-suicidio-georeferenciado, and traffic accidents from World Bank (2026). Panel B shows the 2018 homicide rate per 100,000 people by department. Data comes from the *Policía Nacional*.

A common feature of external deaths is their suddenness. These deaths typically arrive without warning, foreclosing the anticipation, caregiving, and preparation that precede

most deaths from illness and old age. The consequences for surviving family members may therefore differ from those of a natural death. Yet while these consequences have been widely studied for surviving spouses, little is known about the effects on entire family units, or about whether losing a relative to an external cause in fact differs from losing one to natural causes.

Answering these questions requires linking victims to their family members and following relatives' health and economic outcomes over time. Colombia's health system offers an unusual opportunity to conduct this study. Since Law 100 of 1993, the country has a system of universal health insurance in which formal sector workers and their dependents are covered through the contributory regime, and low-income households are covered through the subsidized regime. Crucially for my purposes, enrollment records define family units: dependents (*beneficiarios*) are registered under a contributing member (*cotizante*), allowing me to observe entire families, link them to death certificates, and track survivors' healthcare utilization, diagnoses, and labor market outcomes before and after a death.

3 Data

I use four administrative data sources from the Colombian Ministry of Health and Social Protection. The first is the *Base de Datos Única de Afiliados* (BDUA), the national insurance enrollment registry, from which I have annual June snapshots covering both the contributory and subsidized regimes from 2013 to 2019. Each record reports the enrollee's age, sex, municipality of residence, and insurer, along with a person identifier and the identifier of the contributing member (*cotizante*) under whom the person is enrolled. All individuals registered under the same contributor constitute a family. A limitation is that family links are observed only between a contributor and their dependents. Families in which every member is a contributor therefore cannot be linked, and additional contributors within a family can only be connected if the survivor was previously a dependent.

The second source is the *Base de Suficiencia*, which contains the universe of outpatient, inpatient, and pharmaceutical claims for individuals in the contributory regime from 2013

to 2019. I do not have health claims for the subsidized regime. Each observation is a claim, reporting the service date, provider, insurer, price, and associated ICD-10 diagnosis code.

The third source are death certificates for 2013 to 2019 for all the country (including both contributory- and subsidized-regime enrollees), which report the type of death (fetal and non-fetal), date and manner of death (natural or violent), the municipality where the death occurred, and the age, sex, and municipality of residence of the deceased. External deaths include homicides, suicides, and accidental deaths (traffic accidents, fatal falls, drownings, or poisonings).

The fourth source is the *Planilla Integrada de Liquidación de Aportes* (PILA), the payroll contribution registry, which reports number of days of contribution (a proxy for days worked) from 2013 to 2019. By law, all workers earning at least the minimum wage must enroll in the contributory regime, and noncompliance carries financial penalties. PILA therefore covers effectively the universe of formal-sector workers and, by definition, dependents cannot earn separate income above the minimum wage. Person identifiers are the same across the four databases allowing me to track individuals and their outcomes over time.

Sample restrictions. To analyze impacts on healthcare use, I restrict the sample to surviving family members who are enrolled in the contributory regime throughout their time in the data, since health claims are observed only for this regime. To limit compositional changes, I further require continuous enrollment, defined as individuals who appear in every annual snapshot between their first and last year in the enrollment records. The resulting panel is unbalanced, as individuals may enter or exit the data in different years, but contains no enrollment gaps. As a robustness check, I also estimate the models on a fully balanced panel of individuals enrolled in every year.

When the deceased was the family's contributor, surviving members may leave the contributory regime, either by moving to the subsidized regime or by losing coverage altogether because their enrollment was tied to the decedent's labor market status. For the enrollment analysis, I therefore draw on records from both the contributory and subsidized regimes and construct a balanced person-year panel that indicates, for each year, whether

the individual was enrolled in the contributory regime, enrolled in the subsidized regime, or not enrolled at all. Even though enrollment in any regime is mandatory, individuals might still have disenrollment spells if they haven't gone through the administrative process of switching to the subsidized regime when eligibility in the contributory regime is lost. I also re-estimate the healthcare utilization results on this unrestricted sample as an additional robustness check. Appendix Table 1 details the sample construction and reports the sample sizes remaining after each restriction.

Outcomes. The outcomes in my analysis capture the insurance, health, and economic experience of family members following a relative's death. The first set of outcomes measures enrollment in the contributory regime. The second set of outcomes measures mental health. Using the ICD-10 diagnosis codes attached to each claim, I construct indicators for three categories of conditions: mood disorders, including depression (F30–F39); anxiety and stress-related disorders (F40–F48); and substance use disorders (F10–F19). I define an overall mental health diagnosis as the union of these three categories. For each category, I also measure an extensive margin, defined as having any diagnosis in a given year, and an intensive margin, defined as total spending on claims carrying these codes. I complement the diagnosis measures with treatment take-up which include indicators for filling a prescription for psychotropic medications (identified from ATC codes N06A), anxiolytics (N05B), and antipsychotics (N05A).

The third set of outcomes captures broader health consequences. Following Riascos et al. (2014), who map ICD-10 codes to chronic conditions, I construct an indicator for a chronic disease diagnosis in a given year. Because vital statistics cover the universe of deaths in the country, I also examine mortality among surviving family members. Finally, I examine surviving contributors' days worked, motivated by evidence that bereavement, and the deterioration in mental health that can accompany it, reduces labor supply and productivity (Van den Berg et al., 2017).

Summary statistics. Table 1 reports summary statistics for surviving family members, by the manner of their relative's death and for the period before the death. An observation

TABLE 1: Summary Statistics of Survivors Before Relative's Death

Variable	All deaths		External death type		
	External (1)	Natural (2)	Homicide (3)	Suicide (4)	Accident (5)
Male	0.490	0.417	0.513	0.488	0.476
	(0.500)	(0.493)	(0.500)	(0.500)	(0.499)
Age	29.87	57.79	26.26	29.31	32.40
	(20.58)	(24.35)	(17.39)	(19.66)	(22.33)
Mental health diagnosis	0.026	0.038	0.024	0.041	0.023
	(0.158)	(0.191)	(0.152)	(0.199)	(0.148)
Depression diagnosis	0.012	0.020	0.008	0.026	0.010
	(0.108)	(0.140)	(0.090)	(0.160)	(0.099)
Anxiety, stress-related diagnosis	0.014	0.022	0.013	0.020	0.013
	(0.116)	(0.147)	(0.111)	(0.138)	(0.113)
Substance use disorder diag.	0.005	0.002	0.006	0.006	0.003
	(0.067)	(0.039)	(0.078)	(0.080)	(0.054)
Mental healthcare spending	0.009	0.010	0.009	0.021	0.005
	(0.198)	(0.342)	(0.223)	(0.319)	(0.121)
Antidepressants	0.244	0.934	0.170	0.253	0.289
	(1.494)	(3.609)	(1.157)	(1.509)	(1.671)
Anxiolytics	0.019	0.077	0.011	0.044	0.018
	(0.416)	(0.835)	(0.304)	(0.663)	(0.389)
Antipsychotics	0.080	0.309	0.058	0.097	0.089
	(1.009)	(1.883)	(0.923)	(1.209)	(1.000)
Days worked	326.24	252.75	330.02	347.25	318.05
	(148.76)	(197.19)	(135.34)	(146.14)	(157.30)
Mean family size	2.548	1.985	2.729	2.577	2.434
	(1.339)	(0.916)	(1.417)	(1.317)	(1.284)
Unique individuals	23104	273541	8234	3090	11804
Unique deceased	6440	107529	2164	846	3437

Note: Table shows the mean and standard deviation of main analysis variables across surviving family members by manner of their relative's death and for the years before the death. An observation is a person-year

is a person-year. Two compositional differences stand out and motivate my empirical approach. First, survivors of external deaths are far younger than survivors of natural deaths (29.9 years for the former against 57.8 years for the latter), reflecting that external deaths tend to afflict younger families. Second, consistent with this age gap, natural-death survivors use substantially more healthcare at baseline. Mental health diagnoses are rare overall: only 2.6% of external-death survivors and 3.8% of natural-death survivors have any. Within external deaths, survivors of suicides show the highest baseline prevalence of mental health diagnoses (4.1%), consistent with familial correlation in mental health.

Families afflicted by external deaths tend to be larger than families afflicted by natural deaths. Finally, accidents account for the largest share of external deaths, followed by homicides, and then suicides.

TABLE 2: Summary Statistics of Decedents

Variable	All deaths		External death type		
	External	Natural	Homicide	Suicide	Accident
	(1)	(2)	(3)	(4)	(5)
Male	0.816	0.496	0.882	0.785	0.781
	(0.388)	(0.500)	(0.322)	(0.411)	(0.413)
Age	39.52	71.72	34.92	37.89	42.80
	(20.52)	(18.57)	(15.60)	(19.49)	(22.77)
Contributor	0.353	0.240	0.308	0.343	0.383
	(0.478)	(0.427)	(0.462)	(0.475)	(0.486)
Unique deceased	6439	107161	2165	846	3435

Note: Table shows the mean and standard deviation of decedents' characteristics by manner of death and in the year of the death. An observation is a person.

Table 2 reports analogous summary statistics for decedents. Those who die from external causes are substantially younger and far more likely to be male than those who die from natural causes. Within external deaths, accident victims are older than victims of suicide or homicide. Decedents from external causes are also more likely to have been the family's contributor than those who die from natural causes, and this share is higher among accident victims than among homicide victims. Nevertheless, nearly 65% of decedents due to external causes are dependents rather than contributors.

4 Empirical Design

My main empirical design leverages comparisons of surviving family members who experience a relatives' external death at different points in time. The unit of analysis is a person-year. Specifically, I estimate the event study below:

$$y_{it} = \sum_{s=-3}^{3} \beta_s \mathbf{1}\{t - t^* = s\} + \alpha_i + \gamma_t + \varepsilon_{it} \tag{1}$$

where i indexes individuals, t indexes years, t^* is the year when the first relative's death occurs, α_i is an individual fixed effect, and γ_t is a year fixed effect. The indicator for $s = -1$ is omitted, so all coefficients measure changes relative to the year before the death.

In a first set of analyses, the sample includes only individuals who experience a relative's external death, so the β_s are identified from variation in the timing of these deaths. I then bring in families experiencing a relative's natural death in two different ways: First, as a comparison group, so that the β_s capture the differential effect of external relative to natural deaths. In this case, I set $s = -1$ to individuals who experience a natural death in the family, under the assumption that natural deaths are uniformly distributed over time (Appendix Figure 2). Second, as a placebo test, estimating the event study separately for natural deaths to assess whether the dynamics I attribute to external loss also appear after deaths that are more often anticipated. In all cases, I use Callaway and Sant'Anna (2021)'s estimator to avoid potential biases from staggered deaths. Standard errors are clustered at the individual level. I also present robustness checks clustering at the family level.

Identification of the treatment effects rests on a parallel-trends assumption, which states that absent the death, outcomes of individuals who experience a relative's external death would have evolved in parallel with those of individuals who have not yet experienced one. While this counterfactual is untestable, the pre-death coefficients provide a diagnostic. Identification also requires that one family's bereavement not affect the outcomes of individuals in comparison families. This assumption is plausible in my setting for two reasons. First, comparison individuals belong to different families, and the mental health and labor-market consequences of a death are concentrated within the household; any effect on unrelated individuals is likely second order. Second, treated and not-yet-treated families are dispersed across the national territory, so a given death is a negligible shock to any local environment shared with comparison individuals. Finally, the staggered nature of these external deaths minimizes the possibility that treatment effects are driven by confounders. For instance, one concern is that a surge in guerrilla attacks could simultaneously cause external deaths and disrupt healthcare use in affected areas, confounding the two.

To analyze impacts on mortality, I use a different methodological approach. Because

mortality is an absorbing state, there is no variation in the outcome to identify the individual fixed effects in equation (1). Moreover, because the sample conditions on family members being alive at the time of their relative's death, pre-death mortality is mechanically zero and the pre-period coefficients are uninformative. Hence, I replace the individual fixed effects with comparisons across observably similar individuals. I define cells by the interaction of sex, age in five-year bins, department of residence, and the year of the relative's death. Within a design restricted to external-death survivors, mortality effects would be identified solely from time variation in death rates, which may be confounded by unobserved shocks. Hence, I use individuals who experience a relative's natural death as a comparison group, matching each treated individual to control individuals within the same cell. Then, I estimate:

$$d_{ict} = \sum_{s=0}^{3} \beta_s \mathbf{1}\{t - t_c^* = s\} \times V_i + \mu_c + \gamma_t + \varepsilon_{ict} \tag{2}$$

where d_{ict} is an indicator equal to one if individual i in matched cell c has died in year t, V_i indicates that the relative's death was external, and t_c^* is the year of the relative's death, common to treated and control individuals within a cell by construction. μ_c is a matched-cell fixed effect, and γ_t is a year fixed effect. The coefficients β_s measure the differential mortality rate of external-death survivors relative to natural-death survivors s years after the death, within cells of individuals of the same sex, age, department, and bereavement year. Standard errors are clustered at the individual level.

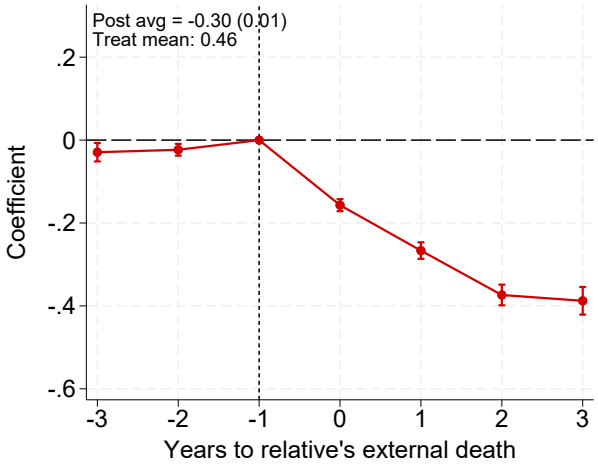
5 Results

Health insurance enrollment. Figure 2 reports event study estimates for a balanced panel of all survivors, where the outcome is an indicator for enrollment in the contributory regime; person-years in the subsidized regime or without coverage are coded as zero. Panel A shows that the probability of contributory enrollment drops sharply after a relative's external death and continues to decline over time: enrollment falls by 17 p.p. in the year of the death and by 40 p.p. three years later. Panel B estimates the event

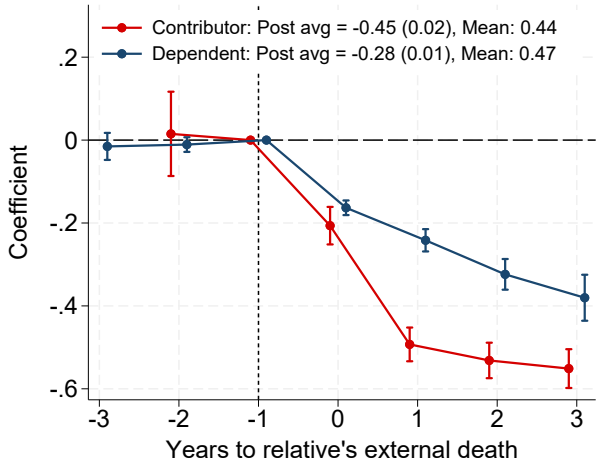
study separately by whether the decedent was a contributor or a dependent.[3] The decline is roughly 20 p.p. larger (in absolute value) when the decedent was the contributor, but it is sizable in both groups. The larger effect among survivors of a contributor is partly mechanical, since dependents lose coverage under the decedent's enrollment unless another family member takes over as contributor or they enroll on their own. However, the fact that survivors of a dependent also exit the contributory regime is consistent with survivors leaving formal employment or losing the income needed to sustain contributions.

FIGURE 2: Impact of External Deaths on Survivors' Enrollment

(A) Health insurance enrollment



(B) By role of the deceased



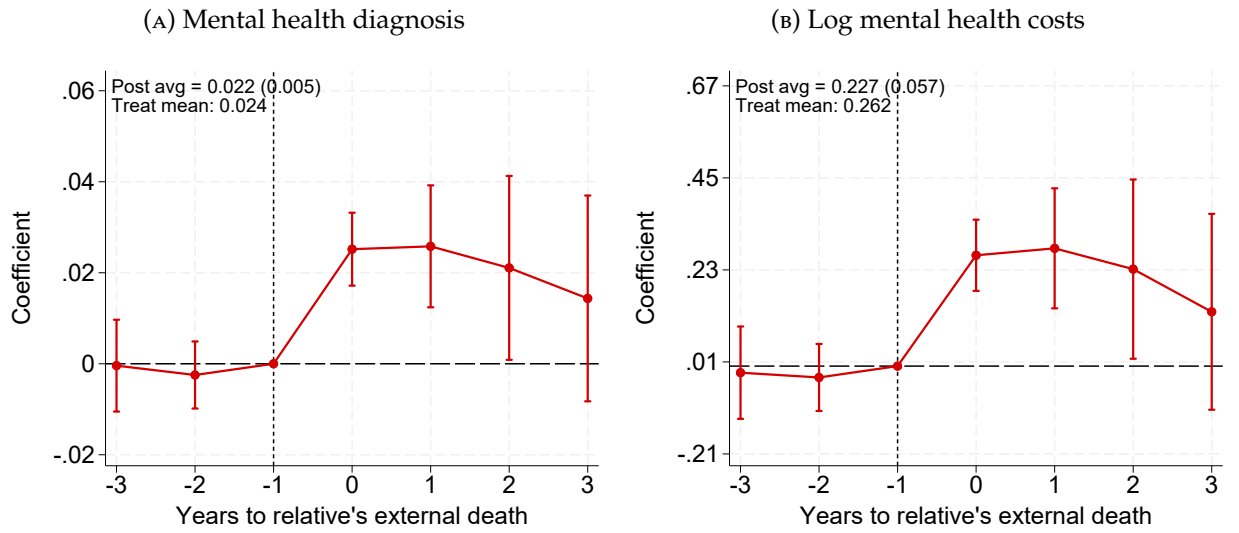
Note: Figure presents coefficients and 95% confidence intervals of an event study design comparing surviving family members that experience a relative's external death at different points in time. The outcome is an indicator for enrollment in the contributory regime. The post-average treatment effect and its standard error and the pre-death outcome mean are reported in the upper left corner. Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the survivor level.

Mental health. Figure 3 presents event study estimates of the effect of a relative's external death on surviving family members' mental health. I use only families that experience an external death, so that identification comes from quasi-random variation in the timing of these deaths. Panel A shows the results for receiving any mental health diagnosis. Pre-death coefficients are small and statistically indistinguishable from zero, supporting the parallel pre-trends assumption. In the year of the death, the probability of receiving a

[3]The event study for survivors of deceased contributors begins at relative time −2 because too few observations are available to identify the coefficient at −3.

mental health diagnosis increases by 2.5 p.p., and the post-period average effect is 2.2 p.p. (s.e. 0.5). This represents an 88% increase relative to the pre-period treated mean of 2.4%. The effect persists at a similar magnitude one year after the death and declines gradually thereafter, though estimates at longer horizons are less precise as they are identified from fewer cohorts (see Appendix Figure 1).

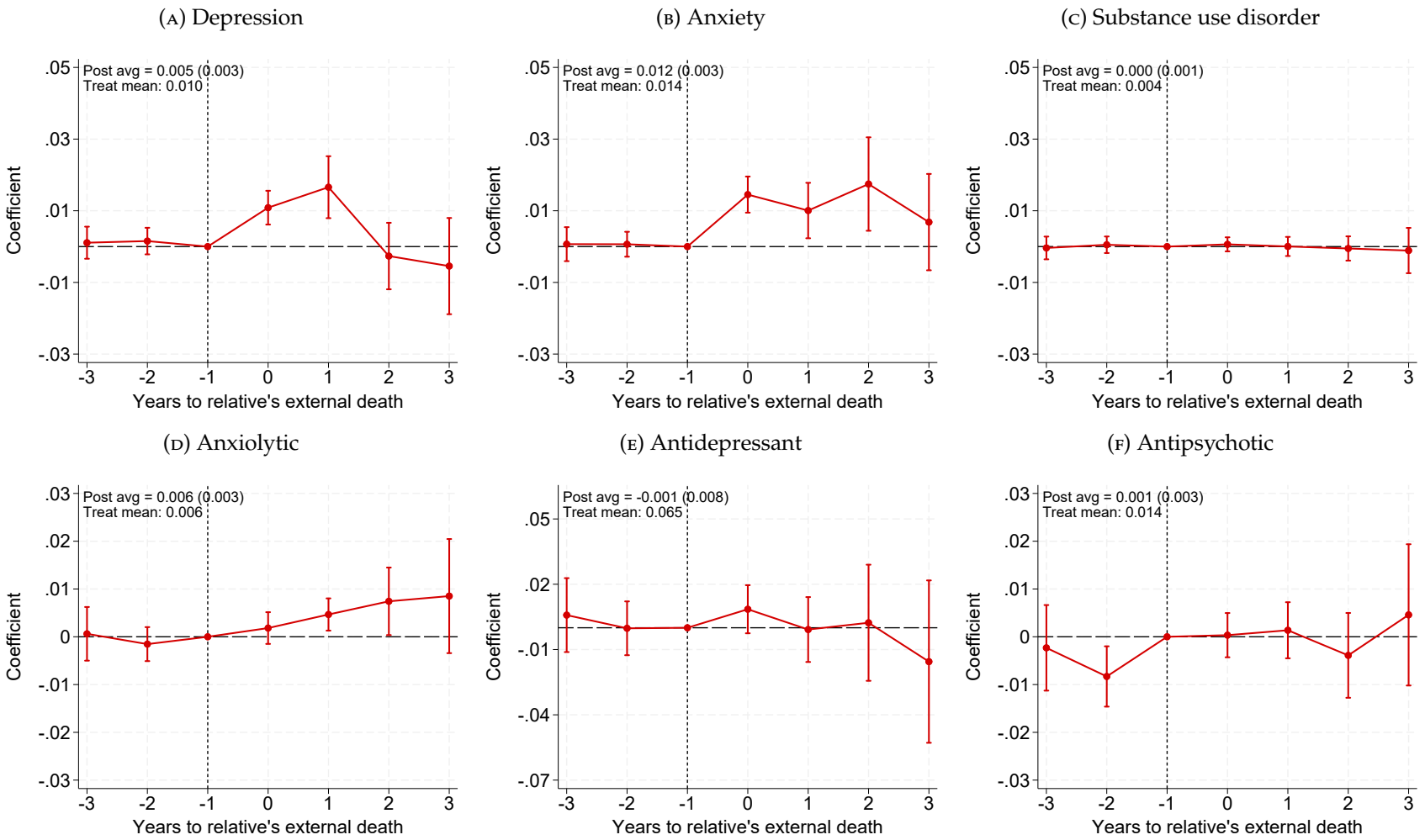
FIGURE 3: Impact of External Deaths on Mental Healthcare Use



Note: Figure presents coefficients and 95% confidence intervals of an event study design comparing surviving family members that experience a relative's external death at different points in time. The outcomes are an indicator for receiving any mental health diagnosis (Panel A) and the log of spending on mental health claims (plus 1) (Panel B). The post-average treatment effect and its standard error and the pre-death outcome mean are reported in the upper left corner. Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the individual level.

Panel B shows the effect on the log of mental healthcare spending (plus 1). Spending rises sharply and immediately: in the post-period, expenditures on mental health claims increase by 0.227 log points on average (s.e. 0.057), roughly 25% ($e^{\beta}-1$) relative to baseline. Most of this increase reflects the extensive margin documented in Panel A, but conditional on having any mental health claim, spending per user changes little. Taken together, these results indicate that a relative's external death raises the incidence of diagnosed mental illness and the associated spending, with the response concentrated in the two years immediately following the death.

FIGURE 4: Impact of External Deaths on Mental Health Diagnoses and Use of Services



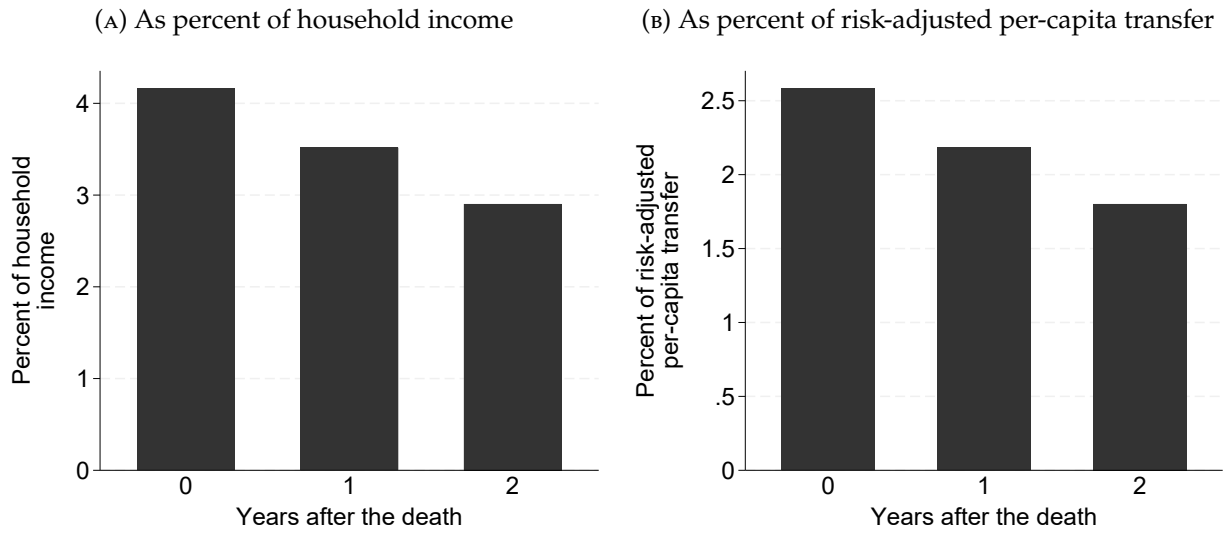
Note: Figure presents coefficients and 95% confidence intervals of an event study design comparing surviving family members that experience a relative's external death at different points in time. The outcomes are an indicator for receiving a depression diagnosis (Panel A), an indicator for receiving an anxiety and stress-related disorder diagnosis (Panel B), an indicator for receiving a substance use disorder diagnosis (Panel C), and an indicator for filling a prescription for anxiolytics (Panel D), antidepressants (Panel E), and antipsychotics (Panel F). The post-average treatment effect and its standard error and the pre-death outcome mean are reported in the upper left corner. Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the individual level.

Figure 4, Panels A to C decompose the effect by condition. Diagnoses of depression and other mood disorders (Panel A) increase by 0.5 percentage points on average in the post-period, a 50% increase over the pre-period mean among treated families. This effect is concentrated in the first two years after the relative's death and dissipates thereafter. In contrast, diagnoses of anxiety and stress-related disorders (Panel B) rise by 1.2 percentage points, nearly doubling relative to a baseline mean of 1.4%, and the effect persists through the third year after the death. I find no change in diagnoses of substance use disorders (Panel C). The mental health consequences of an external death thus operate through mood and anxiety disorders, the conditions most closely tied to grief and trauma, rather than through substance use.

Panels D to F examine the use of psychotropic medications. The clearest response is in Panel D, where I find that the probability of filling an anxiolytic prescription rises gradually after the death, reaching 0.7–0.9 p.p. two to three years after the death. The post-period average treatment effect equals 0.6 percentage points (s.e. 0.3), or nearly double the baseline mean. I find no effects on antidepressant fills (Panel E) or antipsychotic fills (Panel F), suggesting anxiety and stress are the primary conditions afflicting survivors. Other forms of healthcare use and diagnosis, including inpatient care and chronic disease, remain unchanged after a relative's external death (Appendix Figure 4), indicating that the response is specific to mental health rather than reflecting a broad increase in contact with the health system or broad physical health deterioration.

Health system impacts. To gauge the aggregate importance of these effects, I express the additional mental healthcare spending induced by a relative's external death relative to the affected household's income and the health system's per-enrollee budget. Figure 5 reports both, by year since the death. Panel A shows that survivors' additional mental healthcare spending amounts to 4.1% of a household's income in the year of the death, 3.5% one year after, and declines to 3.0% two years out.

FIGURE 5: Aggregate Impacts of Additional Mental Healthcare Spending



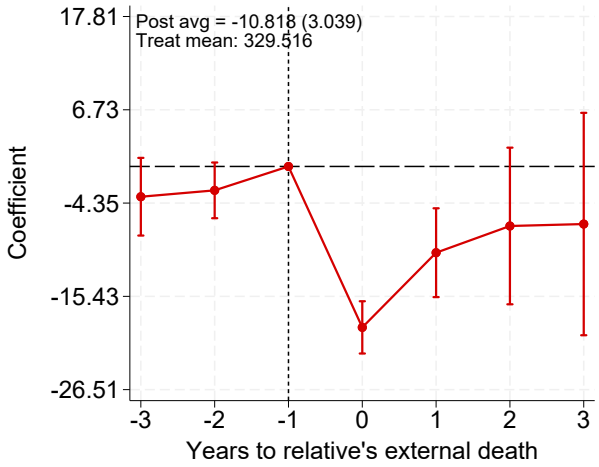
Note: Figure presents the additional mental healthcare spending generated by a relative's violent death as percentage of household income (Panel A) and as percentage of the risk-adjusted per-capita transfer that health insurers receive from the government (Panel B), during the first three years after the death. To calculate the additional mental healthcare spending, I multiply the average family size in my data (3.1) times the average mental healthcare spending in the years before the death (approximately 11,000 pesos), times $e^{\beta_s} - 1$. Then I divide this measure by the average family income in my data for the years before the death in Panel A and by the average risk-adjusted transfer in my data for the years before the death and between 2013 and 2017 in Panel B.

Panel B expresses the same spending as a percentage of the risk-adjusted per-capita transfer that the government pays health insurers (UPC by its Spanish acronym). The induced spending equals 2.6% of the UPC in the year of the death and 2.1% the following year. Because the UPC is calibrated to expected healthcare costs and adjusts only for age, sex, and location – not for bereavement – an external death in the family constitutes an unpriced cost shock of roughly 2.5% per surviving member that insurers currently absorb. These magnitudes capture only realized care and may understate the true health system burden, as many survivors never seek mental healthcare in a setting where it remains stigmatized (Campo-Arias et al., 2014).

Labor market effects. Figure 6 presents effects on formal labor market attachment, measured as the number of days the family's surviving contributor contributed to social security in a given year. This outcome is assigned to every surviving family member, hence the estimates capture the evolution of the formal employment supporting the average survivor, rather than any individual's own labor supply. Days contributed fall by

roughly 19 days in the year of the death, about 6% of the pre-period mean of 330 days, and by about 10 days in the following year. The estimates for years two and three remain negative but are smaller in magnitude and imprecise, indicating a recovery of labor market attachment. The pre-period coefficients are statistically indistinguishable from zero, supporting the parallel trends assumption for this outcome. Because annual days contributed are bounded above at 360 and the treated mean is close to this ceiling, the decline reflects spells out of formal employment of about two weeks rather than marginal adjustments in hours worked. One caveat of this analysis is that days contributed are observed only while the contributor appears in PILA, so the estimates condition on the family retaining a formally employed contributor and may understate the total loss of formal attachment if some families exit PILA entirely.

FIGURE 6: Impact of External Deaths on Labor Market Outcomes

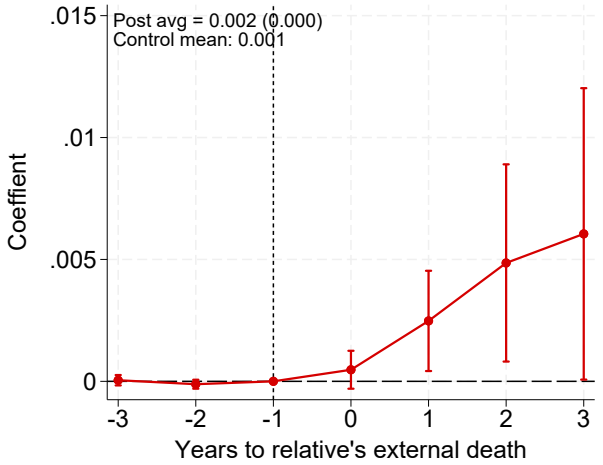


Note: Figure presents coefficients and 95% confidence intervals of an event study design comparing surviving family members that experience a relative's external death at different points in time. The outcome is the number of days contributed. Days contributed of the family's contributor are assigned to each member of the family. So estimates reflect the impact of a external death on the formal labor market attachment supporting the average survivor. The post-average treatment effect and its standard error and the pre-death outcome mean are reported in the upper left corner. Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the individual level.

Mortality upon mortality. Figure 7 presents effects on surviving family members' own mortality. Recall that this outcome requires a different design: because death is an absorbing state, individual fixed effects are not identified, and I instead estimate equation (2), comparing external-death survivors to natural-death survivors matched within cells

defined by sex, age bin, department, and year of the relative's death. I find that the annual mortality of external-death survivors rises relative to matched natural-death survivors, by 0.25 p.p. one year after the death and by 0.5 p.p. two years after. The post-period average is 0.2 p.p. (s.e. 0.0005), a tripling relative to the annual mortality rate of 0.1% among matched natural-death survivors. To put these numbers in context, every 55 external deaths cause one additional death among survivors.[4]

FIGURE 7: Impact of Violent Deaths on Family Member's Mortality



Note: Figure presents coefficients and 95% confidence intervals of an event study design comparing family members who experience a relative's violent death against those who experience a relative's natural death. Natural-death survivors are matched to violent-death survivors by cells defined by a combination of sex, age in 5-year bins, department of residence, and relative's death year. The outcome is an indicator for whether the individual died in that year. Individuals leave the sample after they die. The post-average treatment effect and its standard error and the post-death outcome mean in the control group are reported in the upper left corner. Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the family level.

The manner of death. A natural question is whether the effects documented so far are specific to external deaths or follow any death in the family. To answer it, I estimate the same event study design separately by manner of death, treating homicides, suicides, accidents, and natural deaths each as a distinct experiment and leveraging their quasi-random timing. Figure 8 reports the year-0 coefficient for each manner of death across six outcomes. Two patterns emerge. First, natural deaths also affect survivors' mental health: the estimates in blue are positive and statistically significant for both mental health

[4]With an average of 3 survivors per decedent and effects accumulating over three years, each external death generates $0.002 \times 3 \times 3 \approx 0.018$ deaths among survivors, or one survivor death per 55 relatives' external death.

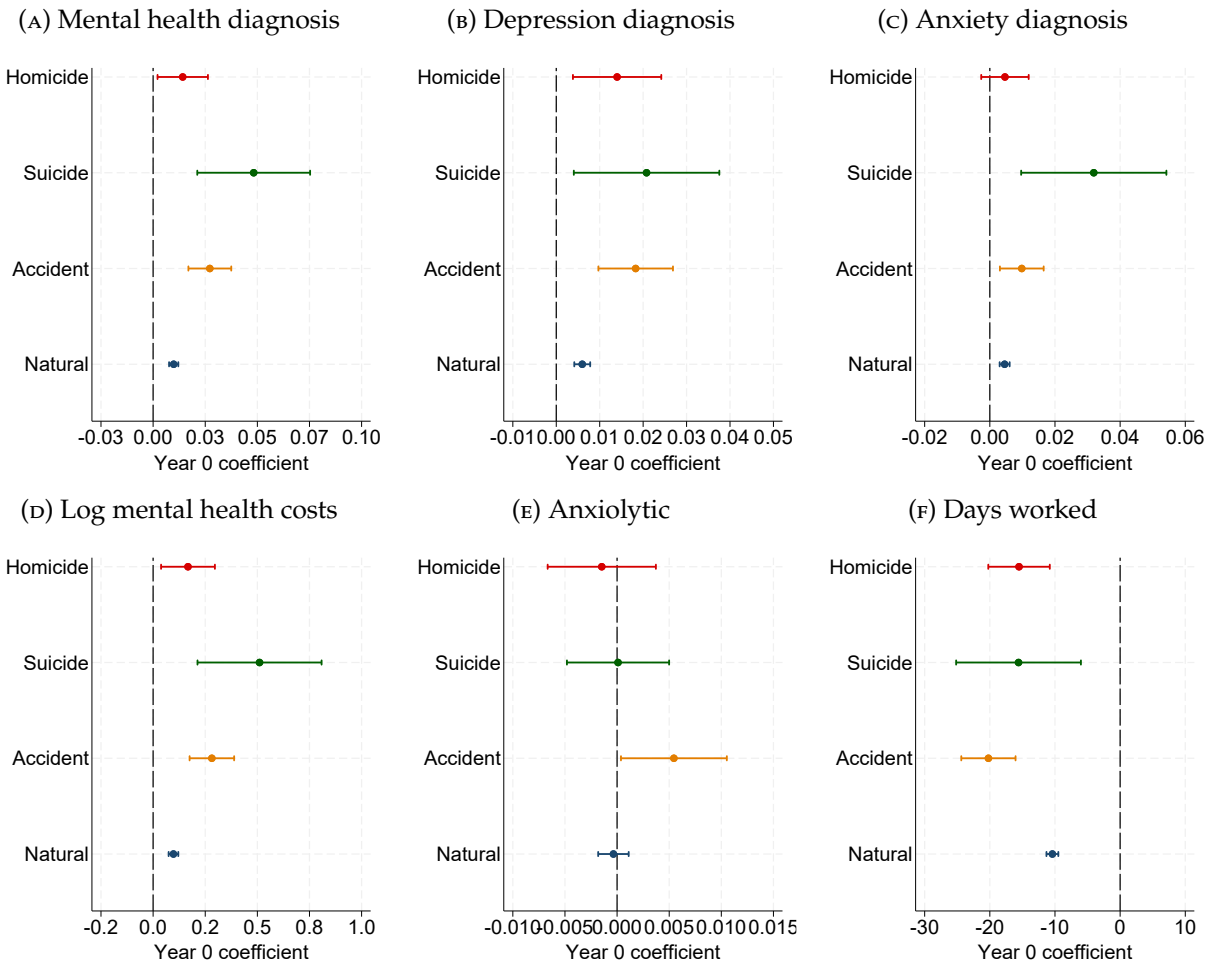
diagnoses (Panel A) and mental healthcare spending (Panel D), corresponding to increases of 1 percentage point and 10%, respectively. Bereavement itself thus carries a mental health cost. Second, the effects of external deaths are systematically larger, between two and five times the natural-death estimates for diagnoses and spending depending on the specific manner of death.

Within external deaths, suicides produce the largest point estimates. For instance, I find a 5 p.p. increase in mental health diagnoses and a 66% increase in spending, roughly three times the corresponding effects of homicides. Nevertheless, suicides are rarer and the estimates correspondingly less precise. Accidental deaths, which are unanticipated but do not involve intentional violence, fall in between, with effects of 2.7 p.p. on diagnoses and 32% on spending, significantly larger than those of natural deaths. These findings are consistent with the clinical literature on traumatic loss, in which suddenness and the search for meaning after intentional or self-inflicted deaths compound the burden of grief (Kristensen et al., 2012).

The labor market results show a similar pattern (Panel F). A natural death reduces the surviving contributor's days worked by about 11 days in the year of the death, so some of the employment response reflects the disruption that follows any death in the family, such as time off for funeral arrangements, caregiving, or settling the decedent's affairs. The reductions after external deaths are nonetheless larger, at roughly 15 days for homicides and suicides and 20 days for accidents, between 1.4 and 1.8 times the natural-death estimate.

Alternatively, rather than estimating separate event studies by manner of death, I can use individuals who experience a relative's natural death as an explicit control group for those who experience a external death. In this specification, the relative time indicators are defined by the external death and set to $s = -1$ for all natural-death survivors. Appendix Figure 3 compares these estimates (light red) with the main estimates from the timing-only design (dark red) for the same six outcomes. The results are similar across the two designs, indicating that the excess effect of a external death, over and above bereavement itself, on mental health diagnoses and mental healthcare spending is large and statistically significant.

FIGURE 8: Impact of Manner of Death on Mental Health



Note: Figure presents the coefficient and 95% confidence interval of the year $s = 0$ in the event study design comparing surviving family members who experience a relative's death, by manner of death. Homicides are reported in red, suicides in green, accidents in yellow, and natural deaths in blue. The outcomes are an indicator for receiving any mental health diagnosis (Panel A), an indicator for receiving a depression diagnosis (Panel B), an indicator for receiving an anxiety and stress-related disorder diagnosis (Panel C), the logarithm of spending on claims associated with mental health diagnoses (plus 1) (Panel D), an indicator for filling an anxiolytic prescription (Panel E), and the number of days worked (Panel F). Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the individual level.

Heterogeneity analysis. Figures 9 and 10 examine heterogeneity by the demographics of the surviving family member and of the deceased, respectively. Each panel reports the year-0 coefficient from estimating equation (1) on the indicated subsample, alongside the baseline estimate. Several patterns emerge. First, the mental health consequences of external deaths are widespread: estimates are statistically significant for every survivor demographic group. Second, mental health effects are larger for female survivors. Women's mental health diagnoses rise by 3.0 p.p. at year 0, compared with 1.7 for men,

and the gap is most pronounced for depression diagnoses (2.3 versus 0.7 p.p.) and mental healthcare spending (38% versus 19%), while anxiety diagnoses rise similarly for both. Although the confidence intervals overlap, the ordering is consistent across all mental health outcomes. This pattern is in line with women's higher baseline rates of diagnosed mood and anxiety disorders and greater propensity to seek care, so I cannot distinguish larger underlying effects from differential help-seeking.

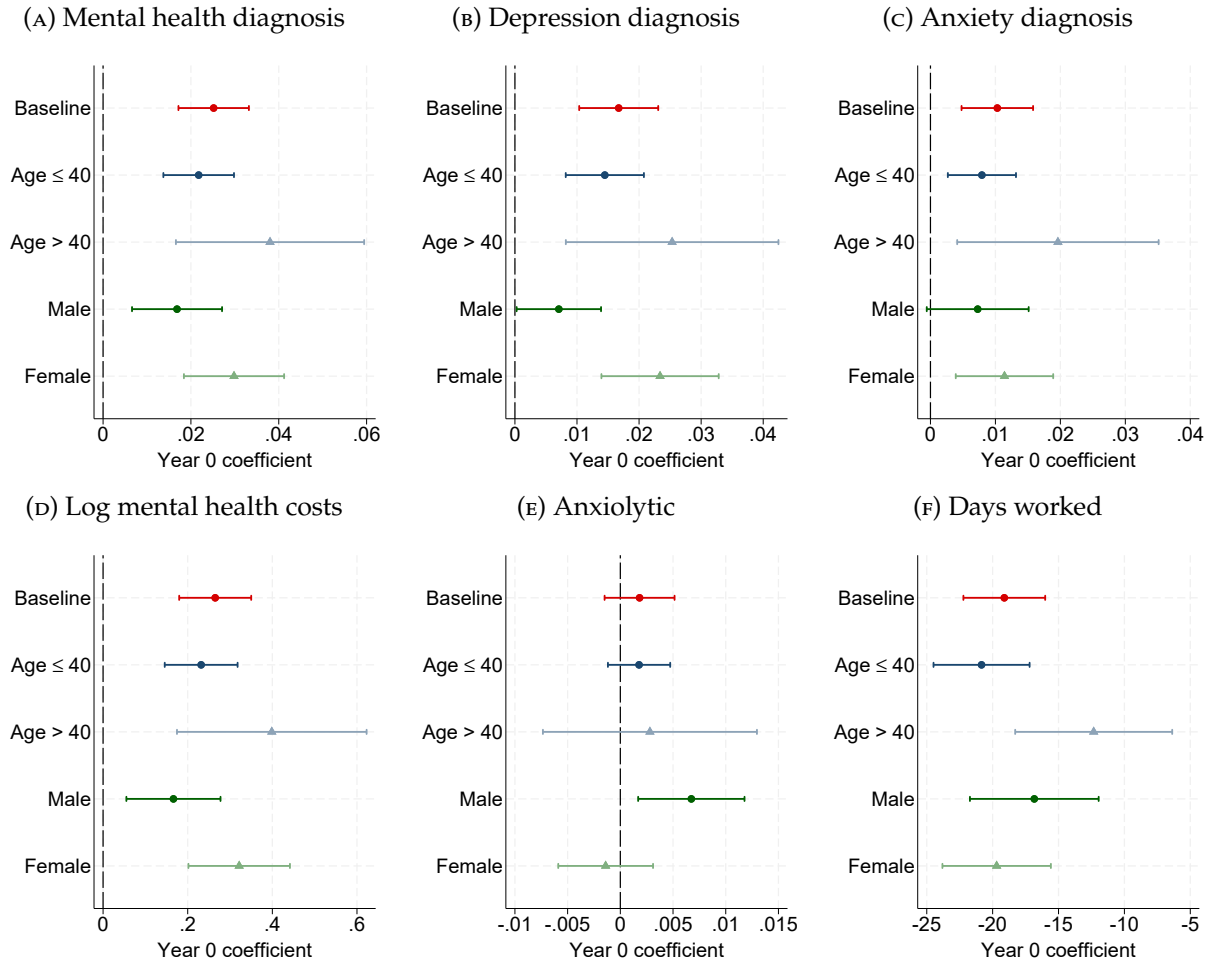
Third, effects are larger for survivors over 40 years old than for younger survivors: mental health diagnoses rise by 3.8 versus 2.2 p.p., anxiety diagnoses by 2.0 versus 0.8 p.p., and spending by 49% versus 26%. These estimates are imprecise, since most survivors in the sample are young, but they point to a heavier mental health toll on older relatives, likely parents and spouses of the typically young victims. The labor market response shows the opposite ordering, with a smaller decline in days worked among older survivors (12 versus 21 days).

Estimates by the deceased's characteristics (Figure 10) are, in contrast, stable. Mental health effects are similar whether the deceased was male or female, younger or older than 40, though estimates for deaths of female relatives and relatives over 40 are less precise, reflecting that external deaths in the sample are concentrated among young men (as seen in Table 2). The deceased's role in the household matters more. When the deceased was a dependent, diagnoses rise by 2.6 p.p., depression and anxiety by 1.9 and 1.1 p.p., and spending by 31%. When the deceased was the family's contributor, the point estimates are uniformly smaller and none is statistically distinguishable from zero. This difference likely reflects the mechanics of the data rather than a smaller psychological toll: as shown in Figure 2, survivors of a contributor are far more likely to exit the contributory regime, so their health claims are observed only if they remain formally covered.

The labor market pattern shows similar results. Days worked by the family's surviving contributor fall by 58 days when the deceased was the contributor, compared with 10 days when the deceased was a dependent. The former captures the loss of the household's primary earner and the transition to a new contributor, who is often entering formal employment or taking over the enrollment mid-year, whereas the latter isolates the surviving contributor's own labor supply response to bereavement. Consistent with this interpre-

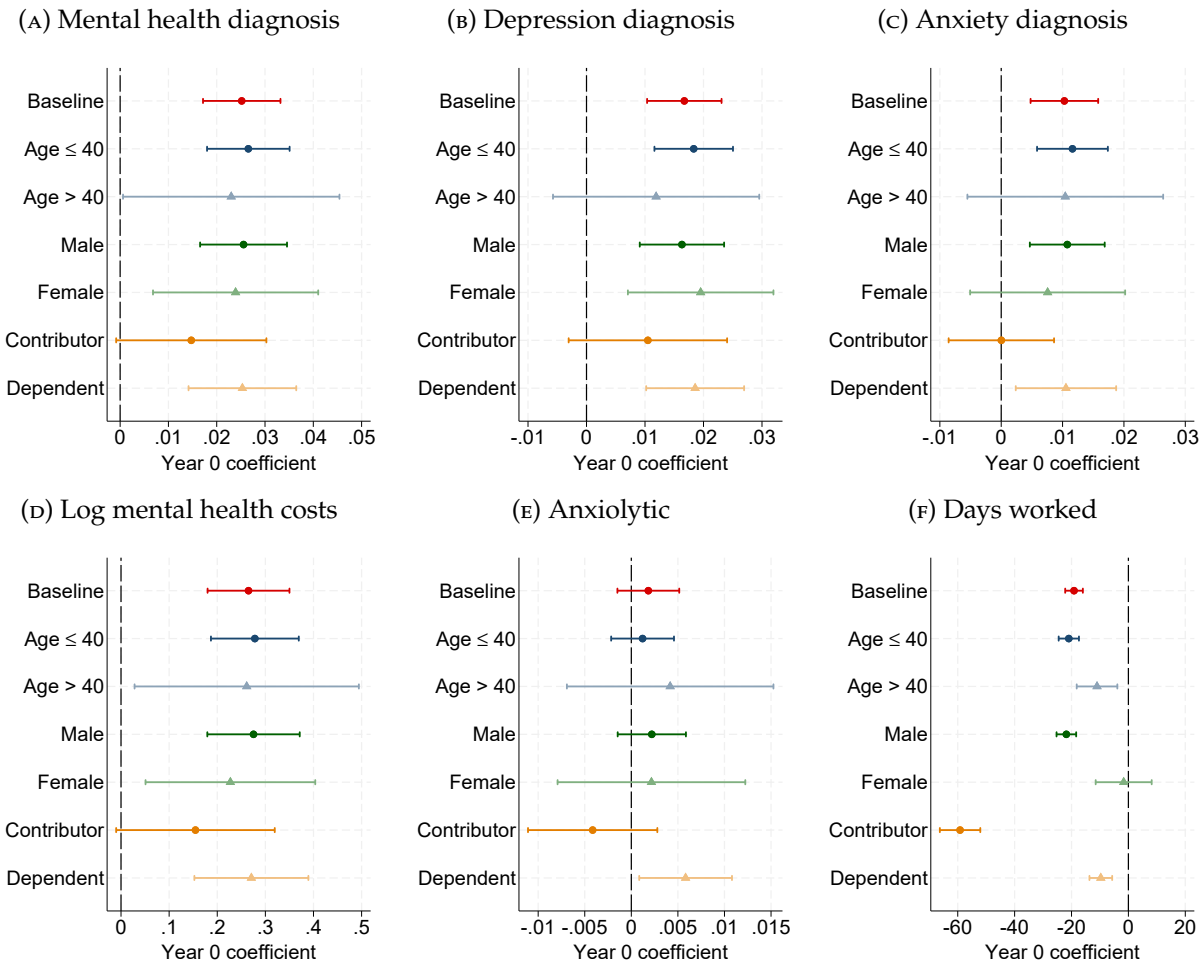
tation, days worked barely move when the deceased was female, since female decedents in the sample are rarely the family's contributor, while they fall by 20 days when the deceased was male. Overall, the mental health burden of external loss is shared across family structures and falls most heavily on female and older survivors, while the economic burden is concentrated in families that lose their contributor.

FIGURE 9: Impact of Violent Deaths by Surviving Member's Demographics



Note: Figure presents the coefficient and 95% confidence interval of the post-average treatment effect in the event study design comparing surviving family members who experience a relative's violent death. The main estimate is reported in red and survivor subgroup estimates are reported in light red. I consider the following subgroups defined by the survivors' demographics: aged 45 or less, aged over 45, males, and females. The outcomes are an indicator for receiving any mental health diagnosis (Panel A), an indicator for receiving a depression diagnosis (Panel B), an indicator for receiving an anxiety and stress-related disorder diagnosis (Panel C), the logarithm of spending on claims associated with mental health diagnoses (plus 1) (Panel D), the number of claims associated with mental health diagnoses (Panel E), and an indicator for filling an antidepressant prescription (Panel F). Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the family level.

FIGURE 10: Impact of Violent Deaths by Deceased's Demographics



Note: Figure presents the coefficient and 95% confidence interval of the post-average treatment effect in the event study design comparing surviving family members who experience a relative's violent death. The main estimate is reported in red and deceased subgroup estimates are reported in light red. I consider the following subgroups defined by the deceased's demographics: aged 45 or less, aged over 45, males, and females. The outcomes are an indicator for receiving any mental health diagnosis (Panel A), an indicator for receiving a depression diagnosis (Panel B), an indicator for receiving an anxiety and stress-related disorder diagnosis (Panel C), the logarithm of spending on claims associated with mental health diagnoses (plus 1) (Panel D), the number of claims associated with mental health diagnoses (Panel E), and an indicator for filling an antidepressant prescription (Panel F). Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the family level.

Robustness checks. Individuals can enter or exit the sample in different years as long as they have no enrollment gaps between their first and last year in the data. To assess whether changes in sample composition drive the results, Appendix Figure 5 re-estimates equation (1) under three alternative sample definitions: dropping the no-gap requirement (in blue), restricting to individuals enrolled in all seven years of the panel (in green), and using the unrestricted sample from the enrollment analysis (in yellow). Pre-period

coefficients are close to zero under every definition. Relaxing the continuity requirement or using the unrestricted sample leaves the estimates essentially unchanged across all six outcomes. Restricting to fully continuous enrollees yields larger mental health effects, though the confidence intervals overlap with the main estimates. This is consistent with continuously enrolled survivors being the group for whom care is most consistently observed, so that the main estimates, if anything, understate the mental health response. The one exception is days worked, where the fully continuous sample shows an attenuated decline of 3 days at year 0 compared with 19 in the main sample. This is expected since requiring seven years of uninterrupted contributory enrollment selects families whose contributor retained formal employment throughout, which mechanically removes the extensive-margin employment losses that drive the main effect. Finally, Appendix Figure 6 shows that my results are robust to clustering at the family level.

6 Discussion

The findings speak, first, to the external validity of a literature developed predominantly in high-income countries. The consequences of bereavement documented in those settings – deteriorating mental health, excess mortality among survivors, pressure on household finances – are also present in a middle-income country with a markedly different epidemiological profile, healthcare system, and exposure to violence. The effects of losing a family member thus appear to generalize across income levels and institutional contexts. What distinguishes a setting such as Colombia is not the existence of these effects but the frequency of exposure.

Second, the result that mental health spending increases after a relative's external death and is higher than the effect of a natural death, speaks to the capacity of the health system to absorb the spillover effects of these deaths even within a lower-income setting. Still, effective access to mental health services remains limited in Colombia and requires integrating bereavement care into primary care and removing the stigma that deters survivors from seeking help in the first place. Improvements in care for survivors would translate directly into both quality and length of life, reducing the burden of untreated

mental illness and, plausibly, the excess mortality that follows loss of relatives due to external causes.

7 Conclusions

This paper quantifies the causal effects of external-cause deaths on surviving family members in a setting where such deaths are prevalent. The analysis draws on administrative data from Colombia linking health insurance enrollment, health claims, death certificates, and social security contributions for nearly half of the country's population. The evidence extends a literature focused on high-income countries where external deaths are rare, and demonstrates that these losses impose costs beyond those of bereavement itself.

A relative's external-cause death produces a significant deterioration in survivors' mental health: diagnoses of mood, anxiety, and stress-related disorders nearly double, and mental healthcare spending rises by roughly a quarter relative to the pre-death mean. The consequences extend to survival itself, with annual mortality of external-death survivors tripling compared to natural-death survivors. Moreover, treatment effects among families who experience a relative's external-cause death are two to five times larger than those experiencing a natural death, suggesting the impacts are not just due to bereavement. Finally, the induced healthcare spending imposes a substantial burden on families, amounting to up to 4.5% of a household's monthly income. External-cause deaths thus claim more than their victims: they leave families measurably sicker, poorer, and at greater risk of death.

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Appendix A Data Construction

This appendix describes the steps used to build the analysis sample from Colombia's administrative death, enrollment, and health claims records.

Identifying deaths and their manner.

1. Death certificates for 2013–2019 are appended from three source extracts and de-duplicated to one record per person. Duplicates may arise due to reporting issues.

2. Deaths are classified as violent or natural based on the code for the official manner of death. Violent deaths are further classified into suicide, homicide, and accident (accidents combining traffic, falls, and other unintentional external causes) using the code for violent deaths and following the data dictionary.

3. For each death, I keep the death year and the age, sex, and role (contributor or dependent) of the deceased.

Constructing family units and identifying bereaved families

1. Annual june enrollment snapshots for 2013–2019 are appended and de-duplicated to one record per person-year. Duplicates arise when the person is enrolled with multiple insurers during a year. Because my analysis does not use information on which insurer the person is enrolled with, de-duplication is possible without creating sampling bias.

2. Families are defined by the contributor identifier: I drop records with a missing contributor or person identifier, then restrict to families with between 2 and 6 members (dropping singleton families, who cannot be linked as described in the main text, and families with more than 6 members).

3. Enrollment records are merged with the death data; individuals who die are matched to their family's enrollment history.

4. Each family is flagged for whether it experienced a violent death, a natural death, and each type of violent death. The sample is restricted to families experiencing at least one death (violent or natural) over the sample period.

5. The date of the family's first death is computed, along with the age and sex of the first deceased member, and the deceased person-year itself is dropped from the sample (I study survivors only).

Restricting to the analysis sample for healthcare use outcomes

1. The sample is restricted to individuals ever enrolled with one of the following contributory-regime insurers: EPS001, EPS002, EPS003, EPS005, EPS008, EPS009, EPS010, EPS012, EPS013, EPS016, EPS017, EPS018, EPS023, EPS037. This sample restriction is needed since health claims are only available for this regime; if an individual is enrolled with any insurer outside this list in any year, they are dropped from the analysis sample.

2. The sample is further restricted to individuals who are continuously enrolled, that is, those present in every annual snapshot between their first and last observed year, with no gaps.

3. Claims-based utilization measures, depression-specific measures, medication measures, days worked (from payroll contribution records, merged at the contributor level and applied to all family members), and primary diagnosis codes are merged in.

Restricting to the analysis sample for health insurance enrollment

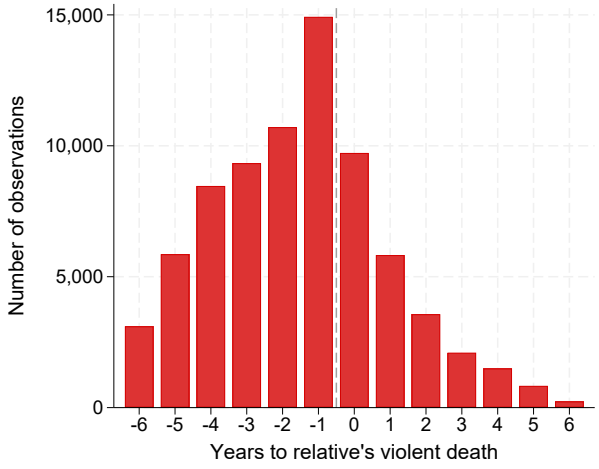
1. The sample of bereaved families containing both contributory and subsidized regime enrollees is expanded to construct a balanced panel. Years of enrollment in the contributory regime (defined as being enrolled with the following insurers: EPS001, EPS002, EPS003, EPS005, EPS008, EPS009, EPS010, EPS012, EPS013, EPS016, EPS017, EPS018, EPS023, EPS037) are marked as one. Years of enrollment in the subsidized regime or outright disenrollment are marked as zero.

Appendix Table 1: Sample Sizes and Cleaning Steps for Healthcare Use Outcomes

Sample restriction	Sample size (person-years)
Full sample	305,573,568
Drop subsidized enrollees	170,026,694
Drop singleton contributors and those with more than 6 family members	77,629,592
Keep families experiencing death	1,179,558
Keep contributory enrollees	808,168
Keep continuous enrollees	602,893

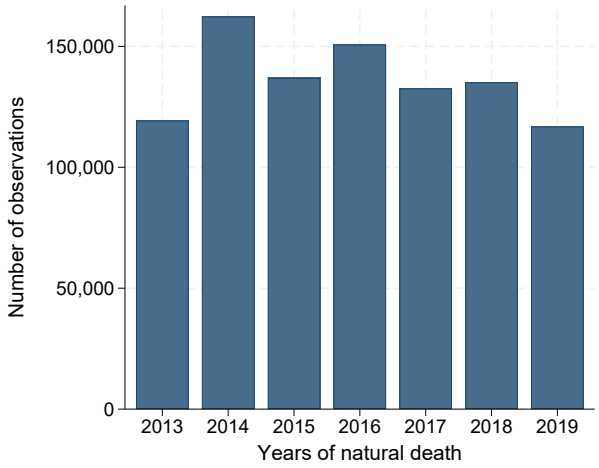
Note: Table presents the number of person-years that remain after imposing each sample restriction. The data span the years 2013 to 2019.

Appendix Figure 1: Number of Individuals per Year to Relative's Violent Death



Note: Figure presents the number of individuals by number of years to the relative's violent death. Only contributory regime enrollees are considered. The data spans the years 2013 to 2019.

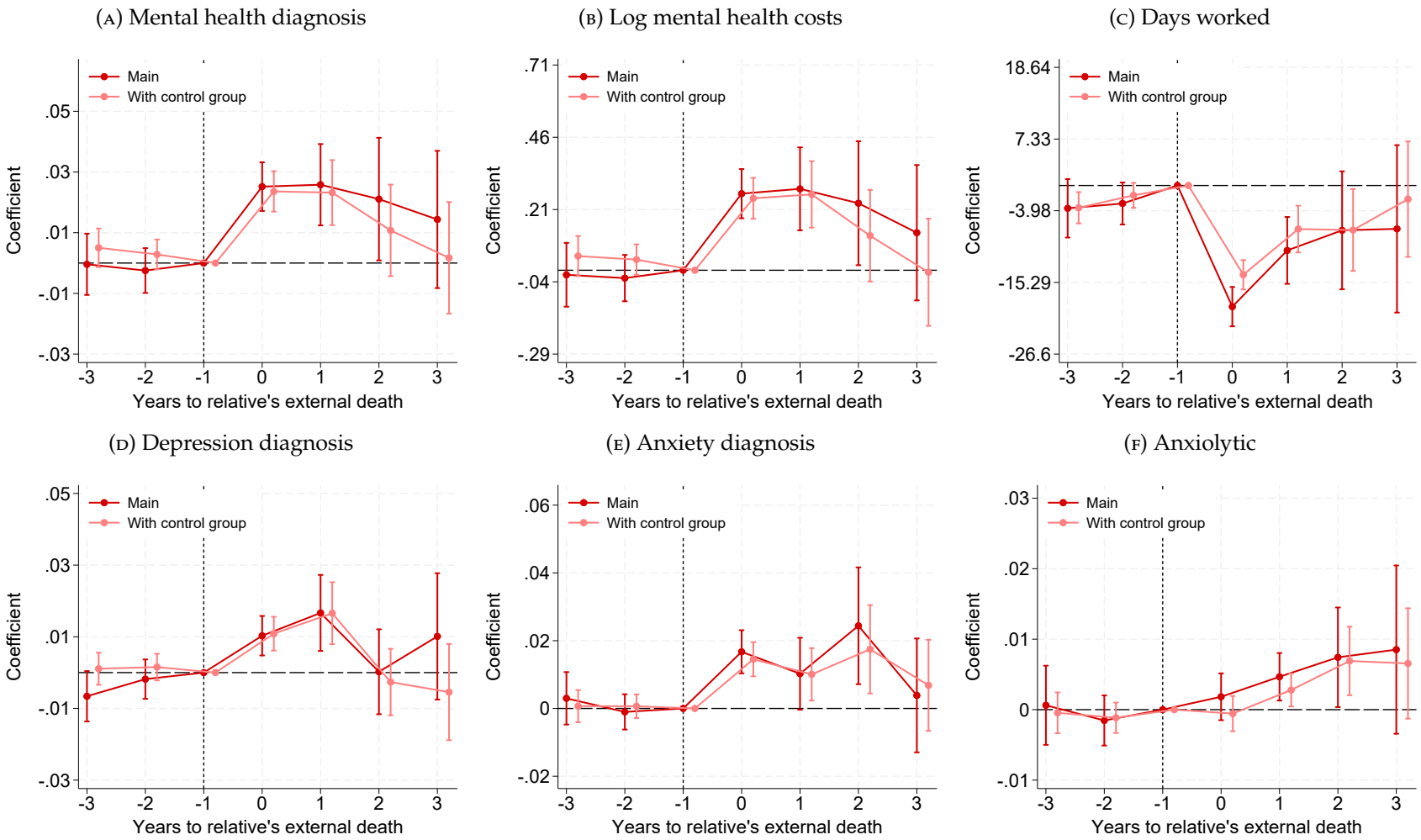
Appendix Figure 2: Number of Individuals by Year of Relative's Natural Death



Note: Figure presents the number of individuals by year in which the natural death of their relative occurs. Only contributory regime enrollees are considered. The data spans the years 2013 to 2019.

Appendix B Robustness Checks and Additional Results

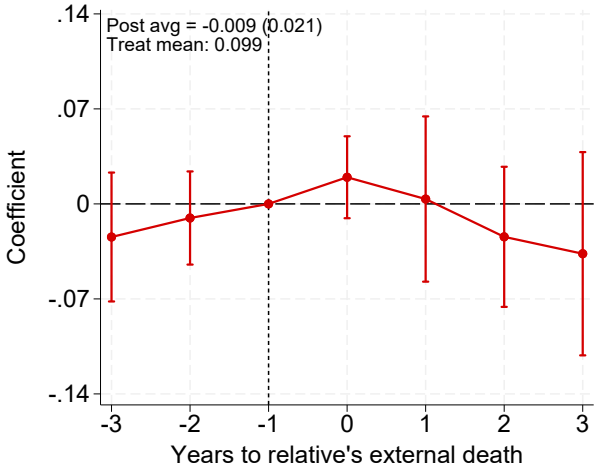
Appendix Figure 3: Impacts of External Deaths with Natural Deaths as Control Group



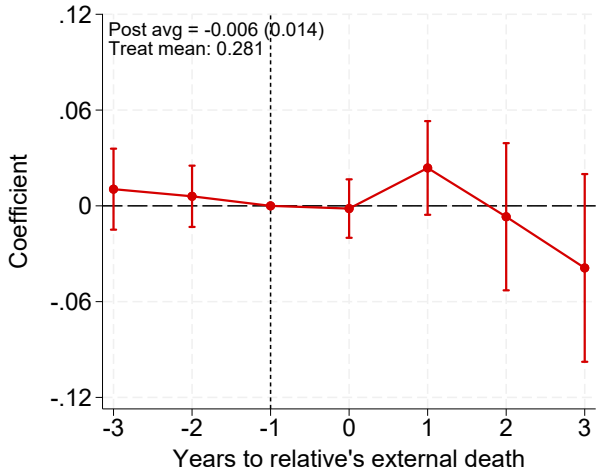
Note: Figure presents coefficients and 95% confidence intervals of an event study design comparing surviving family members that experience a relative's external death at different points in time in dark red. Estimates in light red correspond to an estimation that uses natural-death survivors as a control group. The outcomes are an indicator for receiving any mental health diagnosis (Panel A), the logarithm of spending on claims associated with a mental health diagnosis (Panel B), number of days worked or contributed (Panel C), an indicator for receiving a depression diagnosis (Panel D), an indicator for receiving an anxiety and stress-related disorder diagnosis (Panel E), and an indicator for filling an anxiolytic prescription (Panel F). Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the individual level.

Appendix Figure 4: Impact of External Deaths on Overall Healthcare Use

(a) Hospital admissions

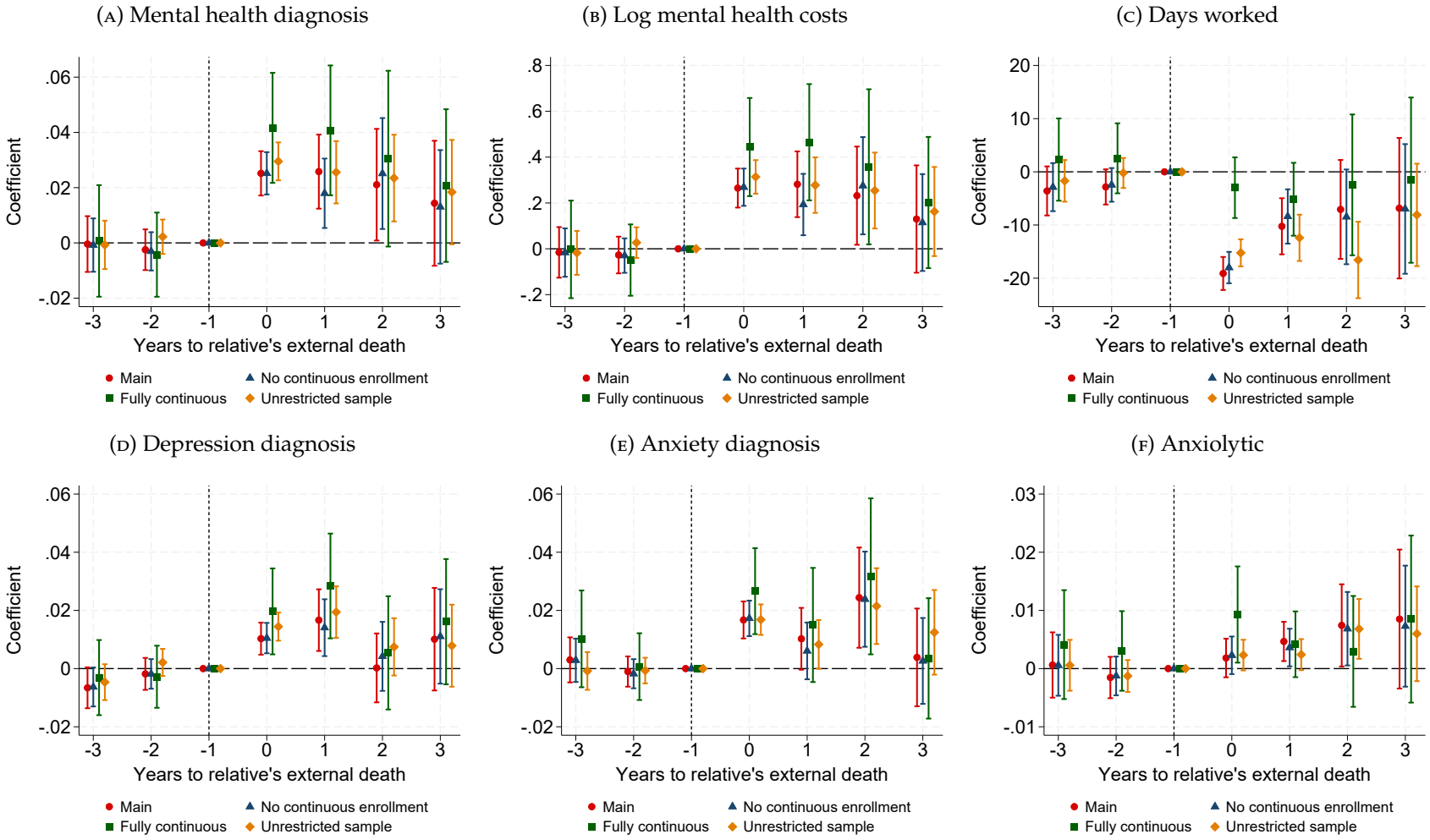


(b) Chronic disease diagnosis



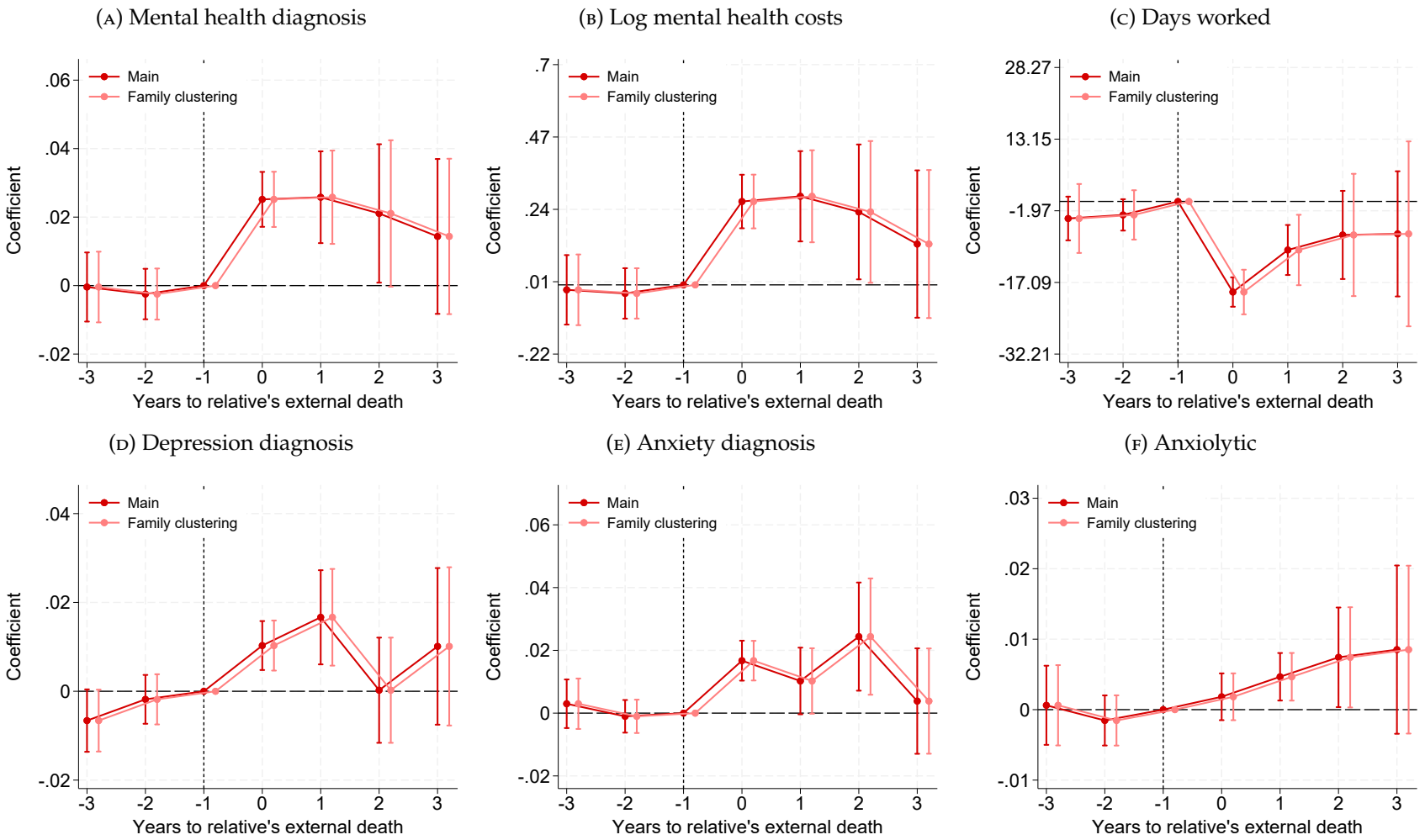
Note: Figure presents coefficients and 95% confidence intervals of an event study design comparing surviving family members that experience a relative's external death at different points in time. The outcomes are an indicator for being admitted to the hospital (Panel A) and an indicator for being diagnosed with a chronic disease based on the ICD-10 code categorization of Riascos et al. (2014) (Panel B). The post-average treatment effect and its standard error and the pre-death outcome mean are reported in the upper left corner. Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the individual level.

Appendix Figure 5: Impacts of External Deaths Among Different Sample Restrictions



Note: Figure presents coefficients and 95% confidence intervals of an event study design comparing surviving family members that experience a relative's external death at different points in time in red. Estimates in green use the subset of individuals who are enrolled for 6 years in the data. Estimates in blue use the subset of individuals who have gaps in enrollment between the first and last observed years. Estimates in yellow use the unrestricted sample of individuals from the enrollment analysis. The outcomes are an indicator for receiving any mental health diagnosis (Panel A), the logarithm of spending on claims associated with a mental health diagnosis (Panel B), number of days worked or contributed (Panel C), an indicator for receiving a depression diagnosis (Panel D), an indicator for receiving an anxiety and stress-related disorder diagnosis (Panel E), and an indicator for filling an anxiolytic prescription (Panel F). Estimation uses family members enrolled in the contributory regime. Standard errors are clustered at the individual level.

Appendix Figure 6: Impacts of External Deaths With Family Clustering of Standard Errors



Note: Figure presents coefficients and 95% confidence intervals of an event study design comparing surviving family members that experience a relative's external death at different points in time in dark red, clustering standard errors at the individual level. Estimates in light red cluster standard errors at the family level. The outcomes are an indicator for receiving any mental health diagnosis (Panel A), the logarithm of spending on claims associated with a mental health diagnosis (Panel B), number of days worked or contributed (Panel C), an indicator for receiving a depression diagnosis (Panel D), an indicator for receiving an anxiety and stress-related disorder diagnosis (Panel E), and an indicator for filling an anxiolytic prescription (Panel F). Estimation uses family members enrolled in the contributory regime.