Uncovering the Impact: Examining the Effects of Peru's Women's Emergency Center Policy and COVID-19 Lockdown and on Women's and children's Safety.

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Table of Contents

Abstract

Gender-based violence, a serious violation of human rights, disproportionately affects women and girls, with one in three experiencing physical or sexual violence in their lifetime. Despite policies aimed at addressing gender-based violence in many countries, including Peru, the region continues to experience high levels of violence. This manuscript-based thesis evaluates the impact of two policies in Peru on gender-based violence, one before and one during the COVID-19 pandemic, using approaches from social epidemiology and causal inference with individual and aggregated data.

The first manuscript focuses on the Women's Emergency Centers (CEMs) in Peru, which provide free counseling for victims and preventive activities in the community. Using a difference-in-differences model, the analysis suggests that while CEMs were created with the aim of reducing intimate partner violence (IPV), they may have had the opposite effect. The increase was only observed for psychological violence, which could be due to an increase in reporting due to awareness rather than in actual incidence. However, CEMs could potentially increase the incidence of psychological violence as a backlash. The second manuscript investigates the effect of differential outcome misclassification on the difference-in-difference estimate of the intervention effect, suggesting that outcome misclassification should be taken into account when evaluating policies that target violence against women using difference-in-difference estimates.

The third manuscript evaluates the effect of COVID-19 lockdown on the general rate of deaths from external causes in Peru, including female homicides and suicides and traffic accidents. External deaths presented a sudden drop after the lockdown was implemented, with changes in suicide and homicide revealing important characteristics of these events, although these changes were expected to be transient and evolve alongside the pandemic. The fourth manuscript analyzes the impact of COVID-19 lockdown on the usage of the nationwide violence helpline, showing a decrease in calls related to violence by outside of the household perpetrators for all age groups, and an

increase in calls related to psychological violence from all types of perpetrators for adult women.

These studies provide valuable insights into various aspects of violence, including external deaths, usage of nationwide violence helpline, and the effectiveness of CEMs in addressing IPV prevention. The findings highlight the complex nature of violence against women and the need to consider multiple factors when evaluating the impact of interventions. The results also shed light on the challenges of evaluating policies aimed at preventing violence and the importance of accounting for differential outcome misclassification. Overall, these manuscripts provide valuable information that can inform policymaking and guide future research in this critical area.

Resumé

La violence basée sur le genre, une violation grave des droits de l'homme, affecte de manière disproportionnée les femmes et les filles, dont une sur trois connaîtra une violence physique ou sexuelle au cours de sa vie. Malgré les politiques visant à lutter contre la violence basée sur le genre dans de nombreux pays, y compris le Pérou, la région continue de connaître des niveaux élevés de violence. Cette thèse basée sur des manuscrits évalue l'impact de deux politiques au Pérou sur la violence basée sur le genre, l'une avant et l'autre pendant la pandémie COVID-19, en utilisant des approches de l'épidémiologie sociale et de l'inférence causale avec des données individuelles et agrégées.

Le premier manuscrit porte sur les Centres d'urgence pour les femmes (CEM) au Pérou, qui fournissent un counseling gratuit pour les victimes et des activités de prévention dans la communauté. En utilisant un modèle de différences dans les différences, l'analyse suggère que bien que les CEM aient été créés dans le but de réduire la violence entre partenaires intimes (VPI), ils ont peut-être eu l'effet inverse. L'augmentation n'a été observée que pour la violence psychologique, qui pourrait être due à une augmentation des déclarations en raison de la sensibilisation plutôt qu'à une incidence réelle. Cependant, les CEM pourraient potentiellement augmenter l'incidence de la violence psychologique en représailles. Le deuxième manuscrit examine l'effet de la classification erronée différentielle des résultats sur l'estimation des différences dans les différences de l'effet de l'intervention, suggérant que la classification erronée des résultats doit être prise en compte lors de l'évaluation des politiques qui ciblent la violence contre les femmes en utilisant des estimations de différences dans les différences.

Le troisième manuscrit évalue l'effet du verrouillage COVID-19 sur le taux général de décès par causes externes au Pérou, y compris les homicides et suicides de femmes et les accidents de la route. Les décès externes ont connu une baisse soudaine après la mise en place du verrouillage, avec des changements dans le suicide et l'homicide révélant des caractéristiques importantes de ces événements, bien que ces changements

étaient censés être transitoires et évoluer avec la pandémie. Le quatrième manuscrit analyse l'impact du verrouillage COVID-19 sur l'utilisation de la ligne d'assistance nationale contre la violence, montrant une diminution des appels liés à la violence par des auteurs extérieurs au ménage pour tous les groupes d'âge, et une augmentation des appels liés à la violence psychologique de tous les types d'auteurs pour les femmes adultes.

Ces études fournissent des informations précieuses sur divers aspects de la violence, y compris les décès externes, l'utilisation de la ligne d'assistance nationale contre la violence et l'efficacité des CEM dans la prévention de la VPI. Les résultats mettent en évidence la nature complexe de la violence contre les femmes et la nécessité de prendre en compte plusieurs facteurs lors de l'é.

List of Abbreviations and Acronyms

GBV: Gender-Based violence

IPV: Intimate partner violence

CEM: Centro de Emergencia Mujer (Women Emergency Centers)

SAU: Servicio de Atencio Urgente (Urgent Care Service)

CAI: Centro de Atención Institucional (Institutional Care Center)

COVID-19: Coronavirus disease

HIV: Human immunodeficiency virus

WHO: World Health Organization

UN: United Nations

CEDAW: Convention on the Elimination of All Forms of Discrimination Against Women

ENDES: Encuesta Demográfica y de Salud Familiar

DHS: Demographic Health Survey

DID: Difference-in-differences

ITS: Interrupted time series

TWFE: Two-way fixed-effects

ATT: Average treatment effect on the treated

AURORA: National Program for the Prevention and Eradication of Violence against Women and Members of the family group

MIMP: Ministry of Women of Peru

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Contribution to original knowledge

This thesis presents a comprehensive evaluation of two policies that could potentially impact gender-based violence in Peru. Specifically, it examines the Women's Emergency Centers (CEMs) and the impact of COVID-19 lockdown measures. The different studies employ social epidemiology and causal inference approaches.

Manuscript 1 employs newly developed methods in quasi-experimental research and policy evaluation that account for the staggered nature of the CEM policy. Previous research has shown that traditional methods such as two-way fixed effects (TWFE) may be biased in policies with multiple time periods, failing to consider the heterogenous effects across units and time. The manuscript provides a rigorous evaluation of the CEM policy using a nationwide cross-sectional survey spanning 12 years.

Manuscript 2 focuses on a neglected topic in the literature - the role of norms and knowledge transfer in policy evaluation. These policies can affect the outcome by reducing the incidence of violence against women and increasing awareness, but they may also create a differential misclassification scenario. The manuscript illustrates how different levels of misclassification can affect the effect estimates and provides code and guidelines for conducting Monte Carlo Sensitivity Simulation using Difference in Difference analysis, which may be useful for other researchers.

Manuscript 3 evaluates the impact of the COVID-19 lockdown on suicides, homicides, and other forms of external deaths using an interrupted time series. It is one of the first papers to evaluate the impact of the lockdown during the early phase of the pandemic.

Manuscript 4 evaluates the impact of the COVID-19 lockdown on the use of nationwide helplines for violence against women. The study uses an event-study to illustrate the dynamic effect of the lockdown across time and provides valuable information in areas that presented a gap, including analysis of children and teenagers and an analysis of perpetrator relationships to survivors.

Contribution of Authors

Manuscript 1:

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RCA, PG, CC proposed the study; RCA, JK, AN, designed the study; AK contributed to the discussion and manuscript structure; RCA conducted the analysis and wrote the first version of the manuscript, AK, JK, AN, PG, CC provided feed back. All authors read and approved the final study.

Manuscript 2:

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RCA and JK proposed and design the study; RCA conducted the analysis and wrote the first version of the manuscript under the supervision of JK; RCA provided the R code and R markdown. All authors read and approved the final study.

Manuscript 3:

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Manuscript 4:

Renzo JC Calderón Anyosa, Felicia Knaul, Jay S. Kaufman.

RCA and JK proposed and design the study; FK contributed to the discussion and manuscript structure. RCA conducted the analysis and wrote the first version of the manuscript; JK, FK provided feed back. All authors read and approved the final study.

Chapter 1: Introduction

Gender-based violence remains a pervasive and alarming issue worldwide, with women and children often bearing the brunt of its impacts[1]. Aiming to address this human rights violation, various policies have been implemented globally to mitigate and prevent such violence[2,3]. In Peru, the Women's Emergency Center (CEM) Policy[4] and the COVID-19 lockdown[5] have played significant roles in shaping the country's response to this issue.

However, the effectiveness and consequences of these interventions warrant further examination to better understand their true impact on women's and children's safety.

The role of policy evaluation in addressing gender-based violence cannot be overstated, as it allows for a rigorous assessment of the effectiveness, efficiency, and equity of implemented interventions[6]. By systematically examining policies, researchers and policymakers can identify potential areas of improvement, inform decision-making processes, and allocate resources more effectively to address the most pressing needs[7]. Furthermore, policy evaluation helps in understanding the unintended consequences and potential drawbacks of interventions, which is essential for refining and adapting strategies to better protect vulnerable populations[8]. In the context of gender-based violence, policy evaluation plays a critical role in ensuring that interventions are not only well-targeted but also cognizant of the complex socio-cultural factors that underpin violence against women and children[6,9,10].

To this end, our research seeks to contribute to the literature on policy evaluation by providing a comprehensive analysis of Peru's Women's Emergency Center Policy and the COVID-19 lockdown, ultimately supporting the development of more effective policies to promote women's and children's safety.

1.1 Research Objectives

- Manuscript 1: To evaluate the effect of CEMs on intimate partner violence against women by employing a quasi-experimental methodology that accounts for the staggered rollout of the intervention.
- Manuscript 2: To explore the impact of different plausible misclassification scenarios on policy evaluation for social norm-changing policies aimed at preventing violence Using a quantitative bias analysis in quasi-experimental designs.
- Manuscript 3: To assess the early impact of the COVID-19 national lockdown on homicide, suicide, and traffic accident deaths in the Peruvian setting.
- Manuscript 4: To examine the impact of the COVID-19 national lockdown on helpline use in Peru by type of violence, perpetrator relationship, and survivor sex and age using a quasi-experimental design.

Through this comprehensive analysis, our research aims to shed light on the complex nature of violence against women and the multifaceted factors that must be considered when evaluating the impact of interventions. Ultimately, the findings of this study will contribute valuable knowledge to the ongoing efforts in addressing gender-based violence, offering essential guidance for policymakers and researchers to develop more effective and targeted solutions for improving women's and children's safety in Peru and beyond.

Chapter 2: Literature Review

2.1 Gender-based violence

Gender-based violence (GBV) is a global issue that continues to plague societies across the world, transcending geographic, cultural, and socio-economic boundaries[11]. It manifests itself in various forms, including physical, sexual, and psychological abuse, and disproportionately affects women and girls[12] . Despite significant strides made in the past few decades to address this issue, GBV remains a pervasive problem that demands the attention of policymakers, civil society organizations, and individuals alike[10]. Its far-reaching consequences not only impact the lives of those directly affected but also undermine the potential for sustainable development and social cohesion.

Over 1 billion women and girls, which is more than a third of the female population, endure intimate partner violence or non-partner physical or sexual violence during their lifetime[13]. Additionally, the prevalence of physical abuse in childhood is reported by almost a quarter of all adults worldwide, while the occurrence of childhood sexual abuse is unacceptably high for both genders, particularly for girls (20%) compared to boys (10%)[14,15]. The impact of these health conditions and risk factors is widespread, affecting a significant proportion of the global population, particularly those living in poverty or experiencing vulnerability due to forced migration or humanitarian emergencies[1].

This widespread violence not only has immediate and long-term physical and psychological consequences for the survivors but also carries significant social and economic costs[16,17]. For instance, it perpetuates gender inequalities[18], exacerbates poverty[19], and hinders women's access to education[20], employment[21], and political representation[22,23]. Moreover, the normalization of GBV within communities fosters a culture of impunity, perpetuating the cycle of violence and further eroding the fabric of society[24–26].

2.1.1 Forms of violence

There are several types of violence that can be classified under the umbrella term of gender-based violence. The term “gender-based” is used because such violence is shaped by gender roles and status in society[12]. Some of the most prevalent forms include intimate partner violence[27], sexual violence[28], human trafficking[29], female genital mutilation[30], and forced marriages[31]. Intimate partner violence involves physical, sexual, or psychological harm caused by a current or former partner, while sexual violence refers to any sexual act committed against someone without their consent. Human trafficking, specifically for sexual exploitation, disproportionately affects women and girls. Female genital mutilation and forced marriages are forms of violence deeply rooted in cultural and social norms that perpetuate gender inequality and the subjugation of women.

Intimate partner violence is the most prevalent form of gender violence, with women being abused by their male partners. Studies have shown that between 10 and 60% of women who have ever been married or partnered have experienced at least one incident of physical violence from a current or former intimate partner[13,32]. While women can also be violent, partner abuse is mostly perpetrated by men against their female partners[33–35]. Physical violence in intimate relationships is almost always accompanied by psychological abuse, and in one-third to over one-half of cases, by sexual abuse[16,36,37]. Women who experience any physical aggression typically suffer multiple acts over time, creating an atmosphere of terror that often permeates abusive relationships[38]. Fear for their lives is a common experience among women who have been physically abused in a relationship, and they often say that the psychological abuse and degradation are even more difficult to endure than the physical abuse itself[33,37].

Sexual coercion and abuse are also prevalent issues in the lives of many women and girls. This type of violence includes a range of behaviors from forcible rape to non-physical forms of pressure that compel individuals to engage in sexual activity against their will[39–41]. Studies show that non-consensual sex often takes place among individuals who know each other, including spouses, family members, courtship partners, or acquaintances[14,42]. Shockingly, non-consensual sex frequently occurs within consensual unions, with women

reporting experiences of forced sex and degrading sexual activity within their marriages[43,44]. However, it is important to note that the prevalence of arranged marriages, which make up around half of all marriages globally[45], complicates the notion of "consent" in such unions, particularly for women who may not have a say in their marriage arrangement.

While it is difficult to obtain accurate data on the prevalence of sexual abuse in childhood due to the taboo nature of the topic, representative sample surveys have raised concerns. Studies indicate that anywhere from 10 to 30% of women report behavior constituting sexual abuse in childhood, with girls reporting a higher prevalence of abuse than boys[46]. Studies consistently show that the vast majority of perpetrators are male and are known to the victim, with many perpetrators having themselves been sexually abused in childhood[47]. Sexual abuse is most likely to cause long-term harm when it is prolonged, perpetrated by a father or father figure, involves penetration, or uses force or violence[47,48].

2.1.2 Consequences of violence

Intimate partner and sexual violence have a significant impact on survivors' physical, mental, sexual, and reproductive health, and can result in high social and economic costs[49]. Women who experience violence by their intimate partners are at a higher risk of injuries[50], sexually transmitted infections, and HIV[51]. Additionally, intimate partner violence is associated with adverse reproductive health outcomes such as induced abortion[52,53], preterm births, and low-birth-weight babies[54]. It is also linked to mental health disorders such as depression, post-traumatic stress disorder, and attempted suicide[55,56].

Children who grow up in households with violence may suffer from various behavioural and emotional disturbances that can lead to perpetrating or experiencing violence later in life[57,58]. Intimate partner violence has been associated with higher rates of infant and child mortality and morbidity, such as diarrhoeal disease and malnutrition[59–62]. The social and economic costs of intimate partner and sexual violence are extensive and have far-reaching effects throughout society, including isolation[37], housing insecurity[63], inability to

work[64], loss of wages[65], limited ability to care for themselves and their children, and decreased participation in regular activities[66].

2.1.3 Response to violence

The prevention of violence against women is critical due to its serious physical, mental, sexual, and reproductive health effects on both women and children. The framework called RESPECT women[67], launched by WHO with UN Women and 10 other agencies, outlines seven strategies that can be used to prevent violence against women. While more research is needed to improve understanding of how interventions work, promising interventions include group-based workshops to promote egalitarian attitudes and relationships and gender empowerment training for women and girls[68–71]. The health system is an essential entry point for responding to violence against women. The system can offer identification of violence, psychosocial support, treatment of presenting health conditions, referrals to support services, and contribute to prevention through health promotion messages[72].

Various actions have been taken by governments, non-governmental organizations, and international bodies to address gender-based violence. These include the formulation and implementation of policies and legislation, awareness-raising campaigns, and the establishment of support services for survivors. Some key international frameworks aimed at addressing GBV include the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW)[73] and the United Nations Security Council Resolution 1325 on Women, Peace, and Security[74]. These instruments recognize the need for a comprehensive and coordinated response to GBV and call for the inclusion of women in decision-making processes at all levels.

According to research and programmatic experience, the prevention of violence against women and girls in low- and middle-income countries can be achieved through interventions that target the root cause of violence: unequal gender-power relations and the associated attitudes, norms, and behaviors[6,75]. Collaboration across various sectors, such as health, criminal justice, faith, education, and civil society, is necessary to achieve

meaningful change in the social and political structures as well as for individuals and communities[6,9,32,76]. Theory-informed programming that consists of complementary and mutually reinforcing components is essential for effective prevention of violence against women and girls[76].

Women's movements play a significant role in advocacy and action against violence and remain central in the design and implementation of high-quality prevention programs[76–79]. Greater investment in programmatic innovations, research-activist collaborations, and health sector-leadership is needed to build momentum for primary prevention of violence against women and girls based on evidence and promising practical models[10,80].

One significant policy in the efforts to address violence is Victoria's Plan to Prevent Violence against Women 2010-2080, also known as "A Right to Respect."[81]. It was a pioneering policy developed by the state of Victoria in Australia with a focus on primary prevention of violence against women and girls. The policy aimed to contribute to a significant reduction in violence against women by cultivating non-violent and non-discriminatory social norms, creating gender-equitable, safe, and inclusive communities and organizations, and building equal and respectful relationships between women and men. The plan used a public health approach with a population-level scope and identified five settings for implementation, including education and training environments, local government health and community services, sports and recreation organizations, workplaces, and the media, art, and popular culture.

The plan's implementation strategies emphasized building organizational infrastructure with a partnership-based model and clear accountable leadership, workforce development, and support for community leadership to bring about change. Although the plan was launched with a costed plan for a four-year pilot implementation, it was not implemented due to a change in political leadership at the state level. However, the framework and policy development process provide a model for similar government policies. The framework for A Right to Respect was developed through a highly consultative process led by the Office of Women's Policy in Victoria's Department of Planning and Community Development, featuring broad consultation across civil society

and government, the development of a solid evidence base, government-community partnerships, and high-level leadership and supportive institutional environments[81].

Another intervention that promoted personal and collective activism was SASA!, which is a community mobilization approach developed by Raising Voices in Uganda that aims to prevent violence against women and HIV by addressing gender inequality[82]. The approach avoids instructional messaging and instead focuses on cultivating a process of consciousness raising in men and women community members, leaders, and other stakeholders through encouragement of critical thought. SASA! continually challenges community members to think about their own experiences and come to their analysis of the benefits or costs of how they use their power. SASA! aims to build a critical mass of individuals and generate communal thought about power and how it manifests as personal and collective action. The approach creates a cohort of women and men from within a community, who are trained by staff of an implementing organization to lead community activities. These community activists engage their friends, neighbors, relatives, and peer groups in informal activities, including quick chats, door-to-door discussions, community conversations, posters, comics, and games as part of their daily routine rather than through formal activities led by non-governmental organizations.

A cluster-randomized controlled trial of SASA! showed the effectiveness of the approach in changing norms and attitudes and reducing violence and HIV risk behaviors. The study found that the intervention led to a significant decrease in the social acceptance of IPV among both women and men. Women and men in the intervention group showed significantly greater acceptance of a woman's right to refuse sex[83].

Another example in Latin America is the Nicaraguan non-government organization “Puntos de Encuentro” (meeting points)[84] which produces and broadcasts two television series, “Sexto Sentido” (Sixth sense) and “Contracorriente” (against the current), to challenge machismo and violence in Nicaragua and Central America. The series are part of a multi-pronged approach, grounded in social learning theory and complexity theories, that seeks to foster an enabling environment for individual and collective change and action. “Puntos de encuentro” combines their television series, radio programme, feminist

magazine, and training courses to change the social and cultural context in which private and public discourse and dialogue occurs. The television series are developed in coordination with organizations and activists working on the issues and reveal the underlying power relations and struggles. Results from the previous comprehensive impact evaluation of “Puntos de encuentro” work on HIV prevention showed that the television series and related activities had substantially affected 13-25 year olds in Nicaragua[85]. Regular viewers had more gender-equitable views about gender roles and relationships and were more likely to know of a center that provides attention for cases of domestic violence. The study also identified certain areas that need greater coordination to better capitalize on the increasing awareness promoted by the mass media components.

Despite the concerted efforts by various stakeholders to combat gender-based violence[80], there is still much work to be done in evaluating the effectiveness of these actions. While progress has been made in increasing awareness and implementing policies[76,79], the prevalence of GBV remains high in many parts of the world[13]. This highlights the need for ongoing assessment and adaptation of strategies to ensure they are effectively addressing the root causes of violence. Moreover, it is crucial to engage men and boys as allies in the fight against GBV, as their involvement is vital in transforming societal attitudes and fostering a culture of gender equality and respect[86].

2.2 Gender-based violence in Peru

Peru has a disturbingly high rate of domestic violence against women. According to the 2019 ENDES: Encuesta Demográfica y de Salud Familiar (Demographic Health Survey, DHS) psychological IPV is the most common form of abuse, with 53% of surveyed women reporting having suffered it, although that percentage can reach to over 80% in some areas of the country[87]. Physical and sexual violence are also prevalent, with 30% and 7% of women respectively experiencing them[87].

Violence against women in Latin America and Peru is closely tied to patriarchal structures that remain deeply ingrained in society[88]. Although the concept of patriarchy has been

criticized for being simplistic and Eurocentric[89], it remains a useful tool for understanding the systematic subordination of women by men, both structurally and ideologically[90]. In Latin America, patriarchal authority over family and women was not weakened by secularization after independence, and existing colonial legislation regulating gender relations was often only modified rather than abolished[91,92]. Although legal improvements were made in favor of women in the 20th century, Catholic morality continues to shape politics and policy in issues related to family and sexuality, keeping patriarchal authority alive[93–96].

The region's violence has also been exacerbated by internal conflict and political instability. Peru experienced widespread violence during the 1980s and 1990s due to the conflict between Shining Path and the armed forces, resulting in the deaths and disappearances of over 69,000 people[97,98]. The “Truth and Reconciliation Commission” found that sexual violence was used strategically to terrorize communities and torture prisoners, with the majority of these cases attributed to the armed forces[99]. The use of sexual violence by both armed groups magnified existing institutionalized and normative violence against women, reflecting long-standing racism and sexism. The Peruvian judiciary has neglected to prosecute cases of wartime sexual violence, despite the outcry from feminist and human rights circles, due to societal ideas about violence against women and sexual violence in particular[94].

Of the 538 cases of rape identified by the “Truth and Reconciliation Commission”, only 16 were investigated and presented for public prosecution, and the majority of these cases remain in preliminary investigation with the public prosecutor[99]. Additionally, lack of evidence and the idea that rape is only rape when there is lasting, and visible physical harm done have hindered prosecution efforts. Furthermore, the military has refused to open archives and cooperate with investigations, claiming that relevant information was burned, and there is an overall reluctance of the public prosecution, judiciary, and military to confront human rights abuses[99,100].

The normalization of violence against women in Peru is evident in both wartime and “peacetime”. The failure to address structural inequalities and the disregard for the

security of women perpetuates violence against women and suggests that women, especially indigenous and/or poor women, are not worthy of human rights[94,101]. Not only is the Peruvian state is the primary perpetrator of violence against women, but it is also complicit in normalizing such violence. This has resulted in social movements adopting the phrase "Perú, país de violadores" (Peru, country of rapists)[102–104]. The persistence of intimate partner violence and impunity further demonstrates the normalization of violence against women in Peruvian society.

Intersecting inequalities also contribute to violence against women in Peru, with socio-economic factors and hierarchical relationships between men and women playing a role[105]. Race is also an important factor, with women generally being perceived as lower on the racial ladder than men from the same group[106–108]. In intimate relationships, violence is often used to maintain and perpetuate hierarchies, and the state is complicit in perpetuating gender, race, and class hierarchies through impunity for violence against women. Overall, patriarchal structures and intersecting inequalities create a vulnerable position for women in both public and private spaces in Peru.

2.2.1 Policy landscape

Peru has made significant progress in developing a comprehensive policy framework to address issues related to gender equality, human rights, and violence prevention. The country has signed and ratified various international treaties that set the standard for addressing these issues. These treaties include The Universal Declaration of Human Rights, the Convention on the Elimination of all forms of Discrimination against Women (CEDAW), and the Inter-American Convention to Prevent, Punish, and Eradicate Violence against Women (Belém Do Pará)[109]. These agreements establish a framework for addressing issues related to human rights, non-discrimination, and violence against women, which are critical for promoting gender equality.

In addition to these international treaties, Peru has also developed several non-binding agreements with significant political and ethical value. The Declaration of Vienna and the Programme of Action of the Second International Conference on Human Rights, the

International Conference on Population and Development, and the Declaration of Beijing are among them[109]. These agreements condemn violence against women and recommend the adoption of measures to eliminate all forms of exploitation, abuse, harassment, and violence against women, adolescents, and girls. They also recommend promoting changes in the attitudes of judicial, medical, police, social, and educational personnel to prevent violence against women.

Peru's legal framework for addressing violence against women has evolved in the past two decades. The country's Constitution recognizes the importance of protecting human dignity and respecting the rights of individuals[110]. In 1997, the first law addressing gender-based violence was passed as Law N°26260, also known as the "Law against Family Violence"[111]. While its main focus was on violent acts within the family, the law aimed to establish the policies of the state and society towards family violence, as well as the corresponding protective measures. Over time, the law evolved, and its scope was expanded, leading to its replacement by Law N° 30364, named "Law to prevent, punish and eradicate violence against women and members of the family group"[112]. This new law had a wider scope that included other forms of violence both within and outside the household. The law establishes policies to eradicate violence, investigate and sanction cases of violence, and provide support and rehabilitation for survivors and aggressors. It also promotes measures to prevent violence, including awareness-raising campaigns and training for key personnel, such as judges, prosecutors, health agents, and educators.

Furthermore, Peru has a National Plan to Combat Violence against Women, which is renewed every five years and marks a significant step forward in addressing violence against women in the country[113–115]. This plan sets out interventions and objectives for five ministries, namely Women, Health, Education, Defense, and Justice, and seeks to fulfill Peru's international obligations regarding women's human rights. The plan aims to establish policies that prevent, punish, and eliminate violence against women, including awareness-raising campaigns, support for victims, and rehabilitation for perpetrators. It also highlights the importance of promoting gender equality and non-discrimination and

stresses the need for coordination among different stakeholders, including government agencies, civil society organizations and communities.

The Ministry of Women in Peru provides various services and interventions to survivors of violence and vulnerable populations[116]. The “Centros de Emergencia Mujer” (CEM) or Women’s Emergency Centers in English are specialized and free public services that offer comprehensive and multidisciplinary care to victims of violence, providing legal and psychological guidance[117]. The Linea 100 is a 24-hour toll-free service that offers emotional support, guidance, and information on family and sexual violence at the national level. The “Servicio de Atencio Urgente” (SAU) or Urgent care service is a specialized and free service that aims to provide immediate and effective attention to victims of family and sexual violence who call the Linea 100[118].

The “Centro de Atención Institucional” (CAI) or Institutional Care Center is an intervention service for adult men who have been sentenced for acts of family violence and are referred by the family court for recovery. Chat 100 provides personalized online information and psychological guidance from the Ministry of Women professionals to identify risk situations[118]. The Ministry of Public Prosecution is an autonomous state agency whose main functions include defending legality, citizens' rights, and public interests. The Ministry of Justice and Human Rights offers legal assistance and representation, guaranteeing access to justice and the right to defense.

The Ministry of Health provides psychological attention through Línea 113, option 5, and the Community Mental Health Centers offer comprehensive care to victims of violence[119]. The Ministry also distributes the Emergency Kit for women, girls, or adolescents who have suffered sexual violence for free[120]. The Peruvian Judicial System provides contacts for the different judicial districts, and the “SiseVe” (Yes, we see it) platform allows reporting of school violence[121]. The JNE allows for registering cases of political harassment towards women, and the Ministry of Labor and Employment Promotion offers a helpline to report cases of sexual harassment or bullying at work[122]. Finally, the Ministry of Women and Vulnerable Populations provides a platform for registering virtual harassment alerts[123], and the Registry of Delinquent Alimony Debtors (REDAM) records those who

owe three consecutive or non-consecutive child support payments established by judicial order[124].

2.2.2 Women's Emergency Centers (CEM)

The CEMs were initially launched in 1999 as a pilot initiative consisting of 14 centers, aiming to combat violence against women[125]. These centers deliver comprehensive and interdisciplinary support for survivors of familial and sexual violence. They provide two primary service categories: assistance services for violence survivors and preventive services targeting the general population, policymakers, institutional authorities, and other professionals involved in the coordinated system, such as educators, doctors, and police officers.

Assistance services cover a variety of free offerings, such as legal guidance, social orientation, judicial defense, and psychological support. Moreover, they assist survivors throughout the process of accessing forensic services or visiting police stations[126].

Preventive and promotional plans within the CEMs consist of training, social participation, and dissemination efforts, focusing on two cross-cutting themes[127]: prevention and promotion. Prevention involves identifying, controlling, and reducing risk factors to avoid violence from emerging, persisting, or causing further harm. Promotion targets interventions that identify and strengthen positive or protective factors against familial and sexual violence at both individual and collective levels. A social communication specialist, also known as a social promoter, assumes responsibility for these preventive and promotional actions. The events are external activities targeting the general public, not solely those affected by familial and sexual violence.

These preventive measures cover a broad spectrum of community activities, including educational workshops, fairs, parades, radio and TV spots, and other initiatives designed to foster a change in societal norms. Examples include coordinating between institutions or jointly managing an individual who reports violence at a healthcare center or another institution. Furthermore, an advocacy component focuses on collaborating with authorities to prioritize efforts toward creating safer communities. The activities address

topics such as altering gender norms, promoting gender equality, ensuring respect for all, recognizing various forms of violence, and familiarizing potential users with the CEMs' extensive services, ultimately encouraging a culture of peace. A comprehensive list of preventive activities and subjects can be found in Manuscript 1's appendix.

The CEMs have undergone a significant expansion since their initial rollout in 1999. From 14 centers, around 20 new ones have been created annually, reaching a total of 245 by 2016, covering every province in the country[125]. In 2017, a new form of CEM was introduced, known as the Police Station CEM[128], which requires CEMs to be located inside police stations. This change aimed to avoid revictimization by eliminating the need for survivors to narrate their events twice, once at the CEM and then again at the police station. Additionally, having the CEMs inside police stations could streamline the police denounce process and speed up paperwork. Despite this expansion, challenges remain, including securing adequate funding, ensuring the availability of trained personnel, and promoting the centers' acceptance and use by the communities they serve. The “Defensoría del Pueblo”, Ombudsman office, conducted a supervision of all CEMs in Peru as of May 31, 2018[129]. The report revealed that only 20% of CEMs operate 24 hours a day, 7 days a week, while 68% have only one professional for legal assistance and representation, and 69% have only one psychologist. Despite this, 57% and 61% of centers can manage the demand for legal and psychological attention, respectively. Additionally, 72% of CEMs lack wheelchair access, and 37% do not have toilets. Only 16.9% of CEMs have childcare services, while 5% lack private spaces for legal, psychological, and social counseling. Most CEMs lack protocols for different vulnerable groups, yet 81% of users report that the information provided was clear. The report also indicates that less than 1% of requested protection measures were granted and executed, and only 5% of cases concluded with a conviction.

The evaluation of the CEMs is essential due to several factors. First, despite being one of the few policies that have physically reached many communities in the interior of the country, they have been ruled out from covering most of the national territory. Therefore, assessing their effectiveness and potential for expansion is crucial. Second, the CEMs

have a preventive component that complements their assistance services, which could reach more people and have a more significant impact on reducing violence against women and violence against children. Third, notable investment has been made in these centers, yet no in-depth evaluation has been conducted to determine their impact and identify potential areas for improvement. Therefore, evaluating the CEMs' effectiveness is necessary to make informed decisions on their future funding, expansion, and improvement. Manuscript 1 covers an in-depth policy evaluation of the CEMs, taking into account their staggered rollout and the potential to have an impact on violence.

2.3 Gender-based violence during the COVID-19 pandemic

The COVID-19 pandemic has had a significant impact on gender-based violence (GBV) globally[130]. The measures taken to control the spread of the virus, such as lockdowns and quarantines[131], have led to a rise in cases of GBV, as victims are confined to their homes with their abusers[132]. Moreover, the pandemic has led to an increase in economic hardship, which exacerbates the conditions for GBV[133]. Women and girls who experience GBV during the pandemic are faced with significant barriers to accessing services, including fear of exposure to the virus, limited mobility, and a lack of available resources[134–136].

Governments and civil society organizations have implemented measures to respond to the increase in GBV during the pandemic. These measures include the expansion of hotlines and emergency services, the provision of remote counseling services, and the establishment of safe spaces for women and girls[137,138]. Governments have also implemented awareness campaigns to encourage reporting of GBV and provide information on available support services. Additionally, many organizations have advocated for the inclusion of GBV services as essential services during the pandemic[139].

Latin America has been disproportionately affected by the COVID-19 pandemic, which has resulted in significant economic consequences and jeopardized the well-being of families in the region[140]. While social protection policies have a critical role to play in safeguarding individual and family welfare, the response has not been adequate to

address the magnitude of the crisis with challenges in the need to provide prompt and effective financial assistance to families who have lost their livelihoods and the increased risk of IPV that must be addressed and mitigated[141].

Despite these efforts, there are still significant gaps in GBV prevention and response during the COVID-19 pandemic[142]. Many survivors still face barriers to accessing services, and the economic and social impacts of the pandemic continue to contribute to the prevalence of GBV[143,144]. More action is needed from governments, civil society organizations, and individuals to address GBV during the pandemic and beyond.

2.3.1 Peru's response to the pandemic

Peru has been one of the countries hit hardest by the COVID-19 pandemic, with one of the highest levels of mortality per capita in the world[145,146]. The country has struggled to control the spread of the virus due to its densely populated cities, poor healthcare infrastructure, and high poverty rates. In addition, many Peruvians work in the informal economy, making it difficult for them to follow social distancing measures or stay at home[147]. As a result, the virus has spread rapidly throughout the country, overwhelming hospitals and leading to a high number of deaths.

Despite these challenges, Peru has made efforts to respond to the pandemic. The government implemented strict lockdown measures early on, which helped to slow the spread of the virus[148].

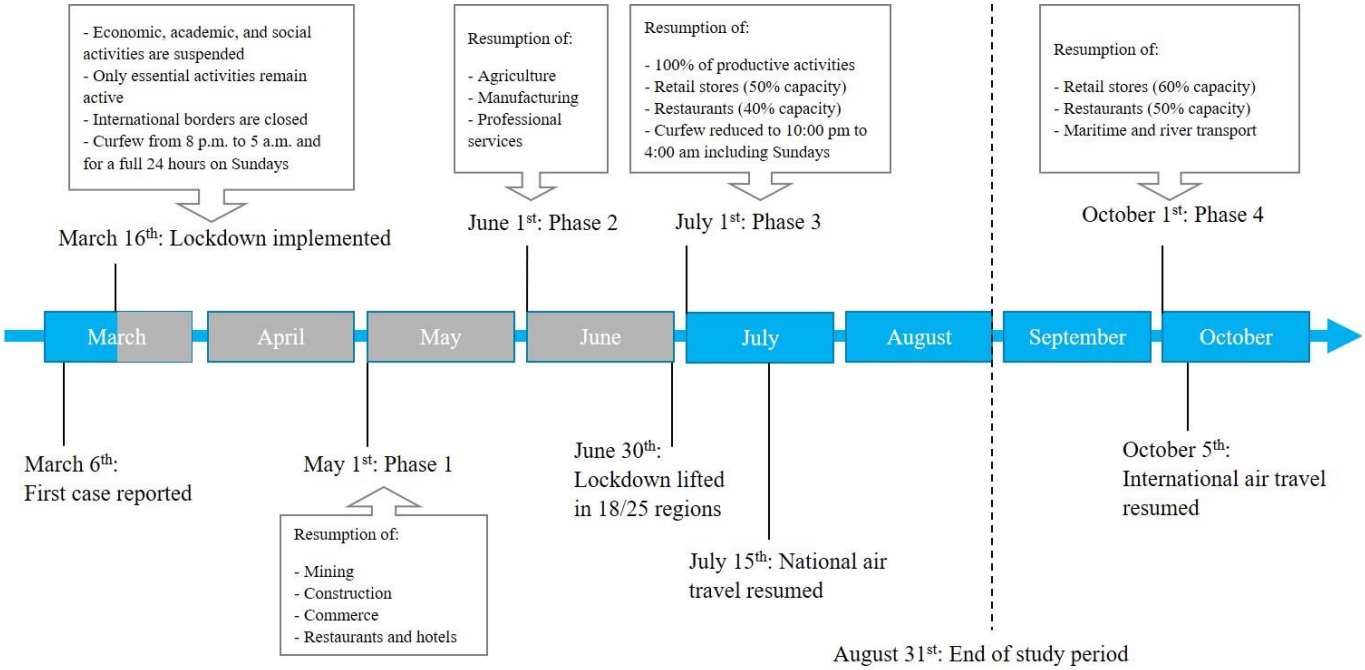
2.3.2 Lockdown

The Peruvian lockdown was one of the strictest in the world, with measures that included the closure of borders, a curfew, and a ban on all non-essential travel[148]. On March 6th, 2020, Peru confirmed its first case of COVID-19[149]. Just ten days later, on March 16th, the government declared a state of emergency due to the pandemic[150]. The emergency measures included the closure of international borders and suspension of economic, academic, and social activities across the entire country, with the exception of essential services like food supply, pharmacies, and banking. Military and police enforced a strict

lockdown with a curfew from 8 pm to 5 am and for a full 24 hours on Sundays. Movement between regions within the country was banned and restrictions on public transportation and movement between regions.

To gradually lift the lockdown and reopen economic activities, Peru implemented a four-phase de-escalation plan. Phase 1 began in May 2020 and included the resumption of mining, construction, commerce, and some services related to tourism[151]. Phase 2 started in June and expanded the reopening to agriculture, manufacturing, and professional services[152]. Phase 3 began on July 1st and gradually incorporated almost 100% of productive activities, including the reopening of retail stores and the lifting of the lockdown in most regions[153]. Phase 4 began on October 1st and allowed for increased capacity in restaurants and retail stores. International borders and air travel reopened on October 5th with flights to six countries in the Americas region[154].

The following figure summarises the Lockdown phases in Peru:



From: *Calderon-Anyosa RJC, Bilal U, Kaufman JS. Variation in Non-external and External Causes of Death in Peru in Relation to the COVID-19 Lockdown. Yale J Biol Med. 2021 Mar 31;94(1):23-40. PMID: 33795980; PMCID: PMC7995934.* Permission granted by the Yale Journal of Biology and Medicine.

Peru's response to the COVID-19 pandemic has been hampered by contextual factors such as diverse populations, deep poverty, and a lack of laboratories for testing. Informal employment, lack of trust in the government, and the need for daily shopping due to cultural norms have also contributed to the spread of the virus[147]. Despite allocating 12% of GDP to individuals and companies who lost income due to lockdown measures, income support arrived too late for many who did not have bank accounts, causing queues outside banks and increasing the risk of virus transmission[155,156]. Food distribution to families on low incomes was slow and ineffective, and public health experts say the government's support has been insufficient, leaving individuals and private organizations to fill the gaps[157,158]. Experts suggest that Peru's failure to stem the spread of the virus was due to a Euro-centric response that did not consider local culture and context, and tailored interventions could have been more effective in controlling the pandemic[147].

In terms of GBV, a study conducted using the double list randomization experiment found that 8.3% of young people aged 18-26 in Peru experienced an increase in physical domestic violence during the COVID-19 lockdown[159]. Those who had previously reported experiencing domestic violence in 2016 were more likely to experience an increase in violence during the lockdown, with 23.6% reporting an increase. The reported increase in violence did not differ by gender.

2.3.3 Helpline 100 (Linea 100)

During the lockdown in Peru, most services were shut down to prevent the spread of COVID-19, including the closure of CEMs, leaving survivors of gender-based violence particularly vulnerable. With limited access to support services, survivors were forced to stay at home with their perpetrators, increasing their risk of violence[160]. In response, the government kept the helpline 100 open as an essential service, providing a lifeline for those in need[161]. The helpline offered support and advice to survivors of violence, as well as information about available services and resources. Additionally, the government

launched a campaign to raise awareness about the increased risk of violence during the lockdown and encourage people to report any incidents of abuse. While the lockdown had a significant impact on the availability of support services, the government's efforts to maintain the helpline and raise awareness about gender-based violence helped to ensure that survivors had access at least to one vital support during this difficult time. Being confined with their aggressors is a significant obstacle for survivors to access this service. In addition, mobility restrictions may prevent other forms of support, leaving survivors with no visible assistance.

The impact of the lockdown on gender-based violence in Peru underscores the broader issue of violence against women worldwide. A study conducted early in the pandemic found a 48% increase in calls to a violence against women helpline in Peru after stay-at-home policies were implemented, with effects increasing over time[162]. The results indicate a pressing requirement for policies to alleviate the unintentional consequences of COVID-19 stay-at-home orders and for further investigation into the unintended consequences on gender-based violence.

In Manuscripts 3 and 4, a deeper understanding of the unintended consequences of lockdowns is explored. The former evaluates the impact of lockdowns on homicides and suicides, providing new insights into previously unknown consequences. The latter examines the only available service during lockdowns, the helpline 100, and evaluates its impact not only in terms of total increase but also takes into account survivor characteristics such as age, gender, and their relationship to the perpetrator.

Chapter 3: Overview of methods

3.1 Quasi-experimental designs for policy evaluation

Quasi-experimental designs are becoming increasingly popular in epidemiology and health systems research. These designs are particularly useful for evaluating health care practice, programs, and policy, as they enable strong causal inferences without the need for randomized controlled experiments[163]. These designs have a pre-existing comparison group that is used to estimate the effect of an intervention. Two of the most commonly used quasi-experimental designs for policy evaluation are interrupted time series (ITS) and difference-in-differences (DID).

3.2 Interrupted Time Series (ITS)

Interrupted time series is a quasi-experimental design that involves collecting data over time both before and after the introduction of an intervention[164]. The intervention is assumed to either have a sudden impact on the outcome of interest, a change in the post-treatment time slope, or a combination of both[165]. The design allows for the identification of a causal relationship between the intervention and the outcome by comparing the pre- and post-intervention trends in the outcome variable. Interrupted time series studies are generally unaffected by typical confounding variables that remain constant over time, such as population age distribution or socioeconomic status[165]. However, time-varying confounders that change more rapidly, such as seasonality, may affect the results. These confounders can be controlled for by including variables representing them in the regression model. Other events occurring around the same time as the intervention can also be considered time-varying confounders. Over-dispersion and autocorrelation are other issues that may affect ITS studies, and they can be addressed by scaling adjustment and statistical methods such as Prais regression or autoregressive integrated moving average (ARIMA)[166,167].

Manuscript 3 utilizes the ITS design to take advantage of continuous measurements of external death rates over a period of 2 years prior to the pandemic and 5 months after.

3.3 Difference-in-Difference (DID)

Difference-in-differences is a widely used quasi-experimental technique for policy evaluation that seeks to estimate the causal impact of a treatment or policy intervention by comparing the outcomes of treated and control groups before and after the implementation of the policy[168,169]. This approach relies on the assumption that, in the absence of the intervention, the treatment and control groups would have followed parallel trends over time. By examining the differences in outcomes between the two groups before and after the policy change, DID isolates the causal effect attributable to the policy, net of any time-invariant unobserved factors that might influence the outcome. The key advantage of this method is its ability to control for unobservable factors that are constant over time and that might otherwise confound the causal relationship between the policy intervention and the outcome of interest. However, the validity of the DID estimates hinges on the parallel trends assumption, which, if violated, can lead to biased results.

Difference-in-Differences analysis has evolved significantly since its inception as a simple two-way fixed-effects (TWFE) regression model for panel data analysis[170]. The original TWFE model compared changes in an outcome variable over time between a treatment group and a control group. The treatment group received an intervention, while the control group did not. The model used fixed-effects to control for time-invariant differences between the two groups.

However, the original two-way fixed-effects model had limitations in its ability to evaluate staggered interventions[171,172]. A staggered intervention occurs when the treatment is rolled out at different times for different groups. The original model was not designed to handle staggered interventions since it assumes that the intervention occurs at the same time for all groups. Additionally, the TWFE regression works best under treatment effect homogeneity, an assumption that is difficult to prove, as it assumes that the effect of treatment does not vary across units or time periods.

The main limitation in using TWFE is in the "bad control group" of late-treated groups to already treated groups in staggered treatments with multiple time periods. The comparison of outcomes for late-treated groups confounds the treatment effect dynamics of already treated groups, leading to negative weighting issues in TWFE regression[168,171,172]. Treatment effect homogeneity justifies using already treated groups as a comparison group, but it does not guarantee that the estimate is equal to the overall average treatment effect when there is treatment effect heterogeneity across groups or time/length of exposure to treatment. This limitation imposes stronger requirements on the data generating process than the DID identification strategy would suggest, leading to poor estimates of treatment effect parameters of interest.

Alternative approaches can directly target particular parameters of interest while being robust to general forms of treatment effect heterogeneity and not much more complicated than a TWFE regression. Callaway and Sant'Anna[173] proposed a new estimator that can handle staggered interventions. The key concept in Callaway and Sant'Anna's DID is the group-time average treatment effect (ATT), which is a unique ATT for a cohort of units treated at the same time. For example, if two units of analysis are treated at the same time, let's say 2005, they will be referred as group 2005. The group-time ATT is a dynamic term, and there are ATT parameters for each group and time combination, from the time of the group received the intervention, until the end of the follow-up. For Group 2005, we will have one group-time average ATT, since 2005 until the end of the follow up. There are numerous group-time ATTs for every group, which can make parameter estimates challenging. Callaway and Sant'Anna's DID provides a simple way to aggregate the numerous group-time average treatment effects (ATTs) into fewer and simpler parameters. One approach is to aggregate by group, where the group-specific ATT is calculated by averaging the group-time ATTs across all time points for each group. This is repeated for all groups, and the group-specific ATTs are further averaged to obtain an overall ATT representing the average effect of the intervention across all groups. Another approach is to average by time in relation to the intervention, allowing for dynamic treatments and presenting the results in an event study. These grouping options

do not impose treatment homogeneity and allow for time heterogeneity by including never treated units or not-yet-treated units in the control group. This approach avoids the problem of already treated units in the control group that was an issue for the TWFE model.

Initially, we intended to use the TWFE model for Manuscript 1. However, as we progressed, new and improved models emerged, allowing me to expand my understanding of quasi-experimental designs for policy evaluation and the advantages and challenges of different methods. Manuscript 1 and 4 extensively used DID, contributing to the literature that previously overlooked bias in staggered treatments. For Manuscript 2, we went a step further by developing tools to address misclassification in the context of DID designs.

Chapter 4:

Manuscript 1.

The impact of Peru's Women's Emergency Centers on the reporting of physical, psychological, and sexual intimate partner violence among women

4.1 Title page

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4.2 Abstract

Background:

Violence against women is a persistent global problem with serious consequences. In response, Peru established Women's Emergency Centers (CEMs) in 1999. This study aimed to assess the impact of CEMs on physical, psychological, and sexual intimate partner violence (IPV) in Peru from 2004, the first year of available data, to 2016.

Methods:

We conducted a secondary analysis of the Demographic and Health Surveys' domestic violence module, using a difference-in-differences approach with the Callaway and Sant'Anna estimator to account for the staggered introduction of CEMs across districts.

Results:

Our findings showed a 3.00 percentage point (pp) (95% CI: 0.61; 5.39) increase in the probability of reporting any form of IPV, primarily driven by psychological violence reporting (3.07 pp, 95% CI: 0.60; 5.55). Analyses of the effect of CEMs on physical and sexual violence were inconclusive but indicate that the CEMs did not have large impacts on these forms of violence.

Discussion:

Despite the goal of reducing IPV, CEMs may have unintentionally increased reporting of psychological IPV in certain intervention groups. This increase could be due to heightened sensitization, more individuals reporting than before, or a rise in incidence stemming from unaddressed root causes of violence or potential backlash effects. Our findings highlight the need to refine CEM services and adopt comprehensive strategies to combat IPV. Policymakers and stakeholders must collaborate to foster a supportive environment for survivors and promote a culture that rejects IPV. Further research is essential to understand the complexities of IPV prevention and intervention efforts and to continuously monitor the progress of such interventions.

4.3 Main body

Introduction

Violence against women is a global issue, with the United Nations defining it as "any act of gender-based violence that results in, or is likely to result in, physical, sexual, or mental harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or in private life" [1]. Despite worldwide efforts to eradicate this type of violence, it remains highly prevalent [2]. Globally, 27% of ever-partnered women aged 15-49 years have experienced physical or sexual abuse or both from a partner, with violence against adolescent girls and young women starting early [3]. Intimate partner violence (IPV) causes severe physical, mental, sexual, and reproductive health problems for women, impacting their children and leading to high social and economic costs for them, their families, and societies [4–8].

In Latin America and the Caribbean, women have been subjected to various forms of violence, including torture and rape during civil war, coerced sterilization during military dictatorships [9], femicide, and domestic abuse linked to *machismo* [10]. Although all countries in this region have laws and policies to tackle violence against women, it remains the most violent in terms of IPV globally [11]. In 2019, 58% of all women living in Peru reported experiencing violence from their partner, with nearly 75% of ever-partnered women experiencing violence in certain regions of the country [12].

To address this issue, the Government of Peru implemented a national plan in 2022 to prevent violence against women, establishing the roles of society and the state in guaranteeing women's right to a life free of violence [13]. This plan includes adopting and implementing public policies, providing abused women access to quality public services, and committing to change the sociocultural patterns that legitimize, tolerate, or exacerbate such violence. This plan has been updated approximately every five years [14].

A key aspect of the Government's approach to addressing violence against women is the establishment of Women's Emergency Centers (CEMs). These centers offer a comprehensive array of free services, including psychological counseling, legal guidance, and other support services for those who have experienced violence. In addition to meeting the needs of women who have already experienced violence, CEMs work to promote gender equity and prevent violence against women and children in Peru.

CEMs conduct various educational activities, such as talks, workshops, conferences, seminars, video forums, and more, to sensitize and inform participants about violence-related topics and provide them with the tools to prevent it. CEMs also focus on empowering women by developing skills and abilities and providing training to teachers and community agents. Their preventive and promotional activities cover a wide range of topics, including human rights and citizenship, sexual and reproductive rights, gender equity, discrimination, stereotypes, and gender roles. CEMs also collaborate with different organizations in the community to facilitate actions, institutions, and authorities [15]. A comprehensive list of the activities and topics covered by the CEM can be found in the Appendix 1.

Since the establishment of the first 13 CEMs in 1999, their number has grown to 245 centers operating across all 24 regions of Peru by 2016. In 2004, 40 active CEMs conducted over 6,717 preventive activities, reaching more than 330,000 participants. By 2016, with 245 CEMs, the number of reported preventive activities increased to 33,862, reaching over 1.5 million people (Appendix table 1). At least 50% of these activities involved direct engagement with communities and individuals, demonstrating the extensive community presence and reach of CEMs.

Although implementing and maintaining CEMs demands substantial financial and human resources, their efficacy in curbing the prevalence of violence is yet to be conclusively determined. Prior research has delved into the effects of CEMs [16] but has not considered the potential bias introduced by the intervention's staggered

implementation over multiple time periods. This study seeks to evaluate the influence of CEMs on intimate partner violence against women by employing a quasi-experimental methodology that accounts for the staggered rollout of the intervention.

Methods

Data sources

We used data from Peruvian Demographic and Health Surveys (DHS), which are cross-sectional, household nationwide surveys that have been conducted annually by the Peruvian National Institute of Statistics and Informatics (INEI) since 2004 [17]. The sampling frequency of the households has varied over time. From 2004 to 2008, the sampling was equally divided over five years, starting in 2009, the sampling was divided to every three years, while from 2015 onwards, the survey has been conducted annually. Each annual DHS takes a nationally representative sample of women between 15 and 49 years of age using a multistage stratified sampling design, however, due to the nature of its sampling design, it may not be as representative at the district level [12]. It is important to note that not all districts in Peru are surveyed every year. Instead, a random sample of districts is selected each year to participate in the survey. The participation rate of the DHS is high, covering about 98% of the assigned households [18] and is publicly available through the Institute of Statistics and Informatics [17]. DHS collects information on various health indicators, including intimate partner violence, ensuring privacy and using standardized questionnaires.

Data on the opening and location of the CEMs is available from the directory of the National Program for the Prevention and Eradication of Violence against Women and Members of the family group (AURORA) of the Ministry of Women [19].

Measures of Intimate Partner Violence

The DHS uses a standardized questionnaire [20] to detect physical, psychological, sexual, and economic forms of IPV. Our study focuses on physical, psychological, and sexual violence, as they are the most widespread reported. The questionnaire asks women about whether their husband or partner has ever behaved in specific ways toward them, such as whether they have ever been slapped or kicked. Women are asked whether they have ever experienced such an event, if it transpired in the last 12 months, and if it occurred within the past year, they are also asked about the frequency of its occurrence. To provide a more comprehensive understanding of our exposure definition, we have added an appendix that contains detailed information on the phrasing of the questions (Appendix 1).

Statistical analysis

We used a difference-in-differences analysis to evaluate the impact of CEMs. Since the opening of CEMs in different districts was staggered over time, we employed the Callaway and Sant'Anna Group-Time Average Treatment Effects estimator [21]. This approach is an improvement over traditional two-way fixed effect difference-in-differences methods, which are known to be biased in the presence of treatment effect heterogeneity in staggered treatment designs [22]. By focusing on the estimation of group-time treatment effects, the Callaway and Sant'Anna method mitigates such biases and provides more flexible ways of aggregating treatment effect estimates [21]. The did package automatically produces confidence bands for multiple hypothesis testing when displaying group-time average treatment effects across various time periods. However, we have disabled this feature to calculate analytical standard errors and corresponding graphics with pointwise confidence intervals. This is because adjusting for multiple comparisons is not necessary and can lead to fewer interpretive errors when evaluating real-world observations [23].

The primary outcome was the reporting of any physical, sexual, or psychological IPV within the 12 months prior to the DHS survey. The intervention group consisted of

districts that implemented a CEM during the study period, and the control group was composed of districts that did not open a CEM by the intervention group year. We included age, household wealth index, educational attainment, and number of children under 5 years living in the household as covariates in our main model [24]. Cluster-robust standard errors at the district level were used in our analysis.

We calculated 3 levels of effect: group-time treatment effects, group-specific average treatment effects (ATTs), and an overall summary effect across all intervention groups ATTs. Additionally, to account for potential dynamic effects, we aggregated the group-time treatment effects using an event study. As a sensitivity analysis, we present a stratified analysis for households in rural and urban areas. Analyses were conducted using R version 4.2.1. Ethics approval for the study was provided by the McGill University Institutional Review Board.

Results

Our sample included 119,695 women residing in 1391 districts of Peru between 2004 and 2016. Of the total, 195 districts opened a CEM at some point over that time period and 1196 districts did not. Table 1 shows the reported incidence of any type of physical, psychological, or sexual IPV in the 12 months prior to the survey. In 2004, 22% (95% CI: 19%-24%) of women in districts without CEMs reported any form of physical, sexual, or psychological IPV in the past 12 months, whereas 16% (95% CI: 6%-26%) of women in districts with CEMs reported any IPV. By 2016, 17% (95% CI: 16%-18%) of women in districts without CEMs reported any IPV in the past 12 months and 18% (95% CI: 17%-20%) of women in districts with CEMs reported any IPV. The mean age of the sample was 34–35 years old over the study period. The number of districts that opened a CEM ranged from one in 2005 to 163 in 2016, with 11 intervention groups – one for each year, except for 2009.

The group-time treatment effects of the 11 intervention groups are presented in Figure 1, which shows no noticeable pre-treatment trend in any of the groups.

However, the group-time effect of the CEMs and the precision of the estimates are heterogenous across intervention groups, years, and type of violence. The group-specific average effect ranges from an increase of 6.49 pp (95%CI: -25.07; 38.05) in the probability of reporting any form of physical, psychological, or sexual IPV in the 2005 group, to a decrease of 6.17 pp (95%CI: -12.38; 0.04) in the 2016 group, with the latter representing the lowest group effect. Conversely, the highest effect was observed in the intervention group from the previous year, 2015 (20.52 pp, 95%CI: 12.41;28.64). The stratified analysis by type of violence shows that the main driver of the overall effect came from the reporting of psychological violence with group-specific average treatment effects ranging from an increase of 8.41 pp (95%CI: -24.32; 34.21) in the probability of reporting psychological IPV in the 2005 group, to a decrease of 4.53 pp (95%CI: -10.91; 0.49) in the 2016 group. There was heterogenous evidence indicating that CEMs had any impact on the reporting of physical or sexual IPV across the group-time treatment effects of the 11 intervention groups consistent with either a modest increase or decrease in reporting of violence, or no effect at all.

The overall summary of group-specific ATT estimates for all intervention groups indicates that opening a CEM lead to an average increase of 3.00 pp (95%CI: 0.61-5.39) in the probability of reporting any form of physical, psychological, or sexual IPV. A similar effect was observed in the stratified analysis for psychological violence, with an increase of 3.07 pp (95%CI: 0.60; 5.55). However, our data are consistent with either a modest increase or decrease in reporting of violence, or no effect at all on the reporting of physical (1.16 pp, 95%CI: -1.22; 3.54) or sexual (0.50 pp, 95%CI: -0.52; 1.53) IPV, as shown in Figure 2.

For the event study, the aggregate analysis of the dynamic effects indicates an increase of 5.24 pp (95%CI: 1.39; 9.09) in the probability of reporting any type of physical, psychological, or sexual IPV after CEMs were implemented. Similar to the group-specific ATT estimates, this increase appears to driven by reports of

psychological violence, with an aggregate effect of an increase of 4.92 pp (95%CI: 1.38; 8.46). Estimates of the impact of CEMS on the reporting of physical or sexual violence in the event study analysis were too imprecise to draw conclusions. As shown in Figure 3, after implementing the CEMs, the summary estimate for physical violence indicates an increase in reporting of 1.18 pp, but the confidence interval (95% CI: -2.51; 4.86) indicates that our data are consistent with either a modest increase or decrease in reporting of violence, or no effect at all. The same is true for reporting of sexual violence, though the confidence interval is more tightly centered around the null, suggesting the implementation of CEMs had a very subtle, if any, effect on the reporting of sexual violence. The event study plot did not show any evident pre-treatment trend and illustrates a rather steady effect across the 7 years post-intervention (Figure 3).

Our sensitivity analysis that included the full length of follow up for the event study yielded a result very similar to that from the primary analysis. We found that opening CEMs led to an increase of 5.48 pp (95%CI: 0.66-10.26) in the reporting of any type of physical, sexual, or psychological violence (Appendix Figure 1). Estimates from analyses stratified by urban and rural districts were imprecise, as expected when further restricting sample sizes, but the direction of the effect of CEMs on reporting any physical, sexual, or psychological violence seems consistent with the main analysis in both urban and rural settings (Appendix Figure 2).

Discussion

This study aimed to assess the impact of CEMs on reporting physical, psychological, and sexual IPV in Peru. The results demonstrate that opening CEMs increased the probability of reporting psychological violence, while the effects on physical and sexual violence were inconclusive. The data are consistent with modest reductions or increases in reporting of these types of violence, or perhaps no change at all.

Psychological violence is a multifaceted type of IPV that includes verbal abuse, threats, social isolation, and humiliation, and it is the most frequently reported type of violence in Peru [25]. However, measuring psychological violence can be challenging due to its subjective nature, making it difficult to quantify through specific questions about actions [26]. Furthermore, the WHO multi-country report and the DHS do not have a consensus on defining and measuring psychological violence, highlighting the difficulty in quantifying this type of violence [27].

Despite these challenges, it is crucial to assess the impact of CEMs on all forms of IPV, including psychological violence, to gain a comprehensive understanding of the role these centers play in addressing and mitigating such occurrences within the community. Moreover, reports of psychological violence also constituted half of all cases handled by CEMs between 2006 and 2016 (Appendix Table 1).

Advancements in measuring violence against women, such as IPV, have improved interviewer training and confidentiality measures, which can encourage more open reporting [3]. However, many factors still influence reporting, highlighting the importance of understanding misreporting in this field [28,29]. Previous studies have attempted to estimate the effects of risk factors on violence by using various methods to reduce endogeneity bias, including randomized controlled trials or quasi-experimental designs like Differences in Differences [30–33]. However, misclassification of outcomes remains an

issue that limits the ability of randomization or quasi-experimental designs to produce unbiased treatment effects.

A study conducted in Peru compared the reporting of IPV using list experiments versus the DHS questionnaire [30]. The study found no significant differences in the reporting of sexual or physical violence between the two methods, although psychological violence was not assessed. However, the list experiment, which provided greater confidentiality, resulted in higher levels of reported IPV prevalence compared to the DHS questionnaire. This difference was even more pronounced among highly educated women. These findings highlight the complexities of measuring sensitive topics such as IPV, which can be influenced by various external and individual factors, including the level of confidentiality, the type of questions asked, the survey location, age, cultural context, among others (29,31,32).

When assessing interventions targeting violence against women, it is essential to consider the potential impact of misclassification on observed effects. Nondifferential misclassification may attenuate the effect, but interventions addressing violence against women can also impact attitudes, beliefs, and social norms, making it more likely that they not only reduce violence but also increase sensitization to survey questions [30]. By providing a safe platform for women to discuss their experiences and concerns, CEMs facilitate a shift in societal attitudes and norms surrounding IPV, thereby challenging the acceptability of such behaviors [35]. CEMs may be better equipped to address the complexities and nuances of psychological violence, leading to increased reporting of this type of IPV.

However, if the root causes of violence are not adequately addressed, CEMs may inadvertently lead to an increase in the incidence of IPV. For example, if the CEMs focus primarily on raising awareness and reporting without delving into the underlying factors contributing to IPV, such as unequal power dynamics, gender inequality, and societal expectations [36], the programs may not be as effective in curbing the actual incidence of

violence. Furthermore, CEMs could trigger a backlash from perpetrators [37] who may feel threatened by the changing societal norms and resort to other forms of violence in order to reassert control over their partners.

Additionally, the substantial number of cases requiring assistance may place a strain on CEM staff, potentially restricting their focus on preventive measures. Although CEMs carry out an average of one preventive activity every other day (Appendix table 1), it's important to recognize that these activities cover a wide range of topics. According to 2018 and 2019 reports, about 50% of CEM preventive activities were aimed at other participants not necessarily related to the general population and were connected with aspects beyond education or community campaigns, including coordination with authorities, community leaders, and other institutions [38]. Special occasions like International Women's Day and the International Day for the Elimination of Violence Against Women, also contribute to the elevated number of activities organized by CEMs. Despite the seemingly high figure, it requires careful consideration, particularly because no evaluation of quality is available.

According to a 2018 survey conducted by the Ombudsman Office [39], CEM users generally hold a favorable view of the centers, with 81% finding the information provided by CEM professionals clear and the services optimal. Furthermore, CEMs have facilitated a more efficient issuance of certificates for violence victims by coordinating medical certificates and physical and mental health reports, which in turn reduces the burden on the Institute of Legal Medicine. However, challenges persist. A mere 20% of CEMs operate seven days a week, while the majority (79%) function only five days a week. A concerning issue is that 68% of CEMs employ just one legal professional to handle cases, and 69% have only one psychologist on staff. The survey also revealed that 21% of CEMs could not meet the demand for any service, 43% struggled to provide sufficient legal assistance, 30% lacked adequate psychological support, and 39% fell short in offering sufficient social assistance [39]. The Ombudsman Office survey primarily focuses on the assistance activities of the CEMs and does not provide comprehensive information about their preventive activities.

This study has several strengths and limitations that warrant consideration. Among its strengths is the adoption of a rigorous methodology, which includes the use of novel difference-in-difference estimators for staggered interventions, to assess the influence of CEMs on the reporting of different types of IPV in Peru. This methodological approach offers valuable insights into the role interventions, such as CEMs, play in tackling IPV.

A previous study evaluated CEMs without considering group-time treatment effects [16], and used methods that have been shown to be biased in interventions with multiple time periods [21,40]. This study found that CEMs significantly reduced violence by 2 pp in the reporting of physical or sexual violence, with an overall prevalence of physical or sexual IPV in the last 12 months of 38%. However, when using the same Two-Way Fixed Effect difference in difference method in our sample, in the same time frame as the mentioned study, we found an effect that goes in the same direction, with a reduction of 0.2 pp (95% CI: -1.4; 0.0). This differs from our main findings because our analysis took into consideration the staggered nature of the intervention. It is important to note that the overall prevalence of physical or sexual IPV in our sample was 13% in the last 12 months, which is in line with the country's national reports. These findings highlight the importance of accounting for staggered interventions where the treatment effect can be heterogeneous by intervention groups or time after the intervention.

Nevertheless, there are limitations to this study. First, the analysis relies on self-reports of intimate partner violence. Though there is no other reliable way to measure the experience of violence, self-reporting is generally thought to result in underestimates of the frequency of violence due to social desirability biases. Under non-differential misclassification, the estimate will lean towards the null. However, several pathways have been discussed regarding how CEMs could impact not only IPV incidence but also reporting behaviours, which might prompt differential misclassification. Further analyses are required to disentangle the effects of CEMs on reporting behaviours versus the incidence of IPV. Despite these challenges, self-reported data from the DHS remains a

valuable source of information on IPV, providing insights into the experiences of a large and diverse sample of women across Peru. Second, the study may not capture the full range of preventive activities conducted by CEMs, as the available data primarily focuses on whether a CEM is open or not. Our analysis did not account for variation in the quality and scope of services provided by different CEMs that could influence their effectiveness. A key limitation in the difference-in-difference model is the level of precision regarding parallel trends, which could potentially influence the validity of the results. Despite these limitations, the findings of this study add to the expanding body of evidence on the role of interventions like CEMs in tackling IPV. These insights can inform future research and policy efforts aimed at preventing and mitigating intimate partner violence.

In conclusion, the results of this study demonstrate the impact of CEMs on the reporting of psychological IPV in Peru, highlighting the crucial role these centers play in addressing the different facets of intimate partner violence. While the evidence may be less conclusive for the influence of CEMs on the reporting of physical or sexual IPV, the findings still underscore the importance of a comprehensive approach to IPV prevention and intervention. Regardless of whether CEMs are effective at reducing the incidence of violence, they remain an important source of support for women who experience violence. This is evident in the large number of women who utilize their services, and the high proportion of survey respondents who report being satisfied with the services provided. Even so, the fact that CEMs do not appear to have had a large effect on the incidence of physical or sexual violence underscores the need for better evidence on what works to prevent violence from happening in the first place. CEMs could then incorporate more effective forms of violence prevention activities into their scope of work. By doing so, a more supportive environment for survivors can be created and a culture that rejects all forms of intimate partner violence can be promoted.

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4.4 Tables

Table 1. Prevalence of intimate partner violence and selected characteristics of respondents by year and district-level exposure status

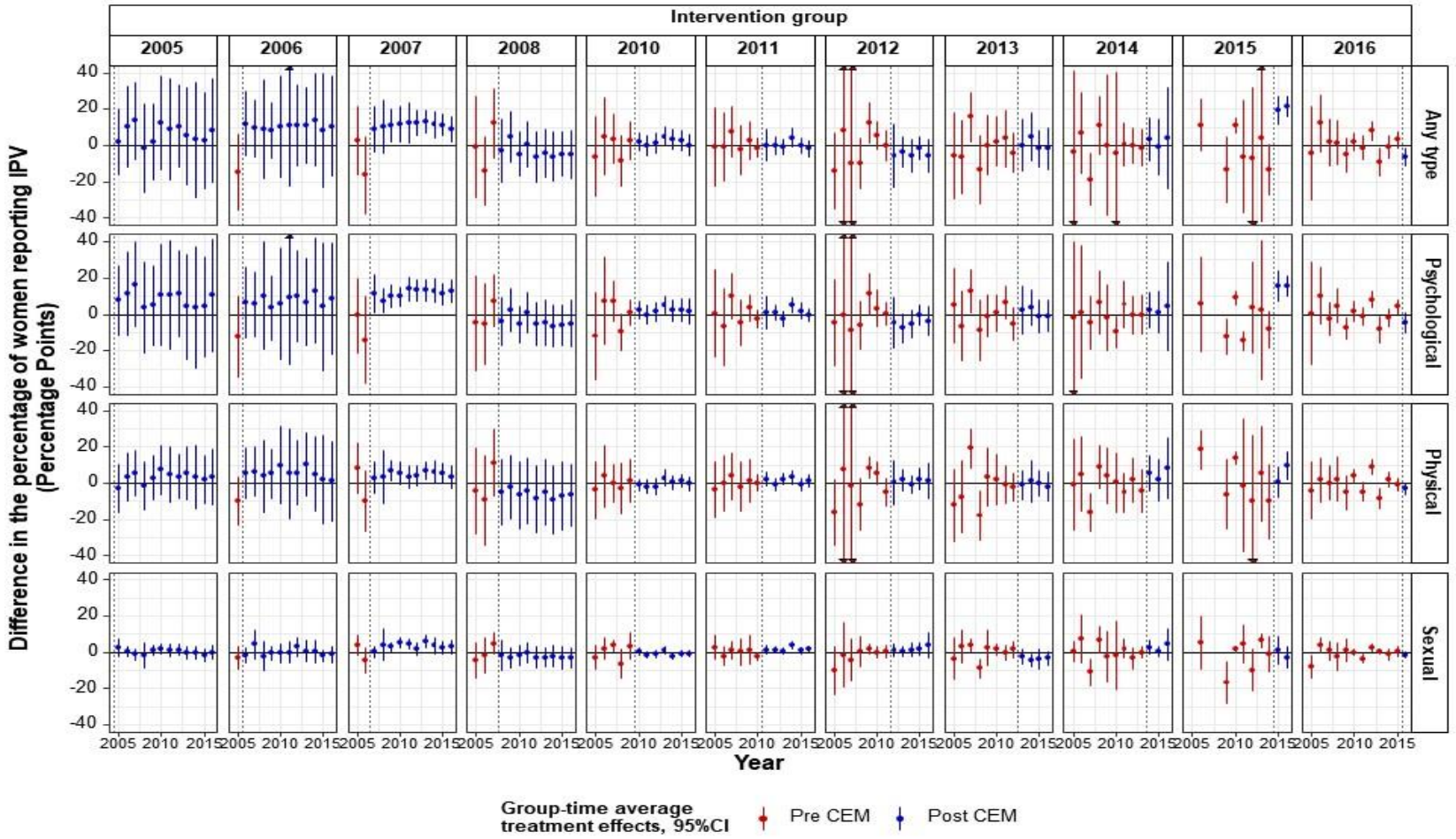
Year	CEM status	N districts	n respondents	Any violence in the last 12 months, % (95% CI)	Age (years), mean ± SE	Households with 1-3 children under 5 years old, %(95% CI)
	Unexposed	196	2545	22% (19%-24%)	33.9 ± 0.2	55% (52%-57%)
2004	Exposed	31	512	22% (17%-26%)	34.7 ± 0.5	51% (46%-57%)
	Unexposed	192	2651	21% (19%-23%)	34.2 ± 0.2	55% (52%-57%)
2005	Exposed	31	711	19% (15%-23%)	34.5 ± 0.4	51% (46%-55%)
	Unexposed	189	2813	19% (17%-20%)	34.3 ± 0.2	53% (51%-56%)
2006	Exposed	37	903	21% (18%-25%)	34.5 ± 0.4	48% (43%-53%)
	Unexposed	182	2499	21% (19%-23%)	33.9 ± 0.2	55% (52%-57%)
2007	Exposed	46	1090	25% (21%-28%)	34.4 ± 0.3	52% (47%-56%)
	Unexposed	276	4618	21% (19%-22%)	33.9 ± 0.2	57% (55%-59%)
2008	Exposed	56	2075	26% (22%-30%)	34.8 ± 0.4	47% (42%-51%)
	Unexposed	538	10215	21% (20%-22%)	33.9 ± 0.1	57% (56%-58%)
2009	Exposed	73	3566	22% (20%-24%)	34.9 ± 0.2	51% (49%-54%)
	Unexposed	504	8883	20% (19%-21%)	34 ± 0.1	56% (55%-57%)
2010	Exposed	91	3997	22% (20%-24%)	34.3 ± 0.2	51% (49%-53%)
	Unexposed	471	8102	20% (19%-21%)	34.1 ± 0.1	55% (53%-56%)
2011	Exposed	111	4796	23% (21%-24%)	34.5 ± 0.2	53% (51%-55%)
	Unexposed	508	8052	19% (18%-20%)	34.1 ± 0.1	55% (54%-57%)
2012	Exposed	141	5431	22% (20%-23%)	34.7 ± 0.2	52% (50%-53%)
	Unexposed	482	7457	18% (17%-19%)	34.1 ± 0.1	55% (53%-56%)
2013	Exposed	146	5717	20% (19%-22%)	34.5 ± 0.2	52% (50%-54%)
	Unexposed	506	7816	20% (18%-21%)	34.2 ± 0.1	56% (55%-57%)
2014	Exposed	154	6250	21% (20%-23%)	34.7 ± 0.1	52% (50%-54%)
	Unexposed	681	12358	18% (17%-19%)	34.1 ± 0.1	58% (56%-59%)
2015	Exposed	197	10337	19% (18%-21%)	34.8 ± 0.1	56% (54%-58%)
	Unexposed	671	11234	17% (16%-18%)	33.9 ± 0.1	59% (57%-60%)
2016	Exposed	203	9881	18% (17%-20%)	34.3 ± 0.1	58% (56%-60%)

* Respondents women 15 - 49 years old

Not all districts are included by the DHS every year.

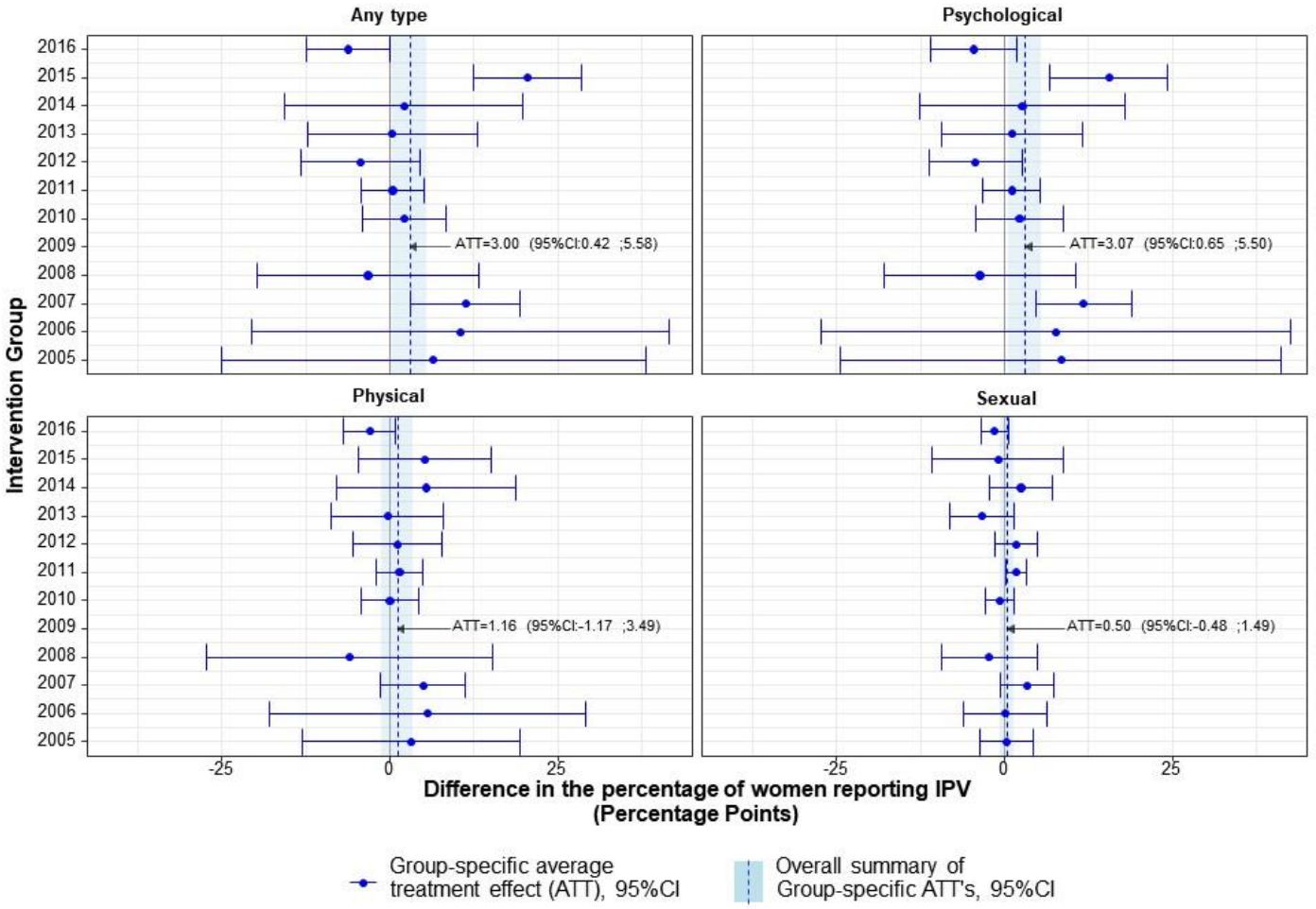
4.5 Figures

Figure 1: Group-time treatment effects of CEMs on IPV reporting by intervention groups and types of violence



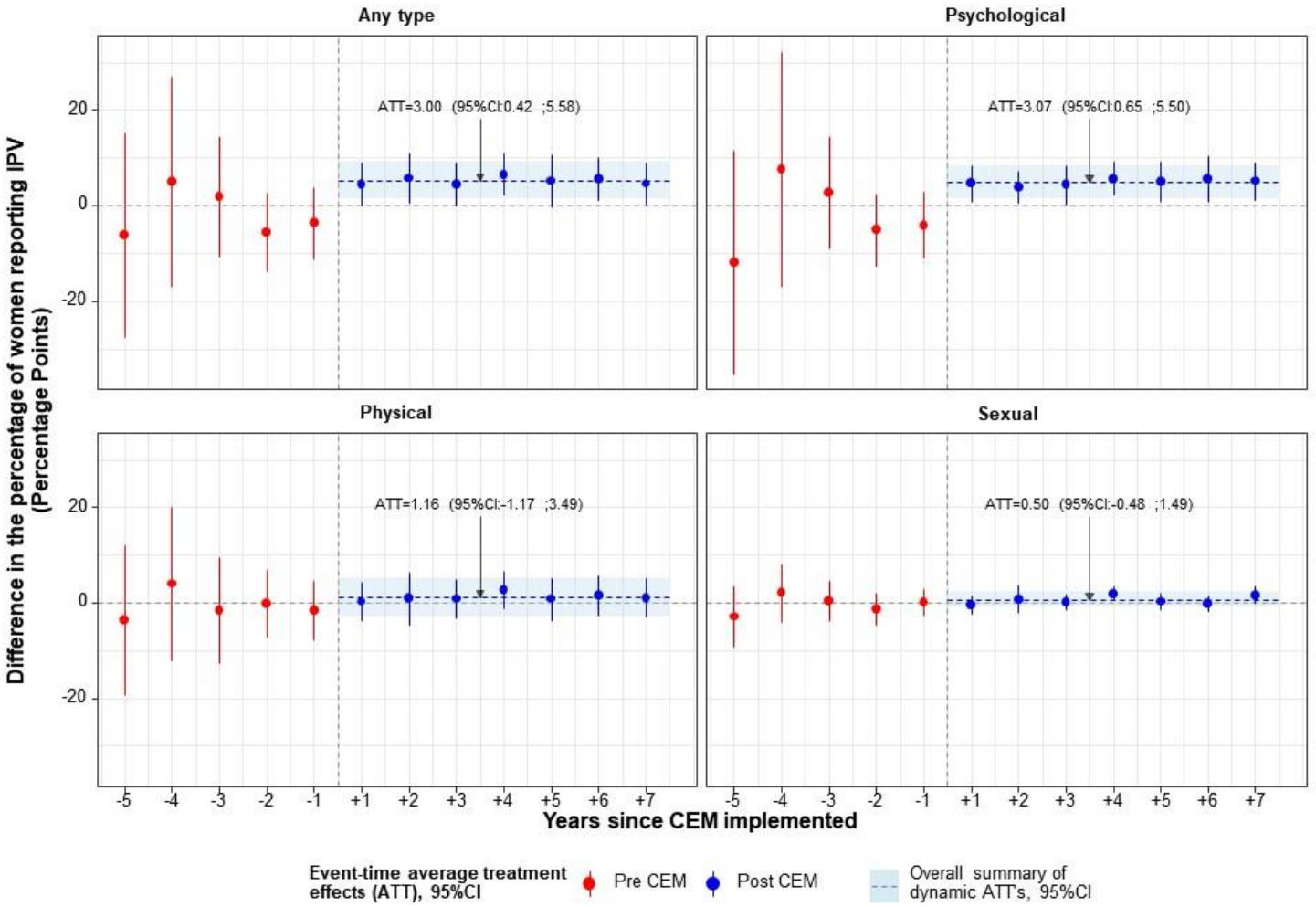
The intervention groups are shown in the vertical grid while the types of violence are in the horizontal grids. The X axis shows the DHS years, and the Y axis shows the Group-Time average Treatment Effects and its 95% CI as a difference in percentage points. Group-Time average Treatment Effects are show in red for the pre CEM period and in blue in the post CEM period.

Figure 2: Overall summary of group-specific average treatment effects of CEMs on IPV by intervention groups and types of violence



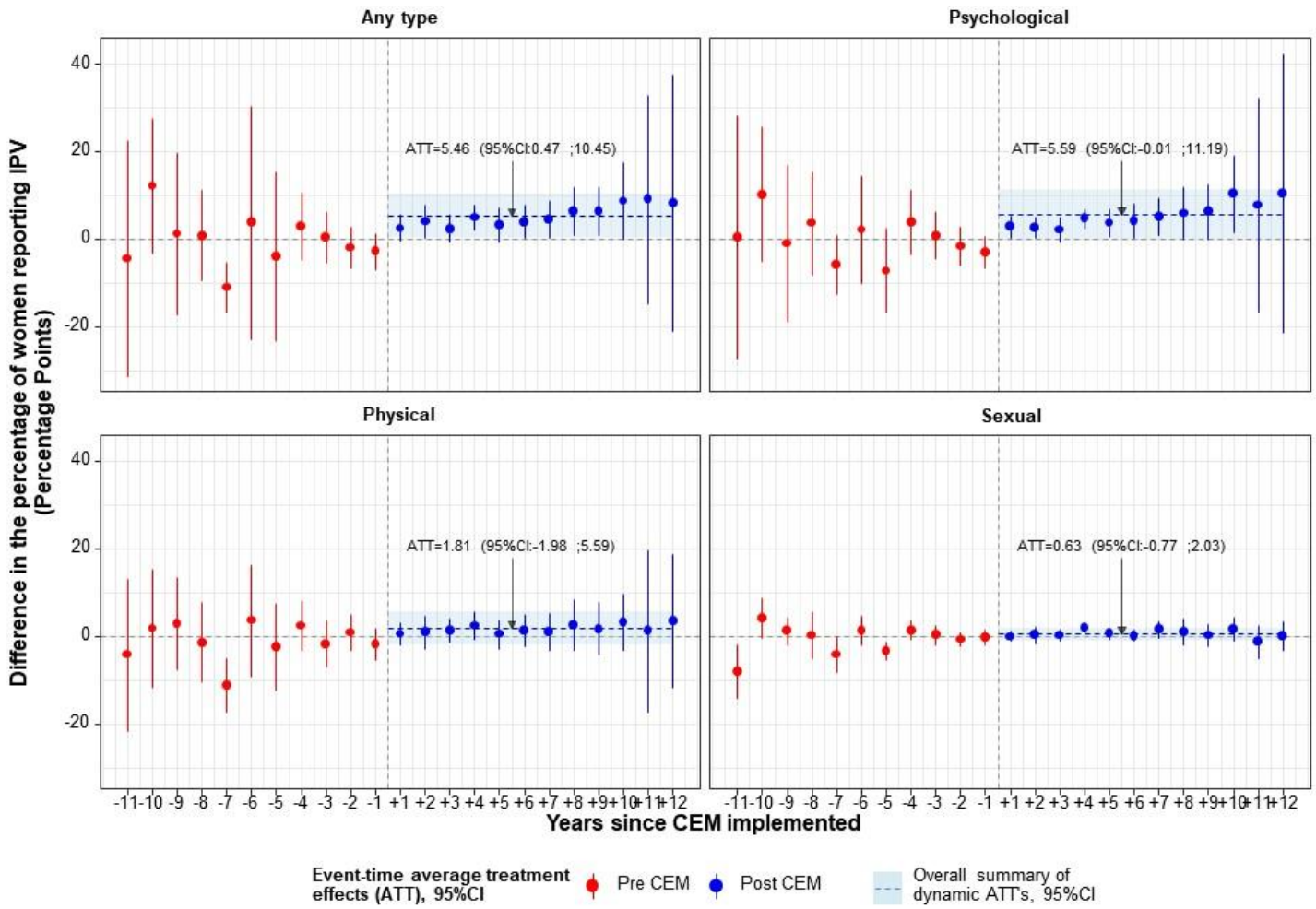
The X axis shows the Group-specific average Treatment Effects as a difference in percentage points and the Y axis shows each intervention group. The dashed vertical blue line represents the overall summary of group-specific average Treatment Effects, and the blue area its respective 95% CI.

Figure 3: Event study analysis of dynamic effects after CEM implementation by type of violence



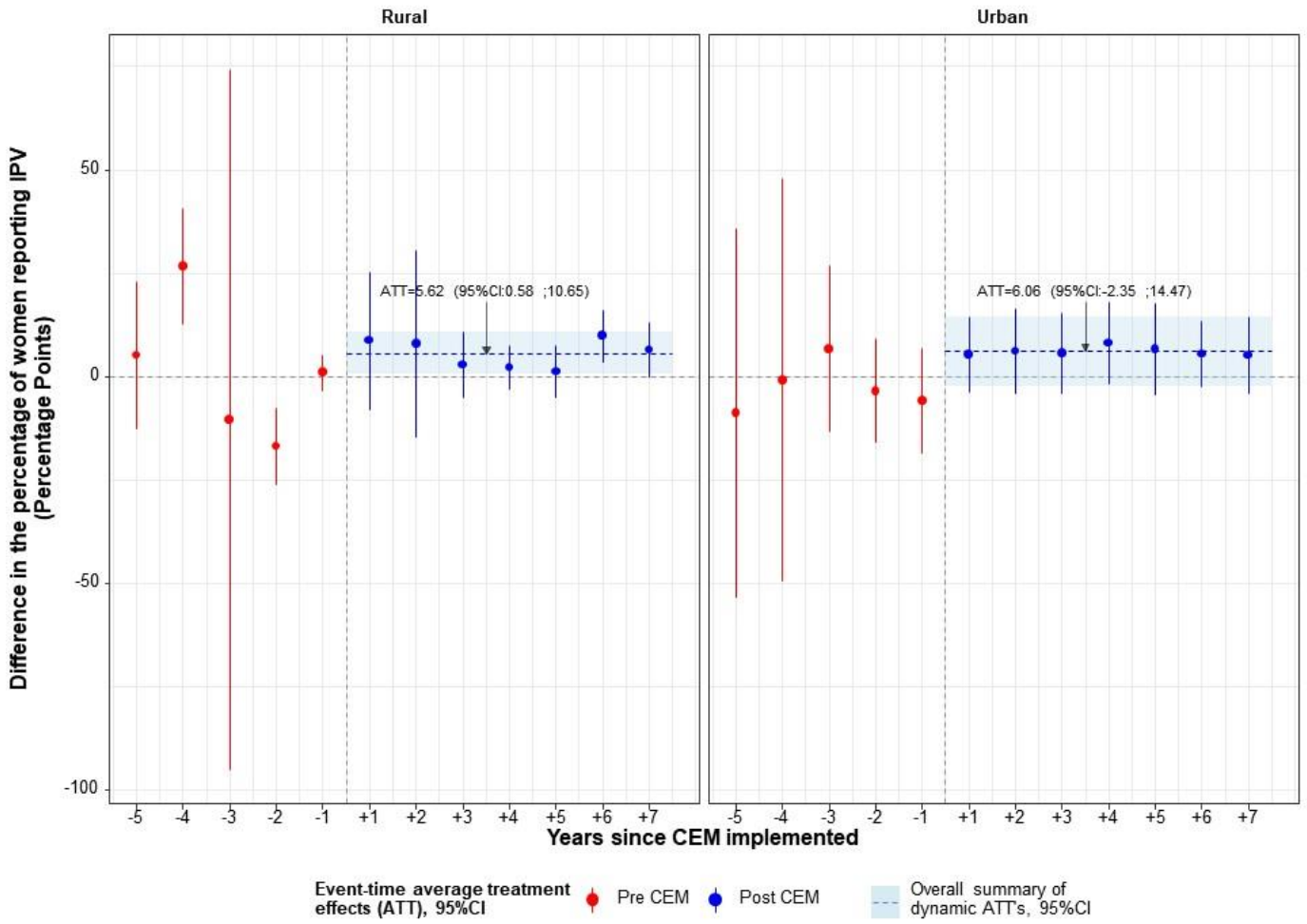
The X axis shows each year relative to the CEM implementation, centering the CEM opening at time 0, and the Y axis shows the Event-Time average Treatment Effects and its 95% CI as a difference in percentage points. The dashed horizontal blue line represents the overall summary of dynamic average Treatment Effects, and the blue area its respective 95% CI.

Appendix Figure 1: Event Study sensitivity analysis with full length of follow up



The X axis shows each year relative to the CEM implementation, centering the CEM opening at time 0, and the Y axis shows the Event-Time average Treatment Effects and its 95% CI as a difference in percentage points. The dashed horizontal blue line represents the overall summary of dynamic average Treatment Effects, and the blue area its respective 95% CI.

Appendix Figure 2: Stratified aggregate event-study effect in urban and rural districts



The X axis shows each year relative to the CEM implementation, centering the CEM opening at time 0, and the Y axis shows the Event-Time average Treatment Effects and its 95% CI as a difference in percentage points. The dashed horizontal blue line represents the overall summary of dynamic average Treatment Effects, and the blue area its respective 95% CI.

4.6 Appendix

Appendix 1.

Type of CEM preventive activities

Interinstitutional Coordination:

a) Establishment of a committee/network against sexual and family violence: These are actions taken to create a space for coordination against family and sexual violence. It is directed at members of public and private institutions.

b) Meetings of the committee/network against sexual and family violence: These are sessions with members of various networks, committees, and tables related to the issue of family and sexual violence.

c) Workshops to strengthen the committee/network against sexual and family violence: These are actions taken to strengthen these spaces, seeking recognition from local authorities, making their coordinated local plans visible, formulating their interinstitutional directories, coordinated protocols, interinstitutional referral forms, and implementing an attention and/or prevention system.

Working with Men

a) Formation of Men's Collectives: A set of actions taken to form a collective of men committed to the prevention of family and sexual violence.

b) Promotional Preventive Activities of the Men's Collective: These are events organized by men in the collective, in coordination with the CEM promoter, to provide preventive messages and sensitization about family and sexual violence.

c) Strengthening of Men's Collectives: A set of actions taken to reinforce concepts, develop skills, and consolidate attitudes of the men who make up the collectives. This takes place the year after they were formed.

d) Training workshops with men from the community: It is an educational activity that will transmit the approach of new masculinities to men in the community to prevent violence against women. The workshops will be conducted by members of Men for Equal Relationships collectives, aimed at men in the community, with an average duration of between 3 and 5 sessions.

Advocacy Actions with Authorities

a) Sensitization sessions with political and/or regional, provincial, or district authorities: These are meetings with political authorities (governors, deputy governors) and/or regional, provincial, or district authorities (regional presidents,

mayors, councillors) to sensitize them to the problem of family and sexual violence.

b) Issuance of ordinances: Consists of the issuance and implementation of ordinances related to the issue of family and sexual violence.

University and Higher Education Community

a) Formation of youth collectives in higher education: These are actions taken to train and educate young students from universities, technical and professional institutes, and higher schools to form Youth Collectives who, after their training, will carry out promotional preventive actions in their study center and will have an Instructional - Record Form for Preventive Promotional Actions with 15 useful competencies for the detection and referral of cases of violence detected in their educational space.

b) Strengthening of collectives: These are actions taken to reinforce the knowledge, tools, and attitudes of young people who make up university collectives. This takes place 6 months to 1 year after they were formed.

c) Preventive actions of collectives: These are events developed by the young people of University Collectives in their higher education centers or in the community, in coordination with the promoter of their area. These events are planned in a Work Plan of the University Collective and aim to provide preventive messages against family and sexual violence.

Communication for Behavioral Change

a) Broadcasting of radio spots: This is registered when it comes to attractive and short messages to be broadcasted on the radio.

b) Broadcasting of TV spots: This is registered when it comes to attractive and short messages to be broadcasted on TV.

c) Production of radio programs: This will be registered as the production of programs whenever it involves the creation of spaces on the radio. This includes the initial development of the program idea, content, format, scripts, style, and the broadcast or airing of the program. The objectives are generally to position the National plan to the prevention of violence, inform and sensitize.

d) Production of TV programs: This will be registered as the production of programs whenever it involves the creation of spaces on television. This includes the initial development of the program idea, content, format, scripts, style, and the broadcast or airing of the program. The objectives are generally to position the National plan to the prevention of violence, inform and sensitize.

e) Appearances on radio: This will be registered on the form as appearances on the radio, whenever the National plan to the prevention of violence participates in interviews or reports in the media of radio. The objective is basically to inform and sensitize. For example, a radio interview.

f) Appearances on TV: This will be registered on the form as appearances on TV, whenever the National plan to the prevention of violence participates in reports, interviews, on television media. The objective is basically to inform and sensitize.

g) Appearances on print media: This will be registered on the form as appearances on print media, whenever the National plan to the prevention of violence participates in reports in the press. The objective is basically to inform and sensitize.

h) Appearances on websites: This refers to any information aimed at sensitizing on the topic of family or sexual violence to be disseminated on a website.

i) Appearances on payment receipts: These are appearances that occur on water, electricity, telephone, or similar bills with prevention messages or CEM services.

j) Radio dissemination in markets or loudspeakers: These are the broadcasts of radio spots on loudspeakers in markets, schools, institutions, or neighboring communities.

k) Dissemination on closed radio/TV circuits: These are the broadcasts that are carried out on closed signal circuits such as those in banks or companies.

l) Sociocultural animation actions (theater, puppets, marionettes, stories): These are actions carried out through different playful strategies such as theater, singing, puppets, marionettes, among others.

m) Activation: These are specific actions to promote and disseminate campaign messages, which can employ thematic setups (for example: heart-shaped structures for taking photos). These events provide attendees with access to social media for their adherence, using computers, laptops, or tablets with an internet connection.

n) Other: This refers to anything that does not relate to the above items and that the promoter must specify.

Mass mobilization actions

a) Fairs: This refers to activities aimed at providing information and entertainment through exhibition stands. The beneficiaries will only be registered as people served at the CEM or National plan to the prevention of violence stands.

b) Parades: This refers to a popular march or communal mobilization of artistic and colorful content accompanied by messages alluding to the central theme of the activity.

c) Friendly Caravans: This is a prevention strategy aimed at the public with the aim of generating reflection on family violence and the need to prevent it. It is carried out in plazas, avenues, markets, commercial centers, and places of great concentration by combining educational action with play and entertainment.

d) Marches or walks: These are mobilization actions. March: a large group of people who walk together with energy, joy, or enthusiasm for a specific purpose. The Walk: a long, slow, and emotional journey that has a specific objective.

e) Parades: These are actions characterized by their formal and institutional nature as they are oriented towards the presentation of different institutions with prevention messages against family and sexual violence.

f) Educational workshops: Any lecture, workshop, video forum, or other academic activity that falls within the framework of a campaign.

g) Contests/championships: This refers to the competition or test between several participants to achieve recognition or a prize. Contest topics should cover family or sexual violence or issues related to this problem. The beneficiaries will be registered as all those who applied or participated in the contest.

h) Carnival: These are actions characterized by the mobilization of mobile units where prevention messages against family and sexual violence are exhibited.

i) Festivals/Concerts: These are events characterized by their festive, artistic, and cultural nature, with the presentation of songs, dances, and other art forms that provide messages about preventing family and sexual violence.

j) Gatherings: These are socialization meetings between members of the same collective, with the objective of fraternizing, unifying criteria, and planning actions together.

Prevention in the educational community

a) Training program for promoter/educators: A program that promotes that teachers are sensitized, informed, and trained to develop preventive actions in the localities of their intervention area and acquire the necessary competencies for the identification and referral of cases detected in their educational spaces.

b) Reinforcement for promoter/educators: It is a course that is carried out the year after having been trained as promoter/educators with the objective of updating knowledge and reinforcing skills.

c) Talks with students from educational centers: An educational activity that consists of a meeting between the promoter/specialist and a group of students from the initial, primary, and secondary levels, in order to raise awareness about a topic. The interaction is friendly and informal, it takes place in a single day, with an average duration of one hour.

d) Workshops with students from educational centers: An educational activity that combines knowledge transmission with active participation of students in educational institutions. In a workshop, knowledge is built, reflection and experience are exchanged. They are usually developed over several days with an average duration of one to three hours. They usually combine the expository part with group work and plenary sessions.

e) Workshops with parents from educational institutions: An educational activity that combines knowledge transmission with the active participation of parents of students from educational institutions who request workshops on demand with topics related to the theme of family and sexual violence, with an average duration of one to three hours, where the expository part is combined with group work and plenary sessions.

f) Talks with parents from educational institutions: An educational activity that consists of a meeting between the promoter/specialist and a group of parents of students from the initial, primary, and secondary levels, in order to raise awareness about a topic requested by the educational institution. The interaction is friendly and informal, it takes place in a single day, with an average duration of one hour.

g) Issuance of School Directive: It means the issuance and implementation of Directives, issued by the Regional Education Directorates, in order to promote the training, strengthening, specialization, and development of preventive promotional activities in their educational institutions. The issuance of these Directives or Resolutions marks the beginning of actions in the educational community.

h) Talks or workshops with organized groups of children, girls, or adolescents: These are training activities aimed at organized groups where children, girls, and adolescents participate, within the framework of preventive campaigns aimed at this group.

i) Promotional preventive actions by educational promoters: Refers to all those activities that educational promoters carry out in their educational institutions, after being trained as educational promoters. These activities to be included are: Workshops for students, talks for students, friendly caravans, theater, socio-drama, posters, contests, etc.

j) Accompaniment of tutoring sessions for students: Refers to the set of accompaniment visits (monitoring) that the CEM promoter carries out to teachers in the application of their group tutoring sessions. For the purposes of registering Promotional Preventive Actions referred to this code, it is considered that each accompanied teacher is equivalent to a promotional preventive action. That is, a teacher may have several accompaniment visits for their Student Tutoring sessions during the year, but it will be counted as a Promotional Preventive Action under this code, and the number of Accompaniment Visits and the average number (not the sum, as it is not cumulative) of students who participated in the tutoring must be specified and updated monthly in the corresponding column, as well as other basic data (start date, end date, teacher's name, others).

k) Accompaniment to workshops for parents: Refers to the set of accompaniment visits (monitoring) that the CEM promoter carries out to teachers in the application of workshops for parents. For the purposes of registering Promotional Preventive Actions referred to this code, it is considered that each accompanied teacher is equivalent to a promotional preventive action. Likewise, it must be specified and updated monthly, in the corresponding column, the number of Accompaniment Visits and the average number of parents (not the sum, as it is not cumulative) who participated in the workshops.

l) Formation of school leaders: It is the process of strengthening capacities and skills of students who have been selected to participate in training sessions with the aim of having a group of adolescent leaders committed to the prevention of family and sexual violence, teenage pregnancy, and human trafficking in the educational institution. This process is conducted by the CEM promoter together with trained teachers. For the purposes of registering Promotional Preventive Actions referred to this code, each leader formation process is considered equivalent to a promotional preventive action. Likewise, the number of sessions held for this purpose must be specified and updated monthly in the corresponding column.

m) Preventive actions by school leaders: These are activities carried out by the school leaders trained as part of the intervention in the educational community, which can be: contests, conversations, video-forums, recreational activities, among others. These actions are aimed at their peers with the aim of informing and sensitizing about gender equity, prevention of violence against women in all its forms, prevention of teenage pregnancy, trafficking for sexual exploitation, violence situations in the stage of falling in love / dating, among others.

Promotion of social responsibility

a) Information and awareness-raising sessions with company workers: These are actions (talks or workshops) that are carried out for private company workers in order to sensitize and commit them to addressing the problem of family and sexual violence.

Economic entrepreneurship

a) Formation of groups: Register the groups formed as economic entrepreneurship, following the guidelines established by the ministry of women.

b) Course on economic entrepreneurship: Register technical specialized training courses in a production activity (for example: tailoring, baking, knitting, etc.) as part of the entrepreneurship activity. It should also consider courses in business management, which will facilitate the administration of the entrepreneurship activity (basic accounting, costs, balance, business formality, among others).

c) Participation in events for commercialization: Register the group's attendance at events (fairs, sales expos, others) to promote the articles produced from the entrepreneurship activity.

d) Inter-district meetings: It is a meeting of participants from the 5 intervention districts. One will be held for each year of project implementation. The development of the meetings will be carried out under two central axes: 1) key empowerment topics and 2) recreational activities that strengthen self-esteem.

e) Others: Register the alliances established with private companies, public institutions, NGOs, or civil society organizations to support the sale of products produced by the project (with the support of the promoter).

Community organizational strengthening

a) Training course for facilitators in action: This refers to the set of workshops held to train facilitators in action, including the replicas they carry out for their certification.

b) Workshops for training community agents: These are educational activities with an average duration of 05 sessions. Community agents are members of social organizations in the community and will be trained by facilitators in action, with the support of the prevention and promotion professional from the CEM. They usually combine the expository part with group work and plenary sessions.

c) Workshops and/or talks for members of social organizations: educational activity that consists of a meeting of the specialist with a group of people from a community or institution, in order to sensitize them about a topic. The workshop will be developed in an average of 03 hours and the talk will last for 01 hour.

d) Preventive promotional actions by facilitators in action and/or community agents: The actions will be carried out with the support of the prevention and promotion professional from the CEM. The actions can be talks, fairs, caravans, parades, among others.

e) Meetings of facilitators in action and/or community agents: These are meetings for socializing experiences and learning between facilitators in action and community agents, aimed at fraternizing, unifying criteria, and planning actions together on the prevention of family violence in the community. They will be held after the training program stage, with an average duration of 2 to 4 hours.

f) Meeting with members of Social Organizations: These will be held in each intervention zone with the objective of presenting the intervention proposal to the social organizations identified in the organizational mapping, in order to achieve greater participation of men and women in the actions to be implemented.

g) Door-to-Door Campaigns: The door-to-door campaign consists of visiting homes located in areas with a high incidence of family and sexual violence to apply the "Zero Tolerance" survey, which allows women to determine if they are living in a situation of abuse.

Capacity Development:

a) Talk: Educational activity that consists of a meeting between the social specialist and a group of people from a community or institution, in order to sensitize them on a topic. The interaction is friendly and informal, it is carried out in a single day, with an average duration of one hour.

b) Workshop: Educational activity that combines the transmission of knowledge with the active participation of the members. In a workshop, knowledge is built, reflections and experiences are exchanged. They are usually developed over several days, with an average duration of one to three hours. They often combine the expository part with group work and plenary sessions.

c) Conference: Educational action that formally addresses a specific topic led by a specialist in the field. It is based on an oral presentation that usually includes a final question-and-answer session. The objective is to inform and sensitize; it is generally carried out in a single day and the average duration is one hour.

d) Seminar: It is an educational activity in which a group of experts analyze and discuss a topic. It is carried out in a formal context and usually lasts several days. Its objective is to inform and sensitize on a specialized topic.

e) Conference: It is an event, usually lasting more than three hours in a day, characterized by combining various techniques such as conferences, workshops, video forums, among others.

f) Video Forum: It is a meeting that centers around the projection of a video, on which the participants then express their different points of view. The facilitator must promote reflection, debate and formulation of conclusions. It usually lasts between one and two hours.

g) Diploma: Professional training of medium length (two to six months) promoted by the PNCVFS and certified by an academic institution. Its objective is to transmit knowledge and develop competencies for specialized professional intervention.

h) Basic course for operators: It is thus named for accredited teaching, which is imparted in several sessions and aims to transmit techniques and knowledge for a specific purpose, for example: Improving the quality of attention in police stations and updating judicial operators on the new laws sanctioning sexual violence (24 hours).

i) Specialization course: Refers to the specialization course given within the framework of a pre or post-graduate program of a higher education institution, organized by the CEM in coordination with the university, in the field of VFS (more than 30 hours).

j) Round table: It is a technique in which several speakers debate different approaches among themselves in the presence of a moderator. Both speakers and listeners know the topic well enough to participate in the discussion. The round table often leads to discussions and controversies.

k) Panel: It is a meeting of experts that addresses a specific topic, predetermined before the panel meeting. Panelists present their opinions and point of view on the topic. The audience can ask questions to clarify the content or position of any panel member. The panel aims to consult experts on a topic.

l) Conversation: Different specialists dialogue or comment on a topic from various perspectives.

m) Forum: Different specialists discuss their experiences or theories on a topic, and then the audience has the opportunity to express their points of view.

Skills development and empowerment:

a) Group formation: Women's groups that do not seek help in situations of domestic violence, but attend empowerment sessions according to the guidelines established by the Ministry of Women, should be registered.

b) Workshops: These are developed with the aim of contributing to the empowerment and skills development of women who use the service. They are carried out by the team of professionals responsible for the Service in San Juan

de Lurigancho, with the support of the Specialist from the Central Office. It is reported by the Ministry of Women service team.

Parenting practices for good treatment:

a) Training workshops for teachers: These are educational activities aimed at teachers from early childhood education institutions to promote good treatment towards children aged three to five years.

b) Reinforcement workshops for teachers: These are educational activities with teachers from early childhood education institutions to reinforce competencies in promoting good treatment towards children aged three to five years.

c) Training workshops for community agents: These are educational activities aimed at community agents (action facilitators, health promoters, university volunteers, etc.) to promote parenting practices oriented towards good treatment with children aged three to five years.

d) Reinforcement workshops for community agents: These are educational activities that reinforce competencies in community agents (action facilitators, health promoters, etc.) to promote parenting practices oriented towards good treatment with children aged three to five years.

e) Training workshops for parents/caregivers: These are educational activities that promote parenting practices towards good treatment. They are aimed at parents/caregivers whose children are studying at the early childhood education level.

f) Reinforcement workshops for parents/caregivers: These are educational activities that reinforce competencies in parents/caregivers for the promotion of positive parenting practices. They are aimed at parents/caregivers whose children are studying in early childhood education.

g) Visited homes: These are families visited by trained facilitators, promoting skills and attitude change towards positive parenting practices in children aged three to five years old.

h) Family meetings: This is a new activity to be registered as part of the methodology for training parents, mothers, and children in early education institutions.

i) Preventive promotional actions: These are activities that have been carried out as part of the intervention through the coordination with local actors to provide information and promote awareness and commitment to the issue.

Main topics discussed on the CEM preventive activities.

- Human rights and citizenship: Sexual and reproductive rights linked to the exercise of a sexuality without coercion or violence.
- Gender equity, discrimination, stereotypes and gender roles.
- Management and planning tools to enable grassroots social organizations and youth organizations to undertake planned actions against family and sexual violence.
- Family and sexual violence: everything related to the implementation of knowledge in the detection, referral, and care of victims of family and sexual violence.
- Child and adolescent abuse: mistreatment of minors under 18 years of age outside the family environment, for example, abuse in schools.
- Child sexual abuse within and outside the home that affects minors under 18 years of age.
- Good treatment: listening, respect, consideration, negotiation, expression of affection, and assertiveness.
- Personal/family growth and development, including topics such as self-esteem, assertiveness, decision-making, life project, among others.
- Femicide: murder of women in situations of family violence, sexual violence or gender discrimination.
- Transfer of violence prevention and care services to local governments.
- Strengthening community organization, including organization, mobilization, decision-making, consensus-building, advocacy, and defense.
- Formulation and implementation of national plans, for example, the National Plan against Violence against Women.
- Fight against and prevention of violence to increase citizens' sense of security, from the faculties that local governments have in coordination with the Peruvian National Police.
- Sexual trafficking/commercial exploitation: refers to the use of people in sexual activities with the promise of economic remuneration or any other type of retribution (payment or in-kind) or even under threats.

- Masculinity: set of characteristics associated with the traditional male role. Some examples of these characteristics are strength, courage, virility, triumph, competition, security, not showing affection, etc. Throughout history, and still today, men have been under great social pressure to respond with behaviors associated with these attributes.
- Parenting guidelines: refers to the fact that children's behaviors are associated with the family, the relationship between the problem behaviors of children and the disciplinary practices of parents.
- Economic enterprises: economic enterprises encompass various forms of economic organization, originating from the free association of workers, based on principles of self-management, cooperation, efficiency, and viability.
- Prevention of drug use associated with violence: identifying drug use as a risk factor (not a cause), actions will be implemented to reduce a risk factor.
- Bullying/school violence: school bullying (also known as school violence, harassment, bullying, or by its English term, bullying).
- Adolescent pregnancy
- Violence prevention strategies: a set of actions that are carried out/implemented with the aim of achieving a specific goal.
- Quality of care in the face of violence: refers to a service that meets the needs and expectations of people who demand support in any service for the care of violence cases.
- International and national normative framework: refers to the set of Peruvian laws, regulations, and public policies and international treaties signed or ratified by Peru.

Appendix 2.

ENDES questions regarding different types of violence

The Peruvian DHS asks women the following questions to measure psychological violence:

- Has your spouse ever humiliated you?
- Has your spouse ever threatened you with harm?
- Has your spouse ever insulted you or made you feel bad?
- Has your spouse ever threatened to leave home, take your children, or stop economic help?

The Peruvian DHS asks women the following questions to measure physical violence:

- Has your spouse ever pushed, shook, or thrown something at you?
- Has your spouse ever slapped you?
- Has your spouse ever punched you with a fist or something harmful?
- Has your spouse ever kicked or dragged you?
- Has your spouse ever tried to strangle or burn you?
- Has your spouse ever threatened you with a knife, gun, or other weapon?

Has your spouse ever attacked you with a knife, gun, or other weapon?

The Peruvian DHS asks women the following questions to measure sexual violence:

- Has your spouse ever physically forced you to have sex when you did not want to?
- Has your spouse ever forced other sexual acts on you when you did not want to?

Has your spouse ever twisted your arm or pulled your hair?

Appendix table 1. CEM Preventive and Assistance Activities (2004-2016)

		Preventive activities				*Assistance activities*				
Year	Number of CEMs	Number of preventive activities	Number of people who attended preventive activities	Average attendees per activity	Average number of activities per CEM	Cases evaluated in the CEMs	Average cases per CEM	Percentage of cases related to psychological violence	Percentage of cases related to sexual violence	Percentage of cases over 18 years old
2004	40	6,717	332,405	49.5	167.9	30,280	757	NA	8%	77%
2005	42	7,028	322,012	45.8	167.3	28,671	683	NA	9%	75%
2006	48	8,914	356,124	40.0	185.7	29,844	622	53%	10%	73%
2007	67	9,134	457,388	50.1	136.3	33,212	496	52%	11%	71%
2008	89	13,082	700,236	53.5	147.0	45,144	507	51%	12%	68%
2009	89	13,872	729,764	52.6	155.9	40,882	459	53%	10%	69%
2010	114	17,015	849,585	49.9	149.3	43,159	379	52%	10%	69%
2011	148	20,331	801,258	39.4	137.4	41,084	278	51%	11%	68%
2012	175	23,143	1,061,573	45.9	132.2	42,537	243	50%	12%	68%
2013	200	26,734	1,199,367	44.9	133.7	49,138	246	50%	11%	66%
2014	226	25,963	1,251,730	48.2	114.9	50,485	223	50%	11%	65%
2015	238	32,319	1,579,667	48.9	135.8	58,429	246	49%	11%	62%
2016	245	33,862	1,565,064	46.2	138.2	70,510	288	50%	11%	62%

NA: Not available

Cases evaluated in the CEMs might include multiple visits from the same person.

Created based on Ministry of Women yearly reports: *Programa Nacional AURORA*: https://portalestadistico.aurora.gob.pe/

4.7 Transition

The findings from Manuscript 1, titled "The impact of Peru's Women's Emergency Centers on the reporting of physical, psychological, and sexual intimate partner violence among women" can provide crucial insights into the efficacy of intervention programs like the CEMs in addressing violence against women. However, accurately assessing the impact of such policies requires an understanding of potential biases and errors in data analysis, which may lead to incorrect conclusions. This is where Manuscript 2, titled "Assessing the Impact of Outcome Misclassification on the Evaluation of Policies Targeting Violence Against Women: A Simulation Study Using a Difference-in-Difference Design," comes into play. This paper seeks to explore the effect of outcome misclassification on the evaluation of policies aimed at curbing violence against women.

A crucial connection between Manuscripts 1 and 2 lies in their focus on evaluating the effectiveness of policies and interventions designed to reduce violence against women. While Manuscript 1 investigates the specific case of Peru's CEMs, Manuscript 2 delves into the broader challenges of analyzing the impact of such policies. By understanding the potential pitfalls in data analysis, researchers can more accurately assess the success of programs like the WECs and determine if they are achieving their intended goals.

In Manuscript 1, we highlight the importance of CEMs in providing a safe space for women to report violence and access support. This study serves as a basis for understanding the real-world implementation of policies aimed at reducing violence against women. However, as Manuscript 2 demonstrates, evaluating the success of these policies can be complicated by outcome misclassification, which can lead to biased or inaccurate results. Consequently, Manuscript 2 emphasizes the need for rigorous methods in analyzing data related to violence against women.

The findings from Manuscript 2 can help inform the interpretation of results presented in Manuscript 1. By acknowledging the potential impact of outcome misclassification, researchers can better account for biases and errors in their analysis. This, in turn, allows

for a more accurate assessment of the effectiveness of the CEMs in reducing instances of intimate partner violence. The findings from both studies can thus be used to support and inform each other, ensuring that the conclusions drawn from Manuscript 1 are both accurate and reliable.

The connection and transition between Manuscripts 1 and 2 highlight the importance of accurate data analysis in evaluating the impact of policies targeting violence against women. By focusing on the real-world application of CEMs in Peru and examining the potential pitfalls in evaluating such programs, the two studies offer complementary insights into the ongoing efforts to reduce violence against women. By addressing these challenges, researchers and policymakers can better understand the effectiveness of existing interventions and develop evidence-based strategies to protect women from intimate partner violence.

Chapter 5:

Manuscript 2.

Assessing the Impact of Outcome Misclassification on the Evaluation of Policies Targeting Violence Against Women: A Simulation Study Using a Difference-in-Difference Design.

5.1 Title page

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5.2 Abstract

Background:

Gender-based violence remains a critical public health concern, affecting one-third of the global female population. Assessing the effectiveness of prevention policies is complicated due to underreporting, differential misclassification, and lack of measurement standards.

Methods:

We evaluated the effect of different misclassification scenarios on policy evaluation for gender-based violence using a simulation-based approach and difference-in-differences (DID) design. Synthetic longitudinal data were generated to create four misclassification scenarios: (1) no misclassification, (2) non-differential misclassification, (3) differential misclassification at the group level, and (4) differential misclassification in the post-treatment period in the intervention group. The estimation process was repeated using a Monte Carlo Simulation approach for Quantitative Bias Analysis.

Results:

Non-differential misclassification biased results towards the null hypothesis, whereas differential misclassification significantly impacted treatment effect estimates, particularly when misclassification changed due to the intervention. The DID estimator recovered the true effect after adjusting for misclassification; however, confidence intervals widened, specifically in scenario 4, reflecting increased uncertainty.

Discussion:

Misclassification, particularly as a direct result of the intervention, can lead to considerable bias in estimates. Therefore, policy research on violence prevention must address this concern, as it not only affects the interpretation of results but also impacts policymaking.

5.3 Main body

Introduction

Gender-based violence is a global public health issue with far-reaching consequences for individuals, families, and communities [1]. Those who are particularly vulnerable to this problem include women and girls living in conditions of forced migration and humanitarian crises [2]. Violence against women directly affects more than one billion women and girls, representing over one-third of the population, and includes experiences of intimate partner violence or non-partner physical or sexual abuse throughout their lives [3]. Governments worldwide have implemented policies to combat violence against women, such as legal reforms and public education campaigns [4]. However, it is essential to evaluate the effectiveness of these policies to enhance their impact [5]. To accurately measure the outcomes of interventions designed to address violence against women, it is crucial to have reliable measures, such as prevalence rates and assessments of health and well-being [6].

Evaluating policies targeting gender-based violence faces various challenges. Violence against women often remains underreported and unrecognized, making it difficult to accurately measure its extent. Self-reported measures may not capture the full scope of the problem, as victims may not report incidents due to fear of retaliation, shame, or lack of trust in the legal system. Furthermore, the normalization of such violence in many societies often leads to women not recognizing it as a reportable offense or feeling that they have no choice but to accept it as a normal part of their lives. This can perpetuate a cycle of violence and abuse that is difficult to break [1]. Similarly, administrative data may not account for all occurrences of violence, as some cases may not be reported to authorities or may not be classified as violence [7], leading to underreporting and making it one of the most underreported crimes [8]. Currently, there is no universally accepted gold standard for measuring violence against women. This lack of a clear standard can lead to outcome misclassification and bias in policy evaluation [3,9]. Furthermore, misclassification of outcomes is often not adequately addressed when evaluating policies using cross-sectional data, such as multipurpose surveys like the Demographic

and Health Survey, which is one of the most commonly used data sources in many studies [10–12].

Over time, there has been notable advancement in measuring violence against women, particularly intimate partner violence, which includes enhancements in addressing factors that may influence reporting. A crucial area of advancement is the training of interviewers to approach survivors with sensitivity and impartiality during interviews. Another significant aspect is ensuring confidentiality, which can encourage survivors to disclose their experiences more freely [12–14]. Nevertheless, despite these improvements, there are still several cultural and individual factors that could impact reporting, underscoring the significance of comprehending the extent and nature of misreporting in the field of violence against women [11]. The use of imprecise self-reported data on victimization could significantly skew the estimates of treatment effects in evaluation studies [12].

When evaluating interventions or policies targeting violence against women, it is crucial to consider the potential impact of misclassification on the observed effects. Nondifferential misclassification, where the error in measurement is equally distributed across groups (e.g. treated and control), could attenuate the effect, pulling it towards the null hypothesis [15]. However, given the unique characteristics of interventions addressing violence against women, which often include components aimed at transforming attitudes, beliefs, and social norms [16], the more likely scenario after an intervention is that it not only affects the incidence of violence but also increases the sensitization to survey questions. Consequently, this heightened awareness may lead to differential misreporting between intervention and control groups, generating differential misclassification, even in studies that seek exogenous variation through randomized controlled trials (RCTs) or quasi-experimental designs [11]. This highlights the need for careful consideration of potential biases and the development of innovative methodologies to accurately assess the effectiveness of interventions and policies addressing violence against women.

This simulation study aims to investigate the effect of various plausible misclassification scenarios using a quantitative bias analysis approach [17]. We will simulate the intervention effect on a hypothetical population using a difference-in-difference design, one of the most widely used methods in policy evaluation[18] and evaluate the impact of different sensitivity scenarios on the effect estimate.

Method:

Study Design

This study utilized a simulation-based approach to investigate how the misclassification of outcomes can impact the evaluation of policies aimed at addressing violence against women, using a difference-in-differences (DID) design. The DID design is a commonly used quasi-experimental research method that attempts to determine the causal effect of a policy intervention or treatment on an outcome of interest, particularly in situations where randomized controlled trials are not feasible or ethical. The DID approach involves comparing the average changes in outcomes between the treatment and control groups prior to and following the intervention. It assumes that the treated group would have followed the same trend in the absence of the treatment. By contrasting the differences between the two groups over time, the DID estimator helps isolate the causal impact of the intervention from other factors that may influence the outcome. However, the parallel trends assumption is crucial for this method and requires that any potential confounding factors that could affect the outcome change at the same rate in both groups over time[18].

One variation of the DID design is known as the staggered interventions DID design, which is suitable for situations where the implementation of a policy occurs at different times for different groups which is particularly useful in evaluating policies that are being phased in over time, where the policy is introduced gradually to different populations or regions. It is important to give special consideration to the analysis of staggered interventions. In the difference in difference literature, two-way fixed effect analysis was commonly used to estimate the effect of interest [19], but this method has been found to produce biased estimates due to variance-weighting implicit in ordinary least squares and

the embedded use of past treated units as effective comparison units for later treated units [20]. Recent developments in the DID methods have provided alternative approaches that explicitly consider the pool of acceptable control units. This enables the assessment of treatment effect heterogeneity across units and time, while also taking into account never treated or not yet treated units as controls [18,21,22]. In this simulation study, we will use the Callaway and Sant'Anna approach[22], which allows us to calculate three levels of effect. Firstly, we can estimate group-time treatment effects for each time unit pre- and post-intervention in each treated group (set of units that start the intervention at the same time). Secondly, we can aggregate these group-time treatment effects into group-specific averages treatment effects (ATTs), which provide a summary measure of the effect for each intervention group. Finally, we can calculate an overall summary effect across all intervention groups' ATTs, which gives us the average treatment effect among all treated units. To account for potential dynamic effects, we can also use an event study to aggregate the group-time treatment effects, which centers the intervention at time 0 and estimates the average effect across all groups for each time in relation to the intervention.

Data Generation

We generated synthetic longitudinal data for 10 geographical units, referred to as districts *d*, each containing 400 individuals *i* who were followed for 10 units of time *t*. Five districts were randomly selected to receive the intervention at different times between time *t*=4 and *t*=8, this to allow for districts to have at least 3 pre and 2 post intervention periods. All districts d which received the intervention at the same time *t* where designated a treatment group indicator *g.time*. A treatment indicator X was also added, taking a value of 0 before the treatment time and 1 after the treatment time for the treated districts, and 0 for the control districts, additionally a group indicator *G* was created to identify treated districts *G*=1, and control districts *G*=0. The outcome of interest was the reporting of violence, which was measured as a binary indicator $Y_{idt[X=x]}$ at the individual level.

We first generated a base prevalence at time *t*=1 for each district *d* with a normal distribution, represented as:

Base prevalence $_{dt=1} \sim N (\mu_{base}, \sigma^2_{base})$ where $\mu_{base} = 0.6$, and $\sigma^2_{base} = \mu_{base}/100$

Then for the treated districts we generate an average effect per unit of time with a normal distribution, represented as:

Average effect $_{d[G=1]} \sim N (\mu_{effect}, \sigma^2_{effect})$ where $\mu_{effect} = -0.05$, and $\sigma^2_{effect} = abs(\mu_{effect}/100)$

Then we created an outcome provability for district *d*, at time *t*, as follows:

$Pr[Y_{dt=t}=1] = \text{Base prevalence}_{dt=1} + \text{Average effect}_{d[G=1]} \times (Time_{t=t} - g.time_t + 1)$

$(Time_{t=t} - g.time_t + 1)$ is the effective time indicator of the treatment, assigning the number of units of time that the treatment has been in effect, for instant if district d=4, received the intervention at g.time t=5, then by time t=6, the effective time of the intervention will take the value of 1, representing the first time unit that the intervention has a potential effect. In this setup, we are allowing the effect of the intervention to have a dynamic effect represented with: Average effect $_{d[G=1]} \times (Time_{t=t} - g.time_t + 1)$, allowing the effect of the intervention to increase for each unit of effective time in a magnitude equal to the Average effect $_{d[G=1]} \times (Time_{t=t} - g.time_t + 1)$. For control districts or treated districts before the intervention, the probability of the outcome will be equal to the base prevalence.

For each individual *i* within district *d* at year *t*, we created a binary indicator Y_{idt} of the outcome following a binomial distribution with a probability of success equal to the outcome probability at the district level: $Pr[Y_{dt=t}=1]_]$, represented as:

$Y_{idt} \sim Bin (1, p)$ where $p = Pr[Y_{dt}=1]$

Misclassification Scenarios

We considered four scenarios with varying degrees of misclassification to assess the impact of outcome misclassification on the DID estimator. These scenarios were defined by different levels of sensitivity (probability of correctly identifying an individual experiencing violence); we maintained specificity at a constant level of 1 due to the subject matter knowledge that false positives are relatively rare. Specificity represents

the probability of correctly identifying individuals who have not experienced violence. In the case of violence against women, it is reasonable to assume that individuals who have not experienced violence would be unlikely to falsely report it [23–25]. Consequently, by setting the specificity at 1, we acknowledge that false positives are improbable in this scenario and focus on the varying sensitivity levels, which are more likely to be affected by misclassification.

Scenario 1: In this scenario, there is no misclassification, and both sensitivity and specificity are perfect, with a value of 1. This means that all the individuals who are truly positive are correctly classified as positive, and those who are truly negative are classified as negative. Therefore, there are no false positives or false negatives, and the accuracy of the classification is 100%.

Scenario 2: In this scenario, there is non-differential misclassification between control and treated units before and after the intervention. The sensitivity is lower in the treated group and control group before and after the intervention, with a value of 0.70, which means that some true positives are classified as false negatives. However, the specificity remains at 1, which means that there are no false positives. Non-differential misclassification biases the results towards the null hypothesis, leading to an underestimation of the effect size.

Scenario 3: In this scenario, there is differential misclassification between control and treated units, which did not change after the intervention. Both groups have a specificity of 1, meaning that there are no false positives. However, the sensitivity is lower in the control group [g=0], with a value of 0.60, compared to the treated group [g=0], which has a sensitivity of 0.70. This type of misclassification can potentially bias the estimates of the treatment effect. However, it should be noted that in a DID design, which accounts for time-invariant characteristics, the bias is expected to be similar to that in scenario 2.

Scenario 4: In this scenario, there is differential misclassification after the intervention in the treated group. The effect of the intervention is an increase in reporting by 0.15. This

increase in reporting leads to an increase in sensitivity in the treated group from 0.70 to approximately 0.95 after the intervention.

Given that the E[Base prevalence $_{dt=1}$]= 0.6 and Sensitivity$_{pre\text{-}treatment}$ = 0.70,

The observed prevalence= E[Base prevalence $_{dt=1}$]* Sensitivity$_{pre\text{-}treatment}$ = 0.6*0.7= 0.42

An increase in reporting by 0.15 = observed prevalence + 0.15= 0.42+0.15= 0.57

Therefore, the Sensitivity$_{post\text{-}treatment}$ = 0.57/0.6= 0.95

This particular scenario is of interest because interventions designed to prevent violence may not only decrease the occurrence of violence but also affect attitudes, beliefs, and social norms. This could lead to a higher chance of misclassification in post-treatment surveys as it may increase sensitivity to survey questions[26]. In this scenario the magnitude of misclassification itself is an effect of the intervention. This idea is intriguing because it is not commonly addressed. It is a plausible and a relevant concept that deserves attention in future studies. Figure 1 displays a DAG that corresponds to each scenario.

Recovering the true effect

Scenario 1: In this ideal scenario, the true effect can be easily recovered since there is no misclassification.

Scenario 2: In this scenario, recovering the true effect becomes more challenging due to non-differential misclassification. Given the lack of a gold standard for the measurement of violence and the various factors affecting reporting, it is acknowledged that there is no single misclassification factor, and this may vary depending on the context. Based on studies aimed at evaluating screening tools [27], comparing DHS with list experiments [11], and comparing DHS with other cross-sectional surveys [12], it is estimated that the sensitivity can range from 0.40 to 0.90. For this particular scenario, we assign a sensitivity for scenario 2 (sc2) following a beta distribution as follows:

Sensitivity$_{sc2}$ ~Beta(α,β), where α = 12, and β=5,

$E(Sensitivity_{sc1})$ =0.70 (95%:CI 0.48;0.89)

To recover the true effect, one can try to adjust for the misclassification using quantitative bias analysis based on assigning a distribution to the sensitivity [17]. This method allows researchers to account for the uncertainty in the sensitivity estimates and to explore the potential impact of misclassification on their results. By incorporating the distribution of the sensitivity into the analysis, researchers can better understand the range of possible effect sizes and potentially reduce the bias introduced by the non-differential misclassification.

Scenario 3: In this scenario, recovering the true effect may appear challenging due to differential misclassification between the control and treated groups. However, the DID design can help account for the time-invariant characteristic. Although the sensitivity distribution assigned to the control group may not accurately reflect the true sensitivity, as long as it remains constant after the intervention time, the true effect can still be recovered as long as the sensitivity in the treated group is assessed.

To illustrate this, two sub-scenarios can be run. In sub-scenario 3A, the same parameters as in scenario 2 are used, resulting in a similar sensitivity distribution for both the control and treated groups. Even if the true sensitivity differs in the control group, as long as the sensitivity distribution for the treated group is close to the true sensitivity, the true effect can still be recovered. In sub-scenario 3B, the control group is given a sensitivity distribution centered at the true sensitivity. In both sub-scenarios, it should be possible to recover the true effect.

For scenario 3B, we assign a $sensitivity_{sc3B[G=g]}$ following a beta distribution as follows:

$sensitivity_{sc3B[g=1]} \sim Beta(\alpha,\beta)$, where $\alpha = 12$, and $\beta=5$,

$E(Sensitivity_{sc1[g=1]})$ =0.70 (95%:CI 0.48;0.89)

$sensitivity_{sc3B[g=0]} \sim Beta(\alpha,\beta)$, where $\alpha = 8$, and $\beta=5$,

$E(Sensitivity_{sc1[g=0]})$ =0.60 (95%:CI 0.35;0.85)

Scenario 4: In this scenario, determining the true effect is especially difficult due to the differential misclassification that occurs after the intervention in the treated group. The intervention leads to an increase in reporting, resulting in a heightened prevalence of 0.15. To accurately represent this measure, it may be necessary to conduct additional, in-depth studies on the intervention's effect. This would involve not only collecting information based on the outcome but also incorporating questions that could provide insight into changes in perception or increased sensitivity to questions about violence. We acknowledge that this may be more challenging than measuring the actual outcome of violence. However, due to the nature of these types of interventions, this factor is crucial when interpreting results.

In this specific scenario, we would first assign a potential effect as a change in prevalence that corresponds solely to reporting sensitivity, using a uniform distribution as follows:

Reporting effect$_{[X=1]}$ ~ U (a , b), where a=0 and b=0.15*2

Sensitivity$_{sc4[X=0]}$ ~Beta(α,β), where α = 12, and β=5

Observed prevalence$_{[X=0]}$ = E[Base prevalence $_{dt=1}$]* Sensitivity$_{sc4[X=0]}$

New prevalence$_{[G=1, X=1]}$= observed prevalence$_{[X=0]}$ + Reporting effect$_{[X=1]}$

We can then calculate the corresponding sensitivity as:

Sensitivity $_{sc4[X=1]}$ = New prevalence$_{[G=1, X=1]}$/ E[Base prevalence $_{dt=1}$]

Analysis

We utilized the Callaway and Sant'Anna R package to perform DID estimation for each misclassification scenario. The DID estimator produced group-time ATTs, which were aggregated into group-specific ATTs and then an overall average ATT. Additionally, the dynamic treatment effect allowed for the aggregation of the group-time ATTs into an event study. We repeated the estimation process 100 times for each scenario following a Monte Carlo sensitivity analysis design. Each replication involves selecting one sensitivity value from the probability distribution specified for each scenario and

assessing whether the true ATT could be recovered. Bias will be assessed by measuring the absolute difference between the average estimated value from the multiple iterations of sample generation and the truth. All analyses were performed using R statistical software (version 4.0.3) and the code can be found here:

http://rpubs.com/renzocalderon/did_mis_simulation_IPV

Results

Our simulation generated four treated groups that received treatment at times 4, 5, 6, and 7. To determine the true effect, we took into account the dynamic treatment effects that were simulated, factoring in the set effect per unit of time (μ_{effect} = -0.05) and the number of effective units post-intervention. For instance, Group 4 (the districts treated at time t=4) had 7 post-treatment time units, with a -0.05 true effect increase per unit of time, resulting in an average ATT of -0.2 across these 7 units of time. Table 1 provides a summary of the true group-specific ATT for each treated group. The overall ATT across all four treated groups revealed a true effect of -16.3 percentage points (pp). The dynamic true ATT is contingent on the length of the post-treatment units included in the event study, and in this case, we incorporated the maximum number of post-treatment time units, which totaled 7. Therefore, the true overall dynamic ATT equates to -20.0 pp.

Scenario 1: No Misclassification

As expected, in the absence of misclassification, the DID estimator successfully recovered the true ATT with high accuracy. The estimated overall summary of group-specific ATTs was -16.85 pp (95% CI: -19.58; -14.13), which was consistent with the true group effect of -16.3, Bias=0.6. Similarly, the summary of dynamic ATT was -21.77 pp (95% CI: -24.73 ;-18.82), Bias=1.7.

Scenario 2: Non-Differential Misclassification

In this scenario, the DID estimator yielded an estimated ATT of -10.92 pp (95% CI: -13.67;-8.18) for the overall group ATT, Bias=5.4, and -14.91 pp (95% CI: -17.88;-11.941) for the dynamic ATT, Bias=5.1, which was an underestimation of the true effect. This result is

consistent with the expectation that non-differential misclassification biases the results towards the null hypothesis. After adjusting for the misclassification the estimated group ATT was -15.57 pp (95% CI: -20.95;-11.49), Bias=0.7, while the recovered dynamic ATT was -21.01 pp (95% CI: -28.26;-16.09), Bias=1.01, which was much closer to the true effect, with a similar Bias to scenario 1. The confidence intervals were wider, reflecting the increased uncertainty due to the misclassification distribution that was used.

Scenario 3: Differential Misclassification between groups (Unchanged after Intervention)

In this scenario, the DID estimator yielded an observed group ATT of -11.60 pp (95% CI: -14.33;-8.87), Bias=4.7, and an observed dynamic ATT of -15.17 pp (95% CI: -18.13;-12.21), Bias=4.8, similar to scenario 2, the misclassification biased the results towards the null hypothesis. However, the difference in sensitivity between the treated and control groups did not add any considerable bias due to the DID design.

Scenario 3a: After adjusting for the misclassification, assigning the same sensitivity for both treated and control groups, the estimated group ATT was -16.46 pp (95% CI: -22.59; -12.40), Bias=0.2, while the recovered dynamic ATT was -21.53 pp (95% CI: -29.70;-16.57), Bias=1.5.

Scenario 3b: After adjusting for the misclassification, assigning different distributions to the sensitivity of the treated and control groups, the estimated group ATT was -15.76 pp (95% CI: -23.11;-13.25), Bias=0.5, and the dynamic ATT was -21.01 pp (95% CI: -28.26; -13.25), Bias=1.0.

In both sub-scenarios 3a and 3b, the DID estimator was able to recover the true effect, showing that the under the DID design, as long as the sensitivity is constant over time, the main driver for the bias is the sensitivity in the treated group.

Scenario 4: Differential Misclassification (Changed after Intervention)

In this scenario, the DID estimator produced an estimated group ATT of -0.42 pp (95% CI: -3.19 ;2.34), Bias=15.9, which shows no evidence of an effect, which is an

underestimation of the true effect. This result highlights the importance of considering the potential impact of differential misclassification on the estimation of the treatment effect. Moreover, the event study shows a dynamic ATT of -4.74 pp (95% CI: -7.74;-1.74), Bias=15.3; with an effect that goes in the opposite direction to the true effect for the first units of time after the intervention.

After accounting for the reporting effect and adjusting for the misclassification, the estimated group ATT was -14.57 pp (95% CI: -34.65;-4.92), Bias=1.7, while the recovered dynamic ATT was -19.56 pp (95% CI:-39.73;-9.89), Bias=0.4. However, the confidence intervals were considerably wider than in the previous scenarios, reflecting the increased uncertainty due to the differential misclassification and the reporting effect, specifically the uncertainty in the effect of the intervention on the change in sensitivity. These results suggest that differential misclassification can significantly bias the treatment effect estimates, particularly if the misclassification changes as a consequence of the intervention. It is crucial to account for such biases when analyzing the impact of interventions in real-world settings. Figure 2 presents a compilation of all the observed scenarios and their corresponding observed and recovered group ATT, figure 3 shows the event study plots and Figure 4, shows the comparison among dynamic ATT.

Discussion

Our simulation study examines different misclassification scenarios that may emerge when evaluating interventions or policies aimed at reducing violence against women. We focus on interventions targeting shifts in social norms and attitudes towards violence and demonstrate how misclassification can affect their assessment. In the realm of violence research, misclassification can significantly influence the estimation of treatment effects. This is particularly relevant as studies on violence often rely on self-reported data, administrative records, or police reports, all of which are susceptible to various forms of misclassification.

In 2019, the WHO and UN Women collaboratively introduced the RESPECT framework, consisting of seven strategies designed to offer a public health and human rights-based

approach to scaling up the prevention of violence against women programs [16]. These strategies encompass strengthening relationship skills, empowering women, ensuring services, reducing poverty, creating safe environments, preventing child and adolescent abuse, and transforming attitudes, beliefs, and norms. Implementing interventions that include these recommended components could influence both the actual outcome and awareness of the outcome measurement. While evidence on the impact of these interventions might be limited in scope and context, considering their effect not only on the incidence of violence but also on reporting could improve, restructure, and enhance current interventions.

An extensive literature review has addressed limitations in data and methodology for determining effective approaches to prevent violence against women and girls [28]. These limitations consist of small sample sizes, diverse outcome measurements and timeframes, and unaddressed confounding variables. However, measurement error could also affect the interpretation of these findings. The impact evaluation literature on violence against women has tried to estimate the effect of risk factors on violence using various methodologies to reduce or eliminate endogeneity bias [11,29–31]. Some studies have utilized exogenous variations introduced by randomized controlled trials (RCTs) or quasi-experimental designs. Nonetheless, misclassification still persists and limits the benefits provided by randomization or quasi-experimental designs to obtain unbiased treatment effects. For example, the SASA! study sought to assess the impact of a community mobilization intervention on reducing violence and HIV-risk behaviors in Uganda through an RCT[30]. Although the intervention was associated with significantly lower social acceptance of IPV among women and men, and greater acceptance of a woman's right to refuse sex among both genders, no evident difference in IPV incidence was observed between the intervention and control communities. The authors acknowledge that reporting bias could be a potential limitation in a study of attitudes and behaviors towards IPV. While under-reporting of IPV is common, increased awareness and sensitization to IPV issues and their disclosure could have disproportionately led to higher reports of IPV experiences among women in intervention communities [30].

Although measurement error is not the sole limitation, given the findings for increased awareness, a similar approach to the one presented in this study could benefit the analysis and interpretation of results.

Other authors have also explored potential pathways for increased reporting, which include bundled programs or concomitant interventions, increased human capital leading to more access to information, exposure to new social norms, or better labor market opportunities, all of which could influence violence reporting[11].

Failing to account for misclassification in violence research can have consequences beyond mere underestimation, with broader implications on result interpretation, policy recommendations, and resource allocation. Misclassification can disproportionately affect specific population groups, such as marginalized or vulnerable populations. If research findings are biased due to misclassification, interventions may not appropriately target the populations most in need, exacerbating existing inequalities. Ethical research practices necessitate accurate and unbiased estimation of treatment effects. Ignoring misclassification can potentially lead to the implementation of ineffective interventions, which may not only waste resources but also raise ethical concerns if they fail to address the target population's needs.

Our simulation has the potential to extend beyond violence research into other domains, particularly impact evaluation, which frequently employs quasi-experimental designs such as DID[32]. We acknowledge that a primary assumption in our model is that factors influencing the outcome in one group should similarly affect the other group both before and after the intervention [18]. An increase in measurement sensitivity could violate this assumption, but we have demonstrated that by using quantitative bias analysis techniques, the true effect can be recovered. Moreover, even under uncertainty regarding the difference in misclassification between treated and control groups, the DID design only necessitates accurate specification within the treated group, assuming the intervention does not impact the control group's sensitivity, which is plausible as the control group typically experiences no effect.

While our simulation example serves as a valuable tool for illustrating the potential advantages of employing quantitative bias analysis to tackle misclassification in violence research, it is crucial to recognize its limitations. One notable limitation is the lack of consideration for specific factors related to misclassification, such as education, age, or context. Consequently, the simulation's accuracy may not fully capture the intricacies of real-world situations. Furthermore, accurately determining parameters like sensitivity or specificity can be difficult, and the methods employed in the simulation may not be appropriate for all misclassification types. We understand that the primary constraint in implementing this quantitative bias analysis in practice is the absence of validation studies that can produce valid assumptions about the bias parameters' distribution, such as sensitivity. However, no consensus currently exists on the best approach for constructing prior distributions [33]. Excessive reliance on prior research or expert opinions may introduce bias into the analysis based on subjective opinions and publication bias. Nevertheless, these simulations represent a step towards fostering more dialogue on the nature of bias in evaluating interventions addressing violence against women.

Despite these limitations, our example still offers valuable insights into the potential benefits of applying quantitative bias analysis in violence research and other fields that specifically utilize quasi-experimental designs. It emphasizes the importance of considering potential misclassification sources, evaluating their impact on research findings, and employing suitable methods for adjusting for them. While assessing the sensitivity of complex subjects like violence can be challenging, ongoing efforts to develop and refine methods for identifying and accounting for misclassification can ultimately result in more accurate and robust evidence.

In conclusion, there is an urgent need for more rigorous research on interventions to prevent violence against women and girls, particularly in low-resource settings. By addressing the methodological shortcomings of current studies and filling gaps in the evidence base, we can start to identify effective interventions and devise strategies to prevent violence and support survivors.

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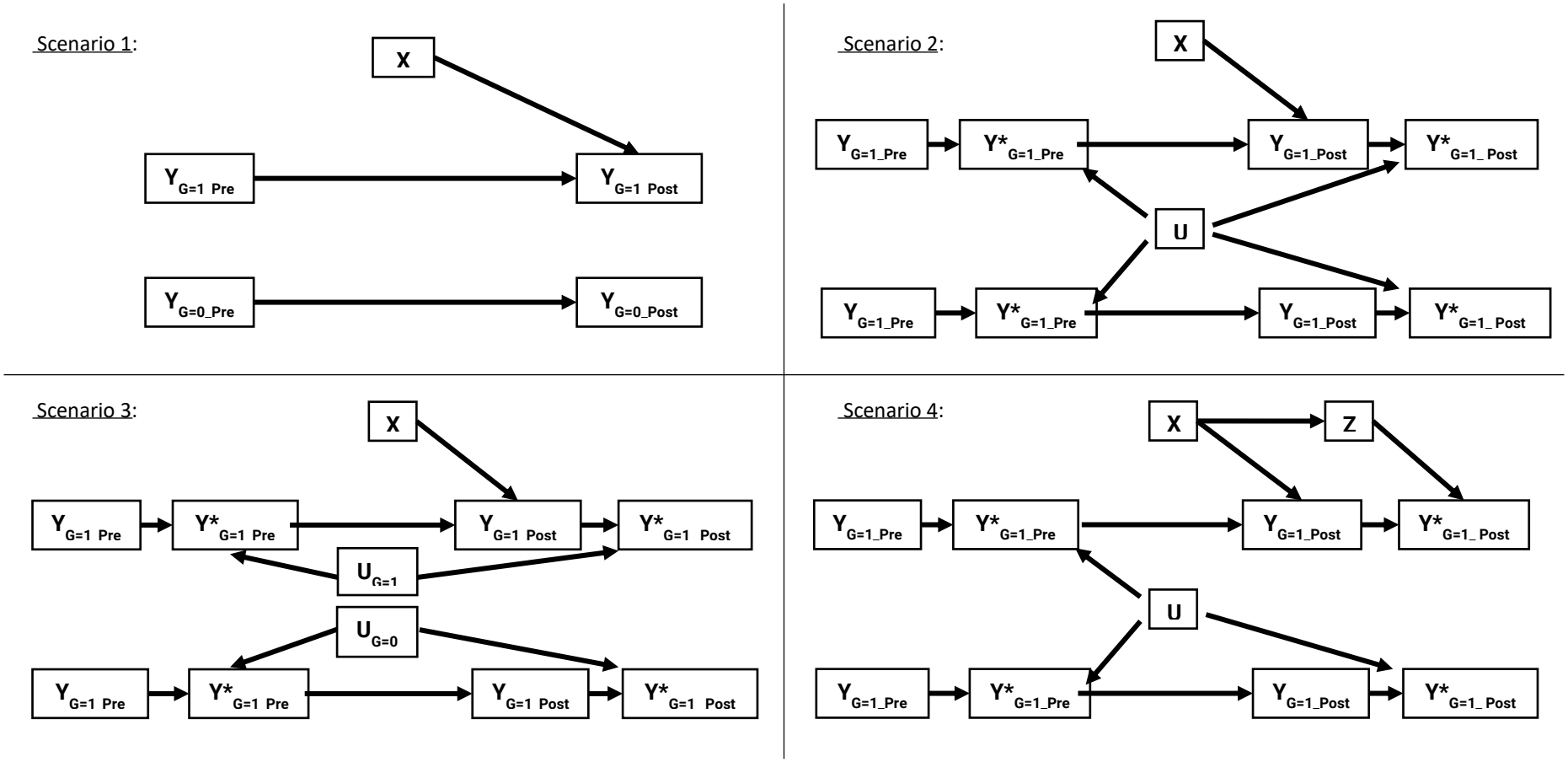
5.4 Tables

Table1. Intervention Group true ATT and overall true ATT

Intervention Group	*Post intervention units of time*	*True group-specific ATT*
4	7	-20.0
5	6	-17.5
6	5	-15.0
7	4	-12.5
	Overall true ATT	-16.3

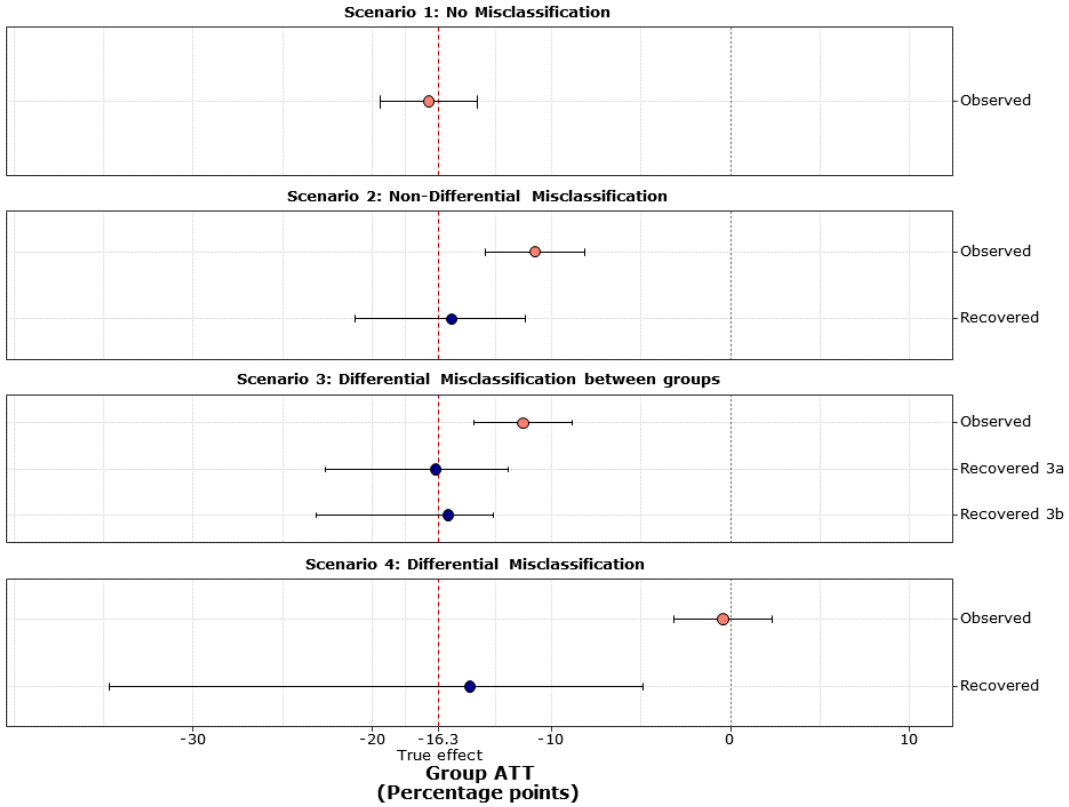
5.5 Figures

Figure 1. Corresponding DAGs for each scenario



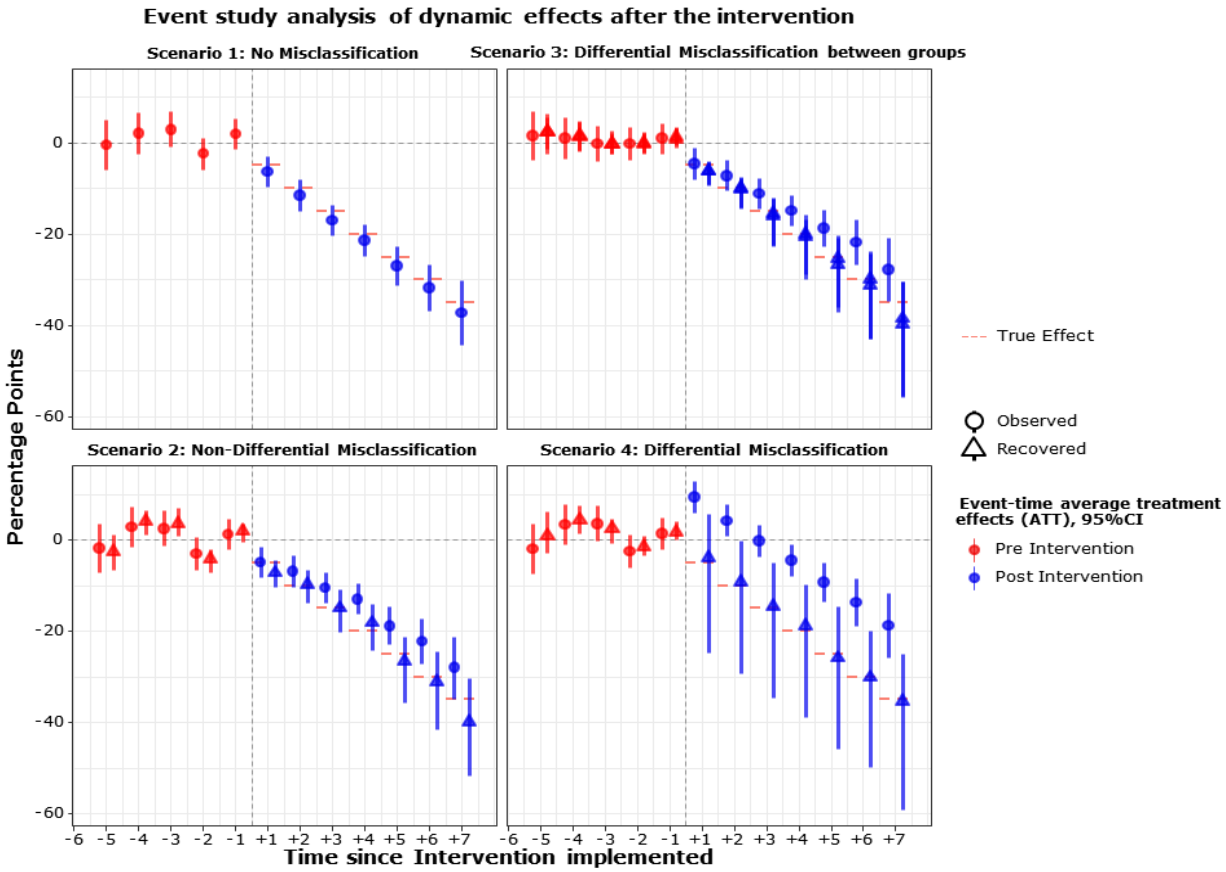
X : Intervention\Y : True outcome\Y* : Observed outcome with misclassification\G=1 : Treated Group\G=0 : Control Group\
Pre : Pre intervention\Post: Post intervention\U : Variable leading to misclassification\UG=1: Variable leading to misclassification in the treated group\UG=0: Variable leading to misclassification in the control group\Z : Variable leading to misclassification caused by the intervention

Figure 2. Comparison of observed vs recovered Group ATT for each misclassification scenario.



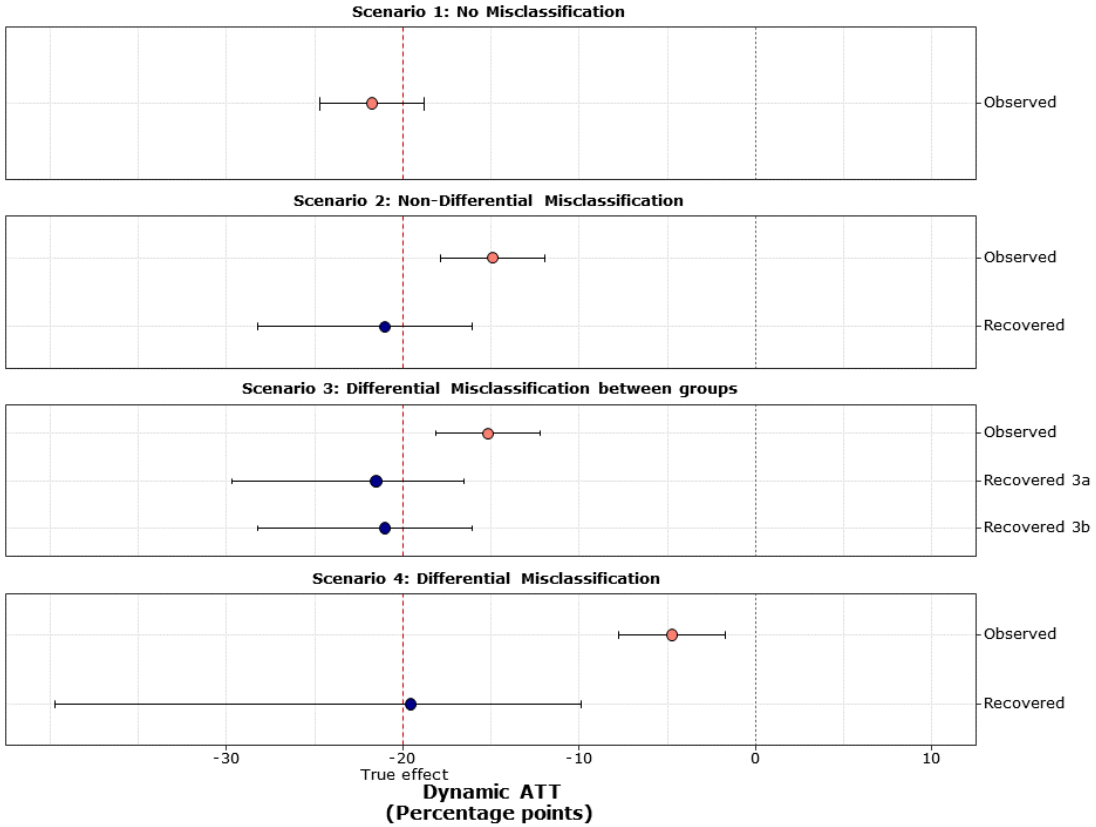
The pink vertical line with dashes represents the actual effect, while the red dots represent the observed effect and their corresponding 95% CI. On the other hand, the blue dots represent the recovered group ATT effect and their corresponding 95% CI after correcting for misclassification.

Figure 3. Comparison of observed vs recovered Event Study plot each misclassification scenario.



The pink horizontal line with dashes denotes the true effect at each point in time concerning the intervention. Meanwhile, the red dots represent the observed effect and their corresponding 95% CI before the intervention, and the blue dots represent the effect and 95% CI after the intervention. The circles indicate the observed effect, while the triangles represent the recovered effect for the dynamic ATT.

Figure 4. Comparison of observed vs recovered Group ATT for each misclassification scenario.



The pink vertical line with dashes represents the actual effect, while the red dots represent the observed effect and their corresponding 95% CI. On the other hand, the blue dots represent the recovered average dynamic ATT effect and their corresponding 95% CI after correcting for misclassification.

5.6 Appendix

Full code can be found here: http://rpubs.com/renzocalderon/did_mis_simulation_IPV

5.7 Transition

The accurate evaluation of public policies has become increasingly essential in understanding the effectiveness of interventions designed to address various social and public health issues. Manuscript 2, titled "Assessing the Impact of Outcome Misclassification on the Evaluation of Policies Targeting Violence Against Women: A Simulation Study Using a Difference-in-Difference Design," investigates the potential biases and errors in data analysis that may affect the evaluation of policies aimed at curbing violence against women. This paper highlights the importance of rigorous methods in analyzing data related to violence against women and ensuring accurate conclusions.

On the other hand, the COVID-19 pandemic has had a significant impact on various aspects of public health and safety across the globe. Manuscript 3, titled "Impact of COVID-19 lockdown policy on homicide, suicide, and motor vehicle deaths in Peru," examines the unintended consequences of the lockdown measures implemented in response to the pandemic. This study focuses on the changes in the rates of homicide, suicide, and motor vehicle deaths during the lockdown period in Peru.

A critical connection between Manuscripts 2 and 3 lies in their focus on evaluating public policies and understanding their impact on different facets of society. While Manuscript 2 examines the challenges of accurately assessing policies targeting violence against women, Manuscript 3 investigates the broader consequences of public health policies, such as lockdown measures, on various aspects of public safety. Both studies underscore the importance of thorough data analysis and interpretation to inform policymaking.

The findings from Manuscript 2 can provide valuable insights for interpreting the results presented in Manuscript 3. By acknowledging the potential impact of outcome misclassification and other biases, researchers can better account for errors in their analysis of the effects of lockdown policies. This, in turn, allows for a more accurate assessment of the consequences of these policies on homicide, suicide, and motor vehicle deaths.

Although Manuscript 3 uses a different quasi-experimental design, it could still benefit from the methodologies employed in Manuscript 2, and can be instrumental in understanding the impact of public policies such as those analyzed in Manuscript 3. By using rigorous analytical methods to account for potential confounding factors, researchers can better isolate the effects of the lockdown policy on public safety outcomes. This approach can also help policymakers identify any unintended consequences of their interventions, enabling them to refine their strategies and optimize their effectiveness.

Transition between Manuscripts 2 and 3 highlight the importance of accurate data analysis and interpretation in evaluating public policies' impact on society. By focusing on the challenges associated with the evaluation of policies targeting violence against women and the broader consequences of public health policies like lockdown measures, these studies offer valuable insights into understanding and addressing various social and public health issues. Ultimately, the findings from both studies can help inform more effective policymaking, ensuring better outcomes for the communities they serve.

Chapter 6:

Manuscript 3.

Impact of COVID-19 lockdown policy on homicide, suicide, and motor vehicle deaths in Peru

6.1 Title page

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6.2 Abstract

Background:

Although lockdown measures to stop COVID-19 have direct effects on disease transmission, their impact on violent and accidental deaths remains unknown. Our study aims to assess the early impact of COVID-19 lockdown on violent and accidental deaths in Peru.

Methods:

Based on data from the Peruvian National Death Information System, an interrupted time series analysis was performed to assess the immediate impact and change in the trend of COVID-19 lockdown on external causes of death including homicide, suicide, and traffic accidents. The analysis was stratified by sex and the time unit was every 15 days.

Results:

All forms of deaths examined presented a sudden drop after the lockdown. The biggest drop was in deaths related to traffic accidents, with a reduction of 12.22 deaths per million men per month (95% CI: −14.45, −9.98) and 3.55 deaths per million women per month (95% CI:-4.81, −2.30). Homicide and suicide presented similar level drop in women, while the homicide reduction was 2.5 the size of the suicide reduction in men. The slope in homicide in men during the lock-down period increased by 6.66 deaths per million men per year (95% CI:3.18, 10.15).

Discussion:

External deaths presented a sudden drop after the lockdown was implemented and an increase in homicide in men was observed. Falls in mobility have a natural impact on traffic accidents, however, the patterns for suicide and homicide are less intuitive and reveal important characteristics of these events, although we expect all of these changes to be transient.

6.3 Main body

Introduction

COVID-19 has had a serious impact on population health worldwide [1], not only as a direct consequence of the infection but also due to the measures taken to reduce its transmission. These unprecedented changes in the lifestyles of millions have also impacted mental health, society and economy in various ways [2,3].

The main strategies to reduce COVID-19 transmission are social distancing and isolation measures. Policies range from advising individuals to keep 2 meters apart in public spaces all the way to generalized lockdowns [4], all to reduce the pace of transmission and to prevent health services from being overwhelmed [5].

By the middle of June 2020, Latin-America had become a focus of COVID-19 infection. To slow the spread, most of the region have taken severe lockdown measures [6]. Peru was one of the countries with the earliest and strictest national lockdown in Latin-America and has won international recognition for its pandemic response, starting restrictions right after the first confirmed case in mid-March 2020 and lasting for over 100 days until the end of June in most of the country [6–9].

Although measures such as national lockdowns are expected to have a direct impact on transmission and subsequent mortality due to COVID-19[10–12], the interruption of all daily activities suggests that they may also impact other aspects of health and causes of death [13–15]. Radical changes in the daily activities of individuals, self-isolation, financial uncertainty, job losses, and reduced incomes have the potential to influence mortality due to violent crimes, suicides, domestic violence, and other external causes of death [16–19].

Early reports have indicated a substantial drop in violent crime rates across the world, with a drop in crime close to 50% in some cities following some of the most restrictive measures [20,21]. Reports of domestic violence have increased since social distancing measures came into effect, as victims are forced to be isolated with their abusers[22,23]. The UN has estimated that domestic violence increased by over 30% in some countries since lockdown with a surge in the need for shelters[24,25].

Lockdowns have also been accompanied by travel bans and a reduction in mobility, leading to a decrease in the use of motor vehicles[26] with a consequential drop in traffic accidents and resultant emergency visits and deaths[27,28]. The mental health effects of COVID-19 and of the accompanying economic crisis have also been profound, with suicide as a concern[16]. Previous pandemic scenarios have also shown a change in suicide trends including the 1918 influenza pandemic and 2003 SARS epidemic[29,30].

Developing countries appear to be more susceptible to the effects of confinement on mental health, due to economic constraints, unavailability of food and overall socio-economic insecurity, which could aggravate psychological conditions[31]. Increased suicides related to economic hardship as well as a result of the lockdown have been reported in Bangladesh [32–34], Pakistan[35] and India [36]. Furthermore, there have been reports on special cases of suicides during the COVID-19 pandemic, such as couples making suicide pacts[37], mother and son suicide pacts due to COVID-19-related online learning issues[33], suicide due to non-treatment by healthcare staff[34], and infanticide-suicide[38]. A common denominator in these cases is the financial instability and uncertainty experienced during the pandemic, which makes an in-depth analysis of the issue necessary to take measures that can prevent this loss of life.

Although by the end June 2020 most countries have relaxed their lockdown measures, their diverse consequences are still unclear and are just now beginning to be studied empirically. Our study aims to assess the early impact of the COVID-19 national lockdown on homicide, suicide, and traffic accident deaths in the Peruvian setting.

Methods

Study population

We used data from the Peruvian National Death Information System (SINADEF)[39] which collects daily death certificates nationwide with available data since 2017. SINADEF has improved the quality of data registration in the recent years, managing to improve its coverage including close to 80% of all deaths in the national territory[40]. Even though coverage has improved, the updating of the database has a certain degree of delay. To assess this delay, the database published on SINADEF's web page[41] has been downloaded on a daily basis for one month. It was found that after 15 days, the database did not show an increase in data greater than 1% from the first day. For the present study, data on deceased adults (18 years old or older) is included from January 1st, 2017 until September 26th, 2020, using the database published on October 25 to minimize any lost of information.

On March 16, 2020, the Peruvian government decreed a state of sanitary emergency, suspending economic, academic, and recreational activities across the entire country of 32 million people. Only essential activities including food supply, pharmacies, and banking remained accessible. Moreover, international borders were closed, military and police patrolled the streets, and a curfew was instituted from 8 p.m. to 5 a.m. Public transport capacity was also reduced by half and movement between regions within the country was banned. Although some of the components of the lockdown have changed throughout its implementation, the core aspects of the lockdown remained constant until the end of June 2020, after this point, the lockdown measures were relaxed maintaining the state of national emergency and with focalized lockdowns in some regions[7,8].

Measures

Because the lockdown was implemented in the middle of March and there is a relatively low count of daily deaths, we chose to aggregate the data in bins of 15 days each to have a uniform time unit throughout our study period.

Information on the cause of death, sex, and age were taken directly from the SINADEF report. The death certificate in the SINADEF system makes the distinction between non-external death, as death from an underlying disease or complication, and external death, as one that occurs as direct or indirect consequence of an injury (accidental, non-accidental or of undetermined intention) or of an injury that is the consequence of violence (homicide, suicide, accident or suspicion of having been caused intentionally) [42]. The specification of each type of external death is reported in an independent item for homicide, suicide, traffic accidents, work accidents and other types of accidental death. This item was used to identify the type of death, obviating the need to use the ICD 10 coding, which is underreported on the death certificates[40]. The number of events was transformed into the rate per 1,000,000 population for better comparison based on the population report from the latest National Census[43].

Because the COVID-19 pandemic imposes additional stress on health workers and the health system, the reporting, and coding of deaths could be affected by this overload of work[44,45]. To estimate if external deaths recording was affected by this scenario, we estimated the proportion of external deaths labeled as “unspecified” as a proportion of the total external deaths. This fraction was assessed in the same way as the main outcomes to find any change in the trends after lockdown. We also examined trends in non-external deaths to ensure that registration was consistent before and during the lockdown.

To have a measure of the degree of compliance with lockdown and an approximation to the use of motor vehicles we used descriptive data from the mobile-phone mobility data provided by Google Community Mobility Reports for public transit places[46]. This report presents the percent change in visits to transport places for each day compared to a baseline value.

Statistical analysis

To assess the immediate impact and change in the trend of COVID-19 lockdown, we analyzed the external death rates per population using an interrupted time series analysis[47]. A linear regression model was fitted to the external deaths rates with a time variable (every 15 days), a variable to indicate post-lockdown, which was defined since March 16, 2020, and an interaction term between the post-lockdown indicator and the time variable, to evaluate a change in the slope of the outcome trend after lockdown. Stratified analysis was performed for women and men because of known differences in external deaths by sex. Autocorrelation of the time series was assessed through a correlogram and seasonality through visual inspection of the plots. The analysis was conducted using R 3.6.1.

Results

A total of 472,153 events were identified as adult deaths from January 1st, 2017 to September 26th, 2020. External deaths sum up to 15,591 including 7,113 traffic accidents, 3,117 homicides, 1,752 suicides, and 3,609 other forms of accidental deaths. No autocorrelation or seasonality was found in any time series because the entire follow-up period spanned only 5.5 months.

The time slope in the pre-lockdown period was positive for all types of external deaths in both sex groups with the highest for male traffic accidents, with an extra 0.77 deaths per year per million men (95% CI: 0.53, 1.00) and the lowest in female homicides, with an extra 0.11 deaths per year per million women (95% CI: 0.05, 0.17). All forms of external deaths presented a sudden drop after the implementation of the lockdown in both groups. The biggest difference in the post-lockdown period was in deaths related to traffic accidents, with a reduction of 12.22 deaths per million men per month (95% CI: -14.45, -9.98) and a reduction of 3.55 deaths per million women per month (95% CI:-4.81, -2.30) after the lockdown. Homicide and suicide presented a similar level drop in women with around 1 fewer death per million women per month, while the homicide reduction was 2.5 times the suicide reduction in men with 5 and 2 fewer deaths per million men per month

respectively. Other forms of accidental deaths in women presented a reduction of 2 deaths per million women per month, being the second-highest drop in this group (Table 1). We detected an increase in the slope of traffic accidents in men in the post-lockdown period with an extra 6.66 deaths per million men per year (95% CI: 3.18, 10.15), an increase in the slope in suicides with an extra 1.20 deaths per million men per year (95% CI: -0.26, 2.65) and an increase in the slope in homicides with 2.19 deaths per million men per year (95% CI: 0.01, 4.37). No other major change in the post-lockdown slope compared to the pre-lockdown period was found in the other types of external death in women (Figure 1) or men (Figure 2). The post-lockdown follow-up is short and so there is limited statistical power to detect a slope change among these points[48].

There was no change in the level or the trend of the unspecified external death proportion (Figure 3A) and the registration of non-external deaths was also consistent in the post-lockdown period (Appendix Figure 1). The mobility data (Figure 3B) shows an early drop in mobility to transit stations right after the first confirmed case with a gradual reduction until the start of the lockdown. After lockdown, the mobility fell below -75% after the second day and held constant at around -80% for 40 days. After that period, mobility gradually recovered, with an increasing tendency through the end of the lockdown. The episodic drops shown close to -100% represent the strict curfew on Sundays and holidays.

Discussion

In this nationwide time series analysis, we found that lockdown implementation was associated with a sudden reduction in all major forms of external deaths (homicides, suicides and traffic accidents represented 79% of total external deaths in 2019[49]) with a detected change in the post-lockdown trend of suicides in men. Nonetheless, we do expect rates to return to their pre-pandemic levels at some future point. The biggest immediate absolute reduction was seen in traffic accidents and the smallest in suicides, but of course this also reflects the higher absolute burden of traffic accidents as a cause of death.

These results are consistent with both the theoretical rationale behind lockdown and various early reports in other parts of the world. The change in lifestyle and behaviors associated with limited outside activities and economic shutdown must certainly play a role in the mechanism behind the acute change in the rates of these types of deaths. Falls in mobility have a natural impact on road traffic accidents, since people staying at home are at no risk for these events. The decreases in suicide and homicide are less obvious. Suicide might be expected to increase from economic and social stress and the disruption of daily routine[50,51].

Expectations about homicide are also not so clear. As lockdown measures began, conventional crimes began to slow down around the world. Studies that evaluated the short-term effects of lockdown on different types of crime reports in Los Angeles and Indianapolis in the USA found a marked decrease in the robbery, burglary, and aggravated assault after the stay-at-home measures took place[18,52].

Most homicides in men in Latin-America and around the world are associated with crime[53,54], and since lockdown, both murder and crime decreased in the region[55]. In Mexico, murder rates, which started at a historic high in 2020, dropped dramatically almost halfway from the national average of 81 per day to 54 after social distancing measures were put in place[56] and a similar pattern has been seen in other countries in the region. In our time series analysis, we also found a marked dropped in homicides after

lockdown. Although this aligns with most reports in the region, this decrease in homicides contrasts with what is happening in some cities in the USA where crime is down, but murder is up, without a clear explanation of this divergence [57]. Now in the post-lockdown period of our time series there is already the first hint of a increase in the rates of homicides.

Most homicides in men are associated with crime, however, most homicides in women are hate crimes, which are classified in Peruvian law as "feminicides". In Peru, the first cause of homicide in women is intimate partner violence, with 1 of every 5 women having the partner as the perpetrator [58]. Isolation measures to prevent the spread of COVID-19 have created greater risks for women living in situations of domestic violence as the victims are isolated with their agressors[23,24,59]. Although we found a reduction in women's homicides overall, this does not exclude the increase in other forms of violence. A recent study from Peru showed a 48% increase in calls to helpline for domestic violence since the pandemic, with effects increasing over time. Similarly, a study conducted in the USA found that the COVID-19 pandemic was associated with a 7.5% increase in domestic violence service calls during the 12 weeks after social distancing began[60].

The reduction in women's homicides found in this study might reflect the conditions in which partner-perpetrated violence occurs. According to a study carried out in autopsies of women victims of violence, the most frequent place where the body was found was in public places, rivers, or open fields (43.4%), compared to the home (22.9%)[61]. Lockdown restrictions may have imposed an additional barrier in the occurrence of these tragic acts as police and military were constantly watching the streets.

Mental health during lockdown has also been a constant concern[13,15,16,62,63]. Some initial reports show the increase in suicides rate during this pandemic as a consequence of lockdown, financial stress, uncertainty, and isolation[63,64]. This financial uncertainty has also been reported in developed countries. In Canada two possible projection scenarios based on an increase in unemployment following the COVID-19 pandemic resulted in a projected total of 11.6 to 13.6 excess suicides in 2020-2021 per 100 000[65].

The main factors contributing to suicidal behaviour during the pandemic have been characterized in terms of anxiety, stress, social isolation, fear of getting infected, uncertainty, and economic difficulties[66,67]. These factors may lead to the exacerbation of phycological distress in vulnerable populations including those with pre-existing psychiatric conditions, persons with low resilience, individuals who live in high disease areas and people who have someone close who has died of or is infected with COVID-19[66–69]. Furthermore, those with pre-existing conditions include not only patients who were under retreatment before the pandemic, who might have difficulties finding treatment during the pandemic, but also a very large number of people with psychiatric conditions who did not receive treatment even before the pandemic[70]. People in suicidal crises require special attention, and the assistance services might be interrupted during the pandemic. Some might not seek traditional help due to fear of infection and others may seek help from helplines where the demand has exceeded the supply of services due to surges in calls and reductions in personnel[67,71,72].

Our results show that after lockdown the immediate rate of suicides declined, however, men presented an increase in the slope of suicides in the post-lockdown period. One of the factors may be the loss of employment and financial stressors which are well-recognised risk factors for suicide[73]. Nearly 81% of men in Peru have a paid job compare to 64% women[74], and during the pandemic, the male working population in the country capital decreased by 47.3% and the female working population by 48.1%[75].

These initial changes in suicide trends may give us an idea of what might come next as a result of these social changes. Furthermore, the lockdown might also affect the younger population differently. An exploratory study based on media reports found that reported suicides among adolescents and youths during the lockdown were related to loneliness, overwhelming academic distress and social media related psychological distress [76].

Traffic accidents were the type of external death that decreased the most and this observation is consistent with many of the specific restrictions adopted, including the

general limit of transit as well as the imposition of strict curfews at night and on Sundays. Other countries have also seen a decline in emergency room visits for trauma injuries related to traffic accidents after the lockdown[28,77].

An increasing rate towards the end of the lockdown is more apparent for traffic accidents than for other types of death. This mirrors quite closely the changes observed in mobility trends. Both, traffic accident deaths and the mobility change present as U-shaped trends during lockdown, demonstrating that the lockdown measures were not fully adopted at the beginning and that they eased gradually towards the end. Other forms of external death have also shown a decline and even appear to be in decline after the lockdown, however, as economic activities resume, this rate may recover the baseline level as with the other types of death.

This report constitutes an initial analysis of the trends in external deaths and as such, we recognize some limitations. Although we found that there was no major change in the occurrence of deaths coded as “unknown” cause, after lockdown, underreporting may be possible for other coding variables. This is a nationwide analysis and some differences by region may not be captured. Peru has tremendous diversity of lifestyle between coastal, mountain and jungle regions, and data come from large cities and small rural communities with radically different rates of events. Competing risk due to COVID-19 is also a possibility although most of the external deaths occur in the younger population, and not necessarily in the population at risk of dying because of COVID-19. For suicide, however, the populations may overlap to a greater extent[78]. Our analysis only considers the beginning and end of the lockdown thus the sudden initial drop that we have described may be accompanied by a sudden increase after the measures are lifted and a later follow-up analysis would be informative.

There is an urgency to consider and understand the myriad indirect mortality consequences of the policies adopted to respond to COVID-19. It is expected that some time after the lockdowns are completely lifted around the world, the lives lost from the impacts of these various policies on the economy, lifestyle, and mental health will outweigh the number of lives lost directly from infection. Indicators of this broad impact,

including the types of external deaths studied here, will be crucial for future decision-making[79].

Conclusions

Lockdown due to COVID-19 has impacted the rates of external deaths, showing a sudden drop after its implementation. The biggest change was seen in deaths related to traffic accidents. This initial drop should not be encouraging, since just as there was a marked drop at the beginning, it is likely to be an equally sharp increase after the lockdown is lifted and the economic activities are resumed. The patterns for suicide and homicide are less intuitive, however, and reveal important clues about the causes and characteristics of these events. There is an urgency for implementing a comprehensive response service for mental health during the pandemic, those services could be enhanced by the surveillance of factors contributing to suicidal behaviours as well as suicide trends in vulnerable populations. In the same way, assistance and prevention services against violence against women could benefit from close monitoring of feminicides and other types of violence. Usual intervention efforts need to be intensified during the lockdown and plan for when the lockdown ends, as a rebound effect might be expected. Policies should take into consideration other aspects of health that might be overlooked during this pandemic.

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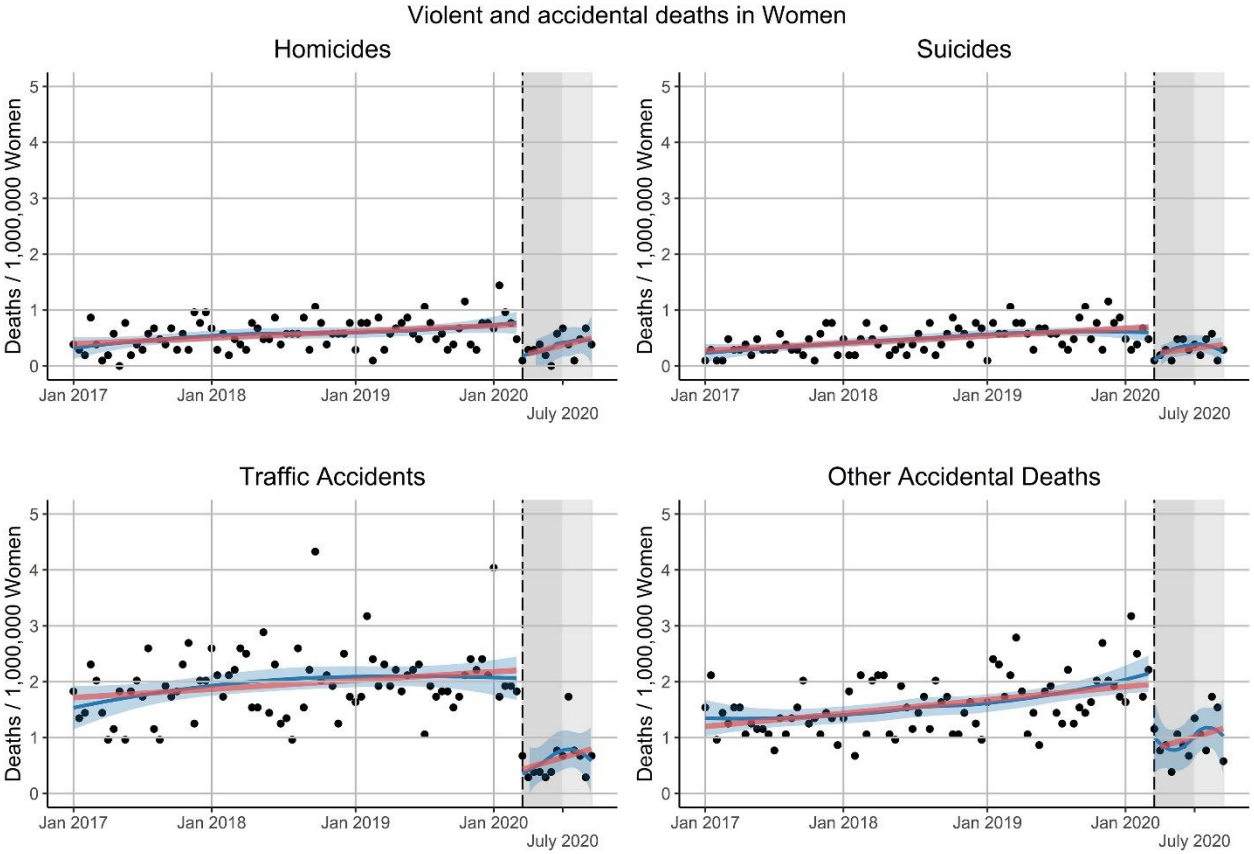
6.4 Tables

Table 1. Interrupted time series coefficients by sex and type of external death

Type of death x 1,000,000	1 year Slope (95% CI)	Post-lockdown Difference per month (95% CI)	Post-lockdown x 1 year Interaction (95% CI)
		Women	
Homicide	0.11 (0.05, 0.17)	-1.10 (-1.65, -0.55)	0.50 (-0.36, 1.36)
Suicide	0.13 (0.08, 0.18)	-0.94 (-1.41, -0.46)	0.18 (-0.56, 0.91)
Traffic accident	0.15 (0.02, 0.28)	-3.55 (-4.81, -2.30)	0.57 (-1.39, 2.53)
Other accident	0.23 (0.13, 0.34)	-2.31 (-3.30, -1.33)	0.49 (-1.05, 2.03)
		Men	
Homicide	0.70 (0.55, 0.84)	-5.05 (-6.45, -3.65)	2.19 (0.01, 4.37)
Suicide	0.24 (0.15, 0.34)	-1.84 (-2.74, -0.91)	1.20 (-0.26, 2.65)
Traffic accident	0.77 (0.53, 1.00)	-12.22 (-14.45, -9.98)	6.66 (3.18, 10.15)
Other accident	0.47 (0.29, 0.66)	-5.26 (-7.04, -3.48)	1.23 (-1.55, 4.00)

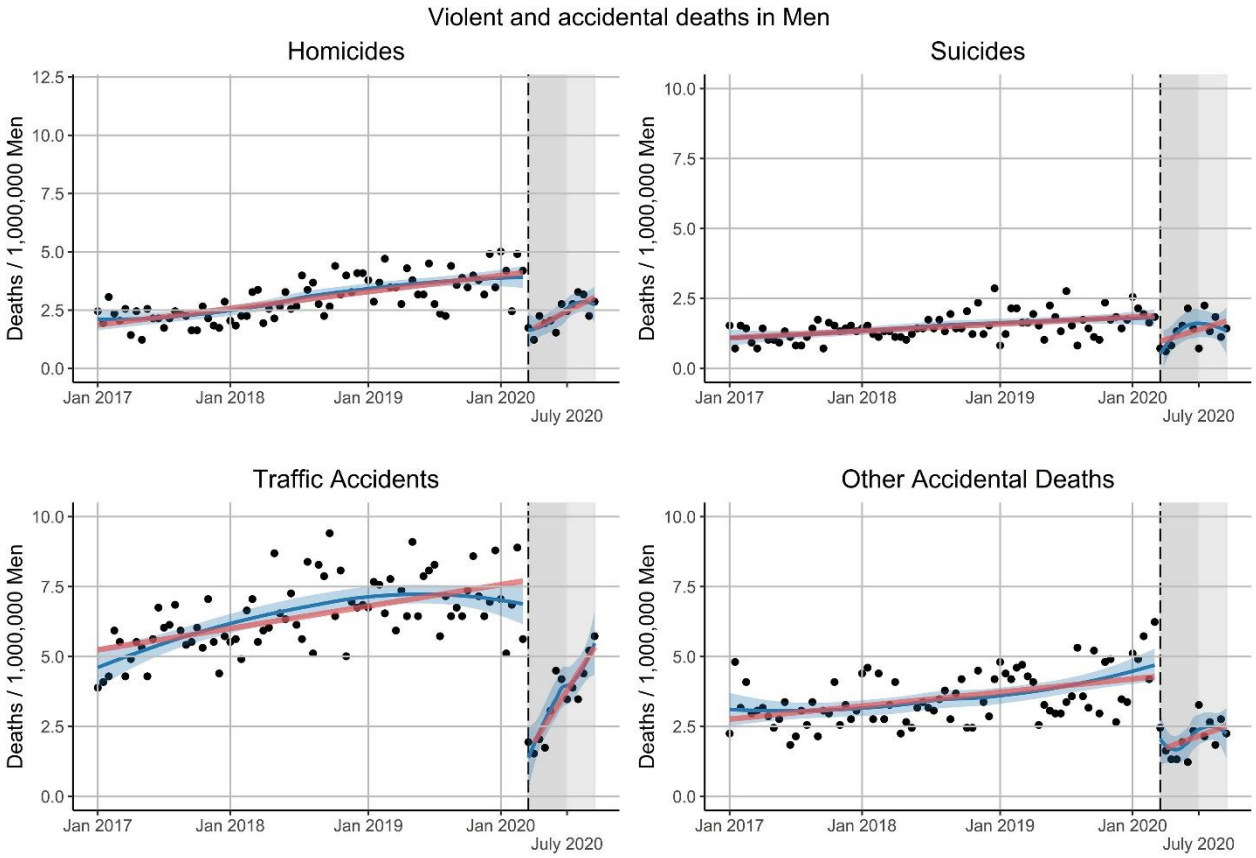
6.5 Figures

Figure 1. Interrupted time-series analysis external deaths by type of death in Women



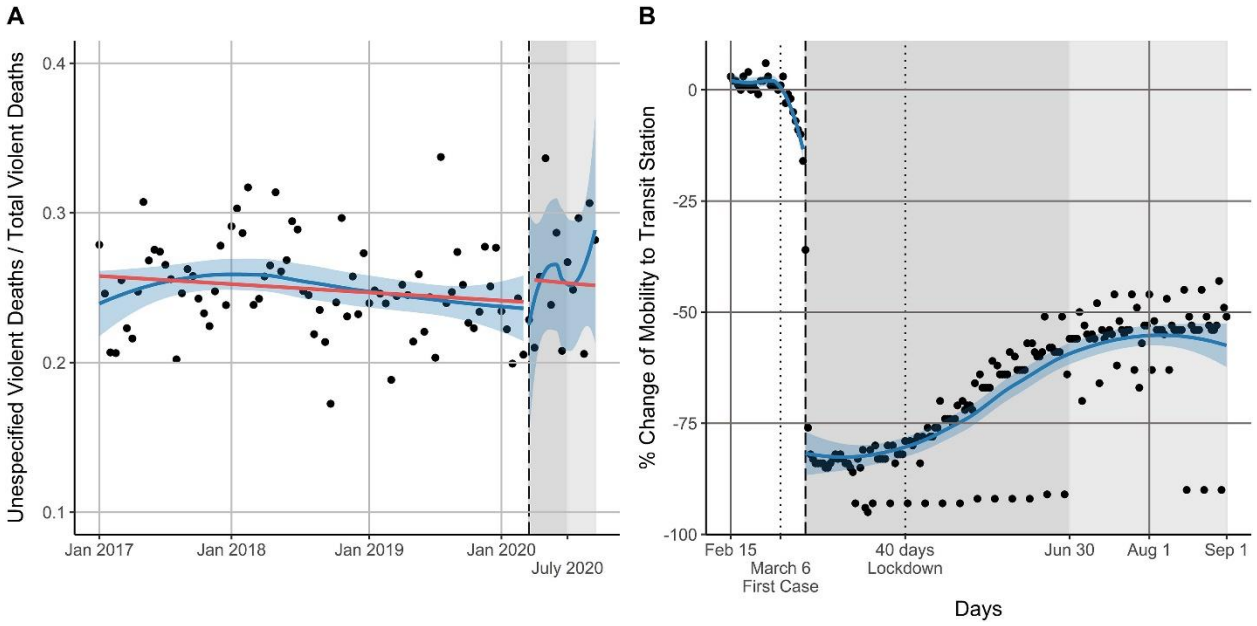
The vertical black dashed line corresponds to the beginning of the lockdown (March 16, 2020) and the grey shading to the lockdown period and ligther grey to the relaxation of lockdown measures. The solid red lines correspond to the interrupted time-series linear regression model, the solid blue line corresponds to the LOESS smoother with 0.6 span and the blue shading corresponds to a 0.95 confidence interval around the LOESS smoother line.

Figure 2. Interrupted time-series analysis external deaths by type of death in Men



The vertical black dashed line corresponds to the beginning of the lockdown (March 16, 2020) and the grey shading to the lockdown period and ligther grey to the relaxation of lockdown measures. The solid red lines correspond to the interrupted time-series linear regression model, the solid blue line corresponds to the LOESS smoother with 0.6 span and the blue shading corresponds to a 0.95 confidence interval around the LOESS smoother line.

Figure 3. Panel A: Interrupted time-series analysis the propotion of external deaths labeled as “unescpecified”. The solid red lines correspond to the interrupted time-series regression model. Panel B: Descriptive view of the percentage change in community mobility to transit stations before and after the lockdown period



The first vertical black dotted line corresponds to the firs case confirmation and the second the 40 day lockdown mark. Panel A and B: The vertical black dashed line corresponds to the beginning of the lockdown (March 16, 2020) and the grey shading to the lockdown period and ligther grey to the relaxation of lockdown measures, the solid blue line corresponds to the LOESS smoother with 0.6 span and the blue shading corresponds to a 0.95 confidence interval around the LOESS smoother line.

6.6 Appendix

Appendix Figure 1. Non-external death trends before and during the lockdown by sex.

The solid red line corresponds to the LOESS smoother with 0.6 span in men and the blue line to the LOESS smoother with 0.6 span in women. The vertical black dashed line corresponds to the beginning of the lockdown (March 16, 2020) and the grey shading to the lockdown period and ligther grey to the relaxation of lockdown measures.

6.7 Transition

The COVID-19 pandemic has had far-reaching consequences on public health and safety, leading to the implementation of various policies to curb its spread. Manuscript 3, titled "Impact of COVID-19 lockdown policy on homicide, suicide, and motor vehicle deaths in Peru," investigates the unintended consequences of these policies, specifically the lockdown measures, on various aspects of public safety. The study focuses on the changes in the rates of homicide, suicide, and motor vehicle deaths during the lockdown period in Peru.

In a related vein, Manuscript 4, titled "Impact of the COVID-19 pandemic on the use of helplines for violence against Peruvian women, youth, and children by perpetrator relationship," explores another aspect of public safety affected by the pandemic. This study examines the changes in the utilization of helplines by individuals experiencing violence during the pandemic, with a focus on the relationship between the victims and the perpetrators.

Both Manuscripts 3 and 4 center on the broader consequences of the COVID-19 pandemic on public safety, specifically in the context of Peru. While Manuscript 3 investigates the effects of lockdown policies on homicide, and suicides, Manuscript 4 delves into the impact of the pandemic on the use of helplines for those experiencing violence. These studies contribute to a more comprehensive understanding of the pandemic's implications on different aspects of public safety, helping policymakers and stakeholders address these challenges.

The findings from Manuscript 3 can provide insights into the broader context within which Manuscript 4's investigation takes place. For instance, the lockdown measures that may have contributed to the changes in homicide, suicide, and motor vehicle deaths in Manuscript 3 could also have had implications for the prevalence of violence against women, youth, and children, as well as the accessibility and utilization of helplines. By examining these interconnected aspects of public safety, the two studies offer a more nuanced understanding of the pandemic's impact on society.

Moreover, the two manuscripts highlight the importance of understanding the dynamics of violence and safety within the context of crisis situations such as the COVID-19 pandemic. The lockdown measures aimed at curbing the spread of the virus may have inadvertently exacerbated certain safety concerns, as evidenced by the findings in Manuscripts 3 and 4. These studies emphasize the need for a comprehensive and balanced approach to addressing public safety, particularly during times of crisis.

The connection and transition between Manuscripts 3 and 4 underscore the multifaceted impact of the COVID-19 pandemic on public safety. By exploring the consequences of lockdown policies on homicide, suicide, and motor vehicle deaths, as well as the pandemic's effect on the utilization of helplines for individuals experiencing violence, these studies contribute to a more comprehensive understanding of the challenges facing societies during times of crisis. The findings from both studies can inform more effective and nuanced policymaking, ensuring that public safety concerns are adequately addressed even in the face of unprecedented global events.

Chapter 7:

Manuscript 4.

Impact of the COVID-19 pandemic on the use of helplines for violence against Peruvian women, youth, and children by perpetrator relationship

7.1 Title page

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7.2 Abstract

Background:

The COVID-19 pandemic has been linked to increased violence against women and children. This study examined the impact of the pandemic on helpline use in Peru.

Methods:

A difference-in-difference analysis was conducted with an event-study between October 2018 and December 2020, using calls per million population per 15 days as the outcome of interest. Stratified analyses were performed by type of violence, perpetrator relationship, survivor sex and age.

Findings:

The pandemic led to a significant increase in calls reporting physical violence from women where the perpetrator was their partner, and a decrease in such calls from children where the perpetrator was their parent. There was an increase in calls reporting psychological violence from women for all sources of perpetrators. There was a decrease in calls reporting sexual violence from women, female teenagers, and female children where the perpetrator was someone from outside the household.

Interpretation:

The study suggests that the pandemic caused a surge in calls to helplines in Peru, particularly for psychological violence against women. The lockdown may have contributed to a reduction in calls related to violence from sources outside the household for both women and children. However, changes in the number of calls related to violence within the family environment may not necessarily reflect changes in incident cases. Continued support and resources are needed for survivors of gender-based violence during the pandemic.

7.3 Main body

Introduction

The COVID-19 pandemic has had disastrous consequences in all aspects of society[1–3]. The interrelated structural issues exposed by COVID-19, such as poverty, inequality, informal worker, unemployed, and unaddressed health needs, make these syndemic forces particularly worrisome in low and middle-income countries[4]. Violence against women and children, a frequently overlooked public health crisis predating COVID-19[5], has emerged as an unintentional outcome of COVID-19 lockdowns, which have compelled many survivors to spend more time at home with their perpetrators and limited their access to safety planning and violence-related services[6–8].

Numerous countries enacted stay-at-home orders or lockdowns at the onset of the pandemic to decelerate transmission rates and avert overwhelming already strained health systems[9]. Following the implementation of these measures, there was a substantial surge in service needs associated with family violence[10–14]. Chances to support survivors diminished, and in-person interventions had to be adapted to the pandemic context. Consequently, several countries broadened their helpline offerings. Due to this rapid expansion, helpline data has become a crucial resource for monitoring the dynamics of violence against women and children during the pandemic[15].

The majority of reports have concentrated on the increase in helpline calls related to violence against women, but information concerning children is inconsistent. A study examining 48 child helplines across 45 countries discovered that the overall number of calls rose, yet calls regarding violence against children decreased in approximately half of the countries[16]. In the United States, calls to children's helplines experienced an uptick following the declaration of a health emergency, but saw a decline after the implementation of school closures[17]. A review of early research on violence against children revealed that a significant portion of these studies concentrated on physical or psychological violence, with less attention given to other forms of violence[18].

This analysis focuses on Peru, a country severely impacted by the pandemic. Peru holds the highest cumulative pandemic excess mortality[19], and the highest per-capita COVID-related deaths globally, in addition to having implemented one of the earliest and most stringent lockdowns[20]. An initial report indicated a nearly 50% rise in calls to the national violence helpline during the lockdown's first months, in a country where almost 60% of women had previously encountered some form of intimate partner violence before COVID-19[21].

Gaining insight into the relationship between lockdowns and changes in helpline utilization for violence against women and children could aid policymakers and public health professionals in devising more effective strategies to comprehensively reach and safeguard the public during emergencies such as COVID-19.

Methods

Data source

In this study, we utilized data from the Peruvian Ministry of Women portal[22], a de-identified administrative database that compiles annual records of all services rendered by the Ministry. Specifically, we retrieved data from 2018 through December 2020 pertaining to telephone calls received by the national helpline, "Linea 100." Notably, due to incomplete information in 2018, only the final quarter of that year was included in our primary analysis.

Established as a free telephone service in 2006, Linea 100 offers information, guidance, and emotional support to individuals impacted by, or involved in, incidents of gender-based violence throughout the country. Equipped with specialized training, the helpline's operators follow a set of care protocols and strict quality standards outlined by the National Registration System for Family and Sexual Violence. Among their responsibilities, these professionals document key information regarding the violence and the survivors, including the date, gender, age, and relationship to the perpetrator[23]. Furthermore, operators possess training in psychological first aid and emotional support, enabling them to provide appropriate referrals to the Urgent Care Service, which is staffed by a psychologist, a social worker, and a lawyer, if deemed necessary.

Measures

Our study encompassed children of both sexes under the age of 15, male and female teenagers between the ages of 15 and 18, and women aged 18 years and older.

To classify the perpetrator's relationship to the survivor, we utilized five categories: (1) Partner, including cohabitants, spouses, or boyfriends/girlfriends, (2) Ex-partner, referring to former partners, spouses, or boyfriends, (3) Parents/stepparents, including fathers/mothers or stepfathers/stepmothers, (4) Other relatives, encompassing siblings, sons/daughters, grandchildren, or other relatives, and (5) Other, which included individuals such as strangers, study partners, co-workers, friends, teachers, neighbors, or other non-family members.

We recorded the type of violence documented in the database as the primary reason for the call to Linea 100, as reported by the representatives. Three categories were used: (1) Sexual violence, which refers to non-consensual or coerced sexual acts, (2) Physical violence, defined as actions causing harm to the body or compromising physical health, and (3) Psychological violence, which includes behaviors intended to control or isolate the individual against their will, to humiliate or shame them, and which may lead to the impairment or alteration of certain mental functions[24].

We divided each year into two periods based on the start and end of the nationwide lockdown measures. Specifically, the pre-lockdown period consisted of January through March 16th, while the post-lockdown period comprised March 16th through December.

Peru's first case of COVID-19 was confirmed on March 6th, 2020[25]. Just ten days later, on March 16th, the Peruvian government declared a state of sanitary emergency and instituted a nationwide lockdown[26]. The lockdown entailed the suspension of economic and academic activities, as well as restrictions on public and private gatherings. Individuals were only permitted to leave their homes for essential purposes or to seek medical attention, and a curfew was in effect from 8 p.m. to 5 a.m. Military and police personnel patrolled the streets, and international borders were closed, with inter-regional movement prohibited. Additionally, public transportation capacity was halved. As of June 2020, lockdown measures were gradually relaxed, with periodic reinstatement of free mobility but continued enforcement of a state of national emergency with night curfews, and focused lockdowns in seven of the country's twenty-five regions[26]. Despite these relaxations, schools and other educational institutions remained closed, and all public and private gatherings were banned throughout the remainder of the year[26].

Statistical analysis

To assess the impact of the COVID-19 pandemic on the utilization of helplines by individuals affected by gender-based violence in Peru, we employed a difference-in-difference analysis using the Callaway and Santa’anna estimator, along with an event study to account for dynamic effectsfects[27]. We adjusted for regional fixed effects and

utilized cluster-robust standard errors. Our primary outcome of interest was the number of calls per million population within a 15-day time frame. Due to the limited pre-treatment period (January 1st to March 16th) in a year, we expanded our analysis to include consecutive months from the last quarter of 2018 to the beginning of 2019, and the same for the last quarter of 2019 to the beginning of 2020. Thus, the intervention group was defined as calls received between October 2019 and December 2020, while the control group comprised calls from October 2018 to December 2019. We evaluated the parallel trends assumption during the pre-lockdown period using event study plots, wherein a null trend was expected.

To assess changes in patterns of missing data, particularly regarding perpetrator relationship information, we utilized a similar difference-in-difference model, with the proportion of calls with missing data on perpetrator relationship as the outcome. We stratified our analyses by type of violence, perpetrator relationship, and type of survivor. All analyses were conducted using R version 4.0.1.

As the data used in this study was collected and managed by the Peruvian Ministry of Women, and was properly anonymized, no ethics approval was required. Furthermore, all information utilized in this study is freely accessible in the public domain, and no additional data was collected.

Results

In 2020, the number of calls received by the helpline showed a 50% increase compared to the previous year, with 127,305 and 87,507 calls in 2020 and 2019, respectively. During the pre-lockdown period in 2020, the majority of calls (54%) were related to physical violence, followed by psychological violence (35%) and sexual violence (11%). This distribution was comparable to the pre- and post-lockdown periods in 2018 and 2019. However, the post-pandemic period in 2020 demonstrated a different pattern, with 49% of calls related to psychological violence, 41% to physical violence, and 10% to sexual violence (Table 1).

The largest demographic group to utilize the helpline in 2020 were women aged 18 years and older, accounting for 56% of calls during the pre-lockdown period and 67% during the post-lockdown period. The second largest group consisted of children under the age of 15, who accounted for 38% of calls (53% female) in the pre-lockdown period and 27% (56% female) in the post-lockdown period. Conversely, the smallest demographic group to utilize the helpline were teenagers between 15-18 years old, comprising only 6% of calls during both the pre- and post-lockdown periods (Table 1). Parents were the most frequent perpetrators across all age and gender groups, except for women over 18 years old. In this category, partners and ex-partners were the most common perpetrator relationships reported (Table 2). Due to limited calls received per district per 15-day bin, we were unable to include male teenagers in our analysis.

Psychological violence calls

Regarding calls related to psychological violence, our aggregate analysis demonstrated a reduction in the number of calls from children under 15 years old when the perpetrator was someone from outside the household, with -1.71 calls/15-days per million (95% CI: -3.70; 0.28) in females and -2.10 calls/15-days per million (95% CI: -4.00; -0.19) in males. No apparent change was observed with regards to other perpetrators, and no significant changes were noted among teenagers in the same category.

On the other hand, in women aged 18 years and older, our aggregate analysis revealed an increase in the number of calls for all types of perpetrators, including partners (28.26 calls/15-days per million, 95% CI: 21.55; 34.97), ex-partners (11.28 calls/15-days per million, 95% CI: 6.08; 16.47), other relatives (10.95 calls/15-days per million, 95% CI: 7.40; 14.50), and other non-family perpetrators (2.13 calls/15-days per million, 95% CI: 0.40; 3.86) (Figure 1). Furthermore, our event-study illustrated that this effect was heterogeneous throughout the intervention period, with a positive slope during the first two months post-lockdown, a peak at the fourth month, followed by a decreasing slope until the end of the lockdown period (Figure 2).

Physical violence calls

Our aggregate analysis of calls related to physical violence revealed a reduction in the number of calls from children under 15 years old. The most significant reduction was observed in calls where the perpetrator was a parent, with -50.63 calls/15-days per million (95% CI: -91.77; -9.48) in females and -35.98 calls/15-days per million (95% CI: -57.83; -14.12) in males. Calls related to other perpetrators showed a lesser reduction. The event study demonstrated that these changes were homogenous throughout the intervention period (Figure 3).

Additionally, a less marked reduction was observed in calls related to violence in teenagers, with the most significant decrease in calls related to violence from other relatives among females, with a reduction of -13.01 calls/15-days per million (95% CI: -28.12; 2.11). The largest reduction occurred in the first month of the lockdown (-26.64, 95% CI: -63.10; 9.81).

However, among women aged 18 years and older, our aggregate analysis showed an increase in the number of calls when the perpetrator was a partner, with 22.20 calls/15-days per million (95% CI: 11.72; 32.68), and the highest increase occurred two months after the start of the pandemic (49.04, 95% CI: 28.64; 69.43).

Sexual violence calls

Our aggregate analysis of calls related to sexual violence revealed a reduction in the number of calls when the perpetrator was someone from outside the household in all female age groups. Specifically, there was a reduction of -10.18 calls/15-days per million (95% CI: -14.56; -5.80) in children under 15 years old, -16.92 (95% CI: -33.37; -0.47) in teenagers, and -1.98 (95% CI: -5.11; 1.15) in adults. Additionally, there was a reduction in calls where the perpetrator was the father in children under 15 years old (-7.43, 95% CI: -16.44; 1.57 in females and -2.34, 95% CI: -5.01; 0.33 in males). Our event-study demonstrated that this effect was heterogeneous throughout the intervention period, with the most significant reduction in all age groups occurring mainly in the first two months after the lockdown (Figure 4).

In our sensitivity analysis, we evaluated whether the lockdown could affect the quality of reporting by changing the proportion of phone call records with missing data on the perpetrator relationship. Using our difference-in-difference model, we observed no significant change in this proportion of missing data throughout the study period (Figure A1 and A2).

Discussion

Our study revealed different dynamics concerning the number of calls with distinct patterns according to the survivor's gender and age, the relationship with the perpetrator, and the phase of the pandemic. The most substantial increase was in calls related to psychological violence in women after the lockdown. However, we also observed a decrease in the number of reported calls, mainly regarding sexual violence when the perpetrator was someone from outside the household, and a reduction in calls where the survivors were children, and the perpetrators of physical violence were the parents.

These results are consistent with early reports from other parts of the world. The disruption of lifestyle and forced isolation within the household due to the lockdown made the home an unsafe space for women and children.[7]. However, we found a sharp decrease in the number of calls at the beginning of the lockdown. Although there was an initial decrease in calls, in some cases, these increased as the lockdown continued.

For both women and children, we found a reduction in calls related to sexual violence when the perpetrator was outside the household or the family during the lockdown. The reduction could be attributed to reduced mobility, closed schools, and work-from-home measures. Additionally, the strict enforcement of these measures in the streets during the first month of the lockdown could have contributed to the decrease in external sources of violence. However, as mobility normalized, violence from these sources could have returned to pre-pandemic levels two months after the lockdown.

A less obvious pattern, in relation to helpline use, is seen when the perpetrator is close to the survivor. In children, calls related to sexual and physical violence when the perpetrator was the parent decreased during the lockdown. In other countries, the reduction in the

number of calls related to children has been attributed to the closure of schools, since teachers are often the ones who report signs of violence. A study conducted in the US found that the number of child maltreatment allegations was 27% lower than expected in months with school closures during the pandemic[28]. In 2019 in the US, professionals, including teachers, lawyers, and health staff, submitted 69% of reports alleging child abuse, with the highest percentages of reports coming from education personnel (21%), while friends, neighbors, and relatives submitted only 16% of the reports[29]. Similarly, in Brazil, the number of reports of violence against children fell 12% during the pandemic, and compared to the first half of 2019, the reported rate of child physical injury decreased by 24·3%[30]. In New York City, from March to May 2020 there were up to -51% fewer reports of child maltreatment compared to previous years[31].

The different barriers that exist between the act of violence in children and the process of seeking help could have been aggravated during the lockdown[32]. According to the National Survey on Social Relationships (ENARES 2019) in Peru, of those children under 14 years who suffered some type of sexual violence in the last 12 months, 59% did not seek help, 25% sought help within the family, 14% in school, friends or from others, and 2% from both family and friends or other. For physical or psychological violence, 53% did no look for help, 39% looked for help within the family, 6% in school/friends and others, and 3% in both. This highlights the fact that most children are not able to seek help, and if they do, it seems to be mostly within the family, and to a lesser extent outside the household (school or friends). However, seeking help and making the call might not necessarily be correlated. The closure of schools and reduced mobility during the lockdown might have decreased the opportunities for children to disclose abuse and seek help, which could explain the reduction in calls related to violence against children.

In terms of helpline use, there was a distinctive pattern observed in calls related to psychological violence, with a considerable increase in the number of calls from women during the pandemic. This increase even surpassed those related to physical violence, which was the leading reason for calls in 2019. The pandemic has taken a significant toll on the mental health of male and female Peruvians[33] , and other countries have reported

similar increases in psychological violence[34]. The pandemic has shifted much of the responsibility onto women, including homeschooling, household work, and work from home, leading to mental health deterioration in women[35].

Interestingly, the lockdown measures appeared to have a protective effect on violence from sources outside the home for both women and children. However, it is less clear how the changes in helpline calls correspond to actual incident cases of violence when it comes to violence from family environments, which is the most prevalent type of violence.

It is important to note that while the use of helplines can be a good proxy for actual incidents of violence, prevalence can only be reliably measured by population-based surveys. Therefore, the changes in the number of calls may not necessarily reflect the actual changes in the incidence of violence during the pandemic. Additionally, while we observed changes in the number of calls related to different types of violence, it is important to keep in mind that not all survivors of gender-based violence may have access to helplines or be able to call them. Hence, these findings may not capture the full extent of gender-based violence during the pandemic. Nevertheless, our study provides valuable insights into the patterns of helpline use during the pandemic and highlights the need for continued support and resources for survivors of gender-based violence.

One of the main limitations of this study is the lack of data to distinguish between changes in reporting and actual incidence, as a large number of incidents go unreported. The lockdown could have impacted the incidence and reporting of events in different ways. Additionally, the intensity of the abuse is not captured, which could be a driver of changes in the volume of calls. The study also lacks information on multiple calls from the same survivor and the identity of the informant making the call. Further clarification on these variables would provide a better understanding of emerging patterns.

Conclusions

Our study provides crucial insight into the patterns of helpline use during the COVID-19 pandemic in Peru. Our analysis showed a substantial increase in the number of calls to the helpline, particularly related to psychological violence against women. Additionally, we observed a decrease in calls for sexual violence against children and women when the perpetrator was someone from outside the household, while physical violence against children perpetrated by parents decreased during the lockdown. However, the changes in helpline calls may not necessarily reflect the actual changes in the incidence of violence during the pandemic, as not all survivors of gender-based violence have access to helplines or can call them. Our study highlights the need for continued support and resources for survivors of gender-based violence during and beyond the COVID-19 pandemic in Peru. Innovative approaches for reaching survivors, such as through digital technologies, and complementary information on barriers to reporting are necessary to mitigate the impact of the pandemic on gender-based violence.

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7.4 Tables

Table1. Number of calls per year by type of violence, survivors' characteristics, and perpetuator relationship

	2018		2019		2020		Overall	
	Pre (N=10131)	Post (N=50030)	Pre (N=19181)	Post (N=68326)	Pre (N=24463)	Post (N=102842)	Pre (N=53775)	Post (N=221198)
Type of violence								
Psychological violence	2962 (29.2%)	14798 (29.6%)	6319 (32.9%)	21440 (31.4%)	8538 (34.9%)	50141 (48.8%)	17819 (33.1%)	86379 (39.1%)
Physical violence	6030 (59.5%)	29020 (58.0%)	10878 (56.7%)	38332 (56.1%)	13106 (53.6%)	42498 (41.3%)	30014 (55.8%)	109850 (49.7%)
Sexual violence	1139 (11.2%)	6212 (12.4%)	1984 (10.3%)	8554 (12.5%)	2819 (11.5%)	10203 (9.9%)	5942 (11.0%)	24969 (11.3%)
Sex and age group								
Male, <15y/o	1875 (18.5%)	8789 (17.6%)	2958 (15.4%)	12123 (17.7%)	4342 (17.7%)	12567 (12.2%)	9175 (17.1%)	33479 (15.1%)
Female, <15y/o	2150 (21.2%)	10862 (21.7%)	3485 (18.2%)	14581 (21.3%)	4987 (20.4%)	15739 (15.3%)	10622 (19.8%)	41182 (18.6%)
Male, 15-18 y/o	140 (1.4%)	705 (1.4%)	253 (1.3%)	1053 (1.5%)	346 (1.4%)	1284 (1.2%)	739 (1.4%)	3042 (1.4%)
Female, 15-18 y/o	468 (4.6%)	2635 (5.3%)	832 (4.3%)	3504 (5.1%)	1217 (5.0%)	4639 (4.5%)	2517 (4.7%)	10778 (4.9%)
Woman, ≥18 y/o	5498 (54.3%)	27039 (54.0%)	11653 (60.8%)	37065 (54.2%)	13571 (55.5%)	68613 (66.7%)	30722 (57.1%)	132717 (60.0%)
Perpetrator Relationship								
Parent	1972 (19.5%)	16933 (33.8%)	5740 (29.9%)	23498 (34.4%)	8287 (33.9%)	24525 (23.8%)	15999 (29.8%)	64956 (29.4%)
Partner	1733 (17.1%)	12323 (24.6%)	5385 (28.1%)	16239 (23.8%)	5618 (23.0%)	26604 (25.9%)	12736 (23.7%)	55166 (24.9%)
Ex-partner	643 (6.3%)	5582 (11.2%)	2291 (11.9%)	7424 (10.9%)	2686 (11.0%)	11597 (11.3%)	5620 (10.5%)	24603 (11.1%)
Other relatives	624 (6.2%)	5166 (10.3%)	2004 (10.4%)	7106 (10.4%)	2656 (10.9%)	13289 (12.9%)	5284 (9.8%)	25561 (11.6%)
Other	385 (3.8%)	3003 (6.0%)	982 (5.1%)	4371 (6.4%)	1521 (6.2%)	5208 (5.1%)	2888 (5.4%)	12582 (5.7%)
Missing	4774 (47.1%)	7023 (14.0%)	2779 (14.5%)	9688 (14.2%)	3695 (15.1%)	21619 (21.0%)	11248 (20.9%)	38330 (17.3%)

Pre: January 01st – March 15th, Post: March 16th – December 31st

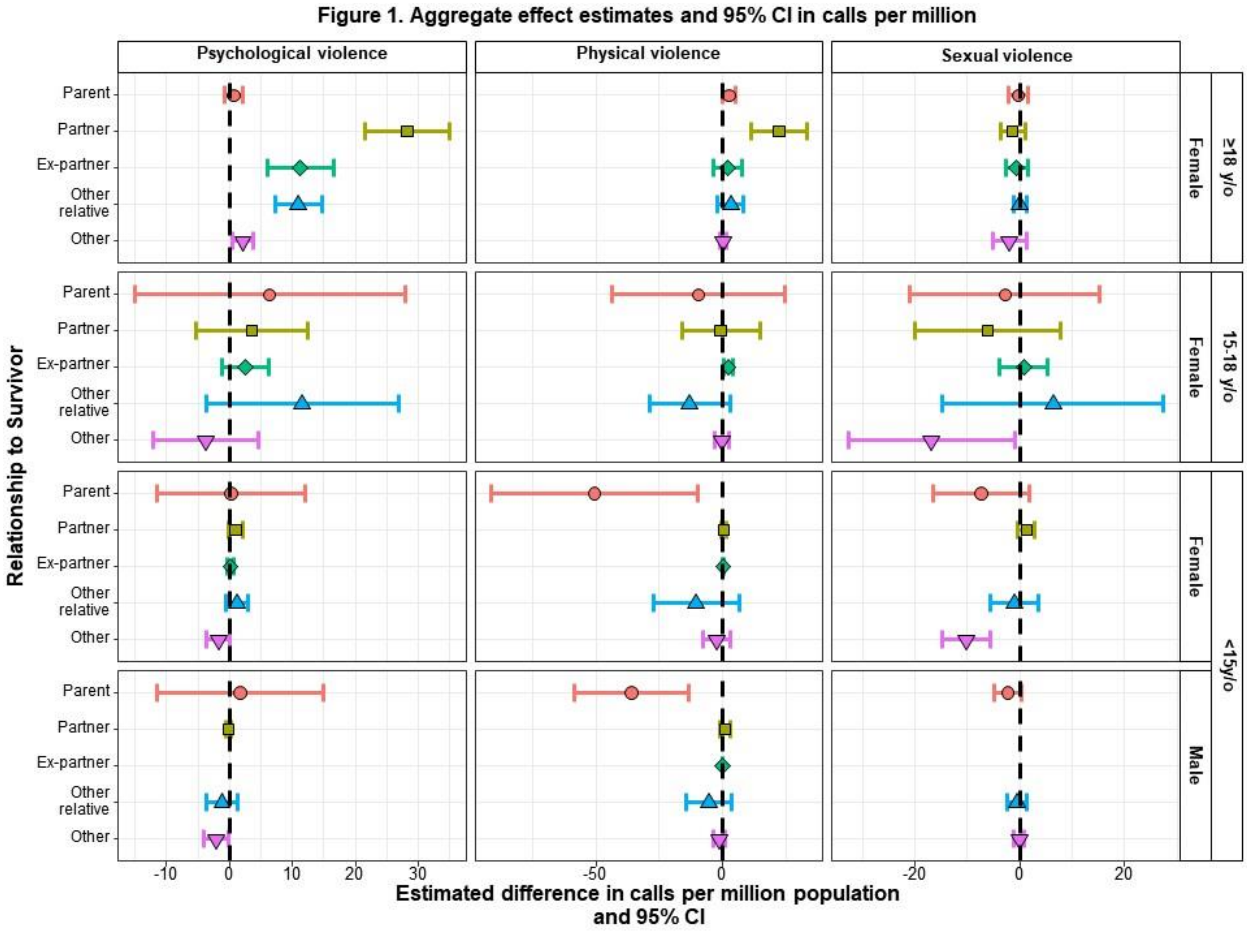
Table2. Number of calls per year, perpetuator relationship and age group

	2018									
	Pre					Post				
Perpetrator relationship with the survivor	Male,<15y/o (N=1875)	Female,<15y/o (N=2150)	Male,15-18 y/o (N=140)	Female,15-18 y/o (N=468)	Woman,≥18 y/o (N=5498)	Male,<15y/o (N=8789)	Female,<15y/o (N=10862)	Male,15-18 y/o (N=705)	Female,15-18 y/o (N=2635)	Woman,≥18 y/o (N=27039)
Parent	865 (46.1%)	849 (39.5%)	54 (38.6%)	101 (21.6%)	103 (1.9%)	6946 (79.0%)	7391 (68.0%)	535 (75.9%)	1124 (42.7%)	937 (3.5%)
Partner	19 (1.0%)	41 (1.9%)	3 (2.1%)	27 (5.8%)	1643 (29.9%)	59 (0.7%)	177 (1.6%)	5 (0.7%)	321 (12.2%)	11761 (43.5%)
Ex-partner	5 (0.3%)	10 (0.5%)	2 (1.4%)	14 (3.0%)	612 (11.1%)	50 (0.6%)	45 (0.4%)	3 (0.4%)	123 (4.7%)	5361 (19.8%)
Other relative	90 (4.8%)	121 (5.6%)	4 (2.9%)	39 (8.3%)	370 (6.7%)	535 (6.1%)	1164 (10.7%)	41 (5.8%)	287 (10.9%)	3139 (11.6%)
Other	39 (2.1%)	121 (5.6%)	7 (5.0%)	50 (10.7%)	168 (3.1%)	286 (3.3%)	866 (8.0%)	42 (6.0%)	425 (16.1%)	1384 (5.1%)
Missing	857 (45.7%)	1008 (46.9%)	70 (50.0%)	237 (50.6%)	2602 (47.3%)	913 (10.4%)	1219 (11.2%)	79 (11.2%)	355 (13.5%)	4457 (16.5%)
	2019									
	Pre					Post				
Perpetrator relationship with the survivor	Male,<15y/o (N=2958)	Female,<15y/o (N=3485)	Male,15-18 y/o (N=253)	Female,15-18 y/o (N=832)	Woman,≥18 y/o (N=11653)	Male,<15y/o (N=12123)	Female,<15y/o (N=14581)	Male,15-18 y/o (N=1053)	Female,15-18 y/o (N=3504)	Woman,≥18 y/o (N=37065)
Parent	2426 (82.0%)	2397 (68.8%)	186 (73.5%)	361 (43.4%)	370 (3.2%)	9807 (80.9%)	10080 (69.1%)	786 (74.6%)	1542 (44.0%)	1283 (3.5%)
Partner	27 (0.9%)	73 (2.1%)	4 (1.6%)	114 (13.7%)	5167 (44.3%)	105 (0.9%)	212 (1.5%)	11 (1.0%)	415 (11.8%)	15496 (41.8%)
Ex-partner	20 (0.7%)	21 (0.6%)	4 (1.6%)	33 (4.0%)	2213 (19.0%)	46 (0.4%)	79 (0.5%)	3 (0.3%)	124 (3.5%)	7172 (19.3%)
Other relative	170 (5.7%)	372 (10.7%)	23 (9.1%)	98 (11.8%)	1341 (11.5%)	757 (6.2%)	1530 (10.5%)	87 (8.3%)	361 (10.3%)	4371 (11.8%)
Other	38 (1.3%)	258 (7.4%)	12 (4.7%)	96 (11.5%)	578 (5.0%)	347 (2.9%)	1265 (8.7%)	62 (5.9%)	587 (16.8%)	2110 (5.7%)
Missing	277 (9.4%)	364 (10.4%)	24 (9.5%)	130 (15.6%)	1984 (17.0%)	1061 (8.8%)	1415 (9.7%)	104 (9.9%)	475 (13.6%)	6633 (17.9%)
	2020									
	Pre					Post				
Perpetrator relationship with the survivor	Male,<15y/o (N=4342)	Female,<15y/o (N=4987)	Male,15-18 y/o (N=346)	Female,15-18 y/o (N=1217)	Woman,≥18 y/o (N=13571)	Male,<15y/o (N=12567)	Female,<15y/o (N=15739)	Male,15-18 y/o (N=1284)	Female,15-18 y/o (N=4639)	Woman,≥18 y/o (N=68613)
Parent	3504 (80.7%)	3531 (70.8%)	252 (72.8%)	525 (43.1%)	475 (3.5%)	9363 (74.5%)	9963 (63.3%)	894 (69.6%)	1812 (39.1%)	2493 (3.6%)
Partner	2 (0.0%)	25 (0.5%)	6 (1.7%)	172 (14.1%)	5413 (39.9%)	48 (0.4%)	172 (1.1%)	12 (0.9%)	490 (10.6%)	25882 (37.7%)
Ex-partner	13 (0.3%)	13 (0.3%)	2 (0.6%)	42 (3.5%)	2616 (19.3%)	53 (0.4%)	86 (0.5%)	7 (0.5%)	209 (4.5%)	11242 (16.4%)
Other relative	296 (6.8%)	462 (9.3%)	29 (8.4%)	142 (11.7%)	1727 (12.7%)	988 (7.9%)	1871 (11.9%)	131 (10.2%)	631 (13.6%)	9668 (14.1%)
Other	132 (3.0%)	411 (8.2%)	21 (6.1%)	176 (14.5%)	781 (5.8%)	259 (2.1%)	1215 (7.7%)	52 (4.0%)	633 (13.6%)	3049 (4.4%)
Missing	395 (9.1%)	545 (10.9%)	36 (10.4%)	160 (13.1%)	2559 (18.9%)	1856 (14.8%)	2432 (15.5%)	188 (14.6%)	864 (18.6%)	16279 (23.7%)

Pre: January 01st – March 15th, Post: March 16th – December 31st

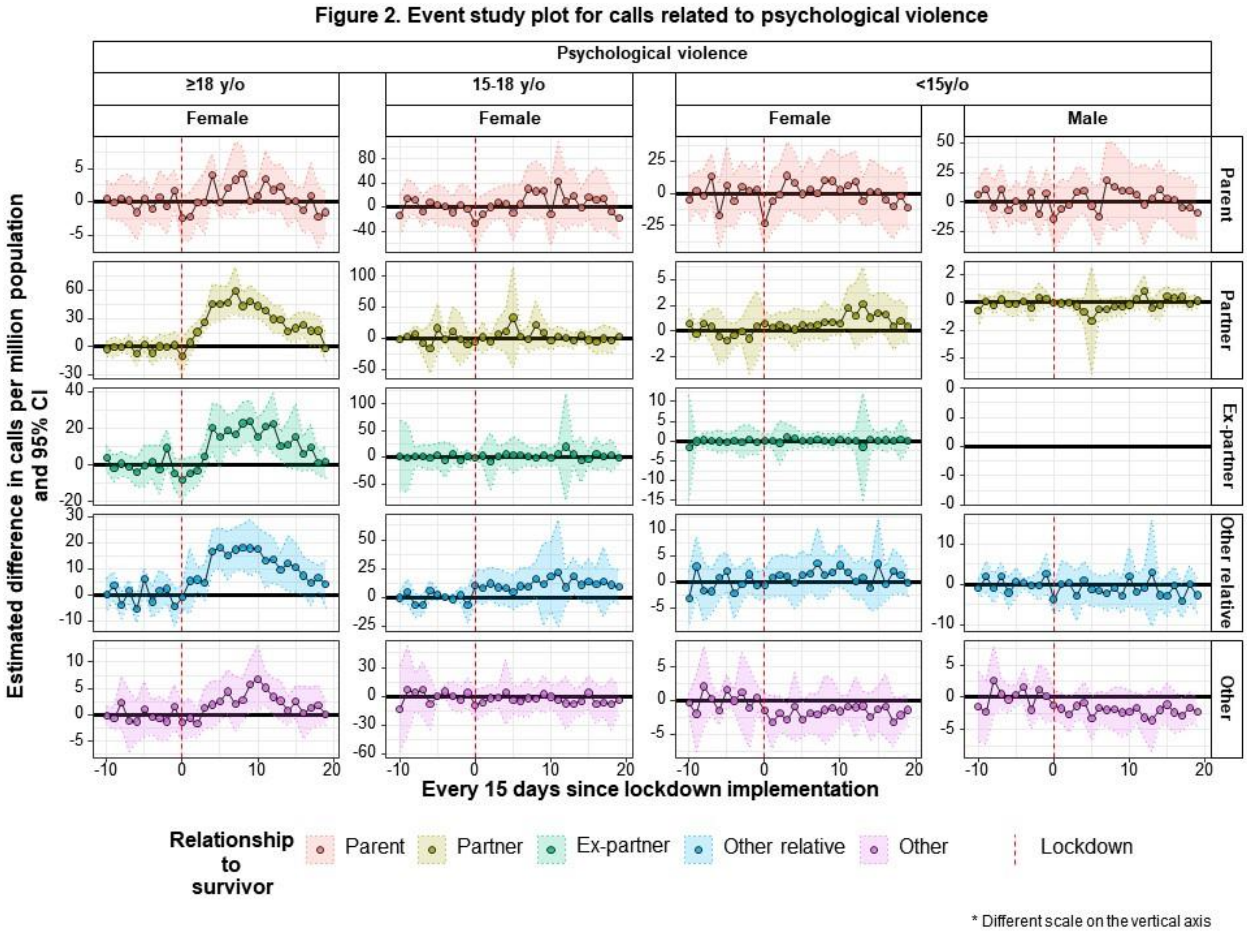
7.5 Figures

Figure 1. Aggregate effect estimates and 95% CI in calls per million.



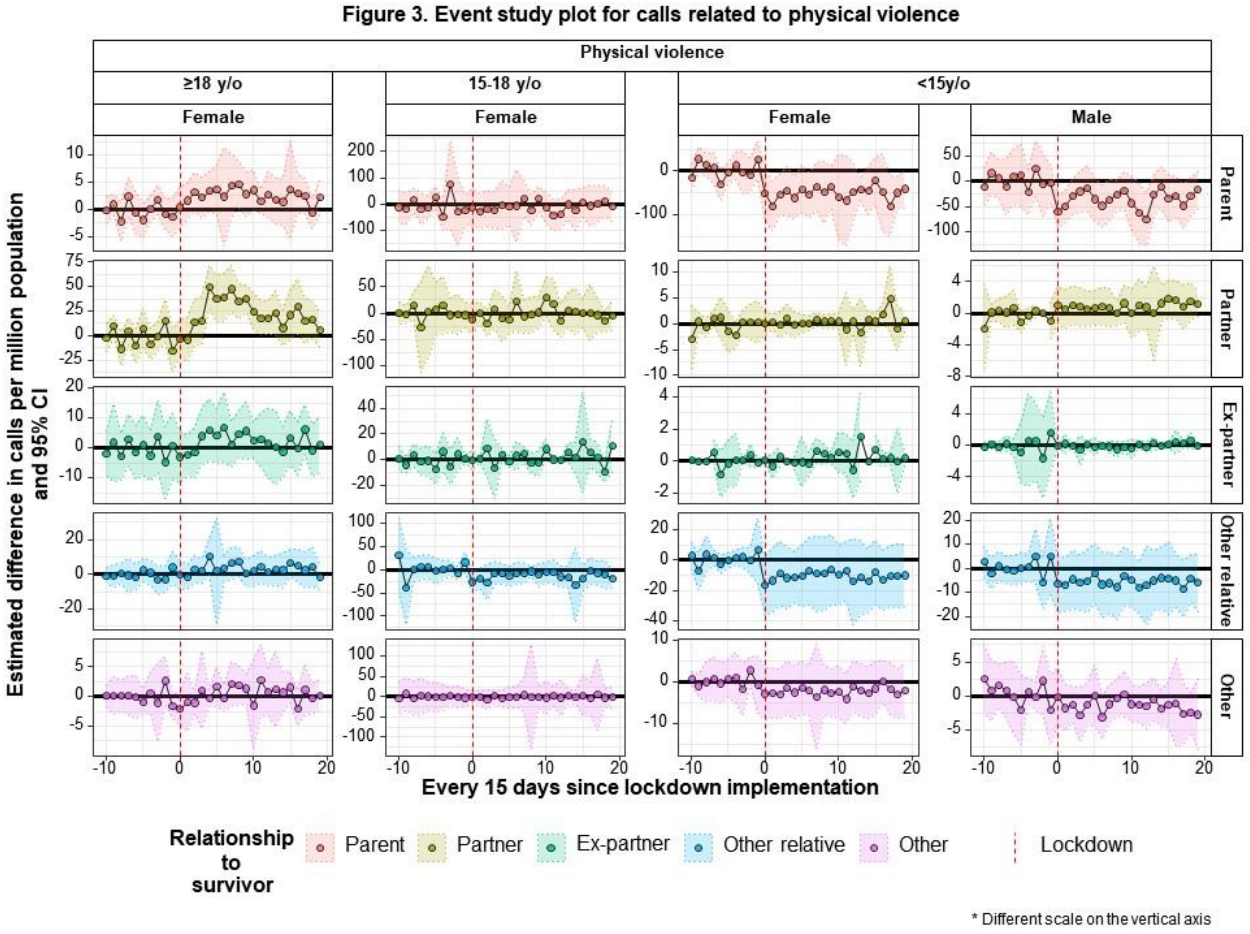
The column panels show the type of violence while the rows show the age and sex groups. The effect estimate is presented by the perpetrator relationship with the survivor. Due to the heterogeneous effect the x axis is presented in independent scales for each type of violence.

Figure 2. Event study plot for calls related to psychological violence.



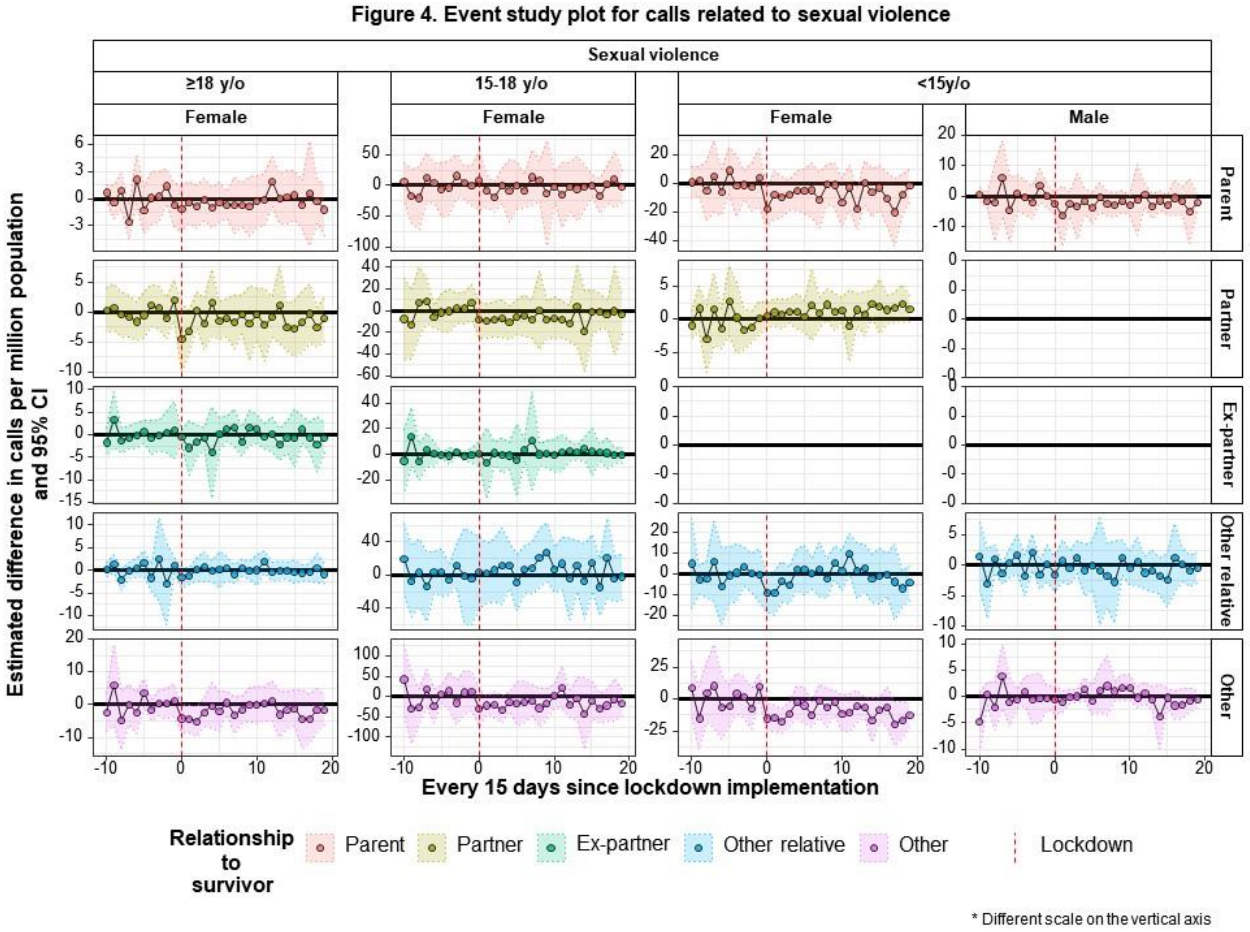
The column panels show the age and sex groups while the rows show the relationship between the perpetrators and survivors. The effect estimate is presented in the y axis in calls per million while the time (15-days bins) in relation to the lockdown implementation is presented in the x axis. Due to the heterogeneous effect the y axis is presented in independent scales for group. Some combinations of age, sex, perpetrator, and type of violence where not able to produce estimates due to the low or no number of calls.

Figure 3. Event study plot for calls related to physical violence.



The column panels show the age and sex groups while the rows show the relationship between the perpetrators and survivors. The effect estimate is presented in the y axis in calls per million while the time (15-days bins) in relation to the lockdown implementation is presented in the x axis. Due to the heterogeneous effect the y axis is presented in independent scales for group. Some combinations of age, sex, perpetrator, and type of violence where not able to produce estimates due to the low or no number of calls.

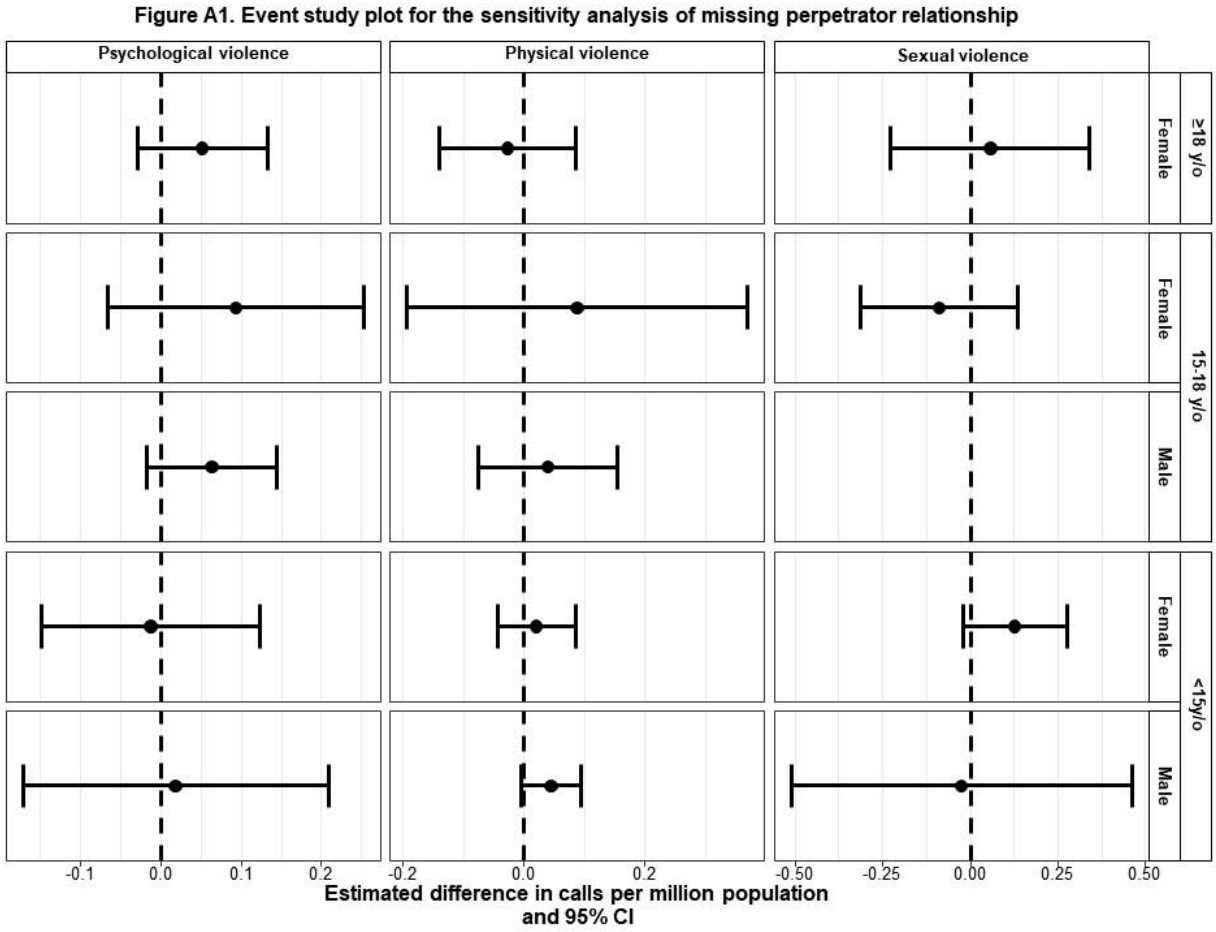
Figure 4. Event study plot for calls related to sexual violence.



The column panels show the age and sex groups while the rows show the relationship between the perpetrators and survivors. The effect estimate is presented in the y axis in calls per million while the time (15-days bins) in relation to the lockdown implementation is presented in the x axis. Due to the heterogeneous effect the y axis is presented in independent scales for group. Some combinations of age, sex, perpetrator, and type of violence where not able to produce estimates due to the low or no number of calls.

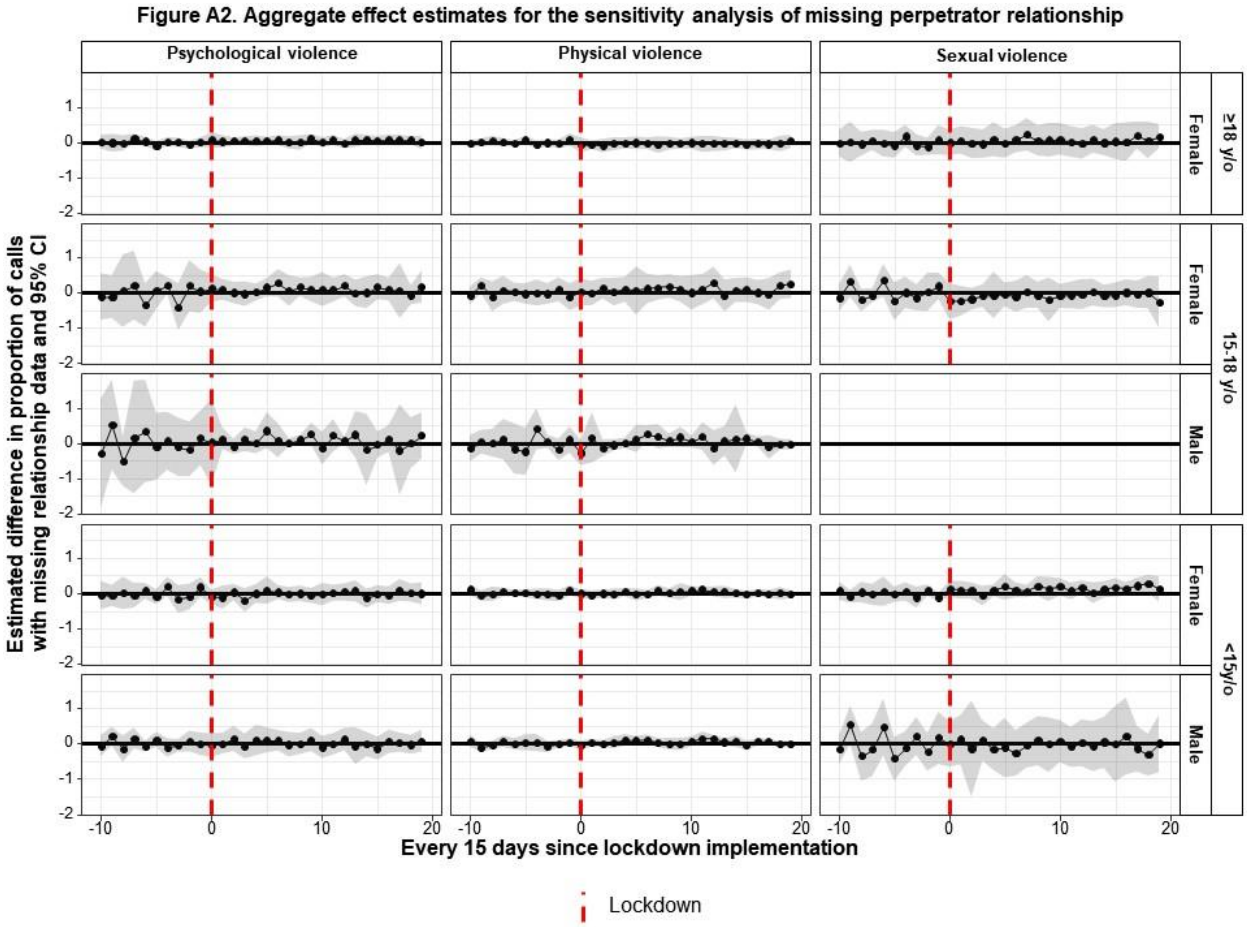
7.6 Appendix

Figure A1. Event study plot for the sensitivity analysis of missing perpetrator relationship.



The column panels show the type of violence while the rows show the age and sex groups. The effect estimate is presented in the y axis as the change in the proportion of calls with missing relationship data. The x axis represents the time (15-days bins) in relation to the lockdown implementation.

Figure A2. Aggregate effect estimates for the sensitivity analysis of missing perpetrator relationship.



The y axis shows the type of violence while the rows show the age and sex groups. The effect estimate is presented in the x axis as the change in the proportion of calls with missing relationship data.

Chapter 8: Overall discussion

The four manuscripts discussed earlier provide valuable insights into the complex interplay of public health policies, violence against women, and the broader implications of the COVID-19 pandemic on public safety. By examining the effectiveness of Women's Emergency Centers in Peru, the potential biases in evaluating policies targeting violence against women, the consequences of lockdown measures on public safety outcomes, and the impact of the pandemic on the use of helplines for individuals experiencing violence, these studies contribute to a more comprehensive understanding of the challenges faced by societies during times of crisis.

The findings from these manuscripts emphasize the importance of rigorous data analysis and accurate interpretation in evaluating public policies and understanding their impact on various aspects of society. They also highlight the need for a balanced approach to addressing public safety concerns, particularly during times of crisis such as the COVID-19 pandemic. By acknowledging the potential unintended consequences of public health policies and taking steps to mitigate these effects, policymakers and stakeholders can work together to create a safer and more supportive environment for all members of society.

Moreover, the interconnected nature of the issues explored in these manuscripts underscores the need for interdisciplinary collaboration in research and policymaking. By drawing on insights from multiple fields, including public health, criminology, and social sciences, researchers and policymakers can develop more effective and nuanced strategies to address the multifaceted challenges faced by communities in times of crisis.

These studies also highlight the importance of contextualizing research findings within broader societal trends and global events. By understanding the impact of external factors, such as the COVID-19 pandemic, on public safety outcomes, researchers and policymakers can better account for these influences in their analyses and develop more targeted interventions to address specific concerns.

Moving forward, it is crucial to continue investigating the effectiveness of public policies and their consequences on public safety and well-being, particularly in the context of rapidly changing global events. As new challenges emerge, researchers and policymakers must work together to adapt existing strategies and develop innovative approaches to addressing the complex issues facing societies worldwide.

The four manuscripts discussed in this thesis offer valuable insights into the challenges of public safety, violence against women, and the broader implications of the COVID-19 pandemic. By examining these interconnected issues, researchers and policymakers can work together to create a safer, more supportive, and more resilient world for all.

8.1 Lessons learned

The lessons learned from this Thesis emphasize the need for a comprehensive understanding of psychological violence, accurate data reporting, addressing the root causes of violence, and rigorously evaluating interventions to better support survivors and prevent future incidents.

The multifaceted nature of psychological violence presents challenges in its definition and measurement across cultures. Efforts to reach a consensus on these aspects would improve our understanding of its prevalence and impact. Furthermore, accurate data reporting is essential for effective policymaking, and researchers should account for factors that may influence reporting, such as confidentiality, cultural context, and individual factors.

Addressing the root causes of intimate partner violence, such as unequal power dynamics and societal expectations, is crucial for creating effective prevention programs. Evaluating the quality and scope of services provided by existing support centers, such as CEMs, can inform improvements and lead to more targeted interventions.

Rigorous methodology in evaluating interventions, such as difference-in-difference estimators, offers valuable insights into the role interventions play in tackling intimate partner violence. It is essential to acknowledge misclassification in violence research and

consider the broader implications of misclassification, which can affect result interpretation, policy recommendations, and resource allocation.

The urgent need for rigorous research on interventions to prevent violence against women and girls, particularly in low-resource settings, is evident. Addressing methodological shortcomings and filling gaps in the evidence base can help identify effective interventions and devise strategies to prevent violence and support survivors.

The COVID-19 pandemic has led to substantial changes in daily life, significantly impacting gender-based violence patterns and helpline calls. During the pandemic, an increase in psychological violence against women and a decrease in some forms of violence, such as sexual violence from outside sources, were observed. The closure of schools and reduced mobility limited children's ability to seek help, potentially contributing to the decrease in calls related to child abuse.

The number of helpline calls is not necessarily reflective of actual incidences of violence, as many cases go unreported and not all survivors have access to helplines. Understanding the changes in violence patterns during the pandemic is important for informing future interventions and providing continued support for survivors of gender-based violence.

8.2 Future direction

Future directions for research and interventions based on the insights gained from this Thesis include:

- Exploring innovative methods for measuring violence: Evaluate new forms of measuring violence using technology, such as audio/video surveys that can be conducted anonymously. Investigate innovative ways of measuring psychological violence, including physiological patterns or social media patterns, to better understand its prevalence and impact.

- Expanding the use of quasi-experimental designs: Enhance policy evaluation by integrating policymakers and end-users into the research process, and use quasi-experimental designs to better understand the effectiveness of interventions. Improve estimates of misclassification distribution by identifying more accurate priors for these measures.
- Examining the long-term consequences of the pandemic: Continue to work on understanding the late consequences of the pandemic, specifically the impact of interrupted health services and the long-term effects on various populations. Evaluate the differences in policy adoption and compliance across different regions to better inform future strategies.
- Improving support services during emergencies: Develop better personal services for situations of violence under emergency circumstances, such as lockdowns. Find new ways to reach those in need, create safe environments or safety routes for decision-making during difficult times, and provide financial and emotional support to survivors.
- Innovative approaches, such as using digital technologies, may help reach survivors and mitigate the impact of the pandemic on gender-based violence. Policymakers should consider the indirect consequences of COVID-19 response policies on the economy, lifestyle, and mental health and implement comprehensive response services for mental health and violence prevention during and beyond the pandemic.
- Building upon existing data: Embrace the limitations of existing data sources and explore alternative ways to utilize available databases, such as mortality data and national surveys, to identify inequalities and inform policymakers. By acknowledging these limitations, researchers can work towards more robust and comprehensive evidence to guide future policy decisions and interventions.
- Integrating intersectionality in research: Consider the intersections of various factors such as race, ethnicity, socio-economic status, and disability when studying gender-based violence, in order to develop more nuanced understandings

of the experiences of different groups. This approach can lead to more targeted and effective interventions that address the specific needs of diverse populations.

- Strengthening qualitative research methods: Complement quantitative data with in-depth qualitative research, such as interviews, focus groups, and ethnographic studies, to gain a more comprehensive understanding of the lived experiences of survivors and the complex dynamics of violence. This will provide valuable context for interpreting quantitative findings and designing more effective interventions.
- Enhancing community engagement: Involve communities in the research process, from problem identification to intervention implementation, to ensure that solutions are culturally appropriate and contextually relevant. Engaging with communities can also foster a sense of ownership and enhance the sustainability of interventions.
- Promoting interdisciplinary collaboration: Encourage collaboration among researchers from various disciplines, such as psychology, sociology, public health, and technology, to develop a more holistic understanding of gender-based violence and its underlying factors. This collaborative approach can lead to innovative solutions that address the issue from multiple angles.
- Fostering partnerships between researchers, practitioners, and policymakers: Strengthen connections among these key stakeholders to promote the translation of research findings into practical interventions and evidence-based policies. This can help ensure that efforts to address gender-based violence are informed by the latest research and best practices.

8.3 Conclusion

The analysis and discussion of the four manuscripts , have provided valuable insights into the complexities surrounding psychological violence, accurate data reporting, measurement errors, and the impact of extreme situations such as lockdowns on intimate partner violence. The multifaceted nature of psychological violence, coupled with the challenges in defining and measuring it across cultures, highlight the need for consensus and innovative approaches to understanding its prevalence and consequences.

The importance of accurate data reporting and the potential impact of misclassification on research findings and policy recommendations cannot be understated. Rigorous methodologies, such as difference-in-difference estimators for staggered interventions and quantitative bias analysis, can help address these challenges and provide a more accurate understanding of the effectiveness of interventions targeting violence against women.

Furthermore, the COVID-19 pandemic and associated lockdown measures have revealed the necessity of studying the indirect consequences of such extreme situations, including changes in gender-based violence patterns and the impact on mental health. The need for comprehensive response services and innovative approaches to support survivors of violence during emergencies is crucial for creating a safer environment and mitigating the adverse effects of such situations.

Future directions should focus on developing innovative methods for measuring violence, expanding the use of quasi-experimental designs, examining the long-term consequences of the pandemic, improving support services during emergencies, and building upon existing data to inform more effective policies and interventions. By addressing these issues and incorporating the lessons learned from the discussed manuscripts, researchers, policymakers, and practitioners can work collaboratively to create a world free from violence against women and girls.

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