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**ABEL BRASIL RAMOS DA SILVA**

**ESSAYS ON THE ECONOMETRICS OF GENDER, DOMESTIC AND INTIMATE  
PARTNER VIOLENCE**

**FORTALEZA**

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ABEL BRASIL RAMOS DA SILVA

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VIOLENCE

Tese de Doutorado submetida à Coordenação do Programa de Pós-Graduação em Economia – CAEN, da Faculdade de Economia, Administração, Atuarial e Contabilidade da Universidade Federal do Ceará, como requisito parcial para a obtenção do título de Doutor em Ciências Econômicas. Área de concentração: Econometria aplicada.

Prof. Dr. José Raimundo de Araújo Carvalho  
Júnior

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“A simplicidade é o último grau de sofisticação”  
Leonardo Da Vinci

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## RESUMO

A tese consiste em três capítulos inter-relacionados que investigam os efeitos da principal forma de violência contra as mulheres, digamos, a violência perpetrada pelo parceiro íntimo (Heise et al., 1994). No primeiro capítulo, avaliamos o impacto de uma política que exige que as DEAMs (Delegacia Especializada no Atendimento à Mulher) atue 24 horas por dia contra a violência doméstica. Desenvolvemos cuidadosamente um modelo sequencial de opções discretas capaz de imitar os principais nós de decisão, digamos, desde a comissão de crime até a denúncia de crimes. Para avançar algumas explicações causais, consideramos o intrincado papel da heterogeneidade não observada em nosso modelo. Concluímos que uma política de “24 horas de plantão” para DEAMs tem tanto efeito “deterrence” (aproximadamente 3% de redução) quanto efeitos de reportar sobre a violência doméstica (um aumento de 8,1% na decisão de relatar - condicional em ser vítima e 13% a decisão de informar à polícia - condicionada pela decisão de relatar). No segundo capítulo, investigamos os fatores responsáveis pela ocorrência de atrito no *PCSVDF<sup>Mulher</sup>*. Nossa análise abrangeu três etapas. Primeiro, comparamos os perfis socioeconômicos e de vitimização dos entrevistados que permaneceram na pesquisa e daqueles que atritaram. Segundo, aplicamos a análise logit para explicar o que determina o atrito. Na terceira etapa, desagregamos ainda mais as categorias de atrito para capturar especificidades focadas na questão de gênero e utilizamos modelos multinomiais. Constatamos que idade, baixa escolaridade, crianças até 4 anos são fatores que favorecem a continuidade da mulher na entrevista, corroborando alguns achados da literatura. A desistência durante a entrevista na primeira onda aumenta o atrito em 7%, a intenção de mudar do local resultou em um aumento de 9% a 14% na probabilidade de atrito. Nossos resultados sugerem que as mulheres que já sofreram violência em qualquer momento da vida têm maior probabilidade de sofrer atrito, aumento de 2%. No terceiro capítulo, documentamos novos fatos sobre a violência doméstica durante a gravidez no Brasil, usando dados originais coletados através do *PCSVDF<sup>Mulher</sup>*. O estudo objetivou analisar a associação da violência doméstica durante a gestação com características sociodemográficas, utilizando a regressão logística para investigar potenciais riscos e fatores de proteção. A taxa de prevalência encontrada atingiu 6,2%. Nossos resultados apontam que as mulheres mais jovens estão mais expostas à violência e que a raça não foi significativa. Mulheres com alto nível de escolaridade são menos propensas a sofrer violência doméstica. Mulheres com mais de três gestações têm pelo menos três vezes mais chances de serem vítimas durante a gravidez. Nosso ensaio também corrobora a literatura: a gravidez não impede a violência doméstica. Resultados mostram que 34% de todas as agressões ocorrem durante todos os trimestres da gestação, e 60% delas relataram que a agressão permaneceu a mesma ou até aumentou durante a gravidez.

**Palavras-chave:** Violência doméstica. Atrito. Dados em Painel. *PCSVDF<sup>Mulher</sup>*. Econometria.

## ABSTRACT

The Thesis consists of three interrelated chapters that investigate the effects of the main form of violence against women, say, violence perpetrated by the intimate partner (Heise et al., 1994). In the first chapter, we evaluate the impact of a policy that mandates DEAMs (Delegacia Especializada no Atendimento à Mulher - Brazilian Women's Police Station) to be on duty 24 hours per day on domestic violence. We carefully develop a sequential discrete choice model able to mimic the main decision nodes, say, from crime commission up to crime reporting. To advance some causal explanations, we consider the intricate role of unobserved heterogeneity in our model. We concluded that a "24 hours on duty" policy for DEAMs has both deterrence (roughly a 3% decrease) and reporting effects on domestic violence (an 8.1% increase on the decision to report – conditional on being a victim and an 13% the decision to report to police – conditional on have decided to report). In the second chapter, we investigated the factors responsible for the occurrence of attrition in the *PCSVDF<sup>Mulher</sup>*. Our analysis spanned into three stages. First, we compared socioeconomic and victimization profiles from interviewees who remained in the survey and those who have attrited. Second, we applied logit analysis to explain what determines attrition. In the third stage, we further disaggregated the categories of friction to capture specificities focused on the gender issue and used multinomial models. We found that age, low schooling, children up to 4 years old are factors that favor the continuation of the woman in the interview, corroborating some findings of the literature. Dropout during the first wave interview increases the friction by 7%, the mobility of the site resulted in a 9% to 14% increase in the probability of attrition. Our results suggested that women who have already suffered violence any time in their lives are more likely to suffer from attrition by 2%. In the third chapter, we documented new facts about domestic violence during pregnancy in Brazil, using original data collected through the *PCSVDF<sup>Mulher</sup>*. The study aimed to analyze the association of domestic violence during pregnancy with sociodemographic characteristics, using logistic regression to investigate potential risks and protective factors. The prevalence rate found reached 6.2%. We found that younger women are more exposed to violence and that race was not significant. High educated women are less likely to suffer domestic violence. Women with more than three pregnancies are at least three times more likely to be victims during pregnancy. Our essay also corroborates the literature: pregnancy does not prevent domestic violence. A 34% of all aggressions occur throughout all trimesters of gestation, and 60% of them reported that aggression remained the same or even increased with pregnancy.

**Keywords:** Domestic Violence. Attrition. Panel Data. *PCSVDF<sup>Mulher</sup>*. Econometrics.

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# 1 THESIS OVERVIEW

The thesis consists of three interrelated chapters investigating the effects of the main form of violence against women, domestic violence perpetrated by the intimate partner (Heise et al., 1994). Roughly 15% to 71% of all women report having experienced physical or sexual aggression, or even both, by their intimate partner at some point in their life (see WHO (2005)). This work contributes to the literature in the area of domestic violence through new empirical evidence extracted from a new set of data, the PCSVDF<sup>Mulher</sup> (Pesquisa de Condições Socioeconômicas e de Violência Doméstica e Familiar contra a Mulher – the Survey of Socioeconomic Conditions and Domestic and Family Violence against Women).

The PCSVDF<sup>Mulher</sup> is an interdisciplinary effort to build a unique dataset that enables the study of domestic violence. The project gathered longitudinal information from more than 10 thousand women aged between 15 and 49, living in the state capitals in Brazil's Northeast Region, in two waves: 2016 and 2017. The project also provides information on bargaining power and the allocation of intra-family resources, social and cultural standards, knowledge about civil rights and the use of judicial measures of protection against domestic violence, as well as information on couples (e.g., education, risky health behavior, anthropometry, skin color, labor market status), and women's subjective expectations and beliefs related to welfare and partner abuse, among many other topics (CARVALHO; OLIVEIRA; SILVA, 2018).

The aim of the PCSVDF<sup>Mulher</sup> is to advance the discussion on domestic violence into two directions: first, by constructing an innovative questionnaire based on an interdisciplinary background (Economics, Sociology, Public Health, Criminology, Anthropology, Statistics, and other fields) and, second, by applying the survey instrument to a representative and a longitudinal sample of women.

The questionnaire of the PCSVDF<sup>Mulher</sup> is divided into twelve sections (for details, see Carvalho, Oliveira and Silva (2018)). The project used CAPI software, a data collection technology provided through the World Bank's Survey Solutions, in face-to-face interviews. The survey used carefully selected female interviewers and supervisors trained using a standardized, week-long training, covering issues of gender, violence, ethical and safety issues, and interview techniques.

The sampling unit is a woman who is a resident of the household selected for the research. The sampling plan was devised by stratifying the population of households in three stages. The first stage consists of a random selection of census tracts in each state capital. To preserve the income distribution, the census tracts were stratified into three strata (at the census tract level) based on the average income of the household head. In the second stage, a random sample of households was drawn from each of the census

tracts selected in the previous step. Finally, in the third stage and to ensure the safety and confidentiality of respondents, only one woman aged 15-49 was randomly selected per household (CARVALHO; OLIVEIRA; SILVA, 2018).

The thesis' first chapter is titled 'Disentangling "Deterrence" from "Incentive to Report" Effects on Domestic Violence: the Case of the Brazilian DEAM on Duty 24 Hours'. This essay was written in partnership with Professor José Raimundo Carvalho. The essay was accepted and presented at the XI Meeting of the ABCP (Brazilian Association of Political Science.) in 2018. We evaluate the impact of a policy that mandates DEAMs (Delegacia Especializada no Atendimento à Mulher – a Brazilian Women's Police Station) to be on duty 24 hours per day on domestic violence. As an increase in the availability of office hours can have both "Deterrence" and "Incentive to Report" effects on domestic violence, we carefully develop a sequential discrete choice model able to mimic the main decision nodes, say, from crime commission up to crime reporting. Our sequential logit model enables us to calculate both conditional and marginal effects on the variables of interest. To advance some causal explanations, we consider the intricate role of unobserved heterogeneity in our model. We concluded that a "24 hours on duty" policy for DEAMs has both deterrence (a roughly 3% decrease) and reporting effects on domestic violence (an 8.1% increase in the decision to report, conditional on being a victim, and a 13% increase in the decision to report to police, conditional on have decided to report). Our study helps to understand the DEAMs' dual role of inhibiting domestic violence and reducing the "dark figure" of crime.

The second chapter is titled 'Modeling of Attrition in a Longitudinal Study on Domestic Violence: The Case of PCSVDF<sup>Mulher</sup>'. This essay was written under the supervision and consideration of Professor José Raimundo Carvalho. The aim was to investigate the factors responsible for the occurrence of attrition in the second application of PCSVDF<sup>Mulher</sup>. In 2017, PCSVDF<sup>Mulher</sup> collected its second wave and sought to interview the 10,094 women again. We conducted our analysis of attrition in three stages. First, we performed a comparative evaluation of the profile of the interviewees who remained in the survey and those who attrited. Second, we disaggregated the attrition classification and applied logistic regression. Third, we further disaggregated the categories of attrition to capture specificities focused on the gender issue and used multinomial models. We found that age, low schooling, and the presence of children up to 4 years of age are factors that favor the continuation of the woman in the survey, thereby corroborating findings in the literature. On the other hand, dropout during the first-wave interview increases friction by 7%, while site mobility resulted in a 9% to 14% increase in the probability of attrition. Regarding the interest in or knowledge about the subject, the results show that women who have more interest in the topic tend to participate more in the research, thus reducing friction. Regarding this research's central aim of evaluating the possible effects of domestic violence on the interviewee's decision to participate in the research, our data show violence has a

positive effect on participation, namely a 2% increase in the probability of friction.

The third chapter is titled ‘Domestic Violence during Pregnancy in Brazil: Prevalence and Correlates from the PCSVDF<sup>Mulher</sup>’. We are grateful for the supervision, participation and consideration of professor Victor Hugo de Oliveira Silva during the execution of this study. We document new facts about domestic violence during pregnancy in Brazil using research data collected through the PCSVDF<sup>Mulher</sup> (Pesquisa de Condições Socioeconômicas e de Violência Doméstica e Familiar contra a Mulher - the Survey of Socioeconomic Conditions and Domestic and Family Violence against Women). The aim of the study was to analyze the association between domestic violence during pregnancy and sociodemographic characteristics. Using logistic regression, we investigated potential risk and protective factors. We also analyzed additional information to understand the occurrence of domestic violence during pregnancy. For example, we asked about the frequency of aggression by trimester and assessed whether the aggressive incidents decreased, remained the same, or increased compared to the period before the pregnancy. We observed a prevalence rate of 6.2%. This recent estimate provides evidence of the absence of a political agenda. We find that younger women are more exposed to violence, while race was not significant. Highly educated women are less likely to suffer from domestic violence. Women with more than three pregnancies are at least three times more likely to be victims during pregnancy. Our work also corroborates a prior finding in the literature: pregnancy does not prevent domestic violence. In 34% of cases, aggression was perpetrated throughout all three trimesters of gestation, and 60% of respondents reported that aggression remained the same or even increased over the course of the pregnancy.

# 2 DISENTANGLING “DETERRENCE” FROM “INCENTIVE TO REPORT” EFFECTS ON DOMESTIC VIOLENCE: THE CASE OF THE BRAZILIAN 24-HOUR DEAM

## 2.1 INTRODUCTION

The unfortunate existence of violence against women, and its deleterious effects, has long been present in societies worldwide. Women suffer from many forms of violence – sexual assault, psychological threats, murder, marital rape, female child malnutrition, forced prostitution, female genital mutilation and sexual abuse and trafficking – but the most common form of violence against women is intimate partner violence (IPV) ([HEISE et al., 1994](#)). Approximately 15% to 71% of all women report having faced physical or sexual aggression, or even both, by their intimate partner at some point in their life (see [WHO \(2005\)](#)). This evidence demonstrates the urgent need to reduce this menace to human dignity and development that fosters gender inequalities.

Although there are several consequences of violence, such as mental health problems, physical injury, suicide attempts, decreased productivity, alcohol abuse, cigarette consumption, sexual and reproductive effects, impacts on the fetus or child, and many others, only recently has the problem of domestic violence (or IPV) been treated as a matter of women’s health and, therefore, public health (see [Schraiber et al. \(2002\)](#), [WHO \(2005\)](#), [Schraiber et al. \(2007\)](#) and [Kiss et al. \(2012\)](#)).

[The United Nation \(1993\)](#) acknowledged the urgent need to universally apply to women the rights and principles related to equality, security, freedom, and the integrity and dignity of all human beings and defined violence against women as “physical, sexual or psychological suffering for women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public life or in private life”.

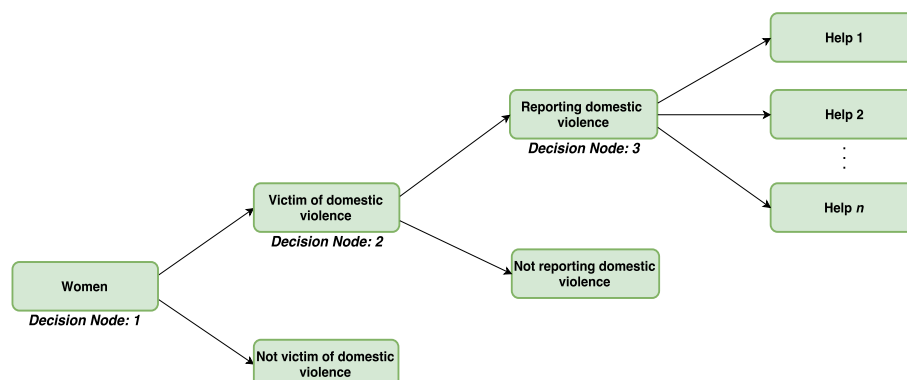
In Brazil, according to [Martins, Cerqueira e Matos \(2015\)](#), women’s organizations and movements have acted extensively on issues related to work, income, political and social participation, health, housing and the right to a life without violence while advocating for women’s rights. According to the authors, the implementation of international policies, coupled with the efforts of the Brazilian feminist movement to achieve rights related to a life without violence, have impacted Brazilian public institutions.

In 2006, the promulgation of the Maria da Penha Law leveraged, implemented and directed public policies in addressing this issue. This law led to considerable advances in women’s rights. Under the auspices of the Federal and State governments, the Federal District (the capital of Brazil), municipalities and non-governmental actors, the law creates integrated prevention and care measures ((BRASIL, 2006)). The Maria da Penha Law also provides subsidies for the creation of public facilities, one of which is the Women’s Specialized Police Station (DEAM – Delegacia Especializada no Atendimento à Mulher).

Despite the increasing availability of services and policies designed to address the problem of IPV, such violence remains widespread, and few women seek help to solve this problem. In Brazil, according to WHO (2005), in 2005, between 29% and 37% of women were victims<sup>1</sup>. From a global perspective, regarding to women’s search for help, between 21% and 66% of victims never report an act of violence against them (GARCIA-MORENO, 2005). In Brazil, the WHO notes that between 21% and 24% of victims do not report these crimes<sup>2</sup>. Many cases of domestic violence occur in people’s social circles but do not prompt a report (GRACIA, 2004). Thus it is necessary to better understand this problem.

Hence, it is fundamental to analyze which factors explain domestic violence and how these factors may explain the decision to report it (or not) to the authorities. When we examine the problem more closely, it seems sensible to treat it as a sequence of ordered choices, similar to a flow or decision tree. Specifically, we can divide it into three parts (see Figure 2.1). The first is to determine whether a woman is exposed to a situation in which she could suffer an episode of domestic violence. The second decision is whether to report such violence. The third decision is who to ask for help. Unlike the current academic literature that considers these issues separately and in isolation, we will analyze them simultaneously.

Figure 2.1 – Sequence of choices



Our primary objective is to build and estimate a sequential model to explain the process

<sup>1</sup> Through the database used in this work, we detected that 30.5% of women were victims, which means that 12 years after the passage of the Maria da Penha Law, the figures remain largely unchanged. Below, we provide further details on the domestic violence database used in this current study, the PCSVDF<sup>Mulher</sup>

<sup>2</sup> In domestic violence database used in this study, almost 61% of women did not ask for help.



of “choice” that a typical woman faces. To do so, we model the choice at each node by employing different sets of independent variables. Our modeling is a methodological apparatus to evaluate the causal impact of the “24-hour” DEAM policy on measures of criminal prevalence and severity and on the act of reporting domestic violence. Our approach differs from prior methods in three dimensions: first, we explicitly incorporate the sequential structure of the domestic violence flow; second, we analyze the impact of DEAM as a public policy delivering two interrelated effects, which we term a “deterrence effect” and a “crime reporting effect”; and third, we employ a much better empirical data set, the PCSVDF<sup>Mulher</sup> (Pesquisa de Condições Socioeconômicas e de Violência Doméstica e Familiar contra a Mulher - Survey of Socioeconomic Conditions and Domestic and Family Violence against Women).

The analytical structure we propose is only possible because of a newly created database. The PCSVDF<sup>Mulher</sup> is an interinstitutional and international effort to build a unique dataset that enables the study of domestic violence, the allocation of resources for household, women’s and children’s health, and child development, and the interrelationships among them through an interdisciplinary approach. The PCSVDF<sup>Mulher</sup> enriches the literature in two ways. The first benefit of the database is its longitudinal capacity. Data were collected in two waves in 2016 and 2017. The second is the development of a questionnaire capable of capturing several interdisciplinary topics.

Overall, our empirical exercise improves our understanding of the role that police institutions play in the domestic violence flow and highlights the importance of keeping a police station open 24 hours a day. The results corroborate prior findings in and extend the literature in various ways. We were able to clarify the 24-hour DEAM policy’s role in inhibiting and communicating acts of domestic violence, thereby contributing to the scarce literature on the effectiveness of police programs. DEAM has an inhibiting effect on acts of domestic violence (the “deterrence effect”); specifically a DEAM operating 24 hours a day can reduce the likelihood of IPV by 3% and increase the probability of crime reporting, conditional on being a victim, by almost 8.1% (“crime reporting effect”). Moreover, having a DEAM open 24 hours increases by almost 13% the odds of a victim of domestic violence reporting it to police authorities, provided that she decided to report in general (the “legal reporting effect”), which is interesting *per se*. These numbers are encouraging given the low costs associated with turning an ordinary (18-hour shift) DEAM into a 24-hour DEAM.

There are four sections after this Introduction. The second offers a literature review on crime reporting for crimes related to domestic violence, based mainly on [Gottfredson e Gottfredson \(1988\)](#) and [Felson et al. \(2002\)](#). In that section, we also discuss the DEAM’s possible impacts on all transitions in the violence process. The third section describes the database used in the research and how scarce the data on this topic are. In the fourth section, we present the methodology used in this study, using [Buis \(2015\)](#)’s theoretical framework

to develop a sequential logit model, as well as its implications and implementation. In the fifth section, we discuss the primary results we obtained, corroborating and contrasting our findings with technical references, in addition to highlighting our new findings. In the last section, we conclude the work.

## 2.2 LITERATURE REVIEW

### 2.2.1 Crime reporting

“If the victim decides not to report a crime to the police, the probability of a sanction’s being imposed upon the offender is reduced to nearly zero”, (GOTTFREDSON; GOTTFREDSON, 1988).

One of the first papers to tackle the issue of crime reporting (“*the dark figure*<sup>3</sup>”) was Skogan (1976). He suggests that the determinants of crime reporting can be divided into three groups: i) determinants related to individual characteristics; ii) variables able to represent the relationship between the victim and his/her aggressor; and iii) the severity of crime. Skogan (1976) shows that individual characteristics are weakly related to crime reporting, while the main factor contributing to it is the severity of the crime/aggression perpetrated. In addition, a key contribution stemming from his work relates to his rationality assumption on interpreting the act of reporting.

The issue of victim rationality as an assumption in work on crime reporting has since Skogan (1976) been extensively discussed in other criminal studies. According to Gottfredson e Gottfredson (1988), there are three decisions the victim can take: the first is to define<sup>4</sup> a behavior as a criminal act; in the second, someone must decide (or not) that the act is judicial responsibility, and the last decision is to invoke the criminal justice system, usually with calling the police as a first step. According to Gottfredson e Gottfredson (1988), the decision to report to the justice system reflects a desire on the part of the victim to demand a solution to the increase of a problem in his/her life.

According to these authors, based on data from the *National Crime Survey* in 1981, the main reasons for not reporting to the police are “nothing could be done”, that it was an “unimportant crime” and, for other types of crimes, that it was a “private issue” or that the victim had a “fear of reprisal”. These authors hold that three dimensions can impact the decision of whether to report to police: the nature of the offense, the victim’s characteristics, and attitudes toward the police. Confirming Skogan’s findings, the more serious the crime is (personal injury or financial loss), the greater the likelihood of informing the police. Similarly, it is also not evident that victims’ attributes (or characteristics) are

<sup>3</sup> Occurrences that not registered in the statistics (BIDERMAN; REISS, 1967)

<sup>4</sup> The definition can be made by some citizen (victim or witness) or the police

correlated with the act of reporting a crime. Indeed, the lack of explanatory power of individual characteristics seems to be an important issue to investigate.

MacDonald (2001), using British data in the years 1994 and 1996, reaches similar conclusions. He divides all variables into four groups: socioeconomic (e.g., age, sex, race), specificity of the incident (cost *versus* benefit), police attitudes (trust in the police) and crime (involvement with drugs, for example). He found that economic factors (employed/jobless) and the specificity of the incident had more weight in the decision to report residential theft (or property crime). He also reinforces that economic cycles affect a victim's decision to report. In a broad analysis, Tarling e Morris (2010) uses the same British data, but for the period 2007/2008, and considers as variables household/individual characteristics, aspects of violence and aggressor characteristics and confirms that the severity of a violent act remains the main reason for reporting a crime.

There is also work that focuses on evaluating whether the police's reputation affects a victim's decision, such as Garcia e Herrero (2006) and Boateng (2016). For example, Boateng (2016) examined the effects of the victim's perception of the police in the context of robberies, sexual crimes and general crimes in Ghana. The author points out that attitudes toward the police are positively related to the likelihood of a victim reporting a crime. That is, victims who have high confidence in the police and are satisfied with their work in the neighborhood are more likely to report crimes.

## 2.2.2 Domestic violence reporting

Most domestic violence cases are not reported. Therefore, only part of the problem is captured in prevalence data (see Gracia (2004)). Between 21% and 66% of women who were victims never reported an act of domestic violence Garcia-Moreno (2005). In the case of Brazil, data available from the WHO state that between 21% and 24% of such women did not report IPV (see WHO (2005)). Therefore, it is important to go beyond the observation of a high prevalence and understand the rational structure that impacts a woman's decision of whether to report a violent act by her intimate partner.

It is not a trivial issue to analyze the factors that impact a woman's decision to report domestic violence (see Felson et al. (2002)). In reviewing the literature, we found that the reasons for reporting domestic violence differ from those related to other crimes. For example, abused women attempt to adopt ways to maximize their safety and that of their children; as noted by Garcia-Moreno Alessandra Guedes (2012), victims have a fear of retaliation, economic dependence, concerns about children, love for their partners and hope that they will change their behavior.

Felson et al. (2002) propose one of the main theoretical frameworks to explain the decision to report a crime of domestic violence. They expand our understanding of reporting a crime from a rational choice perspective (based on the work of Gottfredson e Gottfredson (1988)). They consider the paradigm of benefits and costs associated with the

victim's choice to report the crime (or not). In the rational perspective, victims report a crime when the benefits are greater than the costs. [Felson et al. \(2002\)](#) note that private issues, a fear of reprisal and a desire for protection against the aggressor are factors that impact the decision to not report to the police. On the other hand, self-protection and severity are factors that explain reporting to police.

Other scholars consider socio-demographic determinants such as the characteristics of an act of violence (e.g., the use of guns, the intensity of the act), partner characteristics, and the presence of children. These factors can explain this reporting. By contrast, there is no concrete evidence that characteristics such as age, education and income have an association with crime reporting (see [Kaukinen \(2004\)](#), [Akers e Kaukinen \(2008\)](#), [Bonomi \(2006\)](#), [Kiss et al. \(2012\)](#)). Analyzing the results from these authors reveals a consensus that severity is a crucial factor in explaining this phenomenon. Severity can be characterized by the use of weapons, physical damage, repetition of violent acts and other factors that impact a woman's life. As [WHO \(2005\)](#) depicts, among the main reasons that explain why a woman seeks help are the severity of the violence and the likely impact on her children.

### 2.2.3 Decision making from victimization up to reporting

Not only is it fundamental to understand what determines whether a woman will report violence, but it is also important to evaluate the entire decision-making structure of domestic violence. That is, we can treat the crime and communication structure as a flow (see figure 2.2). The first stage is whether a woman suffers domestic violence; in the second stage, once she has suffered a violent act, she decides whether to report it; in the third stage, the woman decides who to ask for help. Let us then understand the main factors that impact the violence tree<sup>5</sup>.

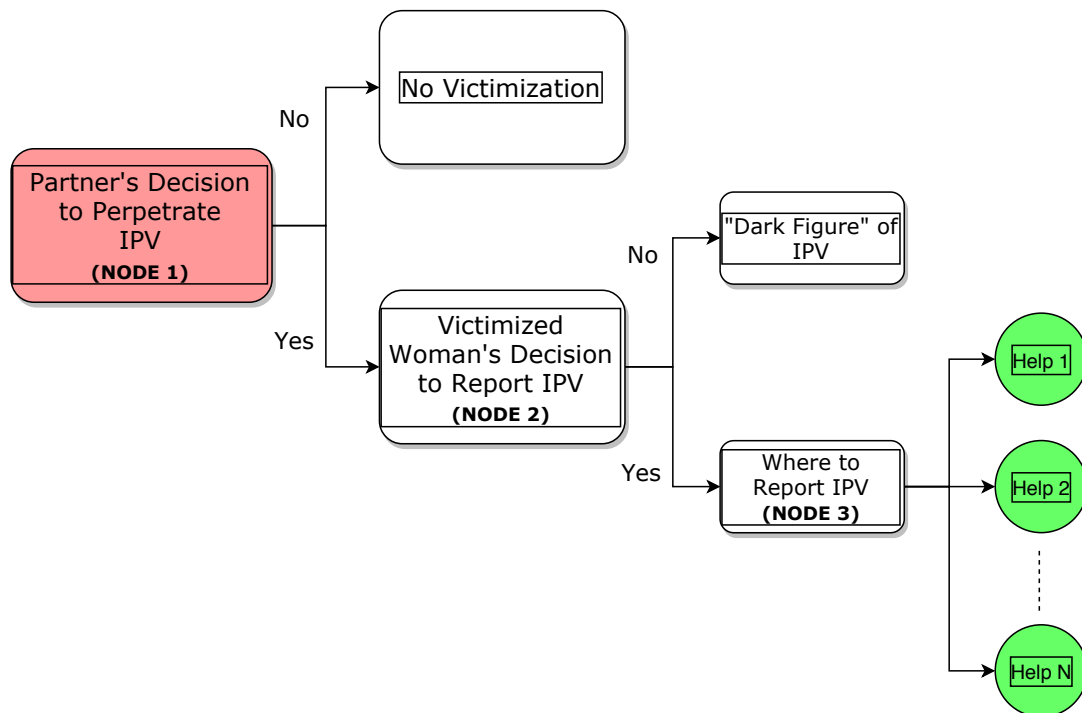
Through this configuration, we are able to understand the factors that influence the paths between transitions and capture the effect on the final result. For example, we can evaluate the woman's final decision to report the crime. To achieve this, we incorporate effects driving decisions at the last decision nodes through effect weights in the previous transitions. We discuss this issue further in section 2.4.

In essence, the problem spans from the commission of the crime until the filing of an official report travels through two other layers. From a behavioral point of view, these decisions cannot be aggregated; we need to differentiate the impacts on each layer by disaggregating the problem into a sequential one. As we will see below, many papers that address these issues focus on studying the problem by analyzing only one of the layers in isolation and do not account for the joint effects.

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<sup>5</sup> In this study, we use the terms violence tree, the structure of violence and the violence flow interchangeably, that is, they are all meant to describe the path from the violent act to the search for help

Figure 2.2 – Sequential process of crime reporting



### 2.2.3.1 Policing strategies to decrease domestic violence

Ellsberg et al. (2015) offer a long literature review on programs and interventions to combat violence against women and girls. One of the interventions cited is the creation of specialized police stations to combat this type of violence. The authors note that these stations increase both visibility and reporting, but there is still little evidence of their effectiveness. Only a few studies have analyzed the effectiveness of these services, and thus, evaluations of them are a recent development in the literature.

According to Kerley e Dantzker (2005), program evaluations need to answer certain questions, for example: 1) do the benefits outweigh the costs? 2) Has the program reached the target population? 3) Can the results be used to validate theoretical hypotheses? 4) Has the program followed mandatory guidelines, regulations and standards? According to these authors, policing programs are criticized for their lack of theory, and in many cases, the evaluation revolves around crime rates and feelings of fear, as policymakers face pressure and choose primary measures of results. As the author emphasizes, in recent decades, methods of evaluation have changed. Researchers are now more interested in evaluating the process. One of the main reasons for the emergence of process evaluation is the maturation and consolidation of programs. Therefore, having a time horizon to consider is fundamental.

In addition to the aspects that are intimately related to the victim, government programs can act as a source of positive externality to curb violence and affect the violence flow. An example of such programs are coping networks. SPM (2011) defines coping networks as “the articulated action among governmental/non-governmental institutions/services

and community, aiming at the development of effective prevention strategies and policies that guarantee the empowerment of women and their human rights, the accountability of perpetrators and qualified assistance to women in situations of violence”.

There are several specialized services that make up the network<sup>6</sup>. In this work, we will analyze the impact of the DEAM on the violence flow, from its inhibiting impact on violent crime to its impact on crime reporting. First, we briefly discuss the institutional development of DEAMs.

Between 1985 and 2002, DEAMs’ functions were limited to services targeting crimes against women, as provided in the Criminal Code (CP). Domestic violence was incorporated into the CP in 2004. The DEAMs’ functionality began to be consolidated after the promulgation of the Maria da Penha Law. Following the adoption of this law, substantial changes were made to the judicial system in favor of the recognition and treatment of violent acts against women (PASINATO; SANTOS, 2008). The law strengthened the creation and implementation of DEAMs. In addition, it represents a joint effort involving Federal and State governments, the Federal District (the capital of Brazil), municipalities and non-governmental actors to curb domestic violence.

DEAMs are designed to handle issues related to domestic and family violence with an eye towards preventing and suppressing such behavior and are responsible for prevention, verification, investigation and legal tasks (SPM, 2011). According to Law 11.340/2006, Art. 11º, a DEAM differs from a traditional police station. The police authorities at a DEAM may adopt appropriate legal measures to ensure police protection, forward victim data to a hospital or health post and the Medical Legal Institute, and impose emergency protective measures for up to 48 hours, among other actions.

The first DEAM opened in the 1980s, in São Paulo, and today DEAMs are distributed across several municipalities in Brazil. According to Martins, Cerqueira e Matos (2015), in 2013, there were 362 municipalities with a DEAM.

There is very little research on Women’s Specialized Police Stations (Pasinato e Santos (2008) and Perova e Reynolds (2017)). According to Pasinato, there are no national studies that allow us to know path followed by women seeking institutional help to overcome situations of violence. Women’s Specialized Police Stations are the main public policy to combat domestic violence against women.

Recently, Perova e Reynolds (2017) analyzed the impact of DEAMs on the number of female homicides (as a proxy for IPV). The authors used panel data from between 2004 and 2009 from 2,074 municipalities. They found that DEAMs reduce the number of homicides in metropolitan areas. However, the data are aggregated and do not take into account characteristics at the individual level. Martins, Cerqueira e Matos (2015) used another type of methodology and correlated the number of units to combat domestic

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<sup>6</sup> The full list can be seen at SPM (2011)

violence available in the micro region<sup>7</sup> with the homicide rate of women by members of their household. They did not find any effect. However, this study does not specifically evaluate DEAMs. Generally, Brazilian studies analyze DEAMs through bulletin numbers, and crime rates, while others, such as [Souza e Cortez \(2014\)](#), analyze aspects of their operation.

The objective of this research differs from the works reviewed above in three dimensions: the first one is to incorporate a sequential structure of the violence flow; the second is to analyze the impact of DEAMs; and the third is to use an unpublished database to study domestic violence.

The first objective is to understand the decision flow of victims and aggressors from the first violent act up to the choice of where to report such violence. We will show how the control variables behave in the violence tree and which have the greatest impact on the flow. To do so, we use a sequential logit econometric model. The sequence structure has a flow form. We propose the following sequence structure:

1. A woman has either suffered partner violence or not.
2. Provided that she has suffered violence, the woman decides whether to report the act or not.
3. Finally, in the third decision node, since she has decided to report, what kind of help does she seek? Here, we will restrict the choices to seeking police help (military police or a DEAM) or seeking other types of help<sup>8</sup>

We emphasize that the first contribution of the present work is our attempt to explain the entire process from the origin of violence to a woman's decision making regarding whether to report it to police. There is no such work in the extant literature. Many papers in the literature analyze each step of the process separately, that is, they estimate the three steps in isolation by restricting the sample they consider. Let us consider some examples:

1. Regarding the first step there, are many complex studies that offer wide-ranging discussions; for further details, see for example [Bachman \(1994\)](#), [Basu e Famoye \(2004\)](#), [WHO \(2005\)](#), and [Sambisa et al. \(2011\)](#). According to [Heise et al. \(1994\)](#), there are four interrelated factors that cause violence: cultural, economic, legal and political.
2. The second stage focuses on crime reporting and so-called "dark figures". Generally, works considering this second stage estimate logistic regressions and their variants (see [Felson et al. \(2002\)](#), [Bonomi \(2006\)](#) and [Akers e Kaukinen \(2008\)](#)).

<sup>7</sup> Define micro region as a grouping of counties

<sup>8</sup> In section 2.3.3, we discuss how we create the variable that will describe the flow.

3. Studies addressing the third stage are oriented towards help-seeking, and authors have addressed this stage through ordinal or multinomial models (see [Kaukinen \(2004\)](#), [Barrett e Pierre \(2011\)](#) ).

The second contribution is to analyze the impact of DEAMs on the overall violence flow. As the literature shows, surveys evaluate DEAMs through regional/municipal female homicide data, which do not necessarily represent victims of domestic violence. These evaluations present problems: not all homicides are the result of domestic violence (femicide), and they do not address the dark-figure effect. We can evaluate DEAMs on two fronts; the first is the effect of curbing violent acts, that is, we want to test whether DEAMs help to reduce domestic violence crimes; the second is to analyze the effect on the reporting these acts.

The third contribution is the use of a database specifically designed to study the phenomenon of domestic violence. This study is possible due to the originality of the database collected in Brazil. The Survey of Socioeconomic Conditions and Domestic and Family Violence against Women (PCSVDF<sup>mulher</sup>) addresses the previous lack of a consolidated database that allows for the study of violence.

We recognize the importance of studying each layer separately, as different factors exclusively affect each layer. An example of this is to analyze the motivational factors that induce women to report such acts. Such choices are characteristic of the second and third stages of the process, while motivational factors on a woman's part do not influence her likelihood of being a victim of domestic violence. Thus, we decided to analyze a set of factors that simultaneously impact the three layers and thus allow us to understand the behavior of the variables between transitions. The only exception we make is to incorporate the type of violence or the severity of the act, since it is a widely supported factor in literature, and thus we cannot fail to include it in the model. Therefore, the only difference in the variables between the first and the subsequent layers is the severity variables, while the rest remain the same<sup>9</sup>.

## 2.3 DATABASE ON THE STUDY OF VIOLENCE

### 2.3.1 Historical context of databases on domestic violence

The lack of data in Latin American countries makes understanding criminality an arduous task. Information on the frequency, absolute numbers or rates, when disclosed, is offered without any correlation or evidence that might explain criminal phenomena. According to [Lima \(2008\)](#), Brazilian public institutions do not apply crime statistics when

<sup>9</sup> We can also specify the model such that the same set of variables is considered across flows; it is sufficient to assume that the coefficients of the severity variables in the first step are constrained to be equal to 1 in that case



making decisions, and there are no centers of study that can interpret the data. However, according to the author,

“ the analysis of Brazilian criminal statistics reveals that data exist and are part of the country’s criminal justice system history, but it does not turn, even after redemocratization, into information and knowledge. The increase in the amount of data produced, resulting from the technological modernization of the state, in turn, causes the opacity of overexposure and allows transparency discourses to be assumed but does not provoke changes in the rules and practices of government (what’s the use of having millions of records available if the non-specialist user does not know what they mean or translate?).”

The quality and disclosure of criminal data are issues in Latin America, as pointed out by [Alvarez \(2014\)](#). The lack of appropriate information leads to inadequate security measures, and there is no standard methodology in Latin America that enables comparability. In the context of Latin America, as pointed out by [Baliki \(2014\)](#), the latest relevant surveys were conducted in 2009-2010 by LatinoBarometre and between 2000 and 2008 by the ICVS, but they did not focus on the issue of domestic violence.

Data on domestic violence in Brazil are scarce. According to [Alves, Dumaresq e Silva \(2016\)](#), the discussion on violence against women as a public issue rather than a private one is new. Moreover, according to the author, it is difficult to employ exiting studies to guide the assessments of domestic violence. Policies and analyses on the topic are based on incomplete data, which can be accessed through the communication systems provided by the Ministry of Health and the National System of Statistics of Public Security and Criminal Justice from the Ministry of Justice. [Andrade et al. \(2016\)](#) used these data from the health system, SINAN, to study the prevalence of violence against women, as well as the characteristics of the victims, in the state of Minas Gerais.

As we can see, there is no institution or policy that provides this information in a consolidated way. That is, there are no research centers equipped with current data to properly diagnose the problem. As noted by [Perova e Reynolds \(2015\)](#), there is no national survey in Brazil that can raise issues related to domestic violence. As the authors point out, obtaining such information represents a considerable challenge.

The latest research on victimization in Brazil was conducted in 2012, ([SENASP, 2013](#)). The survey includes 12 types of crime, robbery (1) and theft of cars (2), robbery (3) and theft of motorbikes (4), robbery (5) and theft (6) of objects or goods, kidnapping (7), fraud (8), traffic accidents (9), assault (10), sexual offenses (11) and discrimination (12). Regarding information on violence against women, according to the survey, 24.3% of women suffered sexual harassment in their homes. Regarding the identities of these offenders, 6.7% of women reported that it was their current mate, while 6.7% were former

mates. Regarding the report of sexual crimes, 37.8% of victims did not report the act, 33.4% informed relatives, and 28% reported to friends<sup>10</sup>.

There are countries that have surveys capable of collecting information regularly to further understand the nature of crime, expanding the knowledge gained from official public safety statistics. For example, in the USA, there is the National Crime Victimization Survey (NCVS), for which data have been collected since 1973, and currently, it surveys a sample of 90,000 households each year, with 160,000 people interviewed.

As noted, the most recent research is limited in its analysis of the effects of violence against women, much less in its analysis of domestic violence. Therefore, a database is needed that considers and expands our understanding of the issue of domestic violence at the individual level. It is also essential to create a database, as in other countries, to monitor and collect data on victimization, especially related to domestic violence.

### 2.3.2 PCSVDF<sup>MULHER</sup> database

This study is part of the PCSVDF<sup>MULHER</sup> (Survey of Socioeconomic Conditions and Domestic and Family Violence against Women<sup>11</sup>). A total of 10,094 women, aged 15-49, were interviewed, distributed across all nine capitals of Brazil's Northeastern Region. This research has interdisciplinary characteristics, and its objective is to study domestic violence, the health of women and children, and the relationship between women and men in the household.

To pursue the aims of the research project, some restrictions were imposed on the initial sample of 10,004 women. The first selection criterion is to consider women who have or had partner(s) over their lifetime<sup>12</sup>. The second restriction is to consider those women who agreed to respond to the section on acts of IPV. Considering these restrictions and the missing information from the variables used in the econometric model, we have 4,862 observations.

<sup>10</sup> Perhaps the only longitudinal database on victimization in Brazil is the survey carried out for the city of São Paulo in 2003, 2008 and 2013, [CPP-Insper \(2013\)](#). The research covers the topics of theft, robbery, aggression and larceny crimes. Regarding physical and verbal aggression, in 2013, 32.9% and 12.3% of the victims recorded the incident, respectively. The executive summary does not contain information on cases of violence against women.

<sup>11</sup> The main motivation for the PCSVDF<sup>Mulher</sup> was to develop a unique, longitudinal data set that would allow for the study of domestic violence, resource allocation and the distribution of bargaining power at home, health outcomes and children's cognitive-emotional development through an interdisciplinary approach. The group of scientists in charge of the first two waves (2016-2017) of PCSVDF<sup>Mulher</sup> included José Raimundo Carvalho (CAEN/UFC and LECO/CAEN, Brazil – Principal Investigator and Study Coordinator), Heidi Colleran (Max-Planck-Institut für Menschheitsgeschichte, Germany), Thierry Magnac (University of Toulouse, France), Miriam Muller (World Bank, USA), Elizaveta Perova (World Bank, USA), Victor Hugo de Oliveira (IPECE and LECO/CAEN, Brazil), Climent Quintana-Domeque (University of Oxford, UK), Eva Raiber (University of Toulouse, France), Paul Seabright (Institute for Advanced Study in Toulouse, France), and Jonathan Stieglitz (Institute for Advanced Study in Toulouse, France).

<sup>12</sup> Whether they cohabitated is irrelevant. Women may (or may not) be/have cohabitated.

### 2.3.3 Measures

#### **Dependent variable:**

The dependent variable consists of three transitions: 1) whether the woman suffered domestic violence, 1 = Yes and 0 = No; 2) after having suffered violence, the woman reported it, 1 = Yes and 0 = No; 3) the woman decided to seek help from the police/DEAM, 1 = Yes and 0 = No. The first variable was created to verify whether the woman suffered any violent, emotional, physical or sexual abuse throughout her life. The second variable indicates whether the woman reported any of the 16 options listed in table 2.4. Finally, the third variable was created to capture only choices 1 and 2 from the table, that is, the woman sought help from the police, a DEAM or both<sup>13</sup>. Two additional notes are relevant here:

1. The first is the difference between reporting and speaking. The act of speaking to someone is not necessarily an act of reporting, and it is not considered in this work. In this study we use “to report” in the sense that the woman went to a place or to someone to seek help.
2. In the third layer, we consider whether the woman went to the police/a DEAM, regardless of whether she went to another place or person as well, since our interest is in whether she reported the act to the police, a DEAM, or both.

#### **Control variables:**

##### *– Demographic variables:*

Based on the literature, victim characteristics should be analyzed. Thus, **Age** is a variable that takes values between 15 and 49 years. **Education** is numerical, where the value 1 represents no schooling and the value 9 represents graduate school.

For the socio-demographic binary variables, we have the following: **Woman’s religion** classified as 1 = Catholic and 0 = Non-Catholic; **Woman’s race** encoded as 1 = White and 0 = Non-white; **Bolsa Família**<sup>14</sup> 1 = Yes and 0 = No; **Woman smokes currently** 1 = Yes and 0 = No; **Woman drinks currently** 1=Yes and 0=No; and **Woman is mother** 1 = Yes and 0 = No.

##### *– Knowledge variables:*

This research project explores women’s knowledge about violent acts by intimate partners, based on the assumption that the victim is a rational agent in choosing to report

<sup>13</sup> Our combination of the police/DEAM options is due to the confusion that many people experience with the practical use of the term “going to the police” being interpreted as “going to the police station”. That is, in some cases the concepts overlap in people’s minds. So we decided to use “seek help from the police/DEAM” jointly as a final decision by the victim

<sup>14</sup> The Bolsa Família program is a direct income transfer program that targets families living in poverty and extreme poverty throughout the country.

a crime or not, that is, she engages in cost/benefit analysis. To understand women's knowledge, this research project considers four domains:

1) The first domain is to understand whether the victim knows that an act by her partner is a violent act, that is, while she may be a victim, she does not know that the act is illegal, and she then treats it as natural. To consider this domain, the respondents were asked to answer the following question:

“The Maria da Penha Law was enacted in 2006 and brought many important changes to help fight DOMESTIC VIOLENCE. However, it is not clear if all women know what the law defines as DOMESTIC VIOLENCE. I will now read some sentences and ask you if you consider each to be an act of DOMESTIC VIOLENCE.”

2) The second domain analyzes the case in which the woman understands that an action of her partner is an act of violence, but she does not know the contents of the law and thus does not know that the act is subject to legal intervention.

“Please, listen carefully to each item and then answer if you agree that it is addressed by the "Maria da Penha Law", that is, considered by it.” 3) The third domain seeks to understand the victim's knowledge of the programs and services offered to victims. The victim may know that the act committed by her partner is violence and that it is illegal, but she may not know that these services are available.

“Now we would like to know more about what you know about women's rights and the different services available to support women who experience domestic violence. I will read out the name of a few laws, programs and available services to women. How often would you say you have heard about...”

4) The fourth domain is related to the woman's willingness to accept a man's violent acts. That is, whether she believes that a man's violent acts may be justifiable in reaction to a woman's behavior. The following question deals with this subject:

“In your opinion, do you agree it to be justifiable for a husband / partner to give slaps, punches, shoves, kicks or commit any other act of physical violence on his wife / partner in the following situations:”

For the first and second domains we have 6 (six) questions each about a violent act, and the response options are listed on a scale from 1 to 5, where 5 represents total agreement and 1 represents total disagreement. For the third domain, we have 7 (seven) questions, and the response options are listed on a scale from 1 to 3, where 1 represents “Never”, 2 represents “A little” and 3 represents “Many times”. Finally, in the fourth domain, there are 5 questions, and the response options vary between 1, total agreement, and 5, total disagreement. The questions are listed in table 3.10.

To create the scale, we summed the responses to the questions for each domain. Then, we standardized all scales to have the interval<sup>15</sup> 0 to 10. Thus, for the first, second and

<sup>15</sup> Our reason for using this procedure is to make the values similar to the scores obtained on a test of knowledge, as most such tests have values in a range from 0 to 10.

third domains, the higher the scale value is, the better the woman’s knowledge about domestic violence. For the fourth domain, the greater the scale value, the less willing the woman is accept that it is justifiable for a man to attack her in response to her behavior.

– *Violence experience:*

Three binary variables, emotional, physical and sexual violence, make up this section. These variables will only be considered in the 2nd and 3rd layers of the violence flow. The following actions are considered emotional violence: insults, depreciating the woman in front of her family or others, intimidation, and threatening to harm the woman or someone else. The following are considered physical violence: slapping, kicking, dragging, beating, pushing, or threatening/using a gun or a weapon against the woman. Sexual violence is defined as the following actions: forcing sexual relations, forcing a woman to engage in something degrading or humiliating, or a woman having sexual relations out of fear of the partner’s reaction if she refuses.

– *Additional information:*

The PCSVDF<sup>MULHER</sup> has a range of questions that go beyond what is already measured in the literature. One of the questions is whether the woman **tolerates/accepts physical violence** to keep the family together. This question has five response options, ranking between strongly agree and strongly disagree. We coded responses of “agree a little” or “strongly agree” as 1 and the other answers, “neither agree nor disagree”, “disagree a little” and “strongly disagree” as 0.

Another question concerns violent acts in a woman’s **social circle**. It was asked whether in the last 12 months, a woman in her social circle has been the victim of (exclusively) physical violence perpetrated by her partner. The variable has only the responses 1 = Yes or 0 = No.

– *Police Information:*

Above, we mentioned the importance of analyzing the impact of **DEAMs** on the violence flow. We consider two binary variables for this purpose. The first binary variable indicates whether the DEAM service is available in the city where a woman resides. The only capital that does not have a DEAM is Aracaju/SE, which takes value 0, and the other eight capitals take value 1. The second binary variable indicates if the capital has a **24-hour DEAM**. Only the capitals<sup>16</sup> Recife and Salvador receive a value of 1, while the other capitals take value 0. Finally we added a binary variable that corresponds to **presence of the police in the neighborhood** where 1 = Yes and 0 = No.

In table 2.1, we present the descriptive statistics of the predictor variables included in the model. By analyzing the table, we note that the average age of women was 33 years; the vast majority, 76%, are white; and the women’s religion is fairly balanced, with almost

<sup>16</sup> Note that Fortaleza’s DEAM has been a 24-hour on-call center since September 2016, immediately after the PCSVDF<sup>MULHER</sup> data collection

50% being Catholic and 50% being non-Catholic. The average education value was 4.7, meaning a high school education. Few of the women smoke; 40% consume alcohol; and 42% currently work. Many of the women are mothers. Regarding to knowledge about domestic violence, many received high values on the knowledge scale: regarding acts of domestic violence, the average was almost 8.9; the average value for acceptance was 9.5, showing that many women disagree that it is justifiable for women to suffer violence based on their behavior. We obtained satisfactory results regarding knowledge about the Maria da Penha Law; however, we observed only a moderate number of women aware of the services and programs offered to women in situations of violence. In the section on other information section, few women tolerate domestic violence and 31% of women know women in their social circles who have been victims of physical violence. In the police information section, 85% of women are aware that police are available. The last section contains information on the data distribution regarding domestic violence: the most prevalent type of violence in data was emotional, at 26%.

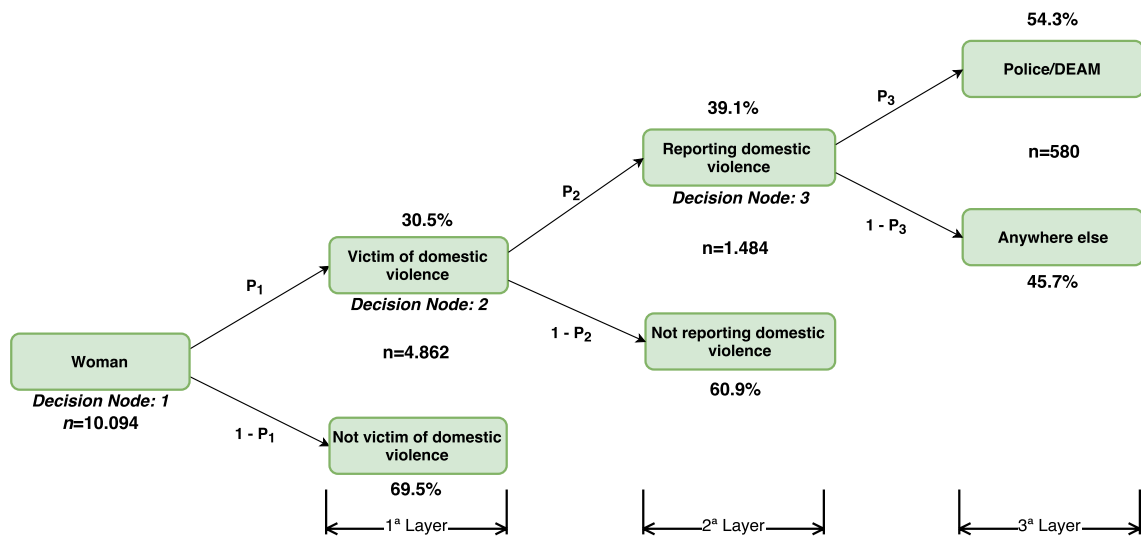
Table 2.1 – Description of variables and summary statistics in 2016 (n=4,862)

Variables	Description	mean ( $\pm$ SD)	Min	Max
<b>Socio-economic</b>				
Age	Age in years	33.10 ( $\pm$ 9.38)	15	49
White	Woman's race	0.76 ( $\pm$ 0.43)	0	1
Catholic	Woman's religion	0.51 ( $\pm$ 0.50)	0	1
Education	Woman's education	4.71 ( $\pm$ 1.90)	1	9
Bolsa Família	Woman received Bolsa Família	0.20 ( $\pm$ 0.40)	0	1
Work	Woman works currently	0.42 ( $\pm$ 0.49)	0	1
Smoke	The woman smokes currently	0.08 ( $\pm$ 0.27)	0	1
Drink	The woman drinks alcohol currently	0.39 ( $\pm$ 0.49)	0	1
Woman is mother	The woman is a mother	0.72 ( $\pm$ 0.45)	0	1
<b>Knowledge</b>				
Domestic violence	Knowledge scale for domestic violence	8.91 ( $\pm$ 2.01)	0	10
Maria da Penha Law	Knowledge scale for the Maria da Penha Law	8.06 ( $\pm$ 1.51)	0	10
Programs and services	Knowledge scale for programs and services	6.37 ( $\pm$ 1.52)	0	10
Acceptance	Knowledge scale for the acceptance of violence	9.52 ( $\pm$ 1.37)	0	10
<b>Others informations</b>				
Victim at Social network	Woman has victim(s) in her social network	0.31 ( $\pm$ 0.46)	0	1
Tolerate physical violence	Woman tolerates physical violence	0.02 ( $\pm$ 0.15)	0	1
<b>Police informations</b>				
DEAM	Presence of a DEAM in the city	0.90 ( $\pm$ 0.30)	0	1
DEAM 24h	The DEAM is open 24 hours	0.25 ( $\pm$ 0.44)	0	1
Police presence	Police presence in the neighborhood	0.85 ( $\pm$ 0.36)	0	1
<b>Violence experience</b>				
Emotional violence	The woman suffered emotional violence	0.26 ( $\pm$ 0.44)	0	1
Physical violence	The woman suffered physical violence	0.17 ( $\pm$ 0.37)	0	1
Sexual violence	The woman suffered sexual violence	0.07 ( $\pm$ 0.26)	0	1

## 2.4 ECONOMETRIC MODEL

Figure 2.3 below provides a broader picture of the flow and process of violence. Most current studies in the area of domestic violence and crime reporting (general or domestic violence) consist of determining the factors that explain each layer of this structure separately. However, in our model, we understand that there are three paths to be studied in the topic of domestic violence.

Figure 2.3 – Empirical violence tree



The purpose of this research is to extend empirical studies on violence by considering a structure of violence. We want to explore the effects of predictor variables along the tree. Our aim is to determine which factors have the greatest impact on the probability of transition in the tree.

### 2.4.1 Sequential logit model

In contrast to traditional methodologies, the present research seeks to estimate the entire violence flow. To achieve this goal, we applied the sequential logit model (MADDALA, 1983). The sequential logit model estimates the relationship between explanatory variables and the odds of passing each transition. One of the virtues of the methodology proposed by Buis (2015) is its ability to calculate the size of the effect of the explanatory variables on the final result of the choice structure. The effect on the final outcome is a weighted sum of the effects on each transition.

These decisions are assumed to be completely independent. Thus, one can estimate the effects on passing each transition by running separate logistic regressions for each transition on the appropriate subsample.

The logit sequential can be written as follows:

$$\begin{aligned} P_1 &= P(\text{violence} = 1 | \mathbf{X}) = \Lambda(\mathbf{X}\beta_1) \\ P_2 &= P(\text{report} = 1 | \mathbf{Z}, \text{violence} = 1) = \Lambda(\mathbf{Z}\beta_2), \text{ if suffered violence} \\ P_3 &= P(\text{police} = 1 | \mathbf{Z}, \text{report} = 1) = \Lambda(\mathbf{Z}\beta_3), \text{ if decided report} \end{aligned}$$

The function  $\Lambda(\cdot)$  is the logistics function,  $\Lambda(\cdot) = \frac{\exp(\cdot)}{1+\exp(\cdot)}$ . The conditional probability that person  $i$  passes transition  $k$  is  $P_k$ , where  $k = 1, 2, 3$ . Then, for example,  $\beta_{1k}$  is the effect of the first variable  $x_{1k}$  on the probability to pass the transition  $k$ . We have two sets of data to consider here,  $\mathbf{X}$  and  $\mathbf{Z}$ . The only difference we will observe in  $\mathbf{Z}$ , relative to  $\mathbf{X}$ , is the inclusion of three severity indicators.

As [Buis \(2015\)](#) points out, this model has two main characteristics. The first is to estimate the relationship between the variables/factors of interest and the probability of experiencing transitions. The second is to explore the effect of these variables on achieving the highest flow result, through the weighted sum of these effects between transitions (see [Buis \(2015\)](#)).

In order to link the effects of a variable on passing transitions and the effect of that variable on the final outcome, it is necessary to first consider how the final outcome can be quantified. By assigning values to each transition ( $l_k$ ), it becomes possible to use the sequential logit model to calculate the expected value for the final outcome ( $E(L_i)$ ). The expected value is a weighted sum of the  $l_k$ s, where the weights are the probabilities of achieving transition  $k$ . For example, based on figure 2.3, we can derived  $E(\text{Police/DEAM})$  (the final outcome):

$$E(\text{Police/DEAM}) = (1 - \hat{p}_{1i})l_0 + \hat{p}_{1i}(1 - \hat{p}_{2i})l_1 + \hat{p}_{1i}\hat{p}_{2i}(1 - \hat{p}_{3i})l_2 + \hat{p}_{1i}\hat{p}_{2i}\hat{p}_{3i}l_3 \quad (2.2)$$

In our research, as summarized in figure 2.3, we considered three final paths with the following parameterization:

1. The woman suffered violence ( $l_0 = -1, l_1 = 0, l_2 = 0, l_3 = 0$ )  $\longrightarrow P_1$
2. The woman suffered violence & decided to report the crime ( $l_0 = 0, l_1 = -1, l_2 = 0, l_3 = 0$ )  $\longrightarrow P_1 \times P_2$
3. The woman suffered violence & decided to report the crime & decided to ask for help from the police/DEAM ( $l_0 = 0, l_1 = 0, l_2 = 0, l_3 = 1$ )  $\longrightarrow P_1 \times P_2 \times P_3$

Equation 2.2 can be understood as a regression equation showing a non-linear relationship. One way to quantify the effects of an explanatory variable on the final outcomes is the first derivative of equation 2.2 with respect to this explanatory variable ([BUIS, 2010](#)).



Through this type of probability structure, we can calculate, for example, the marginal effects of the variables considered in this study on the total probability of a woman being a victim, then deciding to report the crime and finally electing to go to the police/DEAM, that is,  $P_1 \times P_2 \times P_3$ . The first derivative of equation 2.2 is as follows:

$$\frac{\partial E(.)}{\partial x_j} = \begin{array}{l} \{1 \times \hat{p}_{1i}(1 - \hat{p}_{1i}) \times [(1 - \hat{p}_{2i})l_1 + \hat{p}_{2i}(1 - \hat{p}_{3i})l_2 + \hat{p}_{2i}\hat{p}_{3i}l_3 - l_0] \} \hat{\beta}_{j1} + \\ \{ \hat{p}_{1i} \times \hat{p}_{2i}(1 - \hat{p}_{2i}) \times [(1 - \hat{p}_{3i})l_2 + \hat{p}_{3i}l_3 - l_1] \} \hat{\beta}_{j2} + \\ \{ \hat{p}_{1i}\hat{p}_{2i} \times \hat{p}_{3i}(1 - \hat{p}_{3i}) \times [(l_3 - l_2)] \} \hat{\beta}_{j3} \end{array}$$

The marginal effect, say  $x_j$ , on each final result consists of a weighted sum of log-odds effects of  $\beta_{jk}$  at each transition; for details, see Buis (2015). The weights (presented within curly brackets) consist of the following three parts:

- i) the proportion of people at risk of experiencing a transition. The transition receives a larger weight if more people pass through it;
- ii) an indicator variable denoting whether a woman goes through the transition. The transition receives a larger weight if the probability of passing through is close to 50%; and
- iii) the difference in expected outcome between those who passed through the transition and those who did not. The transition receives a larger weight if individuals earn more in the transition.

As noted in Buis (2010), the weights are the product of the risk ratio, the variance, and the expected gain:

$$\frac{\partial \text{outcome}}{\partial x_j} = \sum (\text{at risk}_k \times \text{variance}_k \times \text{gain}_k) \beta_{jk}$$

In addition, to calculate these two characteristics, Buis (2010) developed a sensitivity analysis in the model, the objective of which is to analyze the unobservable effects, and he proposes a tool that can help in the investigation of unobserved heterogeneity by comparing and simulating different scenarios. The author addresses several ways to incorporate unobserved effects. In our model, we do not study this problem in depth by analyzing each situation or scenario. In this study, we will analyze the case in which we assume that the unobserved quantity is constant across transitions and that it exhibits a standard normal distribution. This effect not observed in our model can be visualized as follows:

$$P_1 = P(\text{violence} = 1 | \mathbf{X}) = \Lambda(\mathbf{X}\boldsymbol{\beta}_1 + \beta_u u)$$

$$P_2 = P(\text{report} = 1 | \mathbf{Z}, \text{violence} = 1) = \Lambda(\mathbf{Z}\boldsymbol{\beta}_2 + \beta_u u), \text{ if suffered violence}$$

$$P_3 = P(\text{police} = 1 | \mathbf{Z}, \text{report} = 1) = \Lambda(\mathbf{Z}\boldsymbol{\beta}_3 + \beta_u u), \text{ if decided report}$$

where  $u$  is the standardized unobserved variable with the distribution  $N(0, 1)$ , while  $\beta_u$  is the common feature between transitions. We can see this problem in another way. According to [Buis \(2011\)](#),  $v = \beta_u u$  may be understood as a random error or nonstandard random variable. Note that  $v$  has standard deviation  $\beta_u$ , so it is an unobserved, non-standard variable.

## 2.5 RESULTS

The following results consist of three parts. The first is the analysis of the predictor variables through the sequential model. In this model, we analyze the effects of the variables between transitions. In the second part, we estimate the total effects of the variables on the final result. Finally, we will discuss the unobserved effect.

A sequential logit model was estimated to analyze the variables' behavior in the violence tree, and the results can be seen in [Table 2.2](#). In the table, the coefficients are in the form of marginal effects, that is, the effect on the probability of a given result. The first model examines the effects of the predictor variables on the probability of women suffering domestic violence. In the second model, we analyze the effect of these variables on the probability of reporting a violent act (since the woman was a victim). Finally, in the third model, we analyze the influence of these variables on the woman reporting to the police/a DEAM (since she was a victim and decided to report the incident). All models include variables on socioeconomic characteristics, knowledge, police and DEAM presence, and violence. However, it is worth remembering that the severity of violence will be analyzed only in the last two decisions.

### **Effects on Domestic Violence**

Considering the first stage, we find some results that may explain such violence. We first highlight the effect of Bolsa Familia, which increases by 5% the likelihood of suffering violence, supporting findings in [Moreira et al. \(2016\)](#). Being Catholic reduces the likelihood of suffering violence by approximately 10%. Being a smoker has a very significant impact on the likelihood of being a victim of violence of 14%. A woman who received the maximum score, 10, on the questions related to the Maria da Penha Law has a 10% lower likelihood of suffering violence. Women whose social circles include other women who have been victims of physical violence by their partner are 17% more likely to be victims, that is, if a woman is in a social environment where this kind of act is common, she is more likely to be victimized by her partner. When being present in such an environment is combined with a woman being willing to tolerate violence to keep the family together, she is 27% more likely to be a victim. One of the aims of our analysis is to determine the effect of DEAMs as a public policy to combat domestic violence. We observe that the presence of a 24-hour DEAM inhibits violence, that is, in numbers, the presence of a 24-hour DEAM

Table 2.2 – Summary of the sequential logit model, n=4,882

Variable	Violence vs. no violence	Report vs. no report	Police/DEAM vs. no police/DEAM
<b>Socio-economic</b>			
Age	0.001 (0.001)	0.002 (0.001)*	-0.002 (0.002)
White	0.010 (0.015)	-0.006 (0.017)	-0.077 (0.044)*
Catholic	-0.096 (0.013)***	-0.006 (0.015)	-0.053 (0.039)
Education	-0.014 (0.004)***	0.000 (0.004)	-0.015 (0.011)
Bolsa Família	0.049 (0.017)***	0.014 (0.018)	0.023 (0.043)
Work	0.014 (0.013)	0.002 (0.015)	0.064 (0.039)
Smoke	0.143 (0.026)***	0.026 (0.023)	-0.081 (0.047)*
Drink	0.088 (0.014)***	0.004 (0.015)	0.027 (0.039)
Woman is mother	0.061 (0.015)***	0.007 (0.019)	0.179 (0.050)***
<b>Knowledge</b>			
Domestic violence	0.000 (0.033)	0.006 (0.041)	-0.009 (0.113)
Maria da Penha Law	-0.010 (0.042)**	0.005 (0.051)	0.051 (0.143)***
Programs and services	0.004 (0.043)	0.010 (0.052)**	0.050 (0.131)***
Acceptance	-0.001 (0.047)	0.016 (0.060)***	0.017 (0.157)
<b>Others informations</b>			
Victim in social network	0.171 (0.015)***	0.017 (0.015)	0.022 (0.037)
Tolerates physical violence	0.275 (0.046)***	-0.002 (0.032)	-0.083 (0.070)
<b>Police informations</b>			
DEAM	0.029 (0.021)	-0.024 (0.027)	0.134 (0.055)**
DEAM 24h	-0.030 (0.015)**	0.081 (0.020)***	-0.056 (0.041)
Police presence	-0.031 (0.018)*	-0.014 (0.020)	0.021 (0.046)
<b>Violence experience</b>			
Emotional violence	-	0.112 (0.015)***	-0.038 (0.059)
Physical violence	-	0.178 (0.014)***	0.226 (0.037)***
Sexual violence	-	0.044 (0.017)**	0.096 (0.041)**

Signif. levels: '\*\*\*' = 0.01 | '\*\*' = 0.05 | '\*' = 0.1

Coefficients are the marginal effects, and standard errors are reported in parentheses  
STATA software and the package *seqlogit* were used to conduct the analysis

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reduces by 3% the probability of a woman suffering violence. Another factor that may reduce violence is a police presence in a neighborhood, which reduces the probability of a woman being victimized by 3%.

### Effects on crime reporting

Regarding a woman's decision to report a violent act by her partner, we find interesting results that corroborate the findings reported in the literature. The first of these concerns the literature on communicating the act: socioeconomic variables are not able to explain this decision; only age had a mild positive effect on reporting, with older people tending to report more, as noted by [Skogan \(1976\)](#) and [MacDonald \(2001\)](#). Regarding the level of knowledge, the variable capturing knowledge of programs and services that care for women had strong explanatory power: for women who scored the maximum of 10, their likelihood of reporting increased by 10%. The severity of a violent act continues to be the variable with the greatest impact on the probability of reporting the crime, as the literature points out. The size of the effect was quite significant; women who suffered

physical violence have an almost 18% higher probability of reporting the crime, those who suffered some kind of emotional violence have an 11% likelihood of reporting, and finally, experiencing sexual violence is associated with the lowest likelihood of reporting at 4.5%. Regarding the DEAM effect, we observed an immediate effect of having a 24-hour DEAM. Cities that have a 24-hour DEAM exhibit an 8% higher likelihood of women deciding to report the crime.

### **Effects on requesting help from the police/DEAM**

In the last decision stage, we have the woman's choice to go to the police/DEAM. Similar to the second decision, few socioeconomic variables were significant. For women who are mothers, there is a high probability, of nearly 18%, of reporting a violent act by their partner to the police. In such cases, the women attempt to protect their children from witnessing or experiencing violence, thus maximizing their likelihood of searching for help ([GARCIA-MORENO ALESSANDRA GUEDES, 2012](#)). Being white has a negative impact on seeking help from the police; the decline in probability in this case is approximately 8%. Again, we observe positive effects of the knowledge variables, as having knowledge of the Maria da Penha Law and the services and programs available both increase by 5% the probability of seeking help from the police/DEAM. The severity variables also show greater explanatory power in this decision. Having suffered physical violence increases by 22% the probability of seeking help from the police, having suffered sexual violence increases the likelihood of seeking help by 10%, but having suffered emotional violence yielded no significant results. We found positive results of the presence of a DEAM where a woman lives: the presence of a DEAM increases the probability that women who were victims of domestic violence will report it by 13%.

### **Joint effects on the probability of the final result**

We now discuss the results obtained regarding how the variables affect the final outcome of the flow. The final result is threefold: the first result is to be a victim, the second is to be a victim and deciding to report, and the third is to be a victim, deciding to report, and asking for help from the police/DEAM.

It is worth discussing our attempt to explain the total effect within the flow. As we pointed out, there is no research on domestic violence that takes into account the entire flow from the 1st layer to the 3rd layer. Researchers restrict their attention to analyzing each step separately. We estimate the entire flow, and we now discuss the joint effects highlighted in section 2.4.

Table 2.3 summarizes these three total effects. It is easy to see that the first overall effect is actually the first layer effect reported in table 2.2, so we will not comment on those results, as we have done so above.

We turn to the second overall result, which is “suffer violence and report a crime”. First,

Table 2.3 – Total effect for the violence flow

Variable	Violence vs. no violence	Suffer violence and Report a crime	Suffer violence Report and go to the police/DEAM
<b>Socio-economic</b>			
Age	0.001 (0.001)	0.000 (0.001)	0.000 (0.000)
White	0.010 (0.015)	-0.010 (0.013)	-0.005 (0.004)
Catholic	-0.096 (0.013)***	0.075 (0.012)***	-0.014 (0.004)***
Education	-0.014 (0.004)***	0.011 (0.003)***	-0.002 (0.001)**
Bolsa Família	0.049 (0.017)***	-0.035 (0.015)**	0.009 (0.005)*
Work	0.014 (0.013)	-0.011 (0.012)	0.006 (0.004)
Smoke	0.143 (0.026)***	-0.103 (0.023)***	0.010 (0.007)
Drink	0.088 (0.014)***	-0.069 (0.012)***	0.011 (0.004)***
Woman is mother	0.061 (0.015)***	-0.046 (0.014)***	0.018 (0.004)***
<b>Knowledge</b>			
Domestic violence	0.000 (0.033)	0.002 (0.029)	0.000 (0.010)
Maria da Penha Law	-0.010 (0.042)**	0.010 (0.037)***	0.003 (0.013)**
Programs and services	0.004 (0.043)	0.000 (0.039)	0.005 (0.013)***
Acceptance	-0.001 (0.047)	0.006 (0.042)	0.003 (0.015)**
<b>Others informations</b>			
Victim in social network	0.171 (0.015)***	-0.131 (0.013)***	0.020 (0.004)***
Tolerates physical violence	0.275 (0.046)***	-0.224 (0.042)***	0.014 (0.012)
<b>Police informations</b>			
DEAM	0.029 (0.021)	-0.030 (0.018)*	0.010 (0.005)*
DEAM 24h	-0.030 (0.015)**	0.049 (0.013)***	0.004 (0.004)
Police presence	-0.031 (0.018)*	0.020 (0.016)	-0.003 (0.005)
<b>Violence experience</b>			
Emotional violence	-	0.037 (0.005)***	0.014 (0.004)***
Physical violence	-	0.059 (0.004)***	0.042 (0.004)***
Sexual violence	-	0.015 (0.006)**	0.013 (0.004)***

Signif. levels: '\*\*\*' = 0.01 | '\*\*' = 0.05 | '\*' = 0.1

Coeficientes são os efeitos marginais e entre parênteses estão os erros padrões

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it is observed that there are now many significant results, unlike the findings reported in table 2.2. A second point to note is the small effect size of the severity variables. “Being Catholic” represents an almost 8% increase in the likelihood of reporting a crime, and educational level has significant and positive effect. Note the 3% negative effect of Bolsa Familia receipt on the likelihood of reporting a crime. Women who receive Bolsa Familia are more likely to be financially dependent on their partners, which encourages women to remain silent, and this finding corroborates findings in the literature, as do the findings on motherhood, for which we observe a negative effect of nearly 5% on the likelihood of reporting a crime. Another important factor is a woman’s social circle; if a woman lives in an environment where domestic violence is common, then she has a 13% lower probability of reporting a crime. Our explanation for this finding is that if abuse is

present in a woman's daily life, she might not believe that there is a solution for this type of conflict with her partner. Related to this conjecture, a woman who accepts physical violence has a 22% lower likelihood of reporting such an act to someone else. Regarding the victim's knowledge, the only significant finding was for the Maria da Penha Law, with 10% reporting the crime.

In our study, we are mainly interested in the effect of DEAMs. When examining this effect in the second overall result, we noticed that the presence of a DEAM decreased the likelihood of reporting by 3%, which appears to be the reverse of the expected effect. However, we might be observing a reduction in crime numbers, which is reflected in decreased reporting. Regarding the effect of a 24-hour DEAM, the result is positive; having a DEAM operate for 24 hours affects women's immediate decisions. Therefore, the presence of a 24-hour DEAM may encourage women to decide to report a crime. A reduction in severity levels is also apparent.

Observing the overall effect for the third result, that is, suffering violence, reporting and then going to the police/DEAM, we noticed that receiving Bolsa Familia and being a mother now have positive effects. Thus the woman's decision goes against the hypothesis of [Gottfredson e Gottfredson \(1988\)](#) in the sense that she demands intervention by the state in a situation that is no longer under her control. Similarly, when a woman has victims in her social circle, she is 2% more likely to go to the police/DEAM. Regarding the severity indicators, there was a reduction in these effects relative to the separate logistic regressions, but physical violence continues to have the greatest effect on the total probability. Regarding the presence of a DEAM, the effect was positive and close to 1%.

### **Unobserved heterogeneity**

The decision to assess the degree of unobserved heterogeneity is made to evaluate how sensitive the results may be. The strategy is to create multiple scenarios and analyze the degree of unobserved effects. Our main observable variable is the presence of a Women's Specialized Police Station (DEAM). We analyze how this variable behaves under a random effect from a standard normal distribution, varying within a range of -3 to 3. Since the 24-hour DEAM variable was significant only in the first and second layers as reported in [table 2.2](#), we will analyze the effect in these layers. We follow the same procedure for the presence of a DEAM, where we obtained significant results only for the third layer. The graphs of these effects are presented in [figure 2.4](#). In the graphs, we present the odds-ratio effects due to the computational limitations. The use of odds-ratios does not change the interpretation of the direction of the effects. We can interpret this unobserved effect as per capita spending on public security or as spending on advertising and others, which are variables used in the work of [Perova e Reynolds \(2017\)](#). The results we obtain are not satisfactory. The purported unobserved effect is dubious. For example, if there is a 1 standard deviation shock (in either direction) to unobserved heterogeneity, then it would have an equal impact on the model in the three comparisons we consider.

## 2.6 DISCUSSION AND CONCLUSION

There are no extant works in the criminological literature that analyze the entire domestic violence flow through a sequential structure of aggressor and victim decisions. Much of the literature estimates stages of this flow due to sample restrictions and is limited to studying only one decision. The present work extends the scope of this theme by applying a sequential model. This model has some interesting features. One of them is to understand how the variables behave between transitions. We can analyze which of them has greater explanatory power for the transitions. Another interesting point of this model is its ability to analyze the total effect on the final result. In our study, we had three possible final results: the woman was the victim of her partner, the woman was a victim and decided to report, and finally, the woman was victim, decided to report and sought help from the police/DEAM.

There are few international studies that specifically study crime reporting in the context of domestic violence. In Brazil, there are almost no studies that go beyond simple prevalence reports, and perhaps the only work that addresses this aspect of crime reporting is [Kiss et al. \(2012\)](#). There is thus a lack of knowledge of the factors that could motivate and direct public policy agendas, for both crime prevention and policies that can encourage women to seek help in such situations. In addition to extending the discussion and understanding of this problem, the present work incorporates in the Brazilian and world literature a study of the impact of the Women's Specialized Police Station (DEAM).

As [Moreira et al. \(2016\)](#), [Ellsberg et al. \(2015\)](#), [Pasinato e Santos \(2008\)](#) and [Perova e Reynolds \(2017\)](#) reinforce, there is still much to study about public policies capable of facing one of the great problems of the 21st century: domestic violence. In our work, we have capitalized on two public policies. We highlight the role of the DEAM as a catalyst for inhibiting and/or increasing the reporting of crime. Moreover, in a superficial or indirect way, we analyze a government program: Bolsa Família. The Bolsa Familia effect reflects an aspect of social vulnerability driven by the context in which women find themselves. We found out that women in this context are more likely to be victims of domestic violence.

DEAM yielded plausible effects regarding both the sequential model structure and the total effects. Our study helps to understand the DEAM's role in inhibiting and encouraging reporting of acts of IPV, thereby contributing to the scarce literature on the effectiveness of public security programs. In fact, regarding the first estimate, table 2.2 highlights that the DEAM has an inhibiting effect on acts of domestic violence, particularly if it is a 24-hour DEAM. We can reduce the likelihood of IPV by 3%, and we found robust values in the explanatory power for reporting, where the probability increased by almost 8.1%. In short, 24-hour DEAM has crime inhibiting and pro-reporting effects. Referring again to the same table, the presence of a DEAM increases by almost 13% the likelihood of seeking police help. These numbers are quite encouraging if we treat the estimates separately,

restricting the sample. However, when we consider the total probability, we find another interesting result. We observed that the presence of a DEAM has a negative impact on the second result. This can be attributed to the DEAM reducing crimes. Thus, with fewer crimes, we have fewer reports. Finally, the DEAM increases for the case of the joint domestic violence event, reporting to and seeking help from the police/DEAM, by 1%<sup>17</sup>.

Another interesting point of this work is that report variable effects in terms of the marginal effect on probability. Nearly all studies considered in our literature review use odds ratios. In the current research, we chose to use average partial effects (APE). This effect calculates the marginal effect of the variable of interest for each observation and then calculates the sample mean of that variable, that is,  $APE = E_x \left[ \frac{\partial E[y|x]}{\partial x} \right]$  (GREENE, 2011). Using APEs facilitates the interpretation of the results, as we measure this effect while controlling for other variables.

In our review of the theoretical literature, we stressed the importance of the victim's rationality. We addressed this by including questions related to the victim's knowledge of the topic. We made our findings analogous to those of an evaluative instrument with a score ranging from 0 to 10. We then operationalized this rational framework by using the following knowledge indicators: knowledge of the Maria da Penha Law, knowledge about violence perpetrated by one's partner and knowledge about services and programs available to support women. We emphasize the knowledge about the Maria da Penha Law. As we observe in the results, knowing about the law affects both the likelihood of suffering violence and on reporting the crime. We found an increase of 10% in the probability of reporting. Therefore, it is useful to carry out and maintain governmental policies capable of prompting discussion of and knowledge about the Maria da Penha Law into women's social environments.

We emphasize that we estimate the total probabilities in a sequential structure, which is novel in the literature. Using this model, we find some results that were not previously captured in the literature. One of them pertains to women's socioeconomic characteristics. Analyzing the total effect of the second layer, participating in Bolsa Família and being a mother had negative effects on the probability of reporting the crime to someone. Our explanation for the finding regarding Bolsa Família receipt is that these women live in an unfavorable social environment and are financially dependent on their partners, which negatively impacts the likelihood of reporting the violent act, which supports the findings of Basu e Famoye (2004) and Garcia-Moreno Alessandra Guedes (2012). The negative effect of a woman being a mother can be explained by the desire to attempt to resolve the conflict internally, as there are private domestic motives for such behavior, as we have

<sup>17</sup> It is important to mention that  $PCSVDF^{Woman}$  has characteristics that are desirable for our analyses. One of these characteristics is that it includes georeferenced information from the households interviewed. By using this information, we calculate the distance between the household and the DEAM in the city. This effect was tested through econometric modeling. We did not obtain significant results when including this effect, and thus we do not report this analysis.



seen in the work of [Gottfredson e Gottfredson \(1988\)](#), or even a hope that the partner will change his attitudes, as noted by [Garcia-Moreno Alessandra Guedes \(2012\)](#). We find that the greatest effects on this transition, in absolute terms, related to the woman's social circle and her being willing to tolerate physical violence, which have a negative impact.

When we analyze the effects of the severity variables on the total probability, we obtain different results regarding their size. Initially, these effects were much larger in the logit sequential model, and moreover, these variables have the greatest explanatory power, especially when the violence was physical. However, when analyzed from a joint probability perspective, the effect size decreases dramatically. Thus, when we restrict our sample, we tend to overestimate some of our parameters. This is why it is necessary to analyze the effects on the entire violence flow. It is possible that inserting other motivational/rational variables into this sequential model may produce greater explanatory power than the variable for an act of physical violence. We see in the second total result a point that highlights the difference between suffering violence and accepting physical violence. A woman may suffer physical violence and then tolerate it to keep the family together, which therefore reduces the reporting effect of having suffered physical violence. Thus, it is not enough for a woman to suffer an act of physical violence, as a willingness to tolerate it reduces the reporting effect. Therefore, campaigns that encourage reporting, especially those attempting to mobilize confrontation networks, that act as a catalyst to reduce this tolerance are important. [Garcia-Moreno Alessandra Guedes \(2012\)](#) clearly summarizes the consequences of such violence, including its impact on mental health. Making efforts to change this paradigm is critical.

We did not incorporate variables to capture offender characteristics or variables that capture the intensity of a couple's relationship; for example, a variable that could be considered would measure the how often a couple converses about their daily lives. Other possible variables include the discussion level of the couple, a variable that captures whether the woman has suffered domestic violence in past relationships or a measure of how aggressive the woman is toward people. All of these indicators could act as catalysts. Therefore, there is still much to be studied on the subject.

Future research could extend this work. One possible direction would be to increase the sequential structure to allow for an alternative flow structure. In some cases, the woman initially remains in her private circle and seeks assistance and support from friends and family or other sources of help and only later decides to pursue legal remedies and state intervention to address the problem. Other aspects of the victim's rationality are also able to explain the decision to seek help, such as a fear of death, a fear of revictimization, a fear of retaliation, a desire to protect her children, and many others that will have strong explanatory power. As we pointed out, these factors are strongly correlated in the 2nd and 3rd layers.

## 2.7 APPENDIX

Table 2.4 – Places/people to seek help from following domestic violence

Option	Description
1	Police
2	Women's police station (DEAM)
3	Service center for battered women
4	Special prosecutor's services / Public defender office of domestic violence
5	Brazilian's woman house
6	Dial 180
7	Hospital or health center
8	Social services
9	Legal advice center
10	Shelter
11	Local leader
12	Women's organization
13	Priest/Religious leader
14	Friends and family
15	Integrated center for women's support (CIAM)
16	Anywhere else

Font: PCSVDF *Mulher*

Table 2.5 – Issues that compose the four areas

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**DOMESTIC VIOLENCE**

- 1- He belittles or humiliates her in front of others.
- 2- He does things to intentionally scare or intimidate her (for example, by yelling or smashing things).
- 3- He threatens to hurt her or someone that she cares about.
- 4- He insists on having sex with her even after she initially refused his request.
- 5- He threatens to publish intimate photos or videos of her on the Internet.
- 6- He looks for calls/messages on her mobile phone, or he checks her email/social network account without her permission.

**PROGRAMS AND SERVICES**

- 1- The Maria da Penha Law
- 2- Women’s Specialized Police Station (DEAM)
- 3- Brazilian Women’s Shelter
- 4- Court of Domestic and Family Violence against Women / Prosecutors Office of Domestic Violence
- 5- Integrated Center for Women’s Support (CIAM)
- 6- Bureau of Policies for Women (SPM) / Bureau of Human Rights (SDH)
- 7- Dial 180

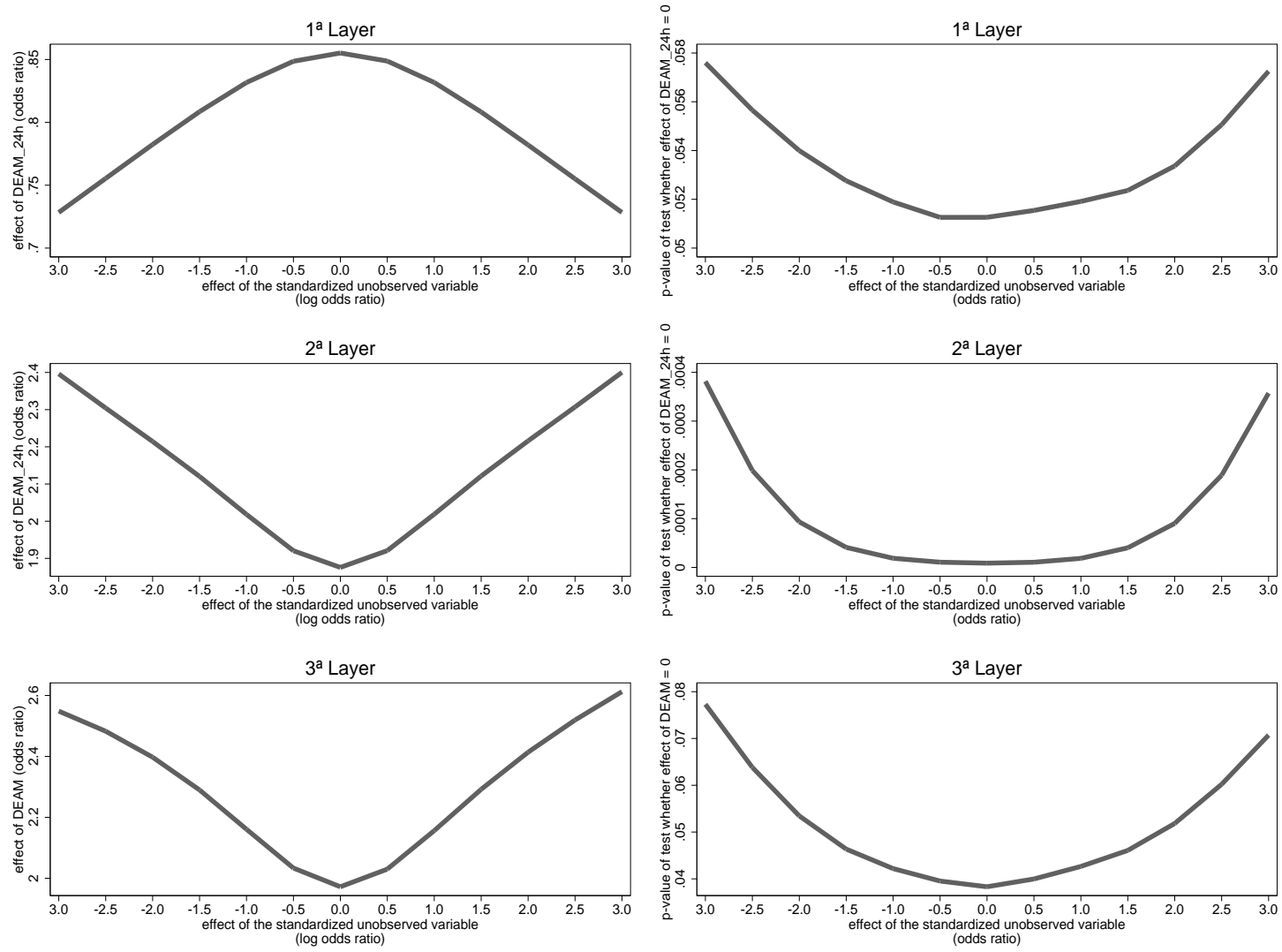
**MARIA DA PENHA LAW**

- 1- The law punishes perpetrators for committing domestic violence
- 2- Under that law, only the victim can report the offender
- 3- Under that law, after reporting aggression, a woman in some cases cannot withdraw her complaint
- 4- The Maria da Penha Law applies equally to lesbians, transvestites, transsexuals and heterosexuals
- 5- The Maria da Penha Law applies to cases of violence perpetrated by ex-husbands/ex-partners/ ex-lovers
- 6- Female victims of domestic violence who can’t afford to hire an attorney can go to Specialized Women’s Police Stations

**ATTITUDES/NORMS ABOUT GENDER RELATIONS**

- 1- If she has many male friends?
  - 2- If she neglects the couple’s children ?
  - 3- If she argues/fights with him?
  - 4- If she refuses to have sex with him?
  - 5- If she cooks bad food, doesn’t cook on time or doesn’t do laundry or other domestic chores?
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Figure 2.4 – Effect of unobserved heterogeneity on DEAM and 24-hour DEAM



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# 3 MODELING ATTRITION IN A LONGITUDINAL STUDY ON DOMESTIC VIOLENCE: THE CASE OF PCSVDF<sup>Mulher</sup>

## 3.1 INTRODUCTION

There have been notable advances in research that considers longitudinal (or panel) effects (MCDONALD et al., 2017). Longitudinal approaches are applied in diverse subject areas and have considerable scope for application in social research. One of the greatest advantages of this type of empirical investigation is its capacity to control for the heterogeneity present in sample units, e.g., individuals, firms, or establishments.

According to Baltagi e Song (2006), panel data approaches are preferred for identifying effects that cannot be observed in a cross-section and for time series data, in addition to being preferable for studying the dynamic individual behavior. These are the only regression techniques that can provide information about cumulative phenomena (SIDDIQUI; FLAY; HU, 1996). However, the greatest challenge in longitudinal studies is the presence of attrition (OLSEN, 2005). One of the consequences of attrition is sample selection bias and, consequently, distortions in the estimation of the effect of the variables of interest (ALDERMAN et al., 2001) (HAUSMAN; WISE, 1979). To this end, understanding which factors explain attrition is crucial to longitudinal studies.

In this work, we will investigate the factors responsible for the occurrence of attrition in the PCSVDF<sup>Mulher</sup> (Pesquisa de Condições Socioeconômicas e de Violência Doméstica e Familiar contra a Mulher – Survey of Socioeconomic Conditions and Domestic and Family Violence against Women). The PCSVDF<sup>Mulher</sup> is an interdisciplinary research project with the aim of studying domestic violence. In 2017, the second wave of this research was conducted, re-interviewing 10,094 women. As in any longitudinal study, attrition is a recurring problem (OLSEN, 2005). Thus, we attempt to model women's decision to stop participating in the survey. The considerable importance of addressing this issue becomes clear once one recognizes that women's decision to drop out may influence observed domestic violence rates, lead to underestimated results, cause sample selection problems and, consequently, invalidate the estimates obtained from their survey data.

This analysis will be conducted in three stages. The first one will be a comparative evaluation of the profile of the interviewed women who continue to participate and those who have not. This stage is very important for studying attrition. For this purpose, we classified all 10,094 women into two groups, those who dropped out and those who continued to participate. In the second stage, we refine the concept of attrition, classifying

it into two sub-types. In the third stage, we further detail the attrition categories to collect specific information related to gender issues, and we use multinomial models. In this stage, we narrow our focus to those women who already had a partner and agreed to answer questions related to domestic violence.

This work differs from others in three respects. The first one is that we model the attrition in a longitudinal population survey designed to collect information about the determinants and effects of domestic violence. The second is our capacity to operationalize attrition in a more disaggregated way. In so doing, we can classify attrition in several ways, not only in a binary way. The third aspect of this work is to study how the gender relations in households may affect a woman's decision to continue to participate in the survey.

We obtained significant results in our attrition modeling. The attrition rate for the survey was 53.8%. Descriptively, the univariate analysis revealed the existence of differences between two groups of women, those who dropped out and those who did not. The women who dropped out have a lower average age, higher labor market participation, and a higher education level, and include the largest share of white women. Furthermore, 32% of these women had reported an intention to leave their partners.

From the application of logistic models, we detected that age, a low level of education, and having children under 4 years of age are factors that favor a woman's continuation in the survey, corroborating some findings from the international literature ((MCHUGO et al., 2005), (STONE; LOVEJOY, 2004), (LEITH, 2006), (YOUNG; POWERS; BELL, 2006)). The expectation of moving has shown to be positively correlated with attrition, and its effect increases the probability of attrition from 9% to 14% (WATSON; WOODEN, 2009). Another important factor determining interview participation is a refusal to respond to questions during the previous interview, which increases attrition by approximately 7%. Our estimates accord with prior findings in the literature.

One of the objectives of our econometric modeling is to identify the effects of the gender relations between the woman and her partner on attrition. To do so, we added partner characteristics and indexes of domestic violence experience into the model. The results reveal evidence suggesting that the decision to continue in the survey may be related to male dominance at home. We found positive effects on attrition when a woman has been a victim of domestic violence anytime during her life. In addition, if the woman's partner has been involved in fights, this favors attrition.

This chapter is divided into four sections. Section two discusses the theoretical literature on attrition in longitudinal studies, as well as its consequences: selection bias and the difficulty of retaining female domestic violence victims in longitudinal studies. In section three, we describe the database used in this research, detailing the characteristics of PCSVDF<sup>Mulher</sup> and the process of re-interviewing women from wave 1, difficulties encountered in the field and the concept of attrition used in this work. In the next section,

we describe our data analysis methods and sample snippets. The results will be discussed in section 5, and the last section offers final considerations.

## 3.2 LITERATURE REVIEW

### 3.2.1 Attrition in general

Attrition is defined as the failure to retain participants in subsequent waves of a study, after the baseline. Some reasons for attrition are death, disability, discontinued participation, a failure to work to retain participants or the failure to return to a participant (YOUNG; POWERS; BELL, 2006). The quality of longitudinal researches depends on continuously following individuals, and ensuring the presence of all participants in all measurements is a challenge (SIDDIQUI; FLAY; HU, 1996).

One of the greatest concerns in relation to attrition is the shape of its randomness. If an attrition action (desistance, refusal, death or another reason) is a random phenomenon, i.e., there is no correlation with the observables, the sub-sample of remaining participants would also be random (Ribas e Soares (2010) and Oliveira e Soares (2012)). Otherwise, if this sub-sample is not random, the econometric modeling of a given phenomenon will result in inconsistent estimation (DUSTMANN; ROCHINA-BARRACHINA, 2007).

Adopting a statistic perspective, the first discussion of the inference process in distributions with missing data appear in the seminal work of Rubin (1976). However, Little e Rubin (2002) discuss and offer tools capable of dealing with data containing this feature. Furthermore, these authors consolidate the theoretical aspects of this literature and developed a terminology and formalization of missing-data mechanisms. The authors offer the following terminology: MCAR (missing completely at random), MAR (missing at random) and NMAR (not missing at random).

For simplicity, let us suppose the existence of a vector,  $Y = (y_1, \dots, y_n)^T$ , where  $y_i$  denotes the value of a random variable for unit  $i$ , and there is another vector  $M = (M_1, \dots, M_n)$ , where  $M_i = 0$  indicates that  $y_i$  is present and  $M_i = 1$  indicates that  $y_i$  is absent. Supposing that the joint distribution of  $(y_i, M_j)$  is independent among individuals, we have the following:

$$f(Y, M|\theta, \phi) = f(Y|\theta)f(M|Y, \phi) = \prod_{i=1}^n f(y_i|\theta) \prod_{i=1}^n f(M_i|y_i, \phi)$$

where  $f(y_i|\theta)$  means the density of  $y_i$  conditional on an unknown parameter  $\theta$ , and  $f(M_i|y_i, \phi)$  is the Bernoulli density for the binary variable  $M_i$ , with probability  $f(M_i = 1|y_i, \phi)$  that  $y_i$  is absent. If the absent value is independent of  $Y$ , i.e.,  $f(M_i = 1|y_i, \phi) = \phi$  is a constant that does not depend of  $y_i$ , the missing data mechanism is MCAR (as there is only one vector, it is also MAR). If the mechanism depends on  $y_i$ , then the mechanism is NMAR.

If MCAR has a value, a direct consequence of this property is the reduction of the sample size from  $n$  to  $r$ ; therefore we may execute the same analysis on the reduced sample. However, if the data constitute a NMAR process, an analysis based on this sub-sample would be biased with respect to the parameters of the  $Y$  distribution.

In economics, discussions involving attrition, as well as the sample selection bias, were begun with the theoretical contributions of Heckman (1979). Hausman e Wise (1979), adopting a panel perspective, add a correction to their theoretical model. For this new structure, the authors use an attrition probability model to correct the estimations of the main model. It also allows them to test whether the attrition occurred in a random way. According to these authors, the occurrence of non-random attrition does not necessarily produce biased estimates. The impact of attrition will depend on whether it is endogenous or exogenous.

Fitzgerald, Gottschalk e Moffitt (1997) also reinforce that the impact of attrition depends on selection related to the outcome variables. They offer mechanisms to understand selection based on unobservable and observable effects, and they suggest ways of testing for attrition bias and the necessary adjustments to eliminate it<sup>1</sup>.

It is important to understand that ignoring attrition may result in bias in parameter estimates, if the attrition is related to the phenomenon being modeled (ZABEL, 1998). In a simple way, Falaris (2003) states that attrition bias will occur if the random error in the probability of attrition is related to the random error in the result of the equation we wish to evaluate using the sample that was reduced by attrition.

Regarding unobservable effects, Fitzgerald, Gottschalk e Moffitt (1997) note that they are related to interviewer characteristics and the interview process. Zabel (1998) points out evidence of these effects on attrition, one of which is the time that the questionnaire is administered. If the process is less taxing, the participant develops loyalty to the study. However, many works do not consider this type of effect if it does not yield additional information. Thus, evaluating attrition through observable effects is more feasible (Outes-Leon e Dercon (2008) and Alderman et al. (2001)).

Some researchers discuss that attrition is not a severe problem that prevents modeling the phenomenon of interest. In their study, Fitzgerald, Gottschalk e Moffitt (1997) did not find strong evidence that attrition has had an impact on the representativeness of the sample, and they also observed that attrition was concentrated among individuals with low socioeconomic status. In a similar way, Falaris (2003) and Cheng e Trivedi (2015) also found little evidence of attrition bias in the estimated coefficients. However, Baigrie e Eyal (2013) and Maluccio (2000) did detect evidence of bias in the estimated coefficients due to attrition.

As discussed previously, the study of attrition has identified certain effects that may

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<sup>1</sup> As the objective of this work is to evaluate a study's retention capacity, we will not address this subject further; for details, see Fitzgerald, Fitzgerald, Gottschalk e Moffitt (1997)

impact econometric modeling, which makes it a challenge when evaluating longitudinal research. Therefore, it is crucial to explain the occurrence of attrition in longitudinal research to avoid problems of selection and consistency in econometric modeling. The aim of this chapter is to offer guidance to efforts seeking to understand the failure to ensure the continued participation of women in longitudinal studies on domestic violence.

### 3.2.2 Attrition in studies of domestic violence

Domestic violence is a global phenomenon. WHO statistics from 2005 showed that between 15% and 71% of women have been victims of physical or sexual aggression, or even both, by their partner in some time in their life. (GARCIA-MORENO *et al.*, 2005). There are several consequences of this type of violence: problems with mental health, physical injuries, suicide attempts, decreased productivity, alcohol and cigarette consumption, reproductive and sexual consequences, and impacts on the fetus or child, among many others (GARCIA-MORENO ALESSANDRA GUEDES, 2012). Therefore, collecting high-quality empirical evidence remains a crucial priority in research on domestic violence.

There is a substantial number of studies on this theme and its consequences as well as reflections on and attempts to understand its causes and effects. Garcia-Moreno *et al.* (2006) studied the extent of physical and sexual violence by the partner against women in 15 places in 10 countries. After the initial WHO reports containing increasingly alarming data on prevalence, new studies were conducted that reinvigorated the literature: Zamorski e Wiens-Kinkaid (2013) in Canada, Kataoka, Imazeki e Shinohara (2015) in Japan, Alfredsson, Ask e Borgstede (2015) in Sweden, and Smith *et al.* (2017) in the USA.

In the longitudinal literature on this topic, there are some studies that investigate the recruitment and retention of female victims of domestic violence. These studies are, often, focused on ethical questions that recognize the subject's sensibility, most importantly in providing protocols to improve the recruitment of participants (CLOUGH *et al.*, 2010) and (LOGAN *et al.*, 2008). In a longitudinal study, Davis e Taylor (1997) investigated whether the accompaniment of public officials when interviewing victims affected the prevalence of reporting domestic violence.

According to Dutton *et al.* (2003), recruitment and retention are relevant issues in studies that investigate domestic violence. However, as observed in Dutton *et al.* (2003), the analysis of retention in longitudinal studies on domestic violence often concerns efforts to evaluate the assailant's participation in treatment programs. These studies target a relatively restricted audience. Examples of such studies include Devries *et al.* (2013), El-Bassel *et al.* (2005) and Fals-Stewart, Golden e Schumacher (2003).

The analysis of attrition or participant retention in studies on domestic violence is very limited, generally related only to a specific group of individuals in the study considered. The purpose of our chapter is to widen the discussion of attrition, targeting population

research and specifically in surveys of surveys. We investigate the effects of domestic violence on woman's participation in a second survey wave. To this end, we use a new database.

The PCSVDF<sup>Mulher</sup> is a scientific effort and an interinstitutional partnership (between UFC and the Maria da Penha Institute) to derive a set of unique data that permit the study of domestic violence, the allocation of resources for households, women and children's health and the development of children and the inter-relations among them through an interdisciplinary approach.

As with any longitudinal study, the PCSVDF<sup>Mulher</sup> faces issues related to the retention of interviewees throughout its implementation, i.e., attrition. Bearing in mind that there is a gap in the attrition literature regarding domestic violence <sup>2</sup>, we will estimate the associations of variables with attrition that occurred in wave 2 of the PCSVDF<sup>Mulher</sup>. To do so, we will analyze individual characteristics and knowledge about acts, actions and services concerning domestic violence. We include in the model some variables that may identify negative externalities arising from robberies or street fights. We also added indexes that indicate whether a woman has ever been a victim of domestic violence, whether she was victim in the last 12 months and her expectation of being victim of violence in the next 12 months, by her current or a former partner.

### 3.3 EMPIRICAL EVIDENCE

#### 3.3.1 The PCSVDF<sup>Mulher</sup> panel

The PCSVDF<sup>Mulher</sup> gathers information on more than 10 thousand women aged between 15 and 49, living in the capitals of the states of Brazil's Northeast Region, in two waves: 2016 and 2017. In addition to this information, the project provides information about bargaining power and the intra-familial allocation of resources, social and cultural standards, knowledge about civil rights and the use of judicial measures of protection against domestic violence, as well as information about couples (for example, education, risky health behavior, anthropometry, skin color, and labor market status), expectations and subjective beliefs of well-being and partner abuse, among many other topics (CARVALHO; OLIVEIRA; SILVA, 2018).

The aim of the PCSVDF<sup>Mulher</sup> is to advance the discussion on domestic violence into two directions, i.e., building an innovative questionnaire concerning its interdisciplinary content about the theme and applying this instrument to a longitudinal and representative sample of women. We highlight the questionnaire's comprehensiveness, as it consists of twelve sections on several themes, as mentioned above.

<sup>2</sup> It is important to observe that we found works that studied attrition in the case of the rehabilitation of men who committed aggression in domestic violence programs; for details see [Jewell e Wormith \(2010\)](#) and [Gerlock \(2001\)](#)

The interviewers were chosen carefully, following a scientific protocol based on WHO recommendations. They received previous training using a framework of domestic violence themes, gender issues, ethics and safety, in addition to training on the use of CAPI software<sup>3</sup>, provided in partnership with the World Bank, for face-to-face interviews.

In 2017, a second wave of this study was administered. Once again, all 10,094 women, as well as their families, were interviewed again and applying the same questionnaire as in 2016. However, attrition was present. In the next sub-section, we will examine a sequential protocol of situations that caused attrition in this research.

### 3.3.2 Protocol for defining attrition

Before turning to more specific discussions on types of attrition, it is important to have a general understanding of empirical strategies used by PCSVDF<sup>Mulher</sup> researchers to minimize future attrition. As a first measure, the PCSVDF<sup>Mulher</sup> used technology capable of georeferencing each household surveyed. In an effort to guarantee better participant retention, an experimental study was conducted in two state capitals that offered monetary stimulus in an effort to retain women might drop out. The third measure was to replace households that attrited with a new independently selected and representative household (sampling with replacement). To better understand the sample composition of PCSVDF<sup>Mulher</sup>, table 3.1 provides statistics on the questionnaires that resulted in attrition and were successfully replaced.

Table 3.1 – Analysis of attrition in PCSVDF<sup>Mulher</sup>

Observation Type	2016	%	Observation Type	2017
Matched	4,665	46.2%	Matched	4,665
Attrition 1	1,031	10.2%	Reposition – original household	1,031
Attrition 2A or 2B	4,398	43.6%	Reposition – another household	4,822
Total – Wave 1	10,094	100,0%	Total – Wave 2	10,518

Source: Table taken from [Carvalho, Oliveira e Silva \(2018\)](#)

To replace all 5,429 women who attrited, 1,031 additional women were interviewed at home and 4,822 outside their homes, yielding a sample of 10,518 women in 2017, of which 5,853 new women served as the “replacement sample”.

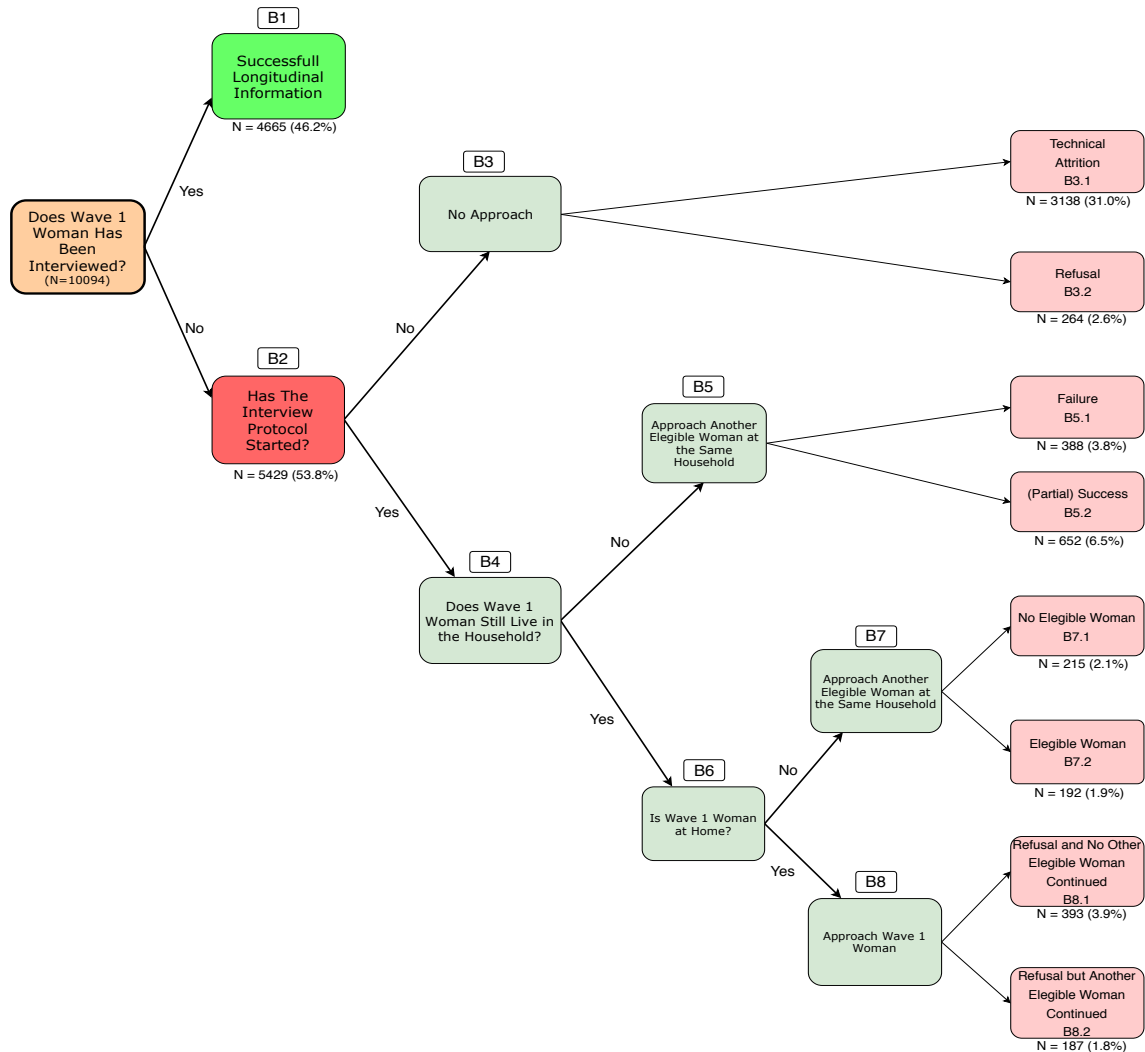
The sequences of actions resulting from the reapplication of 10,094 questionnaires are visualized in figure 3.1. The figure represents a detailed view of the possible results obtained in the new interviews. Initially, we can classify each observation from the first wave as a success (B1) or attrition (B2). We consider an observation a success when the interviewee is the same woman who participated in the first wave. Attrition refers to cases in which the woman surveyed in the first wave was not retained, independent of the reason.

<sup>3</sup> Computer-Assisted Personal Interview (CAPI) is an application for the collection of survey data developed by the World Bank



In the PCSVDF<sup>Mulher</sup>, there are eight possible types of attrition (B3.1 to B3.2) resulting from the flow of actions that occurred during data collection. Each of the eight types represents an instance of attrition deriving from a sequence in the flowchart. For example, attrition B3.1 represents cases of attrition that occurred for technical reasons, beginning at node B3.

Figure 3.1 – Flowchart on questionnaire application – Second Wave



To understand the several types of attrition, we need to go through the flowchart from the left to the right. Node B3 gathers cases in which it was not possible to begin the questionnaire application protocol. Node B4 consists of the cases that began the protocol. The difference between these two types is the contact between the interviewer and household.

The cases of attrition classified as “no approach” originate from situations that prevented the interviewer from finding or entering a household selected in wave 1. This node has two types of attrition, B3.1 “attrition for technical reasons” and B3.2 “resident refusal”. Attrition B3.1 can be further classified into three categories: 1) household was closed -- which consists of the cases in which household was locked, not occupied, or nobody was

at home at the time of the visit; 2) the address was wrong or does not exist – these are cases where there were difficulties in address identification, even with a GPS register<sup>4</sup>; and 3) other reasons includes the cases that are not included in the previous classifications. An example are cases where information is missing from the interviewer’s register, such as quantitative information; see table 3.2.

Table 3.2 – Distribution of categories of attrition B3.1-technical reasons

B3.1-Technical reasons	n	%
1. Household was closed	1339	13.2
2. Wrong or non-existent address	1031	10.2
3. Another reason	768	7.6
Total	3138	31.0

Source: Data provided by the author

Attrition B3.2-“household refusal” comes from cases where any of the residents (other than the woman interviewed in 2016) refused to receive the interviewer. This refusal included actions to prevent the interviewer from entering the household, not giving contact information for interviewee from the first wave, and even acting rudely, including physical and verbal threats, to the interviewer.

Node B4-“woman still lives in the household” comprises the cases where the interviewer enters a household already visited in wave 1, but the woman is not interviewed. This node will produce two other possible results, attrition in the form of a failure to retain the participant from wave 1 or when another woman in the household was interviewed (also known in the study as a “partial success”). Despite being called a “partial success”, this is technically attrition.

The observations classified as “another woman continued” are cases in which the woman from the first wave is replaced by another from the same household. These cases were possible when there was contact between the interviewer and some resident of the first wave household. After exhausting all options for contacting the woman from 2016, the interviewer asked if there was any eligible woman interested in participating in the research in the same household. If the interviewer received a positive answer, this new woman replaced the previous one.

Beginning from node B4, we may obtain six classifications of attrition: B5.1 to B8.2. Distinguishing among these classifications is crucial because we understand that the reasons of these types of attrition are distinct. Analyzing them in a general way may lead to mistakes.

For example, types B5.1 and B5.2 result from a change of the interviewee’s address. The interviewee had chosen not to continue living in the same household. In such cases,

<sup>4</sup> Although the technological resources can consistently identify the same household, in some areas the GPS signal fails to obtain the geo-referenced place, thus making it impossible to correctly locate the household.

efforts were made to contact this woman and book an interview. Therefore, in this case, there is no relationship between attrition and the woman’s decision of whether to continue in the study. These women are not refusing to participate in the PCSVDF<sup>Mulher</sup>.

The other four types of attrition (B7.1 to B8.2) are more plausibly a result of a decision made by the woman of whether to continue in the research. The first node B6 indicates whether the woman was at home or not during the visit. When a woman is absent (B7), we have two types of attrition: a failure to retain her (B7.1), or another woman will continue (B7.2). When the woman was not at home, the PCSVDF<sup>Mulher</sup> interviewer asked the reason why. The following options were given: 1) she was at work; 2) she was traveling; 3) she was addressing private affairs; and 4) another reason. The frequency distributions related to these 407 women who were not at home at the time of the visit can be seen in table 3.3.

This table separates the distribution of these categories in two ways; the first shows the distribution for the node ‘was not at home’, and in the second part of the chart, we present the distribution of the type of attrition conditional on the ‘not at home’ category. First, we note that these women were generally at work, 48%, followed those who were solving private affairs, 20%. Thus, we understand that the dominant profile of this node consists of women who were busy. By observing the distribution of attrition types by category, we observe stronger attrition among those at work.

Table 3.3 – Distribution of categories for the interviewees who were not at home during the interview and by attrition type

Categories	Was not at home		Attrition		Another woman continued	
	n	%	n	%	n	%
1. At work	194	47.7%	119	61.3%	75	38.7%
2. Traveling	61	15.0%	26	42.6%	35	57.4%
3. Private affairs	82	20.1%	35	42.7%	47	57.3%
4. Another reason	70	17.2%	35	50.0%	35	50.0%
Total	407	100.0%	215	-	192	-

Source: Data provided by the author

The last node in the attrition flow consists of those women who were at home at the time of the visit (B8) and is divided into two sub-types: B8.1 – interviewee refusal 1 (attrition) and B8.2 – interviewee refusal 2 (another woman continued). Making a distinction between the two is valid because its interpretation provides distinct decision actions. Interviewee refusal 1 is the strongest and most direct form of attrition, namely, cases in which it was possible to contact women from wave 1 who chose to refuse the re-interview. The second type of attrition occurs when the woman directly refuses to participate in the study, but she allows another woman in the household to continue the interview. The detailed interpretation of these two results concerns the act of refusal: in the second case, the woman does not impose barriers to the application of the PCSVDF<sup>Mulher</sup> questionnaire, thus making it possible to conduct the survey with another woman in the

same household. The first case of attrition is the most extreme one, as the interviewee simply refuses to participate.

In contrast to the literature on attrition, we were more critical of the type of aggregation suggested by figure 3.1 regarding the explanation of attrition. In the international literature, there are only two categories, attrition or non-attrition, as we can see in the Eysenbach (2005), Young, Powers e Bell (2006) and Delfabbro et al. (2016). Given the nature of attrition, as well as its origin, which results from several actions, we thought it more suitable to classify instances of attrition in this more separated structure.

Another point to be highlighted is the occurrence of partial success (another woman continued). Instances of attrition classified this way mean that the household will remain in the study<sup>5</sup>; although the woman from wave 1 does not continue in the survey, we believe that a proxy for this woman remains in the data.

The total percentage of attrition in the PCSVDF<sup>Mulher</sup> was 53.8% and that of success was 46.2%. Based on this first finding, the present work seeks to study the behavior of this attrition. We recognize that there remains considerable research to be conducted in the field of domestic violence. Studying the motivational factors capable of explaining the behavioral aspects of women's decisions to participate in such studies is crucial, because attrition can be a proxy for women's disposition towards participation, as well as discussing and learning more about domestic violence, and on the other side, the restrictive bias arising from a refusal to participate may reflect a certain rejection or other exogenous factors impeding survey participation.

In addition to this and the attrition structure developed in this study, this work has the objective of investigating the determinants of attrition during the second wave of PCSVDF<sup>Mulher</sup>. In order to achieve that objective, we will consider attrition in a distinctive way, in three models. The first stage will evaluate the process of sample selection that divided the 10,094 women into two distinct samples, a group of women who attrited and another that remained in the research, namely, nodes B1 and B2. At this stage, we will investigate whether the process that generated the attrition was random or systematic, and to do so, we will model attrition using a logistic regression model, similar to the approaches in Wolke et al. (2009), Ribas e Soares (2010) and McHugo et al. (2005).

Stage two of this work will be a more disaggregated evaluation of attrition, where we compare cases B1 vs. (B3 and B4), i.e., attrition now consists of multiple categories. In stage three, we address gender relations between the man and the woman, which is a novelty in the literature. The aim of this stage is to evaluate the factors capable of explaining any effect of male dominance on women's participation in this research.

In stage 3, we disaggregate attrition in a different way, where we concentrate on contrasting B1 vs. (B3, B5 and B6), conditional on a sample snippet. Now, we will

<sup>5</sup> We assume that the structure and characteristics of the family, as well as its features, affect the behavior of its members in a similar way

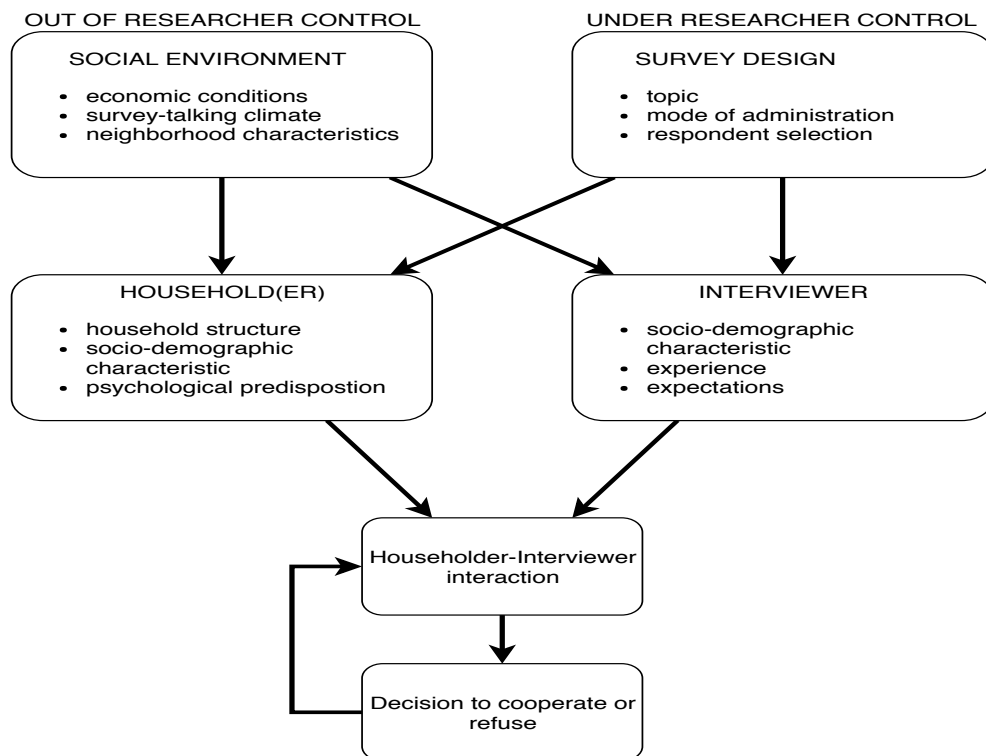
consider only women who already had a partner and answered questions about domestic violence. In this stage, we consider an unprecedentedly detailed attempt to understand the intra-household relation between men and women. We add to the model measures that characterize the woman's last partner, as well as information related to acts of domestic violence committed by her partner.

In a more formal way, the message of figure 3.1 is that the concept of attrition in longitudinal research has a scope that goes beyond a dichotomous categorization of attrition vs. non-attrition. That means that figure 3.1 represents an aggregation map that will define the dimension of attrition in a multinomial dependent variable. The next sub-section discusses the structure used to guide the choice of independent variables.

### 3.3.3 Attrition determinants

We detail the factors that can be used to define the participation of the individual in a survey, based on concepts discussed in the work of Groves and Groves e Couper (1998). These authors detail a broad theoretical structure that surrounds an individual's decision to participate in a survey. This outline will serve as a methodological basis for the present research<sup>6</sup>.

Figure 3.2 – Conceptual framework for attrition developed by Groves e Couper (1998)



According to these authors, there are five dimensions of the attrition process: social environment and household characteristics, survey design, attributes and interviewer be-

<sup>6</sup> See details in Groves e Couper (1998). The intention is to point out the theoretical justifications of the variables we will use in this study.

havior, and the interaction between interviewers and household members. This conceptual scheme can be seen in figure 3.2. On the left side, we present the attributes that are outside researchers' control, and on the right side, we present the researchers' intrinsic characteristics.

We now discuss each of these dimensions. Regarding the social environment, the authors state that the context in which the research theme is inserted affects the interviewee's participation. The level of responsibility may be a determining factor in this decision. In this way, the question of the interviewer's persuasion to the interviewee is relevant. In addition to this context, the neighborhood in which the family is located also affects the participation decision, for example, the place's level of urbanity, crime rates, household structure, and even the neighborhood's contact with outsiders.

Regarding household members' characteristics or demographic aspects, age, sex, social status, and income, among others, influence the participation of an individual, as do past experiences with the survey and household maintenance. In addition to these classic characteristics, the authors note that psychological states, such as depression, anger, and exhilaration, affect the participation decision. All these aspects may influence the cognitive process involved in the interaction between the interviewer and interviewee.

The cognitive question is a key aspect of this issue, with two possible types of decision making, one of which involves deeper consideration in the form of the costs/benefits of participation, and the other type of decision making is a heuristic process, based on more superficial decisions. According to the authors, in this dimension, the decisions based on the heuristic process are more credible, as the participant is not willing to waste time and cognitive energy in evaluating the cost and benefit of his/her participation.

Survey attributes represent the third dimension of this structure. These attributes are designed to ensure cooperation through fast heuristic effects on the interviewee, for example monetary gains. Another important characteristic of an individual's evaluation is the perception of the entities involved in the survey. Another factor is a relative lack of discussion on the theme, where the survey may act as a facilitator of questions not widely explored in society. Characteristics such as time and sensitive questions that cause discomfort for the interviewee are also factors that may impact his/her participation decision.

The interviewee also considers the interviewer's attributes. Thus, the interviewee's judgment at the moment of the interview is crucial. All of the interviewer's superficial characteristics may restrict his or her access to the participant. The interviewer's experience is one of the most important characteristics in each individual's participation decision, according to the authors. The third group of factors related to the interviewer includes the emotional or motivational context that he/she promotes when administering the survey.

Basing our work on these authors' thoughts, we defined the main variables based on this methodology. In the next section, we will identify the characteristics we will employ

and the dimension they belong to, based on the work of [Groves e Couper \(1998\)](#).

### 3.3.4 Variables included in the model

Now we will describe the variables to be used in this study, starting with the dependent variables and then list the predictive and control variables.

#### **Dependent variables:**

1) The main variable in analysis is attrition, namely a failure to retain the participation of the interviewee in the second wave. In the first stage, we will consider attrition in an aggregated way, taking only one of two values, 1 for attrition or 0 for no attrition.

2) The second dependent variable is the classification of attrition into the following categories: B1-there was no friction, B3-no approach and B4-interview protocol started.

3) In the third step, we will work with the friction variable as follows: B1-there was no friction, B3-no approach, B5-woman does not live in the household, and B6-the woman lives in the household.

Next, we list the control variables included in the models. All the following variables were collected during the first wave (baseline) in 2016.

#### **Control Variables:**

##### *- Socioeconomic:*

**Age** takes values in a range between 15 and 49. **Level of education** represents the woman's level of education, from 1- no scholary to 9-post-graduate. The binary variables are **Works**, **Bolsa Família program**, **smokes**, **drinks alcohol**, **catholic**, **white**, **mother**, **children under age 4**, **cohabitation**, **has a partner** and **intention of moving out**. The cohabitation variable takes value 1 for a woman in cohabitation, 0 otherwise; the partner variable is analogous, with value 1 indicating a woman who has a current partner, 0 otherwise.

##### *- Interview quality:*

Respondents were asked how long the interview lasted in minutes. The distribution of reported duration was skewed to the right. Thus, we chose to create a new binary variable, **duration of the interview > 60 min**, where the cutoff was values greater than 60 minutes. **Desistance during the interview** is a binary variable that captures the cases where the interviewee stopped the interview.

##### *- Knowledge about the Maria da Penha Law:*

The survey contains a proxy for a woman's knowledge about domestic violence. To understand women's knowledge, the survey considers four domains:

1) The first domain is included to understand whether the victim knows that **her partner's act** is a violent one, i.e., she can be a victim, but she is not aware that the behavior is considered unjust, and thus she regards it as natural.

2) The second domain is included to understand the victim's knowledge of **programs and services** offered to victims. Even if the victim knows that the act committed by her partner is violence, and illegal, she may not be aware of such benefits.

3) The third domain captures the case in which the woman recognizes that her partner's is a violent one, but she does not know the law, namely that the act is subject to legal intervention.

4) The fourth domain is related to a woman accepting a man's violent acts. This means that she believes that such violent acts may be justifiable given her behavior.

The first and third domains consist of 6 (six) questions each, and the response options range from 1 to 5, where 5 represents total agreement and 1 total disagreement that the question describes a violent act. For the second domain, we have 7 (seven) questions, and the response options range from 1 to 3, where 1 represents "never", 2 "a little" and 3 "many times". Finally, in the fourth domain there are 5 (five) questions with answers varying from 1, total agreement, to 5, total disagreement. The questions are listed in table 3.10.

Each participant received a score, represented by the average of questions in each domain. Thus, for the first, second and third domains, the larger the average score obtained, the greater her knowledge about domestic violence. For the fourth domain, the larger the average score, the less justifiable the woman believes that it is for a man to attack her in response to her behavior.

- *Neighborhood characteristics:*

PCSVDF<sup>Mulher</sup> has information that can capture aspects of the woman's neighborhood. In the present study, we use two variables capable of capturing the riskiness of the area where the woman lives: **robberies/burglaries** and **street fights**. Both variables originally had five response options, which are ordered from 'never' to 'always'. We recoded this variable to be binary, where 1 denotes the answers 'many times' and 'always', and 0 represents the other responses.

- *Experience related to domestic violence:*

We analyzed whether the woman was a victim of any of three types of violence: emotional, physical or sexual, captured by the variables **victimization during life** and over an interval **in the last 12 months**. Emotional violence consists of acts related to insults, humiliation, intimidation and threats. The following behaviors are considered physical violence: punches, kicks, dragging, spanking, pushing, or threatening/using a gun or other weapons against women. Sexual violence is defined as forcing sexual intercourse, forcing something humiliating, having sexual relations out of fear of a partner's reaction.

- *Partner's characteristics:*

We collected crucial information on current or previous partner's involvement in certain acts related to violence, which can also explain the gender relations between the man and woman. We included three partner characteristics, **partner jailed at any time**,



**partner uses illicit drugs, partner involved in fights.** Originally, these questions had three response options: daily, occasionally and never. We recoded these variables as 1 for daily and occasionally, entailing a high risk level, and 0 for never.

Table 3.4 – Relation between the variables included in the research and the attrition structure defined by Groves e Couper (1998)

Variables	Social environment	Household(er)	Survey design	Interviewer
<b>Socioeconomic</b>				
Age		X		
Work		X		
Bolsa familia		X		
Level of education		X		
Smokes		X		
Drinks		X		
Catholic		X		
White		X		
Mother		X		
Children under age 4		X		
Cohabitation		X		
Partner		X		
Intention of moving		X		
<b>Interview quality</b>				
Interview duration > 60 min		X	X	X
Desistance during interview		X	X	X
<b>Knowledge about domestic violence</b>				
Domestic violence			X	
Programs and services			X	
Maria da Penha Law			X	
Violence acceptance			X	
<b>Neighborhood characteristics</b>				
Robberies/burglaries	X			
Street fights	X			
<b>Expectation of violence</b>				
Sexual probability of 50%	X			
Physical probability of 50%	X			
<b>Partner's characteristics</b>				
Partner jailed at any time		X		
Partner uses illicit drugs		X		
Partner involved in fights		X		
<b>Experience related to domestic violence</b>				
Victim of violence any time in life		X	X	
Victim of violence in the last 12 months		X	X	

Source: Data provided by author

- *Expectation of violence:*

Another crucial piece of information for this study is a measure of the expectation of victimization. We asked women for their subjective probability of being a victim of **physical** and **sexual** violence over the next 12 months from the current partner, for those who have one, or an ex-partner, for those who do not have a current partner. The questions about sexual and physical probability were assessed quantitatively and/or qualitatively.

Three randomizations were done in order to separately consider three types of questions.

One group of women was asked to offer the probability of violence as a number from 0 to 100; a second group was asked to choose one of several options ('almost certain', 'very likely', 'likely', 'half-and-half', 'unlikely', 'hardly likely' or 'almost impossible'); and a third group was asked to respond in both ways. If the expected probability reported was higher than 50% or if the interviewee chose at least 'half-and-half', then we coded this response as 1, 0 for the opposite. Therefore, **physical probability of 50%** and **sexual probability of 50%** represent cases where the chance of the interviewee being a victim of these acts is at least 50%.

As discussed previously, our work is based on the structure proposed by [Groves e Couper \(1998\)](#). Thus, we relate the variables used in this research in terms of the conceptual scheme developed by those authors; see table [3.4](#).

## 3.4 ECONOMETRIC MODEL

### 3.4.1 Empirical strategy

To understand attrition, we initially performed a univariate analysis of participant profiles through descriptive statistics. We also conducted non-parametric tests (Fisher and Kruskal–Wallis tests for the numerical and categorical variables, respectively) in order to determine if there are differences in the profiles of the groups of women who attrited and did not.

The reason for conducting these initial comparisons is to verify possible selection biases, through tests of differences between the two groups of women. In this way, we can evaluate whether attrition is initially systematic or random ([MCHUGO et al., 2005](#)), ([SIDDIQUI; FLAY; HU, 1996](#)).

Following the sub-sample comparisons, we performed logistic regressions to evaluate which characteristics are related to the participant's probability of resulting in attrition. The factors to be tested are related to the following: the interviewee's characteristics, such as age, level of education, race, or motherhood status, among many others; interview quality; knowledge about the Maria da Penha Law; neighborhood characteristics; and expectation of victimization.

For the first stage, we apply binary logistic regression. In stages two and three, we apply multinomial regressions. In stage three, we will add to the model information related to experiences of acts of domestic violence perpetrated by a woman's partner and information about him. The partner's additional information may relate to the current or previous partner.

Binary logistic regression models are applied when there are only two possible results, coded as 0 and 1 ([AGRESTI, 2002](#)). The interest is in modeling  $P(Y = 1)$ , the probability of a successful result, given a group of regressors. In this case, the study consists of

modeling  $P(\textit{Atrito})$ , denoting the probability of attrition. The estimation equation is as follows:

$$\Pr(Y = 1|\mathbf{X}) = \frac{\exp(\mathbf{X}'\boldsymbol{\beta})}{1 + \exp(\mathbf{X}'\boldsymbol{\beta})}$$

When there are more than two possible categories in the outcome of interest and there is no ordering of the categories, the model to be used is multinomial (AGRESTI, 2002). Multinomial regression estimates  $J - 1$  equations, where  $J$  is the number of categories, and each equations has  $\boldsymbol{\alpha}_j$  groups. In this type of model, one of the categories as classified as reference category<sup>7</sup>. The equation for this type of model can be represented as:

$$\Pr(Y_i = j|\mathbf{X}) = \frac{\exp(\mathbf{X}'\boldsymbol{\alpha}_j)}{1 + \sum_{h=0}^{J-1} \exp(\mathbf{X}'\boldsymbol{\alpha}_h)}, \quad j = 0, 1, \dots, J - 1$$

where  $\boldsymbol{\alpha}_0 = 0$  represents the reference category<sup>8</sup>.

According to Wooldridge (2001), other measures are necessary to improve the results. In all stages, we calculated the marginal effects (AME – average marginal effect) of the estimated parameters<sup>9</sup>. In addition to these effects, model adjustments were calculated for known values: the percentage of results predicted correctly and measures of pseudo- $R^2$

According to Fagerland e Hosmer (2012), there are two ways to evaluate these types of models: discrimination and calibration. For discrimination, the model is evaluated with respect to the correct classification of observations by the model. Calibration measures assess how well the probabilities estimated by the model agree with the observed results. According to Fagerland e Hosmer (2012), this last measure is verified through goodness-of-fit tests, one of which was developed by Hosmer and Lemeshow. The authors developed a general test, which can be applied to multinomial and binary models. This test was employed in STATA software through the command **mlogitgof**.

Finally, for two variables, age and level of education, we created graphics to use to evaluate possible non-linear behaviors in their effects by varying the interval values in each variable to assess for predictive power with respect to marginal effects (see section 3.6-attached)

### 3.4.2 Test of differences between averages

Before we estimate the logit model, in table 3.5, we report summary statistics comparing the groups of women responsible for attrition and those who were not. Descriptively, we note that the great majority of the results related to the difference tests were significant in

<sup>7</sup> In economics this type of modeling is used for direct choice models, because it allows other issues to enter the model, such as allowing categories' own attributes to be considered in the model (GREENE, 2012)

<sup>8</sup> This is because the response probabilities must sum to unity (WOOLDRIDGE, 2001)

<sup>9</sup> This type of effect is computed individual by individual, and then the average is calculated, i.e.,  $AME = E_x \frac{\partial E[y|x]}{\partial x}$

Table 3.5 – Descriptive summary of factors included in the analysis by result, success and attrition type

Variable	No attrition (B1) n=4,665 (46.2%)	Attrition (B2) n=5,429 (53.8%)	P-value	
<b>Socioeconomic</b>				
Age	32.727 (±9.938)	31.537 (±9.912)	< 0.001	***
Work	0.370 (±0.483)	0.414 (±0.493)	< 0.001	***
Bolsa família	0.188 (±0.391)	0.162 (±0.368)	0.001	***
Level of education	4.626 (±1.849)	4.856 (±1.895)	< 0.001	***
Smokes	0.074 (±0.262)	0.074 (±0.262)	1.000	
Drinks	0.241 (±0.428)	0.261 (±0.439)	0.024	**
Catholic	0.512 (±0.500)	0.504 (±0.500)	0.470	
White	0.224 (±0.417)	0.252 (±0.434)	0.001	***
Mother	0.672 (±0.470)	0.620 (±0.485)	< 0.001	***
Children under age 4	0.235 (±0.424)	0.236 (±0.425)	0.840	
Cohabitation	0.504 (±0.500)	0.473 (±0.499)	0.003	***
Partner	0.637 (±0.481)	0.599 (±0.490)	0.000	***
Intention of moving	0.204 (±0.403)	0.325 (±0.468)	< 0.001	***
<b>Interview quality</b>				
Interview duration > 60 min	0.168 (±0.374)	0.162 (±0.368)	0.450	
Desistance during interview	0.149 (±0.356)	0.163 (±0.369)	0.047	**
<b>Knowledge about domestic violence</b>				
Domestic violence	4.450 (±1.027)	4.426 (±1.070)	0.700	
Programs and services	1.975 (±0.453)	1.937 (±0.454)	< 0.001	***
Maria da Penha Law	4.141 (±0.646)	4.143 (±0.652)	0.880	
Violence acceptance	4.796 (±0.627)	4.776 (±0.625)	0.004	***
<b>Neighborhood characteristics</b>				
Robberies/burglaries	0.583 (±0.493)	0.562 (±0.496)	0.032	**
Street fights	0.108 (±0.311)	0.116 (±0.320)	0.240	

Signif. values: '\*\*\*' = 0.01 | '\*\*' = 0.05 | '\*' = 0.1

The values correspond to the estimation average, and standard deviations are presented in brackets

Source: data provided by the author

the bivariate comparisons between profiles and binary result (success or attrition). These results provide us with evidence that there are differences between the groups of women who remained in the research and those who did not.

Comparing these groups, we note that the profile of women who did not remain in the study are younger (MCHUGO et al., 2005), have an average age of 31, have higher labor market participation (41.4% of them work), have a higher level of education and have the higher share of whites, at 25.2%. Another interesting point concerns moving intention. According to Ribas e Soares (2010) and Watson e Wooden (2009), geographic mobility has a positive impact on attrition, and our analysis echoes this.

### 3.4.3 Econometric results

The results will be divided into three parts. In the first stage, we analyze attrition in a binary way. In the second stage, we expand the classification of attrition, disaggregating the classification. In this stage, we divide attrition into two categories, B3 and B4, according to figure 3.1. Therefore, the model will contrast B1 vs. (B3 and B4). In the third stage, we consider only women who have or had partners and agreed to answer questions about domestic violence. In this stage, we will model B1 vs. (B3, B5 and B6).

To better understand the distribution of attrition into disaggregated categories, we present table 3.6, below. The chart provides the distribution of categories used in each model. M1 represents the distribution for the binary model, and M2 and M3 are the multinomial models for second and third stage, respectively.

Table 3.6 – Distribution of categories in each model used in the research

Categories	M1	M2	M3
B1	46.2%	46.2%	48.8%
B2	53.8%	-	-
B3	-	33.7%	32.8%
B4	-	20.1%	-
B5	-	-	8.8%
B6	-	-	9.7%

Source: Data provided by the author

#### 3.4.3.1 Binary attrition (B1 vs. B2)

In table 3.7, we report the results of the model to explain attrition in the first stage. We obtained both significant and non-significant estimations.

When analyzing the estimation results, we note older women tend to have a lower attrition probability (negative marginal effect of  $-0.002$ ), and this result is corroborated by Leith (2006), who affirms that over time, women create strong links within the household, being more present there. More mature women, probably, have greater knowledge of opinion research. Graphic 1 reported in the graphic table 3.11 shows this decrease (see section 3.6, attached). For example, a 40-year-old woman has an estimated probability of almost 50% of non-attrition.

Work and education level, which are proxies for the opportunity costs of survey participation, increase the attrition probability by 4.4% and 1.3%, respectively. As mentioned above, the interviewees made rational choices, and for these women, the cost of remaining in the study is higher, thus encouraging them towards attrition to reduce this additional cost. Age and level of education also had positive associations with attrition, as noted by Young, Powers e Bell (2006). The attached chart 1 clearly demonstrates this relation.

Table 3.7 – Logistic regression for the probability of attrition

Variable	dy/dx	Std. Err.	P-value		IC 95 %
<b>Socioeconomic</b>					
Age	-0.002	0.001	< 0.001	***	(-0.004; -0.001)
Work	0.044	0.012	< 0.001	***	(0.020; 0.068)
Bolsa família	-0.008	0.017	0.629		(-0.042; 0.026)
Level of education	0.013	0.004	0.004	***	(0.004; 0.022)
Smokes	0.024	0.020	0.232		(-0.016; 0.064)
Drinks	0.018	0.027	0.515		(-0.036; 0.071)
Catholic	0.007	0.009	0.475		(-0.012; 0.025)
White	0.025	0.015	0.091	*	(-0.004; 0.054)
Mother	-0.017	0.017	0.321		(-0.051; 0.017)
Children under age 4	0.002	0.013	0.898		(-0.024; 0.027)
Cohabitation	0.019	0.013	0.144		(-0.006; 0.044)
Partner	-0.031	0.022	0.150		(-0.074; 0.011)
Intention of moving	0.142	0.019	0.000	***	(0.105; 0.178)
<b>Interview quality</b>					
Interview duration > 60 min	0.001	0.018	0.962		(-0.034; 0.035)
Desistance during interview	0.057	0.030	0.056	*	(-0.002; 0.116)
<b>Knowledge about domestic violence</b>					
Domestic violence	-0.011	0.005	0.029	**	(-0.021; -0.001)
Programs and services	-0.055	0.016	0.001	***	(-0.087; -0.024)
Maria da Penha Law	0.002	0.014	0.908		(-0.026; 0.029)
Violence acceptance	-0.013	0.019	0.503		(-0.050; 0.025)
<b>Neighborhood characteristics</b>					
Robberies/burglaries	-0.012	0.023	0.589		(-0.058; 0.033)
Street fights	0.014	0.026	0.592		(-0.037; 0.065)
-					
Number of observations	6576				
Correctly predicted percentage	57.34%				
Log-likelihood value	-4451.904				
Pseudo-R2	0.023				
Hosmer and Lemeshow	0.373				

Signif. levels: '\*\*\*' = 0.01 | '\*\*' = 0.05 | '\*' = 0.1

Source: data provided by the author

Regarding knowledge about violence, two measures were favorable to the interviewee remaining in the sample: knowledge about violent acts and knowledge about services offered to women who are victims, which demonstrate that the more knowledge a woman has about domestic violence, the lower her probability of attrition. This result accords with [Groves e Couper \(1998\)](#). When the subject of the study is interesting to the interviewee, this has a favorable effect on her participation. In our model, if the woman increases her average score by one unit on acts of domestic violence and knowledge about programs and services, the probability of her continuing increases by 1% and 5%, respectively.

Again according to [Groves e Couper \(1998\)](#), themes that make the interviewee uncomfortable may make it difficult to ensure her continuation. In our model, we also obtain this result. If during the previous interview, the a person stopped the interview, there is a positive effect of almost 6% that she will exhibit attrition in the next wave.

## 3.4.3.2 Multinomial attrition I – B1 vs. (B3 e B4)

Table 3.8 – Estimated multinomial model considering attrition in two response categories (B3 and B4)

Variable	No approach (B3)	Interview protocol started (B4)
<b>Socioeconomic</b>		
Age	-0.001 (0.310)	-0.002 (0.014)**
Work	0.037 (0.010)**	0.008 (0.376)
Bolsa família	-0.006 (0.741)	-0.003 (0.824)
Level of education	0.005 (0.484)	0.008 (0.036)**
Smokes	0.005 (0.858)	0.020 (0.429)
Drinks	0.026 (0.193)	-0.008 (0.595)
Catholic	-0.004 (0.814)	0.010 (0.455)
White	0.014 (0.429)	0.011 (0.681)
Mother	-0.012 (0.481)	-0.005 (0.703)
Children under age 4	-0.017 (0.028)**	0.020 (0.185)
Cohabitation	0.006 (0.770)	0.013 (0.563)
Partner	0.032 (0.140)	-0.064 (0.036)**
Intention of moving	0.094 (0.000)***	0.048 (0.006)***
<b>Interview quality</b>		
Interview duration > 60 min	0.006 (0.862)	-0.005 (0.879)
Desistance during interview	-0.018 (0.658)	0.075 (0.019)**
<b>Knowledge about domestic violence</b>		
Domestic violence	-0.008 (0.300)	-0.004 (0.525)
Programs and services	-0.022 (0.323)	-0.033 (0.095)*
Maria da Penha Law	0.014 (0.245)	-0.012 (0.262)
Violence acceptance	0.011 (0.406)	-0.022 (0.142)
<b>Neighborhood characteristics</b>		
Robberies/burglaries	-0.010 (0.598)	-0.002 (0.855)
Street fights	0.020 (0.498)	-0.006 (0.798)
-		
Number of observations	6,576	
Correctly predicted percentage	49.3%	
Log-likelihood value	-6700.534	
Pseudo-R2	0.019	
Hosmer and Lemeshow	0.601	

Signif. levels: '\*\*\*' = 0.01 | '\*\*' = 0.05 | '\*' = 0.1

Coefficients are marginal effects and in brackets are the p-value of Wald test

Source: data provided by the author

In this part of the study, we apply multiple regression to model attrition. The women classified as B3 are those who were not contacted in the second wave, not even at home. Women classified as B4 are those women who rejected participating or women who do not live in the sampled household. The results are presented in table 3.8.

Initially, regarding the effects that affect category B4, factors such as level of education (positive effect of 0.8%) and age (negative effect of 0.2%) were still significant. This shows that there is a relation between these factors and groups of women who no longer participate in the survey, either because they refused or moved.

The size of the effect of the variable indicating that the interviewee stopped participation in the previous interview increased relative to the previous model. The previous effect was

almost 6%, as reported in table 3.7, and in this model, the effect increased the probability of attrition by 1.5%. We note that this effect was not significant for category B3.

When we compare the group of women belonging to category B4 to those who did not exhibit attrition, knowledge about services and programs remained a significant factor increasing the non-attrition probability. If the average score on services and programs increases by one unit, then the probability of remaining in the research increases by 3.3%.

In relation to the effects capable of explaining the results for category B3-no approach, we obtained few significant estimates: only working, having children under age 4 and intending to move. We note that the result for this category is more related to non-behavioral effects. The effect of work was positive. The effect of having a child under age 4 positively influences the probability of the woman remaining in the survey, as the woman remains at home most of the time to raise her children (STONE; LOVEJOY, 2004) and (VANEK, 1974).

The intention to move had positive effects, as observed in the previous model. We observe that intention to moves's effect on category B3 was almost twice that on B4 – start the protocol. Thus, we argue that having an intention to move will contribute to reduced participant retention.

### 3.4.3.3 Multinomial attrition II & gender – B1 vs. (B3, B5 and B6)

One of the main arguments in the literature on domestic violence is that gender issues influence the likelihood of dominance behavior against women in the household. For example, issues such as fertility and resource allocation are strongly influenced by men in homes where there is no gender balance and instead masculine dominance. We conjecture that in our context, whether a woman participates in the second wave can be influenced by gender issues, i.e., the participation decision is related to the partner. Based on this conjecture, we will model this type of effect.

In the third stage, we restricted our sample. The results are obtained for a sample of women who already had a partner and who agreed to answer questions related to domestic violence. The categories analyzed in this stage are B3 – no approach, B5 – woman no longer lives in the household and B6 – woman still lives in the household and refused participation. The benefit of treating attrition is this way is that it permits a closer study of the characteristics that might drive interviewee refusal, i.e., we are interested in the effect of the characteristics on category B6. The results of this model are reported in table 3.9.

Evaluating the estimates of group B3 of women and comparing to the previous model, we can note a small increase (almost 11%) of marginal effect cause by intention of moving, in relation to the previous model with two categories. However, it still carries a lot of the model's explanatory power. This way, as it maintained to the group of women who no longer live in the household.



It seems that the partner effect produces distinct results between the groups of women. On those where it was not possible entering in the household, this effect showed to be negative, favoring non-attrition. On the other hand, the effect was positive in the group which do not live in the household.

Table 3.9 – Multinomial model considering attrition in three response categories (B3,B5 and B6), applied on the third stage, for women who already had a partner

<b>Variável</b>	No approach (B3) n=1653(32.7%)	Woman does not live in the household (B5) n=442(8.8%)	Woman lives in the household (B6) n=487(9.6%)
<b>Socioeconomic</b>			
Age	-0.002 (0.148)	-0.001 (0.016)**	0.001 (0.042)**
Work	0.035 (0.076)*	0.011 (0.055)*	0.007 (0.635)
Bolsa família	0.012 (0.536)	0.012 (0.318)	-0.014 (0.285)
Level of education	0.000 (0.992)	0.004 (0.266)	0.006 (0.015)**
Smokes	0.007 (0.816)	-0.002 (0.890)	0.023 (0.245)
Drinks	0.023 (0.176)	-0.005 (0.688)	-0.002 (0.803)
Catholic	-0.008 (0.567)	-0.006 (0.665)	0.009 (0.352)
White	0.020 (0.405)	-0.005 (0.728)	-0.009 (0.465)
Mother	-0.049 (0.024)**	-0.011 (0.463)	-0.003 (0.744)
Children under age 4	-0.015 (0.385)	0.023 (0.179)	0.018 (0.154)
Cohabitation	0.029 (0.371)	-0.006 (0.584)	0.004 (0.807)
Partner	0.009 (0.807)	-0.002 (0.885)	-0.033 (0.149)
Intention of moving	0.108 (0.000)***	0.055 (0.000)***	-0.009 (0.244)
<b>Interview quality</b>			
Interview duration > 60 min	-0.018 (0.516)	0.021 (0.429)	-0.040 (0.001)***
Desistance during interview	-0.143 (0.123)	0.214 (0.134)	0.091 (0.382)
<b>Knowledge about domestic violence</b>			
Domestic violence	-0.015 (0.150)	-0.003 (0.599)	0.006 (0.390)
Programs and services	-0.025 (0.201)	-0.015 (0.322)	-0.004 (0.699)
Maria da Penha Law	0.028 (0.097)*	-0.001 (0.868)	-0.020 (0.096)*
Violence acceptance	0.042 (0.031)**	-0.016 (0.070)*	0.002 (0.782)
<b>Neighborhood characteristics</b>			
Robberies/burglaries	-0.017 (0.558)	0.006 (0.568)	0.001 (0.927)
Street fights	0.019 (0.552)	-0.002 (0.922)	-0.005 (0.503)
<b>Expectation of violence</b>			
Sexual probability of 50%	-0.039 (0.138)	0.003 (0.909)	-0.011 (0.493)
Physical probability of 50%	0.061 (0.095)*	-0.041 (0.024)**	-0.003 (0.845)
<b>Partner's characteristics</b>			
Partner jailed at any time	0.040 (0.292)	-0.005 (0.770)	0.020 (0.256)
Partner uses illicit drugs	0.019 (0.685)	0.003 (0.801)	-0.006 (0.669)
Partner involved in fights	-0.056 (0.019)**	0.016 (0.034)**	0.009 (0.552)
<b>Experience related to domestic violence</b>			
Victim of violence at any time in life	-0.007 (0.779)	-0.015 (0.208)	0.021 (0.069)*
Victim of violence in the last 12 months	0.027 (0.555)	0.027 (0.351)	-0.022 (0.168)
-			
Number of observations	3406		
Correctly predicted percentage	54.13%		
Log-likelihood value	-3768.340		
Pseudo-R2	0.031		
Hosmer and Lemeshow	0.285		

Signif. levels: '\*\*\*' = 0.01 | '\*\*' = 0.05 | '\*' = 0.1

Coefficients are marginal effects, and numbers in brackets are the p-values of Wald tests

Source: data provided by the author

Observing only the effects obtained for group B6 of women, we can note that the effects of the level of education were significant and positive, showing that opportunity costs still have a positive impact on attrition. However, the size of effect in this group of women decreased to 0.6%. In this sense, the opportunity costs exhibited lower explanatory power in this group. Moreover, the effect of the work was not significant. Moreover, in contrast to our result when attrition was modeled in a binary way, here older women tended to be more likely to refuse to participate. Intending to move did not have any effect in this group of women. Interview time had a significant and positive influence on the probability of women remaining in the research, which could be related to the bond the women developed with the study. Survey characteristics may positively influence women's participation (WATSON; WOODEN, 2009) (GROVES; COUPER, 1998). Watson reinforces that the duration of field work can have a positive effect.

Regarding gender issues, we obtained some interesting results. Current or previous partner characteristics were not significant when comparing the likelihoods of non-attrition and B6. However, domestic violence had a negative effect, i.e., there is a 2% decrease in a woman's probability of participating in the survey related to the effects of acts of domestic violence committed by her partner.

### 3.5 FINAL CONSIDERATIONS

Modeling attrition is often useful for the evaluation of possible sample selection bias in the dependent variable (HECKMAN, 1979). The greatest question to be answered in this respect is whether the regression results obtained from the sub-sample of those who remained in the study differs from those that would be obtained from the attrition group (FALARIS; PETERS, 1998). Thus, it is necessary to better understand attrition behavior to correct the problem of selection bias. Therefore, evaluating attrition before modeling a new phenomenon of interest is crucial.

This study investigated the attrition in the PCSVDF<sup>Mulher</sup>, the main purpose of which is to study domestic violence and its effects. We described and modeled attrition in two ways. In the first, attrition is divided into two classifications: participants who exhibited attrition and those who did not. The second one was to allow a more fine-grained disaggregation, which made it possible to observe attrition as a sequence of actions. We classified attrition in multiple ways, as depicted in figure 3.1.

To achieve this aim, we analyzed socioeconomic characteristics and measures of interview quality, and we added variables that capture a woman's knowledge of domestic violence and information about the interviewee's neighborhood. For the group of women who already had a partner, we included effects that collect their experiences of domestic violence, as well as self-assessed measures of their expected probability of victimization.

Through a logistic equation, we analyzed the probability of attrition. This model satisfactorily evaluated these characteristics through adjusted measures. We obtained significant results, albeit with small marginal effects. The main determinant was the intention to move. This result accords with the works of Ribas e Soares (2010) and Watson e Wooden (2009). Stopping the interview during the previous wave was also significant, following ((GROVES; COUPER, 1998). Additional characteristics that impact the result of friction is whether the woman is working and her level of education. These results demonstrate that opportunity costs affect a woman's decision of whether to participate in the survey.

The second objective was to model attrition again, but from a multinomial perspective. The results were essentially unchanged from those of the previous model. There were some effects able to explain the results for the no approach group. The effects included in this category are related to the process of searching for the interviewee, instead of characteristics that determine her attrition decision. As for category B4, the effects of the level of education and the decision to halt the previous interview are more related to a cognitive process.

The aim of the third stage of this research is to study attrition possibly caused by gender relations. We selected only women who already had a partner, including those with a current partner. The second criterion was reporting acceptance on questions about domestic violence. In this group of women, we compared those who did not exhibit

attrition with three separate types of attrition.

The first interesting point here relates to the intention to move. In table 3.9, the first two comparisons suggest an effect of the intention to move, while this effect is not present in stage three. This indicates that there are other possible factors capable of better explaining a woman's refusal. This group of women's level of education is more related opportunity costs. We find that once enough time has elapsed during an interview, the relationship that develops between the interviewee and interviewer favors the woman's continued participation.

Regarding the considerable interest in the literature on evaluating the possible effects of domestic violence on an interviewee's decision to participate in survey research, our data show that having experienced domestic violence reduces participation. In other words, women who have already suffered violence at any time in their lives are more likely exhibit attrition. The sensitivity of the topic is may cause interviewees embarrassment, making her participation less likely, and women may avoid conversations with strangers that could lead to re-experiencing trauma (GROVES; COUPER, 1998).

Retaining victims of domestic violence in longitudinal studies is a challenge (see Clough et al. (2010)) due to a series of difficulties that they face. The literature considers many ethical and safety strategies to improve these women's participation (CLOUGH et al., 2010), (LOGAN et al., 2008), (SULLIVAN; CAIN, 2004). Failing to consider attrition in these situations can lead scholars to underestimate the prevalence of domestic violence.

The aim of this study was to understand how selected factors affected attrition in the PCSVDF<sup>Mulher</sup>. With these results, we can reduce attrition bias through a better understanding of this phenomenon. Consequently, we can devise better strategies to minimize interviewee attrition in future rounds of the survey. Moreover, this study will serve as guidance for future analysis, allowing scholars to consider the selection bias caused by attrition when estimating the parameters of the equation of interest, as called for in the works of Fitzgerald, Gottschalk e Moffitt (1997), Baigrie e Eyal (2013), Hausman e Wise (1979) and Cheng e Trivedi (2015).

We showed that there is reasonable evidence that, in studies of domestic violence that consider households in which women have or had a partner, participation decisions may be subject to the same gender domination that affects women's other choices. In other words, a woman's decision of whether to participate may be influenced.

In conclusion, we suggest that studying attrition in a disaggregated way may generate more information that cannot be detected in an aggregate analysis because different types of attrition are explained by different variables.

## 3.6 ATTACHMENT

Table 3.10 – Issues that compose the four areas

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### DOMESTIC VIOLENCE

- 1- He belittles or humiliates her in front of others.
- 2- He does things to intentionally scare or intimidate her (for example, by yelling or smashing things).
- 3- He threatens to hurt her or someone that she cares about.
- 4- He insists on having sex with her even after she initially refused his request.
- 5- He threatens to publish intimate photos or videos of her on the Internet.
- 6- He looks for calls/messages on her mobile phone, or he checks her email/social network account without her permission.

### PROGRAMS AND SERVICES

- 1- The Maria da Penha Law
- 2- Women's Specialized Police Station (DEAM)
- 3- Brazilian Women's Shelter
- 4- Court of Domestic and Family Violence against Women / Prosecutors Office of Domestic violence
- 5- Integrated Center for Women Support (CIAM)
- 6- Bureau of Policies for Women (SPM) / Bureau of Human Rights (SDH)
- 7- Dial 180

### MARIA DA PENHA LAW

- 1- It is a law that punishes the perpetrator for committing domestic violence
- 2- Under that law, only the victim can report the offender
- 3- Under that law, after reporting aggression, a woman in some cases cannot withdraw her complaint
- 4- The Maria da Penha Law applies equally to lesbians, transvestites, transsexuals and heterosexuals
- 5- The Maria da Penha Law applies to cases of violence perpetrated by ex-husbands/ex-partners/ ex-lovers
- 6- Female victims of domestic violence who can't afford to hire an attorney can go to Specialized Women's Police Stations

### ATTITUDES/NORMS ABOUT GENDER RELATIONS

- 1- If she has many male friends?
  - 2- If she neglects the children of the couple?
  - 3- If she argues/fights with him?
  - 4- If she refuses to have sex with him?
  - 5- If she cooks bad food, doesn't cook on time or doesn't do laundry or other domestic chores?
- 
-

Table 3.11 – Graphical matrix of effects on the predictive and marginal probability of age among the estimated models

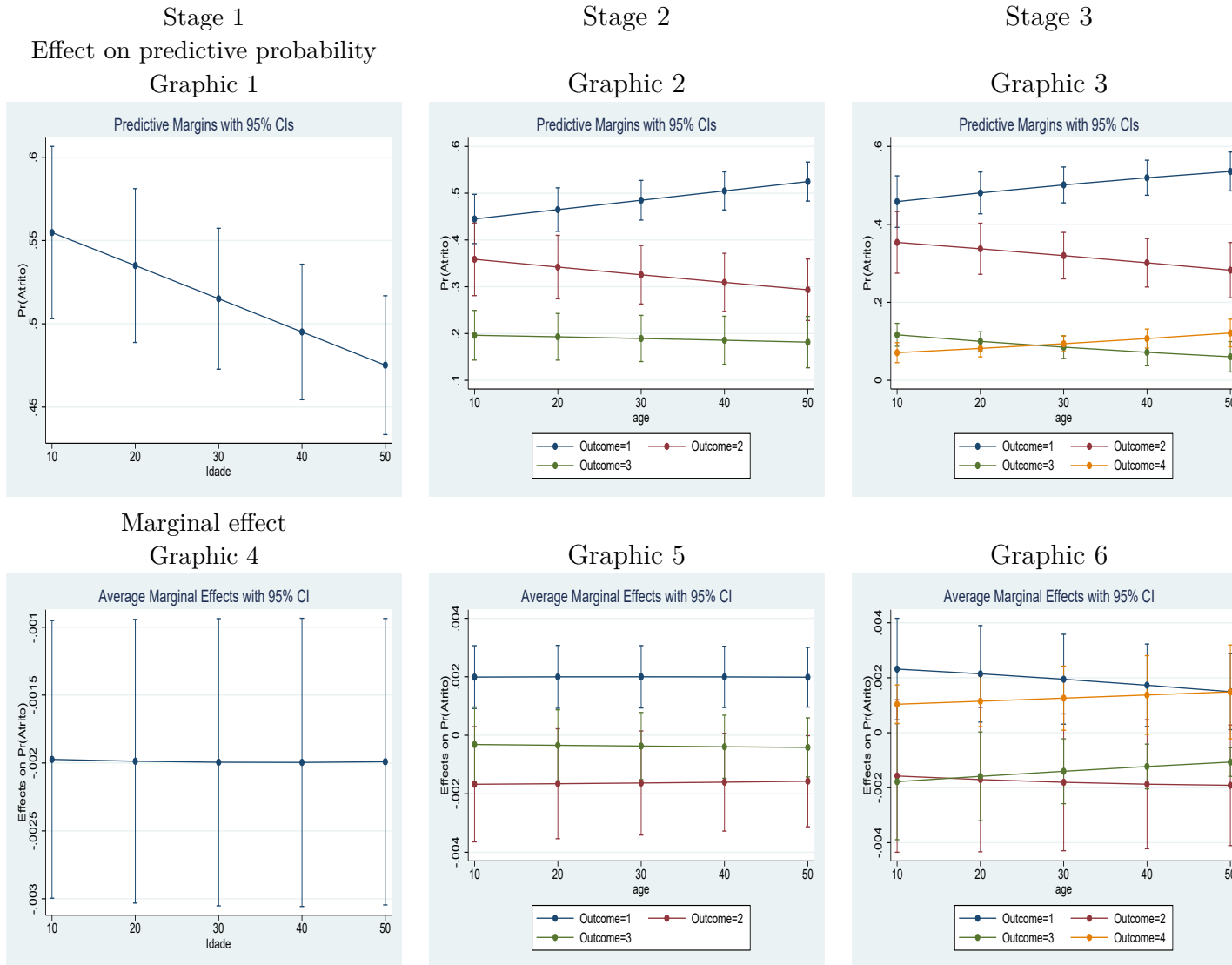
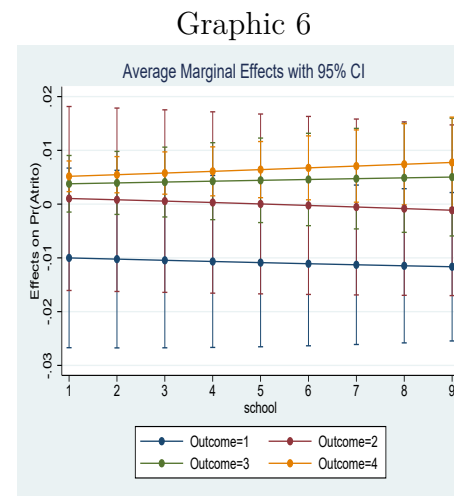
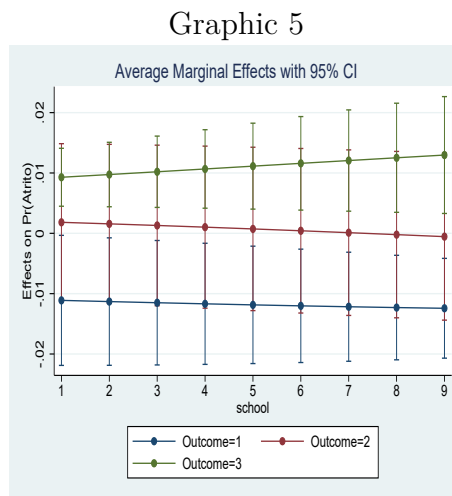
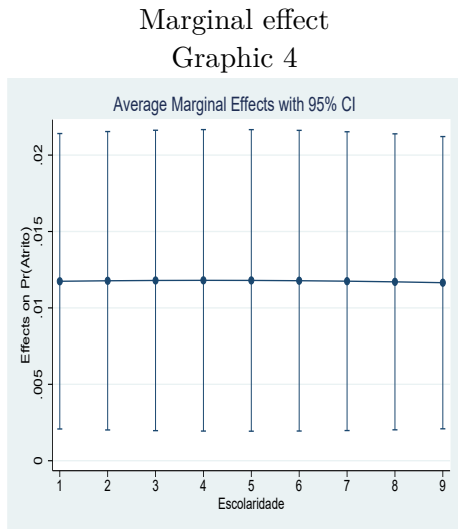
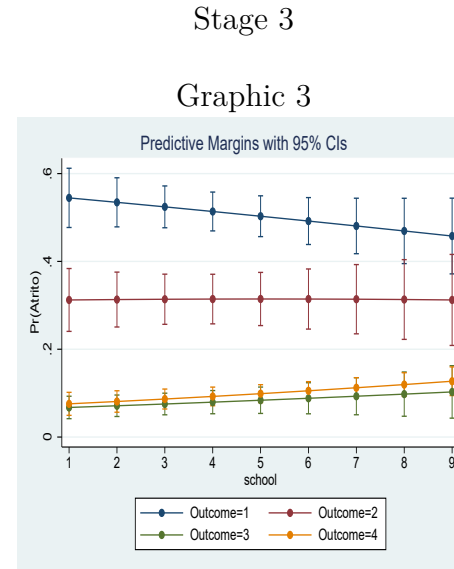
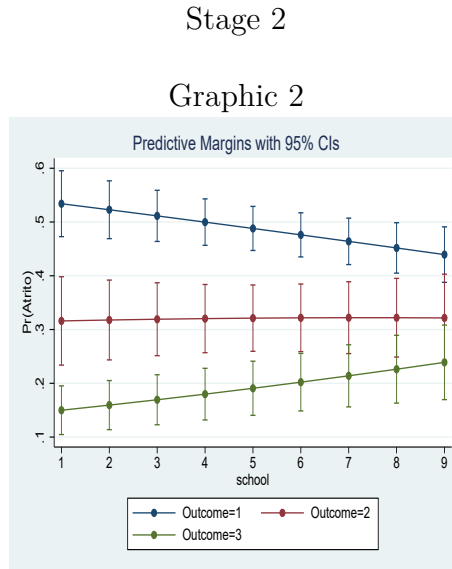
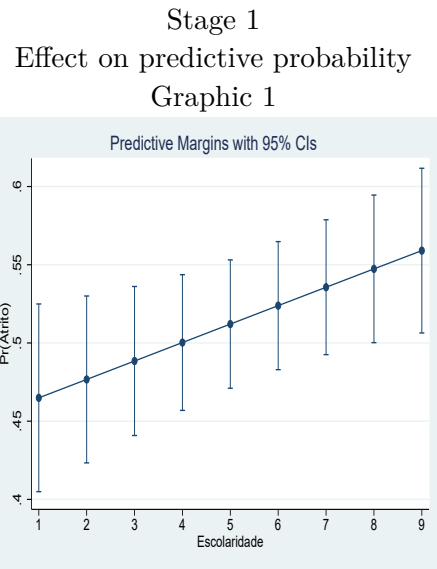


Table 3.12 – Graphical matrix of effects on predictive and marginal probability of schooling among the estimated models



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# 4 DOMESTIC VIOLENCE DURING PREGNANCY IN BRAZIL: PREVALENCE AND CORRELATES FROM THE *PCSVDF Mulher*

## 4.1 INTRODUCTION

Domestic violence is an important public health and human rights issue, victimizing near one-third of women worldwide (([GARCIA-MORENO et al., 2006](#)); ([DEVRIES et al., 2013](#))). In recent years, attention has also focused on intimate partner violence (IPV) during pregnancy due to its prevalence and adverse health consequences for both women and children ([WHO, 2011](#)). Cross-country studies find that this problem is very common in poor and developing countries (([WHO, 2005](#)); ([DEVRIES et al., 2010](#))).

In general, domestic violence during pregnancy affects the physical and mental health of women ([SARKAR, 2008](#)). Pregnant women who suffer from domestic violence are more likely to feel depressed and/or distressed and to have inadequate pre-natal care, in addition to experiencing vaginal bleeding, weight gain, increased cortisol, hypertension, and preeclampsia (([HAN; STEWART, 2013](#)); ([HASSAN et al., 2014](#))). In extreme cases, it may cause maternal death ([MCFARLANE, 2002](#)).

In addition, not only is a woman's life at risk when she is physically assaulted during pregnancy but that of her fetus is as well. Domestic violence during pregnancy is associated with low birth weight, intrauterine growth restriction and short gestation length (([NUNES et al., 2010](#)); ([ALHUSEN et al., 2015](#)); ([HOANG et al., 2016](#))), which are the main risk factors of neonatal morbidity and mortality (([BAILEY, 2010](#)); ([HILL et al., 2016](#)), ([SIGALLA et al., 2017](#))). Such violence also causes miscarriage (([JOHRI et al., 2011](#)); ([HAN; STEWART, 2013](#))). Moreover, the stress generated by domestic violence can lead women to adopt risky health behavior that harms the fetus such as smoking, drinking, and the use/abuse of illegal drugs, and it may lead women to induce abortion ([JOHRI et al., 2011](#)).

In this paper, we document new stylized facts on domestic violence during pregnancy in Brazil, using survey data collected in the first wave of the *PCSVDF Mulher* (Pesquisa de Condições Socioeconômicas e de Violência Doméstica e Familiar contra a Mulher – Survey of Socioeconomic Conditions and Domestic and Family Violence against Women) survey, conducted between March 30 and June 3, 2016. The main objectives of the *PCSVDF Mulher* survey are to measure the causes and consequences of domestic (and, in particular, intimate

partner) violence in Brazil.

The PCSVDF<sup>Mulher</sup> gathers information from more than 10 thousand women aged between 15 and 49, living in the state capitals of Brazil's Northeast Region, in two waves: 2016 and 2017. In addition to this information, the project provides data on bargaining power and the intra-familial allocation of resources, social and cultural standards, knowledge of civil rights and the use of judicial measures of protection against domestic violence, as well as information about couples (for example, education, risky health behavior, anthropometry, skin color, and labour market status), expectations and subjective assessments of well-being and partner abuse, among many other factors (CARVALHO; OLIVEIRA; SILVA, 2018).

We also present results from logistic regressions in order to investigate the potential risk and protective factors associated with domestic violence against pregnant women. These results can provide information for policymakers who want to better understand the potential driving forces behind the occurrence of domestic violence during pregnancy in Brazil and, in turn, better design preventive and protective policies for (pregnant) women.

Our data showed that the prevalence of domestic violence against pregnant women remained unchanged since the last survey conducted on the subject (WHO, 2005). Our estimates indicate that 6.2% of women were victims of domestic violence during pregnancy. Regarding the factors associated with the probability of being victims, we found that being younger, having less schooling, having more pregnancies and residing in the capital of Rio Grande do Norte are factors that are positively correlated with the probability of victimization.

The second part of the paper explores the profiles of victims during their most recent pregnancy. In this section, we depict the periodicity of aggression and the intensity of the acts. The results showed that the prevalence of aggression remained constant across quarters, corroborating the findings of some of the literature. Another shocking result shows that for 60% of these women, the number of incidents remained the same or increased over time. This finding is in line with the literature. In this sense, the results show that pregnancy does not protect women from violence perpetrated by their partners (SILVA et al., 2011).

This chapter is divided into four sections, excluding the present introduction. The second section summarizes studies on the prevalence of domestic violence during pregnancy. We describe the main national and international studies in the area, as well as the prevalences they report. In section three, we present the methodological aspects of this work, as well as the database, description of variables and model used. In the fourth section, we report the results of this work. Finally, in section five, we offer our final considerations.

## 4.2 LITERATURE REVIEW

International studies in the area indicate that a considerable share of women are victims of domestic violence perpetrated by their intimate partner during pregnancy ((GASHAW; SCHEI; MAGNUS, 2018), (WANG et al., 2017)), not only but especially in less-developed countries ((DEVRIES et al., 2010)). There is no consensus in the literature regarding the percentage of female victims. There is a range of studies that report different prevalence rates (see table 4.1).

Table 4.1 – Cross-country amplitude of prevalence rates (%) of physical IPV during pregnancy

Continents	WHO (2005)	Devries et al. (2010)	Range
Africa	2 – 12	3.8 – 13.5	2 – 13.5
Americas	8 – 28	4.1 – 11.1	4.1 – 28
Asia	1 – 12	2 – 5	1 – 12
Oceania	10 – 10*	2 – 2*	2 – 10
Europe	3 – 3	1.8 – 6.6	1.8 – 6.6
Range	1 – 28	1.8 – 13.5	1 – 28

Source: Authors' elaboration using information from WHO (2005) and Devries et al. (2010).

\* Only one country represents the continent in this sample.

Devries et al. (2010) describe the prevalence of IPV in two international surveys, the Demographic and Health Surveys (DHS) and the International Violence Against Women Surveys (IVAWS). The data presented are from 1998 to 2007, covering 19 countries. The purpose of these surveys is to provide data for a wide range of indicators for monitoring and impact assessment in the areas of population, health, and nutrition, in addition to a model of domestic violence. The second survey is a more targeted study, targeting violence against women, especially domestic violence and sexual assault. This survey was applied in 11 countries, covering a total of 23,000 women<sup>1</sup>. A notable feature of the latter is its method of collection, which includes questions asked over the phone. The pioneering work of WHO (2005) in the literature offers a framework for the application of surveys seeking to measure the prevalence of domestic violence, serving as a reference for all studies on the subject. This survey was applied in 2005 and covered 10 countries<sup>2</sup>, with a total of 24,000 women interviewed. One of the objectives of this research was to investigate the prevalence of three types of violence, emotional, physical and sexual, associated with the intimate partner and its consequences, as well as factors that may lead to women being at risk of being a victim.

According to WHO (2005) and Devries et al. (2010), the prevalence of physical violence during pregnancy ranges from 1% to 28%. Clearly, much of the prevalence is attributable

<sup>1</sup> Data for the 2008 publication

<sup>2</sup> For five countries, interviews were conducted in two cities, including one capital or large city, and one province or region, covering the urban and rural population, respectively

to the Americas, more precisely Latin America, and Africa (DEVRIES et al., 2010). Regarding the most recent studies, physical violence impacted 35.6% of respondents in Gashaw, Schei e Magnus (2018), 7.7% of respondents in Wang et al. (2017), 6.3% of respondents in Sigalla et al. (2017) and 3.5% of respondents in Hoang et al. (2016).

There are few studies on this topic that cover the Brazilian context (see table 4.2). The most recent Brazilian article published is Moraes et al. (2017), whose sample was 927 women interviewed in 2007. Moraes et al. (2017) noted that 18.3% of those interviewed reported having experienced some form of physical IPV postpartum. The second most recent study found that 11.9% of 142 women surveyed were victims of any type of domestic violence during pregnancy and that the most prevalent type was psychological violence (OKADA et al., 2015). There are two limitations of these data. The first is the geographical scope: much of the research analyzed the cities of Rio de Janeiro, São Paulo and Pernambuco. The second limitation concerns the time horizon of the surveys. Almost all Brazilian studies used data obtained during the period from 2006 to 2007. Thus, we note the absence of current research that seeks to understand and monitor the rates and prevalence of domestic violence during pregnancy.

Table 4.2 – Brazilian articles that studied the prevalence (%) of physical IPV during pregnancy

Authors	City	Sample	Sample period	Period of violence	Prevalence
Moraes et al. (2017)	Rio de Janeiro (RJ)	927	2007	Postpartum	18.3%
Okada et al. (2015)	São Paulo (SP)	112	2014	During pregnancy	11.9%
Viellas et al. (2013)	Rio de Janeiro (RJ)	8861	2000 - 2001	During pregnancy	2.5% - 5%
Audi et al. (2012)	Campinas (SP)	1379	2004 - 2006	During pregnancy	6.5%*
Moraes et al. (2011)	Rio de Janeiro (RJ)	811	2007	During and Postpartum	37.8%; 16.2%
Silva et al. (2011)	Recife (PE)	960	2005 - 2006	Before, during and postpartum	20.8%; 11.5%; 12.1%
Ludermir et al. (2010)	Recife (PE)	1045	2005 - 2006	During pregnancy	11.8%
Manzoli et al. (2009)	Rio Grande do Sul	627	2006 - 2007	During pregnancy	25.5%

\*Physical or sexual

Font: Data generated by author

The PCSVDF<sup>Mulher</sup> is an interdisciplinary effort among scientists to develop a questionnaire that can expand the scope of analysis on domestic violence. This research has interdisciplinary characteristics and the objective of studying domestic violence, the health of women and children, and the domestic relationships between women and men. In addition to this innovative perspective, one of the substantial distinguishing features of the PCSVDF<sup>Mulher</sup> is its longitudinal perspective, which is rare in the already scarce literature on domestic violence. The data in the PCSVDF<sup>Mulher</sup> provide a more comprehensive understanding of how to reduce domestic violence.

In summary, this study seeks to incorporate new measures of the prevalence of domestic violence during pregnancy. The novelty concerns the use of a new project and new database that depict this context. Another point that we can highlight relates to the region analyzed. We study the nine state capitals of the Northeast Region, which is a context that has not previously been studied. The seminal and pioneering work of WHO (2005) considered two



regions of the country, São Paulo and a city in Recife (in the Northeast Region). Therefore, this research attempts to increase the scope of the discussion of a topic of profound societal importance.

### 4.3 METHODS

The PCSVDF<sup>Mulher</sup><sup>3</sup> is a household survey, focused on women aged between 15 to 49 years, living in the nine state capitals of Brazil's Northeast Region. It is designed to improve the understanding of domestic violence in Brazil by providing information related to intra-household resource allocation, women's health and victimization, bargaining power and subjective expectations, and knowledge about the Maria da Penha Law<sup>4</sup>.

The sampling plan consists of stratifying the population of households in three stages. In the first stage, a random sample of census tracts in each state's capital was drawn, they were grouped into three subsets of sectors according to the head of household's average income per capita in the sector. In the second stage, a random sample of households was selected from each of the three subgroups of sectors selected in the previous step. Finally, in the third stage, and to ensure the safety and confidentiality of respondents.

The survey used carefully selected female interviewers and supervisors trained using a standardized 3-week training, covering issues of gender, violence, ethical and safety issues, and interview techniques<sup>5</sup>. The WHO ethics guidelines required that all interviews take place in complete privacy, except for infants younger than 2 years. Interviewers were trained in several strategies to ensure privacy, including the use of dummy questions in case someone entered the room and use of decoy interviewers to ask questions of mothers-in-law or husbands if this was the only way to ensure privacy with the respondent. All interviews were completed in the local language (Brazilian Portuguese), and information about available local services was provided to all respondents.

The sample size of the PCSVDF<sup>Mulher</sup> was defined in order to guarantee statistical significance<sup>6</sup>. A total of 11,570 eligible households were contacted. Of the eligible

<sup>3</sup> Ethics approval for the study was obtained from the Brazilian Scientific Ethical Committee (Approval Number 53690816.5.0000.5054).

<sup>4</sup> Brazilian law n. 11,340 of August 7, 2006, that typifies the crime of violence against women by defining domestic violence and determining the penalty for offenders.

<sup>5</sup> This was 40-hour training in each of the nine states, provided to roughly 25 - 35 interviewers per site (256 interviewers in total) and composed of three modules. The first module explored concepts of gender, gender norms, equality, gender-based violence and stigma. Instructors addressed how these topics interact at the moment of data collection and how to act during and after interviews (24 hours). The second module presented the technical aspects of the tools used during the field work, such as field and equipment operation, sampling issues, technical details about all sections of the questionnaire, and the use of the tablet and copy of Survey Solutions provided by the World Bank (12 hours). Finally, the third module dealt with incentives and motivations and some specific aspects of the questionnaire (4 hours).

<sup>6</sup> The technical details regarding sample sizes, their respective sampling errors, sample stratification, costs (relating only to the data collection), and other technical and operational details are available upon request.

households, 87% agreed to participate, 5% refused, and 8% were not in the household. Table 4.3 reports on the sample size and the final sample used in the current study.

Table 4.3 – Sample selection criteria for the study sample

Sample criteria	n
Eligible households	11,570
Agreed to participate - PCSVDF <sup>Mulher</sup> final sample	10,094
Women eligible for the domestic violence section	6,922
Women who agreed to participate	5,996
Women with experience of pregnancy (study sample)	4,241

Note. Authors' elaboration using the PCSVDF<sup>Mulher</sup>.

The total number of women sampled in the PCSVDF<sup>Mulher</sup> was 10,094, and 6,922 of them were eligible to participate in the section dedicated to the experience of domestic violence, that is, 6,922 women had ever had a partner. In this section, the response rate was 86.6% (5996/6922). However, the study is restricted to 4,241 women who reported at least one experience of pregnancy prior to the date of the interview and answered questions regarding domestic violence perpetrated by the current partner or ex-partner. This represents 70.7% (4241/5996) of all women who answered the section on experiences of violence perpetrated by the current partner or ex-partner.

The prevalence rates are computed from questions intended to describe the experience of domestic violence during pregnancy. It is worth noting that such experiences of domestic violence are restricted to instances of physical aggression during pregnancy and do not refer to sexual or psychological violence.

The questions related to domestic violence during pregnancy of the PCSVDF<sup>Mulher</sup> were as follows:

– **Panel A: Domestic Violence During Any Pregnancy**

- Was there ever a time when you were slapped, hit, beaten, or faced any other physical aggression by your CURRENT PARTNER, EX-PARTNER (MOST RECENT) OR ANY OTHER PARTNER while you were pregnant?
- During how many pregnancies were you beaten?

– **Panel B: Domestic Violence During the Most Recent Pregnancy**

- Did this happen during the most recent pregnancy?
- During your most recent pregnancy in which you were beaten, was the person who slapped, hit or beat you the father of the child?
- During your most recent pregnancy in which you were beaten, were you living with this person when it happened?

- You said that you were beaten during the last pregnancy. How often did you suffer physical aggression in each of the following periods?
  1. First trimester (never, rarely, sometimes, frequently, always)
  2. Second trimester (never, rarely, sometimes, frequently, always)
  3. Third trimester (never, rarely, sometimes, frequently, always)
- During your most recent pregnancy in which you were beaten, compared to before you were pregnant, did the slapping/beating (REFER TO RESPONDENT'S PREVIOUS ANSWERS) get less severe, stay about the same, or get worse while you were pregnant? By worse, I mean more frequent or more severe.

In Panel A, the first question regards the experience of physical aggression perpetrated by the partner or ex-partner while the woman was pregnant. The definition of physical violence during pregnancy in the PCSVDF<sup>Mulher</sup> is compatible with the definition in the Demography and Health Survey (DHS) and in the International Violence against Women Survey (IVAWS) ((DEVRIES et al., 2010)), as well as in WHO (2005). The second question refers to the number of pregnancies in which the women interviewed suffered aggression from their partner or ex-partner.

In Panel B, the questions are restricted to experience of physical aggression during the most recent pregnancy. For this particular group of women, the PCSVDF<sup>Mulher</sup> asks whether the aggressor is the father of the child and whether the woman and her aggressor were jointly living in the same domicile. The survey also provides information about the frequency of aggression by trimester of pregnancy, allowing us to capture the frequency of aggression within and across gestational periods. Finally, women who were beaten during the most recent pregnancy also reported their perception of the intensity of this aggression relative to the period before pregnancy.

### **Instrument of data entry**

The PCSVDF<sup>Mulher</sup> survey used CAPI (Computer - Assisted Personal Interviewing) data collection technology provided by the World Bank's Survey Solutions: a free computer-assisted personal interviewing software developed by the Development Research Group of the World Bank in collaboration with the Food and Agriculture Organization (FAO)<sup>7</sup>.

### **Statistical analysis**

Violence during pregnancy was modeled by means of a logistic regression model. Violence during pregnancy is treated as a dichotomous event, where  $P_i$  denotes the probability of  $i$ th woman being victim and  $Q_i = 1 - P_i$  denotes the probability of not being a victim. Logistic regression is used to model problems for which the response variable

<sup>7</sup> The goal of Survey Solutions, according to the World Bank, is to build capacity in developing countries by providing national statistical agencies and other institutions involved in data collection with cost-effective and sustainable solutions for conducting complex and large-scale surveys with minimal or no technical assistance.

is binary, meaning that it can take only one of two values, success or failure (AGRESTI, 2002). This type of model is part of the large family of generalized linear models and can be treated as a special case of them. STATA software was used to obtain the estimated model using maximum likelihood methods to estimate the parameters of the equation. Thus, the following formula represents this model:

$$\Pr(Y = \text{IPV during pregnancy} | \mathbf{X}) = \frac{\exp(\mathbf{X}'\boldsymbol{\beta})}{1 + \exp(\mathbf{X}'\boldsymbol{\beta})}$$

where  $\beta_j$  is the coefficient associated with  $x_j$ . The set of variables used to explain the model can be seen in the following section. The odds-ratio (OR) value, calculated through the  $e^{\beta_j}$ , is often used to provide a basic interpretation for the magnitude of  $\beta$ : the odds increase multiplicatively by  $e^{\beta}$  for every 1-unit increase in  $x$  (AGRESTI, 2002). For example<sup>8</sup>, consider a pharmaceutical drug study where  $y = 1$  denotes survival and  $y = 0$  denotes death and the regressors include a measure of drug intake. An odds ratio of 2 means that the odds of survival are twice those of death.

## 4.4 RESULTS

Table 4.4 presents the sociodemographic characteristics of the target group of women for the current study. Women aged 25-34 and 35-44 represent two-thirds of the sample or 33.8% and 32.9% of the sample, respectively. Younger women, aged 15-24, are 15.5% of the sample, and women aged 45-49 are 17.8%.

In addition, women who self-reported as brown (i.e., “pardo” or “mulato”) represent 53.5% of the sample, whereas black and white women constitute 24.4% and 20.8% of the sample, respectively. Asian and indigenous women represent only 0.42% of the sample.

Regarding women’s education, a large fraction of the sample, 48%, is composed by women with high school, technical education or incomplete college education. Women with primary school or incomplete high school represent 21.9%, and women without an education or incomplete primary school represent 21.7% of the sample. Women with college or graduate education constitute 8.2% of the sample.

Nearly 35% of the sample is composed by women who reported only one experience of pregnancy prior to the date of the interview. Another 32.3% of the sample refers to women who reported two experiences of pregnancy, while 18.4% reported three pregnancies, and 14.4% reported 4 or more pregnancies in their lives.

### **Prevalence of Domestic Violence during Pregnancy**

Table 4.5 reports the prevalence rate for the study sample, for subgroups of women defined by state capitals, and for sociodemographic groups. It is worth noting that 95.6%

<sup>8</sup> Example from Cameron e Trivedi (2005)

Table 4.4 – Sociodemographic characteristics of women with experience of pregnancy (N=4,241)

Variable	n	%
<b>Age</b>		
15-19	182	4.29
20-24	476	11.22
25-34	1434	33.81
35-44	1393	32.85
45-49	756	17.83
<b>Race</b>		
White	881	20.77
Black	1035	24.40
Brown	2268	53.48
Asian	3	0.07
Indigenous	15	0.35
Missing	39	0.92
<b>Education (definition 1)</b>		
No education	47	1.11
Some primary school	875	20.63
Primary school	348	8.21
Some high school	580	13.68
High school	1688	39.80
Technical course	98	2.31
Some college	251	5.92
College	262	6.18
Some graduate education	84	1.98
Missing	8	0.19
<b>Education (definition 2)</b>		
No education or some primary school	922	21.74
Primary school or some high school	928	21.88
High school, technical course, or some college	2037	48.03
College or some graduate education	346	8.16
Missing	8	0.19
<b>Pregnancies</b>		
1	1481	34.92
2	1369	32.28
3	782	18.44
4 or more	609	14.36
<b>City</b>		
Aracajú	443	10.45
Fortaleza	560	13.20
João Pessoa	595	14.03
Maceió	459	10.82
Natal	283	6.67
Recife	395	9.31
Salvador	654	15.42
São Luiz	476	11.22
Teresina	376	8.87

Note. Authors' elaboration using the PCSVDF<sup>Mulher</sup>.

(4056/4241) of the sample of women who are the target group of the current study complete the question about having experienced domestic violence during pregnancy.

The first row of Table 4.5 shows an overall prevalence rate of 6.2%. Regarding the state capital subsamples, Natal (the state capital of RN) has the highest prevalence of domestic violence during pregnancy, at 12%, whereas Aracajú exhibits the lowest prevalence, at 4.3%. The same table displays the distribution of prevalence rates across Northeastern Region state capitals and the 95% confidence intervals. Notice that the confidence intervals overlap each other, which means that the differences in prevalence rates across state capitals may be statistically insignificant. The exception is Natal.

The prevalence rates decrease in the age intervals, varying from 7.9% (15-19 years old) to 5.7% (45-49 years old). This evidence is in line with Devries et al. (2010), who show that prevalence rates of domestic violence during pregnancy in Latin America are higher for younger women. On the other hand, the prevalence rates by race/ethnicity groups are very similar. The prevalence rate is 5.9% among brown women, 6.1% among white women and 6.9% among black women.

Regarding women's education, we observe that the prevalence rate is decreasing in education attainment. For women without education or with incomplete primary schooling, the prevalence reaches 9.4%. Among women who completed primary education, 7.3% reported having suffered from physical aggression during pregnancy. For women who have completed high school, the prevalence rate drops to 5.2%. A small portion of women with a college education were victims, 0.9%.

Moreover, the prevalence also varies with the number of pregnancies. High prevalence rates are observed among women who experienced a high number of pregnancies. Approximately 3.1% of women with one pregnancy reported violence during pregnancy. This figure jumps to 5.4% for women with two pregnancies, and to 7.9% for women with 3 pregnancies. For women with 4 or more pregnancies, approximately 13.4% reported violence during pregnancy.

### Results from Logistic Regression

In Table 4.6, we study the correlates of having been physically assaulted by a partner or ex-partner during pregnancy. We run a logit regression of this dependent variable on binary indicators for age (20-24, 25-34, 35-44, 45-49), binary indicators for education (primary, high school, college), binary indicators for race/ethnicity (black and brown), and binary indicators for number of pregnancies and state<sup>9</sup>. The table reports the odds-ratio (OR) for each logit coefficient (i.e., the logit coefficient exponentiated).

The results in Table 4.6 show that the probability of being physically assaulted during pregnancy is inversely related with women's age. Women aged 35-44 have an OR=0.442

<sup>9</sup> The reference categories are women aged 15-19, women with no primary education, whites, women with one pregnancy and women living in Natal (RN).

Table 4.5 – Prevalence of physical aggression during pregnancy by state capitals, age groups, racial/ethnic categories and education (N=4,056).

<b>Variable</b>	n	%	95% CI
<b>Overall prevalence rate</b>	252	6.21	(5.49 - 7.00)
<b>City</b>			
Aracajú	423	4.26	(2.54 - 6.64)
Fortaleza	525	6.29	(4.37 - 8.71)
João Pessoa	571	5.95	(4.16 - 8.22)
Maceió	446	5.61	(3.66 - 8.16)
Natal	259	11.97	(8.28 - 16.56)
Recife	377	6.63	(4.34 - 9.63)
Salvador	638	6.90	(5.06 - 9.15)
São Luiz	468	4.49	(2.8 - 6.78)
Teresina	349	6.02	(3.76 - 9.05)
<b>Age</b>			
15-19	177	7.91	(4.39 - 12.91)
20-24	459	6.75	(4.63 - 9.45)
25-34	1376	6.32	(5.09 - 7.74)
35-44	1318	5.99	(4.77 - 7.41)
45-49	726	5.65	(4.08 - 7.58)
<b>Race</b>			
White	843	6.05	(4.54 - 7.88)
Black	992	6.85	(5.36 - 8.61)
Brown	2167	5.86	(4.91 - 6.93)
<b>Education (definition 2)</b>			
No education or some primary school	879	9.44	(7.59 - 11.57)
Primary school or some high school	893	7.28	(5.66 - 9.18)
High school, technical course, or some college	1941	5.20	(4.26 - 6.29)
College or some graduate education	335	0.90	(0.19 - 2.59)
<b>Pregnancies</b>			
1	1417	3.11	(2.27 - 4.15)
2	1311	5.42	(4.25 - 6.78)
3	745	7.92	(6.08 - 10.1)
4 or more	583	13.38	(10.72 - 16.41)

Note. Authors' elaboration using the PCSVDF<sup>Mulher</sup>.

(p-value<0.05), while women aged 45-49 have an OR=0.375 (p-value<0.01). The odds ratio for women aged 24-35, OR=0.546, is significant only at the 10% level. Beyond these, we did not find significant differences in odds ratios for race/ethnicity, thus supporting the results in Table 4.5.

Highly educated women, those with college or graduate education, are the group of women least likely to report physical aggression during pregnancy, OR=0.139 (p-value<0.01), compared with women without any education or some primary schooling. Women with high school, technical education or some college are less likely to report domestic violence during pregnancy than women without primary schooling, but only at

Table 4.6 – Estimated odds-ratios from logistic regression model

	OR	SE	P-value		OR-95% CI
<b>Constant</b>	0.157	0.061	0.000	***	(0.074 - 0.336)
<b>Age group</b>					
20-24	0.714	0.248	0.331		(0.361 - 1.409)
25-34	0.546	0.176	0.061	*	(0.291 - 1.028)
35-44	0.442	0.146	0.013	**	(0.231 - 0.843)
45-49	0.375	0.131	0.005	***	(0.189 - 0.745)
<b>Race/Ethnicity</b>					
Black	1.050	0.217	0.814		(0.701 - 1.573)
Brown	0.901	0.159	0.554		(0.637 - 1.273)
<b>Education</b>					
Primary school or some high school	0.828	0.150	0.296		(0.581 - 1.180)
High school, technical course, or some college	0.724	0.122	0.054	*	(0.520 - 1.006)
College or some graduate education	0.139	0.083	0.001	***	(0.043 - 0.450)
<b>Pregnancies</b>					
2	1.911	0.395	0.002	***	(1.275 - 2.866)
3	2.950	0.657	0.000	***	(1.906 - 4.565)
4 or more	5.232	1.162	0.000	***	(3.385 - 8.087)
<b>State capitals</b>					
Aracajú	0.326	0.104	0.000	***	(0.174 - 0.611)
Fortaleza	0.467	0.130	0.006	***	(0.271 - 0.805)
João Pessoa	0.509	0.140	0.014	**	(0.297 - 0.872)
Maceió	0.466	0.139	0.010	**	(0.260 - 0.836)
Recife	0.526	0.156	0.030	**	(0.294 - 0.939)
Salvador	0.550	0.149	0.027	**	(0.324 - 0.934)
São Luiz	0.423	0.130	0.005	***	(0.231 - 0.774)
Teresina	0.488	0.153	0.022	**	(0.263 - 0.903)
LogLikelihood					-863.1
LR test, $\chi^2_{(20)}$					123.9
Observations					4012

Note. Authors' elaboration using the PCSVDF<sup>Mulher</sup>.

\* p-value<0.10, \*\* p-value<0.05, \*\*\* p-value<0.01.

the 10% level.

Regarding experiences of pregnancy, the risk of women reporting being physically assaulted during pregnancy increases with the number of pregnancies she experienced over her life course. Compared with women who reported only one pregnancy, women with 2 pregnancies have an OR=1.911 (p-value<0.01), whereas women who reported 3 pregnancies have a OR=2.95 (p-value<0.01). For women with 4 or more pregnancies, OR=5.232 (p-value<0.01).

Finally, Table 4.6 shows that women from other capitals are less likely to report having suffered physical aggression during pregnancy than women from Natal.

### Domestic Violence During the Most Recent Pregnancy

Table 4.7 presents additional information in order to understand the occurrence of domestic violence during pregnancy in state capitals in the Northeastern Region. According



to Table 4.5, a total of 252 women reported having suffered physical aggression during pregnancy. For this particular group of women, the PCSVDF<sup>Mulher</sup> asked them about the number of pregnancies during which they were physically assaulted.

Of the 247 women, approximately 24% reported having been victimized by their partner or ex-partner during at least two pregnancies. Moreover, in Panel B, 143 of 249 women reported having been physically assaulted during the most recent pregnancy. Almost all women who reported domestic violence during the most recent pregnancy, 92.3%, reported that the father of the child was the aggressor, and 84.5% reported that they cohabitated with the aggressor.

In Panel C, we can access the intensity of aggression by trimester of pregnancy for women who reported having been physically assaulted during the most recent pregnancy (N = 143).

The response of “frequently” or “always” being assaulted during the first trimester was reported by 25.4% of women physically assaulted during the most recent pregnancy. Similar proportions are observed when women are asked about the occurrence of physical aggression during the second and third trimesters, 25.9% and 24.1%, respectively.

Moreover, a total of 129 women out of 143 (90%) reported the frequency of physical aggression in all trimesters of pregnancy. Thus, we identify approximately 38% of women who suffered aggression (those who answered rarely, sometimes, frequently and always) in all trimesters of pregnancy. For this particular group of women, domestic violence was regular throughout their pregnancy.

Finally, the PCSVDF<sup>Mulher</sup> asked to women who suffered physical aggression during the most recent pregnancy whether the aggression decreased, remained the same, or increased during pregnancy compared to the period before pregnancy. A total of 131 out of 143 women answered this question, and approximately 60% of them reported that physical aggression remained the same or increased with pregnancy.

## 4.5 DISCUSSION

The current study reported the prevalence of domestic violence in Northeast Brazil. The overall prevalence rate (6.2%), as well as the prevalence rates at the level of state capitals (4.3% - 12%), is in line of the estimates observed in previous studies ((WHO, 2005); (DEVRIES et al., 2010)), as shown in table 4.1, and other Brazilian studies in table 4.2. The WHO Multi-country Study on Women’s Health and Domestic Violence against Women provides a prevalence rate of approximately 8% for Brazil, using samples of women from the state capitals of São Paulo and Pernambuco. When rural municipalities are included, the prevalence rate increases to 11% (WHO, 2005).

These estimates suggest that domestic violence during pregnancy in Brazil remains a social scourge, and public policy has not been able to reduce it despite the Maria da

Table 4.7 – Characterization of domestic violence during pregnancy

Variable	N	%	95% CI
<b>Panel A: Pregnancies with aggression</b>			
1	188	76.11	(70.3 - 81.29)
2	41	16.60	(12.18 - 21.84)
3	10	4.05	(1.96 - 7.32)
>=4	8	3.24	(1.41 - 6.28)
Total	247	100	-
<b>Panel B: Beaten during the most recent pregnancy</b>			
Yes	143	57.43	(51.03 - 63.65)
No	106	42.57	(36.35 - 48.97)
Total	249	100	-
<b>The father of the child was the aggressor (from panel B=yes)</b>			
Yes	131	92.25	(86.56 - 96.07)
No	11	7.75	(3.93 - 13.44)
Total	142	100	-
<b>Woman lives with her aggressor (from panel B=yes)</b>			
Yes	120	84.51	(77.49 - 90.03)
No	22	15.49	(9.97 - 22.51)
Total	142	100	-
<b>Panel C: Frequency of aggression by trimester (from panel B=yes)</b>			
<b>1st Trimester</b>			
Never	46	35.38	(27.2 - 44.25)
Rarely	20	15.38	(9.66 - 22.76)
Sometimes	31	23.85	(16.81 - 32.11)
Frequently	12	9.23	(4.86 - 15.57)
Always	21	16.15	(10.29 - 23.63)
Total	130	100	-
<b>2nd Trimester</b>			
Never	45	33.33	(25.46 - 41.96)
Rarely	20	14.81	(9.29 - 21.95)
Sometimes	35	25.93	(18.77 - 34.17)
Frequently	15	11.11	(6.35 - 17.66)
Always	20	14.81	(9.29 - 21.95)
Total	135	100	-
<b>3rd Trimester</b>			
Never	50	37.59	(29.35 - 46.4)
Rarely	18	13.53	(8.22 - 20.54)
Sometimes	33	24.81	(17.74 - 33.04)
Frequently	9	6.77	(3.14 - 12.46)
Always	23	17.29	(11.29 - 24.81)
Total	133	100	-
<b>Aggression occurred during all trimesters</b>			
Yes	49	37.98	(29.59 - 46.95)
No	80	62.02	(53.05 - 70.41)
Total	129	100	-
<b>Comparing aggression before and during pregnancy</b>			
Decreased with pregnancy	52	39.69	(31.26 - 48.61)
Remained the same during pregnancy	49	37.40	(29.11 - 46.28)
Increased with pregnancy	30	22.90	(16.02 - 31.05)
Total	131	100	-

Penha Law having been passed over a decade ago. For instance, the largest prevalence rate from the PCSVDF<sup>Mulher</sup>, Natal at 12%, is comparable with the prevalence rate in provinces of Bangladesh and Tanzania (WHO, 2005). The lowest prevalence rate, Aracajú at 4.3% is slightly higher than the estimate for Haiti in 2005 (DEVRIES et al., 2010).

Analyzing the association of domestic violence during pregnancy with sociodemographic characteristics, we find that younger women are more exposed to violence during pregnancy than older women, as documented in the literature (CAMPBELL; GARCÍA-MORENO; SHARPS, 2004). However, a potential confounding factor is “recall bias”, as suggested by Devries et al. (2010). According to these authors, younger women are probably less prone to recall bias because they are more likely to have experienced IPV in the past year and to have been recently pregnant relative to women in older age groups.

Race/ethnicity is not a risk factor for domestic violence during pregnancy in Northeast Brazil according to the PCSVDF<sup>Mulher</sup>, in which black, brown and white women have similar prevalence rates, as the odds-ratios become statistically insignificant. Our results contradict some of the literature that has shown that race/ethnicity is associated with domestic violence during pregnancy (BAILEY, 2010), especially for black women in the U.S. ((JASINSKI; KANTOR, 2001); (BOHN; TEBBEN; CAMPBELL, 2004); (CAMPBELL; GARCÍA-MORENO; SHARPS, 2004)). Our results also corroborate the studies reporting that highly educated women are less likely to suffer from domestic violence, during pregnancy or outside it ((SALTZMAN et al., 2003); (BOHN; TEBBEN; CAMPBELL, 2004); (JEYASEELAN et al., 2004); (BAILEY, 2010)). However, assortative mating is a potential mechanism behind the association between education and domestic violence during pregnancy, as education influences marital prospects. An educated person is more likely to marry an educated spouse, resulting in higher household income and surplus. Moreover, education typically boosts the fraction of intramarital surplus received by an individual (BROWNING; CHIAPPORI; WEISS, 2014). On the other hand, having a large number of pregnancies is associated with a high prevalence of domestic violence during pregnancy in Northeast Brazil. Our result resembles the findings of Wang et al. (2017). A potential explanation is that women with several experiences of pregnancy are more likely to have had unintended pregnancies, which is an important risk factor for physical assault during pregnancy ((PALLITTO; CAMPBELL; O’CAMPO, 2005); (GAO et al., 2007); (AZEVEDO et al., 2013), (WANG et al., 2017)).

When we restrict the analysis to women who were physically assaulted during the most recent pregnancy, approximately 92.5% reported the father of the child as the main aggressor, and 84.5% of this group of women reported cohabitating with the aggressor. Moreover, for a considerable fraction of women physically assaulted during the most recent pregnancy, 34%, the aggression was perpetrated throughout all trimesters of the pregnancy, and 60% of them reported that the aggression remained the same or even increased with pregnancy compared to the pre-pregnancy period. This last evidence is in line with studies

that suggest that pregnancy does not protect women from domestic violence ((MACY et al., 2007); (TAILLIEU; BROWNRIDGE, 2010); (SILVA et al., 2011)), although evidence pointing in the opposite direction is also found in the literature (PARYS et al., 2014).

A detailed examination of Brazilian studies in the area of domestic violence that address pregnancy, reveals a vacuum that has not yet been explored (see table 4.2). It is observed that most of these studies analyzed data acquired around the years 2000 to 2007. The bibliographic work developed by Ramalho et al. (2017), on studies from 2006 to 2016, shows that most of the works in this area were published in 2007; in addition, the small number of Brazilian works is stark. A more recent example is the work of Moraes et al. (2017), which uses data from 2007. That is, we have a temporal lapse of almost 11 years without research using current data<sup>10</sup>.

It is important to highlight the considerable efforts made by researchers interested in better explaining this phenomenon, but it is necessary to expand the geographical scope of Brazilian research. Another point to highlight is the number of studies that depict only one specific region, often Recife or Rio de Janeiro, as in the studies of Moraes e Reichenheim (2002), Pereira et al. (2009), and Ludermir et al. (2010), in addition to the authors already cited in this study. In this sense, the PCSVDF<sup>Mulher</sup> broadens the discussion by addressing the issues of the Northeast Region, specifically its state capitals.

Our study contributes to the literature by providing further evidence on domestic violence during pregnancy in Brazil, using new data collected through the PCSVDF<sup>Mulher</sup> survey. The results have demonstrated the quality of these survey data, and their comparability with international data sources that focus on domestic violence against women.

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<sup>10</sup> It is worth mentioning the study by Okada et al. (2015). We consider this work to be more descriptive in nature because it considers a smaller scope than the other works in question

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