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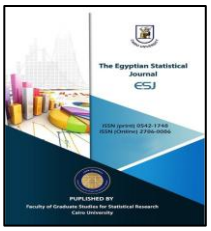

Determinants of Gender-Based Violence in Egypt: A Multilevel Approach

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Gender-based violence; Multilevel models; Hierarchical Structure; Logistic Regression.

Abstract

This study aims to identify the predictors of spousal physical violence against women in Egypt. The study used a two-level random intercept logistic regression model applied to the 2015 Egypt Economic Cost of Gender-Based Violence Survey. This sample was a cluster-stratified sample with two stages consisting of 20000 women aged 18-64. This multilevel model recognizes the nested structure of the data (women within regions) as well as enables regional and individual factors to be analyzed. There is some significant variation in the experience of physical violence by women across the regions as revealed by the analysis. The main findings suggest that factors related to both women and husbands are associated with violence, with higher education for both partners being protective. Women's socioeconomic status, acceptance of spousal violence, and husbands' financial control are identified as significant risk factors. This study highlights the importance of considering contextual factors in understanding women's vulnerability to spousal physical abuse. The results of this study highlight the need for interventions that address both general societal and economic circumstances (e.g., campaigns to challenge unfavorable social norms and economic empowerment initiatives for women) and individual-level problems (e.g., gender equality education programs). When researchers give policymakers clear easy-to-understand, and relevant facts, they can help shape policies, influence laws, and push for resources to support effective programs. It's crucial to get everyone in society involved in efforts to change the social norms, views, actions, and economic factors that lead to gender-based violence.

1. Introduction

Gender-based violence (GBV) represents a fundamental violation of human rights, rooted in deep power imbalances between genders. This global issue transcends geographical borders and socioeconomic strata, impacting women across diverse settings, from the intimacy of their homes to public spaces like workplaces, educational institutions, and communities. The World Health Organization's data indicates that approximately one in three women globally has endured some form of physical or sexual violence (World Health Organization, 2005) highlighting the scale of this problem. The United Nations Declaration on the Elimination of Violence against Women (0, 2015) provides a crucial framework, defining violence against women as any act of gender-based

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violence that results in or is likely to result in, physical, sexual, or psychological harm or suffering, encompassing threats, coercion, and deprivation of liberty, regardless of whether it occurs in public or private life. The repercussions of GBV against women extend far beyond the individual, creating ripple effects that destabilize families, fragment communities, and hinder national development. The economic costs are substantial, encompassing increased burdens on healthcare systems, legal services, and losses in productivity, ultimately impacting national economies and impeding societal progress.

In the Egyptian context, national surveys have consistently documented the prevalence of violence against women. The 2014 Egypt Demographic and Health Survey (EDHS) (MOHP et al., 2015) reported that approximately 30% of ever-married women aged 15-49 had experienced spousal violence, with physical violence being the most common form (25%), followed by emotional (19%) and sexual abuse (4%). Recent spousal violence (within the 12 months preceding the survey) affected nearly one-fifth of women. These experiences often resulted in injuries, with over one-third of those experiencing physical or sexual spousal violence reporting injuries, including 7% with serious injuries. While husbands were the primary perpetrators, violence from other family members, particularly mothers/stepmothers (31%) and fathers/stepfathers (26%), was also reported. Moreover, 7% of women experienced physical violence during pregnancy. Despite these high rates, only about one-third of women who had experienced violence since the age of 15 sought help, primarily from family members.

The 2021 Egypt Family Health Survey (0), the most recent national survey, presents a similar picture. It indicated that three in ten ever-married women aged 15–49 had experienced some form of spousal violence, with physical violence (26%) being more prevalent than emotional (22%) or sexual violence (6%). Approximately one-quarter of these women experienced spousal violence within the past year. Over one-third of those who experienced physical or sexual spousal violence sustained injuries, with 9% suffering severe injuries. Like the 2014 EDHS, husbands were the most frequent perpetrators, but women also reported violence from other family members since the age of 15, including mothers/stepmothers (15%) and fathers/stepfathers (16%). 6% of women reported experiencing physical violence during pregnancy. Alarmingly, only about one-third of women who had experienced violence since the age of 15 sought help, predominantly from family members.

Comparing the 2014 EDHS and 2021 EFHS reveals noteworthy trends. While the overall prevalence of spousal violence remained relatively stable at around 30%, there were shifts in the types of violence reported. The 2021 survey showed a slight increase in physical violence (26% vs. 25%) and more noticeable increases in emotional (22% vs. 19%) and sexual violence (6% vs. 4%). Recent reported experiences of spousal violence also saw a slight increase, from nearly one-fifth in 2014 to roughly one-quarter in 2021. The proportion of women injured due to physical or sexual spousal violence remained consistently high (over one-third in both surveys), with a slight increase in serious injuries from 7% to 9%. A significant difference emerged in reported violence perpetrated by family members other than husbands. The 2021 survey showed a considerable decrease in reports of violence from mothers/stepmothers (15% vs. 31%) and fathers/stepfathers (16% vs. 26%) compared to the 2014 EDHS. The rate of physical violence during pregnancy remained relatively consistent (7% in 2014 and 6% in 2021). The low rate of help-seeking among women who experienced violence persisted across both surveys, with approximately one-third seeking assistance, primarily from family.

The 2015 Egypt Economic Cost of Gender-Based Violence Survey (ECGBVS), a collaborative effort by CAPMAS, UNFPA, and NCW, provided critical insights into the economic ramifications of violence against women in Egypt. This nationally representative survey collected comprehensive data on various forms of violence experienced by women and girls aged 18–64 and estimated their economic costs. The ECGBVS examined physical, psychological, and sexual violence, classifying women as having experienced each type based on their affirmative responses to specific questions related to that form of violence.

The survey identified four cost categories: direct tangible, direct intangible, indirect tangible, and indirect intangible costs, quantifying and monetizing relevant aspects. This was the first study in Egypt to specifically address the economic consequences of domestic violence, translating the costs of experienced violence—such as injuries, work or education disruptions, and psychological problems—into monetary values. However, it's worth noting that the methodology involved simplified calculations and assumptions and did not capture the full multidimensional nature of GBV.

Key findings revealed a concerning the prevalence of spousal and premarital violence. Approximately 46% of ever-married women aged 18–64 had experienced some form of spousal violence, with emotional violence being the most common (43%), followed by physical (32%) and sexual (12%) violence. 10% of these women experienced all three types of violence. Within the 12 months preceding the survey, roughly 24% of ever-married women experienced at least one instance of spousal violence, often involving repeated incidents. 43% of women reported experiencing spousal violence in the past year, and 35% of spousal violence victims from more than a year ago reported injury. Critically, most women who experienced spousal violence did not seek help from services or authorities. Premarital violence was also prevalent, with 17% of women aged 18–64 reporting experiencing some form of violence by their current or most recent fiancé, with emotional violence again the most common (17%), followed by physical (4%) and sexual (1%).

Women at higher risk of GBV often include those with lower levels of education, those residing in rural areas, and those who are not formally employed, suggesting links to socioeconomic marginalization. In a geographically diverse country like Egypt, GBV prevalence can vary significantly across regions due to factors like geographic isolation and uneven income distribution. Localized analysis of disaggregated data can offer insights into regional disparities and underlying socioeconomic and cultural factors. It's crucial to acknowledge that individual characteristics alone do not fully explain GBV patterns. Contextual factors, such as community norms and opportunities available in different residential areas, play a significant role.

This study has two primary objectives: (1) to examine regional variations in women's vulnerability to spousal physical violence across Egypt's governorates through a multilevel framework; and (2) to identify individual-level covariates associated with currently married women's vulnerability to physical spousal abuse. We hypothesize that: (1) there will be significant regional variation in the prevalence of spousal physical violence; and (2) women's and their husbands' socioeconomic characteristics (e.g., education, wealth, employment) and attitudes towards violence will be significantly associated with the likelihood of spousal physical violence. This study focuses on violence within the marital relationship, consistent with the cultural norms in Egypt where cohabitation outside of marriage is rare. Therefore, the terms "spousal violence" and "domestic violence" will be used synonymously.

This paper is organized as follows: Section 2 provides a review of the relevant literature; Section 3 presents a descriptive analysis of the sample data; Section 4 presents the initial and working statistical models employed in this study; Section 5 details the results obtained from fitting these models to the data; and Section 6 concludes with a summary of the key findings and some policy recommendations. In addition, a discussion of limitations and recommendations for future research is presented.

2. Literature Review

All forms of violence against women have been reported in different countries; thus, violence against women is a universal issue drawing the interest of many scholars. This section presents a review of relevant research examining intimate partner violence in the context of other sociological phenomena. Violence against women in Nigeria has been studied in various research. (0 and Tenkorang, 2015) focused on ethnicity as one of the factors contributing to physical, sexual, and emotional violence against women in Nigeria, stating that the higher the incidence of family violence in the childhood of an ethnic group, the greater the incidence of reported physical and sexual IPV in that group. (Alkan et al., 2021)-(0 and Alkan, 2023) in their research in Turkey examined the impact of socioeconomic and demographic factors (region, age, education, employment, health, marital status, and number of children) as a contributory role in violent behaviors and controlling actions toward women. They employed a logistic regression model to analyze the data. Their findings highlighted that women's education, women with higher qualifications are less likely to be sexually abused, but more likely to suffer verbal, psychological, and economic abuse; on the other side, women who work are more likely to experience sexual violence but less economic violence. Other studies have utilized more advanced statistical methods for larger populations. Brazilian women were studied by (Ribeiro et al., 2017), and they applied structural equation modeling to determine if there would be a correlation between higher socioeconomic status with more social support and less exposure to violence. Some studies have used Latent Class Analysis (LCA) to assess the severity and type of IPV. In Mexico, low-income women associated the experience of physical IPV with work disruption and children's school absenteeism (0 et al., 2018, Scolese et al., 2020). In the same context, (Clark, 2019) in Nepal employed the LCA method and they were able to classify the physical IPV into four classes, out of these classes, the higher violence classes were statistically associated with greater depressive symptoms in women, after adjusting for a few confounders.

The most common statistical methods used in research on domestic violence in Egypt include logistic regression, whereas exploratory factor analysis was incorporated by (0 2008). According to their findings regarding wife-beating prevalence, there was an increase during the period from 1995 to 2005. Furthermore, there was a diminished association between sociodemographic factors and violence, which was split into extreme, strong, and moderate. Yount, 2005 analyzed data from Minya, Egypt, found that higher household wealth was negatively related to wife-beating, while lower education, more children, and younger age were positively related. Employment and co-residence with in-laws did not show significant correlations.

(Hafez et al, 2024) adapted a latent trait model based on item response theory to analyze domestic violence and its costs by including thirty-five observed variables. The employed methodology viewed each of these concepts as a multidimensional latent variable. Using their extensive model, they also studied the causal relationship between domestic violence and the economic consequences it has. This also encompassed the examination of the impact of socio-economic factors on violence against women. Mplus software was utilized to analyze data from the 2015

Egypt Economic Cost of Gender-Based Violence Survey (ECGBVS), aiming to achieve the best fit for the model under consideration. According to them, psychological abuse is at least as significant as physical abuse in their measurement of domestic violence. They also discovered that the costs of domestic violence in the first place are best examined in terms of quality of life as well as economic factors concerning the women and children affected. When analyzing for socio-economic factors, their research identified associations between domestic violence and the age, level of education, and occupation of the women and their husbands.

In Egypt, studies of gender-based violence (GBV) have not incorporated multilevel modeling as part of the analysis. Logistic regression together with exploratory factor analysis have been the common methods used to investigate the association between individual socio-demographic variables and incidence of violence ignoring the multi-level nature of the data. In this study, we employ a multilevel design that incorporates both levels of the individual and contextual factors. More specifically, the model attempts to explore the relationship between women's experiences of violence at the micro level and the socio-cultural context at the macro level.

3. Descriptive Analysis

Egypt Economic Cost of Gender-Based Violence Survey (ECGBVS-2015) analyzed data of women aged 18–64. The sample from the 2015 ECGBVS was a cluster-stratified sample with two stages. Stage one: selecting 1000 areas; 45% from urban areas and 55% from rural areas including all the governments except the border governorates. Stage two: selecting 22 families from urban areas and 21 from rural areas resulting in a sample of 20000 women aged 18-64. The ECGBVS excluded the frontier governorates since their populations comprise less than 1% of Egypt's population. The violence module of the survey was administered to all eligible women aged 18 to 64, regardless of marital status (including never married, engaged, currently married, divorced, and widowed).

The current study utilizes a 50% subsample of the ECGBVS survey, resulting in an initial sample of 10,000 women. From this initial subsample, we further focused on the 8,045 women who were currently married and completed the individual ECGBVS questionnaire in 22 of Egypt's 27 governorates, excluding the five frontier governorates. This focus on currently married women is due to the fact that the study focuses on spousal violence.

Egypt is administratively divided into 27 governorates. The ECGBVS 2015 surveyed 22 governorates, excluding the five frontier governorates. While the four urban governorates (Cairo, Alexandria, Port Said, and Suez) lack rural populations, the remaining 22 governorates are divided into rural and urban areas. Nine of these governorates are in the Nile Delta (Northern or Lower Egypt), and nine are situated in the Nile Valley (Southern or Higher Egypt).

The following table demonstrates the percentage of married women reporting physical violence perpetrated by husbands during the last 12 months preceding the survey, according to their residence. Table 1 shows that 10.51% of women who experienced violence perpetrated by husbands are living in urban areas, whereas this percentage is 21.24 % in rural areas. To gain a more detailed understanding of patterns in violence perpetrated by husbands, the data is further disaggregated by region of residence. The findings revealed significant regional heterogeneity. The

lowest rates of violence perpetrated by husbands were observed in all urban governorates (Cairo, Alexandria, Port Said, and Suez), with only 3.80% of women reporting such violence. In contrast, the highest rates were observed in lower Egypt, where 18.94% of women reported experiencing violence compared to 9.02% in upper Egypt.

Table 1. Prevalence of physical violence perpetrated by their husbands according to the residence during the last 12 months preceding the survey

Place of Residence	%
Urban residence	10.51%
Rural residence	21.24%
Urban governorate	3.80%
Northern Egypt (Lower Egypt)	18.94%
Urban areas	3.77%
Rural areas	15.17%
Southern Egypt (Upper Egypt)	9.02%
Urban areas	2.95%
Rural areas	6.08%

Source: Calculated by authors using ECGBVS 2015.

Regarding demographic and socioeconomic factors, exposure to physical violence perpetrated by husbands varies according to age, educational level, employment status, and wealth quintile. Table 2 demonstrates the prevalence of physical violence perpetrated by husbands according to demographic and socioeconomic characteristics.

Regarding demographic and socioeconomic factors, exposure to physical violence perpetrated by husbands varies according to age, educational level, employment status, and wealth quintile. Table 2 demonstrates the prevalence of physical violence perpetrated by husbands according to demographic and socioeconomic characteristics. The age group with the highest percentage of married women reporting physical violence perpetrated by husbands is 30-49 years old. Regarding educational attainment, women with a low educational level (Illiterate, Read and write, Primary, preparatory) have the highest percentage (19.76%) of reporting physical violence. The lowest percentage (2%) is reported among women with a high educational level (University and above). Unemployed women have the highest percentage (28.5%) of reporting spousal physical violence, compared to 3.26% of employed women.

Table 2. Prevalence of spousal physical violence in Egypt: a demographic and socioeconomic analysis in the last 12 months preceding the survey.

Background characteristics of married women	%
Age	
18-29	6.97
30-49	18.92
50-64	5.86
Educational attainment	
Low Education level (Illiterate, Read and write, Primary, Preparatory)	19.76
Middle Education level (Secondary, above intermediate)	10.00
High Education level (University and above)	2.00
Work status	

Background characteristics of married women	%
Employed	3.26
Unemployed	28.50
Wealth quintile	
Lowest	6.84
Second	6.33
Middle	6.04
Fourth	6.61
Highest	5.94
Opinions towards physical violence by husbands	
Agree	11.25
Disagree	20.53
Women's Views on Male Dominance in Households	
Agree	18.57
Disagree	13.18

Source: Calculated by authors using ECGBVS 2015.

The highest percentage (6.84%) of women reporting physical violence perpetrated by husbands is in the lowest wealth quintile. The lowest percentage (5.94%) is in the highest wealth quintile.
20.53% of women who disapprove of their husband's physical violence reported experiencing such violence. This compares to 11.25% of women who approve of their husband's physical violence. 18.57% of women who believe in male dominance declared exposure to physical violence perpetrated by husbands. This compares to 13.18% of women who do not believe in male dominance.

Table 3 presents the percentage of married women who report physical violence perpetrated by their husbands, according to various features related to their husbands. These features include age, education, employment status, and attitude toward financial control.

Regarding age, the highest percentage of married women reporting physical violence is found in the age group of 30-49 years old. This coincides with the age group with the highest percentage of married women reporting physical violence. In terms of educational attainment, women married to men with a low educational level (Illiterate, Read and write, Primary, Preparatory) have the highest percentage (18.56%) of reporting physical violence. Conversely, the lowest percentage (3.5%) is reported among women married to husbands with a high educational level (University and above).

Regarding employment status, women married to currently working husbands have the highest percentage (27.2%) of reporting physical violence, compared to 1.10% of women married to unemployed men and 3.35% of women married to retired men.
Finally, 29.58% of women married to husbands who do not financially control them reported experiencing physical violence, compared to 2.18% of women married to husbands who are financially controlling.

Table 3. Percentage of married women who report physical spousal violence during the last 12 months preceding the survey, according to some characteristics related to the husband

Background characteristics of married women	%
Age	
18-29	1.70
30-49	18.82
50-63	8.86
64 and above	2.39
Education attainment	
Low Education level (Illiterate, Read and write, Primary, preparatory)	18.56
Middle Education level (Secondary, above intermediate)	10.15
High Education level (University and above)	3.05
Work status	
Currently Working	27.20
Unemployed	1.10
Retired	3.35
Husbands Financially Controlling Their Wives	
Yes	2.18
No	29.58

Source: Calculated by authors using ECGBVS 2015 data set.

To summarize, the initial descriptive analysis reveals the complex nature of the examined situation. The analytical findings show substantial differences in the experience of physical use of force from group to group, perhaps mainly by age, education, urbanization, involvement in the labor market, financial decision-making, and attitudes toward male domination. This analysis underscores the complex interplay between geographic, socioeconomic, and cultural factors in shaping spousal physical violence in Egypt. In addition, this duality of individual-level context and the type of residential area is important to consider since it reveals differences in women's exposure to spousal physical violence.

4. Statistical Models

4.1 Regional Variation (Model I – Initial model)

As a first step, to assess the extent to which regional factors influence the likelihood of women experiencing physical violence perpetrated by their husbands, we initially employed an initial two-level model. This model examines the variation in physical violence exposure across different regions without considering individual-level characteristics (i.e. covariates). The dependent variable, y_{ij}, is a binary indicator denoting whether woman i in region j has experienced violence "1" or not "0". The model is specified as follows:

A logit transformation is commonly applied to account for the non-normal distribution of the binary responses. The resulting model

$$logit(P_j) = \gamma + U_j \quad (1)$$

where γ is the overall average logit of physical violence exposure across all regions, and U_j is the random effect capturing the regional variation in the logit of physical violence exposure. The random effects U_j are assumed to be normally distributed with mean 0 and variance τ^2. where $P_j = P(y_{ij} = 1)$ is the probability that the woman (i) in the region (j) has experienced physical

violence, n denotes the number of women, and m denotes the number of regions. It is assumed that this deviation is distributed with zero mean.

Through the defined model in (1), we can test the significance of the second-level variance by comparing its deviance to that of the same model fitted without the U_j terms (i.e. the restricted model). As will be shown later, the results strongly support the inclusion of a random effect for the region, indicating that geographic location is a crucial factor influencing the likelihood of women experiencing physical violence perpetrated by their husbands.

4.2 The Regional and Individual Effect (Model II – Working model)

Once we confirm the two-level structure for the data, we can improve the model by adding individual-level covariates. The updated model predicts the probability that a woman i from region j has experienced physical violence perpetrated by her husband. The logit transformation in (1) can be specified as follows

$$logit(P_j) = \gamma + \sum_{h=1}^{r} a_h \ X_{hij} + U_j \qquad (2)$$

where $U_j \sim N(0, \tau^2)$

The explanatory variables X_h are the individual covariates (continuous or categorical). X_h represents the characteristics of those who were vulnerable to violence, such as age, education, and employment status. The second-level random components U_j, which were already included in the null model defined in (1), now represent the residual effect of each region on the response variable, after controlling for the effect of the covariates X_h . Multilevel models of the form given in (2) have been widely used in the literature. Estimating these models can be made using maximum likelihood (ML), restricted ML (REML), or Bayesian estimation. See for example (Goldstein, 2011), (Hox, 2002), and (Bryk and Raudenbush, 2002). Estimation theory is well established to obtain estimates of the fixed effects and variance components in (2). See for example (McCulloch, 2003), (Jiang, 2007), (Wong and Mason, 1985), and (Rodríguez, 1995), and (Gelman, 2007). For inference about the variance components that support the use of the proposed model, see (Berkhof and Snijders, 2001) and (El-Horbaty, 2024). Estimation of multilevel models for binary response is readily available in R software using the lme4() package.

The model defined in (2) allows us to assess the impact of both individual characteristics and regional factors on violence exposure simultaneously. The individual-level predictors X_{hij} explain how these characteristics influence the likelihood of violence exposure, while the random effect U_j captures the remaining variation between regions. In essence, this model provides an extended view of the factors influencing violence exposure by considering both individual and regional levels.

When analyzing data using statistical models with categorical variables like marital status or employment status, we need to set reference categories. The choice of these reference categories was on purpose in this study. Conducting an initial check of the data based on descriptive analysis to find out which category in each categorical variable had the highest chance of being linked to vulnerability to violence. This smart choice lets us make useful comparisons, so we can compare other groups to the group most at risk. For example, the descriptive analysis showed that women whose husbands are currently working faced the most violence. In that case, we'd pick "employed" as the reference category for the husband's work status. To make things easier to understand, a

"baseline woman" an imaginary woman who fits all the chosen reference categories for all the variables in the model is created. This baseline matters because the model's starting point shows the predicted outcome for this person, while the numbers for other categories show how different the outcomes are compared to this set baseline. By picking reference categories based on who's most at risk, the model gives us more focused insights into the complex workings of domestic violence.

Section 3's descriptive examination of the GBV survey data served as the basis for choosing the covariates for the first-level model. A new variable that represents the age difference between the couple is developed to handle any potential multicollinearity between the age of the woman and her husband. A new covariate that represents the interaction between the lady and her husband's educational levels is developed to address any potential multi-collinearity. Eight interaction levels are produced by using "low education" as the reference level for both. Consequently, the variables listed below are included:

- **Age difference:** A continuous variable representing the difference in age between the woman and her partner, centered by regional mean **Education levels interaction variables:** With "low education" as the reference level for the woman and her husband.
- **Woman's employment:** With "unemployed" as the reference level.
- **Husband's employment:** With " employed " as the reference level.
- **Women's opinions towards physical violence perpetrated by husbands:** With "Disagree" as the reference level.
- **Women's views on male dominance in households:** With "agree" as the reference level.
- **Husbands Financially Controlling Their Wives:** With "No" as the reference level.
- **Wealth quintile:** With the fourth level as the reference level.

By incorporating both individual and regional factors, this model provides a comprehensive understanding of the factors associated with women's vulnerability to physical violence perpetrated by their husbands. The individual-level predictors shed light on how personal characteristics influence this risk, while the random effect captures the regional disparities.

5. Results

The results of Model II, which examines the contextual variability in the likelihood of exposure to physical violence perpetrated by husbands, will be presented first. This model is a multilevel model that does not include individual-level predictors. In this study, the first-level units are 8,045 currently married women aged 18-64 who were interviewed using the individual ECGBVS questionnaire. The second-level units are the 22 Egyptian regions, further disaggregated according to the typology of residence, urban or rural; plus, the four metropolitan governorates of Cairo, Alexandria, Port Said, and Suez that were considered exclusively urban, consequently, there are a total of 40 units at the second level. In the initial model, we obtained a variance component τ^2 of 0.5238, resulting in an intraclass correlation (ICC) of 13.7%. This indicates that 13.7% of the total variability in exposure to physical violence perpetrated by husbands can be explained by regional differences (administrative regions disaggregated into rural and urban areas). The significant value of τ^2 and the ICC suggests that region is a crucial factor influencing exposure to physical violence, justifying the use of a multilevel model to account for the hierarchical structure of the data.

Including first-level covariates in model II defined in (3) has resulted in an increase in the interclass correlation from 13.7% to 15%. This suggests that some of the regional variations in the outcome can be explained by individual-level factors. This increase might indicate that the added predictors are accounting for some of the variation in the outcome that was previously unaccounted for by the random effects. We also run the likelihood ratio test (Self and Liang 1987) using the ANOVA function in R where the obtained p-value is 0.0175, which supports the need to maintain the random region's effect in equation (3). A distribution-free test (El-Horbaty, 2024) was also used where the one-sided p-value was 0.0287. Thus, it is recommended that the current data be modeled using a working model that involves random effects as indicated in (3).

Table 4: Second level variance and corresponding intragroup correlation for the null model, and for model **II**

	Model I	**Model II**
Second level variance	0.5238	0.5799
Intragroup correlation ICC %	13.7 %	15 %

The results of Model II, defined in Equation (3), are presented in Table 5. To facilitate interpretation, the estimated coefficients have been transformed into probabilities of exposure to physical violence committed by the husband. The intercept estimate represents a baseline probability of 34.25% for a woman in a hypothetical reference region. Subsequent estimates can be interpreted as deviations from this baseline probability. It is observed that an age difference between the couple implies a 0.27% decrease in the probability of exposure to physical violence perpetrated by the husband, compared to the baseline woman.

Regarding the interaction between the couple's education levels, five out of the eight levels are significant. In particular, the most significant level is when both partners have a high education level. In this case, the probability of exposure to physical violence perpetrated by the husband decreases by 22.36% compared to the baseline woman. Considering the husband's work status, we notice that being currently not working is significant and implies a 4.09% increase in the probability of exposure to spousal physical violence, compared to the baseline woman.

Regarding the wealth quintile, three out of the four levels are significant, yielding a decrease in the probability of exposure to physical violence perpetrated by the husband between 5.05% and 6.74% as the wealth quintile level increases. Women's approval of physical violence perpetrated by their husbands is significant and yields a 14.93% increase in the probability of exposure to physical violence perpetrated by the husband. The estimate obtained for the variable concerning husbands' financial control is the highest in absolute value. A 51.66% increase in the probability of exposure to physical violence perpetrated by the husband is observed. It is important to highlight that the chosen mixed effects model satisfied the smallest AIC as well as conditional AIC (CAIC) among all competing models for the available covariates from the survey. This indicates the potential predictive capability of the model for further inferential procedures beyond those considered in this study.

Table 5. Model II estimates and interpretations coefficients and probabilities of exposure to physical violence committed by the husband.

Covariates	**Coefficients: β**	**Probability**	**Variation**
Intercept	0.65***	34.25%	-----
Age difference	0.01 *	33.98%	- 0.27%
Education levels interaction (husband's level/wife's level)			

Covariates	Coefficients: β	Probability	Variation
Middle/low	0.18*	30.42 %	- 3.83%
Middle / middle	0.56***	22.87%	-11.38%
High / middle	0.72***	20.21%	-14.04%
Middle / high	0.77***	19.39%	-14.86%
High / high	1.35***	11.89%	-22.36%
Husband work (not working)	0.18*	38.34%	4.09%
Wealth quintile			
Highest	0.32***	27.51%	-6.74%
Middle	0.28**	28.30%	-5.95%
Second	0.23 **	29.20%	-5.05%
Opinions towards spousal physical violence (Agree)	- 0.62***	49.18%	14.93%
Husbands financially controlling their wives (Yes)	-2.46***	85.91%	51.66%

Significance levels: *** 0.001,'**' 0.01 and * 0.05

6. Conclusion

Domestic violence against women, its causes, and its effects on society worry communities and researchers in many fields. This study improves our grasp of what makes women more likely to face physical abuse from their husbands in Egypt using a multilevel random intercept logistic regression model. Here's a summary of the key findings and what they mean. Using a multi-level random effects model to check the chance of experiencing physical violence showed differences in women's risk across regions in Egypt. This result highlights why it's crucial to use a multi-level approach when looking at the survey data. Also, both women's and their husbands' traits play a big role in determining the risk of physical violence. The study's results show that when both partners have more education, women are less likely to face violence.

A woman's place on the socioeconomic ladder measured by how much money she has, has a big impact on her chances of facing violence from her husband. The vulnerability of women to violence increases when women think it's acceptable for their husbands to hit them. The likelihood of violence is also increased when men have sole control over financial affairs. The study makes clear how personal and environmental factors interact to affect the probability that Egyptian women may be physically abused by their husbands.

The results of this study highlight the need for interventions that address both general societal and economic circumstances (e.g., campaigns to challenge unfavorable social norms and economic empowerment initiatives for women) and individual-level problems (e.g., gender equality education programs). When researchers give policymakers clear easy-to-understand, and relevant facts, they can help shape policies, influence laws, and push for resources to support effective programs. It's crucial to get everyone in society involved in efforts to change the social norms, views, actions, and economic factors that lead to gender-based violence.

Limitations and Further Research

This study contributes a focused analysis of currently married women and their vulnerability to physical spousal abuse. This targeted approach enabled a more in-depth examination, including

the identification of relevant covariates and the application of appropriate statistical models. While the scope of the present study is limited to currently married women, future research could expand the sample to include women of other marital statuses, such as widows, divorcees, and single women, to provide a more complete picture.

As the literature suggests, different types of violence (psychological, economic, and sexual) may require distinct modeling strategies and sets of covariates. It would be interesting to apply the multilevel framework to various forms of violence such as psychological, sexual and economic abuse.

A validation of the results established by the multilevel model based on the ECGBVS data set needs a comparative analysis in conjunction and appropriate datasets can be Egyptian national surveys datasets or other countries in the MENA region and Turkey (Alkan, 2021). Datasets may also be supplemented with Western country datasets where the sociocultural and political context is different regarding domestic violence, and this would help in mapping differences and similarities of the various socio-cultural settings into one contextual structure.

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