USING MULTIVARIATE ANALYSIS FOR BETTER EXPLAIN AND PREDICT INTIMATE PARTNER VIOLENCE

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Abstract: This study is intended to be educational and is of particular interest to young researchers. It first aims to present and analyze the most relevant risk factors of intimate partner violence (IPV), then to highlight the most used models in the fight against IPV, and, finally, to discuss them. By incorporating partner-related risk factors into standard screening procedures, we can potentially detect a higher number of women experiencing abuse, as well as those at greater risk of experiencing abuse or physical harm in the future.

Keywords: Domestic violence, Predicting domestic violence, Risk factors, Multivariate analysis, Structural equations modeling.

Résumé : Cette étude se veut pédagogique et s'adresse aux jeunes chercheurs; elle vise dans un premier temps à présenter et analyser de manière critique les facteurs de risque les plus pertinents de la violence conjugale, puis à identifier les modèles les plus utilisés dans la lutte contre ce type de violence et à les discuter. Grâce à l'intégration des facteurs de risque dans les protocoles de dépistage, nous pouvons ainsi identifier plus facilement de femmes maltraitées et celles qui courent un plus grand risque de maltraitance et de blessures.

Mots-clés : Violence domestique, Prédiction de la violence domestique, Facteurs de risque, Analyse multivariée, Modélisation d'équations structurelles.

Rezumat: Acest studiu se doreşte a fi educaţional şi se adresează tinerilor cercetători; îşi propune să prezinte şi să analizeze cei mai relevanţi factori de risc pentru violenţa în familie, să identifice modelele cele mai utilizate în lupta împotriva acestui tip de violenţă şi să le discute. Prin integrarea factorilor de risc în protocoalele de screening putem identifica un număr mai mare de femei abuzate sau cu un risc mai mare de abuz şi rănire.

Cuvinte cheie: Violenţa în familie, Predicţia violenţei în familie, Factorii de risc, Analiza multivariată, Modelarea ecuaţiilor structurale.

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1. Introduction

Different indicators have been highlighted to characterize the main dimensions of IPV. For example, physical aggression « involves dominating behavior such as slapping, hitting, kicking, biting, shoving or dragging, choking, burning or the use or threat of use of a weapon » (Vung et al., 2009), while psychological abuse includes « intimidation, constant belittling or humiliation, and threats, etc. » (WHO, 2012). Other forms of IPV such as forced sexual acts or controlling behaviors – « isolating a person from family or friends, monitoring their movement, and restricting access to information, financial support, or other assistance » (WHO, 2012) have been described. More terms are used to comprehend violence « as an expression of power, control, and domination enacted through a range of ongoing behaviors that often escalate » (Johnson., 2006).

For our analysis, we are going to use the definition of IPV as « physical, sexual, or psychological harm by a current or former partner or spouse » in a broad sense, which « can occur among hetero - or homosexual couples and does not require sexual intimacy » (Bishop and Patterson, 2002; Johnson, 2006; Ellsberg et al., 2008). So, IPV may occur in any intimate relationship: marriage, dating, cohabitation, etc. While men can be victims of IPV, the number of women abused is significantly higher (e.g., in France, in 2022, 82% of deaths within couples are women according to the Ministry of Interior). It's worth noting that most data collected have focused on IPV perpetrated by men against women in heterosexual relationships (Stewart et al., 2021, and the references therein).

International studies conclude that the IPV phenomenon exists in all countries, religions, and societies (Isaac, Enos., 2001; Hoffman, et al., 1994; Walton-Moss et al., 2005). Reported data show all social groups are affected. Despite the efforts of associations and stakeholders in the fight against IPV, there is a gap between the frequency of acts of violence and the number of victims' statements. Police statistics do not provide real data because victims do not always report or report their abuse late. This is particularly the case in France, which stands out for the regular publication of data on IPV. The fight against IPV is a real challenge for French public authorities.

In France, combating all forms of gender-based and sexual violence is the first pillar of the five-year Great Cause for Equality between Women and Men. The commitments made by the President of the Republic, on November 25, 2017, and the Government during the Interministerial Committee of Equality between Women and Men (CIEFH, 2018) on March 8, 2018, have led to accelerated awareness and significant progress for all women who suffer violence. Among the concrete advances, the following can be mentioned:
- Evolution of the legislative framework
- Improved understanding of this phenomenon through specific studies
- Development of systems facilitating freedom of speech and support for victims
- Consolidation and development of victims' care and protection systems

- Strengthened presence of social workers in police and gendarmerie services
- A comprehensive training plan for all concerned professionals

These measures aim to:
- Prevent: eliminate sexist stereotypes from an early age, as these contribute to the perpetuation of violence; this approach aims to reduce society's overall tolerance for such behavior
- Protect: ensuring the highest level of safety and security for victims and their children
- Punish: to end the culture of impunity surrounding these acts and to implement measures that deter repeat offenses

All measures to combat violence are useful but are not enough to reduce acts of domestic violence. To support these measures, it is important to determine the risk factors of violence and to develop models that make it possible to predict IPV (Garcia-Moreno & Watts, 2011).

2. Risk Factors for IPV Perpetration

In the literature, several multivariate approaches have been deployed to model IPV. It is important to note that some risk markers are not necessarily causal factors. Indeed, a correlation does not necessarily reflect a causal relationship.

As previous research shows, the risk of becoming a perpetrator of IPV results from a combination of individual, community, and societal factors. A study conducted in South Africa in 1998 (Jewkes et al., 2002) highlighted different risk determinants associated with violence against women: violence during childhood, low education, drinking alcohol, financial support, and so on; but the strongest relationship was found between women's status in society and the use of violence in conflict or power situation.

Social policies or intervention approaches to prevent violence could be better developed by understanding men's risk factors. Two studies carried out among men in Thailand and India found an increased risk of physical violence against wives associated with lower levels of education and living in poverty among men (Hoffman, Demo, and Edwards, 1994; Martin et al., 1999) or cultural factors such as transgression of gender roles (Martin et al., 1999).

Multivariate analysis was used by Tausch (Tausch, 2019) to investigate the acceptability rates of male intimate partner violence (IPV) in different societies around the world. This comparative study, based on World Values Survey data from 72 countries, found that disrespect of property rights and traditional values emerged as major drivers of high IPV acceptability rates, alongside attitudes on gender equality. It also highlighted geographic variations – there are higher rates of IPV acceptability globally in some countries (e.g., Mali, Serbia, Montenegro, Zambia, India, Egypt, etc.) than in others (e.g., Canada, Italy, Georgia, etc.).

Recent research carried out in France during the COVID-19 pandemic found that changes in anxiety/insomnia symptoms during lockdown increased the

risk of abuse, especially among socially vulnerable women (Peraud, Quintard, Constant, 2021).

Risk factor identification for intimate partner violence (IPV) has been a gradual process conducted by several researchers across multiple countries. While several typologies have been proposed in the literature, some fail to fully explain how specific risk factors contribute to IPV perpetration. Studies indicate that while certain factors consistently correlate with an increased risk of violence against women globally, others are context-dependent, varying between and even within countries (for instance, between urban and rural areas). Interestingly, some risk factors may be common to both victims and perpetrators, such as low educational attainment and exposure to parental violence during childhood. However, other factors may differ; for example, young age is a known risk factor for women experiencing IPV but not necessarily for men committing it.

Historically, research has primarily focused on individual-level factors, including low education, childhood abuse experiences, and problematic alcohol use. However, there's recognition of the significance of community and societal risk factors. These include traditional gender norms, women's unequal social, legal, and economic status, the broader use of violence in conflict resolution, and inadequate community sanctions against violent behavior.

Recent research confirms that domestic violence may be correlated with social and demographic factors (Varcoe, et al., 2011). Economic difficulties can increase the risk of violence by intensifying conflicts, altering power dynamics between partners, and challenging traditional (masculine) roles. Conflict-ridden relationships, particularly those involving financial disputes, jealousy, or perceived violations of gender norms, tend to experience higher rates of violence. Additionally, excessive alcohol consumption is associated with an increased likelihood of violent behavior. Women with high levels of educational, economic, and social empowerment generally face lower risks of domestic violence. However, the relationship between empowerment and violence risk isn't straightforward for women below this threshold. Men may resort to violence as a means of addressing identity crises, often triggered by financial struggles or a perceived loss of control over their partners. Societies that broadly accept violence as a norm tend to see higher rates of domestic abuse. To address these issues, experts recommend focusing preventive efforts on enhancing women's social status, challenging societal norms that condone violence, and reducing poverty and alcohol consumption (Campbell, 2002; Burke et al., 1989).

To synthesize, studies have highlighted four main categories of factors associated with an increased IPV risk:

Psychological/ Individual factors:

- Psychological traits (e.g., low self-esteem, impulsive or antisocial behavior, poor self-control, emotional insecurity, dependency, impulsiveness, etc.)
- Behavioral patterns (e.g., previous experiences of abuse, juvenile delinquency or aggression, substance abuse, lack of conflict resolution skills, etc.)

- Attitudes and beliefs (e.g., misogynistic attitudes, desire for relationship power and control, acceptance of violence, rigid gender roles beliefs, etc.)
- Mental health (depression, borderline personality disorder, etc.)
- Socio-economic resources (age, educational level, financial difficulties, unemployment, etc.)

Relationship factors:
- Unhealthy family relationships, experiencing poor parenting, witnessing violence between parents as a child
- Interactions with antisocial and aggressive peers
- Experiences of divorce or separation
- Relationship conflicts e.g., possessiveness, jealousy
- Social isolation and limited friendships etc.

Community factors:
- Poverty rates in the community
- Lack of educational, healthcare, and economic resources
- High unemployment level
- High levels of crime and violence in neighborhoods
- Low community engagement
- Low social support networks etc.

Societal factors:
- Traditional gender norms
- Weak policies or laws
- Inequality between men and women
- Acceptance of violence
- Income inequality etc.

The typology of risk determinants presented is a comprehensive reference guide but is not an exhaustive list. This framework must be applied methodically, because specific risk factors may manifest differently across diverse communities and contexts depending on the cultural, religious, social, and economic characteristics.

3. Multivariate Analysis Models

The question is: what elements contribute to a higher likelihood of women experiencing violence? The occurrence of violence against women results from a complex interaction of personal, relational, societal, cultural, and environmental influences. To comprehend this dynamic, researchers often use the ecological model. This framework considers both individual characteristics and the interactions between individuals and their environment. In this field, Lori Heise has made significant contributions through her extensive research on IPV prevention. From a multidimensional approach, she proposed a framework that considers the influence of societal and structural factors on IPV to better

comprehend the variation in rates of physical and sexual abuse. She also developed a framework to help identify men at higher risk of perpetrating abuse, as well as to comprehend and predict the circumstances or moments when a potentially abusive man could become violent (Heise, 1998, 2011).

Multivariate analysis allows researchers to simultaneously examine multiple variables and their associations with IPV, providing a more comprehensive understanding of this issue. There are several methods of multivariate analysis to explain violence against women such as *Multivariate Analysis of Variance* (MANOVA), *Multiple Correspondence Analysis (*MCA), and *Multinomial Logistic Regression* (MLR). However, the method most used in the literature is the *Method of Structural Equations Modelling* (SEM) to examine how different factors influence IPV and to better understand the observed conflicting relationships among them (Byrne, 2012).

Precisely, *Structural Equations Modelling* (SEM) is a multivariate statistical analysis method that allows to examination of structural relationships. It integrates elements of factor analysis and multiple regression analysis to explore the connections between observed variables and latent constructs (Kline, 2016; Wang & Wang, 2012).

Studies based on multivariate analyses revealed several important insights:

- Age factors: (e.g., older age has been associated with a decreased risk of violence against women; women who married at an early age (less than 18 years) have a higher risk of experiencing IPV)
- Mental health factors: (e.g. experiencing violence is correlated with anxiety symptoms)
- Individual history factors (e.g. previous experience of abuse is linked to an increased risk of future violence)
- Geographic disparities
- Complex interactions of factors, ranging from individual psychological factors to broader societal and cultural influences.

To concretely illustrate how SEM works statistically, we can provide an example from a study conducted by sociologist Kenneth Bollen (Bollen, 1979), a pioneer of SEM. Bollen modeled the relationships between a measure of development in 1960 (ind60) represented by variables x1, x2, x3, and democracy in 1960 (dem60) and 1965 (dem65) represented by variables y1 to y4 and y5 to y8, respectively. The variables were defined as follows: x1: Press Freedom, x2: Fairness of Elections, x3: Freedom of Group Opposition while y1, y2, etc; denote Energy Consumption per Cap, State's Control of Economy, Percentage of Population Protestant, Black's Timing of Development, Rostow-Collier's Economic Take-off Date etc.

The sociologist hypothesizes the existence of latent variables and the types of relationships between latent and measured variables. SEM analysis calculates which theoretical model is a good „fit".

In the figure below, measured variables are represented by squares, latent variables, which are estimated but not directly measured, are represented by circles, the curved arrows represent the covariances or correlations, and the straight arrows depict the direct effects (regression) between variables.
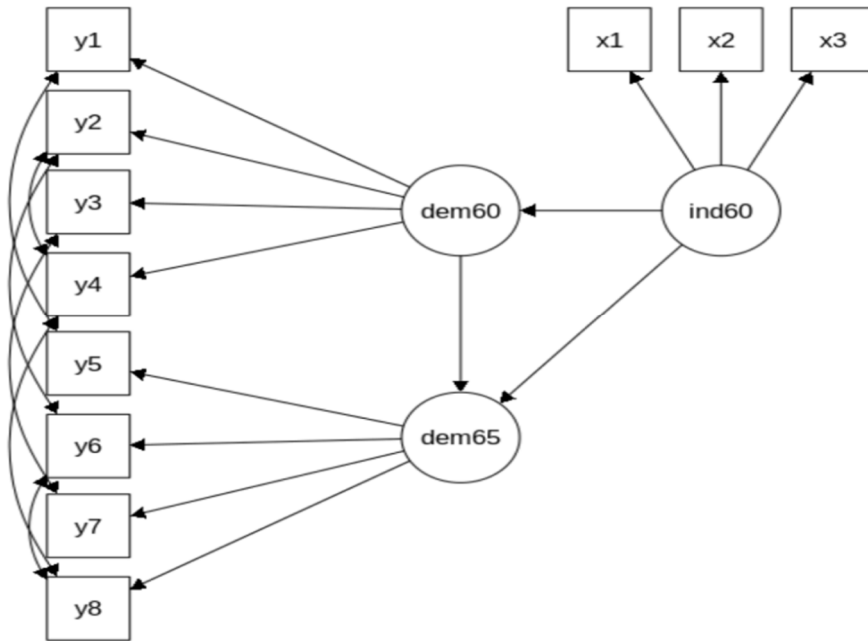
In a particular study of IPV, we could, for example, seek to model IPV as a latent variable influenced by measured variables such as jealousy, alcohol consumption, low economic status, drug use, poor behavioral control impulsiveness, etc. SEM analysis of structural relationships between the latent variable and the measured variables will identify the variables that have the strongest explanatory power for the IPV.

4. Conclusion

The works and research cited in this article lead to the conclusion that the study of violence against women is very complex and difficult to carry out. From a methodological point of view, the researcher motivated by an empirical approach in this field must take several precautions before approaching their work. For example, if he wishes to model IPV, he must consider the societal, community, and individual characteristics of his population. A judicious choice of these dimensions is crucial because it will lead to a relevant choice of risk factors and will determine the quality of the empirical work. There are other difficulties in using multivariate analysis methods such as data collection (because of underreporting of violence) and selection of study samples.

However, there are evident benefits in using this quantitative method: firstly, multivariate analysis allows researchers to identify high-risk groups for interventions; secondly, understanding the complex relationships among different factors of the IPV phenomenon helps in developing more effective prevention and intervention programs as well as in creating better support services.

Developing research on factors that could explain men's use of violence is imperative. That is because transforming supportive attitudes towards violence against women among men and reducing its acceptance play a key role in preventing such violence. Currently, there is limited literature on this topic, making it essential to broaden our understanding in this area.

References

Bishop, J., Patterson, P.G. (1992). Guidelines for the evaluation and management of family violence. *The Canadian Journal of Psychiatry, 37*(7), 458-471.

Bollen, K.A. (1979). Political democracy and the timing of development. *American Sociological Review*, 44(4), 572-587.

Bookwala, J., Frieze, I. H., Smith, C., & Ryan, K. (1992). Predictors of Dating Violence: A Multivariate Analysis. *Violence and Victims, 7*(4), 297-311.

Brown, T.A. (2015). *Confirmatory Factor Analysis for Applied Research*. Second edition. The Guilford Press.

Burke, P. J. et al. (1989). Gender identity, self-esteem, and physical and sexual abuse in dating relationships. In M. A. Pirog-Good & J. E. Stets (Eds.), *Violence in dating relationships: Emerging social issues* (pp. 72-93).

Byrne, B.M. (2012). *Structural equation modeling with Mplus: Basic concepts, applications and programming*. Routledge.

Campbell, J.C. (2002). Health consequences of intimate partner violence. *The lancet, 359*(9314):1331-1336 p. 12.

Comité Interministériel aux droits des Femmes et à l'Egalité entre les Femmes et les Hommes (CIEFH). (2018). dossier de presse

Douglas, K.S., Ogloff, J. R., Nicholls, T. L., & Grant, I. (1999). Assessing risk for violence among psychiatric patients: the HCR-20 violence risk assessment scheme and the psychopathy checklist: screening version. Journal of consulting and clinical psychology, 67(6), 917-930.

Ellsberg, M., Jansen, H. A., Heise, L., Watts, C. H., & Garcia-Moreno, C. W. H. O. (2008). WHO Multi-country Study on Women's Health and Domestic Violence against Women Study Team. Intimate partner violence and women's physical and mental health in the WHO multi-country study on women's health and domestic violence: an observational study. Lancet, 371(9619)1165–1172.

Fazel, S., Singh, J. P., Doll, H., & Grann, M. (2012). Use of risk assessment instruments to predict violence and antisocial behaviour in 73 samples involving 24 827 people: systematic review and metaanalysis. *BMJ, 345,* 4692.

Feder, G., MacMillan, H.L. (2012). Intimate partner violence. In: Goldman L, Schaefer AL (editors), Goldman's Cecil medicine. 24th ed. Elsevier Saunders, 1571–1574.

Ford-Gilboe, M., Wuest, J., Varcoe, C., Davies, L., Merritt-Gray, M., Campbell, J., & Wilk, P. (2009) Modelling the effects of intimate partner violence and access to resources on women's health in the early years after leaving an abusive partner. Social science & medicine, 68(6),1021–1029.

Garcia-Moreno, C., Watts, C. (2011). Violence against women: an urgent public health priority. Bulletin of the world health organization, 89, 2-2.

Heise, L. (1998). Violence against Women. An Integrated, Ecological Framework. *Violence against Women, 4*(3), 262-290.

Heise, L. (2011). *What works to prevent partner violence? An evidence overview.* STRIVE Research Consortium, London School of Hygiene and Tropical Medicine.

Hoffman, K. L., Demo, D. H., & Edwards, J. N. (1994). Physical wife abuse in a non-western society: An integrated theoretical approach. *Journal of Marriage and the Family, 56*(1), 131-146.

Isaac, N.E., Enos, V.P. (2001). *Documenting domestic violence: How healthcare providers can help victims.* Washington DC.

Jewkes, R., Levin, J., & Penn-Kekana, L. (2002). Risk factors for domestic violence: findings from a South African cross-sectional study. Social science & medicine, *55*(9),1603-1617.

Johnson, M.P. (2006). Conflict and control: Gender symmetry and asymmetry in domestic violence. *Violence Against Women, 12*(11), 1003-1018.

Kline, R. B. (2016). *Principles and practice of structural equation modeling.* The Guilford Press.

Mercklé, P. (2020). Les méthodes d'équations structurelles (MES) : Pour qui ? Pour quoi faire? Comment ça marche ? par Alain Lacroux (Vendredis Quanti, 31 janvier 2020). *Les Vendredis Quanti.* https://doi.org/10.58079/t4cf.

Ministère de l'Intérieur et des Outre-Mer. (2022). *Etude nationale sur les morts violentes au sein du couple. Année 2022.*

Peraud, W., Quintard, B., Constant, A. (2021). Factors associated with violence against women following the COVID-19 lockdown in France: Results from a prospective online survey. *PLoS One. Sep 10;16*(9)

Plan interministériel pour l'égalité entre les femmes et les hommes (2023 – 2027) Tous et toutes égaux. (2023). dossier de presse

Riggs, D. S., & O'Leary, K. D. (1989). A theoretical model of courtship aggression. In M. A. Pirog-Good & J. E. Stets (Eds.), *Violence in dating relationships: Emerging social issues* (pp. 53-71). Praeger Publishers.

Stewart, D. E., MacMillan, H., & Kimber, M. (2021). Recognizing and Responding to Intimate Partner Violence: An Update. The Canadian Journal of Psychiatry, 66(1), 71-106.

Tausch, A. (2019). Multivariate analyses of the global accept-ability rates of male intimate partner violence (IPV) against women based on World Values Survey data. *The International Journal of Health Planning and Management, 34*(4),1155-1194.

Trevillion K. et al. (2012). Domestic violence and mental disorders: a systematic review and meta-analysis. PLoS One.;7(12), e51740. Varcoe, C., Hankivsky, O., Ford-Gilboe, M., Wuest, J., Wilk, P., Hammerton, J., & Campbell, J. (2011). Attributing selected costs to intimate partner violence in a sample of women who have left abusive partners: a social determinants of health approach. Canadian Public Policy, 37(3),359-380.

Walton-Moss, B. J., Manganello, J., Frye, V., & Campbell, J. C. (2005). Risk factors for intimate partner violence and associated injury among urban women. Journal of community health, *30*(5), 377-389.

Wang, J. & Wang, X. (2012). Structural equation modelling: applications using Mplus. Noida: Thomson Digital.

World Health Organization & Pan American Health Organization. (2012). Understanding and addressing violence against women: intimate partner violence. World Health Organization. https://iris.who.int/handle/10665/77432

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