

Cross-national and multilevel correlates of partner violence: an analysis of data from population-based surveys



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Summary

Background On average, intimate partner violence affects nearly one in three women worldwide within their lifetime. But the distribution of partner violence is highly uneven, with a prevalence of less than 4% in the past 12 months in many high-income countries compared with at least 40% in some low-income settings. Little is known about the factors that drive the geographical distribution of partner violence or how macro-level factors might combine with individual-level factors to affect individual women's risk of intimate partner violence. We aimed to assess the role that women's status and other gender-related factors might have in defining levels of partner violence among settings.

Methods We compiled data for the 12 month prevalence of partner violence from 66 surveys (88 survey years) from 44 countries, representing 481 205 women between Jan 1, 2000, and Apr 17, 2013. Only surveys with comparable questions and state-of-the-art methods to ensure safety and encourage violence disclosure were used. With linear and quantile regression, we examined associations between macro-level measures of socioeconomic development, women's status, gender inequality, and gender-related norms and the prevalence of current partner violence at a population level. Multilevel modelling and tests for interaction were used to explore whether and how macro-level factors affect individual-level risk. The outcome for this analysis was the population prevalence of current partner violence, defined as the percentage of ever-partnered women (excluding widows without a current partner), aged from 15 years to 49 years who were victims of at least one act of physical or sexual violence within the past 12 months.

Findings Gender-related factors at the national and subnational level help to predict the population prevalence of physical and sexual partner violence within the past 12 months. Especially predictive of the geographical distribution of partner violence are norms related to male authority over female behaviour (0·102, $p < 0\cdot0001$), norms justifying wife beating (0·263, $p < 0\cdot0001$), and the extent to which law and practice disadvantage women compared with men in access to land, property, and other productive resources (0·271, $p < 0\cdot0001$). The strong negative association between current partner violence and gross domestic product (GDP) per person ($-0\cdot055$, $p = 0\cdot0009$) becomes non-significant in the presence of norm-related measures ($-0\cdot015$, $p = 0\cdot472$), suggesting that GDP per person is a marker for social transformations that accompany economic growth and is unlikely to be causally related to levels of partner violence. We document several cross-level effects, including that a girl's education is more strongly associated with reduced risk of partner violence in countries where wife abuse is normative than where it is not. Likewise, partner violence is less prevalent in countries with a high proportion of women in the formal work force, but working for cash increases a woman's risk in countries where few women work.

Interpretation Our findings suggest that policy makers could reduce violence by eliminating gender bias in ownership rights and addressing norms that justify wife beating and male control of female behaviour. Prevention planners should place greater emphasis on policy reforms at the macro-level and take cross-level effects into account when designing interventions.

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Introduction

Violence against women by a male intimate partner is both a violation of women's human rights and a profound health problem that interferes with their full participation in society and their countries' social and economic development.

Although violence affects many women's lives, it does so unevenly. Research shows that the prevalence of violence differs greatly across settings—eg between countries, within countries, and across neighbourhoods

and regions. The 12 month prevalence of partner violence (established with similar questions and methods between countries) varies from 4% in high-income countries such as Denmark, the UK, Ireland, and the USA to more than 40% of women in some low-income countries such as Ethiopia.^{1–5} In the WHO Multi-country Study on Women's Health and Domestic Violence (referred to as the WHO Study), reports of current abuse by a partner varied from less than 4% in Yokohama, Japan, and Belgrade, Serbia to 53·7% in

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See [Comment](#) page e302

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Research in context

Evidence before this study

Before initiation of this study, we did a comprehensive, but non-systematic, review of the scientific literature on macro-level factors associated with partner violence. Between July 1, 2014, and August 8, 2014, we searched Econlit, JSTOR, Scopus, NBER Working Papers, Medline, and Global Health using the search terms: "macro*", "community*", "ecological", "determinant", "cross-national", "country-level", "neighbourhood", and various terms for partner violence (eg, domestic violence, wife abuse) and grey literature available on relevant websites. We searched only English language journals. Only 9 relevant studies were identified, all with substantial flaws in their methods.

Added value of this study

The current study is the first to analyse macro-level predictors of partner violence with a well defined and highly similar measure of partner violence across countries, on the basis of

self-reported victimisation in population-based surveys, all with the same questions, survey methods, and ethical controls. It shows that gender-related factors at the country level and regional level—especially norms and property rights—predict the population prevalence of current partner violence (physical or sexual violence in the past 12 months). The study also shows that the macro-environment can potentiate or dampen the effect that individual-level factors have on the risk of partner violence.

Implications of all the available evidence

Our findings suggest that policy makers could reduce violence by elimination of gender bias in ownership rights and addressing norms that justify wife beating and male control of female behaviour. Prevention planners should place greater emphasis on policy reforms at the macro-level and take cross-level effects into account when designing interventions.

rural Ethiopia and 34.2% the Peruvian department of Cuzco.⁶ The average 12 month prevalence of partner violence across the 28 states of the European Union is likewise 4%. Even between neighbourhoods in a city or villages in a district, the prevalence of partner violence often varies substantially.⁷ This finding raises a crucial question: what accounts for these differences in levels of violence and can the geographical distribution of violence yield insights useful for violence prevention?

Feminists have long contended that the main drivers of partner violence are gender-related norms and hierarchies that shape relationships between men and women and structure women's access to resources.⁸ These factors, combined with genetic predispositions, developmental pathways, and partner-related and relationship-related factors, determine the likelihood that a couple will experience violence and drive the overall level of partner violence in a setting. Feminist-informed theory acknowledges the role of individual life-course factors, but emphasises the importance of community and macro-level factors as fundamental in defining levels of abuse.⁹

Research into intimate partner violence, however, has largely ignored the role of macro-level factors in affecting a woman's risk of violence and the geographical distribution of abuse. Violence research is dominated by studies from North America and other high-income settings and these have emphasised the role of personality and relationship dysfunction, childhood trauma and developmental adversity, and antisocial behaviour as key risk factors for partner violence.¹⁰⁻¹² Efforts from US researchers to test the feminist hypothesis on the importance of gender norms and hierarchies at a state level have yielded equivocal results,¹³ leading many academics to argue that gender plays a minor part in the cause of abuse.^{14,15}

Hence this study has two goals: to test the gender hypothesis by assessment of the degree to which macro-level factors related to women's status, gender inequalities, and norms of male authority and control are associated with population-levels of partner violence and to explore whether these factors interact with individual-level variables to predict a woman's personal risk of partner violence. Specifically, we examine the following four questions: do macro-level gender variables correlate with the geographical distribution of partner violence in the directions feminist-informed theory would suggest? What best accounts for the apparent association between a country's level of socioeconomic development and its overall prevalence of partner violence? Which factors remain important at the macro level when analysed in the presence of other macro-level and individual-level predictors of violence? Do important cross-level interactions exist between macro-level and individual-level factors that affect a woman's personal risk of partner violence?

This analysis builds on and extends the fairly undeveloped scientific literature about macro-level predictors of population prevalence of violence against women. So far, only nine studies^{13,16-23} have sought to explore country-level or state-level predictors of partner violence and all have weaknesses in the methods they have used, especially with respect to the outcome variable utilised. One study²¹ derives a numerical measure of partner violence on the basis of qualitative descriptions in human rights reports and the remainder rely on data from a range of studies that used different definitions and measures of intimate partner violence. Our analysis is the first to analyse macro-level predictors of partner violence at the level of the country and survey year with highly similar outcome data.

Methods

Study design and participants

In this analysis, we used several sources of data including 54 separate Demographic and Health Surveys (DHS) done between Jan 1, 2000, and Apr 17, 2013, 15 population-based surveys representing ten countries obtained between 2000 and 2004, as part of the WHO Multi-country Study of Domestic Violence and Women's Health (referred to as the WHO study); two national replication studies of the WHO study (Turkey²⁴ and New Zealand²⁵); and a national-level survey of partner violence from Germany that used similar measures and methods.²⁶ Prevalence surveys were selected for their similarity in terms of violence questions, methods, and ethical controls, on the basis of our knowledge of the area.

Additionally, we used national-level statistics compiled by the UN, the World Bank, the Organisation for Economic Co-operation and Development (OECD), and topic-specific datasets compiled by academic institutions to track specific issues, such as women's economic and political rights. These institutions routinely obtain or make available country-level data for the economy, employment, education, health, and other national-level statistics compiled by governments.

Both the DHS and WHO studies use in-person household surveys to interview a representative sample of women aged from 15 years to 49 years, either nationally (in the case of the DHS and WHO surveys done in Samoa and Turkey) or subnationally in the remaining WHO surveys. Both surveys used behaviour-specific questions about different acts of physical and sexual partner violence. Although wording about acts of violence differs slightly in some surveys, the variations are minor. All surveys used similar ethical guidelines designed to maximise safety and disclosure, including interviewing only one woman per household, maintaining complete privacy during the interview, and implementation of specialised sensitivity training for interviewers.^{27,28}

Outcomes

The outcome variable for this analysis is the population prevalence of current partner violence, defined as the percentage of ever-partnered women (excluding widows without a current partner), aged from 15 years to 49 years who experienced at least one act of physical or sexual violence within the past 12 months.

Our analysis focuses on partner violence in the past year to address differences in inclusion criteria between the DHS and WHO studies. The DHS is restricted to violence perpetrated by a woman's current or most recent partner, whereas the WHO study asks about violence perpetrated by any partner since the age of 15 years. By focusing on the previous 12 months for both surveys, we maximise similarity between them. Moreover, a comparison of how current macro-level factors affect present day rates of partner violence makes conceptual sense.

Our exposure variables represent various gender-related domains and control variables that offer alternative explanations for the geographical distribution of violence. The gender-related domains include women's status, women's economic participation and entitlements, women's political participation and entitlements, gender inequality between men and women, and gender-related norms and attitudes. Additionally, we include variables to control for a country's level of socio-economic development (natural log of gross domestic product [GDP] in purchasing power parity in 2011 constant US dollars) and the age structure of the population.

Table 1 summarises the individual data sources and variables used to represent each domain. All macro-level variables represent the mean level of that measure aggregated at the survey level (if derived from surveys) or a national-level measure, if taken from data banks maintained by multilateral agencies, such as the World Bank. Several of the indicators represent specialised indices of entitlements or discrimination created by academics or worldwide institutions to track gender-related trends. These include measures of women's political and economic rights from the Cingranelli-Richards Human Rights Database (eg, women's de jure and de facto economic entitlements) and two measures of gender inequality in family law and ownership rights created and maintained by the OECD as part of its Social Institutions and Gender Index (SIGI) database. In both indices, two experts independently assigned scores to countries on the basis of data from the US State Department's Country Reports on Human Rights Practices, according to a detailed coding scheme. The SIGI family law index, for example, assesses the degree to which states discriminate against women on issues of child guardianship and custody, access to divorce, the minimum legal age of marriage, and the right to inherit property. Values range from 0 (no discrimination between men and women in law and practice) to 1 (high discrimination between men and women).

For each explanatory variable tested, we used data from the same year that the violence survey was undertaken. Where an exact match was not available, the closest year to the survey date was used, giving priority to data obtained before the date of the violence survey.

Statistical analysis

This study uses various different techniques to address our different research questions. Scatterplots, histograms, and linear and quantile regression were used to assess normality, identify outliers, and examine the potential associations between macro-level explanatory variables and partner violence at a country and survey level. The goal of this bivariate ecological analysis was to assess whether the population-level distribution of partner violence is associated in the predicted direction with macro-level variations in women's status, gender inequality, and norms related to male authority and control. Quantile regression was used to check the robustness of our findings. Because

For the SIGI database see <http://genderindex.org/>

For the US State Department's Country Reports on Human Rights Practices see <http://www.state.gov/j/drl/rls/hrrpt/>

	Definition	Data source(s)
Women's empowerment		
Educational achievement	Proportion of women aged 15–49 years completing secondary education	Calculated from individual surveys
Educational achievement	Proportion of women in tertiary education	World Bank gender statistics database
Early marriage	Proportion of women aged 20–24 years married before age 18 years	Table 9 of the State of the World's Children 2011; data from DHS, UNICEF's Multiple Indicator Cluster Surveys, and other national surveys; data for Germany, Japan, and New Zealand from World Marriage Data Sheet 2008
Women's economic participation and entitlements		
Women's economic rights (0=no rights; 3=high de facto rights)	Specialised measure that codes the degree to which law recognises women's economic rights and governments enforce them	Women's economic rights and entitlements measure from Cingranelli-Richards Human Rights Database
Women working for cash	Proportion of women 15–49 years who work for cash	Calculated from individual surveys
Participation in formal employment	Percentage of women engaged in wage and salaried work	World Bank gender statistics database
Women's political participation and entitlements		
Women's political rights (0=no rights; 3=high de facto rights)	Specialised measure that codes the degree to which law recognises women's political rights and governments enforce them	Women's political rights measures of the Cingranelli-Richards Human Rights Database
Women's political participation	Share of women in national parliaments	World Bank gender statistics database
Level of gender inequality		
Access to secondary education	Ratio of married women to married men completing secondary education	Calculated from individual surveys
Enrolment in tertiary education	Ratio of female to male gross tertiary enrolment	World Bank gender statistics database based on UNESCO data
Earned income ratio (coded 0 to 1)	Ratio of estimated women's income compared with men's income	World Bank gender statistics database
Discrimination in ownership index	Measure that codes women's vs men's legal and de facto rights with respect to owning land, accessing credit (eg, bank loans), and owning property other than land (eg, a house)	Subindex on ownership of the SIGI, published by the OECD Development Centre
Discrimination in family law	Specialised measure that codes women's legal and de facto rights with respect to marital regimes, child custody, and inheritance	Subindex on family law of the SIGI, published by the OECD Development Centre
Gender-related norms		
Acceptance of wife abuse	Survey mean of women agreeing with at least one of six justifications for a man to beat his wife	Calculated from individual surveys
Male authority and control	Survey mean of women reporting that their partners exhibit one or more of five controlling behaviours	Family code subindex of the Social Institutions and Gender Index, published by the OECD Development Centre
Other variables		
Level of socioeconomic development	Natural log of gross domestic product per person in purchasing power parity (US\$2011)	World Bank gender statistics database

UNESCO=UN Educational, Scientific and Cultural Organization. SIGI=Social Institutions and Gender Index. OECD=Organisation for Economic Co-operation and Development.

Table 1: Variables and data sources for each macro-level domain

quantile regression models the median rather than the mean, quantile regression generally yields more accurate coefficients for skewed datasets, with fewer covariates emerging as significant. It also can be used to assess whether a covariate exerts a differential effect at low versus high ends of an outcome distribution.²⁹

Next, we ran the same ecological analysis with several variables. Standard errors are clustered at the country level to take into account that some countries have several surveys and therefore their observations are not fully independent. For this analysis, we used linear rather than quantile regression.

Our strategy for model building was to establish which variable from each domain dominated when taken together with the other variables selected to represent that domain. We selected the most robust measure for each domain (highest, most stable effect size), and then ran a set of structured regressions to establish whether the apparent association between a country's aggregate GDP per person and its partner violence persisted in the

presence of gender-related variables. All models include year-fixed effects. Robust p values are provided in parentheses. We regarded p values less than 0.10 to be statistically significant.

Multilevel analysis was used to examine whether the macro-level variables associated with the geographical distribution of partner violence were mainly a function of the characteristics of the individuals living there (a compositional effect) or suggestive of a higher order social process (a contextual effect). When we include the same variable at both levels, we essentially test whether there is an extra correlation between the macro factor and abuse in addition to that operating at the individual level.

Role of the funding source

The funder of the study had no role in the study design, data collection, data analyses, or data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

	Correlation coefficient (p value)	Predicted direction	Actual direction
Women's status			
Secondary school completion	-0.004 (0.062)	↓	↓
Enrolled in tertiary education	-0.202 (0.023)	↓	↓
Early marriage (2009)	0.214 (0.127)	↑	↑ NS
Economic participation and entitlements			
Economic rights	-0.056 (0.036)	↓	↓
Working for cash	-0.306 (0.040)	↓	↓
Formal employment	-0.007 (0.0004)	↓	↓
Political participation and entitlements			
Political rights	0.071 (0.316)	↓	↑ NS
Political participation	-0.009 (0.0002)	↓	↓
Level of gender inequality			
F/M ratio secondary school (in girls' favour)	-0.096 (0.260)	↓	↓ NS
F/M ratio tertiary education	-0.002 (0.032)	↓	↓
M/F ratio earned income (in men's favour)	0.139 (0.243)	↑	↑ NS
Gender inequality in ownership	0.271 (<0.0001)	↑	↑
Gender inequality in family law	0.044 (0.025)	↑	↑
Gender related norms			
Norms justifying wife beating	0.263 (0.0004)	↑	↑
Norms of male authority or control	0.102 (0.0002)	↑	↑
Other variables			
Socioeconomic development	-0.055 (0.009)	↓	↓

NS=non-significant. F/M=female to male. M/F=male to female.

Table 2: Bivariate associations between gender-related macro factors and mean levels of current partner violence (n=88 survey years)

Results

Our sample included 66 surveys and 88 survey years from 44 countries, representing 481 205 women. When including only surveys that did not have any missing values for our exposure variables, we had 30 countries and 56 survey years. Surveys are defined as a combination of country and year because some countries have more than one survey. The distribution of surveys by country is shown in the appendix.

Table 2 summarises the bivariate associations between gender-related macro factors and the geographical distribution of partner violence. As indicated by the arrows, all the ecological associations are in the direction that feminist-informed theory would predict (with the exception of political rights) although some did not achieve statistical significance, including early marriage, and the ratio of earned income between men and women. In addition to being associated with women's status and other gender-related variables, levels of partner violence seem lower in high-income countries than in low-income countries. For every log increase in GDP per person, the prevalence of partner violence decreases by 5.5%. These findings are robust to quantile and logistic regression and are largely similar in urban and rural samples (appendix).

	Beta coefficient (p value)							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Ln GDP per person	-0.055 (0.009)	-0.034 (0.037)	-0.015 (0.472)	-0.009 (0.686)	-0.010 (0.666)	-0.005 (0.849)	0.011 (0.641)	0.010 (0.670)
Norms justifying wife beating	..	0.183 (0.010)	0.147 (0.008)	0.164 (0.007)	0.165 (0.008)	0.146 (0.026)	0.079 (0.219)	0.087 (0.151)
Norms of male authority	..	..	0.084 (0.002)	0.078 (0.007)	0.078 (0.009)	0.087 (0.004)	0.094 (0.001)	0.095 (0.001)
Age 15-24 (years)	..	..	..	-0.077 (0.817)	-0.068 (0.849)	-0.077 (0.873)	-1.056 (0.132)	-0.826 (0.245)
Age 25-34 (years)	..	..	..	0.583 (0.234)	0.588 (0.230)	0.596 (0.214)	-0.556 (0.477)	-0.285 (0.697)
Less than 8 years in education	..	..	..	..	-0.007 (0.903)	-0.020 (0.826)	0.041 (0.791)	-0.009 (0.948)
8-11 years in education	..	..	..	..	0.003 (0.966)	-0.020 (0.880)	-0.027 (0.873)	-0.133 (0.420)
Women working for cash	..	..	..	..	..	-0.104 (0.467)	-0.007 (0.966)	-0.029 (0.841)
Discriminatory ownership rights	..	..	..	..	..	..	0.313 (0.006)	..
Unequal access to land	..	..	..	..	..	..	..	0.134 (0.055)
Unequal access to credit	..	..	..	..	..	..	..	-0.011 (0.867)
Unequal access to property	..	..	..	..	..	..	..	0.128 (0.066)
Constant	0.686 (0.0002)	0.514 (0.001)	0.217 (0.263)	0.042 (0.901)	0.050 (0.887)	0.036 (0.915)	0.471 (0.139)	0.380 (0.264)
Observations	88	80	64	64	64	63	56	56
R ²	0.291	0.473	0.585	0.598	0.598	0.584	0.692	0.717

All variables correspond to their mean values in the survey in question. All regressions include year-fixed effects. Robust p values are in parentheses. All standard errors are clustered at the country level. Each column represents a regression model with current intimate partner violence as the outcome variable and other variables as potential explanatory variables. GDP=gross domestic product.

Table 3: Ecological analysis of macro-level factors related to gender and women's status on mean levels of current partner violence

Table 3 explores alternative explanations for why reductions in violence might accompany socioeconomic development. Each column represents a separate regression on intimate partner violence in the past 12 months. With model 1, the negative correlation coefficient for GDP per person (-0.055, p=0.009) confirms that current partner violence decreases as the GDP increases. We postulated that GDP is actually a marker for more complex social processes and transformations in women's roles that frequently accompany economic growth and modernisation. Consistent with this theory, the correlation between GDP and partner violence decreases and becomes non-significant as we add in norms related to wife beating and male authority or control over women (models 2 and 3). We used models 4-6 to examine whether age structure, number of years in education, or the proportion of women working for cash could instead be responsible for the apparent association between norms and violence, but the ecological association remains statistically significant in the presence of these additional controls

See Online for appendix

	Model 1 (GDP + norms + age)	Model 2 (model 1 + education)	Model 3 (model 2 + attitudes + partner control)	Model 4 (model 3 + proportion of women working)	Model 5 (model 4 + discriminatory ownership)	Model 6 (model 4 + unequal land, credit, or property)
Survey-level variables						
Ln gross domestic product per person	0.002 (0.922)	0.010 (0.686)	-0.002 (0.936)	-0.007 (0.748)	0.019 (0.335)	0.004 (0.809)
Norms justifying wife beating	0.118 (0.047)	0.108 (0.063)	0.067 (0.200)	0.075 (0.175)	-0.058 (0.369)	-0.029 (0.588)
Norms of male authority or control	0.062 (0.067)	0.060 (0.073)	-0.023 (0.423)	-0.028 (0.357)	0.006 (0.803)	-0.019 (0.353)
Women working for cash	..	..	..	0.073 (0.660)	0.173 (0.173)	0.137 (0.231)
Discriminatory ownership rights	..	..	..	..	0.281 (0.001)	..
Unequal access to land	..	..	..	..	..	0.132 (0.015)
Unequal access to credit or banking	..	..	..	..	..	-0.084 (0.205)
Unequal access to property	..	..	..	..	..	0.155 (0.003)
Individual level variables						
Attitudes accepting violence	..	..	0.046 (<0.0001)	0.046 (<0.0001)	0.047 (<0.0001)	0.047 (<0.0001)
Partner control	..	..	0.079 (<0.0001)	0.079 (<0.0001)	0.080 (<0.0001)	0.080 (<0.0001)
Age 25–34 years	-0.012 (0.127)	-0.008 (0.355)	-0.004 (0.669)	-0.004 (0.681)	-0.002 (0.832)	-0.003 (0.744)
Age >34 years	-0.051 (0.0005)	-0.049 (0.001)	-0.043 (0.007)	-0.043 (0.007)	-0.039 (0.022)	-0.041 (0.015)
8–11 years education	..	-0.029 (0.211)	-0.016 (0.423)	-0.016 (0.416)	-0.014 (0.484)	-0.017 (0.381)
>11 years education	..	-0.080 (0.007)	-0.048 (0.053)	-0.048 (0.054)	-0.044 (0.063)	-0.046 (0.056)
Constant	0.046 (0.849)	0.000 (0.999)	0.095 (0.655)	0.117 (0.572)	-0.241 (0.247)	-0.014 (0.930)
Observations	366771	366670	351071	349914	341381	341381
R ²	0.020	0.024	0.123	0.122	0.130	0.132

Data are regression coefficients of current partner violence on different variables (p value).

Table 4: Multilevel analysis of gender norms and ownership rights

	Very high (80th percentile) acceptance of violence	High (above median) acceptance of violence	Low (below median) acceptance of violence	Very low (20th percentile) acceptance of violence
Attitudes accepting of violence	0.059 (<0.0001)	0.044 (<0.0001)	0.047 (0.0002)	0.029 (0.016)
Partner control	0.070 (<0.0001)	0.070 (<0.0001)	0.083 (<0.0001)	0.090 (0.007)
Working for cash	0.005 (0.607)	0.008 (0.510)	0.015 (0.084)	0.012 (0.219)
Age 25–34 years	-0.004 (0.575)	0.008 (0.437)	-0.019 (0.089)	-0.013 (0.473)
Age >34 years	-0.059 (0.002)	-0.041 (0.043)	-0.053 (0.041)	-0.047 (0.242)
8–11 years education	-0.052 (0.012)	-0.057 (0.017)	-0.002 (0.871)	-0.012 (0.559)
>11 years education	-0.085 (<0.0001)	-0.087 (0.006)	-0.029 (0.041)	-0.034 (0.287)
Constant	0.106 (<0.0001)	0.101 (<0.0001)	0.032 (0.281)	0.021 (0.647)
Observations	57366	161194	187728	84571
R ²	0.111	0.106	0.151	0.206

Mean acceptance of violence at median is 42% for high and low acceptance of violence; 48% for very high acceptance of violence; and 6% for very low acceptance of violence.

Table 5: Cross-level effect of individual risk factors for intimate partner violence in high versus low acceptance settings

14.6 percentage points higher in a setting where 100% of people agree with at least one of six justifications for wife beating (norms=1) compared with a setting where no one justifies abuse (norms=0), all other things in the model being equal (model 7).

With respect to the association between discrimination in women's ownership rights and current partner violence, the presence of ownership laws and practices that privilege men over women were robustly and significantly associated with higher levels of violence (0.313, p=0.006). The SIGI ownership index seemed to be the strongest predictor of aggregate levels of partner violence of all variables in the gender inequality domain. When the index was broken down into its component parts, only women's access to land and other property were significant, suggesting that ownership of assets rather than access to credit or banking drives the association (model 8). Additional analysis of urban versus rural samples further suggested that it is gender discrimination in ownership among women from rural areas that mostly accounts for the association present at a country level (appendix).

Table 4 shows the results of the same analysis but with multilevel regressions. Multilevel coefficients represent the risk of partner violence to individual women in the presence of macro-level factors. The advantage of multilevel regressions compared with ecological associations is that they show how factors are important at different levels in the social ecology. Table 4 shows that completion of secondary education (-0.080, p=0.007)

(table 3). Overall, this analysis suggests that the population prevalence of current partner violence against women is

and being older than 34 years (-0.049 , $p=0.001$) significantly reduce a woman's personal risk of partner violence. Living in countries or regions where acceptance of wife beating and male authority are high remains significantly associated with partner violence at the 10% level in the presence of these compositional controls.

Table 4 shows that women who accept wife beating as a man's right and who have a controlling partner are at a significantly higher risk of violence at the bivariate level (data not shown) and in multilevel analysis (0.046 , $p<0.0001$ and 0.079 , $p<0.0001$). Macro-level norms of acceptance and male authority are no longer significant in the presence of these individual-level factors, but they might be on the causal pathway between norms and intimate partner violence. Table 4 also shows that living in a country that discriminates against women in access to land and other property remains a strong driver of abuse-related risk (0.132 , $p=0.015$ and 0.155 , $p=0.003$), even in the presence of a range of individual factors.

Table 5 splits the sample between surveys in countries with a high acceptance of partner violence and a low acceptance of violence, showing potential cross-level interactions. High acceptance is defined as above the median of the survey mean of those accepting at least one justification for wife beating. Table 5 shows that the level of overall acceptance of violence affects the effect of individual age-related and education-related variables on women's risk of partner violence. The coefficient for education is greater in settings with high acceptance compared with lower acceptance of violence, suggesting that education is more protective in countries or regions where justification of wife beating is greater. Being in the age range of 15–24 years is also more risky in countries with high acceptance of violence (the p value of the difference is 0.064 for being 25–34 years compared with being younger than 25 years). All interaction p values are available in the appendix.

Table 5 also splits the samples into surveys with very high and very low mean acceptance of wife beating, defined as being above the 80th percentile (where more than 48% of survey respondents accept violence) and below the 20th percentile (where less than 6% do). In countries with very low acceptance, a woman's education, age, and whether she works for cash make no difference to her risk of partner violence, but education and older age are protective in high acceptance settings. Individual acceptance of violence is much more strongly associated with being abused in areas where partner violence is highly normative than where it is not (p value of the difference is 0.004). This finding suggests an interaction between norms condoning violence and individual attitudes. By contrast, having a controlling partner seems slightly more dangerous in settings with very little acceptance of violence than in settings where partner violence is normative (0.090 , $p=0.007$ compared with 0.070 , $p<0.0001$).

We did the same analysis for surveys where many versus few women work (appendix). Working for cash

increased a woman's risk of partner violence substantially more in settings where few women work than in settings where many women work (0.028 , $p<0.0001$ in surveys in the lowest 20th percentile of women working *vs* 0.016 , $p=0.076$ in surveys in the top 80th percentile of women working). Similarly, schooling is much more protective in settings with the lowest share of women working (bottom quintile) compared with the highest quintile (-0.130 , $p<0.0001$ *vs* -0.042 , $p=0.073$).

Discussion

Our analysis suggests that gender-related factors at the country and regional level help to predict the population prevalence of current partner violence (physical or sexual violence in the past 12 months). This includes factors related to women's status, such as educational achievement, women's access to cash or employment, and their *de jure* and *de facto* economic rights. Especially predictive of the geographical distribution of partner violence are norms related to male authority over female behaviour, norms justifying wife beating, and the extent to which law and practice disadvantage women compared with men in access to land, property, and other productive resources. Gender-related discrimination in family law, including differential rights to child custody, to inherit land and money, and to marry and divorce, also predict levels of partner violence across settings. Collectively, these associations provide suggestive empirical support for the gender hypothesis.

We similarly find that despite the strong and consistent negative association between GDP per person and level of partner violence, level of socioeconomic development is unlikely to be causally related to prevalence of intimate partner violence. Rather, GDP per person seems to be a marker for other social processes that often accompany socioeconomic development. These include erosion of the belief in male superiority, entry of women into the paid labour force, and increased access to education and economic assets for women. More gender-equitable norms could naturally emerge as values shift from survival issues to greater emphasis on self-actualisation, individualism, and innovation, as modernisation theorists contend.³⁰ Alternatively, norms could shift in the face of women's emancipatory demands and widespread entry into the paid labour force.³¹

Contrary to our expectations, partner violence was not associated with average prevalence of child marriage or gender inequities in the levels of secondary school completion or earned income. The tradition of child marriage might be restricted to specific regions or groups within a country and hence any association would be better captured at a community rather than at a national level. Previous research³² has shown an association between child marriage and intimate partner violence at the individual level, but to our knowledge, no other studies have examined this association at an ecological level. With respect to secondary school completion, contrary to our

expectations, rates were largely similar for boys and girls in many countries, making it a poor indicator of gender inequality.³³ Similarly, we suspect that reported levels of earned income are less reliable than data about employment or other economic indicators that were associated with intimate partner violence. These factors could partly account for the absence of an association. Alternatively, intimate partner violence could be more strongly associated with women's absolute status, rather than their relative status to men.

Our multilevel modelling suggests that macro-level processes affect women's individual risk of violence in addition to predicting the geographical distribution of abuse. Both gender norms and gender discrimination in access to land and property remain significant at the macro level when adjusted for the age and educational level of the women living there. Macro-level norms become non-significant when acceptance of violence and of a partner's controlling behaviour are added to the model; however, how to interpret this is unclear. Norms are likely to work precisely by affecting attitudes and behaviour, suggesting that these measures should not be in the regression because they are part of the causal pathway. As observed by Boyle and colleagues,³⁴ indiscriminately controlling for individual variables could attribute valid area-level effects to confounding when, in fact, they have set in motion person-level processes that increase risk of intimate partner violence. Additional research, including exploring norms at both the survey and cluster level, could help to clarify the situation.

Our stratified analysis shows the importance of taking into account cross-level effects. A girl's education is more strongly associated with a reduced risk of partner violence in countries where wife abuse is normative than where it is not (as shown by the larger coefficient in the split samples with high acceptance). A similar statistical interaction exists between education and working for cash (at the individual level) and the overall proportion of women who work. Should the association prove causal, educating a girl would yield a bigger dividend in terms of reducing her risk of violence in countries where wife abuse is highly normative. At the ecological level, having many women in the formal work force is negatively associated with a country's level of partner violence, but at an individual level, where few women work, working for cash increases a woman's risk of partner violence. This helps to explain past conflicting findings about the effect of employment on women's risk of violence.³⁵

These findings hold insights for future programming to prevent partner violence in low-to-middle-income countries. First, greater emphasis must be placed on shifting normative expectations around the acceptability of wife beating and the perceived right of men to control female behaviour. Similarly, practitioners and researchers should explore removing barriers to women's access to land and property as a potential strategy for reduction of intimate partner violence levels. A study³⁶ of women in

Kerala, India, identified that women who own immovable property—especially a home—are at a substantially lower risk of both current and lifetime partner violence than are those who do not.

More generally, prevention planning must acknowledge that factors have differential effects at the macro, community, and individual level and that strong cross-level effects exist. Thus, a microfinance or job-creation programme could increase a woman's risk of intimate partner violence in the short term, even though having many women in the workforce reduces a country's overall level of intimate partner violence. Similarly, some factors hold differential potential to reduce risk in high versus low violence settings, as shown by the larger coefficients in the quantile regressions run in countries with the highest levels of current partner violence compared with the lowest (top 20% of intimate partner violence distribution *vs* the bottom 20%). Increased understanding of these differentials could help better target prevention interventions. Given the potential of economic empowerment to increase violence in the short term, programmes must anticipate these risks and incorporate training for staff and safety planning with women to minimise any negative results of shifts in household gender dynamics.

Our findings are only as valid as the reliability of the original data sources, some of which depend on government reporting. Because data for many of the World Bank and OECD exposure variables are available only for certain years, covariate and outcome data are not optimally time-matched for all countries. Because national-level indicators change slowly and explanatory variables aggregated from the studies are not subject to this concern, we do not regard this as a major threat to validity.

An inherent problem in all macro-level analyses is to separate correlation from causality. We do not claim causality for any of the correlations presented here. Many potential variables might affect both abuse and our exposures of interest. We do find, however, that GDP is unlikely to be causally related to intimate partner violence, whereas norms and ownership rights are more likely to be. We urge future studies to use case studies and exploit natural experiments to disentangle the causal association between variables where possible.

Finally, we have used country or survey as our level of interest. Although this makes sense for factors such as laws and GDP, it might be too high a level to analyse acceptance and employment. Multilevel studies that have used cluster-level or village-level data have identified different cross-level effects from the ones we identify in this study. For example, Boyle and colleagues³⁴ identified that, in India, acceptance of violence at the neighbourhood or cluster level dampens the protective effect of education on violence, whereas we report that education is more protective in countries with a high acceptance of violence. Similarly, Cools and Kotsadam³⁷ find that in Africa, women who work are at greater risk of abuse in clusters with higher acceptance of violence, but we identified no such interaction at the macro level across our

more geographically varied dataset. These differences show that the reduction of intimate partner violence needs attention to the variable effects the same factor might have at different levels of the social ecology and a strategic matching of interventions to targeted level. We plan to explore community-level effects on intimate partner violence and cross-level effects of macro-level versus cluster-level factors in future analysis.

Contributors

LLH designed the study and developed the first draft of the manuscript. AK did the analysis and contributed to the manuscript. Both authors coded the data and interpreted the results.

Declaration of interests

We declare no competing interests.

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