# Does Rain Make Women Safer

## The Impact of Rainfall Shock on Domestic Violence

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# Outline

# Fast Facts About Domestic Violence

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# Domestic Violence Social and Public Health Concern & Human Rights Issue

- Intimate partner violence and sexual violence are major public health problems and violations of women's human rights.
- The consequences of domestic violence are extensive and range from the direct physical and mental harm for women and their children to economic losses at the community and national level.
- For children, exposure to domestic violence is associated with lower birth weight and IQ scores, and increased emotional and behavioral problems

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# Dowry Deaths: Consumption Smoothing in Response to Climate Variability in India.

Sheetal Sekhri and Adam Storeygard (2013)

- Using data from 583 Indian districts for 2002-2007
- Examine the effect of rainfall shocks on crimes against women
- They found that a one standard deviation decline in annual rainfall from the local mean increases reported domestic violence by 4.4 percent and dowry deaths by 7.8 percent.
- Wet shocks have no apparent effect.
- These patterns are consistent with consumption smoothing by households relying on agriculture, but inconsistent with hypotheses emphasizing general unrest.

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# Quantifying the Influence of Climate on Human Conflict

Solomon M. Hsiang, Marshall Burke, Edward Miguel (2013)

- They found strong causal evidence linking climatic events to human conflict across a range of spatial and temporal scales and across all major regions of the world.
- Each one standard deviationce change in climate toward warmer temperatures or more extreme rainfall, median estimates indicate that the frequency of interpersonal violence rises 4% and the frequency of intergroup conflict rises 14%.
- Because locations throughout the inhabited world are expected to warm 2s to 4s by 2050, amplified rates of human conflict could represent a large and critical impact of anthropogenic climate change

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# Crime, Weather, and Climate Change

Matthew Ranson (2012)

- This paper estimates the impact of climate change on the prevalence of criminal activity in the United States.
- The analysis is based on a 50-year panel of monthly crime and weather data for 2,972 U.S. counties.
- He documents a robust statistical relationship between historical weather patterns and criminal activity, and use this relationship to predict how changes in U.S. climate will affect future patterns of criminal behavior.
- The results suggest that climate change will have substantial effects on the prevalence of crime in the United States.
    - Temperature has a strong positive effect on criminal behavior, with little evidence of lagged impacts.

# Demographic and Health Survey

- The DHS survey enables the study of domestic violence, demographic and health outcomes, as well as the context in which violence took place.
- DHS program collects data on the prevalence of domestic and other forms of violence against women within the household.
- The questionnaire collects data for women age 15 to 49 years on a variety of characteristics, including age, marital status, parity, contraceptive use, education, employment, and empowerment status, as well as their husband's education, occupation, and alcohol consumption.

# Geographic Information Systems (GIS)

- The data include latitude and longitude coordinates of the surveyed communities and/or health facilities and can be linked to the DHS dataset.
- We Linked DHS and geographic data to see the effect of climate change on the rate of domestic violence

# Rainfall Data

- Data on rainfall and temperature were obtained from the University of Delaware website
- The data covers all of countries the period between1900-2010.
- The data is gridded by longitude and latitude lines, so to match these to districts, we simply use the closest point on the grid to the center of the district, and assign that level of rainfall to the district for each year.

# Rainfall Shock

- Normalized Rainfall Data
- "Negative rainfall shock" as a dummy which takes the value of 1 when annual rainfall in a district is one standard deviation below the long-run mean rainfall level
- "Positive rainfall shock" as the occurrence of rainfall one standard deviation above the long-run mean.

# Different Kinds of Violence

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- Physical Violence:
  - Ever been pushed, shook or had something thrown, slapped , punched with fist or hit by something harmful, arm twisted or hair pulled by husband/partner
  - Ever been kicked or dragged, strangled or burnt , threatened with knife/gun or other weapon by husband/partner
- Sexual Violence
  - Ever been physically forced into unwanted sex , forced into other unwanted sexual acts by husband/partner or physically forced to perform sexual acts respondent didn't want
- Emotional Violence:
  - Ever been humiliated, threatened with harm , insulted or made to feel bad by husband/partner

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Table 1. Summary Statistics

| Variables | Mean | Standard deviation | Minimum | Maximum | Observations |
|---|---|---|---|---|---|
| Sexual Violence | 0.09 | 0.29 | 0 | 1 | 276,320 |
| Physical Violence | 0.29 | 0.45 | 0 | 1 | 285,348 |
| Emotional Violence | 0.21 | 0.40 | 0 | 1 | 223,889 |
| Any Kind of Violence | 0.36 | 0.48 | 0 | 1 | 285,392 |
| **Rainfall Shock** | | | | | |
| Positive Rainfall Shock, Survey Year | 0.05 | 0.21 | 0 | 1 | 363,916 |
| Negative Rainfall Shock, Survey Year | 0.18 | 0.38 | 0 | 1 | 363,916 |
| Positive Rainfall Shock, Previous Year | 0.14 | 0.35 | 0 | 1 | 363,916 |
| Negative Rainfall Shock, Previous Year | 0.06 | 0.25 | 0 | 1 | 363,916 |
| **Respondent's Characteristics:** | | | | | |
| Age | 29 | 10 | 13 | 49 | 368,772 |
| Age Difference b/w Husband and Wife | 6 | 6 | -32 | 81 | 248,886 |
| Years of Education | 4 | 2 | 0 | 16 | 295,427 |
| Husband's Years of Education | 7 | 5 | 0 | 24 | 280,312 |
| Husband Drinks Alcohol | 0.44 | 0.50 | 0 | 1 | 226,024 |
| **History of Violence** | | | | | |
| Father Beat Her/Her Mother | 0.35 | 0.48 | 0 | 1 | 240,706 |
| Justify Beating | 0.35 | 0.48 | 0 | 1 | 323,266 |

Table 2. Effects of Rainfall Shocks and Couples' Characteristics on the probability of experiencing violence, Clustered by Region.

| | Dependent Variables: | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Any Violence | | Sexual Violence | | Physical Violence | | Emotional Violence | |
| **Rainfall Shocks** | | | | | | | | |
| Positive Rainfall Shock, Survey Year | **0.405*** ** | **0.017*** ** | **0.190*** ** | **0.053*** ** | **0.241*** ** | **-0.041*** ** | **0.288*** ** | **0.048*** ** |
| | (0.067) | (0.005) | (0.033) | (0.003) | (0.057) | (0.004) | (0.035) | (0.003) |
| Negative Rainfall Shock, Survey Year | **0.156*** | **0.156*** | 0.021 | 0.021 | **0.156**** | **0.156**** | 0.035 | 0.035 |
| | (0.090) | (0.090) | (0.042) | (0.042) | (0.077) | (0.077) | (0.053) | (0.053) |
| Positive Rainfall Shock, Previous Year | | **0.388*** ** | | **0.137*** ** | | **0.282*** ** | | **0.240*** ** |
| | | (0.072) | | (0.036) | | (0.061) | | (0.037) |
| Negative Rainfall Shock, Previous Year | | 0.095 | | 0.039 | | **0.128*** | | 0.063 |
| | | (0.090) | | (0.042) | | (0.077) | | (0.053) |
| Respondent's Characteristics | YES | YES | YES | YES | YES | YES | YES | YES |
| History of Violence | YES | YES | YES | YES | YES | YES | YES | YES |
| Region Fixed Effect | YES | YES | YES | YES | YES | YES | YES | YES |
| Year Fixed Effect | YES | YES | YES | YES | YES | YES | YES | YES |
| Mean of Rate of Violence | 0.36 | 0.36 | 0.09 | 0.09 | 0.29 | 0.29 | 0.21 | 0.21 |
| S.D of Rate of Violence | 0.48 | 0.48 | 0.29 | 0.29 | 0.45 | 0.45 | 0.40 | 0.40 |
| Number of Observation | 178,852 | 178,852 | 173,131 | 173,131 | 178,834 | 178,834 | 135,039 | 135,039 |

*, **, and *** indicate significance at 10%, 5%, and 1%, respectively.
Data clustered by region
Rainfall data is recorded at the regional level for all samples.
Rainfall shock is calculated based on one standard deviation distance from long-term average rainfall for the region.
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| Negative Rainfall Shock, Previous Year | | 0.095 | | 0.039 | | **0.128*** | | 0.063 |
| | | (0.090) | | (0.042) | | (0.077) | | (0.053) |
| **Respondent's Characteristics:** | | | | | | | | |
| Age/100 | **0.063*** ** | **0.063*** ** | **0.030*** | **0.030*** | 0.008 | **0.008** | **0.106*** ** | **0.106*** ** |
| | (0.037) | (0.037) | (0.016) | (0.016) | (0.008) | (0.008) | (0.034) | (0.034) |
| Age Difference b/w Husband and Wife/100 | **-0.064*** ** | **-0.064*** ** | 0.001 | 0.001 | **-0.109*** ** | **-0.109*** ** | **0.061*** | **0.061*** |
| | (0.030) | (0.030) | (0.014) | (0.014) | (0.029) | (0.029) | (0.033) | (0.033) |
| Years of Education/10 | **-0.038*** ** | **-0.038*** ** | -0.007 | -0.007 | **-0.045*** ** | **-0.045*** ** | -0.012 | -0.012 |
| | (0.009) | (0.009) | (0.005) | (0.005) | (0.009) | (0.009) | (0.008) | (0.008) |
| Husband's Years of Education/10 | **-0.091*** ** | **-0.091*** ** | **-0.035*** ** | **-0.035*** ** | **-0.081*** ** | **-0.081*** ** | **-0.05*** ** | **-0.05*** ** |
| | (0.007) | (0.007) | (0.003) | (0.003) | (0.008) | (0.008) | (0.005) | (0.005) |
| **History of Violence** | | | | | | | | |
| Father Beat Her/Her Mother | **0.186*** ** | **0.186*** ** | **0.051*** ** | **0.051*** ** | **0.163*** ** | **0.163*** ** | **0.107*** ** | **0.107*** ** |
| | (0.012) | (0.012) | (0.005) | (0.005) | (0.013) | (0.013) | (0.011) | (0.011) |
| Justify Beating | **0.077*** ** | **0.077*** ** | **0.024*** ** | **0.024*** ** | **0.072*** ** | **0.072*** ** | **0.037*** ** | **0.037*** ** |
| | (0.006) | (0.006) | (0.003) | (0.003) | (0.005) | (0.005) | (0.006) | (0.006) |
| Husband Drinks Alcohol | **0.159*** ** | **0.159*** ** | **0.051*** ** | **0.051*** ** | **0.156*** ** | **0.156*** ** | **0.105*** ** | **0.105*** ** |
| | (0.007) | (0.007) | (0.004) | (0.004) | (0.007) | (0.007) | (0.005) | (0.005) |
| Region Fixed Effect | YES | YES | YES | YES | YES | YES | YES | YES |
| Year Fixed Effect | YES | YES | YES | YES | YES | YES | YES | YES |
| Mean of Rate of Violence | 0.36 | 0.36 | 0.09 | 0.09 | 0.29 | 0.29 | 0.21 | 0.21 |
| S.D of Rate of Violence | 0.48 | 0.48 | 0.29 | 0.29 | 0.45 | 0.45 | 0.40 | 0.40 |
| Number of Observation | 178,852 | 178,852 | 173,131 | 173,131 | 178,834 | 178,834 | 135,039 | 135,039 |

Table 3. Effects of Rainfall Shocks and Couples' Characteristics on the probability of experiencing violence, Clustered by Region.

| | Dependent Variables: | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Any Violence | | Sexual Violence | | Physical Violence | | Emotional Violence | |
| **Rainfall Shocks** | | | | | | | | |
| Positive Rainfall Shock, Survey Year | -0.013 | -0.013 | -0.009 | -0.009 | -0.005 | -0.006 | -0.003 | -0.003 |
| | (0.013) | (0.013) | (0.010) | (0.010) | (0.012) | (0.012) | (0.013) | (0.013) |
| Negative Rainfall Shock, Survey Year | -0.008 | -0.008 | -0.010 | **-0.011*** | -0.005 | -0.006 | **-0.028*** | **-0.028*** |
| | (0.011) | (0.011) | (0.006) | (0.006) | (0.011) | (0.010) | (0.014) | (0.014) |
| Positive Rainfall Shock, Previous Year | | -0.001 | | -0.001 | | -0.003 | | 0.008 |
| | | (0.009) | | (0.005) | | (0.009) | | (0.012) |
| Negative Rainfall Shock, Previous Year | | -0.011 | | -0.008 | | **-0.025**** | | 0.004 |
| | | (0.014) | | (0.009) | | (0.012) | | (0.017) |
| Living in Urban | 0.005 | 0.005 | 0.002 | 0.002 | 0.002 | 0.002 | **0.014**** | **0.014**** |
| | (0.008) | (0.008) | (0.006) | (0.006) | (0.007) | (0.007) | (0.007) | (0.007) |
| Respondent's Characteristics | YES | YES | YES | YES | YES | YES | YES | YES |
| History of Violence | YES | YES | YES | YES | YES | YES | YES | YES |
| Region Fixed Effect | YES | YES | YES | YES | YES | YES | YES | YES |
| Year Fixed Effect | YES | YES | YES | YES | YES | YES | YES | YES |
| Mean of Rate of Violence | 0.39 | 0.39 | 0.11 | 0.11 | 0.31 | 0.31 | 0.25 | 0.25 |
| S.D of Rate of Violence | 0.49 | 0.49 | 0.31 | 0.31 | 0.46 | 0.46 | 0.43 | 0.43 |
| Number of Countries | | | | | | | | |
| Number of Observation | 147,162 | 147,162 | 138,122 | 138,122 | 147,130 | 147,130 | 100,038 | 100,038 |

*, **, and *** indicate significance at 10%, 5%, and 1%, respectively.
Data clustered by region
Rainfall data is recorded at the local (sub-region geo-location) level. This level of granual geo-location information is only available for a subset of the sample.
Rainfall shock is calculated based on one standard deviation distance from long-term average rainfall for the region.
Age and age difference are dividided by 100, and years of eduation is divided by 10 to bring coefficiens to a comparable range.

Table 4. Effects of Rainfall Shocks and Couples' Characteristics on the probability of experiencing violence, Clustered by Region.

| | Dependent Variables: | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Any Violence | | Sexual Violence | | Physical Violence | | Emotional Violence | |
| **Rainfall Shocks** | | | | | | | | |
| Normalized Rain, Survey Year | **-0.086*** ** (0.016) | **-0.074*** ** (0.002) | **0.017*** ** (0.007) | **-0.014*** ** (0.001) | 0.010 (0.012) | **-0.069*** ** (0.002) | **-0.091*** ** (0.014) | **-0.031*** ** (0.002) |
| Normalized Rain, Previous Year | | **-0.039*** ** (0.011) | | **-0.110*** ** (0.005) | | **-0.110*** ** (0.009) | | **0.055*** ** (0.009) |
| Normalized Rain Squared, Survey Year | **0.266*** ** (0.036) | **0.250*** ** (0.004) | **0.059*** ** (0.016) | **0.149*** ** (0.002) | -0.032 (0.028) | **0.163*** ** (0.003) | **0.292*** ** (0.033) | **0.152*** ** (0.004) |
| Normalized Rain Squared, Previous Year | | **0.044*** ** (0.004) | | **0.094*** ** (0.002) | | **0.072*** ** (0.004) | | **-0.027*** ** (0.003) |
| Respondent's Characteristics | YES | YES | YES | YES | YES | YES | YES | YES |
| History of Violence | YES | YES | YES | YES | YES | YES | YES | YES |
| Region Fixed Effect | YES | YES | YES | YES | YES | YES | YES | YES |
| Year Fixed Effect | YES | YES | YES | YES | YES | YES | YES | YES |
| Mean of Rate of Violence | 0.36 | 0.36 | 0.09 | 0.09 | 0.29 | 0.29 | 0.21 | 0.21 |
| S.D of Rate of Violence | 0.48 | 0.48 | 0.29 | 0.29 | 0.45 | 0.45 | 0.40 | 0.40 |
| Number of Observation | 180,612 | 180,612 | 174,890 | 174,890 | 180,594 | 180,594 | 135,039 | 135,039 |

*, **, and *** indicate significance at 10%, 5%, and 1%, respectively.
Data clustered by region
Rainfall data is recorded at the regional level for all samples.
Age and age difference are dividided by 100, and years of eduation is divided by 10 to bring coefficiens to a comparable range

Table 5. Effects of Rainfall Shocks and Couples' Characteristics on the probability of experiencing violence, Clustered by Region.

| | Dependent Variables: | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Any Violence | | Sexual Violence | | Physical Violence | | Emotional Violence | |
| **Rainfall Shocks** | | | | | | | | |
| Normalized Rain, Survey Year | -0.007 | -0.006 | -0.003 | -0.002 | -0.007 | -0.006 | 0.002 | 0.005 |
| | (0.006) | (0.006) | (0.004) | (0.004) | (0.005) | (0.005) | (0.008) | (0.007) |
| Normalized Rain, Previous Year | | 0.001 | | 0.005 | | 0.004 | | -0.002 |
| | | (0.005) | | (0.003) | | (0.004) | | (0.007) |
| Normalized Rain Squared, Survey Year | -0.006 | -0.006 | -0.005 | -0.005 | -0.006 | -0.006 | -0.002 | -0.002 |
| | (0.004) | (0.004) | (0.003) | (0.003) | (0.003) | (0.003) | (0.005) | (0.005) |
| Normalized Rain Squared, Previous Year | | 0.004 | | -0.003 | | -0.001 | | 0.009 |
| | | (0.004) | | (0.002) | | (0.004) | | (0.005) |
| Respondent's Characteristics | YES | YES | YES | YES | YES | YES | YES | YES |
| History of Violence | YES | YES | YES | YES | YES | YES | YES | YES |
| Region Fixed Effect | YES | YES | YES | YES | YES | YES | YES | YES |
| Year Fixed Effect | YES | YES | YES | YES | YES | YES | YES | YES |
| Mean of Rate of Violence | 0.36 | 0.36 | 0.09 | 0.09 | 0.29 | 0.29 | 0.21 | 0.21 |
| S.D of Rate of Violence | 0.48 | 0.48 | 0.29 | 0.29 | 0.45 | 0.45 | 0.40 | 0.40 |
| Number of Observation | 145,313 | 145,313 | 136,275 | 136,275 | 145,282 | 145,282 | 99,015 | 99,015 |

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Data clustered by region
Rainfall data is recorded at the local (sub-region geo-location) level. This level of granual geo-location information is only available for a subset of the sample.
Age and age difference are dividided by 100, and years of eduation is divided by 10 to bring coefficiens to a comparable range

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- Evidence from 37 countries over multiple years show that in most cases, rainfall shocks increase domestic violence.
- Physical violence increases significantly with both wet and dry shocks
- Sexual and emotional violence show significant increases only by dry shocks.
- When grouping all types of violence into one "any violence" group, both positive and negative shocks lead to significant increases in violence.

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- When grouping all types of violence into one "any violence" group, both positive and negative shocks lead to significant increases in violence.