Using Machine Learning to Assess the Impact of Harsh Violent Discipline on Children and Adolescents in Low- and Middle-Income Countries: A Comparative Analysis Focusing on Its Relationship with Disabilities

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Abstract: Children's exposure to violence has long been a social and cultural concern, manifesting in various forms across societies. According to UNICEF, approximately 300 million children worldwide, aged 2 to 4, experience regular violent discipline from caregivers, with around 250 million subjected to physical punishment. This study leverages data from the Multiple Indicator Cluster Survey to investigate the prevalence of severe violent discipline among children with and without disabilities in 54 low- and middle-income countries. Using machine learning algorithms, including Decision Tree, Random Forest, XGBoost, Support Vector Machine (SVM), and Neural Networks, the analysis revealed that SVM outperformed other models, achieving the highest precision, recall, and F1-score (with values of 78% and 80% for the violence and non-violence classes, respectively). The results highlighted an increase in severe disciplinary violence correlated with the presence of disabilities, particularly in contexts involving the domain of 'controlling behavior'.

1 INTRODUCTION

Violent discipline, which includes physical, emotional, or psychological punishment, is a concerning issue that affects children and adolescents worldwide. Epidemiological studies reveal that about three-quarters of children aged 2 to 4 years old globally, equivalent to 300 million children, are victims of psychological aggression and/or physical punishment, often perpetrated by their own caregivers[1]. These disciplinary methods include the application of physical punishment, resulting in suffering and/or injury, as well as degrading treatment that humiliates, seriously threatens, or ridicules the child or adolescent.

Exposure to violence in childhood has been consistently associated with detrimental effects on children's health, well-being, and future prospects (Sinhorinho and de Moura, 2021). Unfortunately, children with disabilities are at a higher risk of experiencing violent discipline compared to their non-disabled peers (Emerson and Llewellyn, 2021). This vulnerability is attributed to various factors, including social stigmas, lack of support systems, and communication barriers.

Moreover, children with disabilities are often marginalized or underrepresented in public health data, making it challenging to develop specific policies and interventions to address their unique needs. Despite the growing recognition of the importance of including people with disabilities, existing research often overlooks the intersectionality between disability and violence (UNICEF, 2021).

The Multiple Indicator Cluster Surveys (MICS), developed by the United Nations Children's Fund (UNICEF), is an essential tool for filling this data gap. Through modules such as the Washington Group/UNICEF Child Functioning Module (CFM), MICS provides standardized and internationally comparable data on various aspects of child well-being, including exposure to violence and disability status, but without linking them. This data enables a comprehensive analysis of the intersection between disability and severe violent discipline, informing policies and interventions aimed at better protecting and support-

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[1]Available at: https://data.unicef.org/resources/a-familiar-face/

ing children with disabilities, promoting their health, well-being, and rights.

This study utilizes data collected by MICS to investigate the prevalence of exposure to harsh parental discipline among children with and without disabilities in various low- and middle-income countries. Additionally, it seeks to understand how other factors, such as gender, age, and country of birth, may influence these rates.

2 THEORETICAL FRAMEWORK

2.1 Multiple Indicator Cluster Surveys

The Multiple Indicator Cluster Surveys (MICS) is an international household survey initiative developed by UNICEF, aimed at filling data gaps and monitoring human development[2]. MICS provides statistically robust and internationally comparable estimates of essential indicators for tracking global goals and targets. Initially designed to meet the goals of the 1990 World Summit for Children, MICS has been conducted every five years since 1995. In this study, we utilize data from the sixth Multiple Indicator Survey (MICS6), conducted between 2018 and 2019 by the Ministry of Economy and Finance. The sixth round includes 72 questionnaires and 54 countries[3], presenting 177 core indicators and an average sample of 12,000 households, making it the largest round to date.

Figure 1: Countries analyzed in the sixth round of the MICS.

Additionally, the MICS data are organized into questionnaires that allow for various units of analy-

sis. Depending on the focus of the research, up to ten data files are generated and made available in SPSS format, each corresponding to different units of analysis: **hh.sav** - Households; **hl.sav** - Household Members; **tn.sav** - Mosquito Nets in Households; **wm.sav** - Women (15 to 49 years); **bh.sav** - Birth History; **fg.sav** - Female Genital Mutilation; **mm.sav** - Maternal Mortality; **ch.sav** - Children under five years; **fs.sav** - Children aged 5 to 17 years; **mn.sav** - Men (15 to 49 years).

In this study, we will focus on the file **fs.sav**, concentrating our analyses on children aged five to seventeen years and their relationship with disciplinary violence (FCD module) and disabilities (FCF module).

2.2 Disabilities

Historically, the meaning of disability has been understood in various ways. The concept was initially framed within religious discourses of Western Judeo-Christian beliefs, where it was seen as a punishment from God for specific sins committed by the person with a disability (Jean A Pardeck, 2012). This religious perspective has gradually been replaced by medical and scientific approaches, resulting in the substitution of religious leaders by doctors and scientists as cognitive authorities in social values and healing procedures.

In the narrative of the medical model, disability is understood as an individual condition or medical phenomenon that results in limited functioning deemed deficient (Cecilie Bingham, 2013). This can occur due to impairments of body functions and structures, including the mind, caused by diseases, injuries, or health problems. However, the medical model often fails by focusing exclusively on the limitations associated with the person's disability, without considering the environments that may exacerbate or adversely affect their functional abilities.

The medical model is often contrasted with the social model of disability, which emphasizes the social and environmental factors that contribute to a person's disability. The International Classification of Functioning, Disability, and Health (ICF) provides a comprehensive approach to understanding disability in children (Talo and Rytökoski, 2016). It adopts a biopsychosocial model that conceptualizes disability as a complex interaction between biological, psychological, and social factors, influencing the child's physical, mental, and social development. This definition encompasses a range of conditions, from physical impairments, such as vision loss, to limitations in daily tasks and social restrictions, considering the

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[2]Available at https://mics.unicef.org

[3]Afghanistan, Algeria, Argentina, Bangladesh, Belarus, Benin, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Costa Rica, Cuba, Dominican Republic, Eswatini, Fiji, Gambia, Georgia, Ghana, Guinea-Bissau, Guyana, Honduras, Iraq, Jamaica, Kiribati, Kosovo under UN Security Council Resolution 1244, Kyrgyzstan, Lao People's Democratic Republic, Lesotho, Madagascar, Malawi, Mongolia, Montenegro, Nepal, Nigeria, North Macedonia, Pakistan (divided into 4 provinces: Balochistan, Khyber Pakhtunkhwa, Punjab, and Sindh), Samoa, São Tomé and Príncipe, Serbia, Sierra Leone, State of Palestine, Suriname, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkmenistan, Turks and Caicos Islands, Tuvalu, Uzbekistan, Vietnam, Yemen, and Zimbabwe

child's participation in their environment. The ICF classifies areas of disability into two main categories: physical structures (organs, limbs, and the nervous, visual, auditory, and musculoskeletal systems) and bodily functions (hearing, memory, among others) (Farias and Buchalla, 2005).

In this context of identifying children with disabilities, the Multiple Indicator Cluster Surveys (MICS), in its sixth round, employs modules developed by the Washington Group on Disability Statistics (WGDS), which categorize children's difficulties into 13 domains for children aged 5 to 17 years. These areas include difficulties in: seeing, hearing, mobility, self-care, communication/comprehension, learning, remembering, attention and concentrating, relationships, coping with change, affect (anxiety and depression) and controlling behaviour[4].

2.3 Violent Discipline

Violence is a complex phenomenon that continues to pose a significant challenge in the field of health (Linda L. Dahlberg, Etienne G. Kru, 2006). In this context, according to Sinhorinho and Moura (2022), children emerge as a particularly vulnerable group, especially concerning family violence, which often manifests as aggressive conflict resolution in interpersonal relationships. The consequences of these acts vary in magnitude and frequency[5], but are profoundly influenced by the child's emotional, cognitive, and physical development stage, affecting their self-esteem and increasing the likelihood of behavioral disturbances as well as anxiety and depression.

In this scenario, it is important to analyze the influence of violent discipline on children's health and development. UNICEF, for example, employed in the sixth round of the Multiple Indicator Cluster Surveys (MICS) studies that considered children aged 2 to 17 years and investigated whether they experienced violent discipline in the past few months, with responses categorized into non-violent discipline, severe physical punishment, any type of physical punishment, any psychological aggression, and any violent discipline. UNICEF defines severe violent discipline with criteria that include 'Beat (him/her) up, that is hit (him/her) over and over as hard as one could', 'Hit (him/her) on the bottom or elsewhere on the body with something like a belt, hairbrush, stick or other hard object' and 'Hit or slapped (him/her) on the face, head or ears'.

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[4]Available at https://www.washingtongroup-disability.com

[5]Available at https://www.who.int/news-room/fact-sheets/detail/corporal-punishment-and-health

The caregivers were asked about the occurrence of these behaviors in relation to the children, allowing for yes or no responses for each form of violent discipline, thus enabling a clear assessment of the incidence of these behaviors.

3 RELATED WORKS

Emerson and Llewellyn (2021) investigated the implications of exposure to violent discipline in children with and without disabilities in 17 countries[6] of low and middle income. Using data from the MICS, the researchers analyzed whether children with disabilities were statistically more likely to experience eight distinct forms of violent discipline compared to children without disabilities. The results indicated a 71% higher probability of children with disabilities being exposed to violent disciplinary measures in these countries.

The study by Bhatia et al. (2023) analyzed MICS data in 24 countries[7], investigating the relationship between disability and the higher incidence of lack of birth registration, child labor, and violent discipline. The study considered factors such as sex and country of origin, in addition to exploring the interaction with disability status. The authors highlight the scarcity of research linking disability and violent discipline, emphasizing that the intersection with gender and country of origin remains underexplored.

The results revealed that girls with disabilities have a higher likelihood of experiencing violent discipline compared to those without disabilities (27.1% vs. 17.4%). Additionally, the prevalence of violent discipline was 50% higher in 23 of the 24 countries for children with disabilities, regardless of gender.

In the work by (Cuartas et al., 2018), the authors also address exposure to both violent and non-violent discipline in low- and middle-income countries[8] dur-

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[6]Montenegro, Suriname, Iraq, Georgia, Mongolia, Tunisia, Kiribati, Ghana, Zimbabwe, Bangladesh, Lesotho, Kyrgyzstan, Gambia, Togo, Madagascar, Congo, and Sierra Leone

[7]Mongolia, Tonga, Kosovo, Kyrgyzstan, North Macedonia, Serbia, Guyana, Suriname, Algeria, Iraq, Palestine, Bangladesh, Central African Republic, Chad, Congo, Ghana, Guinea-Bissau, Lesotho, Madagascar, São Tomé and Príncipe, Gambia, Togo, and Zimbabwe

[8]Afghanistan, Algeria, Argentina, Bangladesh, Belarus, Belize, Benin, Bosnia and Herzegovina, Cameroon, Central African Republic, Chad, Congo, Costa Rica, Dominican Republic, El Salvador, Ghana, Guinea-Bissau, Guyana, Iraq, Jamaica, Kazakhstan, Kyrgyz Republic, Lao People's Democratic Republic, Lebanon, Macedonia, Malawi, Mexico, Moldova, Mongolia, Montenegro, Nepal, Nigeria, Palestine, Panama, Paraguay, São Tomé and Príncipe, Serbia, Sierra Leone, Saint Lucia, Sudan, Suriname, Eswatini, Togo, Tunisia, Turkmenistan, Ukraine, Uruguay, Vietnam, and Zimbabwe.

ing early childhood. To this end, the study utilizes MICS data collected between 2010 and 2016, aiming to estimate the proportion of children aged 2 to 4 years who are exposed to violent discipline in their homes. This study builds upon previous research, such as the work by (Cappa and Khan, 2011), which analyzes data from children aged 2 to 14 years in 34 countries of the MICS, concluding that, overall, parents and caregivers resort to physical punishment and aggression even in households where these practices are not deemed necessary. In Yemen, 78% of children subjected to physical punishment have parents or caregivers who do not see these acts as necessary.

In addition, the study by Cuartas and collaborators also relies on the research by Lansford in 2010 (Lansford et al., 2010), which observed that 54% of female children and 58% of male children aged 7 to 10 years in nine different countries[9] had already experienced physical aggression at home, with 13% of cases among females and 14% among males classified as severe physical punishment.

The study (Fang et al., 2022) also provides relevant data on the intersection between disability and violence in children aged 0 to 17 years globally. The research analyzed 18 international databases in English, covering physical, mental, intellectual, and sensory disabilities, as well as chronic illnesses, to investigate the relationship between different forms of violence and specific types of disability. The results showed that children with disabilities are 2.08 times more likely to be victims of violence compared to those without disabilities. Moreover, children with cognitive or mental health disabilities face higher levels of violence, with emotional violence being the most frequently reported and neglect presenting the highest statistical probability.

The article by Hendricks et al. (2013) is essential for understanding the relationship between childhood disability and violent discipline. The research analyzes children aged 2 to 9 years and their caregivers in 17 low-income countries[10], aiming to establish connections between cognitive, sensory, and motor disabilities and disciplinary violence, as well as investigating the increased risk of punitive treatment and its variation according to socioeconomic context.

The results revealed significant variations in violence, depending on the type of disability, age, and country. Children with conduct and attention problems were more likely to experience violent disci-

pline. The study also explores how characteristics that complicate the management of children may lead parents to adopt stricter disciplinary methods. For example, children with disabilities that affect verbal communication, such as deafness, may be more susceptible to physical discipline due to communication difficulties, which increase parents' stress and frustration.

In (Pace et al., 2019), the authors analyze data from 62 countries from the 4th and 5th rounds of the MICS, aiming to investigate the relationship between the practice of spanking a child and their behavior. Various indicators were included, such as the child's age (3 to 4 years), their gender, the caregiver's gender, the belief that a child needs to be punished to be raised correctly, the mother's level of education, the number of family members, the country of origin, and whether they reside in an urban or rural area.

This study indicated that 43% of children were spanked in the past few months or lived with another child who was spanked during the same period. Furthermore, 33% of caregivers reported believing in the importance of corporal punishment for raising their children. Additionally, it was observed that countries with higher socio-emotional development tended to practice corporal punishment less frequently on their children.

Finally, it is noted that although there is a considerable number of studies addressing the relationship between children with disabilities and disciplinary violence, there is little information available on how these factors relate to other variables, such as gender, age, and economic situations of the country of origin. Furthermore, many studies use outdated data, failing to incorporate the sixth round of the MICS from 2019, or they primarily focus on high-income countries, thus not using MICS data as a basis. When they do utilize MICS data, they do not always associate these factors with disability, limiting their analysis to some low- and middle-income countries, and they do not always represent the full diversity of children with disabilities or predominantly consider severe violent discipline. It is also important to note that some studies analyze only a restricted age range, such as children aged 2 to 9 years, even though MICS provides comprehensive data. Thus, this article seeks to fill these gaps in the literature by offering a more complete and updated analysis of the topic.

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[9]China, Colombia, Italy, Jordan, Kenya, Philippines, Sweden, Thailand, and the United States

[10]Albania, Belize, Bosnia and Herzegovina, Cameroon, Central African Republic, Djibouti, Georgia, Ghana, Iraq, Jamaica, Laos, North Macedonia, Montenegro, Serbia, Sierra Leone, Suriname, and Yemen

Table 1: Comparison of Related Works.

Authors	Used MICS-Data?	MICS Round	Age Range	Disability Analysis?	Violence Analysis?	Number of Countries
Lansford et al. (2010)		-	7-10		✓	9
Cappa and Khan (2011)	✓	3	2-14		✓	34
Hendricks et al. (2013)	✓	5	2-4	✓	✓	17
Cuartas et al. (2018)	✓	5	2-4		✓	49
Pace et al. (2019)	✓	5	3-4		✓	62
Emerson and Llewellyn (2021)	✓	6	2-14	✓	✓	17
Fang et al. (2022)	✓	3	2-9	✓	✓	33
Bhatia et al. (2023)	✓	6	2-17	✓	✓	24
This Work	✓	6	5-17	✓	✓	54

4 MATERIALS AND METHODS

4.1 Description of the Database

The data used in this study were extracted from the UNICEF website, specifically from the MICS (Multiple Indicator Cluster Surveys) program.

For this analysis, data from the sixth round of MICS (MICS6), initiated in 2018, were employed. The data were collected through various standardized questionnaires, which countries can customize according to their needs. The questionnaires cover the following categories: household information (including a form for water quality testing), data on women aged 15 to 49 years, information on men aged 15 to 49 years, data on children under five years old, information on children aged 5 to 17 years, a vaccination registration form in health facilities, and a questionnaire for water quality testing.

The main focus of this study was the data from the questionnaire for children aged 5 to 17 years, extracted from the fs.sav file, with analysis centered on the Child Discipline Module and the Child Functioning Module. Although the study included data from 62 countries, only 54 had complete and available data, as in some cases the data were empty or duplicated.

4.2 Methodology

For preprocessing, the datasets from the 6th round of the Multiple Indicator Cluster Surveys (MICS), covering 54 countries and children aged 5 to 17 years, were downloaded and converted from .sav to .csv using the mics_library in Python.

Next, records with null values, such as 'don't know' or 'no response', as well as inconsistent or duplicated samples, were excluded. Categorical data were processed: non-hierarchical categories, such as continents, were encoded using one-hot encoding, while ordered data, such as caregiver age, were grouped into 5-year intervals and encoded with label encoding.

In addition, new attributes were added, such as population, area, birth rate, GDP per capita, female and male life expectancy, and mortality rate, obtained from the UNdata website[11].

Attributes with many categories and few responses for each option, such as types of water supply, were grouped for simplification and encoded. Numeric variables were normalized to a range of 0 to 1.

Attributes related to the education level of the caregiver, the child's caregiver, and the child were reorganized, unifying the categories 'Lower Secondary Education' and 'Upper Secondary Education' into a single column called 'Secondary Education'.

Attributes that, after preprocessing, presented only a single response option were discarded.

Outliers were identified and removed using the Isolation Forest method, which isolates anomalous samples by calculating the number of splits required in the isolation trees.

Finally, records of children aged 15 to 17 were removed, as the violent discipline module of the MICS only includes data for children aged 5 to 14, resulting in empty columns for these age groups.

After these preprocessing steps, two main instances were selected for analysis in this study: 'FCD2' and 'FCF'. The instance 'FCD2' represents the module in the MICS that deals with violent discipline, while the instance 'FCF' addresses disability. The variables 'FCD2G', 'FCD2I', and 'FCD2K', which correspond to the methods of violent discipline discussed in Section 2.3, were analyzed. Only these variables were examined, as they are considered by the MICS to be the most severe forms of violence

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[11]UNdata is an online service from the UN that provides access to a vast collection of international statistical databases, allowing users to search and download information on topics such as health, education, economy, and environment.

present. The data were normalized to ensure consistency in the responses, and all were converted to English. If at least one of the two variables from the violent discipline module contained the response 'YES', it was counted toward the variable indicating whether the child experiences violent discipline.

Regarding the instance 'FCF', the modules related to different domains of difficulty were analyzed, such as Seeing ('FCF6'), Hearing ('FCF8'), Mobility ('FCF10' to 'FCF15'), Self-Care ('FCF16'), Communication/Comprehension ('FCF17' and 'FCF18'), Learning ('FCF19'), Remembering (''FCF20'), Attention and Concentration ('FCF21'), Coping with Change ('FCF22'),Controlling Behaviour('FCF23'), Relationships ('FCF24'), and Emotions such as Anxiety and Depression ('FCF25' and 'FCF26'). The responses for the modules were: 1) no difficulty, 2) some difficulty, 3) a lot of difficulty, and 4) total inability, except in the domain of emotions, where the options were: 1) daily, 2) weekly, 3) monthly, 4) a few times a year, and 5) never. A child was considered to have a disability if they reported 'a lot of difficulty' or 'total inability' in any function. In the case of emotions, only daily difficulties were considered a disability.

With the data already normalized and translated, the first column of both datasets, which serves as an identifier, was used to merge the responses regarding disability and violence. Thus, if a caregiver answered 'yes' to any of the violence modules and indicated 'a lot of difficulty' or 'inability' for any of the disability modules, this information was aggregated to estimate how many children per country suffer from both disability and experiences with violent discipline.

Finally, the desired target variable for prediction was selected, which in this case was disciplinary violence.

For the execution of the machine learning models, the data were divided into training and testing sets, with the test set representing 20% of the total. Subsequently, undersampling was applied to the majority class, randomly selecting data from this class for removal until the numbers were equal to those of the minority class. The data from the majority class that were to be discarded were added to the test set.

To optimize the performance of machine learning models, multiple algorithms (Random Forest, Decision Tree, Support Vector Machine, XGBoost, and Neural Network) were tested with their respective hyperparameter optimizations. The search for the best hyperparameter combinations was performed using the random search approach (RandomizedSearchCV), with stratified cross-validation to ensure the robustness of the evaluation. The search space was adjusted

individually for each model with specific intervals of relevant hyperparameters. The best hyperparameters found for each model were compared based on performance metrics, including recall[12], precision[13], F1-Score[14], and accuracy.

All calculations were performed using Python libraries: **Pandas** (version 2.2.2), **NumPy** (version 2.1.1), **Scikit-learn** (version 1.5.1), **Imbalanced-learn** (version 0.12.3), and **Matplotlib** (version 3.9.2). The tests were executed on a system with an Apple M2 processor, 8 GB of RAM, and 8 CPU cores.

5 RESULTS

Figure 3 presents the results of the analyzed algorithms, with SVM standing out for its superior performance, achieving the highest values for precision, recall, and F1-score. These results indicate effectiveness in classifying both negative and positive cases. However, despite the high precision, the model identified a significantly larger proportion of cases in the 'did not experience disciplinary violence' class compared to the 'experienced disciplinary violence' class. This discrepancy may be attributed to the imbalance in the dataset.

Since the SVM, Random Forest and XGBoost models exhibited the best results, with an F1-Score of 80%, 76% and 72% for the 'did not experience disciplinary violence' class and 78%, 75% and 70% for the 'experienced disciplinary violence' class, we conducted a SHAP analysis (in Figure 4) to better understand which attributes influenced the prediction of disciplinary violence cases.

The SHAP assigns an importance value to each feature based on its contribution to the prediction, using Shapley value theory to ensure a fair attribution. In the SHAP plot, the most important variables are at the top, while the less influential ones appear at the bottom. Each point represents an observation, with the color indicating the feature value: red for high values and blue for low values. The horizontal position of each point reflects the magnitude of the feature's contribution, where positions further to the right indicate a greater positive influence on the prediction that the individual experienced disciplinary violence, and to the left, a negative influence (i.e., a lower chance of

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[12]Recall = $\frac{TP}{TP+FN}$: Measures the model's ability to correctly identify positive instances.

[13]Precision = $\frac{TP}{TP+FP}$: Indicates the proportion of correct positive predictions among all the positive predictions made by the model.

[14]F1-Score = $2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$: Combines precision and recall into a single metric for balanced evaluation.
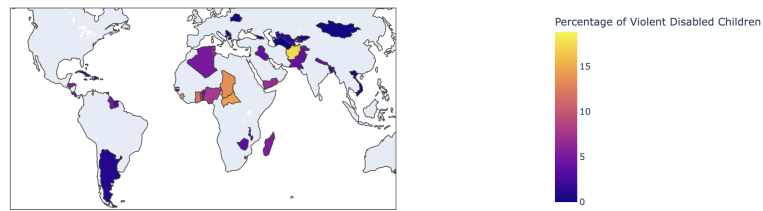
Figure 2: Number of children with disabilities experiencing violent discipline by country in the sixth round of MICS.
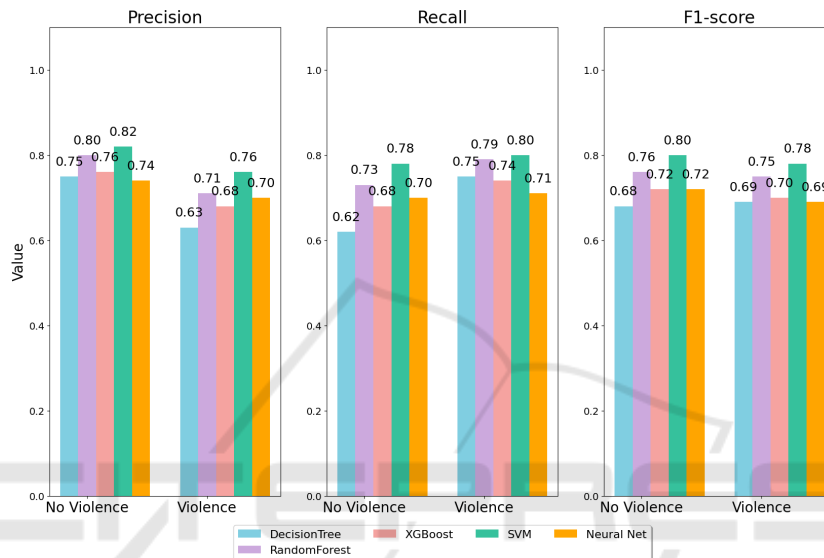

Figure 3: Analysis of metrics by algorithm.

experiencing disciplinary violence).

The analysis identified the 30 attributes that most influence the prediction of disciplinary violence, presented in the image below:

- **Child Needs Punish:** This attribute refers to caregivers' belief that physical punishment contributes to a child's development. In the context of this attribute, it is observed in image 5 that this belief (indicated by the attribute to the right) is a significant factor driving disciplinary violence, as the SHAP values are all positive and quite concentrated. In contrast, the absence of this belief (indicated by the attribute to the left) shows an opposite pattern: the values are all concentrated in the negative region, indicating that the belief that the child deserves to be punished is strongly associated with the presence of disciplinary violence.

- **FCD2A, FCD2B, and FCD2E:**
  The attributes 'FCD2A', 'FCD2B', and 'FCD2E' refer to non-violent forms of discipline, such as preventing the child from doing something or tak-

ing away privileges ('FCD2A'), explaining why the child's behavior was wrong ('FCD2B'), and offering alternatives to distract them ('FCD2E'). In the SHAP graph, the value 1.0 is assigned to the use of these non-violent practices, while the value 2.0 represents their opposite. It is observed that these attributes are correlated with the use of violent discipline, indicating that, even in contexts where non-violent discipline practices are applied, they often coexist with harsher forms of disciplinary violence. This phenomenon may be associated with specific cultural and social factors. Similar results were found in the study by Cuartas et al. (2019).

- **Fertility Rate, Infant Mortality Rate, and GDP per capita:** The analysis of the attributes Fertility Rate and Infant Mortality Rate in the SHAP graph reveals that higher rates are associated with greater severe disciplinary violence, indicating that countries facing these challenges encounter social and economic difficulties, such as limited access to healthcare and education services, favoring strict disciplinary practices.
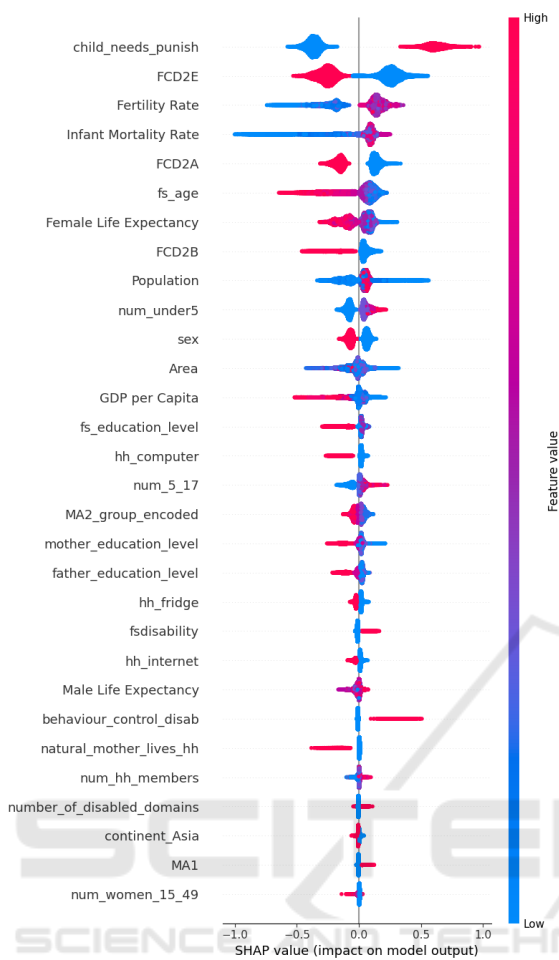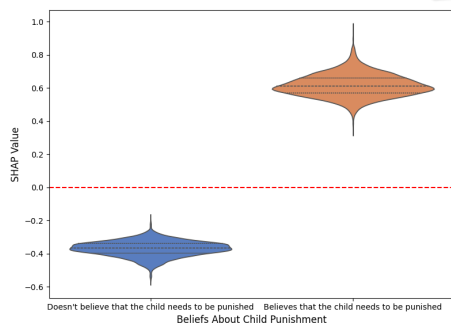
Figure 4: SHAP Analysis in XGBoost.

Figure 5: Analysis of the attribute child_needs_punish.

On the other hand, countries with lower rates tend to have better access to family planning, public health, and contraceptive methods (Aarssen, 2005), which is associated with more accessible education and professional development opportunities, promoting more constructive disciplinary approaches.

The analysis of GDP per capita reinforces this perspective: countries with higher income exhibit lower fertility and infant mortality rates, reflecting better living conditions and access to healthcare and education services, as well as more effective parenting practices and less severe discipline. In contrast, countries with lower GDP per capita face social challenges that result in stricter discipline.

Thus, fertility rate, infant mortality, and GDP per capita not only reflect family dynamics but also the social and economic conditions that impact child disciplinary practices.

- **fs_age:** The analysis of the fs_age attribute, which represents the age of the child being analyzed, reveals a clear trend in the SHAP graphs and in the violin plot (Figure 6). The violin plot, covering ages from 5 to 14, shows that as age increases, particularly from 10 years onward, the values tend to become negative, signifying a reduced likelihood of experiencing severe violent discipline. This relationship suggests that younger children, represented by values more to the left on the graph, are more vulnerable to harsh disciplinary practices, which can be visualized by a greater concentration of positive SHAP values indicating violent discipline. In contrast, those over 10 years old tend to be in contexts where disciplinary approaches may be more positive or constructive.

This pattern can be attributed to several factors. Older children generally have a greater capacity for communication and understanding, allowing parents or guardians to adopt discipline strategies that are more dialogue-oriented and educational, rather than resorting to violence. Additionally, as children grow, family dynamics and expectations regarding behavior may change, resulting in a reduced need for severe disciplinary measures. The violin plot effectively illustrates these shifts, highlighting the need for targeted interventions to protect younger children who are more susceptible to harsh discipline.

- **Male Life Expectancy and Female Life Expectancy:** The analysis of the data reveals that male life expectancy and female life expectancy are associated with complex patterns of discipline. Higher life expectancies, located to the left in the SHAP graph, suggest a lower probability of violent discipline, reflecting access to better social and health resources. Conversely, lower life expectancies, positioned to the right in the graph, indicate a possible association with an increase in violent discipline, suggesting that social and economic challenges contribute to harsher practices. The study by Hendricks et al. (2013) confirms that
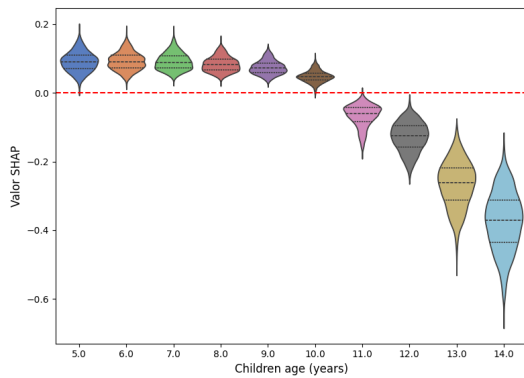
Figure 6: Analysis of the attributes age of the child.

severe violent discipline is negatively related to
the Human Development Index (HDI) and life ex-
pectancy; the lower these indices, the higher the
incidence of reports of violence. This underscores
life expectancy as an indicator not only of health
but also of the social conditions that impact family
discipline.

- **Sex:** The analysis of the sex attribute, which rep-
resents the child's gender, reveals that boys have
a significantly higher probability of suffering vio-
lent discipline (1.0) compared to girls (2.0). This
result suggests that social norms and cultural ex-
pectations related to gender may influence disci-
plinary practices.

  Additionally, similar findings were reported in the
  article by Emerson and Llewellyn (2021) and also
  in data from the MICS in the article by Lans-
  ford et al. (2010), corroborating the observation
  that boys are more subjected to severe disciplinary
  methods. These disparities in disciplinary experi-
  ences reflect not only gender socialization but can
  also impact the emotional and psychological de-
  velopment of children.

- **num_5_17, num_under5, num_hh_members:**
  The analysis of data regarding the number of chil-
  dren aged 5 to 17 years, children under 5 years,
  and the number of household members reveals
  significant patterns related to violent discipline.
  Fewer numbers of children and household mem-
  bers are associated with a reduction in the likeli-
  hood of violent discipline.

  The presence of a single child aged 5 to 17 years
  and the absence of children aged 0 to 5 years cor-
  relate negatively with violent discipline. House-
  holds with 2 to 5 members also exhibit a similar
  trend, suggesting that smaller families foster en-
  vironments less prone to severe disciplinary prac-
  tices.

  Conversely, an increase in the number of chil-

dren and household members is associated with
a higher likelihood of violent discipline, indicat-
ing that larger families may face challenges that
lead to stricter disciplinary practices, which may
be related to the fertility rate attribute.

These results highlight the importance of family
structure and social context in disciplinary expe-
riences, suggesting that smaller family configura-
tions may be better positioned to prevent violent
discipline.

- **hh_fridge, hh_computer, hh_internet:** This
  attribute analyzes the presence of household
  appliances, including refrigerator (hh_fridge),
  computer (hh_computer), and internet access
  (hh_internet) in the home. The analysis of SHAP
  values indicates that the presence of these appli-
  ances is associated with values close to neutral,
  suggesting that they have a minimal impact on the
  model's predictions.

  However, considering the minimal impacts, it is
  observed that the absence of these appliances
  seems to contribute more to the occurrence of vi-
  olent discipline than their presence. This sug-
  gests that homes without access to these ameni-
  ties may be associated with more challenging so-
  cial and economic conditions, as discussed in item
  5, which in turn may lead to stricter disciplinary
  practices, as previously discussed in earlier sec-
  tions.

- **fs_education_level, mother_education_level,
  and father_education_level:** This attribute
  evaluates the highest educational level achieved
  by the child, as well as the educational levels
  of the caregiver and the guardian. The analysis
  of SHAP values indicates an inverse correlation
  between education level and the probability of
  experiencing violent discipline. Children with
  higher education levels, as well as those whose
  parents have higher education levels, tend to have
  a significantly lower probability of experiencing
  violent discipline compared to those with lower
  education levels.

  This behavior suggests that factors associated
  with schooling, such as greater knowledge and
  communication skills, may contribute to a re-
  duced risk of exposure to violent disciplinary
  practices. Additionally, higher education levels
  may be related to a family environment that val-
  ues more positive and constructive disciplinary
  methods, resulting in less reliance on severe dis-
  ciplinary practices.

- **MA2_group_encoded, MA1, and natu-
  ral_mother_lives_hh:** The attributes 'MA1',

which refers to the marital status of the interviewed woman, and 'MA2', which indicates the current age of the husband, demonstrate a significant relationship with the occurrence of violent discipline.

The analysis of SHAP values reveals that married women are less likely to adopt violent disciplinary practices compared to those in long-distance relationships or living with a partner.

Regarding the husband's age ('MA2'), it is observed that the younger the husband, the greater the likelihood of violent discipline occurring. This correlation may suggest that younger husbands tend to have less experience with parenting and family dynamics, which can result in a greater use of violent disciplinary practices.

Furthermore, the attribute 'natural_mother_lives_hh', which indicates the presence of the biological mother in the household, is associated with a lower probability of experiencing violent discipline. The presence of the biological mother may be related to a more stable family environment, which can contribute to the reduction of violent disciplinary practices.

- **number of disabled domains:** This attribute is the main focus of this study, gathering information on the following domains: seeing, hearing, mobility, self-care, communication/comprehension, learning, remembering, attention and concentrating, relationships, coping with change, affect (anxiety and depression) and controlling behaviour. The objective is to estimate whether an increase in these disabilities is related to an increased likelihood of experiencing violent discipline.

The analysis of the SHAP graphs indicates that the absence of difficulty domains has a negative impact on the occurrence of violence, while an increase in the number of domains is associated with a slight rise in the probability of experiencing violent discipline. Supported by this observation, the violin plot (Figure 7) shows that for individuals with no domains of difficulty, 50% of the data (from the first quartile to the third quartile) are concentrated in negative values, reinforcing this lower probability. As the number of deficiency domains increases, especially in the range of 1 to 3 domains, the quartiles are closer to the positive median, suggesting a growing association with severe violent disciplinary practices. This change in distribution reflects a correlation between the number of difficulties domains and the increased likelihood of exposure to severe disciplinary measures, with the median shifting to higher levels as
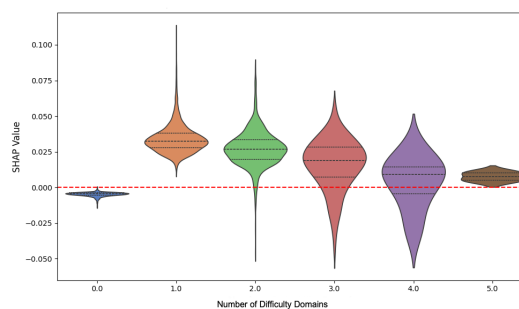

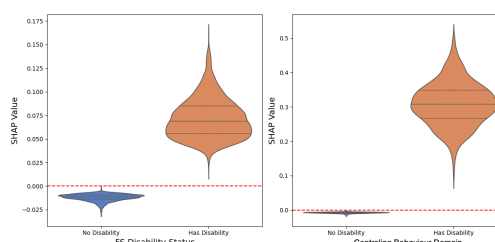Figure 7: Analysis of the number of difficulty domains.

Figure 8: Analysis of disabilities and difficulty domains.

the number of domains increases. This data indicates that the presence of multiple domains may be associated with a higher risk of experiencing violent disciplinary practices.

- **fsdisablity and behaviour_control_disab:** The analyzed attributes refer to the presence of at least one type of disability in the child ('fsdisability'), encompassing seeing, hearing, mobility, self-care, communication/comprehension, learning, remembering, attention and concentrating, relationships, coping with change, affect (anxiety and depression) and controlling behaviour domains. A specific attribute is dedicated to disabilities related to the domain controlling behaviour ('behaviour_control_disab').

The analysis of the SHAP graphs indicates that the absence of disabilities is associated with a decreased likelihood of experiencing violent discipline. In contrast, the presence of at least one disability correlates with a significant increase in the probability of suffering from violent disciplinary practices.

As shown in Figure 8, when there is no disability, the SHAP values are predominantly negative, suggesting a lower likelihood of experiencing violent discipline. However, the introduction of difficulty domains particularly those related to controlling behaviour, results in a notable shift toward positive SHAP values. This trend highlights that the presence of any functioning domain is linked to an elevated risk of experiencing severe disciplinary

methods. This data underscores the need for appropriate interventions and specialized support for children with disabilities.

6 DISCUSSION

This research aimed to investigate the importance of attributes related to various difficulties domains, including seeing, hearing, mobility, self-care, communication/comprehension, learning, remembering, attention and concentrating, relationships, coping with change, affect (anxiety and depression) and especially controlling behaviour. The graphical analysis of proportions reveals a significant correlation between the incidence of violent discipline in children and the presence of disabilities.

The data indicate that, proportionally, a larger number of children facing violent discipline have some form of disability compared to those who do not. This observation suggests that children with disabilities, particularly those related to behavior control, face additional challenges that make them more vulnerable to harsher disciplinary methods.

Controlling behaviour difficulties in children may manifest in actions such as lying, fighting, bullying, running away from home, or skipping school, limiting their ability to interact appropriately with others. These challenging behaviors can lead caregivers to believe in the necessity of punishment, exacerbating severe discipline. This dynamic may result in a vicious cycle, where the lack of adequate support worsens the situation, leading to disciplinary practices that are not only inappropriate but also harmful to the emotional and social development of children (Sinhorinho and de Moura, 2021).

Furthermore, the presence of disabilities may be associated with difficulties in socialization and increased levels of anxiety and depression, affecting interactions with peers and adults. In this context, severe discipline not only fails to address challenging behaviors constructively but may also intensify the vulnerability of these children, necessitating interventions that promote social and emotional support.

The results also demonstrated that the presence of multiple difficulties domains further exacerbates this correlation. Although this research focused on disabilities, socioeconomic factors, such as the level of development of the country, also play a significant role. Less developed countries or those with weaker economies, characterized by lower life expectancy, higher infant mortality rates, lower GDP per capita, and higher fertility rates, show a greater tendency towards the application of severe violent discipline.

Additionally, the belief that violence is necessary to educate and raise a child was strongly correlated with the application of severe disciplinary methods. This cultural perception can perpetuate cycles of violence, making it essential to promote educational practices that challenge these beliefs.

To enrich this analysis, we employed various machine learning algorithms. These methods allowed for the visualization of the relative importance of each attribute in the context of violent discipline. These techniques highlighted the complexity of interactions between the variables and facilitated the identification of patterns that might have gone unnoticed in traditional analyses.

These results demonstrate the urgency of educational practices that promote inclusion and raise awareness about the specific needs of children with disabilities. The adoption of more empathetic disciplinary methods and the implementation of interventions focused on social skills may be essential to reducing the incidence of violent discipline and ensuring a safer and more supportive environment for children.

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