

Trends and Forecasted Rates of Child Abuse Cases and Support Studies: A Study Utilizing ARIMA Model

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ABSTRACT

Child abuse is a significant social issue that impacts the well-being of children. This paper utilized time series data for trend analysis and forecasting using the ARIMA model to visualize the trends of child abuse cases served in the Philippines, specifically focusing on the different types of abuse reported. Figures for every kind of abuse are presented individually using GRETl software. The results of the forecasting showed that neglect was the most prevalent type of child abuse reported, and sexual abuse ranked second. And the least reported cases were pedophilia. The findings highlight the continued challenges in handling child abuse in the Philippines. Future research will focus on refining these trends and exploring other forecasting methods to improve the effectiveness of child protection interventions.

Keyword: ARIMA, Child abuse, Predictions, Trends, Analysis.

1. INTRODUCTION

The maltreatment, abuse, and neglect of children continue to be major global issues of concern. This issue requires immediate attention due to its potential long-term effects on children's physical health, mental health, and overall psychological well-being [1]. Though plenty of literature exists on the facts of child abuse, there is an inspiring opportunity to reduce the gap in knowledge regarding occurrences of violence against children across nations, enhancing our reach and scope for a better future [2]. Every year, millions of children all over the world suffer the most painful experience of abuse; this sad reality brings with it a need for our focus and intervention [3].

Child maltreatment represents a pressing public health challenge that demands our immediate attention and action. Globally, with severe and often debilitating long-term effects on psychosocial development as well as physical and mental health. Unfortunately, however, little is known about the long-term effects of differing types of child maltreatment, which include sexual abuse, physical abuse, emotional abuse, and neglect [7]. Few studies have adequately controlled for confounding factors, such as perinatal risks, socioeconomic adversity, parental psychopathology, and impaired early childhood development, all of which may contribute to both child maltreatment and subsequent adverse health outcomes [8].

In the Philippines, the situation is similarly alarming. According to the Department of Social Welfare and Development (DSWD), child abuse cases reached 2,147 in the first quarter of 2016 [4]. The 2015 National Baseline Study on Violence Against Children by the Council for the Welfare of Children revealed that while 80% of children in the Philippines face challenges, there's great potential for positive change and healing ahead [5]. Much of the violence against children in the country remains hidden or unreported despite alarming statistics [6]. The research on this topic is still in its initial stages.

Child abuse is a significant adverse childhood experience (ACE) that can profoundly affect a child's overall well-being throughout their life. In the short term, those who face maltreatment may encounter behavioral challenges, learning obstacles, and mental health struggles. As these individuals enter adulthood, it's hard to recognize the increased risk of chronic illnesses and shorter lifespans they will encounter [9][10].

2. THEORETICAL FRAMEWORK

2.1 Review of Related Literature

This research seeks to provide a more comprehensive insight into the characteristics of cases that people frequently report and to identify any distinctions between substantiated and unsubstantiated reports [11]. There are still many recorded cases of child abuse in many nations despite the growing awareness of children's rights around the world [12]. Even when parents, kids, and local officials sufficiently understand the target and significance of child discipline, they still need education on recognizing when a disciplinary act harms children [13].

To effectively prevent child sexual abuse in developing nations, it's essential to expand our efforts beyond just school-based initiatives. By exploring successful treatments in diverse community settings, we can fill critical knowledge gaps and develop comprehensive solutions that provide robust protection for children everywhere. Let's create a safer environment for all children [14]. Only tertiary interventions conducted by the criminal justice system following an offense have historically been a part of prevention initiatives. A public health strategy that incorporates elementary and secondary-level interventions has been advocated more recently as a means of reducing child sexual abuse. The goal of secondary prevention is to treat and assist individuals who are at risk of sexual offenses before they participate in the judicial system [15].

Additionally, cross-cultural studies show that some groups of children—such as those with poor health, females, unwanted children, and those born in challenging situations, with unappreciated characteristics, or during periods of rapid socioeconomic change—are more likely to experience abuse in many nations [16]. Adjustment across the lifespan in the areas of mental health, physical health, and psychosocial adjustment was notably correlated with the experience of child maltreatment in long-term care. Survivors of child abuse should have access to evidence-based trauma-focused treatment [17].

Lesbian, gay, and bisexual (LGB) individuals may face challenges to intimate partner violence (IPV) and childhood abuse and neglect (CAN). To better support at-risk populations, it is essential to understand the distinct patterns of victimization that occur throughout childhood and adulthood. These include both face-to-face interactions and technology-mediated IPV. Additionally, recognizing the cumulative impact of these experiences on mental and behavioral health among LGB individuals is crucial for effective intervention and support [18].

3. MATERIALS AND METHODS

3.1 Materials

The data used in this study were sourced from the official Philippine Statistics Authority (PSA) records available in the OpenStat database. The set of reported cases of child abuse by type and region covered the period from 2011 to 2016, noting the instances by region in the Philippines. The information contains forms of child abuse, namely corporal, sexual, and psychological maltreatment and neglect. The reports also capture regional distributions and trends within the period given to allow for an analysis of the patterns and prevalence rates for each region. These data were retrieved from the PSA's OpenStat portal through the link: Child Abuse Data 2011-2016.

3.2 Methods

ARIMA, or autoregressive integrated moving average, is a widely used method for fitting time series data for forecasting and prediction. The ARIMA model is a good substitute that performs satisfactorily in prediction [20], [22]. It is possible to extend the ARIMA models to non-stationary series by allowing the data series to be differentiated, which results in ARIMA models. ARIMA (p, d, q) is the generic non-seasonal model. It has three parameters: p is the autoregressive order, d is the degree of differencing, and q is the moving-average order. Suppose the X_t is a non-stationary series, and we have taken a first difference of X_t to get the ΔX_t to be stationary: the ARIMA (p, 1, q) model is as follows:

$$\Delta X_t = c + \alpha_1 \Delta X_{t-1} + \dots + \alpha_p \Delta X_{t-p} + \epsilon_t - \theta_1 \epsilon_{t-1} - \dots - \theta_q \epsilon_{t-q}, \quad (1)$$

in which $\Delta X_t = X_t - X_{t-1}$. However, in equation (1), if $p = q = 0$, then the model is transformed into an ARIMA (0, 1, 0) random walk model [19]. The analysis began with auto-correlation and partial auto-correlation procedures to explore random, stationary, and seasonal effects within the time series data. The data was then made stationary through differencing techniques. Next, potential models were identified by examining the autocorrelogram and partial autocorrelogram. In the subsequent phase, parameter estimation and model testing were conducted to compare the different plausible models, ultimately selecting the most suitable one. Finally, a predictive analysis was

performed on the historical data to forecast future trends. The GRETL (Gnu Regression, Econometrics, and Time-series Library) software was utilized for plotting graphs and conducting statistical analysis [21]. Figure 1 illustrates the methodology for predicting child abuse trends.

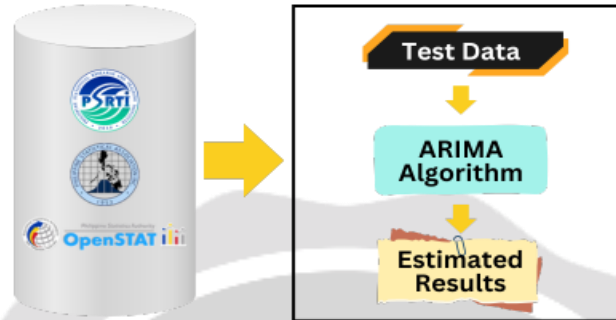


Fig -1: Predicting Child Abuse Trends

4. RESULTS AND DISCUSSION

4.1 Time-series plot

The time-series plot showing the trend of the number of child abuse cases served in the Philippines is presented in Figure 2. The 5-year historical data used was from the years 2011–2016. It is evident in the figure that there was a decreased pattern of cases over this period.

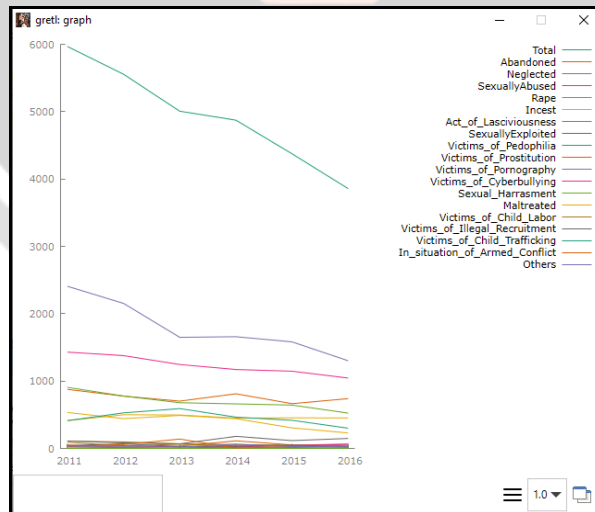


Chart -1: The Time-Series Plot of Child Abuse Cases Served in the Philippines

This decline could suggest improvements in child protection efforts or a possible reduction in reported incidents of abuse during this period. However, it is also essential to consider factors such as underreporting or changes in public awareness and reporting mechanisms, which may influence these trends. While the decrease in cases is a positive sign, it remains crucial to continue focusing on strengthening child protection systems to ensure that all instances of abuse are adequately addressed and that children are provided with the support they need.

4.1.1 Forecasting

The following figures present a 15-year prediction on the progression of child abuse cases served in the Philippines, specifically from 2011 to 2016. These predictions are generated using ARIMA modeling, utilizing historical data from 2011 to 2016.



Chart -2: (a) A Fifteen-Year Forecast of the Total Number of Child Abuses; (b) A Fifteen-Year Forecast of the Abandoned Child Abuses

Historical point forecast of child abuse in the Philippines for 2017-2031 by fitting an unknown modeling technique to historical data with point estimates and the corresponding confidence intervals. This figure contains two sub-figures:

- (a) Total Child Abuse cases: The time series projection from approximately 4800 cases in 2015 rises gradually and then tapers off to about the same level, 4800, during 2022-2023. The widths of 95% prediction intervals are significant, particularly by the end, and reflect enormous uncertainty over the magnitude of any future change.
- (b) Abandoned Child Abuse cases: The forecast rises until 2017. Then, it falls and flattens to about 760 cases annually from 2018 onwards. The 95% prediction intervals for every interval are narrower than for case (a). The uncertainty is much smaller, but the spread of possible values is wide enough.

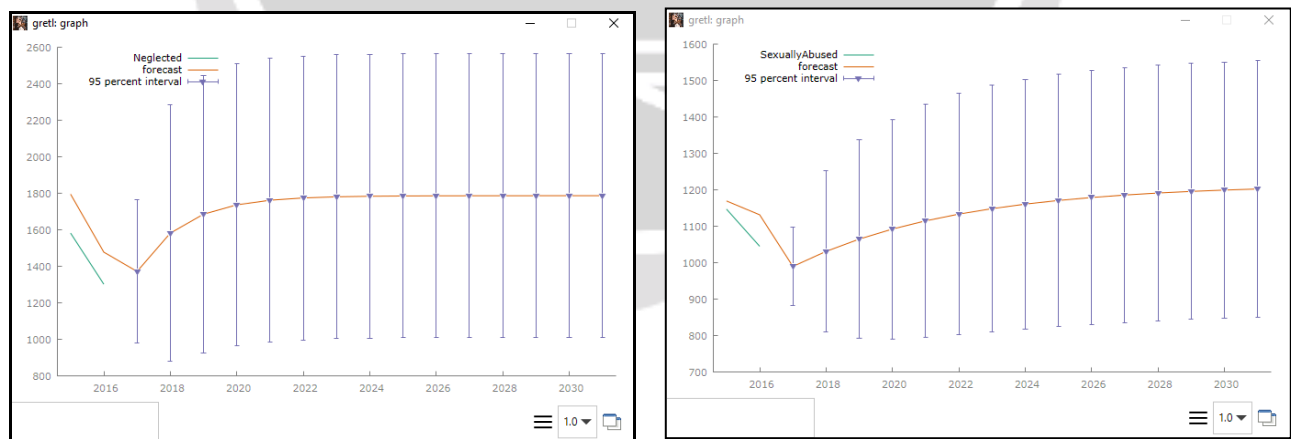


Chart -3: (a) A Fifteen-Year Forecast of the Neglected Child Abuses; (b) A Fifteen-Year Forecast of Sexually Child Abuses

Historical data and a point forecasting model of two classes of child abuse in the Philippines for fifteen years forecasts from 2017 to 2031. The figure was divided into two sub-figures:

- (a) Latent Violations of Child Neglect: The fitted trend (orange line) continues in that fashion from 2015 to 2017 and then gradually increases to level off at approximately 1750 cases from around 2020 to 2030. The wide 95% prediction intervals (purple lines) indicate extreme uncertainty, especially about the magnitude of the increase.

(b) Abused Children: The forecasted series orange line declines between 2015 and 2017, grows dramatically until around 2022-2023, and then levels off at approximately 1200 cases through to 2030. Huge 95% prediction intervals (purple lines), especially in earlier periods, indicate vast uncertainty in both the prediction's magnitude and the flattening date.

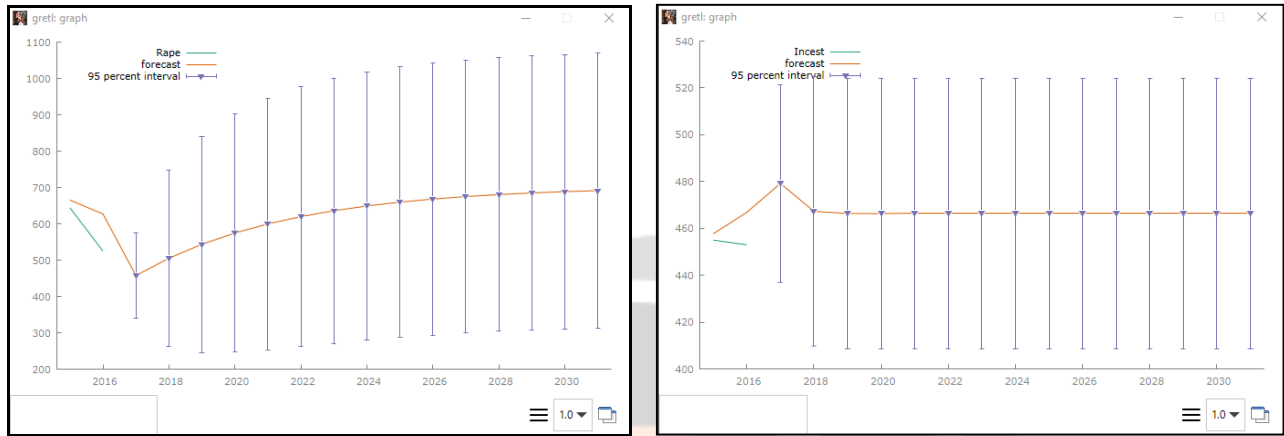


Chart -4: (a) A Fifteen-Year Forecast of Rape Child Abuses; (b) A Fifteen-Year Forecast of Incest Child Abuses

Historical rape and incest child abuse data of the Philippines over fifteen years (2017-2031) projected using historical data with an unspecified modeling technique-probably ARIMA also since the confidence intervals are included. The figure consists of two sub-figures:

(a) Child Rape Abuse Trends: The projection line in orange shows a negative trend until 2015-2017 and then a steady increase with a plateau of around about 650 cases from about 2022-2023 forward. Extensive 95% prediction intervals, in purple lines, for huge uncertainty, especially as to the size of the increase.

(b) Incest Child Abuses: The projection (orange line) increases to 2017 and then decreases and stabilizes to around 460 per year from 2018 to 2030. The 95% prediction intervals (purple lines) are smaller than (a) and imply less uncertainty for predicting outcomes, although the spectrum of possible outcomes is still broad.

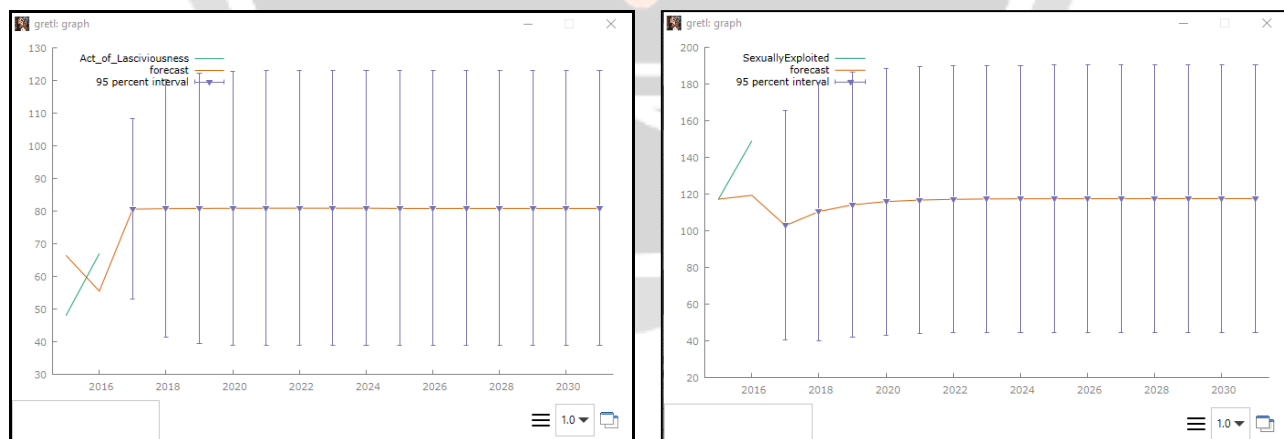


Chart -5: (a) A Fifteen-Year Forecast of Act of Lasciviousness Child Abuses; (b) A Fifteen-Year Forecast of Sexually Exploited Child Abuses

It gives a forecast for the next fifteen years, 2017-2031, of Acts of Lasciviousness and Sexually Exploited Children in the Philippines, based on historical data and by some unknown modeling methodology, apparently ARIMA, as it includes confidence intervals. The figure has two separate sub-figures:

(a) Lasciviousness Child Abuse: The trend (orange line) starts steeply for the first decade and then levels out at around 80 cases per year from 2017 to 2030. Broad 95% prediction bands in purple across the entire forecasting period reflect that much uncertainty remains about the predictions.

(b) Sexually Exploited Child Abuses: The projection (orange line) peaks an order of magnitude up at around 2017 and then becomes flat with some decline to approximately 115-120 cases per year from around 2018 to 2030. In this case, the 95% prediction intervals (purple lines) are tighter than in (a) and indicate less uncertainty than the projection of Acts of Lasciviousness, though some uncertainty does exist.

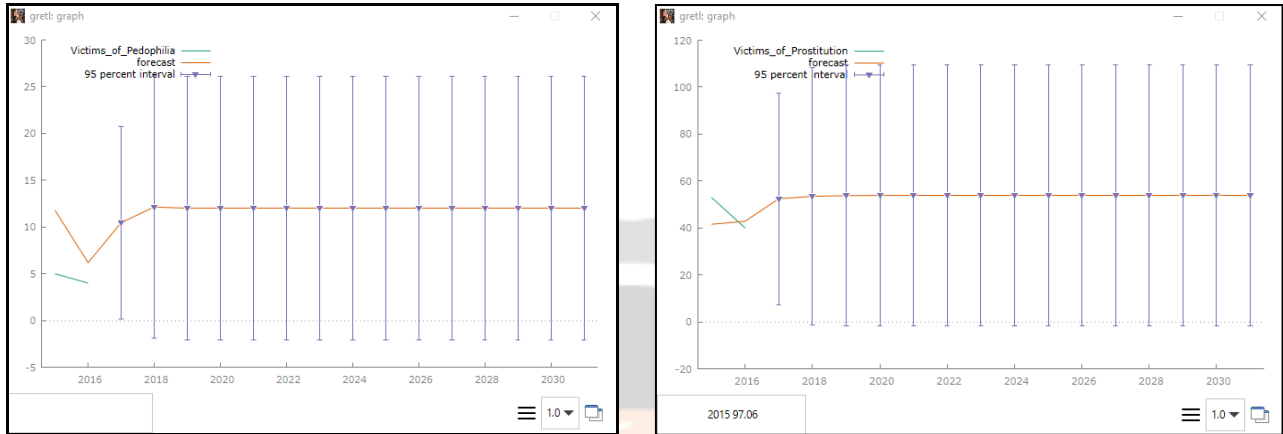


Chart -6: (a) A Fifteen-Year Forecast of Victims of Pedophilia; (b) A Fifteen-Year Forecast of Victims of Prostitution

Fifteen-year projections (2017-2031) of victims of pedophilia and prostitution in the Philippines, using a fitted model and some other modeling technique, which has to be ARIMA, by confidence intervals. This figure has two sub-figures:

(a) Victims of pedophilia: The fitted values (orange line) give a decline until 2017, followed by a jump and a flat line at some 12 victims per year from 2018 to 2030. The extensive 95 % prediction intervals (purple lines), particularly at the beginning, indicate huge uncertainties.

(b) Prostitution Victims: The orange prediction line starts uptrend and peaks about 2018, then taper off a little and stabilizes at about 50 victims per year from 2018 to 2030. The 95% prediction intervals (purple lines) are narrower than in (a), meaning less uncertainty for this forecast than for the pedophilia forecast.

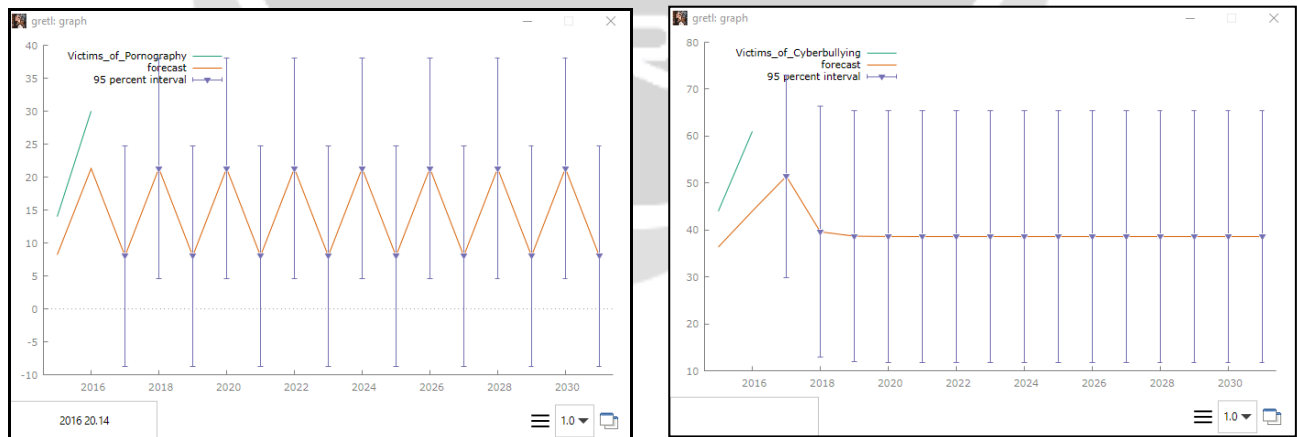


Chart -7: (a) A Fifteen-Year Forecast of Victims of Pornography; (b) A Fifteen-Year Forecast of Cyberbullying Child Abuses

Illustrates forecast for the fifteen years (2017-2031) of those exposed to pornography and cyberbullying in the Philippines using historical data and a rather vague modeling approach, presumably ARIMA, given the confidence intervals. It has two sub-figures

- (a) Adults exposed to Pornography: The forecast (orange line) remains very cyclic, with significant annual fluctuations and high peaks and troughs from 2015 to 2030. Due to this cyclic nature, the extensive 95% prediction intervals (purple lines) reflect the extreme uncertainty in long-term forecasting.
- (b) Victims of Cyberbullying: The orange forecasted line peaks around 2017, then drops off, and remains relatively stable from about 2018 until 2030. The 95% prediction intervals (purple lines) are much tighter than in pornography, and so indicate a greater level of confidence in this forecast than in the forecast for victims of pornography.

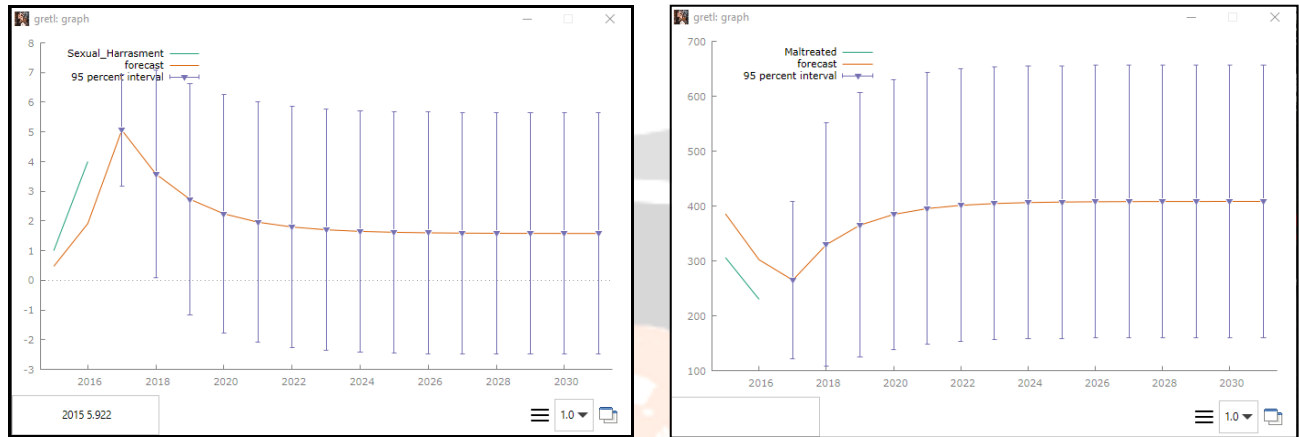


Chart -8: (a) A Fifteen-Year Forecast of Sexual Harassment; (b) A Fifteen-Year Forecast of Maltreated

Fifteen-year forecasts (2017-2031) of sexual harassment and child maltreatment in the Philippines, based on historical data with the indeterminate modeling approach, likely ARIMA, given that there are also confidence intervals. It consists of two distinct sub-figures:

- (a) Sexual harassment: The projection (orange line) spikes steeply initially, peaking around 2017 and dropping steadily into 2030. The relatively wide 95% prediction bands (purple lines), particularly in the early years, suggest a lot of uncertainty.
- (b) Maltreated: The orange-plotted prediction line starts with a downward trend and then increases upward to attain a stable point starting roughly from 2020-2021 and consistently continuing up to 2030. The 95% prediction bands are more comprehensive than in (a), which means that this prediction is less uncertain than the prediction of sexual harassment.

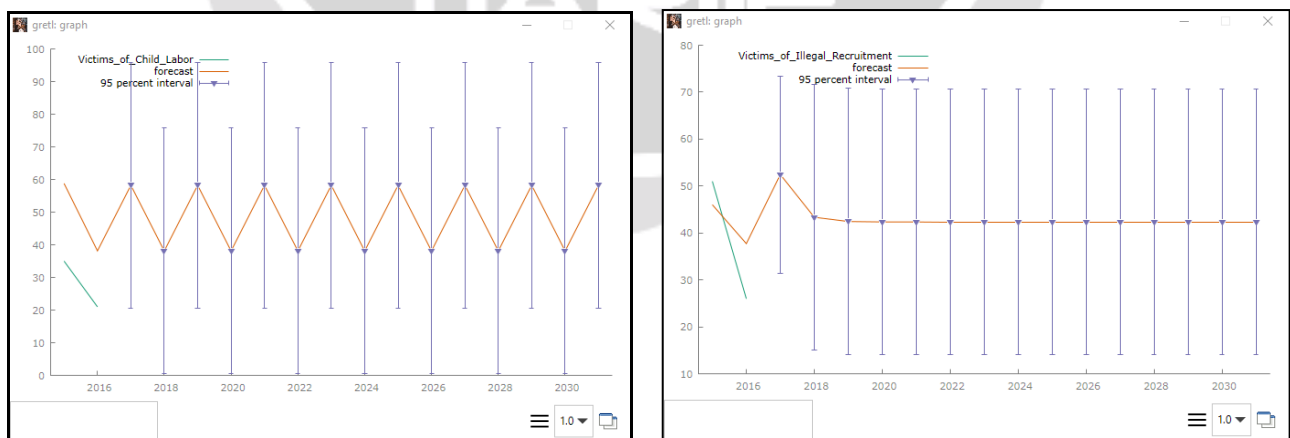


Chart -9: (a) A Fifteen-Year Forecast of Victims of Child Labor; (b) A Fifteen-Year Forecast of Illegal Recruitment Gives forecasts for fifteen years into the future (2017-2031) for child labor victims and victims of illegal recruitment in the Philippines based on historical data and an unspecified modeling technique (likely ARIMA, given that confidence intervals are included). The figure consists of two sub-figures:

(a) Victims of Child Labor: The prediction (orange line) maintains a clear cyclical pattern with intense year-on-year volatility, showing clear peaks and troughs from 2015 until 2030. Significant 95% prediction intervals (purple lines) reflect intense uncertainty over such long-term trends due to such a pattern.

(b) Victims of Irregular Recruitment: The projection (orange line) is plotted as decreasing till around 2017-2018; the level stabilizes from around 2017-2018 to 2030 with a relatively stable level. The 95% prediction intervals (purple lines) are much narrower than for part (a), which means this projection is relatively more reliable than the projection for child labor victims.

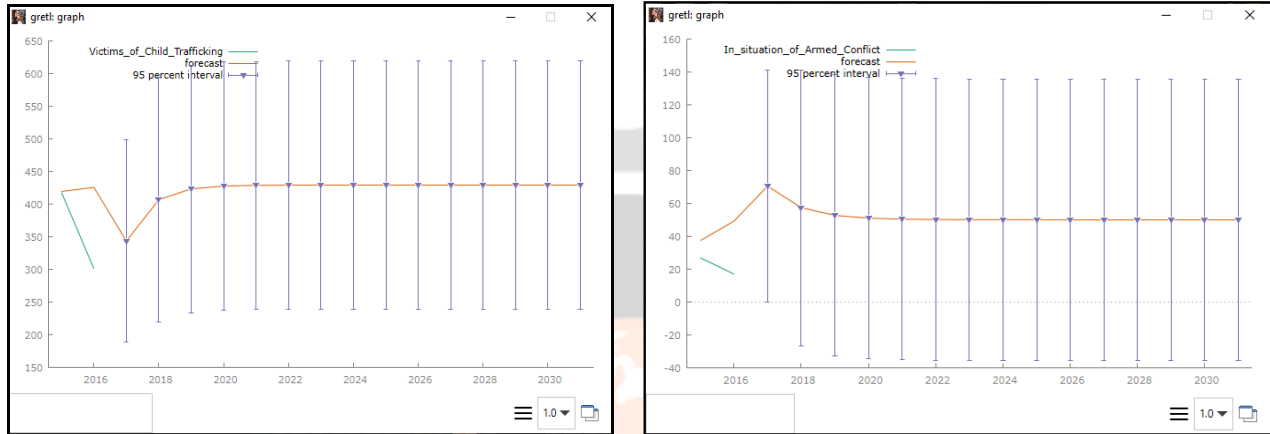


Chart -10: (a) A Fifteen-Year Forecast of Victims of Child Trafficking; (b) A Fifteen-Year Forecast of In situation of Armed Conflict

Projection from the historical data on child trafficking and armed conflict against children in the Philippines from 2017 to 2031 based on an unspecified modeling technique, ARIMA, since a confidence interval is provided. There are two sub-figures in the figure:

(a)Victims of Child Trafficking: The projection, in orange, arcs down to around 2017 and then plateaus to about 420 victims per year from 2017 through 2030. The two purple lines' broad 95% prediction intervals indicate that uncertainty remains high throughout the forecasting period, particularly during the early years.

(b) Children in armed conflict: The forecast (orange line) peaks around 2017 and then tapers to around 50 cases yearly from 2018 to 2030. The 95 percent prediction intervals (purple lines) are narrower than (a), which means this variable's forecast has less uncertainty than the child trafficking forecast.

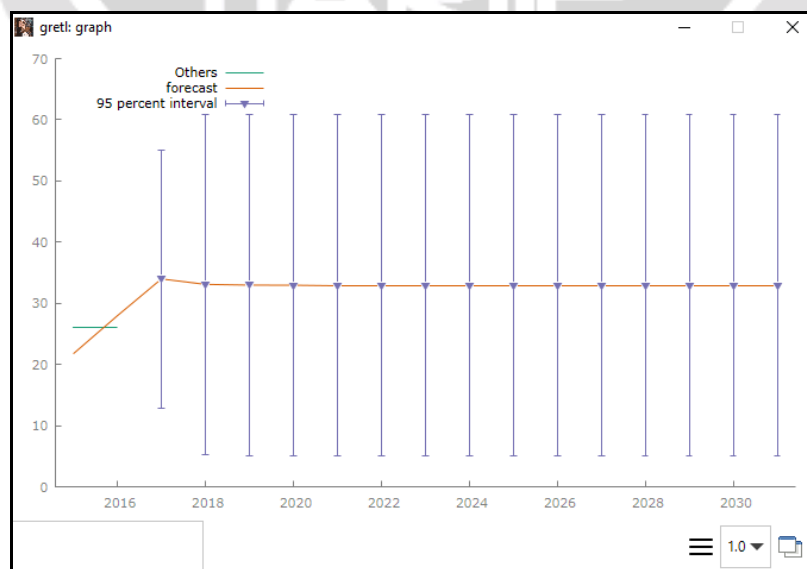


Chart -11. A Fifteen-Year Forecast of Victims of Other Child Abuses

Long-term projection of "Other Child Abuse" in the Philippines based on historical data and some unspecified modeling techniques (we will assume this is probably an ARIMA, given that lines for a 95% prediction interval are shown) from 2017-2031. There is a projection (orange line) with a 95% prediction interval (purple lines).

The projections show a steep increase in victims until about 2017 and, after that, an average of about 33 victims per year through 2030. This comprehensive and steady prediction interval—indicated by the two purple lines for the fifteen years—reflects a lot of uncertainty in the number of victims and the chances for large deviations above and below the predicted average of 33 victims per year.

5. CONCLUSIONS AND RECOMMENDATIONS

Accumulating projected data on child abuse incidents is essential for making effective preventive tactics. Using the ARIMA model to forecast rising and falling abuse patterns, the time-series tool in this study effectively displayed the trends of child abuse incidents in the Philippines. According to historical data, the number of child abuse cases increased between 2011 and 2016, with neglect being the most common type of abuse. However, the prediction for the following fifteen years suggests that such occurrences may decline. Improvement in child protection initiatives must be continued. The improvement areas must be known, and specific regions must be emphasized. Thus, while the country could be making further reductions in child abuse, especially neglect, focusing on prevention and reinforcing support systems can ensure that children will be kept safe and their well-being cared for.

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