

## **Towards Data- Driven Approach: Utilizing Mathematical Modeling to Predict the Number of Child Abuse Cases in the Philippines**

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### **ABSTRACT**

The study used a mathematical modeling approach to determine the best-fit model and the predicted value of child abuse cases in the Philippines in 2017. The data was downloaded from the PSA portal. Based on the findings of the study, the decreasing trend of male and female child abuse cases in the Philippines from 2006 to 2016 suggests progress in addressing child abuse issues. The best-fit model is quintic. These predictions offer insights into the potential trajectory of child abuse cases in the Philippines and can inform preventive measures and resource allocation. Using the best-fit model, the predicted number of cases of male and female child abuse cases in 2017 is 1613 and 4521, respectively.

*Keywords:* female child abuse cases, male child abuse cases, prediction of cases, r-squared, trend of child abuse cases

### **INTRODUCTION**

Child abuse is a serious public health concern with detrimental consequences for individual and societal well-being (Pinheiro, 2006). Data suggests that the Philippines faces a significant challenge in addressing child abuse, with reported cases reaching over 16,000 in 2021 (Philippine Statistics Authority, 2022). Understanding the scope and trends of child abuse cases is crucial for developing effective prevention and intervention strategies. Gaining a deeper understanding of the trends in child abuse cases in the Philippines is crucial for developing and implementing effective prevention and intervention strategies. This research aims to contribute to this understanding by employing mathematical modeling techniques.

In the context of Filipino culture, where traditional values and familial dynamics often shape disciplinary practices and interpersonal relationships, the phenomenon of child abuse takes on unique dimensions. In Filipino households, discipline has traditionally been understood as a parental duty aimed at instilling respect, obedience, and moral values in children. However, the methods employed to enforce discipline often involve corporal punishment, such as spanking or hitting, which can escalate to abusive behaviors when boundaries are crossed or emotions run high. The normalization of physical discipline within Filipino culture perpetuates a cycle where abusive actions may be rationalized as necessary for maintaining authority and discipline within the family unit. Research by Lapa et al. (2012) revealed that child abuse is more common among female children aged 12-18 from families with low socioeconomic status and parents with low educational attainment. Moreover, most abuses lasted 1-5 years before being reported. Perpetrators were often male neighbors, female neighbors, or cohabiting husbands. Also, physical abuse, child rape, spousal abuse, and verbal assault are the common forms of abuse, damaging children both physically and psychologically.

In the Philippines, child labor is considered a form of child abuse due to the severe risks and harm it inflicts on children. There are laws in place to protect children, and the government has made significant progress; however, challenges remain in fully eradicating child labor due to socio-economic factors.

Mathematical modeling studies on child abuse can help us better understand how often child abuse happens and whether it is getting worse or improving. This information also helps plans for the future, as the model can predict where and when more cases might happen. Knowing this allows the government and organizations to be better prepared and send help where it is most needed. The study would also help people who make decisions, like the government, create better rules and programs to protect children. It makes sure that resources

like social services and support systems go to the areas that need them most. On top of that, the research brings attention to the problem, helping raise awareness in the community and encouraging everyone to take action. It can also be used as a starting point for future research on why abuse happens and how to prevent it more effectively. The findings would also support groups that fight for children's rights, giving them stronger evidence to push for changes. In the end, this study would benefit the government, social workers, healthcare providers, schools, and, most importantly, the children and families affected by abuse. This research proposal aims to employ mathematical modeling to examine child abuse cases in the Philippines. This approach offers several advantages. Firstly, it allows for identifying underlying patterns and trends in the data (Montgomery et al., 2015). Secondly, model forecasting allows predicting future trends to inform policy decisions and resource allocation for proactive interventions (Box et al., 2015) of parent-child closeness of children of OFWs, as well as the study attitudes and methods.

This study investigated the best-fit model for the Number of Child Abuse Cases in the Philippines for the years 2006 to 2016. This study aims to determine the trend of male and female child abuse cases in the Philippines from 2006 to 2016; explore and analyze different mathematical models of the number of child abuse Cases in the Philippines in terms of the linear, quadratic, cubic, quartic, quintic, exponential, logarithmic, and power models; and predict the future number of child abuse cases using the best-fit model identified from the analysis, particularly in the year 2017.

## METHODOLOGY

This study utilized a descriptive-predictive approach, combining descriptive analysis to characterize the historical context of child abuse with predictive modeling to forecast future trends. The descriptive design was employed to map the trends in child abuse cases in the Philippines from 2006 to 2016. The study is also predictive in nature, as it utilized the longitudinal data from 2006 to 2016 to forecast the number of cases for 2017. Furthermore, an exploratory design was used to identify the 'best-fit' mathematical model for these predictions. This involved the comparative analysis of various models, including linear, quadratic, cubic, quartic, quintic, exponential, logarithmic, and power functions.

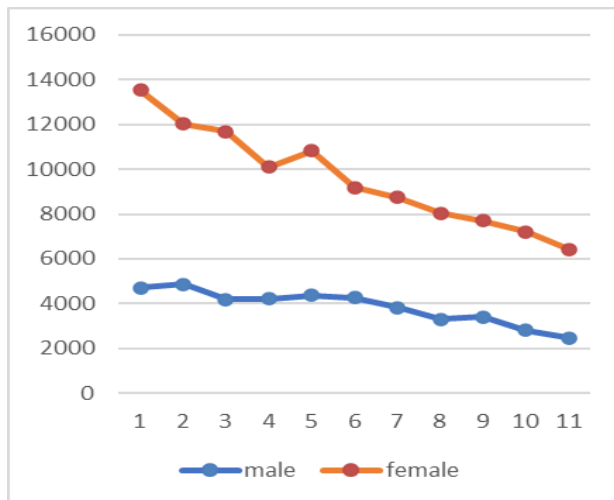
Data was obtained from the Philippine Statistics Authority OpenStat portal. Specifically, the files titled "Number of Child Abuse Cases Among Male Served" and "Number of Child Abuse Cases Among Female Served" were used. Different mathematical models such as linear, quadratic, cubic, quartic, quintic, exponential, logarithmic, and power were applied to find the best model that fits the trend of the child abuse cases. Each model was evaluated based on how well it fits the data using measures like the R-squared ( $R^2$ ) value and the standard error of estimate. The model with the highest r-squared and lowest standard error was chosen as the best-fit model. A prediction was made for the number of male and female child abuse cases in 2017 based on the identified best-fit model.

## RESULTS AND DISCUSSION

### Section 1. Trend of Male and Female Child Abuse Cases in the Philippines from 2006-2016

**Figure 1**

*Trend of Male and Female Child Abuse Cases in the Philippines from 2006-2016*



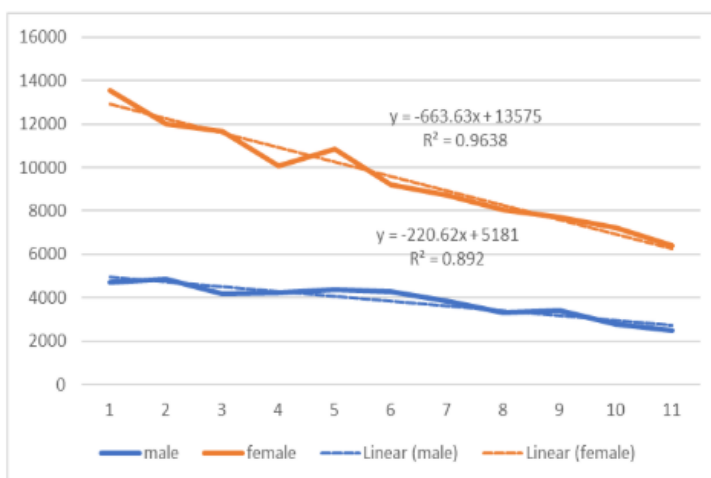
Year	Female	Male
2006	13,542	4,717
2007	12,033	4,865
2008	11,685	4,196
2009	10,098	4,216
2010	10,836	4,377
2011	9,198	4,276
2012	8,747	3,821
2013	8,037	3,290
2014	7,702	3,396
2015	7,217	2,795
2016	6,427	2,481

As shown in the figure, the number of female child abuse cases is higher than the number of male cases in the Philippines from 2006-2016. It can also be seen in the line chart pattern that the trend generally decreases.

### Section 2. Exploration and Analysis of the Different Mathematical Models of the Number of Child Abuse Cases in the Philippines from 2006 to 2016

**Figure 2**

*Linear Model of the Number of Male and Female Child Abuse Cases in the Philippines from 2006 to 2016*



Legend: 1(2006), 2(2007),...,11(2016)

The linear model for male child abuse cases in Figure 2 is represented by the equation  $y = -220.62x + 5181$ . The negative slope indicates a consistent decline in reported cases of male

child abuse over the specified period. The coefficient of determination (r-squared) for this model is 0.892, suggesting that approximately 89.2% of the variation in reported male child abuse cases can be explained by the linear relationship with time. Similarly, the linear model for female child abuse cases, expressed as  $y = -663.63x + 13575$ , exhibits a negative slope, indicating a downward trend in reported cases of female child abuse over the years. The coefficient of determination for this model, at 0.9638, implies that approximately 96.38% of the variation in reported female child abuse cases can be attributed to the linear association with time.

### Figure 3

*Quadratic Model of the Number of Male and Female Child Abuse Cases in the Philippines in 2006 to 2016*

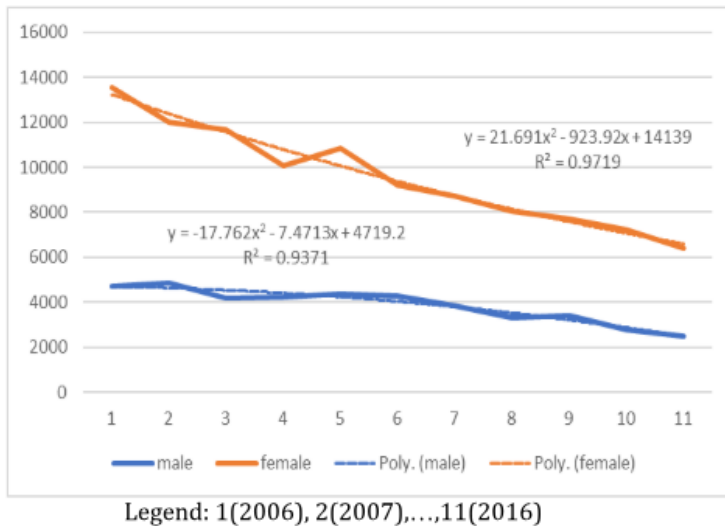
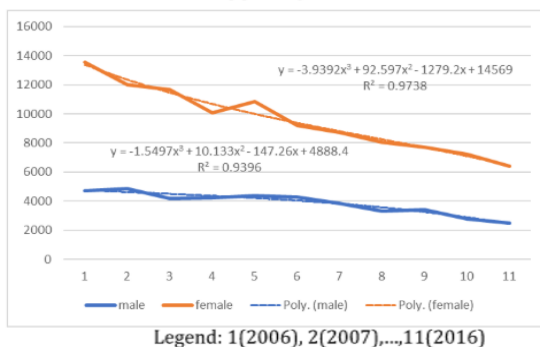


Figure 3 shows that the quadratic model of male child abuse is  $y = -17.762x^2 - 7.4713x + 4719.2$ . This shows a curvilinear relationship between time (x) and the reported cases (y). The negative coefficient attached to the quadratic term ( $-17.762x^2$ ) suggests a concave downward curve, indicating an initial decline in reported cases followed by a gradual decrease. With a coefficient of determination (r-squared) of 0.9371, approximately 93.71% of the variability in reported male child abuse cases can be elucidated by this quadratic relationship with time. Similarly, the quadratic model applied to female child abuse cases, represented by  $y = 21.691x^2 - 923.92x + 14139$ . This illustrates a curvilinear association between time(x) and reported cases (y). The positive coefficient linked to the quadratic term ( $21.691x^2$ ) suggests a convex upward curve, indicating an initial rise in reported cases followed by a slower increase or possible stabilization. With a coefficient of determination of 0.9719, approximately 97.19% of the variability in reported female child abuse cases can be explained by this quadratic relationship with time.

### Figure 4

*Cubic Model of the Number of Male and Female Child Abuse Cases in the Philippines from 2006 to 2016*

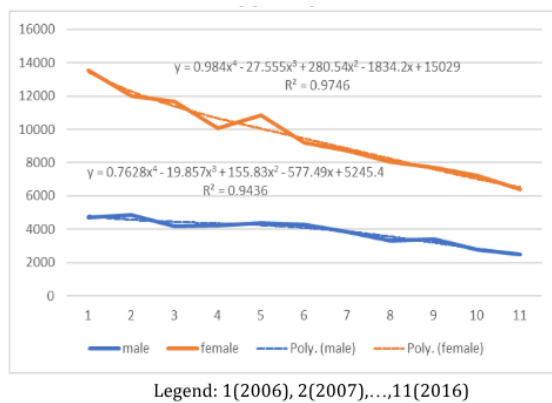


The cubic model for male child abuse cases, represented by the equation  $y = -1.5497x^3 + 10.133x^2 - 147.26x + 4888.4$  as shown in Figure 4. The negative coefficient associated with the cubic term ( $-1.5497x^3$ ) suggests a downward curve with potential fluctuations over time. The model's coefficient of determination (r-squared) of 0.9396 indicates that an impressive 93.96% of the variability in reported male child abuse cases can be explained by this cubic relationship with time. Similarly, female cases of child abuse is represented by  $y = -3.9392x^3 + 92.597x^2 - 1279.2x + 14569$  with a coefficient of determination (r-squared) of 0.9737. The negative coefficient of the cubic term ( $-3.9392x^3$ ) also suggests a downward trend with potential fluctuations. Notably, the model boasts an even higher coefficient of determination (r-squared) of 0.9737, indicating that a remarkable 97.37% of the variability in reported female child abuse cases can be attributed to this cubic relationship with time.

As shown in Figure 5, the quartic model of the male cases is  $y = 0.7628x^4 - 19.857x^3 + 155.83x^2 - 577.49x + 5245.4$ . The positive coefficient associated with the quartic term ( $0.7628x^4$ ) suggests a curve with both concave and convex segments, indicating intricate fluctuations and turning points in the trajectory of male child abuse cases over the specified period. With a coefficient of determination (r-squared) of 0.9436, approximately 94.36% of the variability in reported male child abuse cases can be explained by this quartic relationship with time. Likewise, the quartic model of the female child abuse cases is  $y = 0.984x^4 - 27.555x^3 + 280.54x^2 - 1834.2x + 15029$  with r-squared of 0.9746. The positive coefficient attributed to the quartic term ( $0.984x^4$ ) suggests a similarly intricate curve, reflecting nuanced patterns and fluctuations in the dynamics of female child abuse cases over time. With a coefficient of determination of 0.9746, approximately 97.46% of the variability in reported female child abuse cases can be accounted for by this quartic relationship with time.

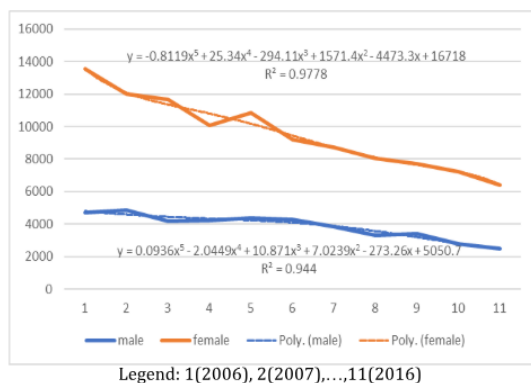
### Figure 5

*Quartic Model of the Number of Male and Female Child Abuse Cases in the Philippines from 2006 to 2016*



### Figure 6

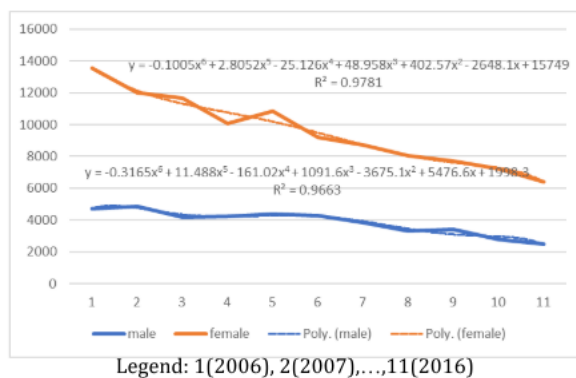
*Quintic Model of the Number of Male and Female Child Abuse Cases in the Philippines from 2006 to 2016*



The quintic model of the number of male child abuse cases in Figure 6 is  $y = 0.0936x^5 - 2.0449x^4 + 10.871x^3 + 7.0239x^2 - 273.26x + 5050.7$  with  $R^2 = 0.944$ . This indicates that approximately 94.4% of the variability in reported male child abuse cases can be explained by this quintic relationship with time. Moreover, the positive coefficients associated with the quintic and lower-order terms suggest a curve with multiple inflection points, indicating nuanced variations in the trajectory of male child abuse cases over the specified period. The quintic model of the number of female child abuse is  $y = -0.8119x^5 + 25.34x^4 - 294.11x^3 + 1571.4x^2 - 4473.3x + 16718$ . The negative coefficients attributed to the quintic and lower-order terms suggest a curve with multiple inflection points, reflecting complex fluctuations and patterns in the dynamics of female child abuse cases over time. With an R-squared value of 0.9778, approximately 97.8% of the variability in reported female child abuse cases can be accounted for by this quintic relationship with time.

### Figure 7

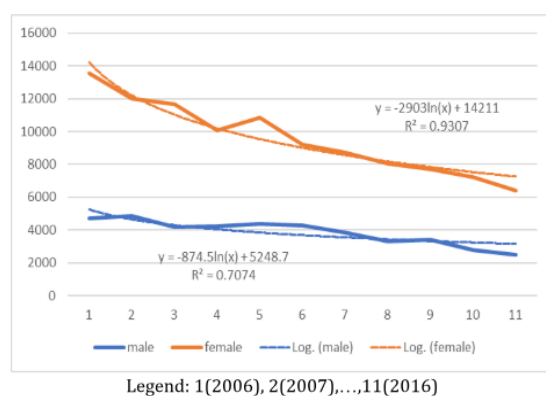
*Sextic Model of the Number of Male and Female Child Abuse Cases in the Philippines from 2006 to 2016*



The sextic model of male cases as shown in Figure 7 is  $y = -0.3165x^6 + 11.488x^5 - 161.02x^4 + 1091.6x^3 - 3675.1x^2 + 5476.6x + 1998.3$  with  $R^2 = 0.9663$ . The negative coefficients associated with the sextic and lower-order terms suggest a curve with multiple inflection points, capturing nuanced fluctuations and patterns in the trajectory of male child abuse cases over the specified period. With an R-squared value of 0.9663, approximately 96.6% of the variability in reported male child abuse cases can be explained by this sextic relationship with time. The sextic model of female child abuse cases is  $y = -0.1005x^6 + 2.8052x^5 - 25.126x^4 + 48.958x^3 + 402.57x^2 - 2648.1x + 15749$  with  $R^2 = 0.9781$ . This means that approximately 97.8% of the variability in reported female child abuse cases can be accounted for by this sextic relationship with time. The negative coefficients attributed to the sextic and lower-order terms suggest a curve with multiple inflection points, reflecting complex fluctuations and patterns in the dynamics of female child abuse cases over time.

### Figure 8

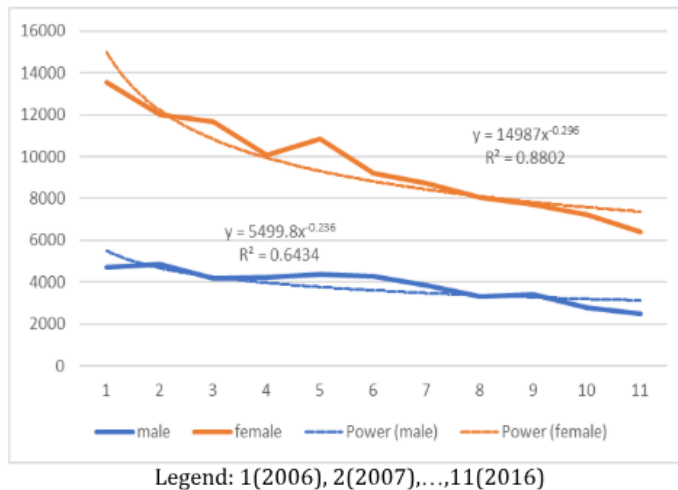
*Logarithmic Model of the Number of Male and Female Child Abuse Cases in the Philippines from 2006 to 2016*



The male logarithmic model is  $y = -874.5\ln(x) + 5248.7$  with  $R^2 = 0.7074$ . This indicates a decreasing trend in reported cases over time, as evidenced by the negative coefficient attached to the natural logarithm of time ( $\ln(x)$ ). With an R-squared value of 0.7074, approximately 70.74% of the variability in reported male child abuse cases can be explained by this logarithmic relationship with time. The female logarithmic model is  $y = -2903\ln(x) + 14211$  with  $R^2 = 0.9307$ . This also depicts a decreasing trend over time with a similar logarithmic decay pattern. With an R-squared value of 0.9307, approximately 93.07% of the variability in reported female child abuse cases can be accounted for by this logarithmic relationship with time.

**Figure 9**

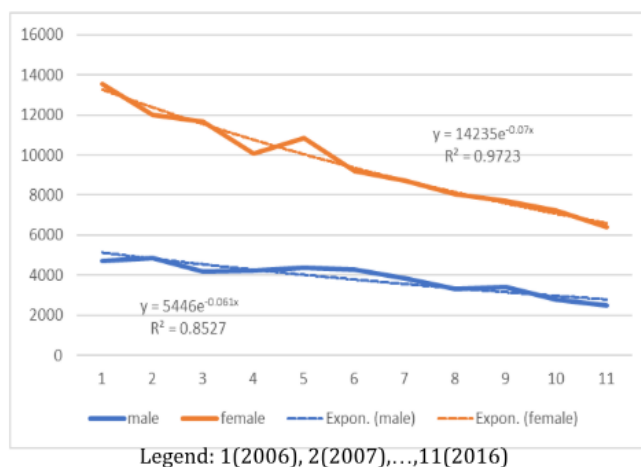
*Power Model of the Number of Male and Female Child Abuse Cases in the Philippines from 2006 to 2016*



In Figure 9, the male is  $y = 5499.8x^{-0.236}$  with  $R^2 = 0.6434$ . This suggests a decreasing trend over time, as evidenced by the negative exponent (-0.236). With an R-squared value of 0.6434, approximately 64.34% of the variability in reported male child abuse cases can be explained by this power relationship with time. Similarly, the power model applied to female child abuse cases, expressed as  $y = 14987x^{-0.296}$  with  $R^2 = 0.8802$ . This also suggests a decreasing trend over time with a decelerating rate of decline, as indicated by the negative exponent (-0.296). With an R-squared value of 0.8802, approximately 88.02% of the variability in reported female child abuse cases can be accounted for by this power relationship with time.

**Figure 10**

*Exponential Model of the Number of Male and Female Child Abuse Cases in the Philippines from 2006 to 2016*



The exponential model of the number of male child abuse is  $y = 5446e^{-0.061x}$  with  $R^2 = 0.8527$ . It demonstrates a decreasing trend over time, as indicated by the negative exponent

(-0.061). This implies a rapid decline in reported cases initially, followed by a more gradual decrease as time progresses. With an R-squared value of 0.8527, approximately 85.27% of the variability in reported male child abuse cases can be explained by this exponential relationship with time. The exponential model of female child abuse is  $y = 14235e^{-0.07x}$  with  $R^2 = 0.9723$ . It also depicts a decreasing trend with a similar exponential decay pattern over time. With an R-squared value of 0.9723, approximately 97.23% of the variability in reported female child abuse cases can be accounted for by this exponential relationship with time.

### Section 3. Prediction of the Future Number of Child Abuse Cases Using the Best-Fit Model Identified

**Table 1**

*Mathematical Model with Their Corresponding Equation and R- squared*

Model	Male Child Abuse Cases Equation	R-squared	Female Child Abuse Cases Equation	R-squared
Linear	$y = -220.62x + 5181$	0.89	$y = -663.63x + 13575$	0.9638
Quadratic	$y = -17.762x^2 - 7.4713x + 4719.2$	0.9371	$y = 21.691x^2 - 923.92x + 14139$	0.9719
Cubic	$y = -1.5497x^3 + 10.133x^2 - 147.26x + 4888.4$	0.9396	$y = -3.9392x^3 + 92.597x^2 - 1279.2x + 14569$	0.9738
Quartic	$y = 0.7628x^4 - 19.857x^3 + 155.83x^2 - 577.49x + 5245.4$	0.9436	$y = 0.984x^4 - 27.555x^3 + 280.54x^2 - 1834.2x + 15029$	0.9746
Quintic	$y = 0.0936x^5 - 2.0449x^4 + 10.871x^3 + 7.0239x^2 - 273.26x + 5050.7$	0.944	$y = -0.8119x^5 + 25.34x^4 - 294.11x^3 + 1571.4x^2 - 4473.3x + 16718$	0.9778
Exponential	$y = 5446e^{-0.061x}$	0.8527	$y = 14235e^{-0.07x}$	0.9723
Logarithmic	$y = -874.5\ln(x) + 5248.7$	0.7074	$y = -2903\ln(x) + 14211$	0.9307
Power	$y = 5499.8x^{-0.236}$	0.6434	$y = 14987x^{-0.296}$	0.8802

Table 1 describes several mathematical models with linear to exponential to logarithmic equations where  $x$  is time and  $y$  is reported cases with their corresponding  $r$ -squared value for both male and female abuse cases. Among these models, the cubic, quartic, and quintic equations exhibit the highest  $r$ -squared values, indicating a stronger fit to the data for both male and female cases. With higher  $r$ -squared values generally indicating a more robust fit of the model to the data. However, aside from the coefficient of determination, the standard error of estimate must be considered to determine the best-fit model. Hence, the standard error computation was computed and presented in section 3 to determine the best-fit model.

**Table 2**

*Actual Number of Male Child Abuse Cases and the Predicted Numbers Using the Mathematical Models*

Year	x	Male	Linear	Quadratic	Cubic	Quartic	Quintic	Exponential	Logarithmic	Power
2006	1	4717	4960.38	4693.97	4749.72	4804.65	4800.41	5123.72	5248.70	5499.56
2007	2	4865	4739.76	4633.21	4622.01	4567.09	4589.52	4820.52	4985.45	10999.36
2008	3	4196	4519.14	4536.93	4495.98	4441.05	4423.69	4535.26	4831.46	16499.16
2009	4	4216	4298.52	4405.12	4362.31	4353.15	4281.95	4266.87	4722.20	21998.96
2010	5	4377	4077.90	4237.80	4211.71	4248.33	4127.95	4014.37	4637.45	27498.76
2011	6	4276	3857.28	4034.94	4034.89	4089.82	3921.21	3776.82	4568.21	32998.56
2012	7	3821	3636.66	3796.56	3822.55	3859.17	3628.30	3553.32	4509.66	38498.36
2013	8	3290	3416.04	3522.66	3565.39	3556.25	3234.13	3343.04	4458.95	43998.16
2014	9	3396	3195.42	3213.24	3254.10	3199.20	2753.15	3145.21	4414.26	49497.96
2015	10	2795	2974.80	2868.29	2879.40	2824.50	2240.58	2959.09	4374.20	54997.76
2016	11	2481	2754.18	2487.81	2431.98	2486.93	1803.66	2783.98	4338.00	60497.56

2017 12 2533.56 2071.82 1902.55 2259.57 1612.87 2619.23 4304.96 65997.36

Table 2 shows the comparison between the actual number of male child abuse cases and the predicted numbers generated by various mathematical models across different years. Each row represents a year, and the columns present the actual male child abuse cases alongside predictions from different models such as linear, quadratic, cubic, quartic, quintic, exponential, logarithmic, and power equations. More complex models like the cubic, quartic, and quintic equations, a closer alignment between predicted and actual values can be observed, especially in the later years. These models capture the underlying trends more accurately, resulting in better predictions reflecting the actual number of cases.

**Table 3**

*Summary of Mathematical Models, R-squared, and Standard Error of Estimate of the Number of Male Cases of Child Abuse in the Philippines from 2006-2016*

Model	Equation	R-square	Standard Error of Estimate
Linear	$y = -220.62x + 5181$	0.892	268.33
Quadratic	$y = -17.762x^2 - 7.4713x + 4719.2$	0.9371	204.75
Cubic	$y = -1.5497x^3 + 10.133x^2 - 147.26x + 4888.4$	0.9396	200.68
Quartic	$y = 0.7628x^4 - 19.857x^3 + 155.83x^2 - 577.49x + 5245.4$	0.9436	193.93
Quintic	$y = 0.0936x^5 - 2.0449x^4 + 10.871x^3 + 7.0239x^2 - 273.26x + 5050.7$	0.944	194.25
Exponential	$y = 5446e^{-0.061x}$	0.8527	313.54
Logarithmic	$y = -874.5\ln(x) + 5248.7$	0.7074	441.72
Power	$y = 5499.8x^{-0.236}$	0.6434	268.33

The table summarizes different mathematical models used to predict the number of male child abuse cases in the Philippines from 2006 to 2016. Each model is evaluated based on its goodness of fit (r-square) and the standard error of estimate, which measures the accuracy of the predictions. Based on the coefficient of determination and standard error of estimate, the best-fit model is a quintic model. Hence, the predicted number of cases of male child abuse cases is 1612.87 or 1613.

**Table 4**

*Actual Number of Female Child Abuse Cases and the Predicted Numbers Using the Mathematical Models*

Year	x	Female	Linear	Quadratic	Cubic	Quartic	Quintic	Exponential	Logarithmic	Power
2006	1	13542	12911	13237	13378	13449	13547	15267	14211	14987
2007	2	12033	12248	12378	12164	12278	12084	16374	13337	12207
2008	3	11685	11584	11562	10903	11387	11355	17561	12826	10826
2009	4	10098	10920	10790	9570	10669	10800	18835	12463	9943
2010	5	10836	10257	10062	8144	10042	10173	20200	12182	9307
2011	6	9198	9593	9376	6599	9447	9448	21665	11952	8818
2012	7	8747	8930	8734	4912	8847	8720	23236	11758	8425
2013	8	8037	8266	8136	3059	8232	8105	24921	11589	8098
2014	9	7702	7602	7581	1018	7613	7649	26728	11441	7821
2015	10	7217	6939	7069	-1236	7026	7225	28666	11308	7581
2016	11	6427	6275	6600	-3727	6529	6436	30744	11188	7370
2017	12		5611	6175	-6477	6206	<b>4521</b>	32973	11078	7183

The table presents the actual number of female child abuse cases and the predictions generated by various mathematical models from 2006 to 2017. More complex models, such as the cubic, quartic, and quintic equations, demonstrate better performance, particularly in capturing the fluctuations in female child abuse cases over time. These models exhibit closer fits to the actual numbers across most years, suggesting a better understanding of the underlying trends.

**Table 5**

*Summary of Mathematical Models, R-squared, and Standard Error of Estimate of the Number of Female Cases of Child Abuse in the Philippines from 2006-2016*

Model	Equation	R-square	Standard Error of Estimate
Linear	$y = -663.63x + 13575$	0.9638	449.48
Quadratic	$y = 21.691x^2 - 923.92x + 14139$	0.9719	396.46
Cubic	$y = -3.9392x^3 + 92.597x^2 - 1279.2x + 14569$	0.9738	618.45
Quartic	$y = 0.984x^4 - 27.555x^3 + 280.54x^2 - 1834.2x + 15029$	0.9746	376.96
Quintic	$y = -0.8119x^5 + 25.34x^4 - 294.11x^3 + 1571.4x^2 - 4473.3x + 16718$	0.9778	351.88
Exponential	$y = 14235e^{-0.07x}$	0.9723	586.76
Logarithmic	$y = -2903\ln(x) + 14211$	0.9307	622.20
Power	$y = 14987x^{-0.296}$	0.8802	817.75

The table summarizes different mathematical models used to predict the number of female child abuse cases in the Philippines from 2006 to 2016. Based on the coefficient of determination and standard error of estimate, the best-fit model is a quintic model. Hence, the predicted number of cases of female child abuse cases is 4521.

## Conclusion

The trend of male and female child abuse cases in the Philippines from 2006 to 2016 is decreasing. This suggests progress in addressing child abuse issues, but continued efforts are needed to ensure further decline and support for victims. The Linear, quadratic, cubic, quartic, quintic, exponential, logarithmic, and power model of the male cases of child abuse in the Philippines are  $y = -220.62x + 5181$ ,  $y = -17.762x^2 - 7.4713x + 4719.2$ ,  $y = -1.5497x^3 + 10.133x^2 - 147.26x + 4888.4$ ,  $y = 0.7628x^4 - 19.857x^3 + 155.83x^2 - 577.49x + 5245.4$ ,  $y = 0.0936x^5 - 2.0449x^4 + 10.871x^3 + 7.0239x^2 - 273.26x + 5050.7$ ,  $y = 5446e^{-0.061x}$ ,  $y = -874.5\ln(x) + 5248.7$ , and  $y = 5499.8x^{-0.236}$  respectively. The Linear, quadratic, cubic, quartic, quintic, exponential, logarithmic, and power model of the female cases of child abuse in the Philippines are  $y = -663.63x + 13575$ ,  $y = 21.691x^2 - 923.92x + 14139$ ,  $y = -3.9392x^3 + 92.597x^2 - 1279.2x + 14569$ ,  $y = 0.984x^4 - 27.555x^3 + 280.54x^2 - 1834.2x + 15029$ ,  $y = -0.8119x^5 + 25.34x^4 - 294.11x^3 + 1571.4x^2 - 4473.3x + 16718$ ,  $y = 14235e^{-0.07x}$ ,  $y = -2903\ln(x) + 14211$ , and  $y = 14987x^{-0.296}$  respectively. The best-fit model is a quintic model. These predictions offer insights into the potential trajectory of child abuse cases in the Philippines and can inform preventive measures and resource allocation. Using the best-fit model, the predicted number of cases of male and female child abuse cases in 2017 is 1613 and 4521, respectively.

## Recommendations

Despite the decreasing trend in child abuse cases, it is essential to maintain and strengthen efforts to address this issue. Continued awareness campaigns, community outreach programs, and support services for victims are crucial to ensure further decline in child abuse cases and provide necessary assistance to those affected. Given the various mathematical models analyzed, it is recommended to utilize the best-fit quintic models for both male and female child abuse cases in the Philippines. These models offer the most accurate predictions and can serve as valuable tools for forecasting future trends in child abuse cases. The predictions generated by the best-fit models offer valuable insights into the potential trajectory of child abuse cases. This information can inform the development and implementation of preventive measures, policies, and interventions aimed at reducing child abuse incidence and protecting vulnerable children. Understanding the predicted number of child abuse cases, such as the estimated 1613 cases for males and 4521 cases for females in 2017, can guide resource allocation efforts. It is recommended to allocate resources towards targeted interventions, support services, and advocacy initiatives to effectively address the needs of victims and prevent future cases of child abuse.

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