Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

Predicting Suicide Incidence in the Philippines Using Random Forest Algorithm

Donna Mabell B. Palo*

[*]Polytechnic University of the Philippines Sta. Mesa, Philippines.

Corresponding Email: [*]dbpalo@gmail.com

Received: 24 May 2024 **Accepted:** 09 August 2024 **Published:** 25 September 2024

Abstract: ***This study determined the trend of suicide in the Philippines and identified which national indicators are possible predictors of suicide incidences. The indicators considered were a mix of objective and subjective indicators. The objective indicators consisted of Real GDP Per Capita, Unemployment Rate, and Volume of Crime while the subjective ones were Perceived Political Instability, Self-Rated Poverty, and Net Personal Optimism Scores. Data were drawn from World Bank Open Data, and records of Philippine Statistics Authority, Philippine National Police, and Social Weather Station. From 2006 to 2021, it was found that the number of suicide deaths more than doubled. The most significant upturn in deaths was observed during the first year of the pandemic, 2020. In addition, the random forest regression model found for the data, it appeared that unemployment, political instability, net personal optimism, and real GDP per capita can predict suicide deaths. Consistent with Durkheim's theory on suicide, the decline in economic well-being of people and an increase in their perceived political instability were found to be related to an increase in suicide deaths. Furthermore, in line with the Hopelessness Theory of Suicide, people's low optimism towards the future quality of their life was also found to be related to increased suicide deaths. Thus, these indicators should be monitored, and relevant government bodies should employ strategies and programs to raise per capita income, create more jobs, make more people employable, manage perceptions of political stability, and make people more optimistic about their lives.***

Keywords: Durkheim, Hopelessness Theory of Suicide, Random Forest, Suicide.

1. INTRODUCTION

Suicide is a major global public health problem. According to World Health Organization (WHO) estimates, there are around 700,000 deaths due to suicide annually. Whenever people attempt or succeed in taking their own lives, it not only takes an emotional toll on people they left behind but also impacts their nation's economy in terms of medical costs and work-loss costs, among others. In the Sustainable Development Goals of 2023 published by United

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

Nations, suicide mortality rate is also listed as an indicator under the third goal which is Good Health and Well-Being. The said goal is about ensuring healthy lives and promoting well-being at all ages. More specifically, the indicator is listed as the second indicator under Target 3.4 whose goal is one third reduction in premature mortality from non-communicable diseases by 2030 through prevention and treatment as well as promotion of mental health and well-being [13]. Suicide cases may or may not have a common reason or contributing factors. One classic theory on suicide is by the sociologist David Émile Durkheim who postulated that lacking or excessive social regulation or social integration affect societal suicide rates. According to the theory, suicides can be triggered when people feel alone or detached from society, killing oneself is instrumental to a collective goal, there are economic, social or political upheavals, or people can no longer endure psychic and physical coercion. Another theory, authored by Abramson et.al, posits that depression leads to suicidal behaviors, mediated by feelings of hopelessness. Most studies on suicide in the Philippines focus on the youth and has outdated data. However, other age groups also have high suicide rates. With this, the researcher conducted this study to supplement existing studies on Philippine suicide. The study aims to understand suicide in the Philippine context covering all age groups and contribute to initiatives that can help lower suicide deaths. The researcher concords with World Health Organization's view that every human has the right to the highest attainable standard of both physical and mental health and believes that, with the right programs, suicide deaths are preventable. Moreover, since suicide deaths in the country have been increasing and entail both economic and human capital loss, the researcher believes that it is an important national issue to address. The research can help policymakers and relevant government agencies in the development of policies, programs, or initiatives that can lower or prevent suicide incidences.

Objectives of the Study

This research investigated if socioeconomic conditions as measured by Real GDP Per Capita, Unemployment, Self-rated Poverty, Net Personal Optimism, and Perceived Political Instability as well as Total Crime Volume in the Philippines have a relationship with the number of suicide incidences, specifically deaths, in the country and if the relationship can predict the latter.

2. RELATED WORKS

An online search for studies related to suicide in the Philippines returns only one study that examined suicide in all age-groups. The study, authored by Redaniel et al.(2011), found that suicide in the country had decreasing trend from 1974 to early 1980s but steadily increased from 1984 to 2005 and male suicide rates were consistently higher than females' and were highest among males aged 15-24 and 65 and above. Other studies are specific to adolescents. One such study was by Estrada et al. (2019) who focused on adolescents enrolled in Alternative Learning System. The study found that age, sex, education, and attitudes towards suicide are significantly associated with suicidal ideation or behavior and fostering belongingness and availability of school-offered and community-based services, among others, could help prevent suicide ideation and behavior. Another study specific to the youth is by Quinto's (2017) who found that the most prevalent reason for attempting suicide is family problems and that factors related to family structure such as whether a person is raised by a complete set of parents or

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

whether they have strict parents affect suicide risk. The results of the study support Durkheim's theory that being integrated into a family reduces social isolation which, in turn, lowers suicide risks. The studies, while insightful, have limited scope. There are available studies which identified possible predictors of suicide across an entire population but are based on other countries. In fact, internationally, there are debates on the effect of the economy on the overall suicide risk which has led to several studies with different findings. One of the oldest studies was Yang's which studied USA suicide rates from 1940-84. Using multiple linear regression, he found that increase in unemployment rate, Catholicism and divorce rate are significantly related to increase in suicide rate while war participation and one-year growth in GNP per capita are related to decrease in suicide. Among all variables, divorce rate has the highest impact. He also found that unemployment rate is significantly related to increase of suicide among white males but is not significant for the other groups considered in the study. Another study looked at USA suicide data from 1999 to 2014. The author of the study is Filbert and the premise of his study is that getting and retaining a job in USA is an important social goal which, if not achieved, leads to people's suicide. In his two multiple linear regression models, he found that that an increase in either business closure or job destruction is significantly related to an increase in suicide rate but Unemployment rate is not significant at all. Also, even if higher earnings per person are normally expected to improve a person's quality of life, an increase in Real GDP per Capita is found to be related to increase in suicide rate in one model and not significant in the other. Population is also found to be significantly related to a decrease in suicide even if being in a more populous state can increase competition for work. In Australia, Dodd et.al (2006) also looked at Australia suicide rates from 1968-2002 and found that they have a significant relationship with macroeconomic indicators but the relationship varies by gender and age. Increase in unemployment is related to an increase in suicide rates of younger males but for younger females and older males, it is related to a decrease. It can be noted that in the aforementioned studies, the relationship of the major macroeconomic variables GNP or GDP and Unemployment to suicide and their significance are not the same. It was shown that it can vary based on race, gender, and age. But there are other studies suggesting that they vary based on the income level of the country in study. In fact, a study by Fontecilla (2012) et al which looked at 1980-2007 data of 10 World Health Organization regions found that the correlation between suicide deaths and GDP per capita is positive in developing countries, negative in high income European countries, and non-existent in African countries. The study argued that positive correlation in developing countries was due to lack of mental health policies and infrastructures which European countries have as well as high incidence of violence, and how economic growth has possible link to economic and health inequalities. In another study by Affizah (2020) which focused on G7 countries (namely Canada, France, Germany, Italy, Japan, United Kingdom, and United States), GDP Per Capita is found to have no significant relationship to number of suicides. The study argued that these countries have the most advanced economies and they are capable of dealing with financial crisis. There is also another study by Tanisho (2013) which found that even if unemployment rate is high and fluctuating in Sweden, its suicide rate had steadily decreased from 1990 to 2010 because there are social policies that benefit the unemployed as well as suicide prevention programs for the general population and those who are at risk of suicide. The U.S. Department of Veteran Affairs also looked at several studies and found that unemployment is a stronger risk factor for suicide

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

among men compared to women. The researchers suggest, however, that people are less likely to blame themselves during a national crisis such that when national unemployment rate increases, the suicide rate of men who have been unemployed for more than two weeks decreases and when the national unemployment rate decreases, their suicide rates increase. Additionally, a study by Tonkus et. al reviewed several studies from different countries that examined suicide and hopelessness in the youth aged 18-30 and found that individuals who attempt suicide generally experience hopelessness. The study suggests that feeling of hopelessness can be a predictor of suicide. The Center for Disease Control also lists sense of hopelessness as an individual risk factor for suicide, in general.

3. METHODOLOGY

This study provided analysis on the relationship of yearly national suicide incidences and socioeconomic indicators and crime. All data for the variables considered in the study were numerical in nature and are secondary. Suicide and crime data were requested from Philippine Statistics Authority and Philippine National Police, respectively. Unemployment, Perceived Political Instability, and Real GDP Per Capita data were exported from World Bank Open Data. Yearly average data of the percentage of families who rated themselves as poor (Self-Rated Poverty) and Net Personal Optimism scores, on the other hand, were obtained from Social Weather Station's quarterly Social Weather Survey whose results were published on their website. To see the trend or lack thereof in the suicide deaths in the country, the data points were visualized using a line chart and year-on-year growths were computed. To further analyze the data and build predictions, random forest regression was used. This black box model was chosen over the white box model multiple linear regression (MLR) as, upon initial inspection, the dependent variable is not normally distributed and its relationship to the other variables are non-linear. Unlike MLR, random forest has no requirement for normally distributed data, can handle non-linearity in data, and has reduced risk for overfitting [1]. In addition, compared to the black box model neural network, random forests are quicker to train, have low computational cost, and require less data [31]. In addition, Local Interpretable Model-Agnostic Explanations (LIME) were used to explain the model's individual predictions. This method is used to approximate and explain individual predictions of a black box model such as a random forest. To come up with the explanation for the prediction for the chosen reference point, it generates points from normal distribution inferred from the dataset and get their corresponding predictions using the black box model, assigns weights for the new points based on their proximity to the chosen reference point, and trains an interpretable model such as a linear regression model on the weighted generated dataset. The resulting variable weights in the explainable model are used to understand prediction. The Interaction plot was also examined to check the relationships between variables and if there are variables that jointly affect predictions. Additionally, the Feature Importance Plot and Accumulated Local Effect Plots were also investigated to determine the relevance and effect, if any, of each variable to the prediction.

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

4. RESULTS AND DISCUSSION

The table below shows the year-on-year growth of suicide deaths from 2006-2021.

Table 1. Annual Number of Suicide Deaths in the Philippines (2006-2021)

Year	Suicide	Year-on-year (YOY) Difference	Year-on-year (YOY) Growth
2006	1,794		
2007	1,699	(95)	-5%
2008	1,822	123	7%
2009	2,076	254	14%
2010	2,123	47	2%
2011	2,451	328	15%
2012	2,272	(179)	-7%
2013	2,055	(217)	-10%
2014	2,184	129	6%
2015	2,481	297	14%
2016	2,413	(68)	-3%
2017	2,463	50	2%
2018	2,984	521	21%
2019	2,808	(176)	-6%
2020	4,892	2,084	74%
2021	4,498	(394)	-8%

Also shown below is the suicide trend in the Philippines from 2006-2021.

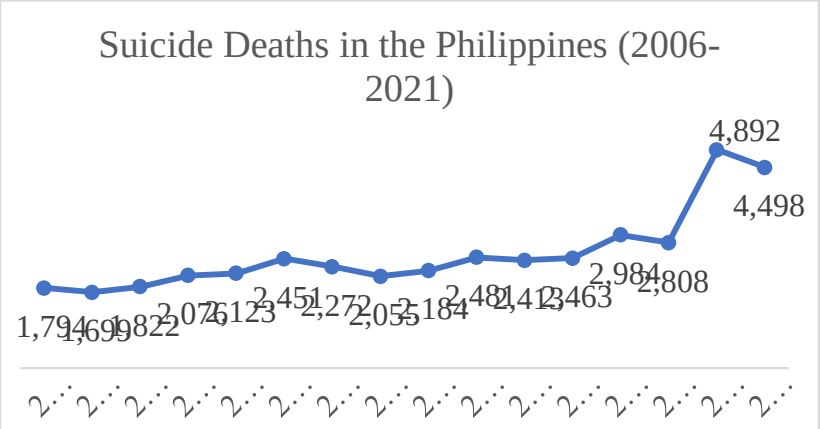

Figure 1. Suicide Trend in the Philippines

From 2006 to 2021, the number of suicide deaths more than doubled. The highest suicide rate was recorded in 2020, the year when the COVID-19 was officially declared a pandemic. This was a 74% increase from the previous year. Considering Durkheim's theory, this was expected as the COVID-19 is a collective crisis that disrupted people's lives and caused what he calls anomie. Despite the government's assurance of support, there was panic, fear, confusion, and even the spread of misinformation among the citizens. In fact, even the perceived likelihood of political instability also increased from 2019 to 2020. It can also be argued that not only social regulation but also social integration was affected during this pandemic. As part of the initiatives to control the spread of the virus, lockdowns were imposed and forced people into isolation. While people may have felt one with the others through collective suffering and

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

having the same goal as avoiding COVID-19, they might have also felt less integrated into society as their interactions with other people became limited. Other studies suggest that social isolation during this pandemic has negative consequences for our mental health [26]. The National Center for Mental Health, in fact, reported that average number of calls they received rose from just 400 monthly to an average of 700 from March to August 2020 and that the top reason for the calls were anxiety-related. It can also be noted that Net Personal Optimism recorded the sharpest decline from 2019 to 2020.Apart from their social lives, people's financial situations changed as a lot of businesses either reduced their operations or completely shut down. Employees and employers alike as well as their dependents are negatively affected by this pandemic. From 2019 to 2020, Unemployment Rate and Self-Rated Poverty increased while Real GDP Per Capita increased. According to Durkheim, this is a trigger for anomic suicides. While there are individuals who have forged other ways to make a living, there are also those who may have remained hopelessly struggling and found an escape from suffering through taking their own lives. In the latest year 2021, the deaths decreased by 8% but were still significantly higher compared to the pre-pandemic average which was 2,259.

The following ALE plots show the main effect of each variable to the prediction.

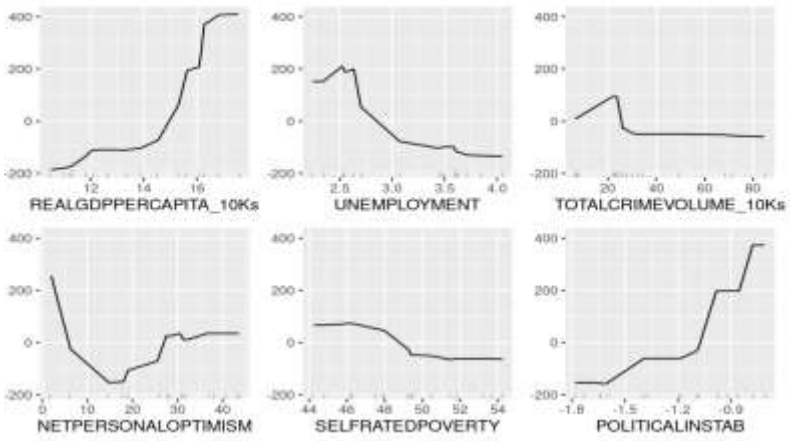

Figure 2. Accumulated Local Effects Plot of the Independent Variables

The x-axes on these plots represent actual values of each variable while the y-axes represent the increment on predictions. The ALE values represent the difference between the prediction at a specific value of the variable and the average model prediction. It can be observed that the effect to the prediction of each variable is not the same across all their values. There are specific values at which suicide deaths increase or decrease. Suicide deaths increase when real GDP per capita is above 15,000, unemployment rate is below 2.75, total crime volume is below 25,000, net personal optimism is below 6 or between 27 and 31, self-rated poverty is below 48.75, or political instability is less than -1.08. One possible reason for how the relationships of some of the variables to suicide deaths are opposite of what is expected is that there is interaction among variables. Among them, as shown in the interaction plot below, total crime volume, self-rated poverty, real GDP per capita, and unemployment have the highest interaction with other variables.

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

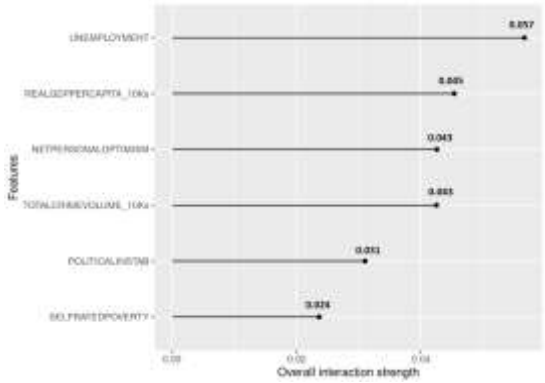

Figure 3. Interaction Plot

This graph below shows the factors by which the average difference between the predicted values of the model when the values of a variable are shuffled and the predicted values of the original model, as measured by the Root Mean Squared Error (RMSE), increase. Several estimates of the RMSE are taken per variable then aggregated. The line shows the 90% confidence interval with the 5% percentile as the lower bound, 95% as the upper bound, and the point as the median. The higher the increase in RMSE, based on the median, the higher the importance of the variable to the model.

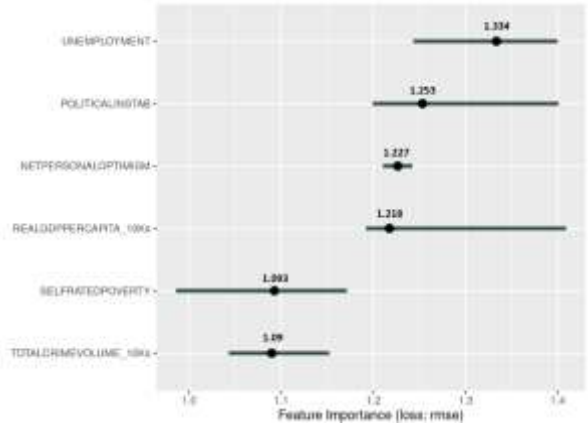

Figure 4. Feature Importance Plot

As shown on the plot, Unemployment is the variable that contributes to the highest increase in RMSE when its values are shuffled and is therefore the most important. It is followed by Political Instability, Net Personal Optimism, Real GDP Per Capita, Self-rated Poverty, and Total Crime Volume. Based on the LIME plots for all sixteen years of prediction, three out of six variables can explain individual predictions of the model. The said variables are Unemployment, Political Instability, and Real GDP Per Capita. Below are the summaries of the results per variable.

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

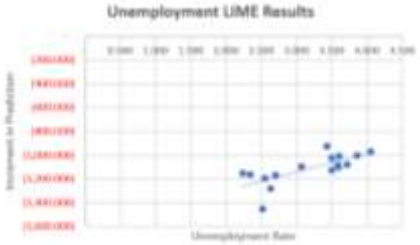

Figure 5. Scatter Plot of LIME Results for Unemployment

Unemployment Rate has a negative effect on prediction. Based on the trend that can be observed in the scatterplot, as unemployment decreases, suicide deaths also reduce further. At the lowest unemployment rate (2.24), suicide deaths decrease by around 1,154. At the highest unemployment rate (4.05), suicide deaths decrease by 971.

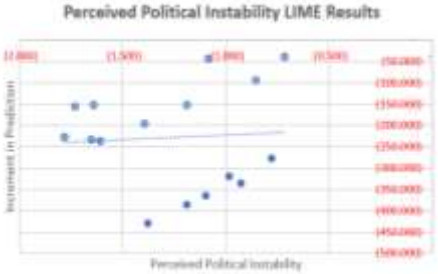

Figure 6. Scatter Plot of LIME Results for Political Instability

Perceived Political Instability has a negative effect on prediction. As seen on the scatterplot, one group of points which are represented by light blue dots corresponds to reduction in suicide prediction ranging from around 40 to 237. These points are 2006-2015 data. In this group, it can be observed that as the perceived political instability decreases, suicide deaths also further decrease. In the second group which has 2016-2021 data and represented by the dark blue dots, the same trend can be observed but the reductions have a higher range. Specifically, the corresponding suicide reductions range from 278 to 429. In addition, at the lowest level of perceived political instability (1.779) from 2006 to 2021, suicide reduction is around 227 while at the highest (0.714), it is around 40.

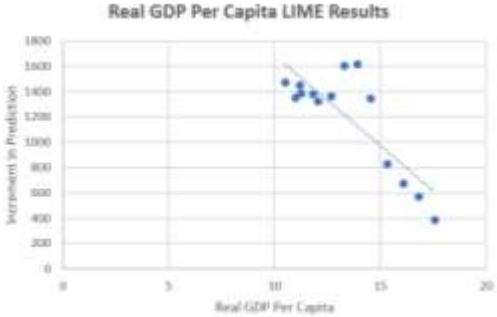

Figure 7. Scatter Plot of LIME Results for Real GDP Per Capita

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

Real GDP Per Capita has a positive effect on the prediction. Based on the trend that can be observed in the scatterplot, as real GDP per capita increases, the positive increment in suicide deaths decreases. In other words, suicide deaths increase by a smaller amount. At the lowest value (10.513), suicide increase is around 1,472 while at the highest value (17.56), it is around 385. In summary, the relationship of unemployment and real GDP per capita to suicide found in the results is the same as the ones in Durkheim's theory and most of the reviewed literature. That is, when more people are employed and their income, as measured by real GDP per capita, is higher, the number of suicide deaths decreases. Furthermore, when there is less perceived threat of political instability, the number of suicide deaths also decreases. It can also be noted that Net Personal Optimism, the variable which was the third most important to the model based on the feature importance plot, did not appear in the LIME plots. One possible reason is its effect lies in its interaction with other important variables to the prediction. Based on the ALE plot in the previous section, one can only conclude that when more people have a low level of optimism regarding their future quality of life, the number of suicide deaths increases the most.

5. CONCLUSION

The predictors in the final obtained model are a mix of objective and subjective indicators. The objective indicators are Unemployment and Real GDP per Capita. The subjective indicators, on the other hand, are Net Personal Optimism and perceived Political Instability. The relationship of the two objective indicators to suicide is consistent with Durkheim's theory which postulates that crises that can cause decline in the economic well-being of an individual increase suicide risks. Specifically, a decrease in real GDP per capita and an increase in unemployment predict an increase in suicide deaths. Also, increased perceived likelihood of political instability, an event that can cause breakdown in social regulations, is related to an increase in suicide deaths. Additionally, people's outlook on their quality of life in the next 12 months, as measured by Net Personal Optimism plays an important role in the prediction of suicide. The relationship found by the model is in concordance with The Hopelessness Theory of Suicide which posits that people who become hopeless become suicidal. Specifically, it was found that at the lowest scores of Net Personal Optimism, the increase in suicide deaths was also the highest. In general, based on the current data, the researcher can only conclude that unemployment, perceived political instability, net personal optimism, and real GDP per capita can be used to predict suicides deaths. In addition, it can be inferred that the government has a huge influence in lowering the latter and that a national crisis, if unmanaged, can cause a surge. The researcher recommends the government employ strategies to create jobs and make citizens employable. For one, it can continue offering and updating trainings through the Technical Education and Skills Development Authority (TESDA) that will encourage entrepreneurship or give trainees skills that can help them find jobs. Interest rates on business loans provided by the government can also be continuously reviewed so that they are attractive to people who intend to start and/or grow their business. With more entrepreneurs and skilled workers, unemployment can decrease. In addition, with the workforce being productive, per capita income can improve. The relevant government departments or agencies can also keep track of the Net Personal Optimism scores in Social Weather Station's quarterly surveys and create

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

programs that will raise awareness about mental health and address mental health issues. The programs should include educating citizens on what feelings are normal or not and when and where to get help when they feel negative emotions such as hopelessness. The Department of Education, for one, can consider including mental health in school curriculums and educate faculties regarding mental health since, according to literature, suicide prevalence tends to be high among the youth. Apart from having awareness, it is important for citizens to also have access to mental health services such as counselling and therapy. According to the Philippine World Health Organization [18], so many Filipinos suffer from mental illness which is the third most common disability in the country. However, as of September 2020, as reported in CNN Philippines, the government's budget for mental health was merely P5.69 per capita. Also, current Phil health coverage is only P7, 800 for hospitalizations due to specific mental health conditions which do not include depression. The government should review its funding for mental health workers and facilities, and make the services affordable. It would be better if Phil health can cover mental health consultations and make the list of covered mental health conditions more comprehensive. Additionally, since suicide cases tend to be high among the youth, the Department of Education that there are enough highly-qualified mental health professionals in schools. Several factors can cause political instability. It is the responsibility of the leaders in the government to come up and/or enforce policies and programs to reduce the risk of political unrest and promote peace in the nation. But apart from that, it is important for them to inspire hope and confidence among the citizens, as the theories previously discussed state that suicide risks tend to increase when people feel like there is breakdown in regulations or when they feel that their situation will not improve. In this regard, the government should be transparent and employ effective public communication to keep citizens informed of the real situation in the country, what efforts are being done to solve issues or crises and what services are available for those who are in need. It can also gain the trust of citizens if it can make important and relevant data available to the public. In addition to disseminating updates, the government should control, address, and dispel fake news as these can cause panic and/or divisiveness among citizens. Lastly, further studies can also be made on individual-level data, if available, as there are possibly more insights than can be uncovered by examining the characteristics of the suicide decedents.

6. REFERENCES

1. AIML, "What are the advantages and disadvantages of Random Forest?" AIML.com, Jun. 11, 2022. https://aiml.com/what-are-the-advantages-and-disadvantages-of-random-forest/
2. "APA Dictionary of Psychology," dictionary.apa.org, Apr. 19, 2018. https://dictionary.apa.org/suicidal-ideation
3. A. M. D. Affizzah and N. S. Sidik, "Economic Distress and Suicide," International Journal of Academic Research in Business and Social Sciences, vol. 10, no. 9, Sep. 2020, doi: https://doi.org/10.6007/ijarbss/v10-i9/7989.
4. "'The Effect of the Economy on Suicide Rates' by Rowland Filbert," Iwu.edu, 2019.

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

5. H. Blasco-Fontecilla et al., "Worldwide impact of economic cycles on suicide trends over 3 decades: differences according to level of development. A mixed effect model study," BMJ Open, vol. 2, no. 3, Jan. 2012, doi: https://doi.org/10.1136/bmjopen-2011-000785.
6. Encyclopedia Britannica, "Anomie | sociology," Encyclopædia Britannica. Nov. 20, 2017. Available: https://www.britannica.com/topic/anomie
7. Centers for Disease Control and Prevention, "Risk and protective factors," www.cdc.gov, Nov. 02, 2022. https://www.cdc.gov/suicide/factors/index.html
8. WHO, "Coronavirus Disease (COVID-19) Pandemic," www.who.int, 2024. https://www.who.int/europe/emergencies/situations/covid-19
9. "Permutation Importance,"kaggle.com.https://www.kaggle.com/code/dansbecker/permutation-importance
10. C. A. M. Estrada et al., "Suicidal ideation, suicidal behaviors, and attitudes towards suicide of adolescents enrolled in the Alternative Learning System in Manila, Philippines—a mixed methods study," Tropical Medicine and Health, vol. 47, Mar. 2019, doi: https://doi.org/10.1186/s41182-019-0149-6.
11. R. A. Jones, "Suicide (1897)," durkheim.uchicago.edu, 1986. https://durk heim.uchicago.edu/Summaries/suicide.html
12. "'The Effect of the Economy on Suicide Rates' by Rowland Filbert," Iwu.edu, 2019. https://digitalcommons.iwu.edu/parkplace/vol27/iss1/14 (accessed Aug. 31, 2024).
13. United Nations, "Goal 3 | Department of Economic and Social Affairs," sdgs.un.org, 2023. https://sdgs.un.org/goals/goal3#targets_and_indicators
14. Geeks for Geeks, "Hyper parameter tuning," Geeks for Geeks, Jan. 23, 2019. https://www.geeksforgeeks.org/hyperparameter-tuning/
15. "GDP per capita (constant LCU) - Philippines | Data," data.worldbank.org. https://data.worldbank.org/indicator/NY.GDP.PCAP.KN?locations=PH
16. "APAPsycNet,"psycnet.apa.org.https://psycnet.apa.org/record/2007-17315-001(acces se d Dec. 14, 2021).
17. E. Lutins, "Ensemble Methods in Machine Learning: What are they and why Use them?" Towards Data Science, Aug. 02, 2017. https://towar dsdatasci ence.com /en semble-methods-in-machine-learning-what-are-they-and-why-use-them-68ec3f9fef5f
18. A. B. Martinez, M. Co, J. Lau, and J. S. L. Brown, "Filipino help-seeking for mental health problems and associated barriers and facilitators: a systematic review," Social Psychiatry and Psychiatric Epidemiology, vol. 55, no. 11, Aug. 2020, doi: https://doi.org/10.1007/s00127-020-01937-2.
19. C. Modesto, "₱5.69 per Filipino: Qu imbo laments DOH's low 2021 budget for mental health program," CNN Philippines, Sept. 18, 2020. https://www.cnnphilippines.com/news/2020/9/18/DOH-low-2021-budget-mental-health-program.html?fbclid=IwAR0yDq4vTXmC9jwiI3h4RqgflfXFyz34ss-dKdOwxj0vP5BuKdtw98znSX4
20. C. Molnar, 8.3 Feature Interaction | Interpretable Machine Learning. Available: https://christophm.github.io/interpretable-ml-book/interaction.html
21. Christoph Molnar, "5.7 Local Surrogate (LIME) | Interpretable Machine Learning," Github.io, Sep. 18, 2019. https://christophm.github.io/interpretable-ml-book/lime.html

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

22. A. S. Mueller, S. Abrutyn, B. Pescosolido, and S. Diefendorf, "The Social Roots of Suicide: Theorizing How the External Social World Matters to Suicide and Suicide Prevention," Frontiers in Psychology, vol. 12, no. 12, Mar. 2021, doi: https://doi.org /10.3389/fpsyg.2021.621569.
23. K. Nyuytiymbiy, "Parameters and Hyper parameters in Machine Learning and Deep learning," Medium, Apr. 05, 2021. https://towardsdatascience.com/parameters-and-hyperparameters-aa609601a9ac
24. Philstar, "Pandemic year sees 57% rise in suicide rate in Philippines," Philstar.com, Jul. 06, 2021. https://www.philstar.com/headlines/2021/07/06/2110596/pandemic-year-sees-57-rise-suicide-rate-philippines
25. R. Patro, "Cross Validation: K Fold vs Monte Carlo," Medium, Feb. 01, 2021. https://towardsdatascience.com/cross-validation-k-fold-vs-monte-carlo-e54df2fc179b
26. G. Pietrabissa and S. G. Simpson, "Psychological Consequences of Social Isolation during COVID-19 Outbreak," Frontiers in Psychology, vol. 11, no. 2, 2020, doi: https://doi.org/10.3389/fpsyg.2020.02201.
27. "Political instability | The Encyclopedia of World Problems," Uia.org, 2016. http://encyclopedia.uia.org/en/problem/political-instability
28. M. Anthony and M. Quintos, "Prevalence of Suicide Ideation and Suicide Attempts among the Filipino Youth and Its Relationship with the Family Unit," Part II Asia Pacific Journal of Multidisciplinary Research, vol. 5, no. 2, 2017, Available: http://www.a pjmr. com/wp-content/uploads/2017/05/APJMR-2017.5.2.2.02.pdf
29. "R: Feature importance," R-project.org, 2018. https://search.r-project.org/CRAN/ref mans/iml/html/FeatureImp.html (accessed Aug. 31, 2024).
30. M. T. Redaniel, M. A. Lebanan-Dalida, and D. Gunnell, "Suicide in the Philippines: time trend analysis (1974-2005) and literature review," BMC Public Health, vol. 11, no. 1, Jul. 2011, doi: https://doi.org/10.1186/1471-2458-11-536.
31. P. Roßbach, "Neural Networks vs. Random Forests – Does it always have to be Deep Learning?" Frankfurt School Blog, Oct. 02, 2018. https://blog.frankfurt-school.de/neural-networks-vs-random-forests-does-it-always-have-to-be-deep-learning/
32. V. Singh, "Unlocking the Black Box: A Comparative Study of Explainable AI Techniques: PDP vs.," Medium, Mar. 02, 2023. https://pub.towardsai.net/unlocking-the-black-box-a-comparative-study-of-explainable-ai-techniques-pdp-vs-ale-and-shap-vs-9ade7e954690
33. "Random Forest | Introduction to Random Forest Algorithm," Analytics Vidhya, Jun. 17, 2021. https://www.analyticsvidhya.com/blog/2021/06/understanding-random-forest
34. World Health Organization, "Suicide," World Health Organization, Aug. 28, 2023. https://www.who.int/news-room/fact-sheets/detail/suicide
35. "Economic Distress and Suicide in Japan Yukiko Tanisho Health and Global Policy Institute i," 2013. Available: https://hgpi.org/wp-content/upload s/Suicide%2 0Issue%20 HGPI%20English%20v2.pdf
36. M. Bat Tonkuş, "The Relationship between Suicide and Hopefulness of Young Adults Age 18-30: A Systematic Review," Journal of Psychiatric Nursing, 2022, doi: https://doi.org/10.14744/phd.2022.76993.

Journal of Psychology and Political Science
ISSN: 2799-1024
Vol: 04, No. 05, August-September 2024
http://journal.hmjournals.com/index.php/JPPS
DOI: https://doi.org/10.55529/jpps.45.27.39

37. D. Tsang, "White Box vs. Black Box Algorithms in Machine Learning," Active State, Jul. 19, 2023. https://www.activestate.com/blog/white-box-vs-black-box-algorithms-in-machine-learning/
38. "Unemployment, total (% of total labor force) (modeled ILO estimate) - Philippines | Data,"data.worldbank.org.https://data.worldbank.org/Indicator/SL.UEM.TOTL.ZS?locations=PH
39. United Nations, "The Sustainable Development Goals Report 2023: Special Edition," unstats.un.org, Jul. 10, 2023. https://unstats.un.org/sdgs/report/2023/
40. "The Effect of Unemployment on Suicide Risk. "Available: https://www.Mentalhealth.va.gov/suicide_prevention/docs/Literature_Review_FSTP_Unemployment_FINAL_508_8-19-2019.pdf
41. G. Visani, "LIME: explain Machine Learning predictions," Medium, Jan. 28, 2021. https://towardsdatascience.com/lime-explain-machine-learning-predictions-af8f18189bfe
42. "Black box Machine Learning," SEON. https://seon.io/resources/dictionary/blackbox-machine-learning/#:~:text=In%20general%20terms%2C%20blackbox%20machine
43. "Human rights," www.who.int. https://www.who.int/news-room/fact-sheets/detail/human-rights-and-health#:~:text=and%20human%20rights-
44. B. Yang, "The Economy and Suicide:" American Journal of Economics and Sociology, vol. 51, no. 1, pp. 87–99, Jan. 1992, doi: https://doi.org/10.1111/j.1536-7150.1992.tb02512.x.
45. J. Zhang, "The strain theory of suicide," Journal of Pacific Rim Psychology, vol. 13, no. 27, 2019, doi: https://doi.org/10.1017/prp.2019.19.