

## Introduction

- To be classified as Suicide, it must be a deliberate act made and performed by an individual in full knowledge of its fatal outcome (WHO)
- In Pakistan, there has been a significant suicide surge from 2012-2016.
- One million people in the world kill themselves every year. According to the World Health Organization, in the last 45 years suicide rates have increased by 60%. Hence, suicide has been labeled as a major public health problem, one that is alarmingly growing
- Psychiatrists now call it an “emerging epidemic”

### Purpose of the study:

- To Investigate and identify a relationship between socio-economic factors and suicide in the province of Sindh, Pakistan. By examining key demographics and economic variables via quantitative analysis, we aim to provide insights for policy makers and healthcare workers to target factors that influence suicide. This paper highlights the need for understanding suicide in Pakistan, overcoming cultural taboos, and collecting accurate data to develop effective policies and interventions.

## Literature

- Most people in Sindh who died in 2020 were under 30. World Health Organization reported suicide as the fourth major cause of death in individuals aged 15-29 in 2019 (SHMA, 2019).
- Poverty has a positive relationship with suicide as deprivation in the form of health, education or standard of living put individual at higher risk of suicide due to depressive feelings (Hector Cabello-Rangel, 2020)
- Households with 'Own' housing tenure have lower suicide rates compared to those in rented housing structures, as ownership provide a sense of stability and relief from housing debts (Lee, 2022)
- Districts with higher net enrolment rates have higher suicide rates; when people face failure in terms of socio-economic advancement, it results in frustration, public shame (Pompili et al., 2013).

## Data

- PSLM (2014-15) & (2019-20)
- UNDP Report (2015)
- RTW PDD (2018-19)
- Sindh Medical Health Authority (SMHA)

Table 1: Description of Explanatory Variables

Variable	Description	Measurement
Education	Numeric variable for education by the district wise gross enrolment rate of people aged 14-15 at matric level.	Such as 23% of people aged 14-15 in Badin with Gross Enrolment Ratio at the Matric Level
Poverty	MPI score as numeric variable to measure poverty.	Lower MPI score denotes lower poverty. Higher MPI scores denotes higher poverty.
Housing Tenure	Ordinal variable of occupancy status ranging from rented house to owned house.	0 owned - 4 rented
Rooms	Numeric variable for the number of rooms in a household	Such as 1 room
Perception of Economic Situation	Ordinal variable of perception of the economic situation of the household compared of the year before (measured in percent distribution of households)	Don't Know Much Better Better Same Worse Much Worse

Table 2: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
District ID	144			1	24
Year	144			2015	2020
Total Suicides	144	5.531	10.579	0	79
Education	144	34.545	12.958	14	89
Household Economic Perception	144	36.724	17.562	1.1	83.31
Own Housing Tenure	144	85.538	12.254	22.84	99.49
Single Room Household	144	46.787	13.598	11.31	71.92
MPI Scores	144	48.925	18.928	1.9	108.702

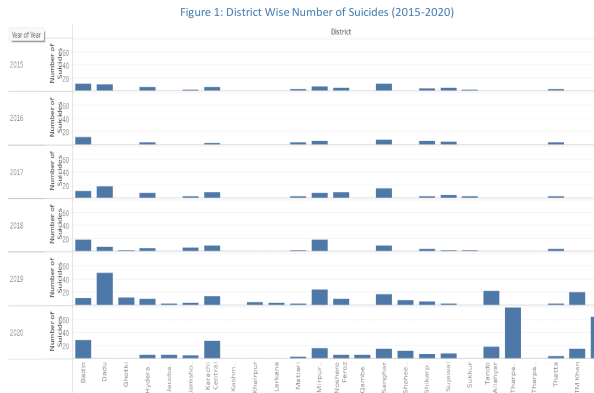


Figure 1: District Wise Number of Suicides (2015-2020)

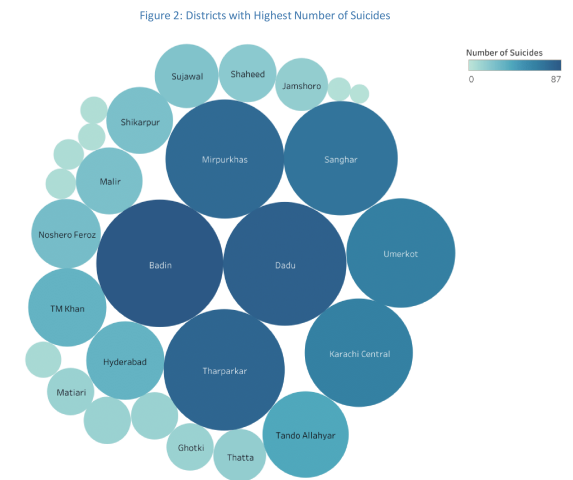


Figure 2: Districts with Highest Number of Suicides

## Theoretical Model

- The nature of our dependent variable is discrete and trails downward, and so it qualifies as Count data.
- This Count data from the Sindh Mental Health Authority captures the number of suicides in districts of Sindh within a specific reference period, resulting in excess zeros and high overdispersion value.
- Often, such data is best modelled using count data models. Due to the high overdispersion value, Negative Binomial was preferred over Poisson.
- Also, to account for unobserved variance within the districts Fixed Effects model was preferred.
- Hence this study found the best-fitting model on this data was Fixed Effects Negative Binomial Regression Model.

The mathematical formula for the fixed effects negative binomial regression can be written as:

$$\log(\mu_{it}) = \alpha_i + \beta X_{it}$$

Where,

- $\log(\mu_{it})$  is the logarithm of the expected value of the dependent variable
- $\alpha_i$  represents the individual-specific fixed effect or intercept, capturing unobserved heterogeneity specific to each individual.
- $\beta$  is a vector of coefficients representing the effects of the independent variables  $X_{it}$  on the dependent
- $X_{it}$  represents the vector of independent variables for district  $i$  at time  $t$ .

- To model the conditional distribution of the dependent variable, we assume a negative binomial distribution, which accounts for overdispersion. The probability mass function of the negative binomial distribution is given by:

$$P(Y_{it}=y) = \frac{\Gamma(y + \frac{1}{\beta})}{\Gamma(y + 1)\Gamma(\frac{1}{\beta})} \left(\frac{1}{1 + \beta\mu_{it}}\right)^{\frac{1}{\beta}} \left(\frac{\beta\mu_{it}}{1 + \beta\mu_{it}}\right)^y$$

## Limitations

- Mental Health Unobservable:** no variable or proxy to measure mental illness in Sindh's districts. Closes linkage to suicidal ideation.
- Trend Analysis :** to compute missing years for regression purposes
- Provincial Labour Force Statistics:** excluded unemployment variable for Sindh districts.
- Missing Data:** PSLM reports before 2020 and after 2015 were missing.
- Diagnosis is difficult:** Suicide cases are covered up as murder or honour killing due to the 'taboo' surrounding it.
- Criminalization:** Under Pakistani Law, Suicide and Deliberate self harm (DSH) are illegal acts subject to punishment and/or imprisonment. .

## Results and Conclusion

- Literacy rates were significant and positively correlated to suicide rates. A one unit increase in literacy caused suicide rates to increase by 3.6%. Increasing knowledge raises awareness, which can amplify hopelessness among the masses about the future and potentially contribute to an increase in suicide rates. Additionally, the positive correlation can be owed to disillusionment from attaining higher education without a secure future.
- Housing Tenure was negatively correlated with the number of suicides. One unit increase caused suicide to decrease by 4%. This suggested people who owned homes felt much more secure about their future.
- However interestingly, the variable for people who owned houses with one room was significant and positively associated with the number of suicides. One unit increase caused suicide to increase by 6.2%. This suggested that living in congested spaces increased the likelihood of committing suicide, despite owning their homes.
- A higher value of MPI, a metric we used to measure poverty, was also positively associated with the number of suicides.

Table 3: Regression Results

Total Suicides	Pooled OLS Model	Poisson Model	Negative Binomial Model	Fixed Effects Negative Binomial Model	Zero-Inflated Negative Binomial Model
Education	.333 *** (.097)	.274 *** (.016)	.229 *** (.065)	.0366 * (.0149)	.239 *** (.066)
Household Economic Perception	1.1 ** (.05)	.067 *** (.008)	.090 * (.036)	.007 (.012)	.101 (.043) **
Own Housing Tenure	-.006 (.072)	.010 (.014)	.011 (.045)	-.04 *** (.012)	-.031 (.051)
Single Room per of Household	.02 (.07)	0.07 *** (.016)	.078 (.046)	.06 *** (.016)	.071 (.053)
MPI Scores	.264 *** (.064)	.168 *** (.010)	.109 ** (.04)	.011 (1.72)	.128 (.043) **
Constant	-23.08	-.277	-.277	-2.278	-.439
N	144	144	144	144	144
AIC	1066.678	1413.036	720.418	489.462	703.443
BIC	1084.497	1430.855	741.207	507.025	742.051