

## Seasonality of Suicide in Jhenaidah District, Bangladesh, 2011-2018

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### **Abstract:**

Suicide is a serious public and social health problem in Bangladesh. The seasonal variance in suicide is an under-researched area in Bangladesh which needs attention due to the nature of its prevalence. This article describes the seasonal variation of suicide for a Bangladeshi district named Jhenaidah for the 2011-2018 period. Suicide data was obtained from the Societies for Voluntary Activities (SOVA), who is knowingly the only non-government organization (NGO) working to prevent suicide in the area. In this paper, descriptive analysis was undertaken. A total of 2,786 suicides occurred in the Jhenaidah district across the study period. Data is aggregated by sex and month. The highest average overall suicide rates occurred during the hot, summer monsoon period, ranging from April to September ( $\geq 8.7\%$  per month for the study period). This period represents the time when Bangladeshis experience the highest average temperatures around  $+28.8^{\circ}\text{C}$ . The incidence of suicide is reported to be higher during summer for both the sexes, though males deviated with a high incidence in winter too. Females still commit more suicide than men, but the gap is narrowing gradually. As an important variable, seasonality may contribute significantly to the explanations of the complex phenomenon of suicide. This study not only contributes to the existing knowledge but also paves the way to undertake further research that can contextualize the relationship between suicide and seasonality in Bangladesh.

*Keywords: Bangladesh, gender, Jhenaidah, seasonality, suicide*

## **INTRODUCTION**

Suicide remains a preventable global phenomenon that claims nearly 800,000 lives annually (World Health Organization [WHO], 2018a). It is projected that suicide will increase in rank from the 16<sup>th</sup> to 12<sup>th</sup> leading cause of death in 2030, and further predisposes susceptible populations (WHO, 2010). Men are considered

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most vulnerable as they commit suicide at a threefold rate compared women, and a third of suicide occur amongst young people (WHO, 2018b). Low-to middle income countries are at heightened risk with their suicide concentration of 79% (WHO, 2018b).

2016 WHO Global Observatory Estimates identified the age standardized suicide rate as highest in South-East Asia region (at 13.4/100,000 population) than the remaining WHO regions (4.3–12.9/100,000 population) and global average (10.5/100,000 population) (WHO, 2017). Even though there has been increased recognition by government institutions, professionals, and non-government organizations of the suicide problem, efforts need to be systematized, coordinated, resourced, and standardized (WHO, 2008).

Bangladesh, a small but densely populated country in South-East Asia region, currently offers no national suicide surveillance system (Khan, Ratele, Najuwa, Islam, & Dery, 2020); though surveys estimate around 10,000 people die annually in the country (Mashreky, Rahman, & Rahman, 2013). Numerous complexities and overlapping factors predispose an individual to commit suicide namely, previous suicide attempts, mental disorders, alcohol and/or drug abuse, cultural and social environmental stressors, trauma, conflict or illnesses (WHO, 2014; Kabir, 2018). Seasonal variations and environmental factors have also been identified as a critical risk factor for suicide (Woo, Okusaga, & Postolache, 2012). Although the relationship between suicide and seasonality has grown in the epidemiological studies in suicide, its findings remain elusive as well as poorly understood (Ajdacic-Gross, Bopp, Ring, Gutzwiller, & Rossler, 2010; Aydin et al., 2013).

Seasonality refers to the period fluctuations of the seasons of the year (Ajdacic-Gross, Bopp, Ring, Gutzwiller, & Rossler, 2010). Review studies have identified the spring to early summer period as the time when people are most at risk to commit suicide (Galvão, Silva, & Silva, 2018). Voices from Bangladesh highlight climatic determinants as impacting psychological health, though further investigation is needed (Kabir, 2018). Seasonal temperature changes resulted in bouts of depression, frustration, and stress among the Bangladeshis due to their inability to perform work. Subsequently, this further prompted family stress, suicidal ideation, magnification of previous trauma, and the increased use of alcohol and drugs (Kabir, 2018).

Research on the seasonality of suicide is required to illustrate whether it can be considered as a determinant of suicide and suicide prevention. Thus, this study aims to describe the seasonality of male and female suicides in Jhenaidah district, Bangladesh, reportedly the most suicide prone area of the country (Khan et al., 2020).

## **METHODOLOGY**

### ***Selection of study area***

Among the 64 Bangladeshi districts, only Jhenaidah district offers a comprehensive database that records the monthly variation of suicide for the 2011-2018 study period (Khan et al., 2020). Jhenaidah is a mid-level administrative district comprised of numerous rural and a few urban areas. With a population of 884,902 females and 886,402 males, 84.14% of the district's population reside in the rural areas (Bangladesh Bureau of Statistics [BBS], 2016). The district predominates in its agricultural production (Rahman, 1988).

### ***Data collection***

Suicide data for seasonality was retrieved from the Society for Voluntary Activities (SOVA)'s suicide database. SOVA is a non-government, Bangladeshi organization which exclusively focuses on suicide prevention in the district. SOVA has mobilized two government agencies, namely the Jhenaidah Police and Civil Surgeon Office to routinely collect data on suicide and attempted suicide in the district. No other district in Bangladesh maintains a systematic mechanism to collect information on suicide and attempted suicide. SOVA corroborates the reported data attained from Jhenaidah Police and Civil Surgeon Office to reduce its burden through preventative measures (Khan et al., 2020). For this study,

seasonal variance in suicide data for 2011-2018 period for Jhenaidah was used, and the data is further aggregated by sex.

### ***Data analysis***

Data was analyzed using Statistical Package for Social Science (SPSS Version 25) program. Simple descriptive analyses, such as frequencies and percentages were used to interpret study results by month of year for the 2011-2018 study period. Results also depict the sex variances for seasonality.

### ***Limitations***

Only reported suicidal cases which are captured by the police and public hospitals are compiled by the District Police and Civil Surgeon Office, this study reports registered suicides only. Due to the stigmatization of suicides there may be an underreporting and misclassification of suicide deaths. As this study is specific to a district only, data are not generalizable to the whole Bangladesh.

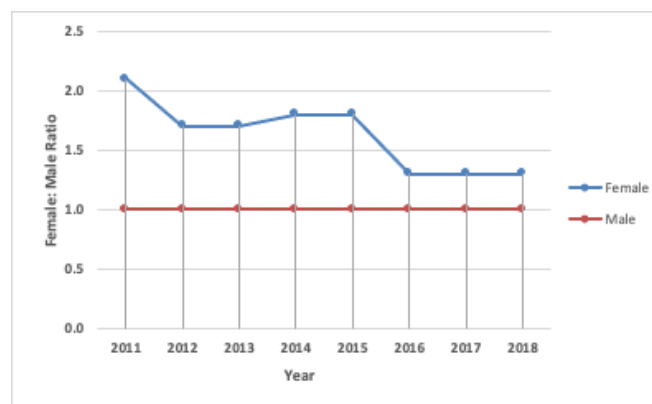
### ***Ethical Issues***

Ethical clearance was obtained from the University of South Africa (Ethical Clearance Code: 2018-CHS-0114) under the flagship project “Masculinity and Suicidal Behaviors in Bangladesh”. For the purpose of this analysis, SOVA provided access to the data once the researchers requested written consent. Data for this study analysis were verified by SOVA, as well as the government agencies in Jhenaidah.

## **RESULTS**

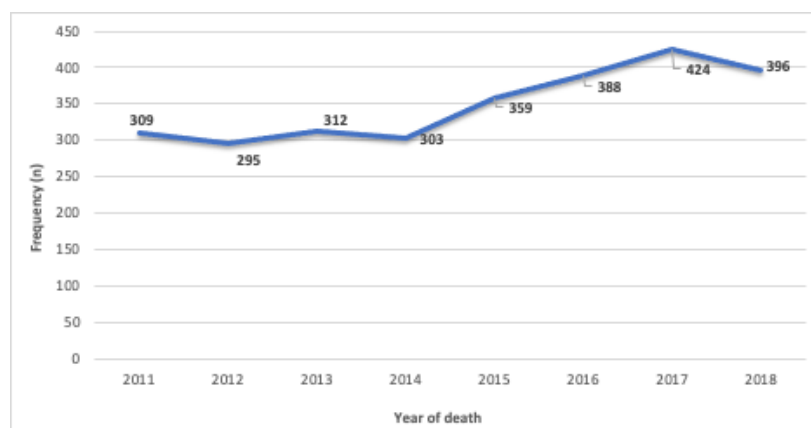
### ***Prevalence of suicide across the study period in Jhenaidah***

A total of 2,786 suicides occurred in Jhenaidah district for the 2011-2018 study period. Females constitute 60.8% (n=1695) and males 39.2% (n= 1095). The average ratio for female to male is 1.6:1. While females are considered more at risk, there is a marked changing trend across the study period (See figure 1 below). In 2011, females committed suicide at a twofold rate to the males, but there has been a steady decline over the study period suggesting that males are becoming equally vulnerable.



**Figure1. Female-male ratio of suicide deaths across the study period, 2011-2018**

Figure 2 below further describes that there has been an increase in the number of total suicides from 309 suicides in 2011 to 396 suicides in 2018. This increase largely represents the increase in male suicides.



**Figure 2. Total frequency of suicide across the study period, 2011-2018 (n=2,786)**

### *Seasonality of suicide by sex across the study period in Jhenaidah*

Across the study period, the highest number of female suicides occurred during the monsoon period (also hot/summer season), from March to October (see Table 1 below). A slight variance occurred in 2014 where mostly female suicides which occurred in December (10.2%). The highest incidence across the study period were reported for the months of May, June, and September.

**Table 1: Female suicide by year and month, 2011-2018 (n=1,695)**

Seasons <sup>1</sup>	Descriptio n of season <sup>1-2</sup>	Month of Year	2011	2012	2013	2014	2015	2016	2017	2018
			%	%	%	%	%	%	%	%
<b>Dry Season</b>	Cool dry winter	<b>January</b>	8.7	9.7	5.6	9.2	4.8	5.5	5.9	6.4
		<b>February</b>	1.0	10.2	2.5	8.2	6.1	3.2	5.9	8.2
<b>Premonsoon</b>	Hot season: high temperature , convection storms	<b>March</b>	9.1	6.5	9.1	8.7	10.4	10.0	7.2	7.7
		<b>April</b>	12.5	6.5	12.6	8.2	5.6	10.0	8.4	6.4
		<b>May</b>	9.1	10.2	7.6	8.2	10.0	9.1	6.8	11.8
<b>Monsoon</b>	Summer: rainy season,	<b>June</b>	14.9	10.2	7.1	6.6	10.4	6.8	9.7	9.5
		<b>July</b>	11.1	4.3	14.1	8.2	9.5	9.6	11.4	10.5
		<b>August</b>	8.7	9.1	13.1	7.1	8.2	11.4	8.0	9.1

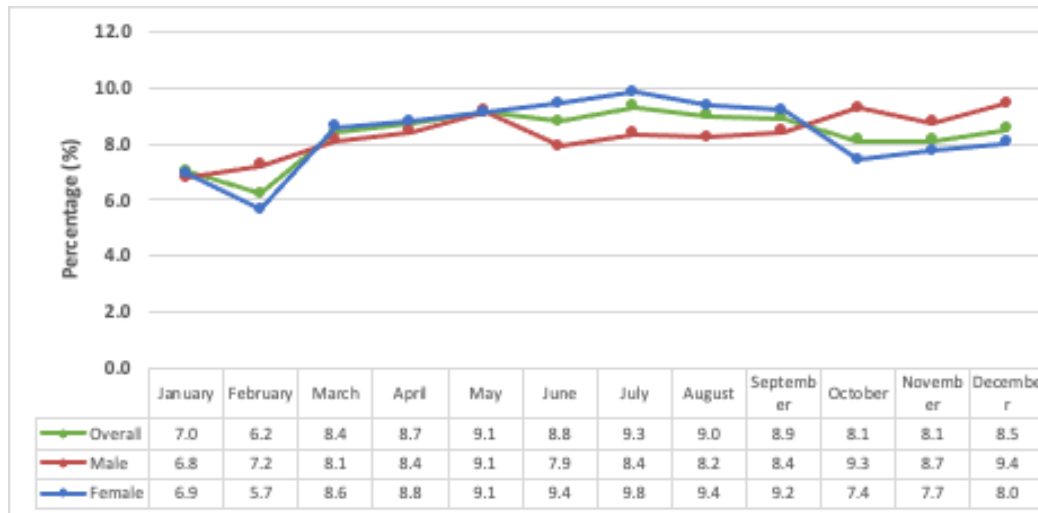
<b>Postmonsoon</b>	high humidity	<b>September</b>	10.6	10.2	9.6	8.2	9.1	13.2	6.8	5.9
	Autumn	<b>October</b>	6.7	4.8	6.6	8.2	6.1	8.2	11.8	6.8
	Cool dry	<b>November</b>	3.4	10.2	6.6	9.2	10.0	5.0	7.6	10.0
	winter	<b>December</b>	4.3	8.1	5.6	10.2	10.0	7.8	10.5	7.7

Across the study period, the highest number of male suicides occurred during the monsoon period ranging from March to April, July to August, and from October to December (see Table 2 below). The highest incidence across the study period were reported for the months of August and December.

**Table 2: Male suicide by year and month, 2011-2018 (n=1,095)**

Seasons <sup>1</sup>	Description of season <sup>1-2</sup>	Month of Year	2011	2012	2013	2014	2015	2016	2017	2018
			%	%	%	%	%	%	%	%
<b>Dry Season</b>	Cool dry	<b>January</b>	1.0	8.3	11.4	6.5	6.3	7.1	8.0	5.7
	winter	<b>February</b>	2.0	8.3	11.4	7.5	9.4	5.3	5.9	8.0
<b>Premonsoon</b>	Hot season: high temperature, convection storms	<b>March</b>	6.9	11.0	5.3	9.3	13.3	4.7	6.4	8.0
		<b>April</b>	6.9	13.8	7.9	8.4	7.0	9.5	5.9	8.0
		<b>May</b>	7.9	7.3	8.8	7.5	11.7	10.1	10.7	9.1
<b>Monsoon</b>	Summer: rainy season, high	<b>June</b>	14.9	7.3	4.4	8.4	5.5	9.5	6.4	6.8
		<b>July</b>	9.9	9.2	5.3	8.4	5.5	6.5	10.2	11.9
		<b>August</b>	3.0	7.3	7.9	10.3	6.3	11.2	8.0	11.9
		<b>September</b>	6.9	4.6	12.3	6.5	11.7	8.3	9.1	8.0
<b>Postmonsoon</b>	humidity	<b>October</b>	15.8	8.3	2.6	8.4	6.3	12.4	11.2	9.1
	Autumn	<b>November</b>	7.9	8.3	9.6	10.3	11.7	8.9	5.9	7.4
	Cool dry	<b>December</b>	16.8	6.4	13.2	8.4	5.5	6.5	12.3	6.3

Within sex distribution, the average suicide rate across the month of year was relatively consistent between males and females (see figure 3 below). The highest rates of suicides occurred from May to September, which falls within the hot/summer season. Females had a higher rate of suicide from March to September, whereas males had the highest occurrence from March to December.



**Figure 3. Average frequency of suicide across by month of year, 2011-2018 (n=2,786)**

## DISCUSSION

Regardless of the hemisphere in which a country is located, suicides tend to occur more often in the spring and summer periods (Caulkins, 2019; Galvão, Silva, & Silva, 2018). The study results resonate, showing that the lowest average overall suicide rate occurred during the October to March (ranging 6.2% to 8.5%) period, which mainly represents the winter season; and the April to September period marked the highest average suicide rate ( $\geq 8.7\%$ ) per month. The summer period also represents the monsoon period when Bangladeshis experience the highest average temperatures between 28.8°C - 30°C and where precipitation and rainfall reaches an average high between 70 – 309mm (Climate-data.org, 2018). Further, longitudinal investigations in Bangladesh from 2006-2015, identify the monsoon season as yielding the most severe and frequent occurring floods, which not only damage lands, but also affects the country's infrastructure and people's health too (Ghatak, Kamal, & Mishra, 2012; Hasan, Saha, & Biswas, 2018). People generally suffer from loss of lives, declining health, loss of livestock and agricultural products, and many are left homeless. Local Bangladeshis have cited monsoons to bring anxiety as they are challenged to increase their housing floors to further protect it from floods, water supplies are contaminated, no electricity, and schools may close for extended periods (Plan International, 2021). Remaining consistent with the preponderance of suicide for males and females during May, June and September; literature shows that the June to October period consistently signify a high frequency of floods (Hasan, Saha, & Biswas, 2018). It has also been highlighted that the number of floods has increased over the 2011 to 2015 period (Hasan, Saha, & Biswas, 2018). In Bangladesh, the high death rate among women during weather disasters is also attributed to their reduced mobility (Asian Development Bank, 2010). The disaster related stress is known to increase the rate of domestic violence within the home due to disaster related infrastructural breakdown of adequately caring for the home as clean water is scarce in order to prepare food and for drinking, or for sanitation purposes (Asian Development Bank, 2010). Bangladesh follows the patriarchal norm wherein women are considered as subordinates to men, and responsible for household duties (Sultana, 2011). This continuing pressures within this context may further place women at risk for suicide.

The study findings are also consistent with literary results in North America where global climate models project that climate change in the United States and Mexico will predispose the vulnerable populations at an increased risk for suicide, at 1.4% and 2.3% respectively, due to deteriorating psychological distress or mental well-being during warmer temperatures (Burke, González, Baylis, Heft-Neal, Baysan, Basu, Hsiang, 2018). Studies in other Asian countries had similar findings. A Japanese study indicated that the average temperature increase promoted aggressive behavior and suicide risk; this after controlling for regional, annual, and monthly historical data on climate, suicide, and crime (Takahashi, 2017). Also, in India, 47 years of suicide and climate data found that high temperatures increased the suicide rate due to the low crop yields (Carleton, 2017). Here, the risk for suicide is indicated to increase with reduced rainfall as the agriculture is rain-fed dependent. These dry seasons are generally characterized by the hardship they endure due to the crop being heat damaged, soaring food prices to cope with the demand, and increased economic hardship on the families (Carleton, 2017). These evidences further support our study findings that dry seasons, and disaster-prone climates are risk factors for suicide mortality. This may account why suicide rates among men have increased and the female to male suicide ratio narrowed as men are not able afford the expected sociocultural climate. A British study found gender variations in seasonality wherein men were most likely to commit suicide in spring, but for women, it would take place in spring and autumn (Meares, Mendelsohn, & Milgrom-Friedman, 1981; Woo, Okusaga, & Postulache, 2012). The findings resonate with the study results.

It is important to note that part of our study findings stand here contrary to popular findings. Our study results further highlight that males continued to report a high incidence of suicides in December, which is characteristic of a dry winter season. Being predominantly an agrarian country, rural livelihood in Bangladesh follows an agricultural cycle which includes two major harvesting deficit periods (also lean season) from late-September to early-December and late-March to early-May (Shonchoy, 2015). During the lean season, villagers who depend exclusively on agriculture for sustenance become extremely vulnerable due to lack of income and alternative means of earning (Khandker, Koolwal, & Samad, 2009). A systematic review on several low-income and middle-income countries indicates that a declining economic status, diminished wealth, and unemployment is consistently associated with suicide (Lemmi et al., 2016). This may also provide an indication why suicide mortality has increased among men as they have a low crop yield and struggle to survive economically and agriculturally.

Another review on suicide and seasonality containing studies from both global North and South reveals that the seasonality of suicides decreases during the time of economic prosperity and increases during the period economic stagnation (Christodoulou et al., 2012). Therefore, the contextual praxis between agricultural lean periods (seasonality), and the higher incidence of suicide may also be considered in the context of Bangladesh. More incidence on suicide during the lean period time in Bangladesh could be embedded in the context of economic vulnerability.

The connection of suicidal cases with seasonality and economic vulnerability in agrarian economy can be framed and understood through Dahlgren and Whitehead's (1991) social ecological model. This model underpins the interrelatedness between an individual, their health and, their environment as influenced by interrelated multi-factors which are within or beyond individual's control. Furthermore, it seeks to highlight that social and environmental risk factors can be more influential than genetic risk factors to an individual's wellbeing, as can be seen with the aforementioned factors extracted from the various suicidal studies and this investigation. Three health determinants have been identified for this model, namely proximal (i.e. being male, mental health status, poor physical health, elder age), intermediate (i.e. alcohol abuse, marital issues, prior suicide attempts, drug use and/or abuse), and distal (i.e. sanitation, stressful life events, economic adversity) social determinants. Although proximal factors are considered as the strongest determinant for suicide, the context of this investigations lends itself to all three determinants (De Carvalho, Costa, Monteiro, Figueiredo, Avelino, & Rocha, 2020). In this instance, males and females have displayed a fluctuating trend throughout the study period, and it was particularly influenced by environmental conditions like seasonal variations. Here, it may be proposed that economic vulnerability due to seasonality factors contributed to the change of male female suicide ratio over the study period. For instance, should Bangladeshi men face joblessness, be landless and/or incapable of maintaining minimum subsistence at individual and family context, they may feel the

need to commit suicide due to their poor placement in their sociocultural (Sultana, 2011) and agricultural context (Asian Development Bank, 2010). This situation may be equated with men's masculine impediments. A recent study in the Jhenaidah district, supports the evidence that rural men tend to commit suicide due to their failure to fulfill socially prescribed masculine family provider responsibilities (Khan, Ratele, Helman, Dlamini, & Makama, 2020). Overall, our understanding regarding variations for male and female suicidal cases and approaching economic vulnerability in low-income resource prone agricultural economy seem to be consistent with previous national level study findings (WHO, 2018b). The social ecological model holds importance in framing that even though the individual lies at the center of their wider social and environmental determinants; their lifestyle and resilience are influenced and impacted by the interrelatedness of their surrounding factors.

Even though female suicide occurred at a twofold rate to the male in 2011, this has substantially reduced in 2018 to 1.3:1. This trend highlights that there has been a considerable growth in the number of men committing suicide, and the effect has lend itself to other Asian countries. Similarly, China reported a small female male suicide rate ratio; females outnumbered males pre-2005, but in 2010 the male-female ratio was 1:0.9 (Chen, Wu, Yousuf, & Yip, 2012; Tandon, & Nathani, 2018). Another Asian country is reported to have a marginally higher female to male ratio, namely Myanmar at 1:06 (Tandon, & Nathani, 2018). More longitudinal data on gender aggregates are required to make further inferences on the male-female suicide trends.

## CONCLUSION

Suicide is a multifaceted phenomenon which is often challenging to grasp as a full understanding of its risk factors, ranging from individual or sociocultural to environmental determinants. These are needed to resolve the nature of this mortality. Therefore, it remains imperative to contextualize the problem in diverse and appropriate ways (De Berardis, Martinotti, & Di Giannantonio, 2018). The social ecological model theoretically integrates the individual's exposures with the environment or seasonal variant and sociocultural elements so to understand the suicide risks; and this brings a comprehensive interpretation to the public health context. Extreme temperatures and weather disasters greatly challenges an individual's resilience and subsequently their suicide risk as their basic living conditions and resource are constrained.

This study also taps into the prevalence of seasonal variance of suicide incidence in Jhenaidah district, and the analysis significantly contributes to the existing suicide knowledge base in Bangladesh as it provides context to suicide risk factors needed for framing prevention practices, and its implementation strategies. This could have further implications for countries of similar profile where the study findings can be considered as a reference point for future research undertakings. Interpretive research will be useful to explore and provide insight to the contextual perspective of the critical areas highlighted by these data could be a good beginning. In this connection, further intervention is warranted to rightly gauge the gender dynamics of seasonal variances influencing suicidal behavior. It is of recommendation that an epidemiological study on suicidality and seasonality be expanded to other areas of Bangladesh to contribute to the development of an integrated database or surveillance system in the country. From the perspective of social health, protective social factors targeted to mitigate the deleterious effects of adverse socio-economic condition brought by seasonality complications of suicide are urgently needed. Preventive measures should consider the need of agricultural and disaster management risk education to sustain these Bangladeshi households during weather disaster climates.

## CONTRIBUTIONS AND DECLARATION

**Declaration of Interest:** None

**Contributions:** Najuwa Arendse drafted the manuscript, analysed and interpreted results. Anisur Rahman Khan contributed to the drafting of the manuscript and interpreted results. Md. Masum Billah and Kopano Ratele have contributed to the revisions. Md. Zahidul Islam has corroborated the data.



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