A Mathematical Model on Social Integration Explaining Global Suicide Rate Among Men and Women

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Abstract

This paper aims to present a mathematical model for explaining global suicide rate among men and women across the world since 2007. Analysis of this nature grants a valuable input to comprehensively associate suicide incidence in men and women to its socially perceivable integrated factors. This paper is designed from a descriptive approach, data mining technique, utilizing available data taken from the Human Development Report 2013 of the United Nations where social integration indicators were specified. Results indicated a huge variation between the incidences of men and women suicide rates and from among the specified indicators; more pronounced in men than women. The variations can be explained by the significant societal-integrated factors affecting men including Well-being Index (p-value 0.03), Societal Index(P=0.00), and Safety Index (P=0.05) while only Societal Index (P=0.00) has contributed significantly to the occurrence of the phenomenon in women. This gender-based and social integration based analysis can significantly contribute to understanding of suicide and designing more effective suicide preventions and interventions for both men and women in the society.

Keywords: suicide, mathematical modeling, social factors, global suicide rate, Human Development Report

1.0 Introduction

The study of suicide rates is an important part of the heritage of sociology since it (suicide) has become one of the most alarming global issues. Annually, 38,364 suicides were reported, making suicide the 10th leading cause of death for Americans (Harsch, 2013). Suicide incidence of countries is reported to have significantly increased to both men and women where almost four times as many males as females die by suicide, according to the Center for Disease Control and Prevention, National Center for Injury Prevention and Control. In 2010, men had a suicide rate of 19.9, and women had a rate of 5.2. Of those who died by suicide in 2010, 78.9% were male and 21.1% were female.

However, many researchers, including that of Madge & Harvey in (1999) have suggested that the reported magnitude of the suicide mortality sex differential is not accurate and the corresponding factors of the suicide incidence are not well-built.

This paper aims to present a mathematical model for explaining global suicide rate among men and women across the world since 2007. Analysis of this nature (mathematical model) grants a valuable input to comprehensively associate suicide incidence in men and women to its socially perceivable integrated factors as tabulated from the 2013 Human Development Report of the United Nations.

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2.0 Conceptual Framework

The Durkheim's Paradigm

Emile Durkheim has argued in his 1897 book "Le Suicide" that collective social forces are more important determinants for suicide than extra-social or individual factors. The theory argues that psychiatric factors namely, race, heredity, climate, temperature, cosmic factors (i.e., seasonality), and imitation are dispatched as peripheral to suicide. Instead, the totality of suicides in a society is deemed the appropriate quantum of investigation. (Dhossche, 2003)

As contained in the British Journal of Sociology in 1975, Durkheim also insisted three currents of opinion -- that the individual has a certain personality (egoism), that this personality should be sacrificed if the community required it (altruism), and that the individual is sensitive to ideas of social progress (anomie) -- coexist in all societies, turning individual inclinations in three different and opposed directions. Where these currents offset one another, the individual enjoys a state of equilibrium which protects him from suicide; but where one current exceeds certain strength relative to others, it becomes a cause of self-inflicted death. Moreover, this strength itself depends on three causes: the nature of the individuals composing the society, the manner of their association, and transitory occurrences which disrupt collective life.

The decisive influence of these currents, however, is rarely exerted throughout an entire society; on the contrary, its effect is typically felt within those particular environments whose conditions are especially favorable to the development of one current or another. But the conditions of each individual environment are themselves dependent on the more general conditions of the society as a whole. No collective

sentiment can affect individuals, of course, when they are absolutely indisposed to it, but the same social causes that produce these currents also affect the way individuals are socialized, so that a society quite literally produces citizens with the appropriate dispositions at the same time that it molds the currents to which they will thus respond. Durkheim did not deny, therefore, that individual motives have a share in determining who commits suicide but he did insist that the nature and intensity of the "suicidogenic" current were factors independent of such psychological conditions. Indeed, this was why Durkheim could claim that his theory, however "deterministic," was more consistent with the philosophical doctrine of free will than any psychologistic theory which makes the individual the source of social phenomena; for the intensity of his currents, like the virulence of an infectious disease, determines only the rate at which the population will be affected, not the identity of those to be struck down (Robert Alun Jones, 1986).

Durkheim also examined the family institution as a source of social integration and as a buffer against the propensity of individuals to commit suicide. For instance, Durkheim observed that regions of France that were characterized by larger families tended to have lower rates of suicide than did regions with smaller families. He reasoned that the greater "density" of social relations in larger households protected against excessive individualism and egoistic suicide. Durkheim also found a relationship between marital status and suicide, in which married persons over the age of 20 generally have lower rates of suicide than do their single or widowed counterparts.

The Integrated Motivational-Volitional (IMV) Model

This integrates the various psychological, biological and social factors associated with

suicidal behavior into a model which explains and predicts the development of suicidal thoughts and when these will progress to action. The model's pre-phases can be utilized to support and postulate the presence of particular psychological, biological and social factors to likely increase/decrease the likelihood of committing suicide.

Pre-motivational phase: background factors and triggering events

Biological or personality factors, or life experiences (e.g., socio-economic deprivation) make an

Individual vulnerable; the individual then experiences a 'triggering' event (e.g., relationship crisis). Significant personality traits include social perfectionism and self-criticism.

3.0 Research Design and Method

The study is designed from a descriptive approach, data mining technique, which makes use of mathematical modeling. Eykhoff (1974) defined a mathematical model as 'a representation of the essential aspects of an existing system

Process of mathematical modelling

(or a system to be constructed)which presents knowledge of that system in usable form.

Suicide rates are reported to have correlations with a wide variety of variables (Stack 2000). This paper utilizes the available data taken from the Human Development Report of the United Nations where social integration indicators were specified, particularly, the perceptions of individual well-being is presented to include overall life satisfaction, satisfaction with the freedom of choice and satisfaction with job while the dimension on perception of the society covered satisfaction with the community and the trust for the people and government. Also, the perception on safety was also considered a domain in the social integration. (UNDP, 2013).
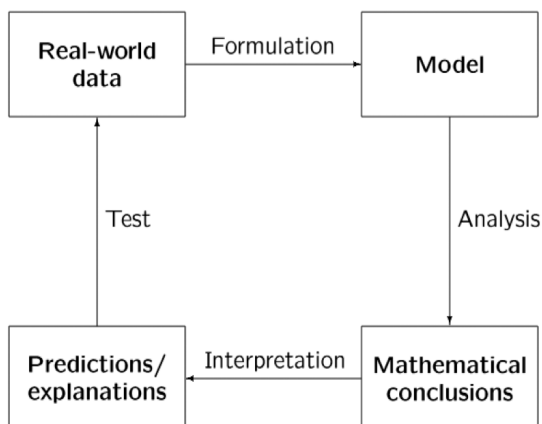
Moreover, the approach in this study is characterized by:

1) Conversion of raw scores to index scores to each domain by factor analysis considering Varimax model as the type of rotation

2) Formulation of a mathematical/statistical model that measures association from suicide-related variables as indicated in the Human Development Report 2013 of the United Nations Development Program.

3) Discrimination of the parameters of the model to only include significant contributors to suicidal tendencies among men and women.

4.0 Results and Discussions

Data mining from the Human Development Report 2013 of the United Nations Development Program, descriptive results are presented as follows:

Descriptive Statistics: female, male

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
female	65	0	**4.737**	0.483	3.892	0.000	1.800	**3.600**	7.050	22.100
male	65	0	**17.32**	1.70	13.70	0.00	7.05	**13.10**	24.30	61.30

Two-Sample T-Test: female, male

Difference = mu (female) - mu (male)
Estimate for difference: -12.59
95% CI for difference: (-16.11, -9.07)
T-Test of difference = 0 (vs not =): T-Value = -7.13 P-Value = 0.000 DF = 74

The great disparity between the suicide rates for women and men (Mean: 4.737 vs. 17.32, Median: 3.60 vs. 13.10) per 100,000 is statistically supported by the results of the t-test showing the significant difference of the suicide rates with p-value-0.00. The results indicate that globally, the suicide rate of men is significantly higher than that of the women.

A number of studies have analyzed indicators for suicidal ideation and behavior, in which gender is one of the most frequently, replicated predictors (Goldacre et al, 1993; Moscicki, 1994; Canetto & Sakinofsky, 1998). The Interpersonal model (Joiner, 2005, 2011; Witte et al., 2012) proposes that sex differences in suicide are the result of differences in acquired capability for suicide.

According to Australian government statistics, and to a number of US researchers, young men and older men are particularly the vulnerable groups. The suicide rate peaks in men between the ages of 20-24, which if isolated from the general statistics on suicide, places suicide as the 3rd ranking cause of death. Majority claims that because men are taught to bottle up feelings inside, so when they are going through a really emotional time sometimes it's easier to end it all while females, being emotional , vent and have people listen and help them solve their problems.

Despite alarming statistics showing a high gender skewing towards males, there has been remarkably little focus on prevention, intervention, strategies or research to address male suicide. (Beaton, 2012)

Multiple Regression Analysis: MALE versus Well-being Index, Societal Index, ...

The regression equation is
male = - 1.3 - 0.338 Well-being Index + 1.02 Societal Index - 0.218 Safety Index

Predictor	Coef	SE Coef	T	P
Constant	-1.26	10.26	-0.12	0.902
Well-being Index	-0.3380	0.1081	-3.13	0.003
Societal Index	1.0176	0.2131	4.77	0.000
Safety Index	-0.2175	0.1097	-1.98	0.052

A negative correlation derived from well-being index

A negative correlation derived from well-being index

A report by a British charity posits that the biggest factor of suicide of males is the changing definition of what it means to be a man in western society. One of the major building blocks of men's identity as men comes from employment, with an emphasis on whether or not men can support their families. The past (economic) recessions have been called the "man-cession" because the overwhelming percentages of people who have lost a job are men. Over the past few decades, our economy has gradually shifted from one based on production and labor (traditional places where men work) to service (traditionally female). And with millions of manufacturing jobs being sent overseas, blue collar men have been especially hard hit.

Men who are not working (or, in some cases, aren't making as much as their wife) can come to see themselves as less-than-masculine. Results include depression, alcohol and drug abuse, an increase in risky behavior, and suicide. And of course other factors contribute to unemployment or underemployment. Divorce and relationship breakups being another (men are generally hit harder by breakups than women in part) because men rely on their partners for emotional support, while women tend to rely on other women. Again, the result is increased suicide risk.

A negative correlation derived from safety index

Safety scores in this context mean the perception of the people when asked by the Gallup World Poll question, "Do you feel safe walking alone at night in the city or area where you live?" This in-global country analysis would indicate that men, generally, provided the information that as they have perceived their safety less, the occurrence of suicide tendencies becomes so evident. Inversely, as they have indicated higher satisfaction with their safety either in being not worried in public transportation at night, not being worried being alone at home during the dark, or feeling safe when walking alone in the neighborhood, the likelihood of commission to suicide tends to disappear. This event is also very evident to developed countries. In 2004, 84% of women in Canada felt safe walking alone after dark in their neighborhood compared with 94% of men. In the same period, 73% of women and 88% of men were not at all worried about being home alone in the evening. And Canada is noted for its low-profile in suicidal risks and incidences.

Multiple Regression Analysis: female versus Well-being Index, Societal Index,...

The regression equation is
female = - 4.96 - 0.0519 Well-being Index + 0.236 Societal Index- 0.0054 Safety Index

Predictor	Coef	SE Coef	T	P
Constant	-4.956	3.013	-1.64	0.105
Well-being Index	-0.05193	0.03177	-1.63	0.107
Societal Index	0.23574	0.06262	3.76	0.000
Safety Index	-0.00535	0.03223	-0.17	0.869

These results can tell us that the only perceived societal factor significantly leading women to commit suicide is derived from social factors. These, as indicated by the HDR 2013 survey results, included the trust in the people, in the national government and satisfaction with the community. Surprisingly, the positive correlation can bring an alarming message delivered by the results. Women tend to perceive more satisfaction to societal events (government, people and the community), yet this can lead them to increasing their records in suicidal attempts and incidences. According to Anu Salmela in her article Lethal Emotions: Shaken Emotions and Female Suicides in Late 19th Century Finland, assumptions about the motives behin d suicides were gendered: female suicides were connected with shaken emotions, caused by love or marital problems and as such, suicide explanations were constructed in accordance with the idea of feminine irrationality and emotionality. When women's easy trust to people easily gets distracted, clouded, and troubled, women has the tendency to overreact or overemphasize on these events leading to unnecessary thoughts of suicide. "Moods can change quickly and unpredictably, behaviors can be impulsive and relationships with others are often resulted to being unstable. Many patients injure themselves and threaten or attempt suicide to relieve their emotional pain" (Brody, 2009)

Significant social integration Indicators of Suicide for men and women from the model

Gender	Social integration Indicators	p-value
Male	Well-being Index	0.003
	Societal Index	0.000
	Safety Index	0.052
Female	Societal Index	0.000

Of the many factors that HDR 2103 reported, the integrating factors appearing above were found to be the most significant to have impacted both of the gender's suicidal tendencies and incidences all around the globe.

5.0 Conclusion

In this article, we have argued that several fatalistic social integrations have been linked to previously high rates of suicide in both men

and women. Suicidologists have called for more attention to the socio-cultural dimensions of self-killing (Canetto, 2008). We believe that this gender-based and social integration based analysis can significantly contribute to understanding of suicide and designing more effective suicide preventions and interventions for both men and women in the society.

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