Machine learning Models for Mental Health Analysis based on Religious Impact

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Abstract—Once a taboo topic, recently we have seen a greater awareness of suicide and the factors that influence the suicide rate. There are many factors that influence the suicide rate, among these factors are religious affiliation and religious diversity. Most of the research on religion's influence on the suicide rate has relied on the study of published articles retrieved from a plurality of databases and surveys performed on the selected population. In addition, hardly any research addresses the impact of religious diversity on the suicide rate. The present paper proposes studying the impact of religion on suicide using a quantitative approach. A data set containing the suicide rate, and religious affiliation rate of over 150 countries is constructed from 1990 to 2010. The countries that constituted a population with a single religion over a threshold percentage are identified as countries lacking religious diversity. The analysis indicates that different religions impact suicide differently. A baseline of suicide rate was generated using countries that are mostly affiliated with no religions. The preliminary research was limited to the top four religions of the world. Our research revealed that countries that are mostly affiliated with Christianity, Hinduism, and Buddhism had lower suicide rate compared to countries with no religious affiliation at all. Even the countries that are religiously diverse shield against suicide compared to countries that are not affiliated with any religion.

Index Terms—Machine learning, Mental Health, NLP, Online Information

1. Introduction

Every death caused by any fact or is distress for the family.The experience is even more painful when the cause of death is self-inflicted. The World Health Organization (WHO) estimates that each year approximately one million people die from suicide, which represents a global mortality rate of 16 people per 100,000 or one death every 40 seconds. It is predicted that by 2020 the rate of death will increase to one every 20 seconds [?]. Based on different studies and statistics the suicide has been a major issue in the past, and the situation is only getting worse over the years.A lot of research has been performed on different factors that impact the suicide rate such as age, socio economics, sex, culture, region, race, mental health etc.. . . The study off actors that impacts the suicide are complex as suicide rate could be impacted by factors ranging from parenthood to the environment; however, understanding each of the factors that could

influence suicide is essential for suicide preventions. One of the factors that could potentially impact the suicide rate is religion. A handful of studies over the past ten years have examined the relationship between religion and suicide risk. Most of these have not found an association,while two found more suicide ideation among persons who gave low importance to religion [2]. Majority of these studies are based on literature reviews, and surveys performed with selected questionnaires. There is hardly any research available that takes a quantitative approach to study the impact of religious affiliation on the suicide rate. In addition,world is becoming religiously diverse,and there have not been any study performed that determines the influence of religious diversity on the suicide rate.Thus,there is a need to investigate impact of religious affiliation,and religious diversity on the suicide rate. The analysis from these study aids us to make data-driven decisions to reduce suicide rates. These decisions include (i)restrictive access to common means of suicide such as (pesticides, firearms) (ii) public awareness of common suicide signs and available help (iii) social support within communities (iv)improving living conditions (v) providing essentials like food (vi) public transportation, education, and jobs(vii)regularly implementing Mental Health Screenings by health organizations.

2. Literature

Ying and Tyler studied first on religion,suicide ideation, and suicide attempts and second investigated on religion and completed suicide. From their first analysis, they found that spirituality may reducethe risk of suicide alideation through some evidence. They also found that communal forms of religious participation such as service attend ancemay reduce the risk of suicidal behaviors. In their second part of the analysis,they found religious affiliations may be associated with a lower risk of suicide,but the associations vary across religious denominations and social contexts.They found stronger evidence that proves that frequent religious service attendance may reduce the risk of death by suicide.They suggest there is a need to understand the association between religion and suicide in the broader context of secularization and shift in the age of distribution of suicide from older to younger groups in many modern societies[3].

Danah and Andrew found predominant religion is significantly associated with the sex suicide ratio. They performed analysis on cultural factors such as geography, religion and life expectancy, PPP, education total fertility rate, and gender

development index on male and female ratio. They also found Christianity is one of the major religions for suicide rates due to colonial historyin countries that may lead to a variety of societal influences in addition to religion.Another religion was Hinduism which ranked third highest suicide mortality ratio. Additionally,they found that associeties become richer and more educated,males have a higher risk of dying as a consequence of suicide relative to females[4] and it shoews in the analysis of online comments. [**?**], [1], [2], [3], [4]

Philippe's analysis revealed religion was important for many of the patient suffering from psychotic or other psychiatric disorders[7]. emotion and sentiment analysis [5], [6], [7], [8], [9], [10] of the online comments could help us to detect mental health patients.For this work, we used machine learning and NLP models for analytic of online texts based on the NLP models developed by our research mentors at George Mason University and other researchers to detect mental health based on text analysis on online information. [11], [12], [13], [14], [15], [16], [17], [18], [19], [20], [21], [22], [23]

Agnus reveals income level of the region showed the strongest negative association with the suicide rate,followed by heavy drinking,the population aged65and had positive associations with the suicide rate [8].

Lawrence et al. examined the relationship between suicide attempts and ideation. Three hundred and twenty-one adult inpatients and outpatients with current diagnoses of Major Depressive Disorder or Bipolar Disorder were recruited for the study. Based on the diagnostic interview results, the study found past suicide attempts were more common among depressed patients with a religious affiliation.Additionally, suicide ideatio nwas more severe among depressed patients who said religion is more important, and among those who Brito et al. examined the association between religious beliefs and observance and the prevalence of psychiatric disorders, psychotic symptoms and history of suicide attempts in the French general population. The study involved interviewing 38, 694 subjects at 47 study sites. A positive associatio nwas found with psychotic disorders. Conversely, a negative association was found between religiosity and history of suicide attempts [9].

Religiosity has been shown to be associated with lower levels of aggression and hostility, drug use, and risky sexual activity, which are related to suicidal behavior. In a prospective study with depressed youth, for a more complex under standing of the relationship between depression and religiousness,finding not all religious beliefs and experiences corresponding with better mental health. Research suggests that only certain aspects of religiosity/spirituality (e.g., importance of religion, sense of connectedness)might be associated with suicidal behavior. Research regarding religion/spirituality in youth,requires more exploratory studies to further this understanding [6].

Gearing et al. discusses the impact of religion on the suicide rate [5]. The study states "an accurate understanding of a client's religious faith and participation may indicate potential suicide risk. In addition, assessing religiosity may also identify potential areas that treatment could target and enhance life affirming beliefs and expectations." The methodology used in this study involved searching the databases for peer reviewed articles on religion and suicide between 2008 and 2017. The study concluded that the influence of religiosity on suicide appears to vary by gender. Similarly, the research also identified that individuals with lower religious orientation are at increased risk of suicide compared to individuals with higher religious orientation.This study was restrictedto males. In addition,the study identifies that research is needed to better understand the unique protective role that religions exert against suicide, specifically as it may be moderated by demographic characteristics (e.g., gender, age, and belonging to specific subgroups)and degree of religiosity (e.g.,participation in religious activities).

The above papers researched on suicide rate influenced by spiritual beliefs, religious rituals, psychotic disorders, heavy drinking,tobacco,alcohol,geographical area,life expectancy, PPP, education, fertility rate, and gender development. However we use applications of machine learning in natural language processing [17], [24], [25], [26], [27], [28], [29], [30], [31], [32], [33], [34], [35], [36], [37], [38], [39], [40] in other domains such as health, security and business, and apply transfer learning models to analyse the online comments [41], [42], [43], [44], [45], [46], [47], [48], [49], [50], [51], [52], [53], [54], [55]. There are only a few papers that have concentrated on religion and suicide rate relation. Additionally, they conducted research based on other paper analyses.This paper aims to analyze the suicide rate based on sex, religion and few other attributes using publicly available data. There are six major religions in the world. These religions are Buddhists, Muslims, Christians, Hinduism, Jews, and folk religions. We would be identifying which religions contributes lowest and highest suicide rate among them. Additionally, we will explore which sex has contributed high suicide rate in top-ranked religion.The above analysis can help to visualize a broader context in society.

2.1. Problem Description

Between 2008 and 2017, publications on religion and suicide were published in the PsycINFO, MEDLINE, SocINDEX, and CINAHL databases. The influence of religious variety, as well other factors,on the suicide rate was not understood in the studies undertaken during these years.To prevent suicide and reduce the ever-increasing suicide rate, we must first determine the relationship between the elements that influence suicide. The literature evaluation suggests that religion may have a significant role in suicide prevention; however,this is not the focus of their study. Determining and for casting the cause of suicide will help us make data-driven decisions in the health curriculum and take proactive preventative efforts through suicide prevention organizations like NSPL, NOFA, AFSP, NIMH, SPTS, and CDC...etc Furthermore,the study will educatethe public about the impact of religion on the suicide rate.

2.2. Problem Investigation

Investigation into the problem set included data collection for the following primaries:

- The factors caused to suicide by the religious believes and its impact when there are diversified religions.
- Is there a link between religion and suicide,the results of this study will be determined by comparing the suicide rates of various faiths to the suicide rates of non-religious persons. The greatest influences of religions on suicide.

3. Methodology

The methodology was divided into two steps:

- Dataset Preparation
- Analytical Approach

3.1. Dataset Preparation

We searched trusted sources for data related to suicide rate of different countries over the years, and religious affiliation of different countries over the years. We retrieved the suicide rate data from world health organization, and religious affiliation data from data world. Once datasets were received and their validity verified, the next step was to combine the datasets to build a dataset that could correlate religious affiliation with suicide rate. The dataset was merged using the countries and years as common attribute.

3.2. Analytical Approach

In order to analyze the impact of religions on the suicide rate, first we needed to determine the countries that are not affiliated with any country as baseline. The non-religious countries were determined, and their suicide rate was analyzed. Next, we determined the most popular religions in the world. Once the most popular religions were determined, analysis were performed to determine the countries that belong to each of the popular religions. In order to ensure that influence of single religion is determined, we selected the countries where the predominant population belongs to a single religion, thus lacking religious diversity. For majority of popular religions, threshold of 95% and above was used to ensure that these areas are only influenced by a single religion. In addition, countries with religious diversity were also determined to analyze the influence of religious diversity on suicide. The results of individual religions were compared wit each other, and the baseline of non-religious affiliation to determine the religious influence on the suicide rate.
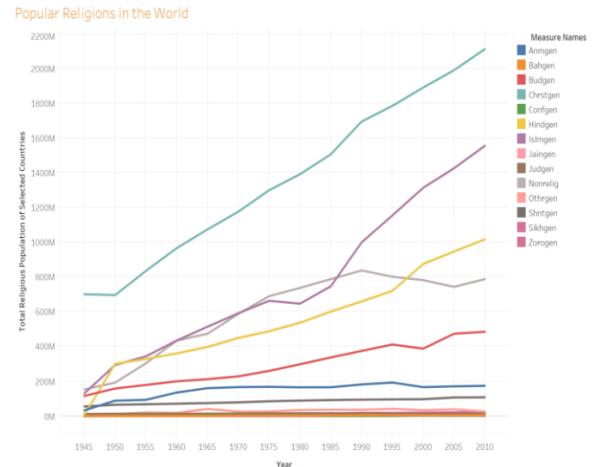

Figure 1. Most Popular Religions in the World -[Tableau]

3.2.1. Top Five Religions in the World: . For this study we focused on top five religions in the world. Figure 1 shows the religious population over the years in the world. As can be seen from the above figure, Christianity, Islam, non-religion, Hinduism, and Buddhism makeup top five religions in the world. In addition, top five religion's population have kept increasing over the time. Christianity is still the leading religion, whereas Islam is growing on faster rate than any other religions.

3.2.2. Countries that Lack Religious Diversity:. Next, for each of the top five popular religions in the world, we identified the countries that belong to a single religion (thus lacking religious diversity). The countries that have a single dominant religion were selected based on religious affiliation threshold. For majority of popular religions, we were able to select countries that have at least 90% religious' affiliation.

3.2.3. Predominant Christian Countries:. Figure 2 bar graph shows ranked snippet of the Christian affiliation for each country in the dataset for year 2010. The analysis was performed from 1995-2010 by each five years. The following table shows countries with at least 95% of the population that belongs to Christianity in 2010.

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Countries with Dominant Christian Affiliation

Country
Panama
Malta
Colombia
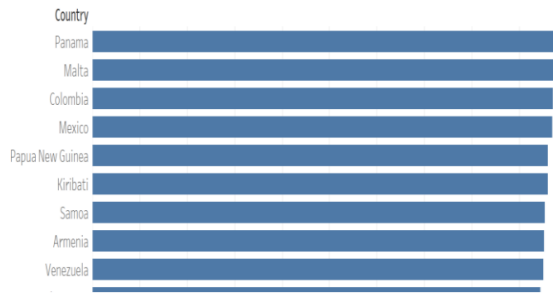Mexico
Papua New Guinea
Kiribati
Samoa
Armenia
Venezuela

Figure 2. : Predominant Christian Countries -[Tableau]

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