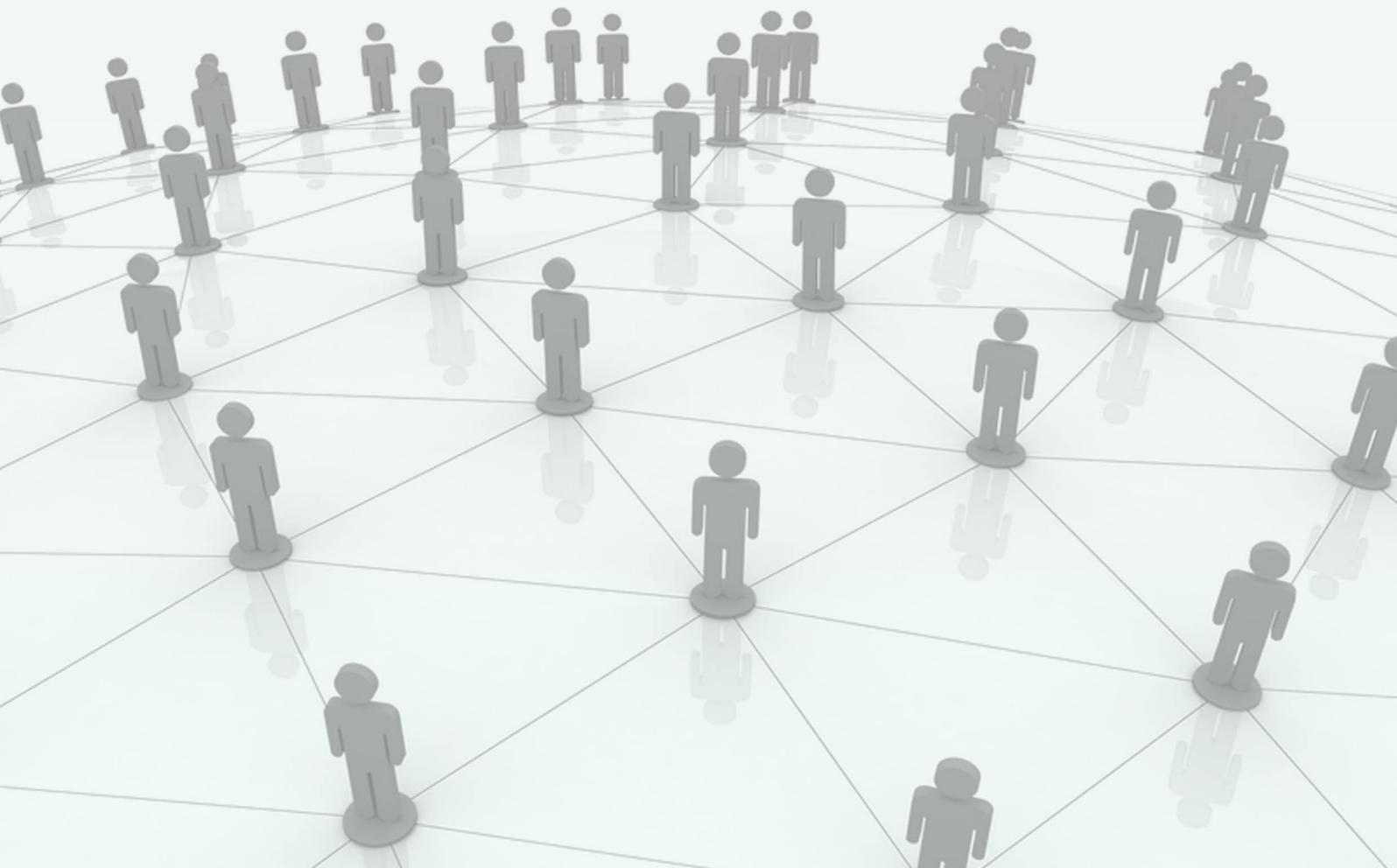


# SOCIAL BEHAVIOR RESEARCH AND PRACTICE

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## Humanization of the Learning Process in Higher Educational Institutions

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In the current context of globalization and integration into the world educational space, the issues related to psychological and information safety of the learning environment are the most topical. Global socio-economic and political changes, along with society's entry into the post-industrial age, have contributed to the democratization and humanization of a man's life and his activities. Treating a human being as the highest value of social existence, has become the condition for the identification and development of the creative potential of a person and the training of highly qualified specialists in higher educational institutions. Successful training of future specialists at the university is achieved not only by being informed, knowledgeable or the quality of teaching (that is obviously very important), but mainly by meaningful guidance, giving the students freedom and allowing them to participate in independent activities, by choosing an appropriate organization and improving the process of education. Humanistic oriented higher education allows each participant to apply his knowledge effectively, develop skills in new situations, and reveal his potential.

The main objectives of the humanistic oriented educational process in high school are:

- Humanistic orientation of the teaching process of all subjects in the curriculum;
- Creating conditions suitable for the realization of an individual approach to the humanistic development of the future specialist's personality;
- Establishing principles of co-operation and promoting the development of student activities in learning and research processes.

The methodology of implementing the humanization of education should be based on contemporary axiology as the foundation for the development of the values of a person, reflecting on one's attitude to the social and the objective world, as well as to oneself.

The problem associated with the making of a humanistic oriented person are commonly attributed to a review of objectives, content and technologies of humanistic oriented education in higher school, with the creative interaction of the actors of this process, as well as the identification of the practical effectiveness of the humanistic paradigm of education.

Methodological foundations of humanization of the educational process are based on the system theory of the personality-developing training,<sup>1</sup> reflected in teachers paying attention to the personality of each student to the personality of each student as the highest social value, focussing on the formation of the future specialist's high intellectual, moral, and physical qualities.

Further development of educational systems is associated with the re-orientation of its aims and goals, methods and means in assisting acquisition of knowledge concerning oneself, human nature and the surrounding world where people live. Worldwide development is directed towards a distinct humanistic orientation.

The humanistic orientation of the pedagogical process in higher educational institu-

tion is changing its traditional idea of goal of education and training, the main component of which is the orientation towards the acquisition of systematized knowledge, skills and competencies. Today a specialist with a university degree is required not only to perform algorithmic actions, but to possess artistic skills and to have the freedom of choice in selecting problem solving tools, as well as skills of defining goals, methods and means of their professional activities. Receiving a comprehensive education could give an individual a true advantage and allow one to be competitive in the labor market.

Under the current circumstances, education is defining the order of preparation of a competitive, comprehensive, and creative specialist. In the educational process, it is of great importance to focus on the individuality of a student, his culturological education, development of physical abilities and aesthetic values. This means that on the basis of education, there should not only be the learner-centered approach, according to which the goal,<sup>2</sup> is neither formation nor training, but discover, support and develop the humane side of an individual.<sup>2(p.5)</sup>

Goal setting, centered around individual growths to re-orient the main aim of the pedagogical process towards the personality development of students (in terms of intellect, ethics, aesthetics, and activity); changing the education and training process, thereby instilling new merits in a specialist. Humanization in goal setting of the educational process is revealed in the prognostication of the specialist's development; in setting specific objectives of an activity at every phase and stage of education and planning future professional activity. Setting the goals in education and training is efficient to the extent that it takes into account the needs of the society and the individual, educational and training facilities of an educational establishment as well as the abilities of the teachers, students, etc. The essence of goal setting is reflected in the curriculum based on prognostication of the specialist's development with due regard to his training, proficiency level, abilities and capabilities, as well as on the selection of means and methods of the teacher-student interaction in response to the circumstances. An integral consideration of pedagogical goals presupposes a double focusing, i.e. an "outside" one that is at the level of the Macromodel applying to the whole system of specialist training and an "inside" one that is at the level of a Micromodel applying directly to a certain stage of future specialist training.

The integrative product of the university education promotes the development of a moral, independent, creative, socially active and competent specialist with a distinct pedagogical and research orientation who is able to adjust to various professional activities in changing conditions.

The strategic aim, i.e. the goal in itself, of humanization of education is to promote development of humanity in an individual, his self-education and self-training. The criterion of attaining the aim, manifests in the obtained level of humanity, which is reflected in a person's attitude towards man, society and other people.

Higher educational institutions of Belarus possess an experience in the organization of humanistically oriented pedagogical process. According to the sociological studies, institutions of higher education have made progress in the field of humanization:

- The majority of higher educational establishments apply more educational programs aimed at realization of humanistically oriented pedagogical process;
- Institutions of higher education have developed or have been developing theoretical and methodological issues of humanization with regard to the conditions and specificity of the given institution;
- Issues pertaining to humanization of pedagogical process are discussed at the chair meetings in the institutions of higher learning and in academic conferences;
- Learner's guides have been prepared covering the issues of humanization of education and training;
- Humanistically oriented educational processes of students training are used.

At the same time, it should be noted that the realization of humanization goals of the pedagogical process in higher education has certain difficulties and shortcomings. The problems and shortcomings of the humanistically oriented education processes in higher education institutions are deep rooted in history and society. Firstly, the authoritarian system of education and training prevailed for a long-time and secondly, there is a decline of prestige of the teaching profession.

Subjective reasons for insufficient implementation of humanization goals are caused by insufficient attention paid by the authorities of many institutions of higher education to popularization of humanization goals and to monitoring of putting into practice. A survey conducted among teachers demonstrated that clear understanding of goals and objectives in the given sphere is a characteristic of the minority of the respondents. There are only two thirds out of 1500 teachers of technical higher educational establishments who approve of the humanization ideas. But even among them there are quite a lot who consider humanization to be temporary, though an important stage in the development of higher education, not seeing that it makes a constant and enduring

content of its theory and practice.

Setting the goals in the humanistic oriented course of study serves as an important feature of its success. We regret that in the system of higher education, there are certain shortcomings in the implementation of goal-setting. Aims and objectives of educational activities are not always explained in lectures and practical classes. If students do not understand the aim to learn some academic material, then they learn it passively, without necessary diligence and assiduity. In many ways, the success of humanization of the educational process depends on the students “*setting and undertaking training goals and objectives. The survey of teachers has shown that a clear understanding of the goals and objectives in the subject area is a characteristic of the respondents*” minority.

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## Legalizing Recreational Marijuana: Another Pandora's Box Opened?

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When I was an adolescent in the 1960's, I remember Sergeant Joe Friday of the popular television program *Dragnet*, discussing all the deficits of marijuana and arresting people either for using or potentially selling marijuana. I remember his immortal line "*I judge weed by the company it keeps*". Moreover, the popular television show *Cops*, which aired until 2013, further reinforced these ideals.

As far back as 1982, the Surgeon General's warning on marijuana included short-term memory impairment, reproduction difficulties, and adverse effects in lung and immune system functioning.<sup>1</sup> Moreover, additional side effects may include depression and anxiety,<sup>2</sup> whereas potentially longer-term effects may include cough, wheezing, and breathing problems.<sup>3</sup> Likewise, additional deleterious effects may include hallucinations<sup>4</sup> and decreased IQ.<sup>5</sup>

However, as time has unfolded, individuals who have epilepsy,<sup>6</sup> multiple sclerosis symptoms,<sup>7,8</sup> cancer,<sup>9</sup> or chronic pain,<sup>8</sup> have benefitted from medical marijuana. Indeed, individuals with these severe maladies obtained some physical and psychological relief, albeit not a cure. Although, many of these positive effects are short-term, nevertheless, they provided an impetus for visualizing marijuana in a different manner. Therefore, because of its adverse symptomatic relieving effects, some of the stigma has been removed from marijuana. To this end, 28 states have legalized medical marijuana.<sup>10</sup> Eight states (including my current home state of Nevada) have legalized the recreational use of marijuana.<sup>11</sup>

The legalization of marijuana from both medical and recreational aspects has spawned a plethora of questions, concerns, and research possibilities. For example, studies<sup>12</sup> have suggested that states with legalized medicinal marijuana use will have higher rates of marijuana use than those states that have not legalized it. Moreover, medical marijuana states may also have higher odds of abuse and dependence. Yet, studies<sup>13,14</sup> have found no significant differences in increased adolescent marijuana usage related to legalizing medical marijuana. In fact, legalization may have beneficial effects by reducing the price, lowering alcohol consumption, and even decreasing traffic fatalities by 8-11%.<sup>15</sup> However, other findings<sup>16</sup> have indicated increases in traffic fatalities over time. Hence, these may be equivocal findings.

In Nevada, individuals can only use marijuana in medical or prescription form, or recreationally within their own home. Senate Bill 236,<sup>17</sup> if passed, would allow recreational use to be more widespread. This would include businesses and public events. In fact, I would not be surprised if it were to be introduced in casinos. This would especially be true if there was a study correlating the use of marijuana with gambling, similar to alcohol consumption and cigarette smoking. However, Vadhan et al<sup>18</sup> reported that for experienced marijuana users, although speed was slower in a gambling task, accuracy was not significantly impaired while under the influence. Yet, Wesley et al<sup>19</sup> found that chronic marijuana users performed more poorly on the Iowa Gambling Task because they are less sensitive to negative feedback. Hence, marijuana use can impair cognitive functioning in a variety of ways. These deficits include solving problems, strategizing, and making decisions.<sup>20</sup>

Of course, it is hoped that should we begin to see more public recreational marijuana use, then there should be designated places for that indulgence. In other words, within a casino, there should be a designated and fully enclosed area for marijuana use far enough away from the more populated areas so that individuals are not subjected to second-hand smoke. Obviously, I have the same view of cigarettes and e-cigarettes based on potential breathing problems. Although some casinos offer small non-smoking areas when playing slot machines, nevertheless, they are still quite close to smoking areas. Hence, one can never totally escape second-hand smoke. However, unlike cigarettes and e-cigarettes, marijuana comes in a variety of forms. Such forms include candy, brownies, cookies, and chocolate. The fact that marijuana is incorporated into these forms introduces a new risk.

Given the plethora of risks involved with marijuana, Malouff and Rooke,<sup>21</sup> based on their survey of research experts, suggested that warnings be developed addressing issues contained within six categories namely: safety, physical health, fetal harm, mental health, drug dependence, and developmental deficits. In their subsequent work,<sup>22</sup> these categories included mental health risks, machinery operational risks, short-term and long-term physical problems, reasonable use, and dependency, addiction, and abuse.

The problem becomes what type of warning label should be used and especially given the consumable products. The State of Washington now uses a picture of an open hand coupled with the words "NOT FOR KIDS" written in red on a white background.<sup>23</sup> Although this is certainly a nice first step, there are potential problems with this label. For example, there are no consequences provided. Hence, an explicit warning might provide greater compliance than an implicit one.<sup>24</sup> An uninformed or ignorant adult user might wonder what the dangers are for children. Furthermore, will children read the warning and if they read it, what is the probability that they will comply?

My position is that cigarette consumption should have been outlawed years ago, especially given the overwhelming evidence of health risk. Given the minor amount of evidence so far, I would also advocate the same thinking for e-cigarettes. However, I can certainly understand legalizing and regulating marijuana use for medical purposes only, given the case histories and research evidence of symptomatic relief for severe maladies. Yet, given the plethora of evidence indicating health risks, it is difficult for me to fathom the legalization of recreational marijuana. Perhaps one day, whether it is consumable products like cigarettes or marijuana or even environmental issues such as pollution or oil drilling, legislators will consider health risks as far more paramount than profits or personal freedoms. Then again, given this questionable type of legislative thinking, it is understandable why our health costs are skyrocketing and why our health care system is nothing more than a cattle call provided one can obtain an appointment within three months.

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## Research

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# Translating Data into Discovery: Analysis of 10 Years of CDC Data of Mortality Indicates Level of Attainment of Education as a Suicide Risk Factor in USA

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## ABSTRACT

The goal of this research is to identify and promote awareness of prominent demographic risk factors to predict individuals at risk for suicide and aid in the prevention within the USA. This would support the Education Development Center's Zero Suicide initiative and provide strategies and tools to health and behavioral health systems to reduce suicide mortality. The research presented in this paper focuses on the hypothesis that demographic variables available in the Center for Disease and Prevention (CDC) mortality data sets should be integrated into initiatives to identify and prevent suicide mortality. A comprehensive analysis of the CDC mortality data from 2003 through 2013 was extracted, transformed, loaded and analyzed utilizing Python, R Scripting, RStudio and Tableau. The CDC mortality data was subsided into a data frame of 17 variables from the original 75 variables that indicated the most statistical significance as a function of the respective suicide ICD10 codes. Education attainment levels of a 12<sup>th</sup> grade education emerged as one of the most statistically significant variables that contributed to suicidal deaths; this observation is consistent with initial observations of the 2013 CDC mortality data analyzed in our previous studies.<sup>1</sup> Based on this unique finding of education emerging as a strong and consistent variable in the comprehensive analysis of CDC data over an 11 year period, the authors hypothesize education attainment level segments are the most significant demographic predictor variable of suicide and a systematic approach to targeting continuing educational opportunities to patients with low education attainment levels paired with other high risk segments including but not limited to age, race, ethnicity, marital status and gender.

**KEY WORDS:** Center for Disease and Prevention (CDC); Data Science; Demographics; Education; Suicide; Suicide risk factors; Mortality data.

**ABBREVIATIONS:** CDC: Center for Disease and Prevention; SSI: Scale for Suicide Ideation; MSSSI: Modified Scale for Suicide Ideation; SABCS: Suicidal Affect Behavior Cognition Scale; SBQ: Suicide Behaviors Questionnaire; LOI: Life Orientation Inventory; RFL: Reasons for Living Inventory; NGASR: Nurses Global Assessment of Suicide Risk.

## INTRODUCTION

Developing a zero-suicide culture in a healthcare system requires the application of data driven quality improvement to identify at risk patients and measure the outcomes of preventative care to eliminate suicide as a leading cause of death in the United States. Variability in patient behavior and health care provider observations and assessments lead to subjective measures of

risk factors that create data quality issues impeding the ability of healthcare systems to standardize data collection to discern meaningful information from their data.

**Problem Space**

- Suicide rates continue to rise in the United States
- Suicide ideation, attempt and mortality data quality reporting integrity
- Systematic adoption of suicide risk identification and prevention protocols
- Significant monetary impact to the United States

**Rising Suicide Rates**

A data driven quality improvement to identify suicidal patients and implement preventative measures has been difficult by healthcare systems. Despite the efforts of the organizations to prevent suicide, the CDC data revealed 400,349 suicide related deaths, marking a 2.8% increase per year 2003 to 2013. Amongst the reported deaths, the epidemic affects white, middle-aged males with a 12<sup>th</sup> grade education attainment level the most out of the United States population. The subset of 17 variables from the CDC revealed the following notable information (Table 1).

Table 1: Data Subset Summary Statistics.	
<b>Suicide deaths by gender</b>	
Male	315,175
Female	85,174
<b>Suicide deaths by race (Top four of fifteen)</b>	
White Non-Hispanic	334,184
White Hispanic	27,334
Black	23,355
American Indian	4,720
<b>Suicide deaths by education attainment level</b>	
High School Diploma	70,195
Some college, Bachelor and Advanced Degrees	57,198

**Data Quality Reporting**

Attainment of beneficial and accurate suicide ideation, attempt and mortality data is a barrier to healthcare systems to truly capture the scope of the suicide epidemic in the United States. Western Michigan University (2016) established a Suicide Prevention Program that outlines some of the barriers impacting research, identification and prevention efforts. These are<sup>2</sup>:

- Provide an incomplete picture of the problem of suicidal behavior: Most suicide attempts do not result in death and are not included in mortality data
- Despite better reporting than morbidity data, not all suicides are reported: Sometimes there is not enough information to determine intent. Without conclusive evidence, potential suicides may be recorded as unintentional or undetermined on

death certificates

- Less completely reported: While psychologically serious, many suicide attempts are not medically serious enough to require medical attention and do not get reported/coded
- Captures a biased view of the suicide injury problem: Hospital datasets are more accessible for public health surveillance than data from private physicians, clinics, and health maintenance organizations. However, hospital data may under- or over-represent certain sub-groups
- More difficult to accurately collect data about the way people feel or think *versus* how they behave
- Subject to reporting biases. For example, high school students are asked on the youth risk behavior survey if they ever seriously considered suicide. This question is subject to recall bias (not all people will remember), social desirability bias (not all will want to admit suicidal feelings, even on an anonymous survey), and to definition issues. After all, what is meant by “seriously” considered suicide?

**Identification and Prevention Protocols**

Suicide is a sensitive subject for many people suffering from a mental illness, a traumatic event, friends and families with suicidal loved ones, school systems and even healthcare providers. The solution to treating the United States suicide epidemic will not be a simple solution. However, research suggests that a zero-suicide culture adopted from a systematic approach can reduce and even eliminate suicide related deaths, as proven with Henry Ford Health System’s award winning Depression Care Program and Centerstone’s Crisis Care Services program.<sup>3</sup> Positive results have been identified in these two healthcare facilities; however, the United States healthcare system is extremely large, highly regulated and financially burdened. The implementation of programs like the EDC’s Zero Suicide initiative would require a leadership-driven culture change with how suicide prevention training is conducted within healthcare systems.<sup>4</sup> Non-healthcare organizations and systems may not be able to take the same approach; however, as the United States begins to act to remediate the closeted conversation of mental illness and suicide, additional systematic approaches can be developed for a greater national impact.

**Monetary Impact**

Suicide related deaths take an enormous toll on society in the United States. Aside from the emotional ramifications, the CDC reported in 2010 that suicide related death cost \$44.6 billion USD for ages 10 and older. The seemingly large figure is calculated upon the combination of medical and work lost cost. Each suicide related death is reported to impact society at a rate of \$1,164,499 USD. The application of this figure to the 400,349 suicidal related deaths from 2003 to 2013 amounts to a cumulative cost of \$466,206,010,151.

## MOTIVATION

The CDC recognizes suicide is one of leading cause of death worldwide, and the United States is not an exception, accounting for 42,773 deaths in just 2013. As of 2015, suicide was the 10<sup>th</sup> highest causes of death. For years, healthcare professionals have been fighting relentlessly regarding this issue. According to Dinah Miller,<sup>5</sup> of Psychology today suicide rates are increasing every year. In Simon's<sup>6</sup> article Suicide risk assessment: Is clinical experience enough? He states, "Accurate and defensible risk assessment requires a clinician to integrate a clinical judgment with the latest evidence-based practice, although accurate prediction of low base rate events, such as suicide, is inherently difficult and prone to false positives."

According to contributors to the Assessment of Suicide Risk,<sup>7</sup> effective suicide risk assessment, "...should distinguish between acute and chronic risk. Acute risk might be raised because of recent changes in the person's circumstances or mental state, while chronic risk is determined by a diagnosis of a mental illness, and social and demographic factors. Suicide risk assessments are currently conducted with the following assessments:"

- The Scale for Suicide Ideation (SSI)
- The Modified Scale for Suicide Ideation (MSSI)
- The Suicide Intent Scale (SIS)
- The Suicidal Affect Behavior Cognition Scale (SABCS)
- The Suicide Behaviors Questionnaire (SBQ)
- The Life Orientation Inventory (LOI)
- The Reasons for Living Inventory (RFL)
- The Nurses Global Assessment of Suicide Risk (NGASR)

Bryan and Rudd<sup>8</sup> in Advances in the assessment of suicide risk noted that, "There are risks and disadvantages to both overestimation and under-estimation of suicide risk. Over-sensitivity to risk can have undesirable consequences, including inappropriate deprivation of patients' rights and squandering of scarce clinical resources. On the other hand, underestimating sociality because of a dismissive attitude or lack of clinical skill jeopardizes patient safety and risks clinician liability."

As suicide rates continue to rise, there is reason to believe the assessments that are currently in use are not comprehensively capturing the motivations and severity of being able to properly classify the suicide risk level of patients.

The purpose of this paper is to explore social and demographic factors that are currently not being utilized in assessments that could help identify the risk of suicide in people. By uncovering these indicators, we speculate insights can be gained to aid in the improvement of suicide risk assessments being utilized by healthcare professionals to positively impact the efficacy of the efforts to decrease suicide rates in the United States. If the correlation is discovered between suicide and previously ignored risk factors, actionable programs could be de-

veloped and targeted for high risk groups. These programs could be designed to help patients seeking clinical care and, as well as those at high-risk who are not actively seeking clinical help.<sup>9</sup>

## Related Work

While the CDC has gathered an extraordinarily large data set on suicides in the United States, the variables have not revealed clear motivators as to why suicides rates continue to rise. Per Miller,<sup>5</sup> The CDC reports revealed the following:

*"The news from the Centers for Disease Control shows a striking increase in suicide rates. Among those ages 35 to 64 years old (the baby boomers), there is a 28% increase in suicide rates from 1999 to 2010. It holds for males (up 27%), females (up 31%), and across different regions of the country. The peaks were seen in men in their 50's and women in their early 60's. The gender difference continues to show that men die of suicide at three times the rate of women, and suicide is now the 4<sup>th</sup> cause of death for that age group. More people die of suicide than car accidents. The rise is most striking in non-hispanic whites and native american alaskan indians, groups that have always had the highest rates. The suicide rate is now 17 per 100,000, up from 13 per 100,000. And while we worry more about homicide, suicide rates are twice the homicide rates. Marriage is protective, as is a college education, and in fact the suicide rate in college-educated women went down."*<sup>10-12</sup>

Further, according to Milner et al<sup>13</sup> in a study published in the British Journal of Psychology, not all variables are known that are strong indicators of suicide.

*"This study confirms that certain occupational groups are at elevated risk of suicide compared with the general employed population, or compared with other occupational groups. At greatest risk were laborers, cleaners and elementary occupations (ISCO major category 9), followed by machine operators and ship's deck crew (ISCO major group 8). The greater risk of suicide in lower skilled occupational groups may be symptomatic of wider social and economic disadvantages, including lower education, income and access to health services."*

In addition to the non-monetary impacts of suicide, according to the CDC's,<sup>14</sup> there are significant financial impacts to society:

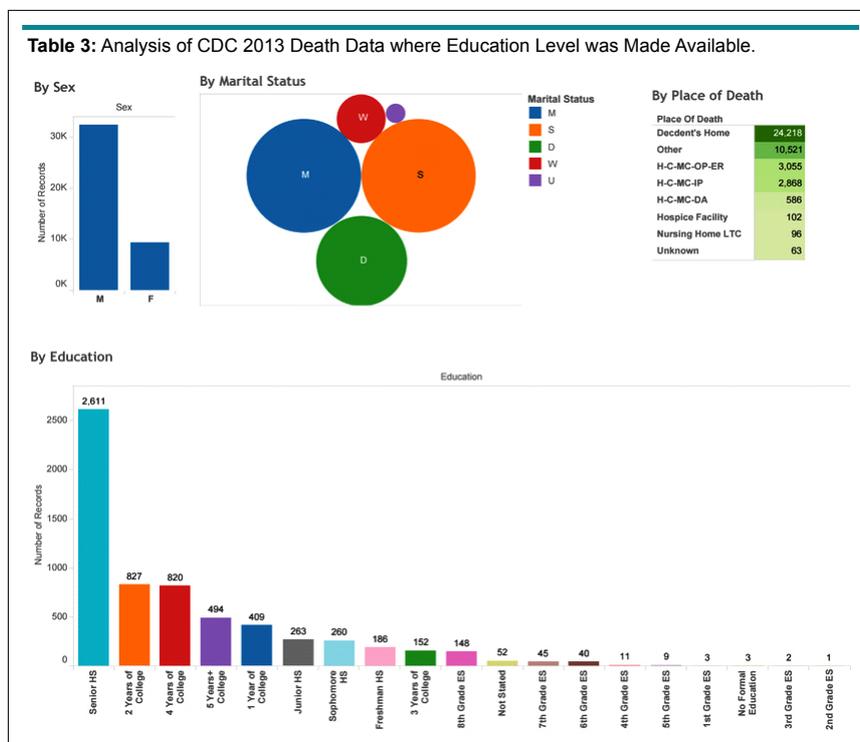
- Suicide costs society over \$44.6 billion a year in combined medical and work loss costs
- The average suicide costs \$1,164,499

The majority of the individual suicide cost is a result of the work-loss amounting in \$1,160,655 and the total amount increases once the average medical cost of \$3,646 is calculated.<sup>15</sup> The monetary impact to society was explored in Suicide and Suicidal Attempts in the United States: costs and Policy Implications. Sheppard et al calculated the cost to society in millions

**Table 2: Suicide Breakdown Cost.**

Components	Males	Females	Total	%
<b>Medical cost</b>				
Suicides	\$121	\$26	\$146	0.3
Nonfatal suicide attempts	\$1,149	\$388	\$1,537	2.6
Total (all self-inflicted injuries)	\$1,270	\$413	\$1,684	2.9
<b>Indirect economic cost</b>				
Suicides	\$43,589	\$9,458	\$53,047	90.8
Nonfatal suicide attempts	\$3,196	\$518	\$3,714	6.4
Total (all self-inflicted injuries)	\$46,785	\$9,976	\$56,761	97.1
<b>Total economic cost</b>				
Suicides	\$43,710	\$9,483	\$53,193	91.0
Nonfatal suicide attempts	\$4,346	\$906	\$5,251	9.0
Total (all self-inflicted injuries)	\$48,056	\$10,392	\$58,445	100

Source: Author's calculation.  
 \*Items may not sum to totals due to rounding.



by component and age range in the following table 2 and 3.<sup>16</sup>

The analysis of the CDC suicide data performed by Brandt et al<sup>1</sup> made a case that a sample data set which only uses records where the education level of the deceased is known can be used to identify trends. The data matched national statistics around sex, marital status (Table 3) and location leading to a conclusion that these records would also reflect the education levels of the larger population.

**Outline of Paper**

This paper is organized as follows. Section 1 is the introduction of the paper, containing the problem space, motivation and related work. Section 2 describes the materials and data preparation involved in analyzing and drawing meaningful conclusions. Section 3 is a discussion of the results of the various data science techniques. Section 4 discusses potential challenges. Sec-

tion 5 presents the possible future work for this project. Section 6 offers a conclusion based on the results. Section 7 lists the references used in the research paper. Finally, section 8 contains tables, code, and charts of interest.

**MATERIALS AND METHODS**

**Data Collection**

The data was collected from The Centers for Disease Control and Prevention (CDC), [http://www.cdc.gov/nchs/data\\_access/vitalstatsonline.htm#Mortality\\_Multiple](http://www.cdc.gov/nchs/data_access/vitalstatsonline.htm#Mortality_Multiple). The files contain all the death records of all known deceased individuals from 2003-2013 across the United States. The data is gathered through the CDC's National Vital Statistics Systems, with the exception of the ICD10 Codes that are sourced from the World Health Organization (WHO).<sup>17</sup> The data files report on the 75 applicable variables for each record in respect to the deceased individual's

known demographic data, reported death indicators and ICD10 Codes.

**Statistical Data Analysis**

- Step 1: The 2003-2013 death data file was downloaded in a DUSMCPUB format
- Step 2: The file required to be parsed and converted into a CSV format to be imported into RStudio. To accomplish this task, a modified python script (Appendix B) available on Git Hub, was utilized to parse the DUSMCPUB data into a CSV file.
- Step 3: After parsing file and converting into a CSV file, the data was imported into RStudio.
- Step 4: As suicide risk could be correlated to objective demographic variables, a subset of 18 variables from the original 75 variables were identified to create a subset for statistical analysis of unknown variables to suicide risk. The variables identified as potentially significant are listed in Appendix A.
- Step 5: To aid in correlation analysis and, ultimately, a linear regression model of the most significantly correlated variables, variables were assigned factor levels, except for age, as described in the Rscript in Appendix B.
- Step 6: The original data contained all causes of death in the manner of death variable; however, the research is focused only on variables correlated with the suicide value. As described, in the Rscript in Appendix A subset of data was created to contain only suicide related death.
- Step 7: According to aforementioned studies, the Education variable was likely to be highly significant to suicide risk. As described in the Rscript in Appendix C, the records without Education data were removed to clear the data set.
- Step 8: After removing the records without a reported Education level and NA's, the subset of data contained 158,970 records.
- Step 9: A combination of RStudio and a Tableau were used to visualize the data for analysis.

**RESULTS**

**Description of Data Set Found and Created for Analysis**

As can be seen in the Table 4 below, the original death data file contained 27,224,858 rows and 75 variables (i.e., columns). This data was reduced to contain only death labeled as suicided, bringing the record count to 400,349. Some of these rows of data were missing education levels; these records were removed, leaving a sample size of 158,970 and 17 variables that represent demographic data that could be valuable to the research.

**Potential Data Science Approach**

Potential data science approaches being explored are clustering, regression and hypothesis testing to identify any significance the 18 selected variables will have to predict the probability a subject would commit suicide. Cluster analysis or clustering is the task of grouping a set of objects in such a way that objects in the same group (called a cluster) are more similar (in some sense or another) to each other than to those in other groups (clusters). It is the main task of exploratory data mining, and a common technique for statistical data analysis, used in many fields, including machine learning, pattern recognition, image analysis, information retrieval, bioinformatics, data compression, and computer graphics.<sup>18</sup> Regression is defined as a technique in which a straight line is fitted to a set of data points to measure the effect of a single independent variable. The slope of the line is the measured impact of that variable.<sup>19</sup> Hypothesis testing is the use of statistics to determine the probability that a given hypothesis is true. The usual process of hypothesis testing consists of four steps namely null hypothesis, test statistic, *p* value and comparison of *p* value to an acceptable significance value called  $\alpha$ -value to see if the effect is statistically significant, then the null hypothesis is ruled out, and the alternative hypothesis is valid.<sup>20</sup>

The rationale for applying a data science approach to the 2003-2013 CDC death dataset is the success achieved in genome sequencing using data science. In the Center for Disease Control and Prevention blog, Khoury states, “*Genome sequencing of humans and other organisms has been a leading contributor to Big Data, but other types of data are increasingly larger, more diverse, and more complex, exceeding the abilities of currently used approaches to store, manage, share, analyze, and interpret it effectively. We have all heard claims that Big Data will revolutionize everything, including health and healthcare.*”<sup>21</sup> By discovering associations and understanding patterns and trends

**Table 4:** Observation and Variable Counts.

Name	Observations	Variables
Original death data set	27,224,858	75
Original by suicide	400,349	18
Suicide by education	158,970	18

within the data, big data analytics has the potential to improve care, save lives and lower societal impact.

**Findings**

The following graphs show the findings from the analysis of the 11-year period 2003-2013 (Figure 1, 2 and 3).

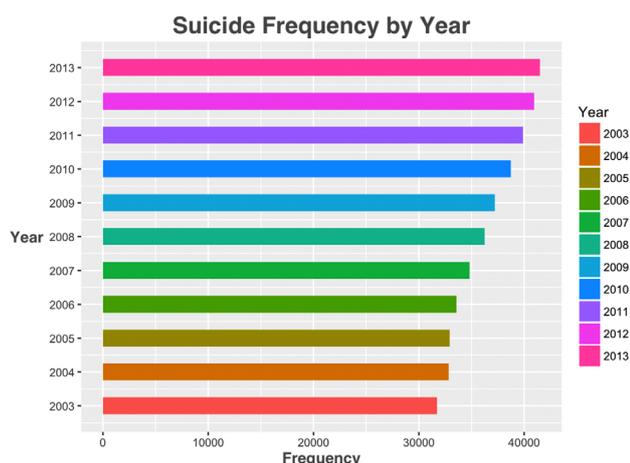
**Rationale for using Data Set**

The CDC's<sup>22</sup> defines suicide as, "Death caused by self-directed injurious behavior with intent to die as a result of the behavior." It is believed the appropriate data to find unknown suicide risk indicators from the large number variables available and data

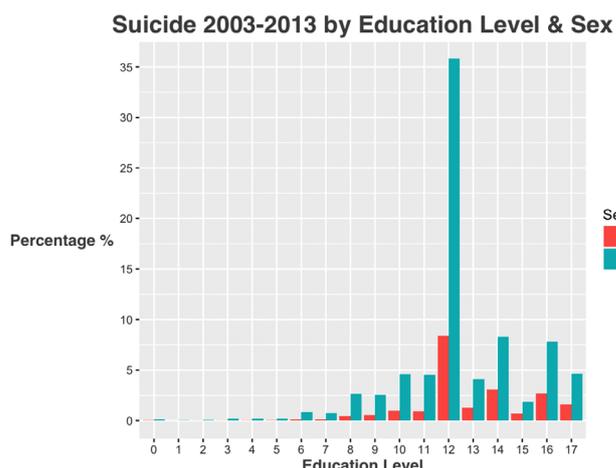
published by the CDC. In addition to the large number of variables and records, their data is reliable. According to the CDC's,<sup>7</sup> their suicide data is gathered through the resources:

- National Electronic Injury Surveillance System-All Injury Program (NEISS-AIP)
- National Hospital Ambulatory Medical Care Survey
- National Inpatient Sample (NIS)
- National Violent Death Reporting System
- The National Vital Statistics System
- WISQARS
- Youth Risk Behavior Surveillance System (YRBSS)

**Figure 1: Suicide Continues to Rise Year Over Year.**

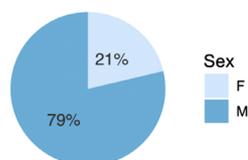


**Figure 2: This Graph Supports the Idea that Education Level could be a Key Risk Factor in Suicide Prevention.**

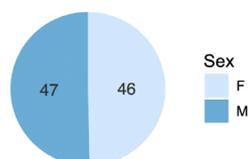


**Figure 3: Suicide Ratio of Male Versus Females is 4 to 1 but the Average Age is Very Similar for both.**

**Suicide 2003-2013 Percentage by Sex**



**Suicide 2003-2013 Age Mean by Sex**



### Other Federal Data Sources

- Drug Abuse Warning Network
- National Survey on Drug Use and Health (NSDUH)

### Non-Federal Data Sources

- Pan American Health Association, Regional Core Health Data Initiative
- The American Association of Sociology
- WHO Statistical Information System (WHOSIS)

### POTENTIAL CHALLENGES

There has been significant research conducted in the rise of suicide in the United States; however, the published research has been unable to produce a solution to the rise of suicide. Within the scope of this research, the potential challenges have been identified by the research team:

- The majority of the research team is new to data science and is considered non-experts in the domain. The ability to find and use the correct data science method could prove difficult
- The data set made available only accounts for the deceased and does not include any living patients. Additional data sets may be needed for a conclusive study, which may be protected information
- Managing false positives and mis-classifying someone with a high risk or low risk of committing suicide
- If an unknown variable is identified, how would information be provided to the proper people in a timely manner to help with prevention?

### FUTURE WORK

In the course of this research, the authors met with several individuals to gather a better understanding of the current work being done in the field of suicide prevention as well as insight to where the discovery could be used as a mechanism for change. Scott Ridgeway, Executive Director of the Tennessee Suicide Prevention Network, highlighted the need for a more rigor around how the data is collected not only across counties in Tennessee but across the nation, meeting notes in Appendix D. Jennifer Lockman, Program Evaluator and PhD candidate from Centerstone Research Institute, conveyed the fact that there needs to be more analysis of the data and echoed the need for more standardization of data collection, meeting notes in Appendix E. The data presented at the Tennessee Suicide Prevention Network Advisory Council Retreat reinforced what the CDC data is showing, suicide rates are increasing, meeting notes in Appendix F. These meetings showed the need for more work in Tennessee and across the nation. The next steps include getting data specific to Tennessee suicides and comparing to what is being found on the national level. Concluding if education level is a factor that can be used in prevention and if so, help support initiatives that

ensure the correct data is being collected.

Using the added data, information from experts, and the updated analysis publishing again to have the highest impact is a consideration. According to Journal Selector, the top 3 journals that would have the highest impact using the abstract of this paper are: *Pediatrics*, *American Journal of Preventive Medicine*, and *American Journal of Public Health*.

### CONCLUSION

Due to the increasing rise of suicide in the United States, research was initiated with a data science approach to identify previously unknown indicators that could lead to the prevention of suicide in the US. Previous research has been conducted to determine indicators of suicidal deaths; however, the research was based on subjective analysis of a suicidal subject's likelihood to commit suicide. This research sought to focus on indicators that were objective characteristics so the risk assessments conducted on suspected suicidal patients could potentially increase the accuracy of the risk assessment study. The studies reviewed prior to forming the research question did not utilize data science approaches to reach their conclusions that lower education levels and labor intensive occupations lead to a higher suicidal risk. It is believed that a linear regression model can be formed to fit the variables identified in the Center for Disease Control's death datasets from 2003-2013 that are the most significantly correlated with reported suicidal death. If the model proves accurate, subjects of the populations fitting the criteria of high risk characteristics could be introduced to potentially life-saving preventative actions to reduce the probability the subject's cause of death would be suicide.

### ACKNOWLEDGMENTS

The Authors acknowledge the CDC and the WHO for the making the data available to public and for analysis, to Scott Ridgeway for taking time to meet with the authors to discuss about TN state suicide rate and Jennifer Lockman for her insights on how data is currently being collected and suggestions of where change is needed.

### CONFLICT OF INTEREST

The authors have no conflicts of interest.

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APPENDIX

**Appendix A:** Data Subset Variables.

Residence Status	Education	Month of Death	Sex	Age Value	Place of Death
Marital Status	Day of Week	Data_year	injured_at_work	manner_of_death	activity_code
place_of_causal_injury	icd10	race_recode3	race_recode5	hispanic_origin_recode	

**Appendix B:** Python Script.

```

"""
Lipscomb University: Data Science Project.

Authors: Gilberto Diaz | Toni Brandt | Jacob James | Ashwini Yenamandra

Data Analysis of Suicide from 2003 to 2013.
- This script will parse CDC's death data sets and save it as .csv.
- This script was found on github and modified to correctly parse all 11
  years data sets.
"""

fileObj = open('VS12MORT.DUSMCPUB', 'r')
fileOutObj = open('mort_2012.csv', 'a')

fileOutObj.write('Resident_Status, Education, Month_Of_Death, Sex, Age_Key, ' +
'Age_Value, Age_Sub_Flag, Age_Recode_52, Age_Recode_27, ' +
'Age_Recode_12, Infant_Age_Recode_22, Place_Of_Death, ' +
'Marital_Status, DOW_of_Death, Data_Year, Injured_At_Work, ' +
'Manner_Of_Death, Method_Of_Disposition, Autopsy, ' +
'Activity_Code, Place_Of_Causal_Injury, ICD10, ' +
'Cause_Recode_358, Cause_Recode_113, ' +
'Infant_Cause_Recode_130, Cause_Recode_39, ' +
'Entity_Axis_Conditions, EAC1, EAC2, EAC3, EAC4, EAC5, ' +
'EAC6, EAC7, EAC8, EAC9, EAC10, EAC11, EAC12, EAC13, ' +
'EAC14, EAC15, EAC16, EAC17, EAC18, EAC19, EAC20, ' +
'Record_Axis_Conditions, RA1, RA2, RA3, RA4, RA5, RA6, ' +
'RA7, RA8, RA9, RA10, RA11, RA12, RA13, RA14, RA15, RA16, ' +
'RA17, RA18, RA19, RA20, Race, Race_Bridged, ' +
'Race_Imputation, Race_Recode_3, Race_Recode_5, ' +
'Hispanic_Origin, Hispanic_Origin_Recode\n')

outStr = ""

for line in fileObj:
    Resident_Status = line[19].strip()
    Education = line[60:62].strip()
    Month_Of_Death = line[63:67].strip()
    Sex = line[68].strip()
    Age_Key = line[69].strip()
    Age_Value = line[70:73].strip()
    Age_Sub_Flag = line[73].strip()
    Age_Recode_52 = line[74:76].strip()
    Age_Recode_27 = line[76:78].strip()
    Age_Recode_12 = line[78:80].strip()
    Infant_Age_Recode_22 = line[80:82].strip()
    Place_Of_Death = line[82].strip()
    Marital_Status = line[83].strip()
    DOW_of_Death = line[84].strip()
    Data_Year = line[101:105].strip()
    Injured_At_Work = line[105].strip()
    Manner_Of_Death = line[106].strip()
    Method_Of_Disposition = line[107].strip()
    Autopsy = line[108].strip()
    Activity_Code = line[143].strip()
    Place_Of_Causal_Injury = line[144].strip()
    ICD10 = line[145:149].strip()
    Cause_Recode_358 = line[149:152].strip()
    Cause_Recode_113 = line[153:156].strip()
    Infant_Cause_Recode_130 = line[156:159].strip()
    Cause_Recode_39 = line[159:161].strip()
    Entity_Axis_Conditions = line[162:164].strip()
    EAC1 = line[164:171].strip()
    EAC2 = line[171:178].strip()

```

APPENDIX

```

EAC3 = line[178:185].strip()
EAC4 = line[185:192].strip()
EAC5 = line[192:199].strip()
EAC6 = line[199:206].strip()
EAC7 = line[206:213].strip()
EAC8 = line[213:220].strip()
EAC9 = line[220:227].strip()
EAC10 = line[227:234].strip()
EAC11 = line[234:241].strip()
EAC12 = line[241:248].strip()
EAC13 = line[248:255].strip()
EAC14 = line[255:262].strip()
EAC15 = line[262:269].strip()
EAC16 = line[269:276].strip()
EAC17 = line[276:283].strip()
EAC18 = line[283:290].strip()
EAC19 = line[290:297].strip()
EAC20 = line[297:304].strip()
Record_Axis_Conditions = line[340:342]
RA1 = line[343:348].strip()
RA2 = line[348:353].strip()
RA3 = line[353:358].strip()
RA4 = line[358:363].strip()
RA5 = line[363:368].strip()
RA6 = line[368:373].strip()
RA7 = line[373:378].strip()
RA8 = line[378:383].strip()
RA9 = line[383:388].strip()
RA10 = line[388:393].strip()
RA11 = line[393:398].strip()
RA12 = line[398:403].strip()
RA13 = line[403:408].strip()
RA14 = line[408:413].strip()
RA15 = line[413:418].strip()
RA16 = line[418:423].strip()
RA17 = line[423:428].strip()
RA18 = line[428:433].strip()
RA19 = line[433:438].strip()
RA20 = line[438:443].strip()
Race = line[444:446].strip()
Race_Bridged = line[446].strip()
Race_Imputation = line[447].strip()
Race_Recode_3 = line[448].strip()
Race_Recode_5 = line[449].strip()
Hispanic_Origin = line[483:486].strip()
Hispanic_Origin_Recode = line[487].strip()

outStr = (Resident_Status + ' ' + Education + ' ' + Month_Of_Death +
' ' + Sex + ' ' + Age_Key + ' ' + Age_Value + ' ' +
' ' + Age_Sub_Flag + ' ' + Age_Recode_52 + ' ' +
' ' + Age_Recode_27 + ' ' + Age_Recode_12 + ' ' +
' ' + Infant_Age_Recode_22 + ' ' + Place_Of_Death +
' ' + Marital_Status + ' ' + DOW_of_Death + ' ' + Data_Year +
' ' + Injured_At_Work + ' ' + Manner_Of_Death + ' ' +
' ' + Method_Of_Disposition + ' ' + Autopsy + ' ' +
' ' + Activity_Code + ' ' + Place_Of_Causal_Injury + ' ' +
' ' + ICD10 + ' ' + Cause_Recode_358 + ' ' +
' ' + Cause_Recode_113 + ' ' + Infant_Cause_Recode_130 + ' ' +
' ' + Cause_Recode_39 + ' ' + Entity_Axis_Conditions + ' ' +
' ' + EAC1 + ' ' + EAC2 + ' ' + EAC3 + ' ' + EAC4 + ' ' +
' ' + EAC5 + ' ' + EAC6 + ' ' + EAC7 + ' ' + EAC8 + ' ' +
' ' + EAC9 + ' ' + EAC10 + ' ' + EAC11 + ' ' + EAC12 + ' ' +
' ' + EAC13 + ' ' + EAC14 + ' ' + EAC15 + ' ' + EAC16 +
' ' + EAC17 + ' ' + EAC18 + ' ' + EAC19 + ' ' + EAC20 +
' ' + Record_Axis_Conditions + ' ' + RA1 + ' ' + RA2 + ' ' +
' ' + RA3 + ' ' + RA4 + ' ' + RA5 + ' ' + RA6 + ' ' + RA7 +
' ' + RA8 + ' ' + RA9 + ' ' + RA10 + ' ' + RA11 + ' ' +
' ' + RA12 + ' ' + RA13 + ' ' + RA14 + ' ' + RA15 + ' ' +
' ' + RA16 + ' ' + RA17 + ' ' + RA18 + ' ' + RA19 + ' ' +
' ' + RA20 + ' ' + Race + ' ' + Race_Bridged + ' ' +
' ' + Race_Imputation + ' ' + Race_Recode_3 + ' ' +
' ' + Race_Recode_5 + ' ' + Hispanic_Origin + ' ' +
' ' + Hispanic_Origin_Recode + '\n')

fileOutObj.write(outStr)

print("Parse complete.")
fileOutObj.close()
fileObj.close()

```

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**Appendix C:** R Script from R Studio.

```
---
title: "Suicide 2003-2013"
author: "Gilberto Diaz | Jacob Jones | Ashwini Yenamandra | Toni Brandt"
date: "July 2, 2016"
output: html_document
---

----

# Data & Environment Preparation

```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)
```

### Set working environment

```{r setwd}
setwd("~/Documents/r_projects/practicum_1/cdc_mortality_2003_2012/suicide_2013_2003/")
```

### Loading libraries

```{r libraries, message = FALSE}
library(dplyr)
library(ggplot2)
library(gridExtra)
library(rmarkdown)
```

### Loading suicide data sets by year (2003-2013).

```{r, warning = FALSE, message = FALSE}
suicide.2003 <- read.csv(file = 'suicide.final.2003.csv',
                        header = TRUE,
                        stringsAsFactors = FALSE)
suicide.2003 <- tbl_df(suicide.2003)

suicide.2004 <- read.csv(file = 'suicide.final.2004.csv',
                        header = TRUE,
                        stringsAsFactors = FALSE)
suicide.2004 <- tbl_df(suicide.2004)

suicide.2005 <- read.csv(file = 'suicide.final.2005.csv',
                        header = TRUE,
                        stringsAsFactors = FALSE)
suicide.2005 <- tbl_df(suicide.2005)

suicide.2006 <- read.csv(file = 'suicide.final.2006.csv',
                        header = TRUE,
                        stringsAsFactors = FALSE)
suicide.2006 <- tbl_df(suicide.2006)

suicide.2007 <- read.csv(file = 'suicide.final.2007.csv',
                        header = TRUE,
                        stringsAsFactors = FALSE)
suicide.2007 <- tbl_df(suicide.2007)

suicide.2008 <- read.csv(file = 'suicide.final.2008.csv',
                        header = TRUE,
                        stringsAsFactors = FALSE)
suicide.2008 <- tbl_df(suicide.2008)

suicide.2009 <- read.csv(file = 'suicide.final.2009.csv',
                        header = TRUE,
                        stringsAsFactors = FALSE)
suicide.2009 <- tbl_df(suicide.2009)

suicide.2010 <- read.csv(file = 'suicide.final.2010.csv',
                        header = TRUE,
                        stringsAsFactors = FALSE)
suicide.2010 <- tbl_df(suicide.2010)

suicide.2011 <- read.csv(file = 'suicide.final.2011.csv',
                        header = TRUE,
```

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```

stringsAsFactors = FALSE)
suicide.2011 <- tbl_df(suicide.2011)

suicide.2012 <- read.csv(file = 'suicide.final.2012.csv',
  header = TRUE,
  stringsAsFactors = FALSE)
suicide.2012 <- tbl_df(suicide.2012)

suicide.2013 <- read.csv(file = 'suicide.final.2013.csv',
  header = TRUE,
  stringsAsFactors = FALSE)
suicide.2013 <- tbl_df(suicide.2013)
...

### Binding all suicide data sets into one dataframe.

```{r, warning = FALSE, message = FALSE}
suicide.11.years <- rbind(suicide.2003, suicide.2004, suicide.2005, suicide.2006,
  suicide.2007, suicide.2008, suicide.2009, suicide.2010,
  suicide.2011, suicide.2012, suicide.2013)
...

### Summary statistic

```{r, message = FALSE}
ss11y <- summary(suicide.11.years)
ss11y
...

```{r, message = FALSE}
age.outlier = suicide.11.years %>%
  filter(Age_Value == 999)

count(age.outlier)
count(age.outlier) / count(suicide.11.years) * 100
...

|Variable|Description|
|:-----|:-----|
|Education|NA's: 233733 / no education level|
|Age_Value|Max: 999 / 121 outliers; 0.03%|
|Age_Value|Mean: 46.8 / age most people suicide|
|Race_Bridged|NA's: 398143|
|Race_Imputation|NA's: 397188|

### Count observations by year

```{r, message = FALSE}
suicide.by.year <- suicide.11.years %>%
  group_by(Data_Year) %>%
  select(Data_Year) %>%
  summarise(Freq = n())

suicide.by.year
...

### Graphing suicide frequency by year.

```{r, warning = FALSE, message = FALSE}
ggplot(suicide.11.years, aes(x = Data_Year, fill = factor(Data_Year))) +
  geom_histogram(bins = 11, binwidth = 0.5) +
  scale_x_continuous(breaks = seq(2003, 2013, 1)) +
  coord_flip() +
  labs(x = 'Year',
    y = 'Frequency',
    title = 'Suicide Frequency by Year',
    fill = 'Year') +
  theme(plot.title = element_text(family = 'Helvetica',
    color = '#666666',
    face = 'bold',
    size = 18)) +
  theme(axis.title = element_text(family = 'Helvetica',
    color = '#666666',
    face = 'bold',
    size = 12)) +
  theme(axis.title.y = element_text(angle = 360))

```

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```

...

Please notice that suicide frequency has a non stop increase for 11 years.

### Analyzing by education level.

```{r, message = FALSE}
edu.table<- table(Education = suicide.11.years$Education, useNA = 'always')
edu.table
edu.table<- as.data.frame(edu.table)

edu.na.percentage<- edu.table %>%
summarise(Percentage_With_Education_Level = sum(edu.table[1:18, 'Freq']) / sum(edu.table[, 'Freq']) * 100)
edu.na.percentage
...

Suicide for all 11 years has **400349** observations. After grouping by education level is found that **241379** observations don't
have education level reported or NA's (empty). Therefore, the amount of **observations that do have education level is almost
40%**.
```

```

### Suicide 2003-2013 percentage group by education and sex. Observations with no education level are excluded.

```{r, warning = FALSE, message = FALSE}
percentage.by.education.sex<- suicide.11.years %>%
  filter(Age_Value<= 250, Education != 'NA', Education != 99) %>%
  select(Resident_Status, Education, Sex) %>%
  group_by(Education, Sex) %>%
  summarise(Percentage = n() / length(.$Resident_Status) * 100)
percentage.by.education.sex
...

### Percentage of people with more than a bachelor degree
```{r, message = FALSE}
more.bachelor<- percentage.by.education.sex %>%
  filter(between(Education, 13, 17))
sum(more.bachelor$Percentage)
...

### Graphing suicide 2003-2013 group by education & sex

```{r, warning = FALSE, message = FALSE}
ggplot(percentage.by.education.sex, aes(x = factor(Education), y = Percentage, fill = Sex)) +
  geom_bar(stat = "identity", position = position_dodge()) +
  scale_x_discrete(name = "Education Level") +
  scale_y_continuous(name = "Percentage %",
    breaks = seq(0, 40, by = 5)) +
  labs(title = "Suicide 2003-2013 by Education Level & Sex") +
  theme(plot.title = element_text(family = 'Helvetica',
    color = '#666666',
    face = 'bold',
    size = 18)) +
  theme(axis.title = element_text(family = 'Helvetica',
    color = '#666666',
    face = 'bold',
    size = 12)) +
  theme(axis.title.y = element_text(angle = 360))
...

|Item|Education Level Description|
|:-----|:-----|
|0|No education|
|1|1st grade|
|2|2nd grade|
|3|3rd grade|
|4|4th grade|
|5|5th grade|
|6|6th grade|
|7|7th grade|
|8|8th grade|
|9|9th grade|
|10|10th grade|
|11|11th grade|
|12|12th grade|
|13|1 year of college|
|14|2 years of college|
|15|3 years of college|
|16|Bachelor degree|
|17|Bachelor +|

```

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```

|99|Not state education level|

### Suicide 2003-2013 frequency by year & sex. Age_Value outlier are excluded.

```{r, warning = FALSE, message = FALSE}
suicide.by.year.sex<- suicide.11.years %>%
  filter(Age_Value<= 250) %>%
  select(Resident_Status, Data_Year, Sex) %>%
  group_by(Data_Year, Sex) %>%
  count(Sex) %>%
  rename(Count = n)

suicide.by.year.sex
```

### Graphing suicide 2003-2013 frequency by sex.

```{r, warning = FALSE, message = FALSE}
a1 <- ggplot(suicide.by.year.sex, aes(x = factor(Data_Year), y = Count, fill = Sex)) +
  geom_bar(stat = "identity", position = position_dodge(), width = 0.5) +
  scale_x_discrete(breaks = seq(2003, 2013, 1)) +
  scale_y_continuous(breaks = seq(0, 40000, by = 5000)) +
  labs(x = 'Year',
       y = 'Frequency',
       title = 'Suicide 2003-2013 by Year & Sex',
       fill = 'Sex') +
  theme(plot.title = element_text(family = 'Helvetica',
                                  color = '#666666',
                                  face = 'bold',
                                  size = 18)) +
  theme(axis.title = element_text(family = 'Helvetica',
                                  color = '#666666',
                                  face = 'bold',
                                  size = 12)) +
  theme(axis.title.y = element_text(angle = 90))

a2 <- ggplot(suicide.by.year.sex, aes(x = Sex, y = Count, fill = Sex)) +
  geom_bar(stat = "identity", position = position_dodge(), width = 0.5) +
  scale_y_continuous(breaks = seq(0, 40000, by = 10000)) +
  labs(x = 'Sex',
       y = 'Frequency') +
  theme(plot.title = element_text(family = 'Helvetica',
                                  color = '#666666',
                                  face = 'bold',
                                  size = 18)) +
  theme(axis.title = element_text(family = 'Helvetica',
                                  color = '#666666',
                                  face = 'bold',
                                  size = 12)) +
  theme(axis.title.y = element_text(angle = 90)) +
  facet_wrap(~ Data_Year)

grid.arrange(a1, a2, heights = 1:2)
```

### Suicide statistic by age

```{r, message = FALSE}
suicide.statistic<- suicide.11.years %>%
  group_by(Sex) %>%
  summarise(Group_Count = n(), Percentage = n() / length(.$Resident_Status),
            Mean = mean(Age_Value),
            Std = sd(Age_Value)) %>%
  mutate(perc.pos = cumsum(Percentage) - Percentage / 2,
         perc_text = paste0(round(Percentage * 100, "%"), "%") %>%
         mutate(mean.pos = cumsum(Mean) - Mean / 2,
                mean_text = round(Mean, 0))
  )
suicide.statistic
```

Please notice that the average age for both, male and female, are the same, 46 years old. Also notice that almost 79% of people that commit suicide are male and 21% are female.

### Graphing suicide 2003-2013 percentage & age mean by sex

```{r, message = FALSE}
# Suicide 2003-2013 Percentage by Sex
p1 <- ggplot(suicide.statistic, aes(x = "", y = Percentage, fill = Sex)) +

```

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geom_bar(stat = "identity", width = 1) +
geom_text(aes(y = perc.pos, label = perc_text),
  size = 4,
  colour = '#666666',
  family = 'Helvetica') +
coord_polar(theta = 'y', start = 0) +
  labs(title = 'Suicide 2003-2013 Percentage by Sex') +
scale_fill_brewer(palette = 'Blues') +
theme_minimal() +
  theme(axis.title.x = element_blank(),
axis.title.y = element_blank(),
axis.text.x = element_blank(),
panel.grid = element_blank(),
plot.title = element_text(family = 'Helvetica',
  color = '#666666',
  face = 'bold',
  size = 22))

# Suicide 2003-2013 Age Mean by Sex
p2 <- ggplot(suicide.statistic, aes(x = "", y = Mean, fill = Sex)) +
geom_bar(stat = "identity", width = 1) +
geom_text(aes(y = mean.pos, label = mean_text),
  size = 4,
  colour = '#666666',
  family = 'Helvetica') +
coord_polar(theta = 'y', start = 0) +
  labs(title = 'Suicide 2003-2013 Age Mean by Sex') +
scale_fill_brewer(palette = 'Blues') +
theme_minimal() +
  theme(axis.title.x = element_blank(),
axis.title.y = element_blank(),
axis.text.x = element_blank(),
panel.grid = element_blank(),
plot.title = element_text(family = 'Helvetica',
  color = '#666666',
  face = 'bold',
  size = 22))
grid.arrange(p1, p2)
...

### Subset by age

```{r, message = FALSE}
suicide.by.age<- suicide.11.years %>%
  filter(Age_Value< 200) %>%
  count(Age_Value)

suicide.by.age
...

### Percentage group by Age_Value 39 to 57

```{r , message = FALSE}
group.39.59 <- suicide.by.age %>%
  filter(between(Age_Value, 39, 57))

sum(group.39.59$n) / count(suicide.11.years) * 100
...

### Graphing suicide frequency by age

```{r}
ggplot(suicide.by.age, aes(x = Age_Value, y = n, colour = n)) +
geom_bar(stat = "identity", position = position_dodge()) +
scale_y_continuous(breaks = seq(0, 9000, by = 500)) +
  labs(x = 'Age',
  y = 'Frequency',
  title = 'Suicide 2003-2013 Frequency by Age',
  colour = 'Frequency') +
  theme(plot.title = element_text(family = 'Helvetica',
  color = '#666666',
  face = 'bold',
  size = 18)) +
  theme(axis.title = element_text(family = 'Helvetica',
  color = '#666666',
  face = 'bold',
  size = 12)) +
  theme(axis.title.y = element_text(angle = 360))
...

```

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```
### Subset by ICD10:
There were many ICD10 with frequencies less than 10. I decide to create a subset that contains frequencies greater than 100.

```{r, message = FALSE}
suicide.by.icd10 <- suicide.11.years %>%
  count(ICD10) %>%
  filter(n > 100) %>%
  arrange(desc(n))

suicide.by.icd10
```

ICD10	Description
X74, X72	by discharge of firearms
X73	Self-harm by rifle, shotgun and larger firearm discharge
X70	by hanging, strangulation and suffocation
X60, X64	by and exposure to drugs and other biological substances
X61	by and exposure to drugs and other biological substances
X62	by and exposure to drugs and other biological substances
X63	by and exposure to drugs and other biological substances
X65, X66, X68, X69	by and exposure to other and unspecified solid or liquid substances and their vapors
X67	by and exposure to other gases and vapors
X66	by and exposure to other and unspecified solid or liquid substances and their vapors
X44	by and exposure to drugs and other biological substances
X80	by jumping from a high place

Table is create for ICD10 with high frequency. Description for X73 was not found anywhere in the documentation files. The internet was searched for a accurate description and many websites agree that X73 description is a "Self-harm by rifle, shotgun and larger firearm discharge". The website can be accessed [here.](http://icdlist.com/icd-10/X73.9)

### Graphing frequency of ICD10

```{r, message = FALSE}
ggplot(suicide.by.icd10, aes(x = ICD10, y = n, fill = n)) +
  geom_bar(stat = "identity", position = position_dodge()) +
  scale_y_continuous(breaks = seq(0, 150000, by = 15000)) +
  labs(x = 'ICD10',
       y = 'Frequency',
       title = 'Suicide 2003-2013 ICD10 Frequency',
       fill = 'Frequency') +
  theme(plot.title = element_text(family = 'Helvetica',
                                  color = '#666666',
                                  face = 'bold',
                                  size = 18)) +
  theme(axis.title = element_text(family = 'Helvetica',
                                  color = '#666666',
                                  face = 'bold',
                                  size = 12)) +
  theme(axis.title.y = element_text(angle = 360),
        axis.text.x = element_text(angle = 45, hjust = 1))
```

### Calculating percentage of people that commit suicide by discharge of firearms.

```{r}
suicide.by.icd10 %>%
  filter(trimws(ICD10) %in% c('X74', 'X73', 'X72')) %>%
  summarise(Sum = sum(n) / nrow(suicide.11.years) * 100)
```

Please notice that 203,146 people committed suicide by discharge of firearms.

```{r}
percentage.by.icd10 <- suicide.by.icd10 %>%
  mutate(Percentage = n / nrow(suicide.11.years) * 100)
```

```{r, message = FALSE}
ggplot(percentage.by.icd10, aes(x = ICD10, y = Percentage, fill = Percentage)) +
  geom_bar(stat = "identity", position = position_dodge()) +
  scale_y_continuous(breaks = seq(0, 100, by = 10)) +
  labs(x = 'ICD10',
       y = 'Percentage %',
       title = 'Suicide 2003-2013 ICD10 Percentage',
       fill = 'Percentage') +
  theme(plot.title = element_text(family = 'Helvetica',

```

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        color = '#666666',
        face = 'bold',
        size = 18)) +
theme(axis.title = element_text(family = 'Helvetica',
        color = '#666666',
        face = 'bold',
        size = 12)) +
theme(axis.title.y = element_text(angle = 360),
axis.text.x = element_text(angle = 45, hjust = 1))
...

```

Please notice that almost **51%** people committed suicide by discharge of firearms. That is the combination of X72, X73, and X74.

### Subset by high school diploma & committed suicide by discharge of firearms.

```

```{r , message = FALSE}
# Counting all with high school diploma
hsd<- suicide.11.years %>%
  filter(Education == 12) %>%
  count(Education)
hsd

```

```

# Counting all with high school diploma & committed suicide by discharge of firearms.
suicide.hs.fa<- suicide.11.years %>%
  filter(Education == 12, trimws(ICD10) %in% c('X74', 'X73', 'X72')) %>%
  count(Education)
suicide.hs.fa

```

```

# Calculating percentage of people with high school diploma & committed suicide by discharge of firearms.
suicide.hs.fa$n / hsd$n * 100
...

```

Please notice that the percentage of people with an education level of high school diploma & committed suicide by discharge of firearms is **55%**, which is higher than all the people that committed suicide by discharge of firearms from 2003-2013, which is **51%**.

## Research

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# The *Stickiness* of Weight Stigma: An Examination of Residual Weight Stigma, Stigma Targets, and Willingness to Date

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### ABSTRACT

This research examined the stickiness of stigma related to being overweight and dating. Three studies explored whether residual weight stigma exists by comparing being overweight to other stigmatized conditions. The first study showed little evidence that overweight was a stigmatizing condition, with participants showing similarities in willingness to date someone who is overweight compared to other physical or medical conditions. There was partial support in the second study for the prediction that overweight was a stigmatizing condition in comparison to conditions related to physical appearance. The third study indicated that there was a tendency for participants to attribute greater personal responsibility for the overweight condition compared to other stigmatized conditions. Taken together, the results provided little evidence for residual stigma associated with the overweight condition and dating preferences.

**KEY WORDS:** Residual weight stigma; Social stigma; Appearance stigma; Dating.

### INTRODUCTION

Stigma directed at individuals who are obese (i.e., those with a Body Mass Index over 30) is pervasive and harmful, leading to prejudice and discrimination in employment, healthcare, and education.<sup>1,2</sup> Experiencing weight bias negatively affects one's mental and physical health and increases mortality risk.<sup>3-5</sup>

Underpinning the severity of this stigma is the perception that obesity is able to be controlled by the individual.<sup>6,7</sup> For example, psychological research demonstrates that people perceive individuals who are obese as responsible for their condition due to overeating and lack of exercise, which are perceived to be personally controllable factors.<sup>8-10</sup> Thus, obese individuals are characterized as lazy and/or lacking self-control.<sup>11-13</sup> Because of these attributions, people who are obese face a similar form of stigma to conditions that are also thought to be under one's personal control, such as being homeless and having an addiction.<sup>14</sup> There is evidence that obesity is considered the responsibility of the individual even when compared to other diseases and health conditions. For example, Crandall and Moriarty<sup>15</sup> noted that respondents perceived obesity to be behaviorally caused by the individual, similar to sexually transmitted diseases, and this resulted in others exhibiting greater social distance from those afflicted.

Obesity is also stigmatized more harshly than eating disorder conditions, such as anorexia or bulimia.<sup>16</sup> Research indicates that while eating disorders are perceived negatively, participants also associate positive attributes to those with these conditions (e.g., being thin and

losing weight).<sup>17,18</sup>

Issues of controllability are likely to affect the amount of stigma obese individuals face and contribute to obesity stigma moving from prejudice to discrimination. Interpersonal relationships are one area in which one's weight can affect outcomes, specifically in terms of romantic relationships. For example, overweight women are rated to be unattractive, unlikely to have a partner, and unworthy of attractive partners.<sup>19-21</sup> Similarly, men are less likely to respond to dating advertisements for women who identify as obese<sup>22</sup> compared to when the women identified as having drug problems.<sup>23</sup>

This issue of weight bias in dating seems to be primarily a women's issue, with research showing that women are judged more harshly for their weight than men.<sup>21,24,25</sup> For example, Meltzer<sup>26</sup> and colleagues conducted a 4-year longitudinal study on married couples and found that when controlling for extraneous variables, such as income level and education, partners reported more marriage satisfaction if the wife was thinner than the husband. Moreover, when romantic partners do not have similar body shapes (i.e., if one partner carries more weight than the other), they are stigmatized and are viewed as having a less successful relationship.<sup>27</sup>

Unfortunately for those who are overweight, weight stigma is long-lasting.<sup>16,28</sup> The term *residual stigma* is used to refer to stigma that exists after a stigmatized condition is remedied (e.g., an obese person loses weight), and research indicates that those who lose weight are viewed more positively yet are still rated as unhealthy compared to weight-stable individuals.<sup>29-31</sup> Moreover, these studies note that the way in which one loses weight is a moderating factor. For example, Fardouly and Vartanian<sup>29</sup> found that individuals who lost weight through diet and exercise were rated more positively than those who lost weight through surgery. Those who lost weight through surgery were still viewed as lazy, even after losing the weight.

Residual stigma is a relatively new concept. Therefore, in the current set of studies, we sought to expand the literature regarding residual stigma in relation to weight, or the *stickiness* (i.e., persistence) of weight stigma. For our first study, we sought to examine if weight stigma still resides, or sticks, after one has lost the weight, specifically in the area of dating. We wanted to address a gap in the literature regarding residual stigma and dating as well as expand on earlier research regarding the desirability of overweight individuals.<sup>20,22,30</sup>

## Study 1

We designed Study 1 to examine the first set of hypotheses, which focused on comparing being overweight with other physical and social conditions. Research has noted that being overweight is often compared to being homeless or having an addiction.<sup>11,14</sup>

Therefore, we sought to frame the first study by comparing residual stigma associated with being overweight to other stigmatized groups, including those who face addictions. For our first hypothesis, we predicted that currently having a stigmatized condition would be associated with lower willingness to date than having had a condition in the past ( $H_1$ ). This prediction is based on research by Romer and Bock,<sup>32</sup> which suggests that having overcome a stigmatized condition is judged more favorably than currently having a stigmatized condition.

In addition, based on the research indicating the severity of the stigma associated with being overweight,<sup>2,11,14</sup> we predicted that participants would be less willing to date a person who is currently overweight compared to the other conditions ( $H_2$ ). The stigma targets that were used for comparison included the following: being an alcoholic, being a drug addict, being overweight (at least 50 lbs), being homeless, having ovarian cancer (female) or prostate cancer (male), having lung cancer, having an eating disorder, or suffering from clinical depression.

These stigma targets were chosen for several reasons. First, with the exception of the lung and prostate cancer condition, the targets are groups of people who often experience blame for their condition. For example, being homeless, an alcoholic, and a drug addict are viewed as the fault of the individual,<sup>14</sup> and even those with lung cancer are viewed as being at fault for their conditions due to smoking, even when that is not the direct cause.<sup>33</sup> Similarly, those who are overweight are also blamed for their condition,<sup>8-10</sup> even if the condition could be due to genetics or medication. Having an eating disorder was chosen as a comparison group because dating someone with an eating disorder, such as anorexia or bulimia, has been shown to be preferred to dating a person who is obese.<sup>34</sup> Ovarian or prostate cancer was used to have a comparison to the cancer (e.g., lung cancer) that people often view as the fault of the individual. Finally, suffering from clinical depression was used as a stigma target because mental illness is also a highly stigmatized condition, and like being overweight, an individual suffering from the condition often self-stigmatizes.<sup>35</sup>

Due to the severity associated with weight stigma, for our third hypothesis, we predicted that participants would be less willing to date people who used to be overweight than a person who used to have the other social and behavioral conditions ( $H_3$ ). Finally, we predicted that participants would rank formerly overweight individuals as least likely to date over those who used to have the other social and behavioral conditions ( $H_4$ ).

## MATERIALS AND METHODS

### Participants

Participants (81; 53 women, 27 men, 1 other) were undergraduate students from a large (23,000+) public university located in the

southeastern U.S. Students ranged in age from 18-46 ( $M=20.74$ ,  $SD=4.88$ ). Most of the participants were either Caucasian (46; 57%) or African-American (28; 35%). The majority of participants were freshmen (41; 51%) or sophomore (22; 27%).

Participants came from a psychology department mass-pretesting session conducted at the beginning of an academic term. Students volunteered from the General Psychology course to complete a survey containing a variety of demographic, behavioral, and attitudinal measures. They participated in groups of 10-30, signed an informed consent form, completed the survey in approximately 20 minutes, and received course research credit for their participation.

Brinthaup and Pennington<sup>36</sup> provide a more detailed description about the structure and operation of the pretesting session and resulting data archive.

### Materials and Procedure

As part of the pretesting survey, participants received a series of statements describing people who currently have or have had several different kinds of conditions or experiences. Ratings and rankings appeared on the survey in the following order. Instructions directed participants to assume that the information provided was all that they knew about the target person and to rate each statement using a 5-point Likert scale (0=*strongly disagree*, 4=*strongly agree*). The targets included eight physical or medical conditions. Each statement began with the stem “*I would be willing to date someone who...*” In particular, participants first rated their willingness to date someone who is an alcoholic, is a drug addict, is overweight (at least 50 lbs), homeless, has ovarian cancer (female) or prostate cancer (male), has lung cancer, has an eating disorder, or suffers from clinical depression.

Following the current condition ratings, participants rated their willingness to date someone who used to have those same conditions (e.g., “USED to be an alcoholic”). Finally,

participants rank ordered each of the eight conditions in terms of their likelihood of dating someone who used to have that condition (1=*your top choice (most likely to date)*, 8=*your last choice (least likely to date)*). Seven participants failed to follow the directions for the ranking task, resulting in a sample size of 74 for these data.

### Results and Discussion

Table 1 presents the descriptive statistics for the current and past versions of each of the conditions. As the  $t$ -test and mean values in the table show, the data supported our first hypothesis that currently having any of the stigmatized conditions (including overweight) would be associated with lower willingness to date than having had the conditions in the past. Analysis of gender differences on the 16 current and past condition ratings (using Bonferroni adjusted  $\alpha$ - levels of .003 per test (.05/16)) revealed no conditions with statistically significant differences.

Our second hypothesis predicted that participants would be less willing to date a person who is currently overweight over the other current conditions. Paired samples  $t$ -test analyses comparing the overweight condition to the other conditions (using Bonferroni adjusted  $\alpha$ -levels of .006 per test (.05/8)) revealed several interesting results. First, as Table 1 indicates, participants reported being *more* willing to date a person who is currently overweight than a person who is an alcoholic ( $t(80)=6.36$ ,  $p<.001$ ), a drug addict ( $t(80)=9.42$ ,  $p<.001$ ), or homeless ( $t(80)=6.50$ ,  $p<.001$ ). Overweight was not significantly different from the remaining conditions. Therefore, this hypothesis was not supported.

The third hypothesis specifically examined how residual weight stigma would be related to willingness to date when compared to other stigmatized conditions. With respect to having had the condition in the past, participants reported being *more* willing to date a person who used to be overweight than a person who was an alcoholic ( $t(80)=3.88$ ,  $p<.001$ ), a drug

**Table 1: Dating Willingness Ratings of Target with Physical or Medical Condition Currently or in the Past.**

Item	Currently...		Used to...		t-value	d
	Mean	SD	Mean	SD		
Is/be overweight (at least 50 lbs)	1.88	1.05	2.99	0.68	8.17 ***	1.25
Is/be an alcoholic	0.88	1.08	2.59	0.93	14.36 ***	1.70
Is/be a drug addict	0.53	0.92	2.23	1.12	13.27 ***	1.66
Is/be homeless	1.07	1.05	2.93	0.80	14.33 ***	1.99
Has/have ovarian/prostate cancer	2.20	0.99	2.85	0.85	6.47 ***	0.70
Has/have lung cancer	1.98	1.02	2.69	0.83	7.54 ***	0.76
Has/have an eating disorder	1.73	1.16	2.77	0.81	8.40 ***	1.04
Suffer(s) from clinical depression	1.84	1.21	2.80	0.73	7.96 ***	0.96

Note: N=81. Participants rated the items using a 5-point scale (0=strongly disagree, 4=strongly agree). \*\*\*  $p<.001$ .

addict ( $t(80)=6.42, p<.001$ ), or had lung cancer ( $t(80)=3.22, p<.003$ ). There were no conditions in comparison to which participants were significantly less willing to date a person who used to be overweight. Thus, there was no evidence of residual stigma associated with overweight and no support for the third hypothesis. We also conducted a 2 (gender: Male, female) X 2 (time: Current, past) mixed ANOVA on the overweight condition. While replicating the time difference reported earlier, this analysis revealed no significant interaction between gender and time.

Our final analysis of the residual stigma question addressed how participants would rank individuals who used to have stigmatized conditions in terms of willingness to date. Analysis of the rank data revealed that overweight was ordered near the middle of the conditions ( $M=4.08, SD=2.04$ ), with drug addict ranked the lowest ( $M=6.50, SD=1.99$ ) and being homeless ranked the highest ( $M=2.54, SD=2.17$ ). Consideration of the individual rankings of overweight indicated that 55% of participants ordered this condition as one of their top four preferences with respect to willingness to date, with 45% ordering it as one their four lowest preferences. Six participants ranked overweight as their top choice, and two ranked it as their lowest choice. The one-way chi-square test of the rankings indicated a significant effect,  $X^2(7)=15.08, p<.04$ . Thus, there was no support for  $H_4$ , that participants would rank overweight individuals as least likely to date compared to the other social and behavioral conditions.

In summary, we found little evidence that overweight was an especially stigmatizing condition. Participants showed similar patterns of willingness to date for overweight compared to other physical or medical conditions. The evidence for residual stigma was similar for overweight and the other conditions. Participants also placed overweight as relatively moderate in terms of their preferential ranking of all the conditions. These results provide little support for the view that overweight is a particularly pernicious stigma, at least when it comes to willingness to date.

## Study 2

In Study 1, our comparisons focused on conditions that may not be visible to the eye. For example, a person can look at another individual and not know that person is a drug addict or is depressed. For our second study, we sought to examine residual weight stigma in comparison to physical characteristics or conditions that are visible to the eye. Thus, for Study 2, we had similar hypotheses and research questions. However, in Study 2, we compared overweight to other visible physical conditions. These conditions included the following: Someone who has acne, has a large birthmark on their cheek, wears eye glasses, stutters when they speak, is missing a front tooth, is underweight (at least 15 lbs.), or has a tattoo on their face. We chose these conditions because they are easily visible to other people, as is

overweight.

Therefore, we hypothesized the following:

$H_5$ : Currently having a visible physical condition will be associated with lower willingness to date than having had a physical appearance condition in the past.

$H_6$ : Participants will be less willing to date a person who is currently overweight over the other current visible physical condition conditions.

$H_7$ : Participants will be less willing to date a person who used to be overweight over the other physical conditions that one used to have.

$H_8$ : Participants will rank formerly overweight individuals as least likely to date over the other physical conditions.

## MATERIALS AND METHODS

### Participants

Participants (83; 46 women, 37 men) were undergraduate students from a large (23,000+) public university located in the southeastern U.S. Students ranged in age from 18-43 ( $M=19.73, SD=3.19$ ). Most of the participants were either Caucasian (41; 49%) or African-American (30; 36%). The majority of participants were freshmen (58; 70%) or sophomore (20; 24%). Participants came from public speaking courses and were drawn from a different academic term than the Study 1 participants. They completed the materials in class, after signing an informed consent form. Students finished the survey in approximately 20 minutes and received course research credit for their participation.

### Materials and Procedure

The methodology and procedure were the same as with Study 1. In this case, we included overweight with conditions that were more visible to the eye. In particular, participants first rated their willingness to date (0=*strongly disagree*, 4=*strongly agree*) someone who has acne, has a large birthmark on their cheek, is overweight (at least 50 lbs.), wears eye glasses, stutters when they speak, is missing a front tooth, is underweight (at least 15 lbs.), or has a tattoo on their face. Following the current condition ratings, participants rated their willingness to date someone who used to have the same conditions. Finally, participants rank ordered each of the eight conditions in terms of their likelihood of dating someone who used to have that condition (1=*your top choice (most likely to date)*, 8=*your last choice (least likely to date)*). Three participants failed to follow the directions for the ranking task, resulting in a sample size of 80 for the ranking data.

### Results and Discussion

Table 2 presents the descriptive statistics for the current and past

versions of each of the conditions. As the table indicates, there were negative aspects of most of the conditions. In particular, participants were significantly less likely to want to date targets who currently had each of the conditions (except eyeglasses) compared to targets who used to have those conditions. These results replicated the time findings from Study 1, showing support for hypothesis five (that currently visible physical conditions would be associated with lower willingness to date than having had those conditions in the past). As Table 2 indicates, seven of the eight conditions showed that current-condition ratings were significantly lower than past-condition ratings. Analysis of gender differences on the 16 current and past condition ratings (using Bonferroni adjusted  $\alpha$ -levels of .003 per test (.05/16)) revealed no conditions with statistically significant differences.

For hypothesis six, we used paired-samples *t*-tests (using Bonferroni adjusted  $\alpha$ -levels of .006 per test (.05/8)) to compare the overweight condition to the other physical appearance conditions. These analyses revealed several interesting results. First, as Table 2 shows, participants reported being less willing to date a person who is currently overweight than a person who has acne ( $t(82)=4.49, p<.001$ ), a facial birthmark ( $t(82)=3.68, p<.001$ ), or wears glasses ( $t(82)=9.92, p<.001$ ). They reported being more willing to date a person who was currently overweight than a person who is missing a front tooth ( $t(82)=7.23, p<.001$ ) or has a facial tattoo ( $t(82)=7.62, p<.001$ ). Thus, there was partial support for hypothesis six, that participants would be less willing to date a currently overweight person than a person with other visible physical conditions.

The seventh hypothesis specifically examined how residual weight stigma would be related to willingness to date when compared to the other physical appearance conditions. With respect to having had the condition in the past, participants reported being less willing to date a person who used to be overweight than a person who used to have acne ( $t(82)=2.96, p<.005$ ) or wear glasses ( $t(82)=3.29, p<.001$ ). They reported being more willing to date a person who used to be overweight than a person who used to have a tattoo on their face ( $t(82)=6.05, p<.001$ ). Therefore, there was minimal support for the seventh

hypothesis. As with Study 1, we conducted a 2 (gender) X 2 (time: Current, past) mixed ANOVA on the overweight condition. This analysis revealed no significant interaction between gender and time.

Our final analysis of the residual stigma question addressed how participants would rank individuals who used to have the various physical appearance conditions in terms of willingness to date. Analysis of the rank data revealed that, as in Study 1, overweight was ordered near the middle of the conditions ( $M=4.08, SD=2.00$ ), with having had a facial tattoo ranked the lowest ( $M=6.96, SD=1.64$ ) and used to wear glasses ranked the highest ( $M=2.26, SD=1.98$ ). Consideration of the individual rankings of overweight indicated that 60% of participants ordered this condition as one of their top four preferences with respect to willingness to date, with 40% ranking overweight in the four lowest preferences. Ten participants ranked overweight as their top choice, and seven ranked it as their lowest choice. The one-way chi-square test of the rankings indicated a significant effect,  $X^2(7)=22.80, p<.002$ . Thus, there was little support for  $H_3$ , that participants would rank formerly overweight individuals as least likely to date compared to the other physical conditions.

In summary, we found partial support for the prediction that overweight was a stigmatizing condition in comparison to conditions related to physical appearance. Compared to Study 1 (which examined a variety of disease and behavioral conditions), Study 2 results showed that, relative to certain physical appearance conditions, there may be some stigma associated with being overweight. However, similar to Study 1, there was little evidence for residual stigma associated with the overweight condition.

### Study 3

To better understand the findings of Studies 1 and 2, we also needed to understand the extent to which individuals consider obesity to be an issue of personal responsibility compared to other stigmatized conditions. While there have been several studies regarding personal responsibility of one being overweight, the

**Table 2:** Dating Willingness Ratings of Target with Physical Appearance Condition Currently or in the Past

Item	Currently...		Used to...		t-value	d
	Mean	SD	Mean	SD		
Is/be overweight (at least 50 lbs)	2.28	1.05	3.16	0.90	7.53 ***	0.90
Has/have acne	2.80	0.92	3.41	0.68	6.68 ***	0.75
Has/have a large birthmark on their cheek	2.71	0.90	3.22	0.81	4.70 ***	0.60
Wear(s) eye glasses	3.57	0.57	3.47	0.65	1.65	0.16
Stutter(s) when they speak	2.48	1.00	3.23	0.85	6.90 ***	0.81
Is/be missing a front tooth	1.31	1.05	3.02	1.06	13.64 ***	1.62
Is/be underweight (at least 15 lbs)	2.52	0.92	3.16	0.89	6.08 ***	0.71
Has/have a tattoo on their face	1.12	1.34	2.41	1.31	9.51 ***	0.97

Note: N=83. Participants rated the items using a 5-point scale (0=strongly disagree, 4=strongly agree). \*\*\* $p<.001$ .

extant research<sup>10,14,15</sup> was conducted prior to obesity being labeled a disease in 2013 by the American Medical Association.<sup>37</sup> Thus, we sought to examine the level of controllability that individuals associate with being overweight compared to the variety of other conditions we used in Studies 1 and 2 (e.g., homelessness, drug addiction, depression, cancer, missing teeth). Based on previous research, we predicted that participants would attribute personal responsibility for being overweight more than the other conditions ( $H_9$ ).

**Materials and Method**

**Participants**

Participants (257; 169 women, 88 men) were undergraduate students from a large (23,000+) public university located in the southeastern U.S. Students ranged in age from 18-67 ( $M=19.81$ ,  $SD=4.89$ ). Most of the participants were either Caucasian (156; 61%) or African-American (55; 21%). The majority of participants were freshmen (151; 59%) or sophomore (70; 27%).

Participants came from a similar Psychology Department mass-pretesting session as described in Study 1. They completed the measures in a different academic term from the previous studies. They participated in groups of 10-30, signed an informed consent form, completed the survey in approximately 20 minutes, and received course research credit for their participation.

**Materials and Procedure**

We examined the extent to which participants believed that a

person with a medical, behavioral, or physical appearance condition is personally responsible for that condition. We used the 16 unique items from Studies 1 and 2 and worded the items in present tense (e.g., “someone who is an alcoholic” and “someone who has a tattoo on their face”). The complete list of items appears in Table 3.

Participants received these instructions for rating the items: *For the following items, please rate the extent that you believe that the person with the “condition” is personally responsible for having that condition. Without knowing anything else about the person, to what extent do you think having the condition is due to their own behaviors, actions, or lifestyle?* They rated these items with a 5-point scale (0=They are not at all personally responsible for this condition, 2=They are moderately personally responsible for this condition, 4=They are completely personally responsible for this condition).

**Results and Discussion**

Table 3 provides descriptive statistics and results of *t*-test comparisons of mean responsibility ratings to the rating scale midpoint. As the table shows, participants rated four items significantly above the midpoint: Alcoholic, drug addict, overweight, and tattoo (using Bonferroni adjusted  $\alpha$ -levels of .003 per test (.05/15)). Except for the homeless, eating disorder and underweight items, participants rated all the remaining conditions as significantly below the midpoint, with the person being less rather than more responsible for those conditions.

As we expected, overweight was more likely than most other conditions to be seen as something for which one is per-

**Table 3:** Personal Responsibility Ratings of Medical, Behavioral, and Physical Appearance Conditions

Item	Mean	SD	t-value	d
Someone who is overweight (at least 50 lbs).	2.58	0.87	10.66 ***	0.67
Someone who is an alcoholic.	3.00	0.90	17.76 ***	1.11
Someone who has acne.	0.82	0.78	-24.39 ***	1.51
Someone who is a drug addict.	3.16	0.88	21.22 ***	1.32
Someone who has a large birthmark on their cheek.	0.03	0.20	-153.91 ***	9.85
Someone who wears eye glasses.	0.44	0.80	-31.41 ***	1.95
Someone who is homeless.	2.07	0.94	1.13	0.07
Someone who has ovarian (female) or prostate (male) cancer.	0.31	0.64	-42.43 ***	2.64
Someone who stutters when they speak.	0.31	0.60	-45.09 ***	2.82
Someone who has lung cancer.	1.30	1.18	-9.61 ***	0.59
Someone who is missing a front tooth.	1.49	1.00	-8.23 ***	0.51
Someone who has an eating disorder (i.e., anorexia or bulimia).	1.87	1.25	-1.64	0.10
Someone who is underweight (at least 15 lbs).	1.81	1.06	-2.87	0.18
Someone who suffers from clinical depression.	1.12	1.01	-14.09 ***	0.87
Someone who has a tattoo on their face.	3.82	0.62	47.08 ***	2.94

Note: N=257. Participants rated the items using a 5-point scale (0=They are not at all personally responsible for this condition, 4=They are completely personally responsible for this condition). Means were tested against the scale midpoint (2=They are moderately personally responsible for this condition). \*\*\* $p < .001$

sonally responsible, with participants rating it between the moderately and largely responsible response options. Analysis of the percentage of participants who chose each of the five response options revealed that most respondents chose either the moderately personally responsible (38.5%), largely personally responsible (41.2%), or completely personally responsible (13.3%) options for the overweight item. The one-way chi-square test of the response options indicated a significant effect,  $\chi^2(4)=178.08$ ,  $p<.001$ . Thus, the ninth hypothesis, that participants would attribute personal responsibility for being overweight more than the other conditions, was partially supported.

Matched-pairs *t*-tests comparing overweight ratings to the other conditions revealed several significant differences. As Table 3 indicates, someone who is overweight was judged to be less personally responsible for that condition than a target who is an alcoholic ( $t(256)=6.04$ ,  $p<.001$ ), a drug addict ( $t(256)=9.14$ ,  $p<.001$ ), or has a facial tattoo ( $t(256)=20.60$ ,  $p<.001$ ).

Participants rated overweight as a condition with significantly greater personal responsibility than all of the other conditions (all  $p<.001$ ). We also examined gender differences in the responsibility ratings. This analysis indicated that (using Bonferroni adjusted alpha levels of .003 per test (.05/15)) none of the 15 items showed significant gender differences.

The results suggest that there is a tendency for participants to attribute greater personal responsibility for the overweight condition compared to some of the other disease, behavioral, and physical appearance conditions. In Studies 1 and 2, three of the most stigmatized conditions (alcoholic, drug addict, and facial tattoo) were lower on dating likelihood than overweight, and overweight was rated as a condition for which one was less personally responsible compared to these conditions. However, despite overweight being rated more personally responsible than the remaining conditions, most of these did not show differences in dating preference relative to overweight. Thus, the responsibility data did not provide support for the residual weight stigma concept.

## DISCUSSION

These studies examined the concept of residual weight stigma in the context of dating, specifically examining how residual weight stigma is perceived when compared to social, behavioral, and physical conditions. Results from Study 1 revealed that when compared to social and behavioral conditions, such as alcoholism, drug addiction, and homelessness, being overweight was less stigmatized both regarding current and past conditions. In addition, the results from Study 2 showed that being overweight was stigmatized, but it fell in the midpoint of stigmatized conditions both past and present, indicating that there is little residual stigma associated with being overweight in the context of dating. Finally, Study 3 examined the extent to which participants viewed individuals as personally responsible

for the conditions they have. The results revealed that individuals view an overweight person as more personally responsible for many but not all of the conditions we examined.

While we found in Studies 1 and 2 that obesity stigma was not as severe as other stigmatized conditions, previous research<sup>14-16</sup> has shown different findings. Obesity stigma has been viewed as one of the worst stigmas that currently exists,<sup>2</sup> and our findings confirm that obesity stigma exists in the context of data. However, unlike other studies, we found that when compared to other highly stigmatized conditions, being overweight is not as stigmatized in the context of dating. For Study 1, several of the conditions, including alcoholism and drug addiction, could be harmful either to the individual with the condition or to those who associate with that person. Therefore, it is likely that participants viewed dating someone as being overweight as less harmful than these other conditions. Similarly, Latner and colleagues,<sup>30</sup> concept of residual stigma was not supported with these studies when compared to other conditions in the context of dating. Residual weight stigma was similar to the residual stigma of other social and behavioral conditions (i.e., Study 1) and being overweight was not stigmatized as much as some other physical conditions in Study 2. These findings are not supported by previous research.

However, despite being less stigmatized than other conditions, participants still rated overweight as a condition for which one is more personally responsible for than other conditions (Study 3). The third study examined all of the conditions in general, without any reference to dating. This brings up more questions regarding current and residual weight stigma in dating. Few research studies have focused specifically on the context of dating and obesity or overweight stigma. Studies that have examined the weight stigma and dating<sup>19,21,22</sup> have primarily examined overweight individuals in comparison with *normal* weight individuals and found that participants are less likely to date overweight partners. This study expanded on that research and situated the idea of overweight stigma in comparison to other physical, social, and behavioral conditions.

It is also worth noting that studies of obesity stigma conducted prior to 2013 examined obesity as a condition that a person brought upon him or herself. However, since 2013, obesity has been classified as a disease by the American Medical Association.<sup>37</sup> Thus, this classification could be a reason for why the stigma regarding overweight is not as severe as other conditions. Future research will need to examine if the classification of obesity as a disease is related to perceptions of stigma, whether people are aware of or agree with the disease classification, and the extent to which people differentiate between conditions of overweight and obesity with respect to their perceptions and preferences.

Overall, the results of this study lead to more questions regarding residual weight stigma, general weight stigma, and

dating. This topic is worth exploring further, for as the obesity rate continues to increase,<sup>38</sup> more of the population will have to consider dating individuals who fall into the obese category. This could create issues with how individuals seek partners, what they are willing to accept in a partner, partner expectations, and partner communication.

#### LIMITATIONS AND FUTURE RESEARCH

It is important to note that this study is not without limitations. First, while using a college research pool is convenient, the results may not be generalizable to other populations. Future research should seek to examine perceptions of overweight stigma outside the college population. The results may also have been different if we surveyed individuals regarding their perceptions about stable, long-term relationships (e.g., marriage) rather than shorter-term dating behavior.

Second, because there is a lack of research in the realm of residual weight stigma and dating, we created this study as exploratory in nature. Thus, our questions to participants were broad. Future research could seek to ask more specific questions regarding overweight and obesity stigma in the realm of dating.

Finally, previous research regarding overweight and dating has found gender differences, with men being more likely to stigmatize women regarding weight.<sup>22,24</sup> Our studies found no gender differences in terms of willingness to date individuals who are currently and used to be overweight. Future research might examine whether employing weight stigmatization is differentially related to willingness to date for men and women.

#### CONCLUSION

The present studies provided little evidence for residual stigma associated with the overweight condition and dating preferences. This exploratory set of studies has helped us understand the level of stigma associated with weight *versus* other conditions. The practical implications of this study include knowing how college students view weight in relation to other stigmatized conditions when it comes to dating among this age group. Residual weight stigma is a unique concept that can be further explored in relation to other conditions and interpersonal or group relationships.

#### CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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## Review

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# Impact of the Shadow Activity on Social and Economic Relationships, Income Level and Welfare of the Population

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## ABSTRACT

The main purpose of the literature review is an analysis of the impact of shadow activity on social and economic relations and the welfare of the population. The scientific novelty of the research is in the development and realization of the model of interaction of the state and population as a factor contributing to the shadow economic activity. It was shown that shadow economy promotes an increase in the welfare of the population only in case of one representative and on the contrary it decreases the welfare of the population when represented by many representatives. The direct dependence of the growth of the state debt and the growth of a share on the shadow economy was elaborated. The social reasons underlying the growth of shadow activity and the level of its impact on the welfare of the population was analyzed in various countries. It was reasoned that the high-level of shadow economy in the Russian Federation intensifies the social inequality and discrepancies associated with the income and property of its population. The scale and differentiation of the shadow activity was distinct in the constituent territories of the Russian Federation, including the Republic of Dagestan.

**KEY WORDS:** Excess profits; Shadow economy; Industrial and developing countries; Impact; Russian Federation; Labor relations; Disguised employment; Income level; Social differentiation; Welfare of population; Model simulation.

## INTRODUCTION

In the modern world, problems associated with the shadow economy is a very significant concern for Russia and many foreign countries. Thereby, some branches of the shadow activity (financing of extremism and terrorism, drug business, and corruption) were recognized as potential threats to the national economic stability of the state structure. These issues were fairly included in the list of global problems affecting the modern world.

The shadow economy is typical of all methods of production and is an essential characteristic of the social and economic processes. There are many possible definitions of the "shadow economy". The most distributed definition of the shadow economy in the academic circles was formulated by Thomas who stated that: "...shadow economy is an economic activity such that the income derived from it avoids government regulations, taxation and control".<sup>1</sup>

It is noteworthy that, developed industrial countries have been solving the problems of shadow economic activity for a long time already. Among the works of the leading specialists who dedicated their studies to this topic and are worth being mentioned are P Willis, D Gershuni, D North, M Carter, E De Soto, K Simisa and K Hart. Among the soviet and Russian scientists, a significant contribution was made by scientists as S Menshikov, A Krylov, Yu Korchagin, S Golovnin, N Bokun, A Abalkin, A Ponomarenko and many others, towards research concerning shadow economy problems.

Despite the fact that social and economic research of the shadow economy has been investigated over several decades, its specific attributes have still not been properly studied. In particular, the problems associated with the impact of shadow economy on the level of income differentiation and welfare of the population and economic interests, that forms the basis of shadow economic activity has not been studied in great detail.

## DISCUSSION

There are many possible reasons supporting the shadow economic activity that is studied in great detail in the world practice. The shadow economy arises under the conditions when it is profitable to hide the economic activity from the general public. The shadow economy, as a rule, is rather closely connected to the official economy. Presently, there has been a mention of a new stage in the development process of the shadow economy, such that an institutionalization of the relations of the shadow economy with the authorities was established. The shadow economic activity has already moved beyond the official economy and has become parasitic in all the spheres of society life: from household economies to large companies, including state activity and the changing level and living standards of the population of the country.<sup>2</sup>

One of the contributing factors in the development of shadow economy is attributed to social factors. These factors are associated with the inability to fulfill the social orientation obligations by the state, availability of social and psychological climate and objectives in the society, existing social and economic problems of the society. Reports of domestic and also the foreign experience show that as soon as this system is destroyed and fails, the shadow economy obtains the additional stimulus for development. Contradictions between the demands of economy development and state policy also significantly affect the process of formation of the shadow economy.

Studies conducted by researchers from different countries confirm that the degree of impact of a shadow sector on social and economic relations weakens while the economy develops. The first comparative study of the volumes of shadow economy in different countries was performed in 1991 by the UN Economic Commission. The next project was implemented together with Eurostat from September 2001 till June 2002. Only 9 countries participated in the 1<sup>st</sup> project while in the 2<sup>nd</sup> project, 29 countries took part. According to the results of the project, the volume of the shadow economy was: Canada – 3% of GDP, Ireland – 4% of GDP, Belgium – 3-4% of GDP, Italy – 15% of GDP, Croatia – 8% of GDP, Macedonia – 14% of GDP. The states that were included in the EU after May 01, 2001, had the following levels of shadow economic activity: Czech Republic – 9% of GDP, Poland – 13% of GDP, Bulgaria and Hungary – 16% of GDP each, Latvia – 17% of GDP, Lithuania – 18% of GDP, Slovakia – 22% of GDP. CIS countries have a higher volume of the shadow economy: Belarus – 12% of GDP, Turkmenistan – 14% of GDP, Kazakhstan – 27% of GDP, Armenia – 29% of GDP,

Moldova – 31% of GDP and Kirghizia – 48% of GDP.<sup>3</sup>

According to the research undertaken by the World Bank for 2014, the shadow economy is: China – 13% of GDP, Switzerland – 8% of GDP, Israel – 7% of GDP, Russian Federation – 43% of GDP. As the statistics and its analysis indicate, developed industrial countries have a comparably low-level of shadow economy relative to the developing countries (40-48% of GDP).

In the Russian Federation, the shadow economic activity is widely distributed in terms of labor relations. About 51% of the total entrepreneurship in Russia, is presently working on the shadow economy.<sup>4</sup> In case of the absence of official registration of the business, labor relations are not regulated by legal norms and labor contracts, and are based upon informal agreements. The development of shadow relations in the employment sphere decreases sharply the level of guarantee for an employee and does not ensure him of the legal protection of his rights. This condition influences various aspects of economy:

- Remuneration of labor (discretionary establishment of the salary, that often does not correspond to the real labor contribution);
- Mode of work (non-standard working day without any compensation for overtime works and work during holidays and weekends);
- Working conditions (insanitary conditions, non-observance of labor safety norms);
- Dismissal procedure (absence of the preliminary notice and the non-payment of the dismissal compensation, lack of protection from the discretionary dismissal);
- Social guarantees (refusal to provide a regular annual leave and monetary compensation during the period of temporary disability);
- Pension coverage (off the record wages are not taken into account for the pension calculation).

According to the estimations of the Centre of Macroeconomic Research of the Russian Federation, published in 2014, about 20 million Russians worked in the “informal” sector of the economy of Russia, which is 10% less in number than in 2011. However, about 4 million of them were self-employed. Eventually, 16 million people were employed without any registration in accordance to the labor legislation in 2014 that was 20% of the working-age population of the country. At the same time, for 91% of the people belonging to this category of employees, the informal salary is a main source of their income.

In Russia, the volume of the shadow economic activity was differentiated mainly according to the constituent entities of the Federation. Thus, the shadow employment is minimal in the north-east of the Russian Federation. For instance, in 2015 only 2% of the population was employed in Saint Petersburg, Russia.<sup>5</sup> In Moscow, this indicator was about 3.5%. The shadow employment in the republics of the North Caucasian district is the

highest.<sup>4</sup> For example, in the Republic of Dagestan, the shadow employment was more than 12% for the employed population of this region. Also, high-level of unemployment is a typical characteristic for the Republic of Dagestan (according to the methodology of the International Labour Organization for 2015, in the Republic of Dagestan where 11.9% of the economically active population were unemployed). The high rates of unemployment typical to the Republic of Dagestan as well as for other regions of the North Caucasian Federal District (excluding the Stavropol Territory) is estimated by the faster growth of labor resources, absence of significant number of permanent working places especially in the rural area.<sup>6</sup> In the Republic of Dagestan, the number of unemployed people registered in the state institutions of employment service was 38 people per vacant position in December 2015.<sup>7,8</sup>

One of the existing problems of the modern society is social differentiation that results in the growth of the shadow and criminal activity. The shadow activity “attracts” a large number of deprived people due to the existence of deformed, destructive relations in the social sphere.<sup>9</sup> The number of potential participants of the shadow economy is determined from the structure of the society. The representatives of the low-income and marginal layers are mainly involved: youth, unemployed people, workers-immigrants, etc. According to their number, they constitute the main layer of participants of the shadow economy. The availability of these or other “groups of risk” among the population composes the “shadow potential” of the society and this provokes the growth of the shadow economic activity. Most of the work force of the criminal economic actions constitutes the low-income marginal layers of the population. The heavy social situation triggers young people to participate in criminal organizations, mostly leading the unemployed people to indulge in the shadow business such that the workers-immigrants look for working places mostly in the shadow sector of the economy.

On the basis of the rating for the complex living standards of the Legatum Institute in 2015, the first ten countries have been ranked in the following order: Norway, Switzerland, Canada, Sweden, New Zealand, Denmark, Australia, Finland, Netherlands, and Luxemburg. They received an advantage in comparison to the economically developed countries such as Singapore, Hong Kong and Japan due to a lower share of the shadow economy and high efficiency of the state. Thus, according to the level of the shadow activity in order of its increase, Slovenia ranks 24, Czech Republic – 34, Estonia – 36, Slovakia – 38, Hungary – 41, Lithuania – 43, Kazakhstan – 47, Latvia – 48, Bulgaria – 49, China – 51, Croatia – 53, Romania – 55, Mongolia – 57, Belarus – 58, Georgia – 84 and unfortunately, the Russian Federation ranks 88. According to the gross domestic product (GDP) level per capita, Russia is ahead of many countries that rank much higher than it, though this key factor has been decreased under the conditions of crisis and a fall in the rouble exchange rate. This situation can be explained by the fact that a major aspect of the national wealth of Russia is con-

centrated in the hands of several hundreds of families with the highest income. Consequently, in the Russian Federation, there is a huge differentiation and inequality between the incomes of the population. The coefficient of funds (ratio of the average salary of the employed people with the highest salary to the average salary of 10% of the employed people with the lowest salary) is 20% though it should have been lower than 8-10%. In the USSR, this coefficient was 4% only. As the examples and experience in history show, such situations should be considered as critical.

By now, in the Russian Federation, the system of legal coverage of activity was formulated to prevent, reveal and suppress economic crimes. The shadow economic activity is a rather negative phenomenon in the modern world. With regards to this phenomenon, the primary objective of the state should be to eliminate and legalize the shadow incomes.

At the modern stage, the problems in research as an impact of the shadow economy on the welfare of the population (utility function) of taxpayers are insufficiently studied and disputable. To study this impact, in the present research, the simulations of the game model were realized allowing for the estimations of the shadow economy for the randomly selected initial parameters and the corresponding values of the utility function of the population. We considered the following situations:

- Population can hide its incomes ( $m \geq 0$ );
- Population cannot hide its incomes ( $m = 1$ ).

Model simulations show that at non-boundary balance values, the utility function of the population is maximal in case of one representative ( $n=1$ ). The calculations of the estimation of the impact of the shadow economy on the size of the welfare of the population performed by us on the base of the model simulation are shown in Table 1.

The value of the utility function of the population at  $n > 1$  in 99.9% cases is less than the value of the utility function when the shadow economy is absent. Thus, on the basis of our research, the availability of the shadow economy decreases the welfare of every person, at  $n > 1$  (in 99.9% cases) and increases in case of one representative ( $n=1$ ).

This result can be illustrated by the example described by Hardin<sup>10</sup> in the work “Tragedy of the Commons”. The author considered the problem of the collective use of limited resources that are in general use. To elucidate this problem, the scientist, Hardin Garrett considered the example of the common pasture in which he mentioned that every stock breeder pastures his animals on the common pasture; he can increase the stock and use the pasture more intensively but at the same time its fertility will be decreased. To make its utility function maximal, every stock breeder will pasture the maximal number of animals and this will ruin the pasture. The problem arises due to the fact that as a result of the use of the pasture (public goods), every individual

derives the profit for himself and all the expenses are incurred by the society.

A taxpayer has to make a choice: he can maintain the volume of the hidden incomes or increase them by decreasing the amount of revenues to the state budget. The increase of the hidden incomes by all taxpayers will decrease significantly the budget revenues and will lead to the decrease of volume of the generated state public goods that will decrease the individual utility functions of the taxpayers. Besides, if the shadow economy grows, the state will experience a deficit of resources for the full financing of the provided budget expenses and use the borrowings which will further increase the state debt. This, at the end, will also lead to a decrease in the welfare of the population. And, alternatively, the increase in the tax revenues in the budget system, as a rule, increases the volume of the public goods generated by the state.

Model simulations led to the conclusion that the shadow economy has a positive impact on the society only when the volume of the hidden incomes is regulated by the public, that is, when all the members of the population rests the function of regulation of the size of the shadow economy on one representative. In this model, it corresponds to the situation when  $n=1$ .

Let us perform the comparative analysis of the utility functions of the population yielding different results, in different balance points. We shall consider three situations:

- balance in case of the population size  $n=1$  ( $n$  is simulated by the geometrical distribution with the success probability 0.02);
- balance in case of the representative of the population (medial representative);
- balance in case of absence of the shadow economy (situations when the shadow economy cannot exist).

At this, such coefficients as  $g1$ ,  $g2$  and  $t$  are used, where;

- $g1$  is a coefficient of the specific weight of the tax revenues in the utility function of the state that depends upon the general policy of the acting government;
- $g2$  is a coefficient of the specific weight of the public goods

generated by the state, in the utility function of the  $i^{\text{th}}$  person;

- $t$  is a coefficient of the expenses of the population (punitive sanctions charged by the taxation authorities during the shadow activity and non-payment of the taxes)

The coefficient of the specific weight of the tax revenues in the utility function of the state is a positive value ( $g1 > 0$ ), the growth of the tax revenues increases the utility function of the state, all parameters being equal.

The value  $g2$  depends upon the efficiency of the government in power. In particular, it depends on its ability to generate the public good, the size of the criminal economic activity and corruption and also upon the general mentality of the population. This coefficient characterizes how much the people want to use the public goods generated by the state in the form of the paid taxes.<sup>11</sup> Within the framework of this game model, the shadow economy is understood as a hidden economic activity. With an increase in the criminal economy, the coefficient  $g2$  is decreasing.

First, the variables  $g1$ ,  $g2$ ,  $t$  and  $n$  are generated randomly. Then, the equal sizes of the shadow economy and the tax rates for every case are measured. Then, the utility functions of the population are calculated and compared to each other. The situations of non-boundary values are considered:

$$ng > g2, t > \frac{4(ng1 - g2)(g2 + n + 1)}{2(1 + g1)(n + 1)} \text{ and } m > \frac{g1}{1 + g1}$$

The results of the simulation described by us during the research are shown in Table 1.

Thus, from the simulation performed by us, it follows that the welfare (utility function) of the population is maximal in case of the single representative of the population (medial representative). The welfare of the population in case of the absence of the shadow economy is higher than the utility function of the population in 99.9% of the cases, if the size of population when  $n > 1$ , in 100% cases when  $n > 2$ .

**Table 1:** Comparative Analysis of the Utility Function of the Population in Different Balances.

No.	Balances	$n > 1$ of population	$n = 1$	Absence of shadow economy
1	$n > 1$ of population	100%	0%	0.09%(0% at $n > 2$ )
2	$n = 1$	100%	100%	100%
3	Absence of shadow economy	99.9% (100% at $n > 2$ )	0	100%

**\*Note:** The model considers the situations when the utility function at balance in the lines is bigger or equal to the utility function at the balance in the columns, %.

**CONCLUSIONS**

The main conclusions and proposals of this review are the following:

1. The analysis of the world shadow economy showed that the developed countries have a rather low-level of the shadow economy (3-15%). The states with the transition economy are characterized by a rather high-level of share of the shadow economy and are distinguished into 2 types in terms of GDP that do not cross: the countries of Eastern Europe (10-22%) and the countries of the Commonwealth of Independent States (13-48%). Despite the tendency for the decrease, a share of the shadow economy in the Russian Federation is high. In the Russian Federation, the size of the shadow activity, to a great extent, is differentiated according to the territories (the shadow activity is minimal in the north-east of the country and it is maximal in the regions of the North Caucasian Federal District).
2. One of the main problems of the modern society is still the social differentiation of the society. The shadow activity "attracts" a huge amount of deprived people due to the existence of the deformed, destructive relations in the social sphere. A number for the potential participants of the shadow economy is determined from the structure of the society. The representatives of the low-income and marginal layers are widely involved in the shadow economy. As a result of the high-level of shadow economy, there is a huge differentiation and inequality between income and property in the Russian Federation.
3. The research conducted by us on the basis of the game model analyzing the interaction of the state with the population helped formulate the mechanism of formation of the shadow economy. The following properties of the shadow economic activity are revealed and described mathematically:
  - The shadow economy contributes to the increase in the welfare of the population only in case of a single representative in the population. The shadow economy decreases the welfare of the population if the population presents the set (more than one) of the representatives;
  - The size of the shadow economy depends on the size of the population in the country, all parameters being equal;
  - The growth of the shadow economy leads to an increase in the state debt and, all parameters being equal, to the decrease in the welfare of the population;
  - The improvement of the quality of the state services will lead to a decrease in the shadow economy.

At the modern stage, especially in the conditions of the Russian Federation, it is necessary to develop appropriate measures to ensure the legalization of the shadow sector, first of all, for the efficient control of social and economic develop-

ment, growth of the investment activity of the region, provision of the employment, increase of the living standard of the citizens, the complete implementation of the human potential and thereupon the enlargement of the taxation base. The analysis of information associated with law enforcement, statistic and fiscal authorities concerning the forms of shadow activity in the Republic of Dagestan allowed us to conclude that at the bottom of the objectively existing reasons there is a breach of the economic self-interests of economical entities. The main cause of attractiveness of the shadow sphere is in its easy access to business activity and the possibilities to completely satisfy economic self-interests. Thus, there is an economic and tax potential that can be, if supported, used for the welfare of the region and the state as a whole.

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