



Cross Disciplinary Project-Report

The Biology of Suicidal Behavior

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I. Overview

Suicide is a serious global public health issue. It is among the top twenty leading causes of death worldwide, with more deaths due to suicide than to malaria, breast cancer, or war and homicide. The Global Burden of Disease study – alongside the World Health Organization – estimates that almost 800,000 people die from suicide each year. That's one person every 40 seconds. This makes it one of the leading causes of death globally. Around twice as many die from suicide as from homicide. Suicide is more common than homicide across most countries in the world – often as much as ten to twenty times higher.

Understanding the risk factors combined with careful assessment and clinical decision-making is the standard of care at this time, though in the future we may have neuroscience-based techniques to provide more objective and reliable assessment. In the meantime, researchers continue to identify relevant risk factors, which doctors and patients include in treatment planning, especially when there is concern about suicide and self-injury.

II. Definition of Suicide

Suicide is defined as an act with a fatal outcome that is deliberately initiated and performed by the person in the knowledge or expectation of its fatal outcome. It is a complex phenomenon; In surmountable disparity between expectations and outcomes, real or imagined- tremendous pressure on mind, blinding its logic, forcing it a conclusion of escape.

The word suicide means "deliberate killing of oneself," originated during 1650s, from Modern Latin *suicidium* "suicide," from Latin *sui* "of oneself" and *-cidium* "a killing,".

It is the primary emergency for a mental health professional and a major public health problem.

III. Problem of the Research

In everyday life, equilibrium refers to the condition of a system in which competing influences are balanced. Equilibrium ensures the stability and the continuity of a system. The more balanced your internal medium, the higher the body functions physically, mentally and emotionally.

Hormones neurotransmitters and other molecules work on maintaining the balance of the body physically, mentally and emotionally.

Thus, what relationship exists between the chemical imbalance of the body and suicide?

IV. Scientific Part of Suicide

While the symptoms of depression can vary depending on the severity, there are some standard symptoms to watch for. Common symptoms include: sadness, tiredness, trouble of focusing or concentrating, anger, irritability, frustration, loss of interest in pleasurable or fun activities, sleep issues, no energy, craving unhealthy food, anxiety, isolation, worrying, trouble thinking clearly or making decisions, poor performance at work or school, guilt, **suicidal thoughts or tendencies**, drug or alcohol abuse...

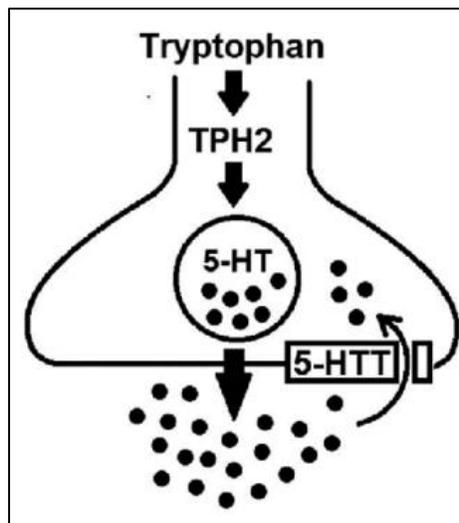
A. Imbalance in neurotransmitters

Depression is a complex condition that does not have a single, simple cause. Some psychiatrists look at brain chemistry with cases of depression. Serotonin, dopamine and norepinephrine affect feelings of happiness and pleasure and may be out of balance in people with depression. Therefore, depression may stem from an imbalance of neurotransmitters in the body. Below we will talk about the role of serotonin and the treatment of low levels in the nervous system.

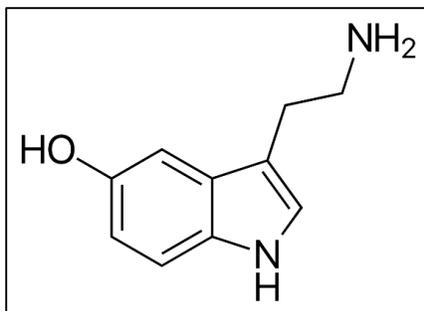
Serotonin:

a. Mode of Action:

Serotonin vesicles are released from the end of the presynaptic cell into the synaptic cleft (document 1). The serotonin molecules can then bind to receptor proteins within the postsynaptic cell, which causes a change in the electrical state of the cell. This change in electrical state can either excite the cell, passing along the chemical message, or inhibit it. Excess serotonin molecules are taken back up by the presynaptic cell and reprocessed.



Document 1: mode of action of serotonin



Document 2: serotonin molecule

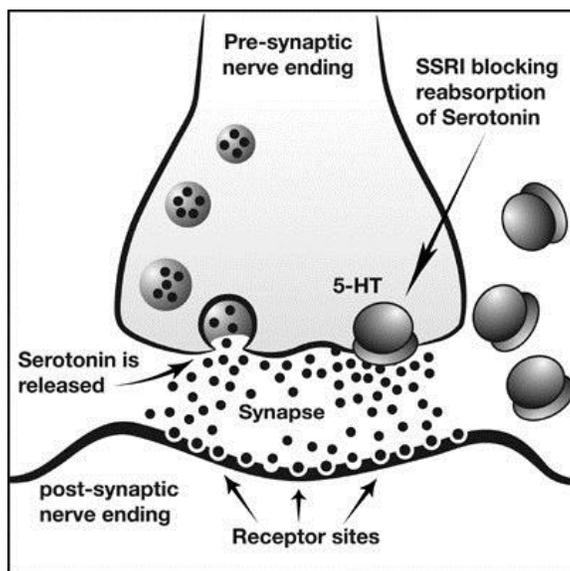
Serotonin impacts all your body, from your emotions to your motor skills. Serotonin is considered a natural mood stabilizer. It's the chemical that helps with sleeping, eating, and digesting.

Serotonin helps regulate your mood naturally. When your serotonin levels are normal, you feel happier, calmer, more focused, less anxious and more emotionally stable.

b. Low Levels Treatment

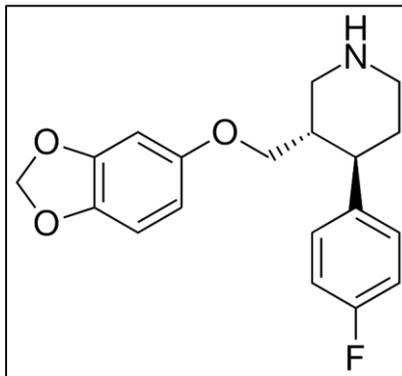
Low levels of serotonin in the brain may cause depression, anxiety, and sleep trouble. Many doctors will prescribe a Selective Serotonin Reuptake Inhibitor (SSRI) to treat depression. They're the most commonly prescribed type of antidepressant.

Normally, the body reabsorbs a neurotransmitter after it has transmitted its neural impulse. SSRIs stop the body from reabsorbing serotonin, leaving higher levels of serotonin to circulate (document 3). Many people find SSRIs help relieve their symptoms.



Document 3: SSRIs activity at the level of the synapse

Paroxetine is a type of antidepressant. The document below shows the molecule of paroxetine that has similar parts as serotonin.



Document 4: paroxetine molecule

B. Imbalance of Hormones

Hormones are involved in every aspect of health. We need them in very specific amounts for our bodies to function optimally.

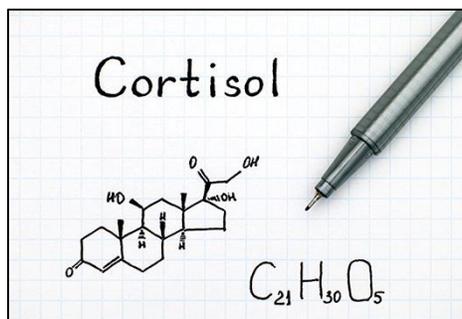
Changes in hormone production or functioning could lead to the onset of depressive states. Any changes in hormone states, including menopause, childbirth, thyroid problems, or other disorders, could cause depression.

1. Cortisol

The body's stress-response system is usually self-limiting. Once a perceived threat has passed, hormone levels return to normal. As cortisol (document 4) levels drop, your heart rate and blood pressure return to baseline levels, and other systems resume their regular activities.

But when stressors are always present and you constantly feel under attack, that fight-or-flight reaction stays turned on.

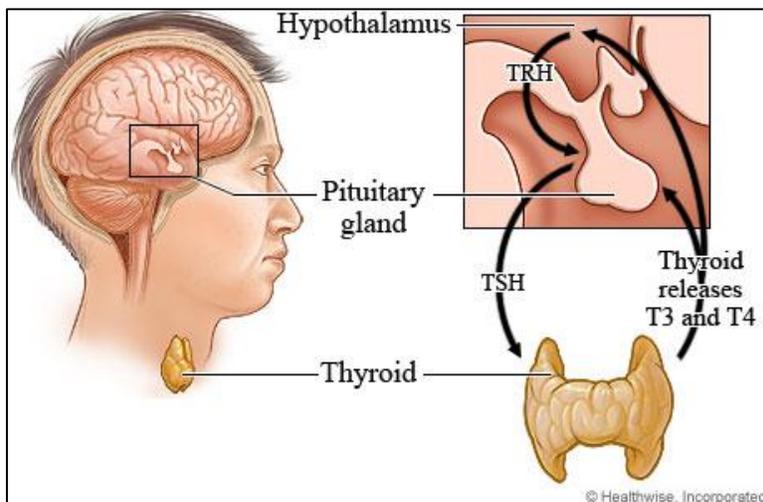
The long-term activation of the stress-response system and the overexposure to cortisol and other stress hormones that follow can disrupt almost all your body processes. This puts you at increased risk of many health problems, including: anxiety, depression, digestive problems, headaches, heart diseases, sleep problems, weight gain, memory and concentration impairment.



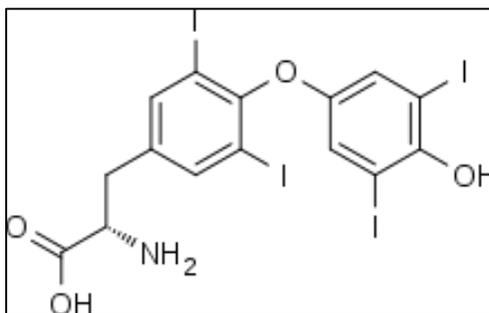
Document 4: cortisol molecule

2. Thyroid hormones:

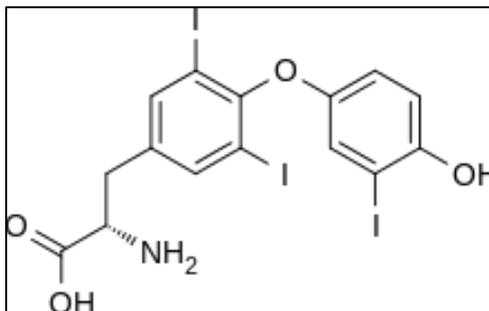
The secretion of thyroid hormones is regulated by pituitary thyrotropin (TSH) which itself is stimulated by hypothalamic thyrotropin-releasing hormone (TRH) and downregulated by serum thyroid hormones (document 5). Twenty percent of triiodothyronine (T3) (document 6) in the cerebral cortex is secreted directly by the thyroid while 80% is derived from local conversion of thyroxine (T4) (document 7) by deiodination.



Document 5: thyroid hormones production



Document 6: thyroxine (T4)



Document 7: triiodothyronine (T3)

The relation between thyroid function and depression has long been recognized. Patients with thyroid disorders are more prone to develop depressive symptoms and conversely depression may be accompanied by various subtle thyroid abnormalities. Traditionally, the most commonly documented abnormalities are elevated T4 levels, low T3, elevated rT3, a blunted TSH response to TRH, positive antithyroid antibodies, and elevated CSF TRH concentrations.

To test the concentration of thyroid hormones, the doctor prescribes a test to check the concentration of TSH (thyroid-stimulating hormone), free T3, free T4 and thyroid antibodies.

Thyroid hormones have been used as an adjunct to antidepressant therapy to accelerate clinical response to antidepressants and to potentiate clinical response in non-responders to antidepressants.

3. Female Hormones:

Because of higher frequency of suicidal attempts in females, several studies evaluate the serum estrogen and progesterone concentration and their relationship with suicidal attempt ranking in the attempted females.

The results of a research conducted on 111 females, where the estrogen and progesterone serum levels were measured during 24 hours after suicidal attempt. The suicidal attempt ranks significantly related to the serum progesterone concentration and the luteal phase.

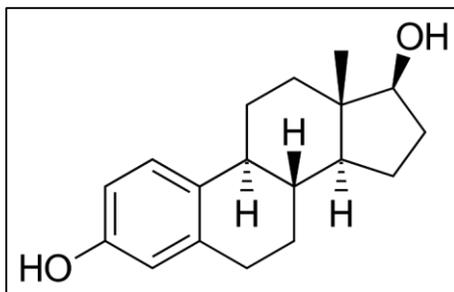
*In order to investigate the role of hormonal contraception on suicide-related factors, Skovlund and colleagues (2017) analyzed population data to look for patterns in contraception use and suicide risk factors. They note that hormonal treatments are used by 100 million women around the world for purposes ranging from contraception, to relief of menstrual symptoms such as pain and bleeding, and premenstrual syndrome.

Hormonal contraception has been associated in previous studies with depression and negative effects on mood, and has also been shown to increase the risk of suicide and suicide attempts in multiple studies (Skovlund et al., 2016; Schaffir et al., 2016; Bertolote et al., 2003).

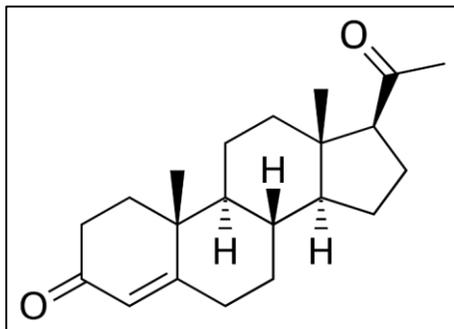
*The perimenopause is a transitional stage between fertility and full-blown menopause, and during this time, a woman's hormones fluctuate causing mood swings. Diet, exercise and stress also play a role in increasing or decreasing depression at this time in a woman's life.

The fact that women can experience mood disorders associated with their menstrual cycle, such as premenstrual dysphoric disorder (PMDD), a mood disorder characterized by depressive symptoms that occur prior to the start of the menstrual cycle, also points to a relationship between female sex hormones and mood.

Hormonal imbalances associated with aging can begin when women are still in their thirties. The result can be depression, anxiety and insomnia, amongst a handful of other symptoms.



Document 8: estrogen molecule



Document 9: progesterone molecule

Estrogen helps give serotonin a boost. When it drops considerably women can feel very depressed, and may even have consistent thoughts of suicide and death. Estrogen is also responsible for raising endorphin levels, and increasing the neurotransmitter GABA, which has a calming effect.

The hormone progesterone plays a role in balancing estrogen. However, during menopause, its concentration fluctuates, resulting in depression. When progesterone levels are normal, they act as an antidepressant.

Testing can uncover imbalances which can then be directly addressed.

- The DUTCH urine test: This test does not show levels of sex hormones and cortisol; it gives information about how the body is breaking down those hormones. This allows the metabolic pathways to be optimized in addition to balancing hormones.
- DHEAS: DHEA sulfate is a hormone that converts into other hormones, including estrogen and testosterone. DHEA contributes to optimal adrenal function and the feeling of overall well-being. The ratio of DHEAS to cortisol can give information about stress-related effects on adrenal function.
- Estradiol: Estradiol is the main type of estrogen produced in the body. Low levels can cause memory lapses resulting in anxiety, depression, uncontrollable bursts of anger, sleeplessness, night sweats and other symptoms.
- Progesterone: Progesterone is a hormone that stimulates the uterus and prepares it for pregnancy. It also regulates the menstrual cycle. Low levels of progesterone can cause insomnia, irritability, anxiety and heart palpitations.

→ *Seeking help can save your life*

Women experiencing depression due to hormonal imbalances can show other related symptoms, such as insomnia, being overwhelmed, indecisiveness, fatigue, appetite fluctuation, and feelings of worthlessness, guilt and decreased pleasure in life.

Those who think they may be experiencing hormonal imbalances can benefit from seeking help from a medical professional for diagnosis. They may be prescribed hormone replacement therapy (HRT) or an alternative therapy to address imbalances and put them on the road to a more joyful life.

Real life case of hormone imbalance:

Janet was in her late 40's when she split up with her husband. She was a financially strapped single mom to two teenage boys. Janet had a long history of issues with depression, which culminated at age 42 with 2 hospitalizations for suicide attempts.

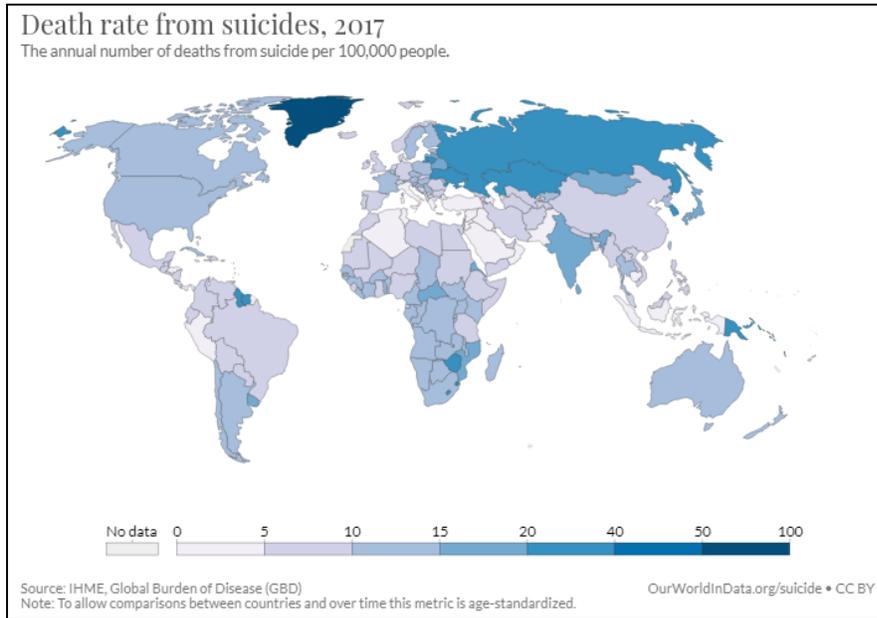
What is even remarkable in this case is that her severe depressive issues were not related to a chemical imbalance in her brain, but to a hormone imbalance. Her depression completely lifted once she started a bio-identical hormone replacement therapy (BHRT).

V. Statistics across the World and Lebanon

The following data present the most recent available suicide mortality data from the Global Burden of Disease study alongside the WHO Global Health Estimates for the year 2017 and trend from 1990.

Death rates from suicide across the world

Globally, 10 people per 100,000 died from suicide in 2017. In the map we show the differences in suicide rates across the world.



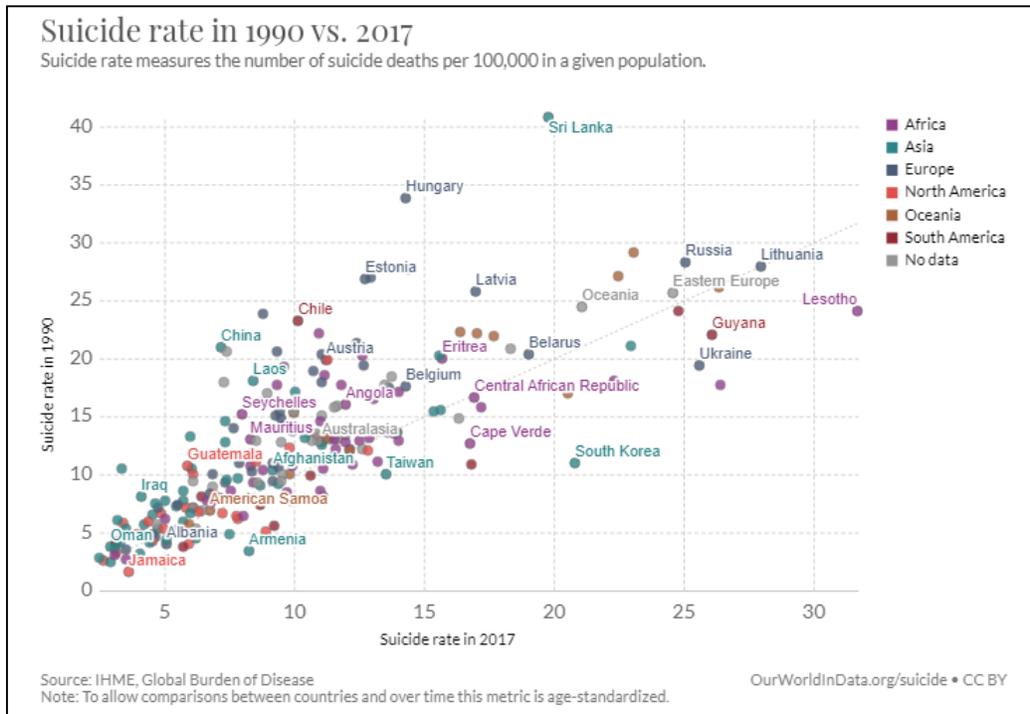
**This map shows the annual number of deaths from suicide per 100,000 people around the world in 2017*



**This map shows the annual number of deaths from suicide across the world in 2017*

→How have suicide rates changed?

The chart below represents the suicide rates across the world in 1990 Vs 2017 per 100,000 in a given population.



We see the comparison of suicide rates across countries in the years 1990 (shown on the y-axis) and 2017 (on the x-axis). The grey line shows that the countries that lie along this line would have the same rates in 2017 as they did in 1990. Countries which lie above the grey line had higher rates in 1990; and vice versa for countries below the line.

The majority of countries lie above the grey line, meaning suicide rates have fallen since 1990. But a significant number fall below it, indicating an increase over this period. Most countries in Europe have seen a decline in suicide rates; Asia too has seen impressive declines. Across other regions, the trend has been more varied.

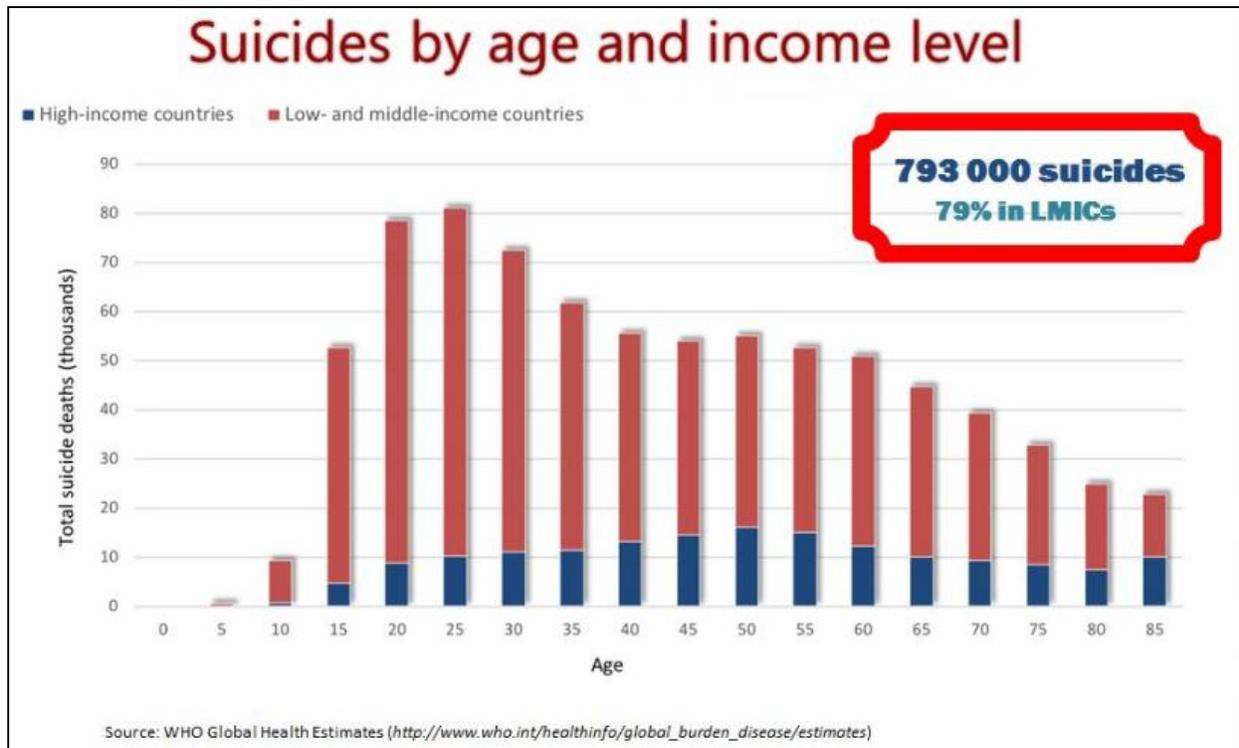
In Asia we see that Sri Lanka shows a decline in suicide rates from 40.83 deaths per 10,000 in 1990 to 14.28 deaths. China also shows a huge decline in suicide rates from 20.92 deaths to 7.21 deaths. Although, Armenia shows an increase in suicide rates from 3.42 deaths to 8.28.

As for Europe, we see that Russia shows a slight decrease in suicide rates from 28.32 to 25.09 deaths. We see that Lithuania lies along the grey line showing the same rates 27.97 deaths in 2017 as in 1990.

In Africa, we see that Zimbabwe shows an increase in suicide rates from 17.76 to 26.39 deaths. Angola shows a decrease in suicide rates from 16 to 11.97 deaths....

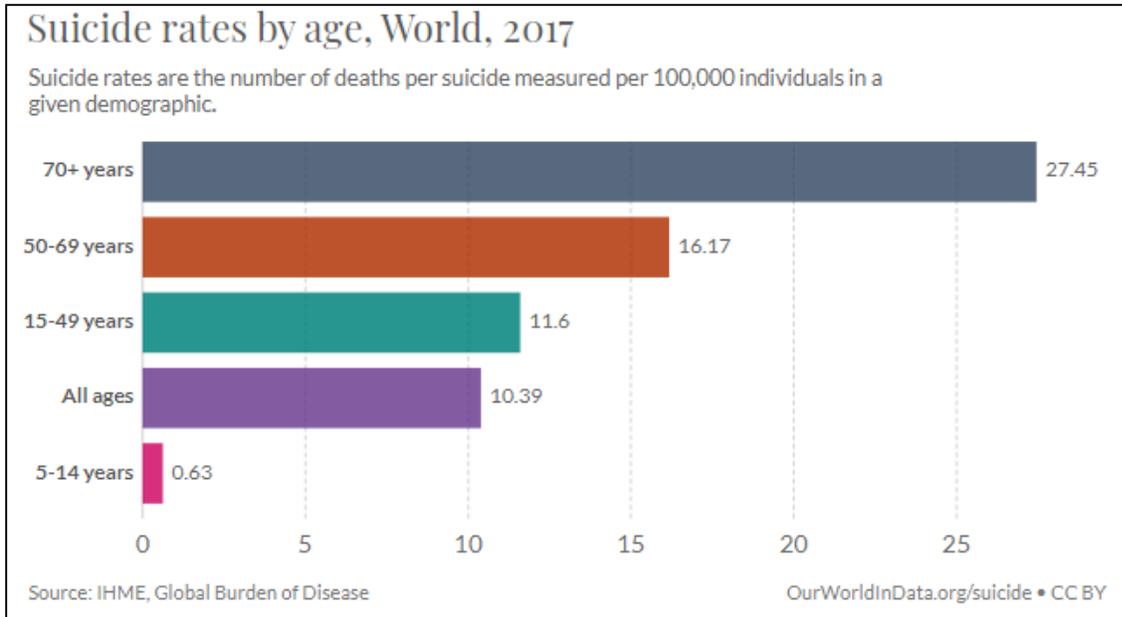
1. Suicide rates by age and income level

The chart below represents the global suicides by age and country income level (thousands), 2016



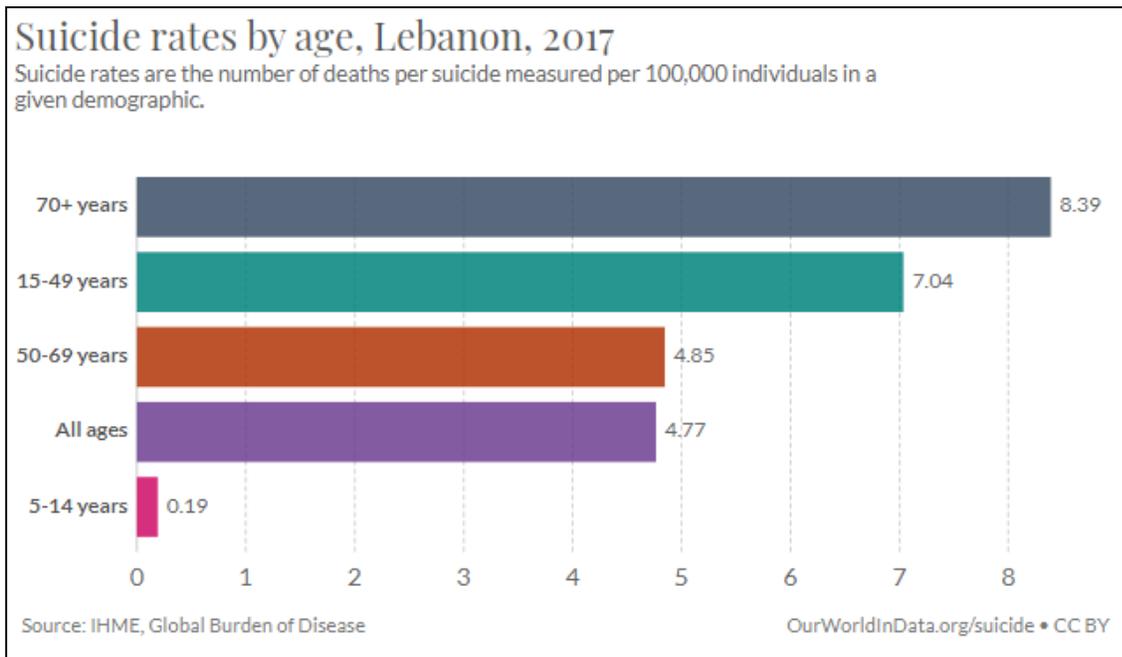
- Globally, the majority of deaths by suicide occurred in low-and-middle-income countries (79%), where most of the world's population lives (84%). Regarding age, more than half (52.1%) of global suicides occurred before the age of 45 years. Most adolescents who died by suicide (90%) were from low- and middle-income countries where nearly 90% of the world's adolescents live.
- Suicide is one of the leading causes of death in young people. But this does not necessarily mean suicide is more likely to occur in young people than old. It's largely a reflection of the fact that older populations also die from many other causes. We see this when we look at causes of death in people aged 70 years and older: most die from cardiovascular diseases, cancers, dementia and respiratory diseases. The number of suicides is high, but lower than other causes.

In the chart below, we see suicide rates broken down by age groups, in a given demography, 2017. These rates are given as the number of suicide deaths per 100,000 people in a given demography. Globally, suicide rates are actually highest in people aged 70 years and older. And actually, suicides globally follow a standard pattern of the older the age group, the higher the death rate.



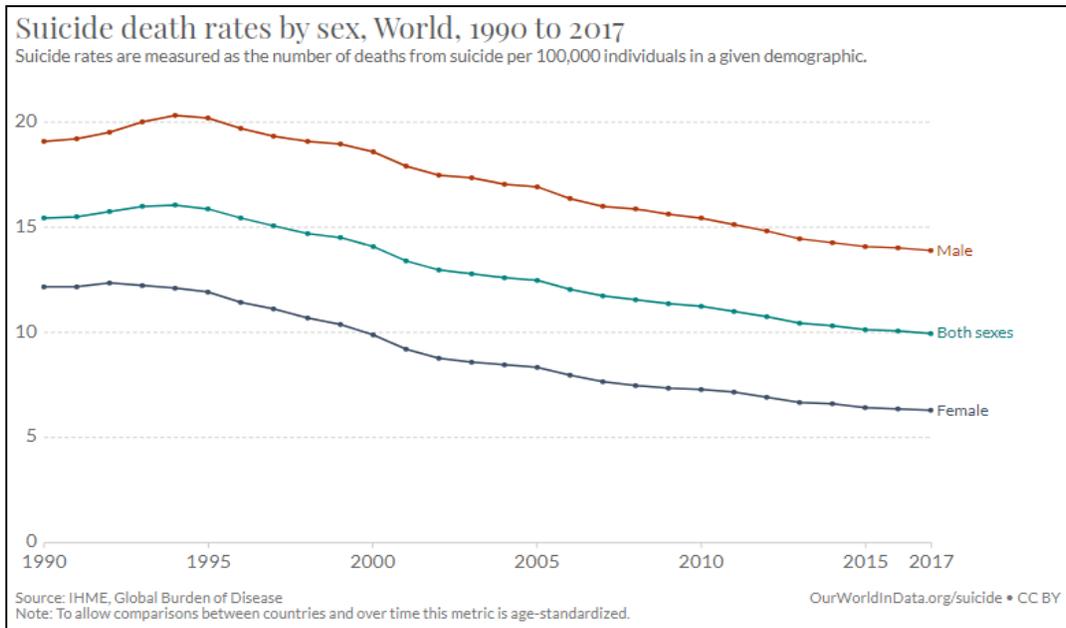
*Suicide rates by age in Lebanon

In the chart below, we see suicide rates broken down by age groups, in Lebanon, 2017



2. SuicideRate by Gender

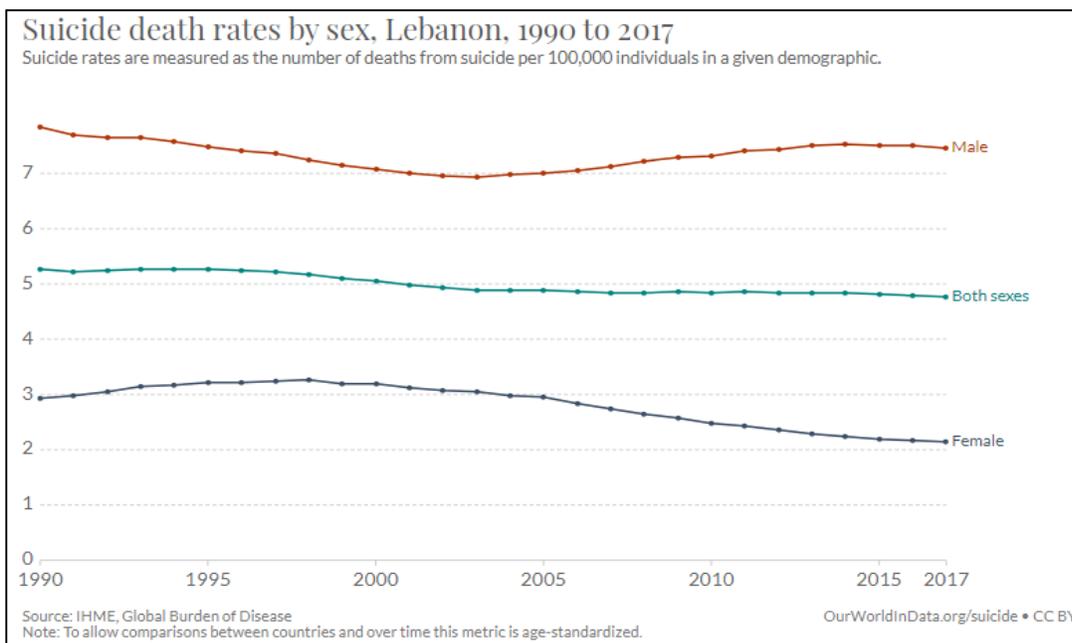
The chart below represents the suicide death rates by sex in the world, from 1990 to 2017.



Globally, suicide rates in men are just over twice as high as for women. In 2017 – as we see in the visualization – the global suicide rate for women was 6.3 deaths per 100,000; for men, it was just over twice that figure at 13.9 per 100,000.

*Suicide rates by Gender in Lebanon

The following chart represents the suicide death rates by sex in Lebanon, from 1990 to 2017.



Data was collected from 100,000 individuals. In Lebanon, in 1990, we see that 7.84 deaths were male and 2.94 were female. In 2005, 7.01 deaths were male and 2.95 deaths were female. In 2017, we see that 7.47 deaths were male and 2.15 were female.

According to the data collected in Lebanon, the number of deaths from suicide per 100,000 individuals was higher for men than women.

VI. Fatality by Suicide Methods

- 60% of firearm deaths in the US are from suicides
Firearms are one of the most common suicide methods globally. They are responsible for approximately 8% of global suicide deaths. But they play a much larger role in certain countries.
- 14 million have died from self-poisoning from pesticides over the past 50 years.
- Drowning and submersion
- Suffocation and hanging
- Jumping, drugs, cutting, piercing and others...

VII. Suicide Risk Factors and Warning Signs

***Risk Factors**

Life challenges can cause some people to have suicidal thoughts. Going through a divorce, losing a loved one, or having financial troubles may instigate a depressive episode. The latter may cause hormone imbalance or fluctuation in neurotransmitter concentrations. This can lead people to begin contemplating a “way out” from the negative thoughts and feelings.

***Warning signs**

Almost everyone who has committed suicide will have shown some signs or warnings.

A person might show they are considering suicide in how they feel, talk and behave.

Warning signs that someone is considering suicide include:

- Feeling sad, angry, ashamed, rejected, lonely, overly happy or exhausted, helpless, guilty...
- Describing feelings of hopelessness and having no reason to live...
- Talking about being a burden to others
- Abusing drugs or alcohol
- Withdrawing from friends, family and society
- Appearing anxious, having trouble sleeping or sleeping all the time
- Acting recklessly
- Losing interest in their appearance, rapid weight changes
- Threatening to hurt or kill themselves
- Talking, drawing or writing about death, dying or suicide...

VIII. Suicide Prevention

The best way to prevent suicide is to recognise the warning signs of suicide, take them seriously and act upon them. And if you notice any of these warning signs in a friend, relative or loved one, encourage them to talk and share their feelings with a member of their healthcare team.

If you're *having suicidal thoughts*, it's important to first promise yourself that you won't do anything until you seek help. Make sure to talk to someone if you're having trouble coping with suicidal thoughts on your own. By seeking help, you can start to realize that you aren't alone and that you can get through difficult time. Speak with your doctor if you suspect depression or another mental illness is contributing to your suicidal feelings. If the problem is caused by a chemical imbalance, your doctor may prescribe a treatment to regulate hormones imbalance and neurotransmitters concentrations, or/and refers you to a licensed counselor who can help you work through the challenges of your condition. Through therapy and medication, many formerly suicidal women and men have been able to get past suicidal thoughts and live full, happy lives.

***Ways to Decrease the Risk of Suicide (suicide solutions)**

Suicide and non-fatal suicidal behavior are significant public health issues worldwide requiring effective preventive interventions. However, there is still a need to identify what prevention strategies should be prioritized to achieve the biggest impact on the reduction of suicide attempts and suicidal deaths.

- Generally improving the quality of people's lives thereby reducing stress
- Increasing public awareness
- Campaigning to reduce stigma
- Guidelines for the mass media
- Selective strategies included in schools and institutions so that depressed and suicidal individuals can be identified and treated before they harm themselves
- Focusing on high risk groups, those already diagnosed as depressed
- Decreasing the availability of lethal means, such as control of guns
- Regulating formulations, packaging and sale of pesticides
- Regulation of over the counter medication
- Introducing alcohol policies
- Establishing sentinel centers and developing an information system
- Training and personal working in high risk settings
- Establishing crisis intervention and counseling centers and telephone hotlines

IX. Stigma around Suicide

Stop the silence and stigma of suicide!



Suicide is a concept people desperately try to avoid. Many people still consider suicide to be taboo and avoid talking about it because they don't understand it or know what to say. The idea of someone taking their own life is frightening and tragic.

Some research suggests that higher suicide rates may be linked to greater stigma toward mental illness. Common misconceptions about people who have died by suicide are that they are selfish or took the easy way out. In popular culture, people with a mental illness may face ridicule or even be feared.

Unfortunately, the culture of silence may be causing many people who are having suicidal thoughts to not seek help. The undesirability of discussing suicide has created a stigma surrounding the subject. As a result, people who are having suicidal thoughts are confronted with the stereotype that mentally ill individuals are dangerous or weak.

While attention and support for mental health and mental illness continue to grow, and positive steps are being taken to acknowledge and support people suffering from mild to severe issues, the stigma around suicide continues.

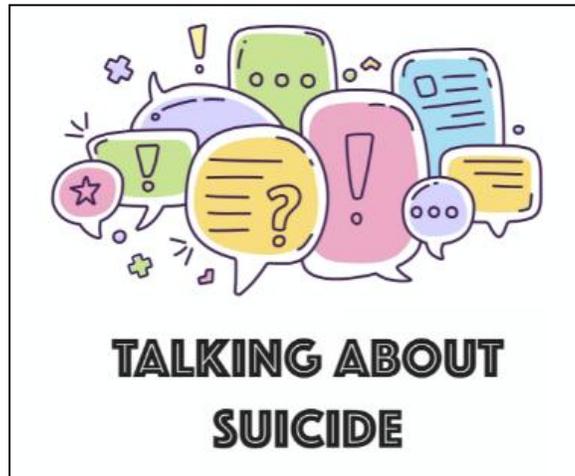
The unfortunate side effect of this can result in people not seeking help when they need it, while those who have lived experience of suicide internalise their feelings of shame because of this perception of how they're viewed by their peers and society.

Stigma also affects those bereaved by suicide. Research suggests that those bereaved by suicide report higher levels of rejection, shame and blame than other bereaved people.

It's time for a change. We have to reexamine and overhaul how we think, speak, and act on the topic of suicide.

***What can we do to help break down the stigma?**

- Research suggests that individuals recognise suicide warnings as easily as they do for heart attacks, but there is discomfort and uncertainty about how to help. Act on those thoughts and concerns, as your help could make all the difference.
- Raise your voice. Survivors shouldn't be expected to carry this weight by themselves, so tackling stigma and prejudice around mental illness is a part we can all play.
- Reach out and show your support if someone you know is bereaved by suicide.
- Investigate ways to spread education in schools, universities, workplaces and in social environments to discuss the underlying psychological mechanisms of suicide.
- Examine your thought processes; your understandings. Are they right? Could you invite more sensitivity into yourself around mental illness stigma?
- Use your social networks to discuss suicide and mental illness openly, share content on social media, and spread the word.



X. Combating Suicide in Lebanon

In Lebanon, on average, every 3 days one person dies of suicide and on average, every six hours, one person attempts suicide.

While these figures may not seem high, they are not representative of the actual suicide rates as prevailing religious, legal, and social issues that surround suicide often result in the mislabeled cause of death as natural, accidental, or undetermined. Furthermore, these numbers do not take into account the number of individuals who experience suicidal ideation. Hence, the rate of suicide in Lebanon is expected to be underreported.

The *Embrace Lifeline* is a non-profit organization which works to raise awareness around mental health in Lebanon. It is the first National Emotional Support and Suicide Prevention Helpline in Lebanon. This specialized telephone service (1564) includes a network of highly trained operators who provide over the phone emotional support, suicide risk assessment and referrals to community mental health services.



Emotional Support



Suicide Risk Assessment



Orientation to Community Services

One in four Lebanese will suffer from a mental illness sometime during his or her lifetime. If left untreated, mental illness can result in serious disabilities and even death. However, due to the stigma and social taboos surrounding the subject of mental health, many people who need treatment will not seek it. Negative attitudes, negative opinions, and misinformation keep people from seeking the help they need to live healthy and productive lives. Embrace is working to provide information, community awareness, and support to break down the stigma of mental illness in Lebanon.

Stigma and the financial cost of treating mental illness should never be a barrier to seeking help. Embrace grew out of the need to fight these challenges in order to raise awareness about mental illness and facilitate access to treatment.

**Mission of The EmbraceLifeline*

- To increase awareness about suicide in Lebanon
- To ensure the respect and empowerment of individuals suffering from suicidal thoughts
- To provide individuals with access to appropriate care while also creating a referral network of community resources for intervention and treatment
- To support those bereaved from suicide

Embrace Lifeline has launched a project committed to talk about mental health and suicide and raising awareness in Lebanese municipalities, universities, schools and others.

Embrace's suicide hotline:

1564
embrace

Mental illness isn't
a **taboo** subject.



1 in 4 of the people you know may be
silently suffering.

www.embracefund.org

Share this
You might save a life

“

TAKE A BREAK
from the desk when you can.
Take a brief walk, get some fresh air.
Breathe in and out regularly



embrace | TALKING SAVES LIVES | Talk to us on the Embrace Lifeline at 1564.

“

Do not take things personally
Remind yourself that any
**ANGER IS NOT DIRECTED
TOWARDS YOU**



embrace | TALKING SAVES LIVES | Talk to us on the Embrace Lifeline at 1564.

“

Talk about your feelings with friends
and colleagues at work
If you are alone, reach out to the
EMBRACE LIFELINE (1564)



embrace | TALKING SAVES LIVES | Talk to us on the Embrace Lifeline at 1564.

XI. Conclusion

A suicidal person may not ask for help, but that doesn't mean that help isn't needed. People who take their own lives don't want to die—they just want to stop hurting. Suicide prevention starts with recognizing the warning signs and taking them seriously. If you think a friend or family member is considering suicide, you might be afraid to bring up the subject. But talking openly about suicidal thoughts and feelings can save a life.

While Janet's case was extreme, it highlights the importance of making sure that chemical balance is at least considered as a contributor to prevent suicide.

XII. Model

Beyond IQ game

Suicide



Description :

It's a box containing 50 cards with 25 myth or fact cards and 25 questions cards with answers about suicide.



Instructions:

This game is played by two teams. One team pick a card and ask the question written/ or read the sentence written on it, and the second group must answer the question correctly/ or guess if the sentence written is a fact or myth, in order to win . They have two trials to answer correctly: they will get 5 points, if they answer correctly from the first time, and 2 points from the second time. The group who reaches 100 points will be the winner.

Age: 14+



Social and educational importance:

- raising awareness of suicide amongst young people
- enhance emotional intelligence
- develop social emotional skills and emotional self-regulation

XIII. References

1. <http://mayoclinic.org/healthy-lifestyle/stress-management/in-depth/stress/art-20046037#:~:text=Cortisol%2C%20the%20primary%20stress%20hormone,flight-or-flight%20situation.>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3246784/>
3. <https://www.uofmhealth.org/health-library/zm2424#zm2424-sec>
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