

## PATHOLOGICAL STUDY

# Suicides and their preventive interventions possibilities: are there some relationships between mechanisms and different mental disorders?

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**ABSTRACT**

Suicides are one of the topics discussed around the world. This problem receives large space in scientific and professional literature, in order to eliminate its occurrence. Mechanisms of suicides are determined by whole spectrum of reasons determined by/depending on physical and psychological health. The objective of this work is to document the differences in mechanisms and realization of suicides by mentally sick people. Ten cases of suicides are reported in the article: three of which in people with a history of depression of the victim noted by family members, one with treated depression, three with anxiety-depressive disorder and three schizophrenic patients cases. There are five men and five women. Four of these women overdosed themselves by medicaments and one jumped out of a window. Two men shot themselves, two hanged themselves and one jumped out of a window. Persons without anamnesticly proven psychiatric diseases end their lives mostly because of inconclusive situation or as a result of balancing their whole life (usually with good plan and preparation of the act). Persons with treatment of depression or anxiety-depressive disorder kill themselves mostly after several “unsuccessful” attempts. In case of victims with schizophrenia suicides follow a hardly predictable sequence of actions which sometimes do not seem to have any logic. Differences have been found between victims with and without mental disorders in ways of realization of suicides. Psychological predispositions in mood changes, long-term sadness and threatening suicide should be recognized by family members. Prevention of suicides in cases of people with a history of mental disorders is based on medical treatment and cooperation between the client and family members and a psychiatrist (*Ref. 30*). Text in PDF [www.elis.sk](http://www.elis.sk)

**KEY WORDS:** forensic medicine, mental disorders, prevention, psychiatry, risk factors, suicides.

**Introduction**

Suicidium, or suicide, is defined as the conscious, voluntary and violent attempt at taking one's own life by means that are expected to result in death (1). Approximately 1,000 people die in this way every day worldwide, 10,000 attempt suicide and around 50,000 threaten to commit suicide (2). This presents a serious social, medical and economic problem. In a broader sense, the issue involves philosophical, sociological, theological, psychological, biological and medical interpretations, and in a narrower sense, the problem is perceived as a socio-pathological phenomenon and a sign of mental illness (3–5). In Slovakia, the number of suicides in recent years has oscillated between 466 and 631 cases (6). In the Czech Republic, between 1,389 and 1,622 people end their lives voluntarily each year (7). The male sex prevails. Several scientific disciplines have been addressing this problem from different perspectives. Their common denominator is the intention to better understand this phenomenon, define the presuicidal risk factors and, consequently, minimize the number of suicides by

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introducing preventive measures. In this sense, the manifestations and development tendencies of suicide in children and adults are very well analysed (8–11). There is much more ambiguity in the relationships between social and biological causes and other context that ultimately led to suicide. In this sense, the analysis of individual case studies could contribute not only to the recognition of risk factors, but also to the identification of specific traits that are associated with suicidal behaviour. Therefore, in this article we decided to compare suicide in people who were not treated by a psychiatrist versus people who were in psychiatric care, including the possibility to define differences and options of preventive interventions. Given the limited material, these are rather case studies that demonstrate the importance and relevance of this issue in the wider society.

## Material and Methods

Ten cases of suicide were selected from our archive, the first three of which (cases 1, 2, 3) were committed by people who had not been under the care of a psychiatrist, one (case 4) by a person with depression, the next three (cases 5, 6, 7) by people who had been diagnosed with anxiety-depressive disorder, and the last three (cases 8, 9, 10) by schizophrenic patients. Autopsies were performed in all the above cases in the premises of our department (Prosektúra Mimoň Czech Republic) or in the premises of the Pathology Department of the Hospital in Česká Lípa (Czech Republic). During the autopsies, (where possible) blood samples were taken to determine the presence of ethyl alcohol and sampling of selected internal organs (liver, kidney and spleen) was done for the purpose of chemical-toxicological examination to detect the presence of toxicologically significant substances from the group of drugs and medicaments.

## Results

### Case 1

The husband stated that their family had been in a state of turmoil for a long time, taking advantage of each other and endless arguments. It was much more difficult for his wife to cope with the situation than for him, which, according to him, was reflected in her mood. Otherwise, however, she had not been treated by a psychiatrist, either at present or in the past. On the day in question, he and his wife went to bed together at about 23.00. Around 00.15, he noticed his wife opening the bedroom window. He then heard a scream and wailing. He jumped out of the bed almost immediately and ran out of the apartment, and just below the window of their apartment he saw his wife in a semi-sitting position on her right side in the snow. He immediately questioned her as to what had happened, but she did not answer, just continued to wail. The distance between their window and the ground was 2.8 m. He tried to lift her up and eventually succeeded in doing so by supporting her under her arm with one hand and under her knee with the other, she was dragging her legs behind her in the snow. When they reached the apartment, he did not notice any visible injuries. However, as she was not responding, he called the Emergency

Medical Services, who transported her to the hospital unconscious in haemorrhagic shock. At the hospital, resuscitation was initiated during an operative abdominal revision and the 57-year-old woman died at 4:50 am. The forensic autopsy determined that the cause of death was shock from blood loss. Chemical-toxicological analysis by chromatography showed the presence of ethanol (0.25 g/kg) in the deceased's blood, the reaction for the presence of narcotics was negative.

### Case 2

According to the wife's testimony, her husband had been remarkably moody for several months, eating irregularly, communicating only to a limited degree and not showing much interest in anything. Her attempts to activate him had repeatedly resulted in her husband making verbal suicide threats. However, he had never been treated by a psychiatrist. She went to the baker's shop at around 10:00 that morning and returned home at around 12:15 p.m. She found her husband sitting in an armchair, with his head covered by a blanket. At first, she thought he was asleep because he usually covered his head like that when he slept in bed or even in the armchair. After a while, she thought it was strange, so she pulled the blanket from his head. It was only then that she noticed the pistol lying between his left hand and his left thigh, and the pool of blood on the carpet. She called Emergency Medical Services and the doctor on duty pronounced the 64-year-old man dead at 3:00 p.m. as a result of a gunshot wound through the right temple on his head. The forensic autopsy determined that the cause of death was traumatic brain swelling with cerebral contusion caused by the gunshot wound of the head.

### Case 3

The man had been somber, inactive for quite some time. He had never been treated by a psychiatrist. One day in the early evening, without mentioning anything, he got into his car and drove away. His son stated that as it was already night and his father had still not returned, he and his mother decided to go looking for him. Around 10 p.m., they finally saw the father's car parked near a wooded area. When they came closer, they saw the father sitting in the driver's seat motionless with his face covered in blood. The son tried to open the door, but it was locked. They did not do anything else and called the Police who upon arrival called the Emergency Medical Services. Inside the locked vehicle was a dead 68-year-old man, the glass of the driver's door had a shot through hole and the roof of the car had another shot through hole, bent outward, over the driver's seat. The man's body was in a fixed position on the seat with his head passively dropped to the right side. Left hand was slightly in a fist, right hand slightly bent. A pistol on the floor on the left side of the driver's place and a 0.5 litre half empty bottle of plum brandy on the right from the driver under the passenger's seat. Next to the bottle there was one empty cartridge case and in the front under the driver's seat was the other empty cartridge case. There were damaged, twisted glasses in the back seat. The forensic autopsy described the trajectories of two independent gunshot wounds, the cause of death being exsanguination from a gunshot wound going through the right cheek artery. The results

of the chemical and toxicological analyses showed the presence of ethanol (chromatography method: 1.44 g/kg in blood; 1.50 g/kg in urine); the reaction for narcotics was negative.

#### Case 4

The woman had been treated for depression for a long time, according to her husband for some 20 years. During this time, she had been hospitalized approximately 12 times in various psychiatric hospitals. During the last period, she was seeing two psychiatrists regularly, from whom she was receiving prescriptions for large amounts of medication, which she took herself, but very often in quantities greater than prescribed. For example, sometimes she was supposed to take a maximum of three doses of a particular drug per day, but she took many more. The husband said that he tried to talk to his wife repeatedly, and also tried to control the dosage of the medication, but it was very difficult as she used to hide it all over the house. At approximately 5:30 p.m. on that day, she went to the restroom, demanding her medication from him. He told her that he did not have any. She then returned and went to the bedroom. When he went to check on her, he saw her taking some pills, which he immediately took from her. However, he could not say for certain how many and which drugs she had taken. She then calmed down and went to bed. As this had happened frequently, he did not pay more attention to it afterwards. However, he went to check on her during the night just in case. The first time he did so at around midnight and the second time in the morning at 5:30 a.m., when she was asleep and fine. Thereafter, he checked on her every hour, finding no problems. At about 9:30 he thought she had been asleep for an unusually long time and decided to wake her up. At that point he found out that she was no longer breathing. He immediately called the Emergency Medical Services. The doctor on duty found the 60-year-old woman dead in bed. He first called the Police, but then called again to revoke it. The police patrol was eventually dispatched to the scene anyway at 9:46, when the Emergency Medical Service was no longer there. An official report was written. A forensic autopsy determined that the cause of death was inhibition of consciousness due to drug poisoning. The chemical-toxicological analysis did not prove the presence of ethanol in the blood of the deceased. In response to the presence of toxic narcotics, the presence of Citalopram, Mirtazapine, Phenobarbital, Levomepromazine, Paroxetine and Chlordiazepoxide was proven by screening examination of internal organs.

#### Case 5

The man left home at 5:15 p.m. to go to work for the night shift. As he was leaving his wife came down with him from the seventh floor of their apartment building, and then went to walk their dog. She worked in the health service and had herself been treated by a psychiatrist for anxiety-depressive disorder on several occasions in inpatient setting and on a long-term basis in outpatient setting. When the man came home at 5:30 a.m. the next morning, he saw that the lights were still on in the apartment. He opened the door and when he entered the living room, he saw his wife lying on the sofa and next to her on the table were many empty blister packs of various medications. As she had made repeated suicide

attempts in the past, he assessed the situation as her having deliberately overdosed on the medication. He tried to wake her up, but she was unresponsive. He called the Emergency Medical Services and the Police. Upon arrival, the doctor on duty pronounced the 57-year-old woman dead. The forensic autopsy determined that the cause of death was drug poisoning. The chemical-toxicological analysis did not prove the presence of ethanol in either the blood or urine of the deceased. The screening examination of internal organs and stomach contents proved the presence of Ibuprofen, Trazadone, Citalopram, Bromazepam and Amlodipine.

#### Case 6

The man left his flat in the evening but could not state what time it was. His wife had been treated for anxiety depressive disorder in an inpatient setting and also in a long-term outpatient setting, and living with her was very difficult. He returned home a little before midnight to find her lying motionless on her back in the bedroom. He tried to wake her, but she was unresponsive. He immediately called the Emergency Medical Services, he was advised to start CPR, which was continued by paramedics when they arrived, and was ended as unsuccessful at 11:45 p.m. The doctor on duty pronounced the 39-year-old woman dead. A forensic autopsy determined that the cause of her death was drug poisoning. The chemical-toxicological analysis did not prove the presence of ethanol in either the blood or urine of the deceased. The presence of Dosulepin was proven by screening examination of internal organs.

#### Case 7

The woman had been in inpatient and long-term outpatient treatment for anxiety-depressive disorder. One day in the afternoon she left on her bicycle without telling anyone and did not send any communication until the evening. As her mobile phone was switched off, her parents reported her missing to the Police in the evening. There was no contact from her in the following days either. Ten days later, a body of a 33-year-old woman lying on her back was found in a forest by random passers-by, the body was later identified as the missing woman. An expert in forensic medicine was called to the scene, who found insect larvae on her body, around her eyes, in her mouth, between her fingers, around the front of her neck, and under her arms. He further determined that the post-mortem bruises corresponded with the position of the deceased and that the post-mortem stiffness was fully developed in all muscle groups. There was an empty rucksack beneath her body, the bicycle next to her, and an open empty 1-litre bottle without a label lying at her feet. Empty medicine boxes (Brufen 400, AmoxiHexal) were scattered around, and blisters from these medicine boxes were found in her pockets (Brufen 400 none was missing, but the missing AmoxiHexal tablets were not found). The ground around the lower extremities was gouged by the heels (cramps?). The forensic autopsy determined that the cause of her death was hypothermia while consciousness had been inhibited by alcohol and drugs. The presence of ethanol (0.70 g/kg in urine) was proven by gas chromatography. The presence of Citalopram was proven by screening examination of internal organs by thin-layer chromatography.

#### Case 8

A paranoid 28-year-old man with auditory and visual hallucinations was transported to the Psychiatric Ward after a suicide attempt to cut his veins with a piece of tin from a lighter. The discharge report stated that he was a paranoid impulsive personality who had an acute polymorphic psychotic attack with symptoms of schizophrenia. After discharge, he left home during the night and did not return. In the morning he was found by random passers-by hanging from a lone Ash tree at the end of the street. The man was hanging from a deciduous tree, with his lower extremities hanging about 5 cm above the ground. The ligature mark was visible, with the rope running along the right side of his head, which was tilted to the left. It was a 7 mm braided rope, with the knot on the tree branch at 265 cm from the ground and 26 cm from the tree trunk. The rope was knotted at about two-thirds from the neck to the branch. The knot making the loop was placed under the right ear and there was a distinct bruise on the neck under this knot. No other signs of violence were found during the examination of the body. The forensic autopsy determined that the cause of the man's death was asphyxiation by hanging.

#### Case 9

After repeated suicide attempts the man, who had been diagnosed with schizophrenia serving a sentence in a specialized ward of a prison, finally hanged himself in his cell due to remorse. He used a bed sheet as a tourniquet, which he tied to the top of the bed construction. He was found thus hanged by his fellow prisoners, who informed the prison guards of the finding at 4:45 p.m. They immediately lowered the man to the ground and began to resuscitate him. He was transported to the hospital after the arrival of the Emergency Medical Services. Two days later at 8:45 a.m. he died in the Coronary Care Unit. It was found later from the CCTV footage from the prison corridor that at the time of the suicide, the 22-year-old man was alone in his cell. The forensic autopsy determined that the cause of death was heart failure due to brain swelling. The chemical-toxicological analysis did not prove the presence of ethanol in either the blood or urine of the deceased. The presence of Paracetamol and Metoclopramide was proven by screening examination of internal organs by thin-layer chromatography.

#### Case 10

The man who had been receiving inpatient and outpatient treatment for paranoid schizophrenia was left alone in his apartment from the morning. Around noon, a resident of the complex found his dead body under the windows of the apartment building at 4.4 m from the centre of his window. The circumstances and time of the fall are not clear, but it was a fall from a height of 15 meters. The objective findings of the doctor on duty at the scene indicate the body of a dead 23-year-old man on the cobblestone ground in a passive position on his back and with his legs elevated, stuck in a fence. Unstable deformed head with multiple laceration-crush wounds, including visible pieces of brain tissue. Discharge of blood from ears, blood in oral cavity, suppressed, deformed chest, open fracture of the wrist of left upper extremity. The forensic autopsy

determined that the cause of death were multiple injuries to organ systems vital to life. Toxicologically, by gas chromatography, ethanol was not detected in the blood or urine of the deceased. The reaction to detect the presence of toxic narcotics was negative.

#### Discussion

When we look at the dynamics of the suicides in our cases, the second and third cases document well thought out, prepared acts that were most likely planned over a longer period of time. The third case bears the features of a balance suicide, which is carried out in robust mental and physical health, on the basis of rational reflection and consideration of the positive and negative prospects of one's future life (12). In both cases, there are anamnestically documented changes in mood by the immediate family. Similarly, in the first case, there is a psychiatrically untreated woman, and the process how the suicide was carried out rather imitates a response to a desperate situation. But it could also have been a short-circuited act or an act in affect with no clear intent to commit suicide. It is hopelessness and, in the mentally ill, demoralization that have been cited in the literature as risk factors leading to suicide (13, 14). Thus, the first three cases suggest that family members could be the first ones to recognize suicidal tendencies. The other cases of suicide occurred in persons who were in outpatient psychiatric care. The fourth case describes a woman who was being treated for depression with tendencies toward uncontrollable medication use that ultimately, whether intentionally or unintentionally, ended fatally. In the other cases, the suicides were carried out in a similar scenario, but the stories show a more intense conviction to carry out the suicide. This is particularly documented in the fifth case against the background of repeated suicide attempts. A similar pattern is also seen in the sixth case, but here we cannot state exactly from the documented records whether this is a case of repeated drug overdose. Between 1985 and 2002, drug poisoning was the most frequent method of suicide or suicide attempts (15). Similarly, in the population of children and adolescents, drug poisoning was the most common form of suicide (16). The seventh case is partly reminiscent of a well-executed suicide plan. In the case of depression, including cases of anxiety and depressive disorders, the illness often has a chronic course and is associated with an increased risk of both suicidal thoughts and attempts. These individuals are frequently and repeatedly hospitalized, which corresponds with our cases. The risk of suicidal behaviour cannot be excepted and family members are also informed about it. The last three cases involve individuals who died at a young age. The eighth case highlights the fact that, despite hospitalization, the young man continued to have suicidal thoughts, which he eventually realized. Similarly, the ninth case, which takes place against a backdrop of despair, bears the features of the presence of suicidal thoughts. In the last, tenth, case, the body was found more than 4 meters away from the wall of the apartment building, indicating conscious act before the actual fall. Thus, it can be hypothesized that this was not an accidental fall, but an active jump, which, given the psychiatric history, can be characterized more as an unfortunate

accident and less as a typical suicide where the victim takes his life after mature reflection. It is thus more a case of taking one's life, which is understood as an act in disorders of consciousness, with the active concurrency of delusions, hallucinations, or even as an act in affect. In several cases, and especially in cases of premeditated suicides, ethyl alcohol was used. This corresponds with findings that ethyl alcohol use is associated with a higher risk of suicide (17, 18). Alcohol consumption has been found to be more closely associated with suicidality in Slovakia compared with the Czech Republic (19). Psychodiagnostically, suicidal tendencies are manifested by high anxiety scores, hypersensitivity, irritability, and depression, whereas suicidal tendencies usually continue with an attempt and end with a perfect suicide (20). Relatively little attention is being paid to laboratory diagnosis in this sense. Changes in the levels of neurotransmitters and their metabolites have been hypothesized, but in reality, the possibilities of routine screening in practice are still very limited with unknown reference values of potential suicidal activity (21–23). Some hope is placed on research that is based on targeted genetic mutations, with assumptions of predisposition to particular diseases as the primary basis (24, 25). Similar causalities are now being tested by primary research that is fundamentally based on genetically modified rodents (26, 27). Here, however, a more complex problem is involved, because suicide is likely to be the result of a process or the outcome of a combination of multiple factors, including the importance of social factors. This also correlates with our cases, some of which happened against a background of bad family or even deeply damaged social relationships. Nevertheless, some studies also document practical results, which holds a promise for the future. From a representative sample of 100 children and adolescents who had previously attempted suicide, it was shown by comparison with 100 healthy children that the children with psychiatric distress had significantly higher gene expression of BDNF (Brain Derived Neurotrophic Factor) compared with the healthy children (28). Thus, it is clear that laboratory parameters will play some role in the future in the prediction of potential suicidal ideation. Disturbances at the level of regulatory mechanisms that promote transcriptional changes also seem to be involved in the pathophysiology of suicide (29). However, it is questionable whether these are individual genetic mutations or whether mutations of groups of multiple related genes are involved in the mechanism. In fact, several risk factors have been identified that are involved in forming of suicidal ideation and suicides (30). In the course of reflecting on satisfaction and dissatisfaction with one's life, the level of fulfilment of one's life's purpose, along with sensitivity to environmental irritants, possible disappointments, the ability to cope with stressful situations, and ultimately also a lower capacity for adaptability to change of life conditions, thoughts of voluntarily ending one's life are born in people's minds. Conversely, in mentally ill people, suicidal thoughts and suicide itself are dependent on medication, the patient's cooperation with the psychiatrist and, ultimately, the patient's involvement in family and work life. Here we have found differences in the dynamics and realization of the suicides themselves, and therefore we are of the opinion that the predispositions associated

with a higher risk of suicide should also be assessed by the scale of changes in the above parameters.

## Conclusion

Suicides, but also attempts or such thoughts, present a certain problem in our society. In our opinion, it is necessary to look for possibilities that would lead to the elimination of this cause of mortality. One possibility seems to be to search for the population at risk by using predisposing factors. In our research, based on ten suicide cases, we confirmed that the first signs of suicidal behaviour could be noticed by family members. These are mood swings and suicide threats. In the cases of people with a history of mental illness, prevention is based on personal medication, closer psychiatrist-client collaboration with the gradual transfer of responsibility to the patient, learning to better manage stress, and finally motivation to be active with the support of other family members.

## References

1. Sidlo J, Mlynar J, Kuruc R, Ocko P, Valuch J. Psychoactive substances related to the deaths. *Bratisl Lek Listy* 2012; 113 (1): 26–29.
2. Wislowska-Stanek A, Kolosowska K, Maciejak P. Neurobiological basis of increased risk for suicidal behaviour. *Cells* 2021; 10: 2519.
3. Akkus M, Davarci PZ, Bas S, Odluyurt H, Aydogan M. Evaluation of inflammatory parameters in patients who attempted suicide by taking drugs. *Bratisl Lek Listy* 2022; 123 (6): 435–439.
4. Rezek J, Sidlo K, Dzupa V, Horacek J, Hulín I. Suicide attempts as a cause of pelvic injuries during the COVID-19 pandemic. *Bratisl Lek Listy* 2022; 123 (4): 231–235.
5. Yagci I, Avci S. Biochemical predictors in presentations to the emergency department after a suicide attempt. *Bratisl Lek Listy* 2021; 122 (3): 224–229.
6. NCZI. Národné centrum zdravotníckych informácií. [http://www.nczisk.sk/Statisticke\\_vystupy/Tematicke\\_statisticke\\_vystupy/Samovrazdy\\_samovrazedne\\_pokusy/Pages/default.aspx](http://www.nczisk.sk/Statisticke_vystupy/Tematicke_statisticke_vystupy/Samovrazdy_samovrazedne_pokusy/Pages/default.aspx)
7. ČSU. Český statistický úřad. [https://www.czso.cz/csu/czso/sebevrazdy\\_zaj](https://www.czso.cz/csu/czso/sebevrazdy_zaj)
8. Casant J, Helbich M. Inequalities of suicide mortality across urban and rural areas: A literature review. *Int. J. Environ. Res. Public Health* 2022; 5, 2669.
9. Carrasco-Barríos MT, Huertas P, Martín P, Martín C, Castillejos MC, Petkari E, Moreno-Kustner B. Determinants of suicidality in the European general populations: A systematic review and metaanalysis. *Int. J. Environ. Res. Public Health* 2020; 11, 4115.
10. Praisová J, Chomynová P, Dvořáková Z, Přihodová K, Csémy L. Analysis of the display of suicidal behavior among Czech adolescents: Risk factors for suicidal thoughts, plans, and attempts. *Česk-slov psychologie* 2018; 62: 16–31.
11. Williams AJ, Kloess JA, Gill C, Michail M. Assessing and responding to suicide risk in children and young people: Understanding views and experiences of helpline staff. *Int. J. Environ. Res. Public Health* 2022; 17, 10887.
12. Kafka J. *Psychiatry*. Martin: Osveta; 1998, 256.

13. Berardelli I, Sarubbi S, Rogante E, Hawkins M, Cocco G, Erbutto D, Lester D, Pompili M. The role of demoralisation and hopelessness in suicide risk in schizophrenia: a review of the literature. *Medicina (Kaunas)* 2019; 55: 200.
14. Miniati M, Callari A, Pini S. Adult attachment style and suicidality. *Psychiatria Danubina* 2017; 29: 250–259.
15. Bernert RA, Hilberg AM, Melia R, Kim JP, Shag NH, Abnoui F. Artificial intelligence and suicide prevention: A systematic review of machine learning investigations. *Int. J. Environ. Res. Public Health* 2022; 16: 5929.
16. Fonseca-Pedrero E, Al-Halabi S, Perez-Albeniz A, Debbane M. Risk and protective factors in adolescent suicidal behaviour: A network analysis. *Int. J. Environ. Res. Public Health* 2022; 3, 1784.
17. Amiri S, Behnezhad S. Alcohol use and risk of suicide: a systematic review and Meta-analysis. *J. Addic. Dis* 2020; 38: 200–213.
18. Xiang Z, Naimi TS, Kaplan MS, Bagge CL, Few LR, Maisto S, Saitz R, Freeman R. Alcohol policies and Suicide: a review of the literature. *Alcohol. Clin. Exp. Res* 2016; 40, 2043–2055.
19. Grohol M. Alcohol and suicides. *Alkoholizmus a drogové závislosti (Protialkohol obzor)* 2012; 47: 27–42.
20. Kolves K, Chitty KM, Wardhani R, Varnik A, de Leo D, Witt K. Impact of alcohol policies on suicidal behavior: A systematic literature review. *Int. J. Environ. Res. Public Health* 2022; 19, 7030.
21. Kukumberg P. Neuropsychology of suicide. *Neurol. pro praxi* 2009; 10: 80–82.
22. Marini S, Vellante F, Matarazzo I, De Berardis D, Serroni N, Gianfelice D, Olivieri L, Di Renzo F, Di Marco A, Formaro M, Orsolini L, Valchera A, Iasevoli F, Mazza M, Perna G, Martinotti G, Di Giannantonio M. Inflammatory markers and suicidal attempts in depressed patients: A review. *Int. J. Immunopathol. Pharmacol* 2016; 29: 583–594.
23. Kim JW, Szigethy EM, Melhem NM, Saghafi EM, Brent DA. Inflammatory markers and the pathogenesis of pediatric depression and suicide: a systematic review of the literature. *J. Clin. Psychiat* 2014; 75: 1242–1253.
24. Cheung S, Woo J, Maes MS, Zai CC. Suicide epigenetics, a review of recent progress. *J. Afect. Disorders* 2020; 265: 423–438.
25. Clayden RC, Zaruk A, Meyre D, Thabane, L, Samaan Z. The association of attempted suicide with genetic variants in the SLC6A4 and THP genes depends on the definition of suicidal behavior: a systematic review and meta-analysis. *Translat. Psychiat* 2012; 2: 166.
26. Makovický P. What does modern veterinary pathology have to offer? *ARC J. Anim. Vet. Sci* 2015; 1: 43–47.
27. Makovický P, Švecová I. Veterinary pathology: the past, present and the future. *Phenogenomic Newsletter* 2016; 2: 22–23.
28. Yilmaz R, Oztop DB, Sener EF, Cikili-Uytun M, Dal F, Yildiz E, Sahpolat M, Zararzi, G. BDNF gene expression association with suicide and psychiatric disorders in children and adolescents: (Relationship between BDNF gene expression and suicide). *Beh. Brain Res* 2021; in press.
29. Cabrera-Mendoza B, de Anda-Jauregui G, Nicolini H, Fresno C. A meta-study on transcription factors networks in the suicidal brain. *J. Psychiat. Res* 2002; 136: 23–31.
30. Anders M. Suicide – a serious health and social problem with the possibility of prevention. *Čas. Lék. Českých* 2017; 156: 58–67.

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