

Research article

## Suicide in northern Tunisia: A twelve-years study (2005-2016)

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### Abstract

**Introduction** : Suicides represents a global public health problem. It is the second most frequent cause of death of persons aged between 15 and 35 years-old. This phenomenon was well described in western and Asian countries. However, data are scarce in countries in the Arab world.

The objective of our study was to analyze the pattern of suicides in Northern Tunisia.

**Methods** : We performed a cross sectional descriptive study, with a retrospective data collection. The study was realized in the Legal Medicine Department of the Charles Nicolle Hospital of Tunis, during a 12 years period (2005-2016). We included all cases of suicides that occurred in the North of Tunisia and whose victims were autopsied in our Department.

**Results** : We counted 1401 cases of suicides. Victims were mainly males (72.66%) and aged between 20 and 39 years-old (42.82%). A history of mental disease was reported in 43.32% of cases, specifically Schizophrenia (36.90%) and Depression (23.39%).

A history of suicidal attempts was reported in 15.70% of cases. Victims were most frequently single or married (80.87%) and jobless (47.46%).

Motives of suicide were most frequently, a decompensation of a psychiatric disease (29.84%), familial and/or intra-marital conflicts (10.06%) or financial problems (7.42%).

Suicides occurred mainly in private housings (62.60%) followed by public places (18.70%). The three main suicidal modes were hanging (44.54%), self-immolation (18.92%) and self-intoxication (15.92%).

**Conclusion** : Our results permitted to identify the epidemiological features of victims of suicide. This would ensure to policy-makers to adapt their policies and strategies aiming to prevent the suicidal risks.

**Key words**: Suicide, Judicial Hanging, Intoxication, Victim, Autopsy, Forensic Medicine.

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### 1. Introduction

Suicide is a global public health problem. According to data from the World Health Organization (WHO) (2018), on an international scale, nearly 800,000 people commit suicide each year [1]. Every suicide is a tragedy that affects families and has lasting effects on those who remain. Suicide occurs at any point in life and was the second leading cause of death among the 15-29 age group in the world in 2016, and this global phenomenon is not the only cause of High income, indeed, in 2015, over 78% of suicides occurred in low- and middle-income countries [1]. These projected deaths could result in a serious socio-economic burden for society, particularly by increasing the burden of health care.

Suicide represents a complex and multifactorial human behavior. It has been closely associated with mental illness, mainly depression, alcoholism, schizophrenia and personality disorders [2,

3]. Genetic [4, 5], biological [2, 6] and socioeconomic [7] factors also contribute to the etiology of suicidal behavior. Many epidemiological studies indicate that the frequency of suicide varies considerably between countries and their different cultures. According to the OECD (2017) [8] for the suicide index per 100,000 inhabitants, South Africa has the lowest rate in 2015, with less than 5 suicides /100,000 inhabitants, while Lithuania had the highest rate, with 29 suicides /100,000 inhabitants [8] [OECD 2017]. The average annual suicide rate according to WHO in 2018 is 10.7/100,000 inhabitants [9].

The national incidence of suicide in Tunisia for the year 2015 was 3.27/100,000 inhabitants against 3.4/100,000 inhabitants in 2014 [10]. Which proves that we are among the low-suicide countries.

In almost all, the societies for which data are available, suicide rates are higher for men than for women, they tend to increase with age and are higher

for single, divorced and widowed men [11]. In Western countries, suicide rates are generally higher in urban areas than in rural areas.

Tunisia is a developing country suffering from the rising cost of living since the global financial crisis of 2008, followed by the 2011 revolution, which has worsened the economic situation of the population [12]. These results could suggest the increasing number of suicide deaths in Tunisia and specifically in northern Tunisia from 2005 to 2016, from 95 to 165 victims respectively.

During this period of our study, our results show that the profile of suicide in northern Tunisia is represented by a young adult male, under 40 years old, single, without profession, often following a decompensation of a mental illness, with a suicide by hanging.

The phenomenon of self-immolation has also evolved dramatically since the self-immolation of Mohamed Bouazizi, which occurred on December 17, 2010. Suicide by self-immolation has become a means of protest [12,13]. This mode of suicide by self-immolation has now become the second mode of suicide after being the fourth mode. The aim of this retrospective study was to establish the epidemiological profile of suicides in northern Tunisia, and to discuss the preventive measures adapted to our context.

## 2. Methods

### 2.1. Type, location and duration of the study

Our study was carried out a descriptive study with retrospective data collection conducted at the forensic department of the Charles Nicolle Hospital of Tunis, spread over a 12-year period, from January 1, 2005 to December 31, 2016. Our service covers the activity forensic of the 10 governorates of northern Tunisia namely: Tunis, Ben Arous, Manouba, Ariana, Beja, Le Kef, Jendouba, Zaghouan, Bizerte and Siliana (Figure 1). According to the 2014 official statistics, the north of Tunisia has a population of 4,657,480 inhabitants [10].

### 2.2. Type of variables and data collection

Variables collected from the Victims' Memorials file, forensic autopsy reports, judicial police reports and hospitalization records in the event of death at a distance suicidal act.

The variables collected, divided into three sections as follows:

- ✓ Description of the population: Age, sex, civil status, then profession, psychiatric history, type of psychiatric illness if exist.
- ✓ Circumstances of suicide: the places, days, months and seasons of death of the victims, the suicidal mode, the reason for suicide.
- ✓ The autopsy findings: It has been practiced in all victims where we have determined the

signs most frequently observed during the lifting of the body in each suicidal mode.

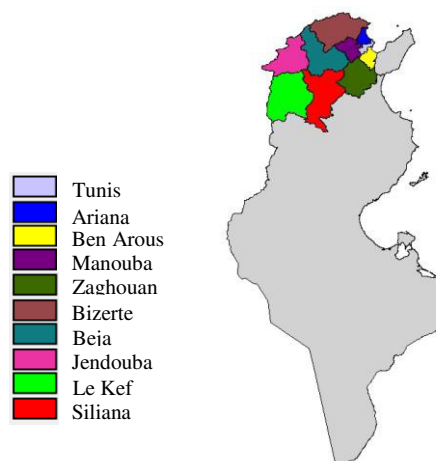


Fig. 1: The 10 governorates of northern Tunisia covered by the forensic department of Charles Nicolle Hospital, Tunisia.

### 2.3. Statistical analysis

The data was entered using both Microsoft Excel 2007® software for Windows® and SPSS 20.0® software for Windows®.

We calculated simple frequencies and relative frequencies (percentages) for qualitative variables. We calculated means, medians and standard deviations (standard deviations) and determined the range (extreme values: minimum and maximum) for the quantitative variables.

Our sample includes 1401 cases; statistically this number of individual is very important. It can be considered as representative according to the weak law of large numbers. Indeed, if the number of individuals is large ( $> 30$  observations), all the laws converge towards the normal law. Because of this, our sample is assumed to follow the normal law. In order to highlight the statistical dependence between two (variable) phenomena, a bivariate test was performed, namely the Chi-square test and the probability (P-value)

## 3. Results and discussion

Tunisia is a developing country suffering from the rising cost of living since the global financial crisis of 2008, followed by the 2011 revolution, which has worsened the economic situation of the population [12]. These results could suggest the increasing number of suicide deaths in Tunisia and specifically in northern Tunisia from 2005 to 2016, from 95 to 165 victims respectively.

At the end of our study, our results show that the profile of suicides in northern Tunisia is represented by a young adult male, aged under 40, single, without profession, often following a decompensation of a mental illness, with a hanging suicide most often committed in the private home. Suicides occurred most often in the spring, in the month of May, Monday to the beginning of the week.

The phenomenon of self-immolation has also evolved dramatically since the self-immolation of Mohamed Bouazizi, which occurred on December 17, 2010. Suicide by self-immolation has become a means of protest [12,14,]. This mode of suicide by self-immolation has now become the second mode of suicide after being the fourth mode.

Our study is criticized for the retrospective nature of the data collection, which meant that several data were missing. In fact, during the development of the database, several victims have missing and / or inaccurate data, as examples, in 40% of the victims we did not know the reason for suicide and in 47% of the victims. victims we did not know the profession. Another limitation of our study is that it focuses only on northern Tunisia except Nabeul governorate, it is desirable that the study is multicentric covering the whole country and that it is prospective.

Nevertheless, our study finds its strength and its interest, on the one hand by the statistical representativeness of its workforce of 1401 victims and its duration of more than a decade (12 years), on the other hand, our study swept all modes of suicide with its different characteristics. Finally, the legal medicine service of Tunis covers almost half of the Tunisian people (41.75%). The importance of our study lies in improving our knowledge of this phenomenon-suicide that threatens our citizens.

### 3.1. Profile of the suicide

Suicide as an act could be preventable. However, every 40 seconds, someone commits suicide somewhere in the world. Faced with this international phenomenon, unfortunately no region or age group is spared. On a global scale, suicides occur in adolescents and adults of all ages. But it particularly affects young people aged 15 to 29, for whom it is the second leading cause of death [1]. Worldwide, nearly 800,000 suicide deaths occurred in 2016. Men are 75% more likely than women to commit suicide [9].

In Tunisia, the extent of the suicidal phenomenon is difficult to appreciate because of the social and religious taboos surrounding it. The studies carried out on this subject have shown that in Tunisia, as everywhere in the world, no age group is in savings and all types of suicides are practiced [13,15,16,17]. These findings of Tunisian literature are almost identical to those of our study of northern Tunisia. In fact, we recorded 1401 suicides of all types, ranging from hanging, which is the most common mode (44.5%) to electrocution (0.14%). We observed a male predominance with a sex ratio equal to 2.65, the victims cover all age groups ranging from children (<18 years old) to elderly people (> 65 years old) (Table 1). The international incidence of suicide for the year 2012 was 11.4/100,000 inhabitants including 15/100,000 for men and 8/100,000 for women. For Europe 12/100 000 inhabitants, for Asia 17.7/100,000 inhabitants, for America 6.1/100,000 and for Africa 10/100 000 [1]. The national incidence of suicide in

Tunisia for the year 2015 was 3.27/100,000 inhabitants against 3.4/100,000 inhabitants in 2014; corresponding to 365 cases of suicide in 2015 against 372 cases in 2014 [10].

#### 3.1.1. Age

In our study, the most affected age group was between 21 and 29 years old. Comparing our results with those of international epidemiological studies, they are different. In fact, elsewhere, the risk of suicide increased with age with a higher suicide rate for people over 65, between 14 and 33% of all suicides [18,19], and recent WHO study on age, the highest suicide rates are among people aged 70 and over, both males and females, in almost all regions of the world [20].

However, according to the WHO in 2014 [20], among young people, overall, suicide is the second leading cause of death among 15 to 29 year-olds [20]. As a result, our results in northern Tunisia coincide perfectly with the WHO global result, where suicide particularly affects young people aged 15 to 29 years. In Tunisia, the 30-39 age group comes second after the age group 21-29 years, these two age groups together constitute 47.9% of all victims by suicide between 2005 and 2016. This result is the same for suicides across the country in 2015, where the highest frequency was 45.33%, and the highest incidence of suicide was observed among individuals aged 20 to 39 (4). , 43/100,000) [10]. In the majority of cases it is a young person without a desperate profession with a difficult psychological situation.

In France, the suicide death rate increases sharply with age. In 2013, it stood at 5.7 per 100,000 population aged 15 to 24 and 37.2 per 100,000 population aged 75 and over. On the other hand, the share of suicide in general mortality accounts for 17% of all deaths among people aged 15-24 and less than 0.5% of all deaths among people aged 75 and over [21,22]. Between 2000 and 2013, suicide death rates declined overall by 22%, but for men aged 45 to 64, they increased slightly [21,22].

In the United States, in 2013, suicide is the third, second, fourth and fifth leading cause of death for people aged 10 to 14, 15 to 34, 35 to 44, and 45 at age 54 [23].

The same result is found in South Korea in 2012 where the suicide rate increases with age. The suicide index per 100,000 population is 19.25 for the 20-year-olds, 26.94 for the 30-year-olds, 30.41 for the 40-year-olds, 35.52 for the 50-year-olds and 42.45 for the 60-year-olds. and 83.19 in the 70 years [24].

Our results for northern Tunisia coincide with those of whole Tunisia in 2015, where the average age of suicide was  $37.9 \pm 17.6$  years with extremes ranging from 9 to 88 years. The highest incidence of suicide was observed in individuals aged 20 to 39 years old 4.43/100,000, the lowest was observed in those under 20 (1.4/100,000), remaining age groups, it decreases according to the advancement in age, it is as follows: 40-59 are the age group 3.86/100,000, the age group

60-79 years 3.84/100,000 and the age group > 80 years 2.79/100,000 [10].

Table 1: Distribution of victims by age

Age range	Numbers	Percentage
<18	107	7,6
18-20	48	3,4
21-29	351	25,1
30-39	320	22,8
40-49	244	17,4
50-59	174	12,4
60-65	62	4,4
>65	95	6,8
Total	1401	100

Suicide is the result of complex interactions between various factors, such as socio-demographic characteristics, social status, religion, and personality traits [25,26]. The mental disorder associated with suicide is particularly strong in East Asian countries compared to other countries [27]. Having suicide in Tunisia decreases with advancing age could be explained by a certain family balance, religious commitment and stigma; these various factors may influence attitudes towards suicide [28]. Individuals who had previously attempted suicide or suicidal ideation may have been more supportive of suicide than those who did not have the idea [29], this suicide could be a kind of problem-solving method. Only for those who had an unfavorable attitude toward suicide.

**3.1.2. Genre:**

We observed a male predominance with a sex ratio equal to 2.65 (Figure 2). This finding has been made in several studies on suicide in general, where male belonging appeared in all publications as a major risk factor [29,30].

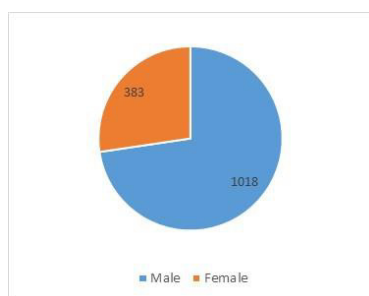


Fig. 2: Suicide distribution by sex

This is a self-report-to-men-to-men, the simple of the emphasis of the violent and radical bolder, a lyce to old sexes [30]. But also, with the real intent to die, with the same name less important on women than on men, who engage more easily in suicidal behavior and on the facts men have less help and reconciliation than women [31]. This does not mean that the number of female victims is negligible; it would be especially related to the breakdowns of mental illnesses, young age, somatic diseases, as well as violence and sexual

abuse [32]. Although the suicide rate has been reached among men, the sex ratio (male/female) varies considerably from one country to another. In Western countries, it is 3 to 4: 1, while it is generally less than 2: 1 in eastern countries [33]. It is even in some societies like Korah's about 1: 1 among Korean teens and young adults [34]. This difference in suicide rates between the sexes may be greater in communities where men and women are supposed to be distinguished [35]. The suicide rate between men and women was higher in the United States and Finland, where differences in methods of suicide between men and women were more pronounced in Korea and Japan [34]. The prevalence of deadly suicide methods can be reflected in suicide rates in each country and in men versus women. The difference between suicide methods is an important factor distinguishing completed suicide attempts [36]. On the Mists for An's Mids, In The Moods to Buy, Mists for Women, How to Buy, Mists of Women, for Respective Differences in Suicide.

Women have a long history of social disadvantage, with a lower suicide rate than their male counterparts. The inequality between the sexes in the world in the form of health, social status, economic status, intellectual status [37]. However, the discrimination inherent in culture can not be easily eliminated through economic prosperity. Thus, understanding the cultural component has helped to reveal suicide rates around the world [44].

Suicide rates between men and women were higher in countries with more egalitarian gender norms [44]. Strategies for eliminating gender discrimination in culture have the potential to prevent suicides. In some societies, particularly in low- and middle-income countries, due to excessive child mortality and sex-selective abortion, all girls are missing in a particular cultural attitude [38,39]. Her son's preference is a discrimination between women on culture, whether internalized themselves, this kind of sexist bias is self-sustaining with little need for direct reinforcement on the part of the male world [38, 40].

**3.1.3. Civil status:**

In our series, the majority of suicides were alone (49.53%), either widowed, divorced or single (Figure 3). Also, 48.03% of the men were single and 36.83% were married, however for the women 53.82% were single and 33.42% were married. These results corroborate perfectly with what is in the literature [41]. For example, social factors such as being single, divorced, widowed, socially isolated, lonely, or losing social connections have been reported as risk factors for the desire for death, suicidal thoughts and behaviors. in adolescents [42], the elderly [43,44,45,46], and psychiatric patients [47].

The French sociologist Emile Durkheim [48] defined suicide as a social phenomenon and emphasized the influential role played by social factors. Durkheim emphasized the link between suicide

and situations of social integration, including marriage, divorce and parenthood. In addition, marital status is known to reflect the vast phenomenon of social integration in the social structure [49]. Marriage also increases integration and regulation, makes more sense and should reduce the risk of suicide. On the other hand, divorce tends to increase the risk of suicide because it breaks the links between the individual and the marriage [49].

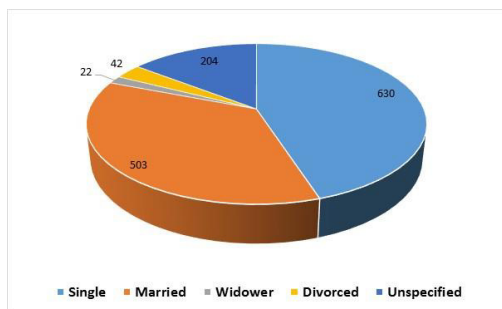


Fig. 3: Distribution of suicides by marital status

From the time of Durkheim until the 2000s, sociologists have studied to show that marital status was a predictor of significant suicide, and they found that the risk of suicide of unmarried persons was significantly higher than that of their married counterparts [50,51]. In a review of the literature on suicide factors, Fässberg et al., [52] highlighted the positive relationship between social factors (family, friends and social groups) and suicide. In other research on suicide mortality, divorce has shown a positive association with suicide at the individual and global levels, while marriage has a negative association with suicide [53]. Some researchers have performed meta-analyses to synthesize estimates reported in individual studies on the association between marital status and suicide [54]. They showed that the end of marriage under its different forms of divorce or widowhood had a statistically significant association with the risk of suicide. Yip et al., (2015) [54] found that socio-cultural differences and gender inequalities were important moderators in the relationship between marital status and suicide risk. Yoshimasu et al., (2008) [54] assessed the effects of mood disorders, adverse marital status, unfavorable work status, and found that they are strongly associated with suicide risk. In a meta-analysis of marital status and mortality similar to suicide studies, Shor et al., (2012) [55] found that dissolution of marriage (ie, divorce and separation) and widowhood are associated with high mortality. Another work has shown that single people have a higher risk of premature death than married persons [56]. These meta-analyses are notable for examining the effects of multiple potential moderators, such as gender, age, cultural differences, and period [55,56].

Many studies have suggested that the association between marital status and suicide is sensitive to socio-economic variables, such as gender, age, and cultural factors [57,58]. Therefore, important

moderators must be carefully considered to improve understanding of the association between marital status and suicide [66]. According to Maalaoui (2011) [59] elderly suicides seem to be more socially isolated than the general population at the same age. The remoteness of children, common today, is often painfully lived. The traditional family, characterized by geographical proximity, is now replaced by a scattered family including the departure of children to find a job. Retirement, loss of professional activity, deterioration of financial conditions, especially in rural areas, are all factors that undermine self-esteem and may affect the independence of the subject.

#### 3.1.4. The profession :

Suicide can be a hidden business risk because suicide is not defined as a profession-related death, unless the worker chooses to end his or her life at the place of employment [60]. Many authors have reported that the profession has an impact on suicidal behavior [61,62,63]. Although the relationship between suicide and unemployment has been the subject of many studies [64,65] showing an increased rate of suicide among the unemployed, the relationship between suicide and occupation has been much less studied, probably because of the relatively small number of people in each group. In addition to national statistics describing the relationship between occupation and suicide, a number of studies have examined in greater detail some of the specific occupations characterized by a high suicide rate. These included health-related occupations, such as physicians [66], nurses [67], farmers (including horticulturists and farmers) [81], armed forces [68], students [69,70] and artists [71].

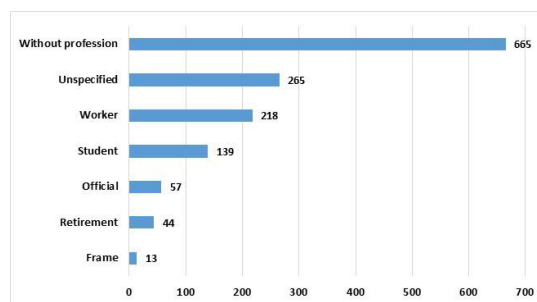


Fig. 4: Distribution of victims according to their professions

The epidemiological literature reports several studies, mainly based on death statistics, which include, among others, the United States, England, Japan and New Zealand [72,73,74,75], describing suicide mortality. according to the professional category. These studies, which report inequalities between professional categories, are not always convergent. However, they generally agree on an excess risk of farmers compared to other categories [76]. The use of the industry or, better still, the use of both industry and occupational categories is less common [63] whereas such analyzes could enrich the questioning. In addition, analyzes of these mortality data are generally not limited to asset age classes.

However, it may seem useful to restrict oneself to the study of mortality up to age 65, with the objective of epidemiological surveillance of occupational risks [77].

In our series, apart from the unprofessional victims come in order the workers, followed by students and students, civil servants and finally retirees. This result corroborates with what we have just quoted above in consulting the international literature (Figure 4).

3.1.5. Psychiatric history, suicidal attempts and suicidal motives:

At the global level, WHO considers that five of the top ten most serious diseases in the 21st century are mental disorders: schizophrenia, bipolar disorder, addiction, depression and obsessive-compulsive disorder. They are responsible for most of the suicide mortality, disability and severe disability, as well as a deteriorated quality of life for those affected [23].

People with mental illnesses have a higher risk of prematurely dying from natural or unnatural causes [78] and their average lifespan is 15 to 20 years lower than that of the general population in general [79]. Excess mortality in psychiatric patients can be partly explained by an increased risk of suicide [80]. Several studies based on national data have shown that approximately 44% of all people who die by suicide have been admitted to a psychiatric hospital [81,82]. In the long run, about 4% to 5% of people admitted to a psychiatric hospital will die by suicide. Psychological autopsy studies estimated that up to 90% of those who died by suicide met the criteria for a psychiatric disorder [82]. Interviews showed that nearly two-thirds of self-injurious people reported having mental health care prior to the incident [79, 82]. Thus, the association between mental illness and suicidal behavior is well established

3.2. Circumstances of suicides

Time, temperature and seasonal variations: these are the three themes that interested, even fascinated sociologist Emile Durkheim, he wrote in his book Suicide "Every season brings its contingent of suicides". Time, temperature and seasonal variations: these are central elements in the life of our contemporary societies. Be it lifestyles, political regimes or criminality, observers of social life could not ignore the effect of geographical location and therefore temperature. Criminologists, especially those from the Italian School, have analyzed the links between crime and meteorology. "Good time for crime!", Violence, whether assault or sexual assault, increases with the increase in temperature. The phenomenon is explained by the theory of routine activities: people go out of their homes more in the sunny days, which leads to an increase in interactions between people and thereby an increased risk of interpersonal conflict [83].

Richard Trudeau (2015) [84] also observed a certain seasonality in suicides, much less marked

however than for other causes of death. Thus, the average daily number of suicides tends to peak in the spring. For many of the years under study, there was also a second increase in the fall. The monthly profile of suicides has also changed somewhat since the mid-1970s. For the last few years, there has been a peak in March, whereas previously this summit was from April to June. Throughout the study period, seasonal peaks were about 9% above average. Although, some people think that there are more suicides during the holiday season, seasonal peaks in the number of suicides actually occur during this period [84].

In our study between 2005 and 2016 we noted a perpetual increase in the number of suicides from 95 to 169 victims respectively (Figure 5 and Figure 6). But in all cases we still have the same results and the majority of suicides occurred in the spring (28.8% of cases) and in summer (28.1% of cases). Suicides occurred in 20% of cases in May and June, with respectively 10.2% and 10.1%.

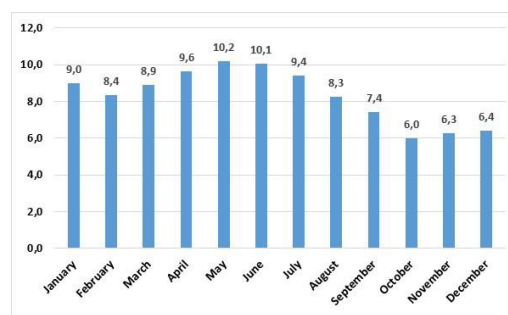


Fig. 5: Frequency of cases by months (%)

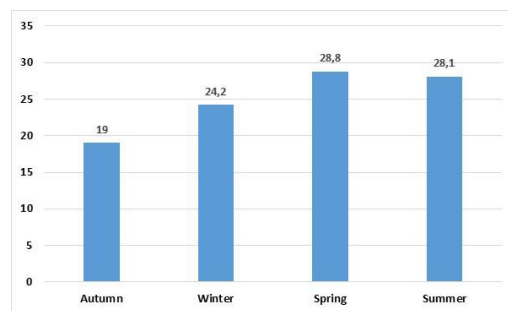


Fig. 6: Frequency of cases by season (%)

This result is in perfect coherence with what has been quoted from the international literature. In addition, Monday represents the number 1 day in the number of suicide (237 cases) and Sunday the day with the lowest cases (152 cases). Indeed, suicidal acts occurred in 32% of cases at the beginning of the week (Monday and Tuesday), in 44% of the cases in the middle of the week (Wednesday, Thursday and Friday) and in 24% of the cases during the weekend. This result also corroborates with what is found elsewhere in other countries, it also coincides with the profession of the victims who are either workers or people who do not have professions.

In our study, only 13 people left a suicidal note that was <1% (0.92%) of our series. However, the

presence of a suicide note, and depending on its content, is a valuable contribution to the investigator, the medical examiner and the relatives of the victim because it can specify whether the suicide was planned or not, the reason (s) for the suicide, the psychological state prior to the death and also, especially if it is written by hand, to specify whether it was really a suicide or a masked homicide [85]. However, our result is very different from the international literature where 15% to 43% of cases were tired of a suicidal note [86,87,88], this can be explained by the intellectual level of suicides or by their cultures.

Suicide places are multiple either indoors in private homes, residences; hotels, inns and other public places of accommodation in vehicles, including cars, trailers, commercial vehicles and caravans; outside, they were roads, highways, fields, parks and campgrounds [35,89,90,91].

In our series we have 62% of cases committed the suicide act in their private homes and 18% in public places, women are present in all places except schools (Figure 7). This observation makes it possible to suggest that our results corroborate with the literature [35,91,92].

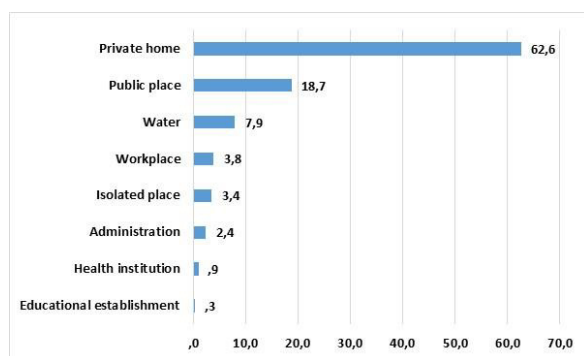


Fig. 7: Distribution of places of suicides

### 3.3. Prevention

Suicide remains an important public health problem. Most people with depression do not seek help for their mental disorders. It is a preventable public health problem, it can be solved by interventions to improve the detection of patients with suicidal ideation. Identifying high-risk individuals makes intervention possible before they attempt to end their lives. This loss of life has an emotional impact on the family and friends of the victim. Suicidal behavior is complex and many etiologies need to be considered when discussing suicidal behavior and prevention.

Identifying high-risk patients is the first step in preventing suicide. However, this identification is not simple. It is often a question of tracking the patient before his suicidal thoughts result in an attempt at suicide or death. [93] Control should be at the family level or with senior citizens' homes, they should learn about mental illness and suicidal ideation [93,94]. Primary health care providers and retirement homes need to be trained and sensitized to these issues in

order to improve the detection of persons with suicidal desires [93].

The prevention of suicidal risk is therefore organized around three levels :

- (i) Primary prevention by detecting subjects at risk. This is upstream prevention to identify risk factors or stress.
- (ii) Secondary prevention is to promote access to care.
- (iii) Tertiary or medical prevention consists in delivering care by identifying the dimensions, treating and managing suicides at an individual and collective level.

Finally, the phenomenon of imitation or the effect of copying can be prevented in a reasoning and framed how to mediate suicides that obeyed the rules of good practice [95].

In conclusion, suicide represents a public health problem in Tunisia. Our study on the general victim profile and profiles specific to each suicidal mode. These results were used by decision-makers as part of the suicidal risk prevention strategy and strategies in Tunisia.

On our part and according to the Tunisian victimological profile, we propose for the prevention:

- To detect personality disorders from an early age, especially among adolescents, by transmitting a body of knowledge and skills in different environments, hospitals, schools, prisons,
- Improve access to care and mental health care and guarantee a better price.
- The return to the traditional architecture of Tunisian family solidarity and cooperating.
- Ensure a satisfying social life and social integration, eg. through work, constructive use of free time and community involvement.
- Strengthen religious, cultural and ethnic beliefs.
- the cultural of risk of general must be a teaching module, from the level of primary education to higher education.

This teaching must be easily assimilated by the natural risks, up to the biological, medical and psychic risks.

### 4. Conclusions

In our study we noted that the majority of suicides occurred in the spring (28.77% of cases) and in summer (28.05% of cases). Suicides occurred in 20.27% of cases in May and June, with respectively 10.21 and 10.06%. This result is in perfect coherence with what has been quoted in the international literature.

Only 13 people left a suicidal note. This result is different from Western literature, where 15% to 43% of victims have a suicidal note, which can be explained by the intellectual level of suicides or by cultural determinants.

In our series, 62.60% of cases had committed suicide in their private homes and 18.70% in public places, women are present in all places except schools. This observation makes it possible to suggest that our results join the data of the scientific literature.

The first suicidal mode in northern Tunisia was hanging (44.54%). Hanging is, because of the ease of its realization and its almost radical character, one of the great causes of voluntary death. Self-immolation by fire represented the second suicidal mode in northern Tunisia (18.92%). The phenomenon of self-immolation has also evolved since the self-immolation of Mohamed Bouazizi, which occurred on December 17, 2010. This event was at the origin of the popular demonstrations against the political regime where the latter acquired social prestige and the title of a martyr. As a result, suicide rates increased 1.8 times in the four years after the 2011 revolution, and self-immolation increased three-fold. In our study, this suicidal mode was the 4<sup>th</sup> mode in the North of Tunisia, today after the revolution it occupied the second rank after the suicide by hanging. The increase in the frequency of fire immolation could be explained in part by an imitation phenomenon, called a copy-cat effect.

In conclusion, suicide represents a public health problem in Tunisia. Our study has made it possible to identify the general victimological profile of this phenomenon and the profiles specific to each suicidal mode. These results could be used by policymakers in setting policies and strategies to prevent suicidal risk in Tunisia.

**Conflict of interest** None.

## References

- [1] Organisation mondiale de la Santé. Prévention du suicide, l'état d'urgence mondial. Organ Mond la Santé 2014:89p.
- [2] Bunch J, Nelson B, Sainsbury P, Barraclough BB, Theanatomy FW. Cases of Suicide : Clinical Aspects s. d.
- [3] Henriksson MM, Aro HM, Marttunen MJ, Heikkinen ME, Isometsa ET, Kuoppasalmi KI, et al. Mental disorders and comorbidity in suicide. *Am J Psychiatry* 1993;150:935-40. doi:10.1176/ajp.150.6.935.
- [4] Egeland JA, Susser JN. for Affective Disorders. North 2010.
- [5] Åsberg M, Träskman L, Thorén P. 5-HIAA in the Cerebrospinal Fluid. *Arch Gen Psychiatry* 1976;33:1193. doi:10.1001/archpsyc.1976.01770100055005.
- [6] Banki CM, Arató M, Papp Z, Kurcz M. Biochemical markers in suicidal patients. Investigations with cerebrospinal fluid amine metabolites and neuroendocrine tests. *J Affect Disord* 1984;6:341-50. doi:10.1016/S0165-0327(84)80012-9.
- [7] C. LV, F. L, F. L. Worldwide trends in suicide mortality, 1955-1989. *Acta Psychiatr Scand* 1994;90:53-64.
- [8] Panorama de la santé 2017. 2017. doi:10.1787/health\_glance-2017-fr.
- [9] OMS. World health statistics 2018: monitoring health for the SDGs, sustainable development goals. OMS. 2018.
- [10] Comité technique de lutte contre le suicide. Statistiques nationales du suicide en Tunisie pour l'année 2015 2015;61:1-5.
- [11] Kreitman N. Suicide, age and marital status. *Psychol Med* 1988;18:121-8. doi:10.1017/S0033291700001951.
- [12] Ben Khelil M, Zgarni A, Bellali M, Thaljaoui W, Zhioua M, Hamdoun M. Deaths among homeless in northern Tunisia: a 10-year study (2005–2014). *Public Health* 2018;162:41-7. doi:10.1016/j.puhe.2018.04.016.
- [13] Ben Khelil M, Zgarni A, Ben Mohamed M, Allouche M, Benzarti A, Banasr A, et al. A comparison of suicidal behavior by burns five years before and five years after the 2011 Tunisian Revolution. *Burns* 2017;43:858-65.
- [14] Ben Khelil M, Zgarni A, Zaafrane M, Chkribane Y, Gharbaoui M, Harzallah H, et al. Suicide by self-immolation in Tunisia: A 10 year study (2005–2014). *Burns* 2016;42:1593-9. doi:10.1016/j.burns.2016.04.019.
- [15] Gharbaoui M, Ben Khelil M, Harzallah H, Benzarti A, Zhioua M, Hamdoun M. Pattern of suicide by self-poisoning in Northern Tunisia: An eleven-year study (2005–2015). *J Forensic Leg Med* 2019;61:1-4. doi:10.1016/j.jflm.2018.10.004.
- [16] Ben Khelil M, Gharbaoui M, Farhani F, Zaafrane M, Harzallah H, Allouche M, et al. Impact of the Tunisian Revolution on homicide and suicide rates in Tunisia. *Int J Public Health* 2016;61:995-1002. doi:10.1007/s00038-016-0834-8.
- [17] Allouche M, Banasr A, Ben Khelil M, Shimi M, Bekir O, Gloulou F, et al. Le suicide du sujet âgé au Nord de la Tunisie. *J Med Leg Droit Med* 2010;53:68-74.
- [18] Byard RW, Hanson KA, Gilbert JD. Suicide methods in the elderly in South Australia 1981-2000. *J Clin Forensic Med* 2004;11:71-4. doi:10.1016/j.jcfm.2003.10.005.
- [19] Shah A. Elderly suicide rates in the United Kingdom: Trends from 1979 to 2002. *Med Sci Law* 2007;47:56-60. doi:10.1258/rsmml.47.1.56.
- [20] World Health Organization. Preventing suicide. World Health Organization; 2014.
- [21] ESP. L'état de santé de la population en France rapport 2017. France: Dicom; 2017.
- [22] Observatoire National de Suicide France. Suicide 2. vol. 2ème Editi. 2016.
- [23] Rostami M, Jalilian A, Rezaei-Zangeneh R, Salari A. Factors associated with the choice of suicide method in Kermanshah Province, Iran. *Ann Saudi Med* 2016;36:7-16. doi:10.5144/0256-4947.2016.7.
- [24] Na KS, Oh KS, Lim SW, Ryu SH, Lee JY, Hong JP, et al. Association between age and attitudes toward suicide. *Eur J Psychiatry* 2018;32:44-51. doi:10.1016/j.ejpsy.2017.08.007.
- [25] Crump C, Sundquist K, Sundquist J, Winkleby MA. Sociodemographic, psychiatric and somatic risk factors for suicide: A Swedish national cohort study. *Psychol Med* 2014;44:279-89. doi:10.1017/S0033291713000810.
- [26] Na KS, Oh SJ, Jung HY, Irene Lee S, Kim YK, Han C, et al. Alexithymia and low cooperativeness are associated with suicide attempts in male military personnel with adjustment disorder: A case-control study. *Psychiatry Res* 2013;205:220-6. doi:10.1016/j.psychres.2012.08.027.
- [27] Cho SE, Na KS, Cho SJ, Im JS, Kang SG. Geographical and temporal variations in the prevalence of mental disorders in suicide: Systematic review and meta-analysis. *J Affect Disord* 2016;190:704-13. doi:10.1016/j.jad.2015.11.008.
- [28] Foo XY, Mohd. Alwi MN, Ismail SIF, Ibrahim N, Jamil Osman Z. Religious Commitment, Attitudes Toward Suicide, and Suicidal Behaviors Among College Students of Different Ethnic and Religious Groups in Malaysia. *J Relig Health* 2014;53:731-46. doi:10.1007/s10943-012-9667-9.
- [29] Álvaro-Meca A, Kneib T, Gil-Prieto R, Gil de Miguel A. Epidemiology of suicide in Spain, 1981-2008: A spatiotemporal analysis. *Public Health* 2013;127:380-5. doi:10.1016/j.puhe.2012.12.007.
- [30] Langhinrichsen-Rohling J, Friend J, Powell A. Adolescent suicide, gender, and culture: A rate and risk factor analysis. *Aggress Violent Behav* 2009;14:402-14. doi:10.1016/j.avb.2009.06.010.
- [31] Cibis A, Mergl R, Bramefeld A, Althaus D, Niklewski G, Schmidtke A, et al. Preference of lethal methods is not the only cause for higher suicide rates in males. *J Affect Disord* 2012;136:9-16. doi:10.1016/j.jad.2011.08.032.
- [32] Kposowa AJ, McElvain JP. Gender, place, and method of suicide. *Soc Psychiatry Psychiatr Epidemiol* 2006;41:435-43. doi:10.1007/s00127-006-0054-2.



- [33] Yip PS. Age, sex, marital status and suicide. *Physiol Rep* 1998;3:11-22.
- [34] Park S. Brief report: Sex differences in suicide rates and suicide methods among adolescents in South Korea, Japan, Finland, and the US. *J Adolesc* 2015;40:74-7. doi:10.1016/j.adolescence.2015.01.007.
- [35] Silvia Sara Canetto and Isaac Sakinofsky 1998. The Gender Paradox in Suicide. *Handb Food Eng Pract* 1997;28:1-23. doi:10.1111/j.1943-278X.1998.tb00622.x.
- [36] Spicer RS, Miller TR. Suicide acts in 8 states: Incidence and case fatality rates by demographics and method. *Am J Public Health* 2000;90:1885-91. doi:10.2105/AJPH.90.12.1885.
- [37] Chang Q, Yip PSF, Chen YY. Gender inequality and suicide gender ratios in the world. *J Affect Disord* 2019;243:297-304. doi:10.1016/j.jad.2018.09.032.
- [38] Das Gupta M, Zhenghua J, Bohua L, Zhenming X, Chung W, Hwa-Ok B. Why is Son preference so persistent in East and South Asia? a cross-country study of China, India and the Republic of Korea. *J Dev Stud* 2003;40:153-87. doi:10.1080/00220380412331293807.
- [39] Sen A. Missing women—revisited. *Bmj* 2003;327:1297-8. doi:10.1136/bmj.327.7427.1297.
- [40] Kabeer N. Resources, agency, achievements: Reflections on the measurement of women's empowerment. *Dev Change* 1999;30:435-64. doi:10.1111/1467-7660.00125.
- [41] Wilks CR, Morland LA, Dillon KH, Mackintosh MA, Blakey SM, Wagner HR, et al. Anger, social support, and suicide risk in U.S. military veterans. *J Psychiatr Res* 2019;109:139-44. doi:10.1016/j.jpsychires.2018.11.026.
- [42] King CA, Merchant CR. Social and interpersonal factors relating to adolescent suicidality: A review of the literature. *Arch Suicide Res* 2008;12:181-96. doi:10.1080/13811110802101203.
- [43] Draper BM. Suicidal behaviour and suicide prevention in later life. *Maturitas* 2014;79:179-83. doi:10.1016/j.maturitas.2014.04.003.
- [44] Minayo MC de S, Cavalcante FG. Tentativas de suicídio entre pessoas idosas: revisão de literatura (2002/2013). *Cien Saude Colet* 2015;20:1751-62. doi:10.1590/1413-81232015206.10962014.
- [45] van Wijngaarden E, Leget C, Goossensen A. Experiences and Motivations Underlying Wishes to Die in Older People Who Are Tired of Living: A Research Area in its Infancy. *OMEGA - J Death Dying* 2014;69:191-216. doi:10.2190/OM.69.2.f.
- [46] Yi E-S, Hwang H-J. 2BA study on the social behavior and social isolation of the elderly Korea. *J Exerc Rehabil* 2015;11:125-32. doi:10.12965/jer.150215.
- [47] Pompili M, Amador XF, Girardi P, Harkavy-Friedman J, Harrow M, Kaplan K, et al. Suicide risk in schizophrenia: Learning from the past to change the future. *Ann Gen Psychiatry* 2007;6:1-22. doi:10.1186/1744-859X-6-10.
- [48] Durkheim É. Suicide - Durkheim. s. d. doi:10.1097/00001504-200003000-00002.
- [49] Stack S. Suicide : A 15-Year Review of the Sociological Literature : Part I : Cultural & Economic Factors. *Suicide life-threatening Behav* 2000;30:163-176. doi:10.1111/j.1943-278X.2000.tb01073.x.
- [50] Cutright P, Stack S, Fernquist R. Marital Status Integration, Suicide Disapproval, and Societal Integration as Explanations of Marital Status Differences in Female Age-Specific Suicide Rates. *Suicide Life-Threatening Behav* 2007;37:715-24. doi:10.1521/suli.2007.37.6.715.
- [51] Denney JT, Rogers RG, Krueger PM, Wadsworth T. Adult suicide mortality in the United States: Marital status, family size, socioeconomic status, and differences by sex. *Soc Sci Q* 2009;90:1167-85. doi:10.1111/j.1540-6237.2009.00652.x.
- [52] Fässberg MM, van Orden KA, Duberstein P, Erlangsen A, Lapierre S, Bodner E, et al. A systematic review of social factors and suicidal behavior in older adulthood. *Int J Environ Res Public Health* 2012;9:722-45. doi:10.3390/ijerph9030722.
- [53] Milner A, Spittal MJ, Pirkis J, LaMontagne AD. Suicide by occupation: Systematic review and meta-analysis. *Br J Psychiatry* 2013;203:409-16. doi:10.1192/bjp.bp.113.128405.
- [54] Yoshimasu K, Kiyohara C, Miyashita K. Suicidal risk factors and completed suicide: Meta-analyses based on psychological autopsy studies. *Environ Health Prev Med* 2008;13:243-56. doi:10.1007/s12199-008-0037-x.
- [55] Shor E, Roelfs DJ, Bugyi P, Schwartz JE. Meta-analysis of marital dissolution and mortality: Reevaluating the intersection of gender and age. *Soc Sci Med* 2012;75:46-59. doi:10.1016/j.socscimed.2012.03.010.
- [56] Roelfs DJ, Shor E, Davidson KW, Schwartz JE. Losing life and livelihood: A systematic review and meta-analysis of unemployment and all-cause mortality. *Soc Sci Med* 2011;72:840-54. doi:10.1016/j.socscimed.2011.01.005.
- [57] Padubidri JR, Menezes RG, Pant S, Shetty SB. Deaths among women of reproductive age: A forensic autopsy study. *J Forensic Leg Med* 2013;20:651-4. doi:10.1016/j.jflm.2013.03.029.
- [58] Yeh J-Y, Xirasagar S, Liu T-C, Li C-Y, Lin H-C. Does Marital Status Predict the Odds of Suicidal Death in Taiwan? A Seven-Year Population-Based Study. *Suicide Life-Threatening Behav* 2008;38:302-10. doi:10.1521/suli.2008.38.3.302.
- [59] Maalaoui F. Suicide du sujet agé au nord de la Tunisie a propos de 98 cas. *Faculté de Medecine de Tunis, Université de Tunis El Manar*, 2011.
- [60] Pegula SM. An Analysis of Workplace Suicides , 1992-2001 2004:1-5.
- [61] Kposowa AJ. Suicide mortality in the United States: Differentials by industrial and occupational groups. *Am J Ind Med* 1999;36:645-52. doi:10.1002/(SICI)1097-0274(199912)36:6<645::AID-AJIM7>3.0.CO;2-T.
- [62] Stack S. Occupation and suicide. *Soc Sci Q* 2001;82:384-96. doi:10.1111/0038-4941.00030.
- [63] Agerbo E, Gunnell D, Bonde JP, Bo Mortensen P, Nordentoft M. Suicide and occupation: The impact of socio-economic, demographic and psychiatric differences. *Psychol Med* 2007;37:1131-40. doi:10.1017/S0033291707000487.
- [64] James D, Gabriel L. Factors influencing the development and amelioration of suicidal thoughts in the general population: Cohort study. *Br J Psychiatry*, 2004; 185:385-93. doi:10.1192/bjp.185.5.385.
- [65] Blakely TA, Collings SCD, Atkinson J. Unemployment and suicide. Evidence for a causal association? *J Epidemiol Community Health* 2003;57:594-600. doi:10.1136/jech.57.8.594.
- [66] Hawton K, Malmberg A, Simkin S. Suicide in doctors: A psychological autopsy study. *J Psychosom Res* 2004;57:1-4. doi:10.1016/S0022-3999(03)00372-6.
- [67] Hawton K, Simkin S, Rue J, Haw C, Barbour F, Clements A, et al. Suicide in female nurses in England and Wales. *Psychol Med* 2002;32:239-50. doi:10.1017/S0033291701005165.
- [68] Nicola T Fear SW. Suicide and open verdict deaths among males in the UK regular Armed Forces, 1984-2003 2004:1-29.
- [69] Collins IP, Paykel ES. Suicide amongst Cambridge University Students 1970-1996. *Soc Psychiatry Psychiatr Epidemiol* 2000;35:128-32. doi:10.1007/s001270050195.
- [70] Hawton K, Simkin S, Fagg J, Hawkins M. Suicide in Oxford University students, 1976-1990. *Br J Psychiatry* 1995;166:44-50. doi:10.1192/bjp.166.1.44.
- [71] Preti A. Musical creatmty and suicide 2001; 09129:719-27.
- [72] Hawton K, van Heeringen K. Suicide. *Lancet* 2009;373:1372-81. doi:10.1016/S0140-6736(09)60372-X.
- [73] Nishimura M, Terao T, Soeda S, Nakamura J, Iwata N, Sakamoto K. Suicide and occupation: Further supportive

- evidence for their relevance. *Prog Neuro-Psychopharmacology Biol Psychiatry* 2004;28:83-7. doi:10.1016/j.pnpbp.2003.09.023.
- [74] Meltzer H, Griffiths C, Brock A, Rooney C, Jenkins R. Patterns of suicide by occupation in England and Wales: 2001-2005. *Br J Psychiatry* 2008;193:73-6. doi:10.1192/bjp.bp.107.040550.
- [75] Gallagher L, Kliem C, Beautrais A SL. Suicide and occupation in New Zealand. *J Occup Heal Saf - Aust New Zeal* 2008;2001-5.
- [76] Bedeian AG. Suicide and occupation: A review. *J Vocat Behav* 1982;21:206-23. doi:10.1016/0001-8791(82)90030-6.
- [77] Cohidon C, Santin G, Geoffroy-Perez B, Imbernon E. Suicide and occupation in France. *Rev Epidemiol Sante Publique* 2010;58:139-50. doi:10.1016/j.respe.2010.01.001.
- [78] Dag T, Waern M, Stefansson CG, Elofsson S, Runeson B. Excess mortality in persons with severe mental disorder in Sweden: A cohort study of 12 103 individuals with and without contact with psychiatric services. *Clin Pract Epidemiol Ment Heal* 2008;4:1-9. doi:10.1186/1745-0179-4-23.
- [79] Wahlbeck K, Westman J, Nordentoft M, Gissler M, Laursen TM. Outcomes of Nordic mental health systems: Life expectancy of patients with mental disorders. *Br J Psychiatry* 2011;199:453-8. doi:10.1192/bjp.bp.110.085100.
- [80] Michael Bostwick J, Shane Pankratz V. Reviews and Overviews Affective Disorders and Suicide Risk: A Reexamination. *Am J Psychiatry* 2000;157:12. doi:10.1176/appi.ajp.157.12.1925.
- [81] Mortensen PB, Agerbo E, Erikson T, Qin P, Westergaard-Nielsen N. Psychiatric illness and risk factors for suicide in Denmark. *Lancet* 2000;355:9-12. doi:10.1016/S0140-6736(99)06376-X.
- [82] Mortensen PQEPB. Bupropion in children with attention deficit disorder. *Psychopharmacol Bull* 1989;25:198-201.
- [83] Fournier M. Temps , température et variations saisonnières. *Eur Jounl Soc Sci* 2004;XLII-129:1-12. doi:10.4000/ress.387.
- [84] Trudeau R. quotidiens des décès Profils mensuels et quotidiens des décès 2015.
- [85] Abdelaziz Mastouri. Les suicides complexes au nord de la Tunisie: étude sur 11 ans (2005-2015) et revue systématique de la littérature. Faculté de Medecine de Tunis, Université de Tunis El Manar, 2017.
- [86] Ho TP, Yip PSF, Chiu CWF HP. Suicide notes : what do they tell us ? *Acta Psychiatr Scand* 1998;98:467-73.
- [87] Girdhar S, Leenaars AA, Dogra TD, Leenaars L, Girdhar S, Leenaars AA, et al. Suicide Notes in India : What Do They Tell Us ? *Arch Suicide Res* 2004;8:179-85. doi:10.1080/13811110490271362.
- [88] Shneidman ES. Suicide Notes Reconsidered. *Psychiatry Interpers Biol Process* 1973;36:379-94. doi:10.1080/00332747.1973.11023772.
- [89] Conwell Y, Caitlin Thompson. Suicidal Behavior in Elders. *Psychiatr Clin North Am* 2008;31:333-56. doi:10.1016/j.psc.2008.01.004.
- [90] Stack S. Gender , Marriage , and Suicide Acceptability : A Comparative Analysis. *Sex Roles* 1998;38:501-2.
- [91] Stack S. Suicide in the Media: A Quantitative Review of Studies Based on Nonfictional Stories. *Suicide Life-Threatening Behav* 2005;35:121-33.
- [92] Rugulies R, Bültmann U, Aust B, Burr H. Psychosocial work environment and incidence of severe depressive symptoms: Prospective findings from a 5-year follow-up of the Danish work environment cohort study. *Am J Epidemiol* 2006;163:877-87. doi:10.1093/aje/kwj119.
- [93] Brooks S E, Burruss S K MK. Suicide in the Elderly A Multidisciplinary Approach to Prevention. *Clin Geriatr Med* 2019;35:133-45. doi:10.1016/j.cger.2018.08.012.
- [94] Sylvie Lapierre, Annette Erlangsen, Margda Waern, Diego De Leo, Hirofumi Oyama, Paolo Scoco, Joseph Gallo, Katalin Szanto, Yeates Conwell, Brian Draper, Paul Quinnett T international research group for suicide along the E. A systematic review of Elderly suicide prevention. *Crisis* 2011;32:88-98. doi:10.1027/0227-5910/a000076.A.
- [95] Stack S. Media coverage as a risk factor in suicide. *J Epidemiol Community Health*. 2003;57:238-40.