ORIGINAL ARTICLE

Mortality from cancer in Tunisia in 2020 and death certification quality

La mortalité par cancer en Tunisie en 2020 et la qualité des données des certificats des décès par cancer

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Abstract

Introduction-Aim: According to the World Health Organization, cardiovascular disease and cancer figure among leading causes of death worldwide. This aim of our study was to identify the deadliest cancers in Tunisia and to assess the quality of medical certification related to cancer deaths.
Methods: We led a descriptive observational study based on data from the national information system on causes of deaths in 2020. Were included all medical death certificates received by the National Institute of Health and related to deaths occurring in 2020. Causes of death were coded according to the International Classification of Diseases (ICD-10). The share of Garbage codes was determined by ANACONDA software. Data entry and analysis, were performed by SPSS software.
Results: In total, 45420 deaths were enrolled, including 7001 deaths from cancer, representing 15.1% of all deaths. The sex ratio (Male/Female) was to 1.7 with median age was 67 years ±0.2. The deadliest cancers were the following cancers: bronchopulmonary (22.8%), colorectal (7.9%), breast (7.4%), prostate (5.9%), liver (4.9%) and pancreas (4.8%). The share of garbage codes was 12%, dominated by cancers with "unspecified primary location" (6.1%), "primary cancers with multiple independent locations" (1.6%), uterine cancer of undefined location (1.3%), “cancer of the digestive tract of undefined location” (1.2%).
Conclusion: Our study highlighted the important place of cancer among all deaths in Tunisia. We recommend training of certifying doctors on the rules of good quality certification, and the strengthening of primary prevention by fighting against risk factors and secondary prevention by screening and early diagnosis of cancers.

Key words: Cancer-Epidemiology-Tunisia-Mortality

Résumé

Introduction: Selon l’organisation mondiale de la santé, les maladies cardiovasculaires et les cancers constituent les premières causes de décès dans le monde. Notre objec-tif était d’identifier les cancers les plus meurtriers en Tunisie et d’évaluer la qualité de la certification médicale des décès par cancer.
Méthodes : Etude observationnelle descriptive menée à partir des données du système d’information national sur les causes de décès. Ont été inclus les certificats de décès survenus en 2020 et parvenus à l’Institut National de la santé. Les causes de décès ont été codées selon la Classification Internationale des maladies (CIM-10). Le pourcentage des Garbage codes a été déterminé par le logiciel ANACONDA. Pour la saisie et l’analyse des données, le logiciel SPSS a été utilisé.
Résultats: Au total 45420 décès ont été retenus dont 7001 décès par cancer soit (15,1%) de l’ensemble des décès. Le sex-ratio (Masculin/Féminin) était de à 1,7 et l’âge médian était de 67 ans ±0,2. Les cancers les plus meurtriers étaient les cancers suivants : bronchopulmonaire (22,8%), colorectal (7,9%), sein (7,4%), prostate (5,9%), foie (4,9%) et pancréas (4,8%). Le pourcentage de Garbage code était de 12%, dominés par cancers avec « localisation primitif non précisé » (6,1%), « cancers primitifs avec localisations multiples indépendantes » (1,6%), « cancer d’utérus de localisation non définie » (1,3%), « cancer de l’appareil digestif de localisation non définie » (1,2%).
Conclusion: Notre étude a souligné la place importante du cancer parmi l’ensemble des décès en Tunisie. On recommande la formation des médecins certificateurs sur la bonne qualité de rédaction, et le renforcement des mesures de prévention secondaire par dépistage et diagnostic précoce des cancers

Mot clés: cancer, épidémiologie, Tunisie, mortalité

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Introduction

Cancer ranks as the second leading cause of death globally, resulting in nearly 10 million fatalities annually. The standardized mortality rate for cancer is estimated at 100.7 deaths per 100,000 inhabitants [1]. The World Health Organization (WHO) predicts that cancer cases will rise by 81% in low- and middle-income countries by 2040 due to inadequate prevention measures [2].
As per the World Health Organization (WHO), approximately 10 million cancer-related deaths were estimated worldwide in 2020, with nearly 70% of these deaths occurring in low and middle-income countries. The survival rate for cancer is higher in developed countries compared to developing countries, where it is roughly half of that in developed nations [3]. In Tunisia, cancer poses a significant public health concern. According to the WHO estimates for 2020, the overall standardized incidence rate of cancer was 133.5 cases per 100,000 individuals, and there were 11,855 cancer-related deaths, resulting in a standardized mortality rate of 78.7 deaths per 100,000 inhabitants [4].
In Tunisia, similar to other countries worldwide, there exists a national system for recording information about deaths. The purpose of this system is to provide a comprehensive understanding of the overall health status of the population. However, the national system of recording causes of death does not accurately represent the actual health conditions of the population due to the low coverage rate of reporting causes of death. As far as our knowledge extends, besides the estimates provided by Globocan regarding cancer mortality, there are no published national data specifically addressing this significant public health issue. Our objective is to present an overview of the epidemiology of cancer mortality in Tunisia and assess the quality of medical certification for deaths attributed to cancer.

Methods

Study Design

This study is a descriptive observational study based on systematically collected data from the National Institute of Public Health (NIPH) as part of the National Information System of the Causes of Death (NISCD).

Inclusion Criteria

All Medical Certificates of Death (MCD) received by the NIPH from various municipalities in Tunisia, reporting deaths occurring between January 1 and December 31, 2020, were included [5].

Non-Inclusion Criteria

Medical Certificates of Death (MCD) for the year 2020 that were received after April 2021 were not included [5].

Data Collection

Data were collected from the medical certificates of death obtained from different municipalities in Tunisia as part of the National Information System of the Causes of Death (NISCD).

Coding of Cause of Death

The causes of death recorded on the medical certificates were coded according to the 10th International Classification of Diseases (ICD-10) using detailed 4-character codes, with a specific focus on sub-chapters related to malignant tumors [6].

Underlying Cause of Death (UCD)

In this study on cancer mortality, the underlying cause of death refers to malignant tumors, which are defined as the disease or trauma that directly led to the fatal progression [7,8].

Creation of Indicators

1. Rate of Coverage of Cancer Death: This indicator is calculated by dividing the number of cancer deaths received by the NIPH by the total number of cancer deaths reported by the World Health Organization (WHO) for the year 2020. The WHO estimated the number of cancer deaths in Tunisia to be 11,855 (7,279 men and 4,576 women) [3].
2. Proportional Cancer Mortality by Location by ICD-10 Sub-Chapters: This indicator is determined by calculating the ratio of the number of deaths according to specific cancer locations (based on ICD-10 sub-chapters) to the total number of deaths due to cancer in 2020.

The Evaluation of Data Quality

To assess the quality of the data recorded on the Medical Certificates of Death (MCDs), the ANACONDA software, an internationally standardized tool, was utilized. The evaluation focused on several key elements, including:
1. Presence of Age and Gender Information: The assessment involved verifying whether the MCDs contained accurate information regarding the age and gender of the deceased.
2. Quality of Cause of Death Information: The quality of the cause of death information mentioned on the certificates was examined. This assessment included evaluating the presence of specific details and identifying any potential issues, such as the presence of "Garbage codes." These codes refer to causes of death that lack sufficient precision or do not accurately represent the true underlying cause of death. Garbage codes provide little or no relevant information and can hinder the development and implementation of effective health policies by concealing the actual causes of death [9-12].

Results

Socio-demographic characteristics of cancer deaths

The median age of cancer deaths was 67 years ±0.2 years, with an interquartile range Q1-Q3 (57-77). The average age was higher in men (65.8 years) compared to women (64.1 years). Regarding the distribution by age group, the most represented age group was that of 65 to 69 years, and more than 50% of cancer deaths in 2020 were aged 65 and over.
Of all the 7,001 cancer deaths, 4,061 men and 2,366 women were recorded, i.e. a sex ratio: men/women equal to 1.3

Proportional cancer mortality

The National Institute of Public Health (NIPH) received from the different municipalities 46,126 medical certificates of death of 2020. From 46,126 medical certificates of death, there were 7,001 deaths by cancer: The proportional cancer mortality was 15.6%

The rate of coverage of medical certificates of deaths by cancer

According to the WHO estimates, the number of cancer deaths in Tunisia in the year 2020 was about 11,855. However, the number of the medical certificate of cancer deaths that arrived to the national institute of public health was only 7,001 so the rate of coverage of medical certificates of cancer deaths was 59.1%.

The most common cancer locations in the deaths by cancer

In both sexes, the most common cancers of causes of death were cancers of the trachea, bronchi and lung (22.8%), followed by cancers of the colon, rectum and anus (7.9%), breast cancer (7.4%), prostate cancer (5.9%), intrahepatic bile duct cancers (4.9%), pancreatic cancer (4.8%) and leukemia (4.4%). Lung cancer was the cause of almost a third of cancer deaths in men, followed by prostate cancer (9.3%) and colorectal cancer (7%). In women, breast cancer was the cause of nearly 20% of cancer deaths in women, followed by colorectal cancer (9.7%) and lung cancer (7.4%). The proportional mortality figures by type of cancer are presented in Table 1 "

Table 1. Proportional cancer mortality by location (according to the WHO condensed list no. 1 for tabulation of statistics of medical causes of death) and by sex, 2020

	Males			Females		
Rank	**Seat**	**Number**	**Proportional mortality**	**Seat**	**Number**	**Proportional Mortality**
1	Lung	1297	31.9%	Breast	458	19.4%
2	Prostate	377	9.3%	Colorectal	230	9.7%
3	Colorectal	283	7%	Lung	174	7.4%
4	Liver	185	4.6%	Pancreas	131	5.5%
5	Pancreas	178	4.4%	Leukemia	126	5.3%
6	Leukemia	153	3.8%	Liver	124	5.2%
7	Stomach	149	3.7%	Uterus	107	4.5%
8	Bladder	143	3.5%	Stomach	98	4.1%
9	Pharynx	119	2.9%	Ovary	85	3.6%
10	Brain	111	2.7%	Brain	82	3.5%
	Remaining	1066	26.2%	Remaining	751	31.7%
	Total	4061	100%	Total	2366	100%

The most fatal cancers among children under the age of 18 in Tunisia were primarily cancers of lymphoid or hematopoietic and related tissues, accounting for 39.2% of cancer deaths. Cancers of the eye, brain, and other parts of the central nervous system were also significant, contributing to 13.9% of cancer deaths. Combined, these two cancer types constituted 53.1% of cancer-related deaths in children under 18 years of age in Tunisia.

Data Quality

In the dataset analyzed, there were certain instances where the quality of the data was compromised. Specifically:
Gender Data: Out of the total medical certificates of death by cancer, gender information was missing in 574 certificates, which accounts for 8.2% of all the medical death certificates by cancer. Age Data: In 841 medical certificates of death by cancer, age information was not recorded, which corresponds to 12% of the medical death certificates by cancer.
Garbage Codes: In 834 medical certificates of death by cancer, the underlying cause of death was classified as a "garbage code." These garbage codes represented 12% of all deaths attributed to cancer. The garbage codes mainly included categories such as "cancers of ill-defined location" and "cancers of multiple independent seats." A detailed breakdown of the garbage codes in all the medical death certificates by cancer can be found in Table 2.

Table 2. Distribution of Garbage Codes in Medical Certificates of Death by Cancer, by Categories, in 2020

Cause of death coded as Garbage code	Number	Percentage (%)
Malignant tumor, without precision	425	6.1
Malignant tumors of multiple independant seats (primitive)	112	1.6
Malignant tumors of the uterus, part unspecified	94	1.3
Malignant tumors of ill-defined seat of digestive tract	86	1.2
Malignant tumors of ill-defined seat of head, face and neck	37	0.5
Malignant tumors of the respiratory tract and intra-thoracic organs	21	0.3
Secondary malignant tumor (metastase)	20	0.2
Malignant tumors of the urinary organs, others and unspecified	16	0.2
Malignant tumors of lymph nodes , secondary and unspecified	4	0.1
Kaposi Sarcoma	3	0
Secondary malignant tumor of other seats	3	0
Malignant tumor of the male genitalia	1	0
Total garbage codes	834	12
Total deaths by cancer	7001	

Discussion

This study is the first of its kind to focus specifically on cancer mortality in Tunisia and assess the quality of medical certification of cancer deaths. The study relied on data obtained from the national information system on the causes of death.

One significant finding of this study is the low coverage rate of deaths attributed to cancer. This can be attributed to various factors, including failures within the process of medical certification of death, a lack of awareness among civil status agents, and instances of illegal burial without proper medical certification in certain rural areas of Tunisia. Despite these challenges, it is important to note that there has been an improvement in the coverage rate of death certificates compared to 2017. The rate has increased from 41.1% in 2017 [13] to 61% in 2020.

According to statistics from the United Nations in 2017, developed countries consistently achieve death coverage rates exceeding 90%. In the Middle East and North Africa (MENA) region, countries like Saudi Arabia, Turkey, and Iran also exhibit high death coverage rates, surpassing 90%. On the other hand, countries such as China, Yemen, and certain sub-Saharan African countries like Niger have notably lower death coverage rates, falling below 50% [14].

In Tunisia in the year 2020, cancers accounted for 15.1% of all deaths. When comparing proportional cancer mortality rates globally, Eastern Europe and East Asia had the highest rates, while Central Asia (including India), Central America, and Sub-Saharan West Africa had the lowest rates [15].

In both males and females, the most prevalent cancers causing death were bronchopulmonary cancers, cancers of the colon, rectum, and anus, breast cancer, prostate cancer, cancers of the intrahepatic bile ducts, pancreatic cancer, and leukemia. For children under the age of 18 in Tunisia, the most common causes of cancer-related deaths in 2020 were leukemia and cancers of the central nervous system. According to estimates from the Global Burden of Disease (GBD) [16-18], certain types of cancer are commonly responsible for causing death worldwide. These include lung cancer, colorectal cancer, breast cancer, prostate cancer, liver cancer, and pancreatic cancer. However, there are notable regional variations in the leading causes of cancer-related deaths. For example, in Egypt, liver cancer accounted for approximately 2.42% of all deaths and represented the most frequent cause of cancer-related deaths in 2019. In East Asia, stomach cancer was a significant cause of cancer-related deaths, accounting for nearly 3% of all cancer deaths. Stomach cancer ranked as the second most common cause of cancer-related deaths in the region, following lung cancer (Table 3).

Table 3. Deadliest cancers in descending order of proportional mortality (GBD 2019)

Rank	Tunisia (2020)	Egypt	France	United-States	East-Asia
1	Lung	Liver	Lung	Lung	Lung
2	Colorectal	Lung	Colorectal	Colorectal	Stomach
3	Stomach	Bladder	Breast	Pancreas	Colorectal
4	Breast	Breast	Prostate	Breast	Esophagus
5	Esophagus	Colorectal	Pancreas	Prostate	Liver
6	Liver	Stomach	Liver, bladder	Leukemia	Breast
7	Pancreas	Leukemia	Leukemia	Malignant Non-Hodgkin lympoma	Pancreas
8	Prostate	Pancreas	Stomach	Liver	Leukemia
9	Leukemia	Central nervous system	Malignant Non-Hodgkin lympoma	Bladder	Prostate
10	Malignant Non-Hodgkin lympoma	Prostate	Kidney	Esophagus	Central nervous system

According to estimates from the Global Burden of Disease (GBD), certain types of cancer are among the leading causes of cancer-related deaths in males and females worldwide. In males, the ten most common causes of death by cancer are lung cancer, prostate cancer, colorectal cancer, liver cancer, pancreatic cancer, leukemia, and bladder cancer (Table 4).

In females, the ten most common causes of death by cancer are breast cancer, colorectal cancer, lung cancer, pancreatic cancer, leukemia, liver cancer, stomach cancer, and ovarian cancer (Table 5).

According to data from the United Kingdom, the leading causes of cancer-related deaths in children under 14 years of age between 2016 and 2018 were leukemia, central nervous system cancer, and lymphoma [19]. Interestingly, in countries with a higher socioeconomic

status, cancers of the central nervous system are more commonly associated with cancer-related deaths compared to leukemia.

Table 4. Deadliest cancers in males in descending order of proportional mortality (GBD 2019)

Rank	Tunisia 2020	Egypte	France	United-States	East-Asia
1	Lung	Liver	Lung	Lung	Lung
2	Prostate	Lung	Prostate	Prostate	Stomach
3	Colorectal	Bladder	Colorectal	Colorectal	Colorectal
4	Liver	Colorectal	Pancreas	Pancreas	Esophagus
5	Pancreas	Stomach	Bladder	Leukemia	Liver
6	Leukemia	Prostate	Liver	Esophagus	Prostate, pancreas
7	Stomach	Pancreas, prostate	Stomach	Malignant Non Hodgkin Lympoma	Leukemia
8	Bladder	Leukemia	Leukemia	Liver, bladder	Central nervous System
9	Pharynx	Central nervous System	Esophagus	Kidney	Malignant Non Hodgkin Lympoma
10	Central Nervous System	Malignant Non Hodgkin Lympoma	Kidney	Central Nervous System	Bladder

Table 5. Deadliest cancers in females in descending order of proportional mortality

Rank	Tunisia 2020	Egypt	France	United-states	East-Asia
1	Breast	Breast	Breast	Lung	Lung
2	Colorectal	Liver	Colorectal	Breast	Breast
3	Lung	Colorectal	Lung	Colorectal	Stomach
4	Pancreas	Lung	Pancreas	Pancreas	Colorectal
5	Leukemia	Leukemia	Ovary	Liver	Cervix
6	Liver	Stomach	Leukemia	Bladder	Esophagus
7	Uterus	Pancreas	Stomach	Leukemia	Liver
8	Stomach	Central nervous system	Malignant Non Hodgkin lympoma	Stomach	Pancreas
9	Ovary	Bladder	Liver	Uterus	Ovary
10	Central nervous system	Ovary	Uterus	Cervix	Leukemia

The quality of cancer mortality data can be assessed by examining the percentage of medical certificates of cancer deaths that contain garbage codes, which refers to codes that are insufficiently precise or do not accurately represent the underlying cause of death. In this study, the percentage of medical certificates of cancer deaths with garbage codes was found to be 12%. When considering all causes of death, countries with high, medium, and low socioeconomic statuses had percentages of medical certificates of deaths with garbage codes of 23.8%, 39.7%, and 40%, respectively [20]. It is important to consider that the prevalence of garbage codes can vary depending on the specific chapter of the international classification of diseases. This observation aligns with the findings of a recent study conducted by Eglingen, which focused on the analysis of garbage codes in the Norwegian register of causes of death from 1996 to 2019. The study revealed similar results to our own investigation.

Eglingen's study identified the most common garbage codes in the cancer chapter as C80 (malignant tumor of unknown primary site), C91 (lymphoid leukemia), and C26 (malignant tumor of ill-defined digestive organs). The percentages of these codes within the cancer chapter were reported as 7.4%, 1.3%, and 1.0%, respectively [21]. The findings of this study highlight that the most fatal cancers in the Tunisian population are largely preventable through various preventive measures, including primary, secondary, and tertiary prevention strategies. Some of these measures include:

Promoting the avoidance of known risk factors, such as tobacco and alcohol, and addressing carcinogenic infectious factors like hepatitis B and C.

Encouraging regular screenings and early detection of cancer to identify and treat the disease at its early stages.

Enhancing the quality of care for cancer patients to improve survival rates and enhance their overall quality of life.

Mortality data plays a crucial role in providing an overview of population health, and it is essential that this data is based on valid and representative information. Developed countries have improved their death information and notification systems through the implementation of electronic death certification [22], and similar advancements should be promoted in Tunisia. In a study conducted by Hart et al., which evaluated the quality of death certification in countries with medium socioeconomic levels, it was observed that the proportion of medical certificates with "garbage codes" significantly decreased by nearly 30% after training doctors on the proper rules of medical certification of death [23]. Similarly, in other countries, the implementation of self-teaching e-Learning modules has proven effective in enhancing doctors' skills in accurate death certification and facilitating distance training opportunities [24].

Conclusion

Cancer posed a significant burden on the Tunisian population, accounting for 15% of deaths in 2020 and ranking as the second leading cause of death. These findings align with the estimates provided by IARC/GBD (2019). The most prevalent cancer types leading to death included lung cancer, colorectal cancer, liver cancer, pancreatic cancer, prostate cancer in men, breast cancer in women, and leukemia, which emerged as the primary cause of cancer-related deaths in children under 15 years of age.

The completeness of data, particularly regarding gender and age, was high, with 92% of death certificates containing this information. However, it is worth noting that 12% of medical certificates for cancer-related deaths had underlying causes classified as garbage codes, prominently featuring "undefined location" and "multiple

independent locations."

In conclusion, the following recommendations emerge from our study:

Enhance the quality of cause-of-death data by providing comprehensive training to certifying physicians regarding the accurate recording of causes of death.

Strengthen prevention efforts, particularly in the secondary prevention domain, by emphasizing the importance of cancer screening and early detection initiatives.

Abbreviations list:
ICD: International codes of Death
GBD: Global Burden of Disease
MCD: Medical Certificate of Death
NIPH: National Institute of Public Health
UCD: Underlying Cause of Death

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