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## Epidemiological profile of cancer patients in the region of Laayoune Sakia El Hamraa, Morocco

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### ABSTRACT

Our research explores the management of cancer patients in the Laayoune Sakia El Hamraa region. The study analyzes the epidemiological context of cancer, takes into account current approaches and identifies specific challenges while proposing strategies and interventions to improve this management. The results indicate that sociodemographic factors, such as age, gender and marital status, influence the type and stage of cancer. For the purpose of this study, the sampling frame selected to meet the sampling requirements consisted of 286 individuals drawn from the oncology hospital database. The evaluation of the 100 cancer patients of different types of cancer in the study population shows that the most common type of cancer is C50, recorded in 47 patients. According to the frequency analysis, stage 1 includes 38 respondents while stage 2 includes 36, stage 3 includes 18 and stage 4 includes 8. The proposed strategies include economic measures such as food subsidies and logistical solutions such as meal delivery services to improve access to adequate nutrition. Despite some methodological limitations, this study provides a solid foundation for future interventions and ongoing research aimed at optimizing the care of cancer patients, particularly in underserved areas. An integrated and holistic approach to nutritional management is needed to improve the quality of life and health outcomes of cancer patients.

**Keywords:** Epidemiology, Cancers, socio-demographics, Laayoune, Morocco.

## Introduction

Like many other developing countries, Morocco has experienced a demographic, socioeconomic, epidemiological and nutritional transition. This transition has been accompanied by an increase in the number of elderly people, urbanization rates, a change in the lifestyle and eating habits of the Moroccan population. Thus, it has given rise to a new epidemiological situation characterized by the emergence and the morbidity burden of non-communicable diseases continues to evolve.

Morocco is experiencing a considerable demographic transition with a very significant decline in fertility. The total fertility rate has fallen from 7,2 children per woman in 1962 to 2,33 children per woman in 2021 (HCP, 2022). Thus, Morocco is seeing a major change in its age pyramid, with a base that is increasingly narrowing following the decline in fertility, and conversely, a peak that is gradually widening due to the increase in life expectancy and the number of elderly people (HCP, 2020).

Alongside this demographic dynamic, Morocco has also experienced very strong urbanization. Indeed, the urbanization rate increased from 29,1% in 1960 to 64,3% in 2022 (HCP, 2023). Morocco, like many developing countries, is experiencing rapid and often uncontrolled urbanization of populations, which plays a crucial role in environmental degradation and changes in the lifestyle of its inhabitants (Araby, 2002; Cullis et al., 2019; Yasin et al., 2020). This urbanization phenomenon, as everywhere in the world, is characterized by a massive influx of people leaving rural areas to settle in cities, leading to an increase in demand for natural resources, such as water, energy and building materials (Ahmed et al., 2020). This increased pressure on natural resources leads to their overexploitation (Joshua, 2017), deforestation and pollution (Yogender, 2022), thus altering local ecosystems and contributing to environmental degradation, especially with the increase in foreign direct investment (FDI) and economic growth (Muhammad et al., 2021).

Urbanization can thus lead to better health for some residents, but it can also expose them to greater risks and poorer health than their wealthier neighbors, particularly in developing countries (Phillips, 1993). Indeed, urbanization can also expose some residents, especially the poorest, to increased health risks and poorer health compared to their wealthier neighbors (Dye, 2008).

Sedentary lifestyles are another major problem related to urbanization. In urban environments, lifestyles are often more sedentary due to the prevalence of office jobs and screen time (Parry & Straker, 2013; Nguyen et al., 2020). This lack of physical activity contributes to increasing rates of obesity, type 2 diabetes, and cardiovascular disease (Biswas et al., 2015; Patterson et al., 2018; Lavie et al., 2019). Green spaces and recreational facilities, although present in some cities, are not always accessible to all, limiting opportunities for regular physical activity (Shen et al., 2021). All these factors have led to a change in the Moroccan age pyramid with a tendency towards an aging population and therefore a progressive increase in the prevalence of chronic and degenerative diseases (Ministry of Health & Unicef, 2011).

Morocco is in the midst of an epidemiological transition, with a rise in non-communicable diseases (NCDs), the most common of which are cardiovascular diseases, diabetes, cancers and chronic respiratory diseases, psychological and psychiatric disorders and emerging and re-emerging diseases in addition to infectious and parasitic diseases. Indeed, the health situation in Morocco is distinguished by a sharp decline in mortality linked to non-communicable diseases, reflecting a profound change in the epidemiological structure of the country.

The national epidemiological situation concerning non-communicable diseases with alarming statistics indicating that 83% of deaths in Morocco are attributable to these diseases. Cardiovascular diseases, cancer, diabetes and chronic respiratory diseases represent 24% of premature deaths among Moroccans aged 30 to 70 (Ministry of Health, 2023).

The demographic transition and the epidemiological transition are usually accompanied by a change in lifestyle including eating habits, and consequently the appearance of overweight and obesity and the increase in the prevalence of certain chronic diseases. Indeed, the Moroccan food profile is experiencing profound and rapid changes resulting from the growth of the food industry production and the presence of the media that encourage the consumption of products that promote the appearance of obesity and other metabolic disorders and thus the installation of a nutritional transition.

Nutrition is an essential condition for physical, mental and psycho-affective well-being for both children and adults. It is a major determinant of health and a key factor for the development of a country. Nutritional disorders hinder economic growth and perpetuate poverty (Ministry of Health, 2017). It should be noted that nutritional disorders do not only result from food insecurity since children living in good conditions are subject to deficiency anemia, underweight or overweight or even stunted growth (Ministry of Health, 2019).

Morocco, compared to many developing countries, is suffering the consequences of a deviation from the Mediterranean dietary model (Soualem, 2008). The state of nutrition and health of women varies considerably from one country to another, as well as within the same country due to several factors such as the local prevalence of women's diseases, their access to health information and their access to health care. Poverty, environmental degradation, and migration also influence women's health (World Bank, 1999). Nevertheless, progress has been made, and certain improvements have been noted in the area of nutrition. Indeed, the Ministry of Health has implemented a set of specific interventions aimed at improving the nutritional status of populations, particularly the most vulnerable. These include growth monitoring, promotion of breastfeeding, vitamin and mineral supplementation for children and women during pregnancy and postpartum, and promotion of the consumption of micronutrient-fortified foods (WHO, 2005). The nutritional situation of the Moroccan population is marked by three determinants: the country's economic development, improvement of health services, and the development of other sectors such as agriculture, education, the agri-food industry, and other socio-economic services. However, Morocco is experiencing both some nutritional problems that persist and others that are emerging in relation to globalization, urbanization, and changes in lifestyles and diets. Compared to countries in the EMRO region, Morocco is classified among the countries experiencing an early nutritional transition characterized by moderate levels of overweight, obesity, and undernourishment associated with a high level of micronutrient deficiencies (FAO, 2003). The analysis of the nutritional situation of the Moroccan population involves the analysis of its socio-demographic evolution, its epidemiological profile, the evolution of its food consumption at the origin of a food transition which itself is at the origin of a nutritional transition and finally nutritional indicators (HCP, 2006).

The demographic transition and the epidemiological transition are generally accompanied by a change in lifestyles, in particular dietary patterns and physical activity. This dietary transition usually made up of a traditional diet, based on cereals and legumes, is transformed into a diet that includes more products of animal origin, and tends to become excessive in relation to the energy needs of a sedentary life.

This change has also been accompanied by the increase in the consumption of fast foods and industrialized products, which are potentially involved in the occurrence of various chronic

diseases including cancer. Furthermore, the pace of this change is characterized by a great disparity at the national level, as well as between residential areas and socio-economic classes.

This transition is characterized by the coexistence within the same social segments or even the same families, of different pathologies: adult obesity and malnutrition in young children. Which obesity is responsible for the onset of diabetes, cardio and cerebrovascular diseases or certain cancers, contributing to the phenomenon of epidemiological transition previously described.

Indeed, the Moroccan food profile is experiencing profound and rapid changes resulting from the growth of the food industry production and the presence of the media that encourage the consumption of products that promote the onset of obesity and other metabolic disorders and thus the installation of a nutritional transition (DP, HCP, 2019).

The central problem of our research is to explore the complex relationship between demography and cancer, focusing specifically on the Laayoune Sakia El Hamraa region in Morocco. It aims to answer the following question: What is the nature of the relationship between nutrition and cancer, with a focus on identifying specific nutritional factors (foods, nutrients, dietary habits) associated with increased or reduced risk of developing different types of cancer, and how can this knowledge be used to inform cancer prevention recommendations and nutritional interventions in disease management?

## **I- Material and methods**

The methodology of the epidemiological and demographic study, explaining the methodological framework, the selection of the target population, and the tools used.

### **1. Methodological framework of the study**

This is a descriptive and analytical study that explores the relationship between diet and the occurrence of cancer over a period from 2020 to 2024. This research aims to identify potential links between dietary habits and the occurrence of various types of cancer, by providing an in-depth understanding of these relationships at the local level. The documentation and iconography used in this work come mainly from empirical data collected at the university hospital center of the Laayoune region as well as recent scientific articles, carefully selected and cited in the bibliography. These sources provide a solid and rigorous basis for the analysis.

This is a cross-sectional, descriptive, analytical and correlational epidemiological survey. This study was conducted at the University Hospital of Laayoune, and it aims to explore the epidemiological profile of cancer patients at different levels: individual, biological and organizational. The approach adopted in this research is quantitative, which made it possible to measure and describe in a detailed and systematic manner the epidemiological profile of patients.

The quantitative approach allowed for the collection of structured and large-scale data, thus enabling robust statistical analysis. The variables studied include individual factors (such as age, sex, medical history and dietary habits), biological factors (such as types of cancer diagnosed, stages of disease progression, and treatment outcomes), as well as organizational factors (including access to health care, the quality of services offered and the support available to patients).

### **2. Target Population and Sampling**

#### **2.1. Sampling Frame**

One of the essential elements in establishing a probabilistic sampling plan is the constitution of an adequate sampling frame. A well-constructed sampling frame ensures that each member of the target population has a known and non-zero chance of being included in the sample, which is crucial for the representativeness and reliability of the results.

For the purposes of this study, the sampling frame selected to meet the sampling requirements consisted of 286 individuals drawn from the oncology hospital database. This frame was developed by the administrative pole of the university hospital of Laayoune, based on the clinical and biological data of the population of the region. These data included detailed information on cancer patients, including their medical history, the types of cancers diagnosed, the treatments received, as well as other variables relevant to the study.

The use of this sampling frame has several notable advantages. First, it allows extrapolating the results obtained from the sample to the entire target population, thus providing an accurate and reliable overview of the epidemiological and nutritional situation of cancer patients in the region.

In addition, probability sampling facilitates the application of various advanced statistical techniques to analyze the collected data. This includes the use of hypothesis testing, analysis of variance, and multiple regressions, allowing the identification of correlations and causalities between the variables studied, such as dietary habits, types of cancer, and treatment outcomes.

## **2.2. Stratification Criteria by Cancer Type**

Stratification of observation units from any sampling frame allows for the design of sampling designs that ensure optimal sample size, significant cost reduction, and substantial improvement in the precision of the expected estimators. In the context of this study, stratification criteria by cancer type may include:

1. Cancer type. Classifying patients by cancer type (e.g., breast cancer, lung cancer, colorectal cancer, etc.) allows for targeting specific groups and understanding variations in dietary habits and clinical outcomes.
2. Cancer stage. Dividing patients by stage of their cancer progression (early, advanced, metastatic) to assess how needs and responses to treatments vary at different stages.
3. Age and sex. These demographic variables are crucial for understanding differences in cancer incidence and responses to nutritional treatments.
4. Socioeconomic status and education level. These criteria can influence dietary habits and access to care, which is essential for a thorough analysis.

## **2.3. Data Collection Instruments**

To ensure consistent and reliable data collection, triangulation of data collection instruments was adopted. This approach allows for the combination of multiple collection methods to obtain rich and diverse data, thereby enhancing the validity and reliability of the results. The data collection instruments used in this study are:

1. Observation: Direct observation of patients and the conditions in which they live and receive their treatments provides important contextual data. This method allows for the recording of behaviours and interactions that could not be captured by questionnaires or interviews.

2. Questionnaire: A structured questionnaire was developed to collect quantitative data on demographic characteristics, dietary habits, medical history, and other relevant variables. Questionnaires are particularly useful for obtaining standardized and comparable information on a large number of participants.

3. Qualitative interview: Semi-structured interviews were conducted to gain a deeper understanding of patients' individual experiences, perceptions of the care they received, and the challenges they faced. This qualitative method allows for the collection of rich and detailed data, providing a valuable complement to quantitative data. By combining these three data collection instruments, the study benefits from a holistic approach that covers both the quantitative and qualitative aspects of the research. This triangulation ensures that the data collected are robust, reliable, and provide a comprehensive overview of the nutritional and epidemiological profiles of cancer patients in the Laayoune Sakia El Hamraa region.

### 3. Tools and techniques used

#### 3.1. The quantitative component

The statistical analyses of this study were carried out using the software "SPSS", version 21.0, under the code: 867267. SPSS (Statistical Package for the Social Sciences) is a software widely used in the field of research to perform a variety of statistical analyses, ranging from descriptive statistics to complex multivariate analyses.

For this study, several steps were followed in the quantitative component:

- Data preparation: The collected data were cleaned and prepared for analysis. This includes checking for missing values, correcting data entry errors and coding variables.
- Descriptive statistics: Descriptive statistics were used to summarize the demographic and clinical characteristics of cancer patients. This includes the frequency, percentages, means, medians and standard deviations for different variables.
- Tests of Association: To assess the association between the independent variables and the dependent variables, appropriate statistical tests were used. For example, the Chi-square test was used to examine the relationships between categorical variables.

#### 3.2. The steps to perform a Chi-square test are

- Formulate the Hypotheses: The null hypothesis (H<sub>0</sub>) is that there is no association between the two categorical variables (they are independent), while the alternative hypothesis (H<sub>1</sub>) is that there is an association between the two categorical variables (they are not independent).
- Create a Contingency Table: A contingency table is a matrix that presents the frequency distribution of different combinations of the categorical variables.
- Calculate Observed Frequencies (O): The observed frequencies are simply the actual values that you have in your contingency table.
- Calculate Expected Frequencies (E): The expected frequencies are calculated under the null hypothesis of independence. For each cell in the table, the expected frequency is calculated as follows:

$$E = \frac{(\text{line total})(\text{total column})}{\text{total general}}$$

- Calculate the Chi-Square Statistic: The chi-square statistic is calculated using the following formula:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Where O is the observed frequency and E is the expected frequency.

- Determine the Degrees of Freedom: The degrees of freedom for the chi-square test are calculated as follows:

Degree of freedom = (number of lines-1) x (number of colognes-1)

- Find the Critical Value: Use a chi-square table to find the critical value corresponding to your degrees of freedom and significance level (usually 0.05).

- Compare the chi-square statistic to the critical value:

\* If the calculated  $\chi^2$  is greater than the critical value, we reject the null hypothesis.

\* If the calculated  $\chi^2$  is less than the critical value, we do not reject the null hypothesis.

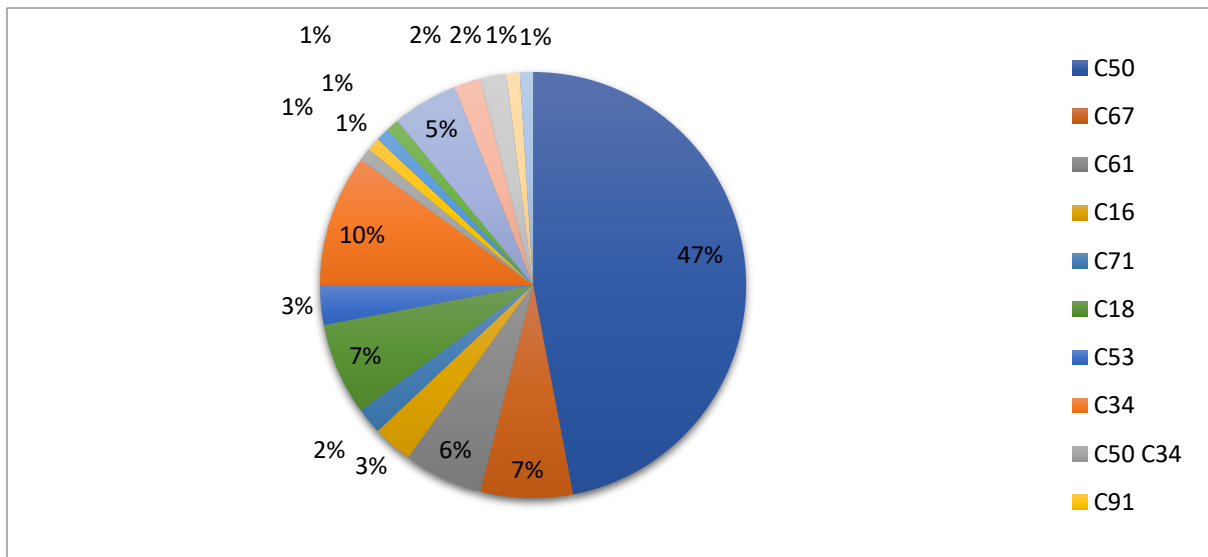
- Regressions: Logistic and linear regression models were applied to explore relationships between variables and to predict outcomes based on multiple predictors. These models allow to control for confounding variables and to identify the most influential independent factors.

- Level of significance: The accepted level of significance for statistical tests was set at a P value less than 0.05. This means that the results are considered statistically significant if there is less than a 5% chance that the observed results are due to chance.

## II-Results & Discussion

In order to study cancer patients by assessing their nutritional profile and epidemiological profile, our work focuses on the empirical implementation of the proposed methodology. Here, using the IBM SPSS tool, the assessment of the 100 cancer patients will be carried out using the aspects that influence the health of cancer patients in the Moroccan region of Laayoune Sakia El Hamraa. First, the research hypothesis is stated, followed by a quantitative data analysis in which the demographic data and the profile of the respondents will be assessed. In addition, an inferential analysis will be carried out in which, using a chi-square test, the assessment of cancer patients will be carried out. Finally, the results of the hypothesis tests will be discussed regarding the existing research.

Figure 1: Different Types of Cancer Patients



This issue is part of an important local context, where for a year, patients in the region have been able to benefit from comprehensive care in Laayoune thanks to the opening of an oncology and haematology centre, as well as the efforts of the Lalla Salma association in the fight against cancer.

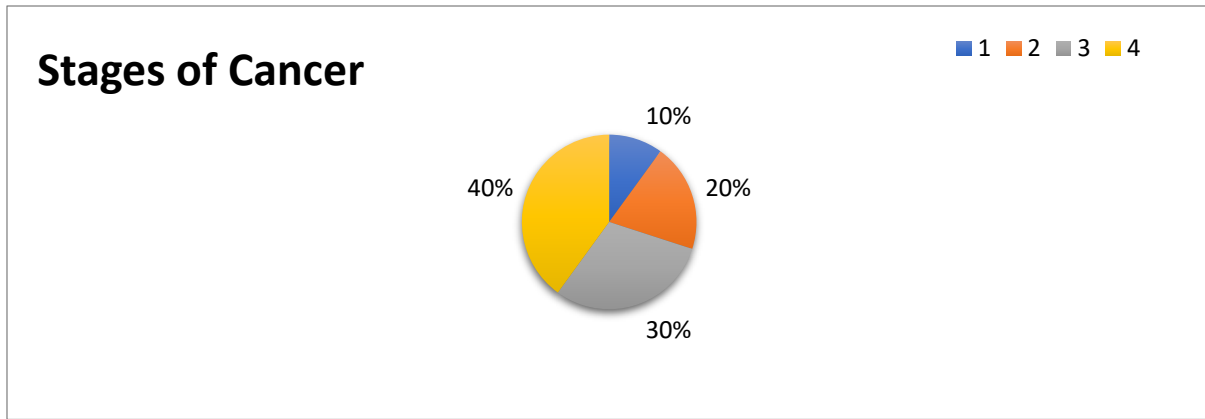
This multifactorial approach allows for an in-depth exploration of the various facets of the relationship between cancer, nutrition, and various sociodemographic and behavioural factors in the specific context of the Laayoune Sakia El Hamraa region. The study aims to provide a nuanced understanding of these relationships, taking into account local particularities and potential risk factors specific to this population.

Figure 1 below shows the different types of cancer in the study population. It is observed that the most frequent type of cancer is C50, recorded in 47 patients. Then, C34 is mentioned for 10, after which there are C67 and C18 with a share of 7 for each type. At the same time, C16 and C53 have a frequency of 3, as for the rest of the cancer types, C71, C25 and C11 are reported for 2, and various other types have a lower frequency. Thus, most of the study participants are diagnosed with C50 cancer.

Figure 2 below shows the distribution according to the different stages of cancer. According to the frequency analysis, stage 1 comprises 38 respondents while stage 2 comprises 36, stage 3 comprises 18 and stage 4 comprises 8. This distribution shows that most of the patients are from the initial stage of cancer, which is more curable. This pattern implies a possibility of early diagnosis.

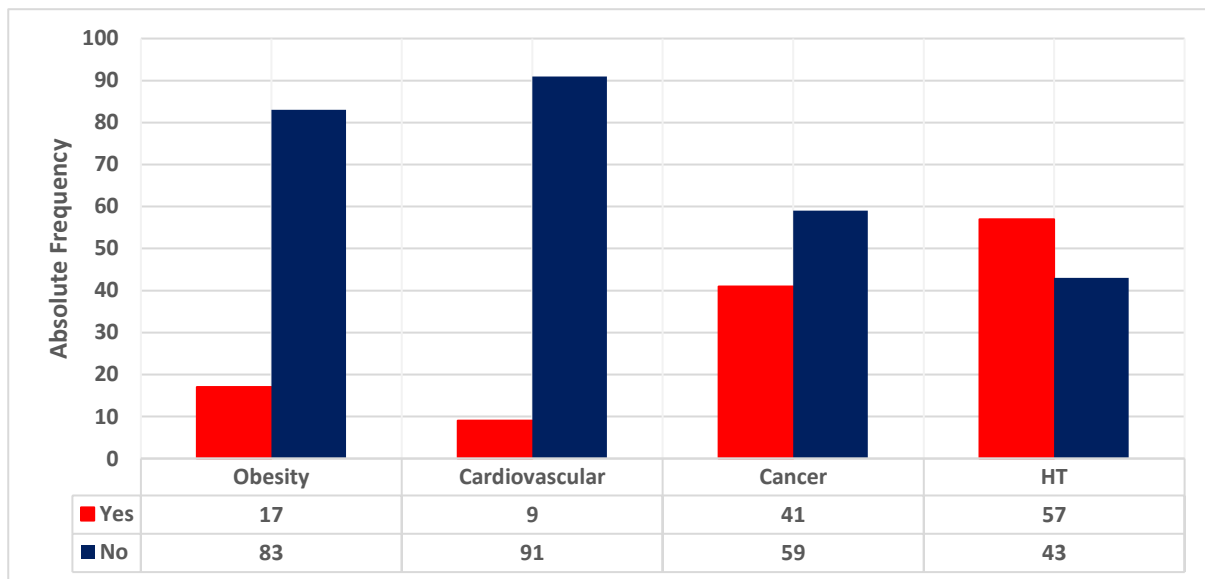
Figure 2: Relative frequencies of different stages of cancer





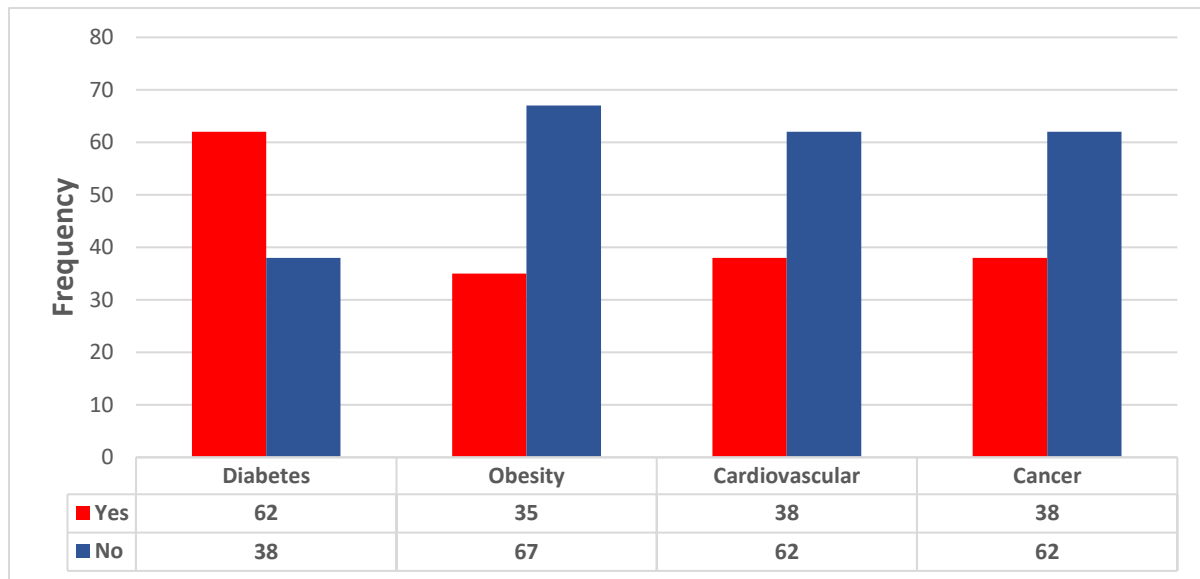
According to the figure 3 below, 17 respondents reported having suffered from obesity. Then comes cardiovascular diseases with 9 patients. It is important to note that cancer affects 41 respondents. This fact shows that the chosen phenomena have a considerable impact on this region. All these results are remarkable because they reveal the popularity of comorbidities in cancer patients. This is important because comorbidities could exacerbate treatment outcomes and other aspects of health.

Figure 3: Personal medical history



Frequency analysis of family medical history (Figure 4) revealed that diabetes is one of the most common pathologies and 62 respondents reported its history. Regarding obesity, 35 cases also indicate a family tendency. The incidence of cardiovascular diseases is also a common problem in the study population, with 38 respondents reporting a family history of such diseases. The percentage of cancer coincides most with that of cardiovascular diseases, which was also 38. The data highlight the complex and multifactorial potential of carcinogens. Therefore, these results highlight the complex relationship between lifestyle factors and genetic predispositions in the development of cancer in people from this region.

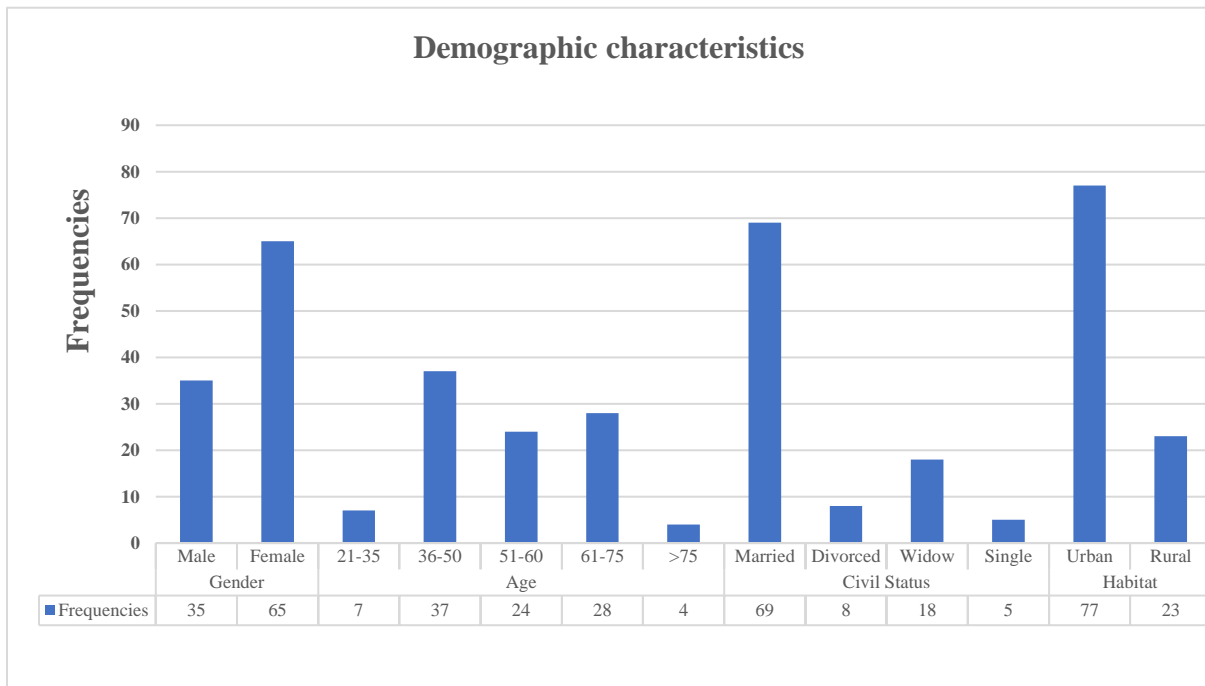
Figure 4: Family medical history



This section presents the results on the demographic characteristics of the patients who participated in the survey. Frequency analysis is used for the representation, consisting of text and graphs. The figure below shows the demographic composition of the main factors such as gender, age, marital status and residential area.

Frequency analysis (Figure 5) revealed that more female respondents responded to the survey, 65 compared to 35 male respondents. This shows a higher representation of females in the survey. Regarding age, it was found that the majority (37) of the study participants are in the age bracket of 36-50 years. This was followed by 28 respondents in the age bracket of 61-75 years, and 24 respondents are between 51-60 years. Civil status shows that 69 respondents in the study sample are married, 18 of whom are widows. The urban population is highly represented in the results, as 77 participants are urban, while the remaining 23 are rural. Therefore, most of the study participants are middle-aged married women residing urban areas.

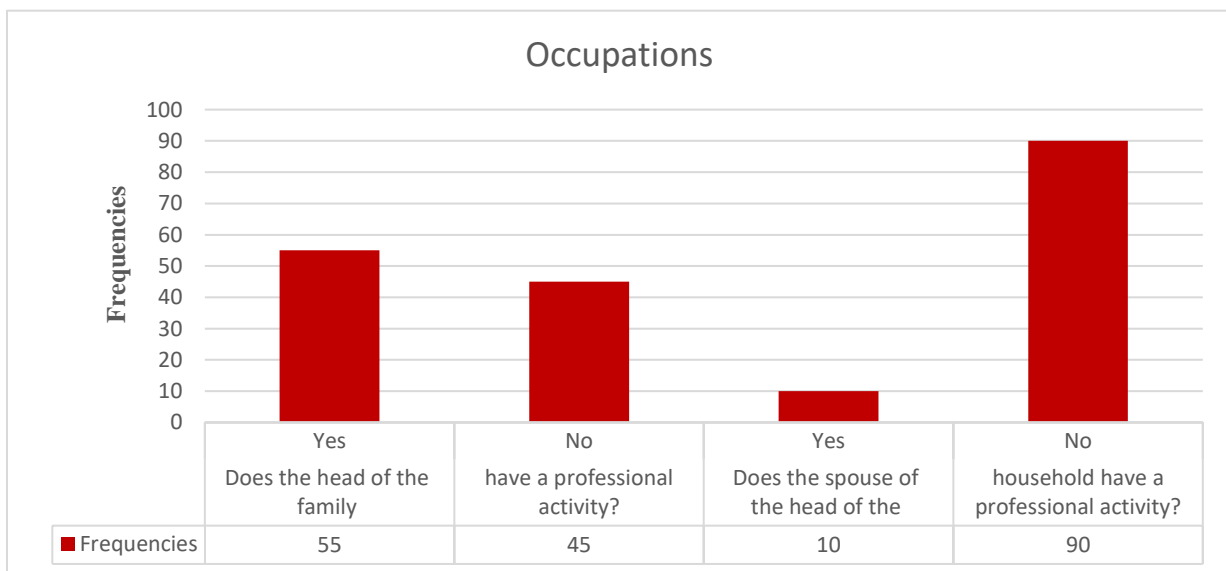
Figure 5: Demographics of survey participants



In Figure 6 below, we can see that the majority (55) of respondents reported having a professional activity against 45 without work.

Figure 6 below also shows that only 10% of spouses of heads of households reported having a professional activity compared to a majority of 90% who were unemployed. In Figure 7 below,

Figure 6: Occupation of head of household and spouse.

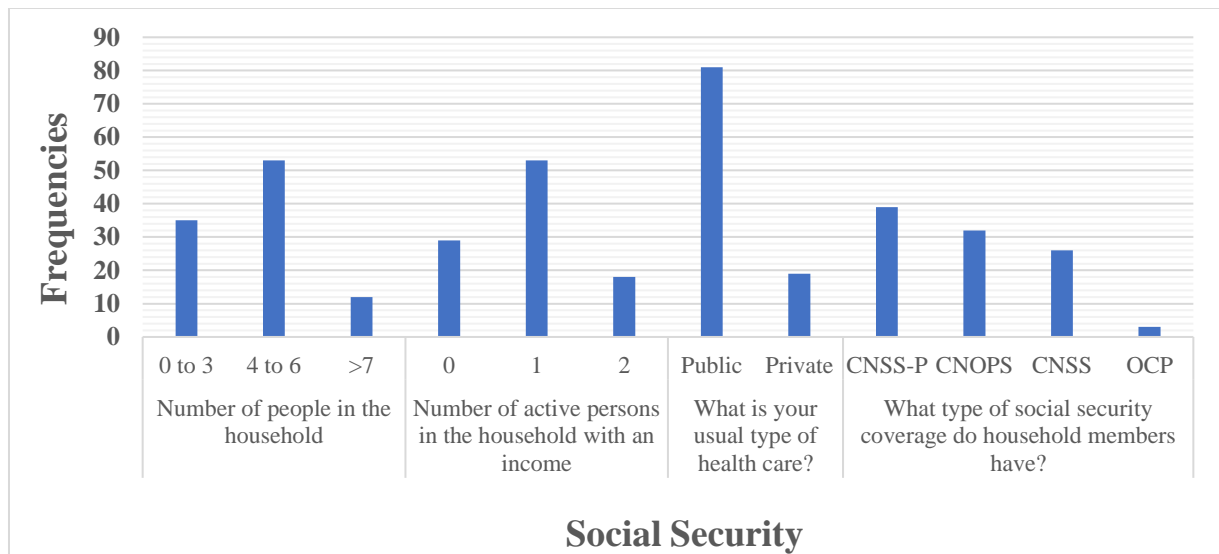


it can be seen that the majority (53) of respondents have households of 4 to 6 people. At the same time, 35 and 12 respondents in the sample reported between 0 and 3 individuals and more than 7. In terms of income categories, 53 households have active support, 29 have none and 18 have two. This suggests a potential strain on the resources of single-income households.

It is important to note that most of the respondents (81) usually use public health services. In terms of social coverage, the most widely applied scheme is the CNSS-P, reported by 39 households. This is followed by the CNOPS for 32 households, the CNSS for 26 and the OCP

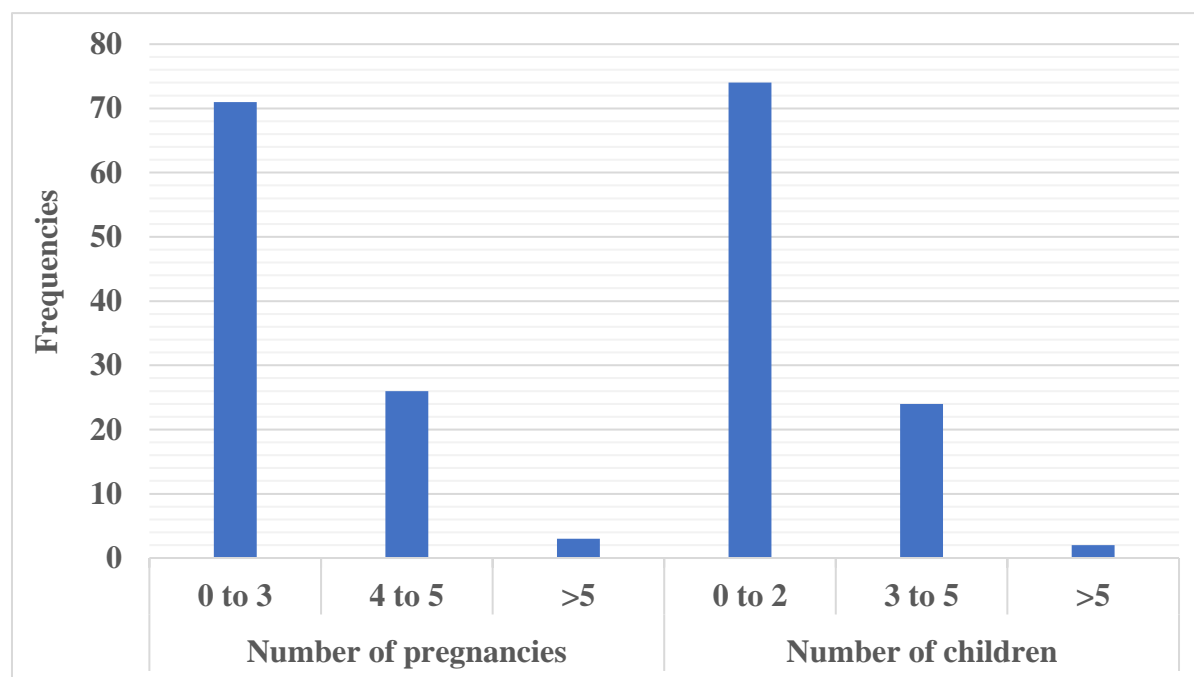
for only 3. Thus, the results show that most cancer patients in the region rely on public health services, while the type of social security is diverse, with the CNSS-P being the most common source.

Figure 7: Health care and social security information.



Analysis of Figure 8 below shows that among the women surveyed, a significant majority reported a number of pregnancies of 0 to 3, representing 71 of the respondents. 26 women surveyed had 4 to 5 pregnancies, and 3 of them had more than five pregnancies in their lifetime. Intuitively, the situation with children is similar, as 74 had between 0 and 2. Others 24 reported a number of between 3 and 5 children and only 2 reported having more than five children. Thus, the results reinforce the notion of a declining number of pregnancies and children among the surveyed population.

Figure 8: Background to the number of pregnancies and children.



## Conclusion

The present research focused on the evaluation of the epidemiological profile. The analysis included patients who were predominantly female, living in an urban area, aged 36 to 75 years, married and non-smokers. With the evaluation of the relationship between variables using the chi-square test, it was deduced that age, sex and marital status affect the type of cancer in patients, but only sex affects the stage of cancer in patients.

In addition, age affects the medical history of cancer patients. Even with the medical history, the analysis showed that the patient's cardiovascular disease affected the cancer. Thus, the study revealed that sociodemographic factors and medical history are important factors that influence the cancer of patients.

The culmination of the study, exposes the epidemiological profile of cancer patients in the Laayoune Sakia El Hamraa region, presenting an in-depth quantitative analysis. This component formulates the research hypotheses, offers a descriptive analysis of the collected data, and conducts an inferential analysis to test the hypotheses and explore the relationships between the different variables studied. The results of this study could have important implications for the prevention and management of cancer in this region. They could provide valuable information for the development of public health strategies adapted to the local population, by identifying modifiable risk factors and guiding the development of targeted nutritional interventions. Ultimately, this research aims to contribute to the improvement of public health and the reduction of cancer incidence in the Laayoune Sakia El Hamraa region.

The study shed light on various aspects of the epidemiological profile of cancer patients. For example, it revealed trends in the prevalence of certain types of cancer based on specific dietary habits. The results obtained provide valuable insights into the potential relationships between diet and cancer occurrence, paving the way for targeted interventions to improve cancer prevention and management in the region.

The data collected and analyzed in this study provide a basis for practical recommendations and public health policies aimed at reducing cancer incidence through nutritional improvements. In

summary, this research contributes significantly to the understanding of the epidemiological factors associated with cancer and suggests avenues for future research and interventions in the field of nutrition and public health.

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