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# Measuring the Impact of Demographic, Economic and Social Variables on Consanguineous Marriage in Egypt

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**Abstract:** Consanguineous marriage remains a notable social phenomenon in Egypt. According to the Egyptian Family Health Survey (EFHS 2021) conducted by the Central Agency for Public Mobilization and Statistics, approximately 30% of ever married women have married a relative, with 72% of these marriages being between first- or second-degree paternal relatives. This trend is significantly more common in rural areas (especially Upper Egypt, at 47%) than in urban regions (as low as 18%). Socioeconomic and educational factors strongly influence the prevalence of such marriages. Women with lower educational attainment and those not earning cash income are more likely to marry a relative. Similarly, families from lower wealth index categories show higher rates of consanguineous marriage, motivated by economic cooperation and trust. In contrast, wealthier families can engage in such marriages to retain wealth within the family. The study used multinomial logistic regression to analyze the influence of various factors such as age, region, education level, employment, and household wealth on the likelihood of consanguineous marriage. Data were collected from EFHS 2021, covering over 34,000 households. Results show that younger age groups, particularly 20–24, show the highest probability of marrying paternal first cousins. The findings also suggest an inherited trend across generations. A lower educational level was consistently associated with higher rates of consanguineous marriage, pointing to education as a crucial factor in partner selection freedom. The study concludes that consanguineous marriage in Egypt is shaped by economic, cultural, and educational influences. It poses significant health risks, including a higher probability (up to 10%) of genetic disorders in offspring and a 25% recurrence rate in affected families, contributing to long-term family and public health burdens.

**Keywords:** Consanguineous Marriage, Socioeconomics factors, Multinomial Logistic Regression, Wealth Index.
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## 1. Introduction

Although consanguineous marriage is widely practiced in Egypt, the justifications believed to support it have not yet been widely tested. Three justifications have been identified for consanguineous marriage among married women, based on various surveys in Egypt. The first rationale for consanguineous marriage is to avoid family property and fragmentation, as women who worked in the family's private business are more likely to marry consanguineously. The second rationale is to limit the financial expenses spent on marriage, as consanguineous marriage is based on the principle of sharing marital expenses with the groom. The third rationale for encouraging consanguineous marriage is the belief that women who marry relatives will enjoy special advantages vis-à-vis their husbands and in-laws [5].

Arabs are a Semitic people primarily defined as individuals who speak Arabic as their native language despite the presence of many regional dialects and who self-identify as being of Arab ancestry. The Arab world stretches from Iraq and the Gulf states in the east to Morocco and Mauritania on the Atlantic coast of North Africa in the west. Over time, it incorporates various populations with ancestral origins outside the Arabian Peninsula. Today, large Arab communities reside permanently in western Europe, North and South America, and Australia. The global Arab population is currently estimated at 300–350 million [14].

Consanguineous marriage remains prevalent in Egypt, particularly among first cousins, despite a global trend of decline. It is commonly associated with early marriage, low levels of education, large family size, and limited economic resources. Regional differences persist, with higher rates in rural Upper Egypt and lower rates in urban Lower Egypt. An analysis of the 2014 Survey of Young People in Egypt found that 27.4% of youth aged 13-35 were in consanguineous marriages. The rate was highest in rural Upper Egypt (43.6%) and lowest in urban Lower Egypt (13.2%). The study recommended the implementation of public health education programs aimed at reducing consanguineous marriage and addressing its underlying social determinants [3].

The impact of social and economic factors on consanguineous marriage in Egypt remains evident, as it is widely considered a social practice strongly shaped by these influences. Economic status plays a key role in the decision to marry within the family; individuals often view it as a way to strengthen the family's economic position and ensure financial stability. Social factors also contribute to the preference for consanguineous marriage, as it is seen as a means of preserving family ties, cultural traditions, and social values [23].

Understanding the impact of socioeconomic factors on consanguineous marriage in Egypt can contribute to developing awareness and education strategies on the importance of diversifying marital choices and reducing the adoption of consanguineous marriage. Communities and social institutions should also seek to raise awareness of the dangers of this type of marriage and provide resources and support to individuals and families inverted in this type of marriage. Moreover, economic opportunities should also be provided to improve living conditions and reduce the economic pressures that force some families to resort to consanguineous marriage, this is likely to occur through improving the economic situation and providing job opportunities, education and health care, which in turn leads to reducing reliance on consanguineous marriage. In conclusion, understanding the impact of social and economic factors on consanguineous marriage in Egypt is vital to promote a culture of difference and a preference for marriage based on love and compatibility rather than kinship relationships [12, 29].

## 2. Research Problem:

Despite the great importance of studying the phenomenon of consanguineous marriage in Egypt, researchers face several challenges and difficulties that can be summarized as follows:

1. First: scarcity or lack of data: Egyptian data on the phenomenon in Egypt are limited or incomplete on consanguineous marriage and the factors affecting it.
2. Second: difficulty in measuring some variables: It may be difficult to measure some variables, such as psychological and social factors related to Egyptian customs and beliefs. They may require specialized study designs or complex measurement tools.
3. Third: cultural sensitivity: The practice of consanguineous marriage may be culturally sensitive, which hinders the process of collecting data and conducting field studies. Individuals may fear sharing their private matters about their marriage or family members for fear of social stigma or criticism [28].

## 3. Research Goals and Methodology:

This research primarily aims to:

- Identify the prevalence of consanguineous marriage in Egyptian society.
- Determine the key demographic, economic, and social variables that influence consanguineous marriage in Egypt.
- Examine the demographic dynamics of consanguineous marriage and its contribution to early marriage.

To achieve these objectives, the Multinomial Logistic Regression method is employed to test the following main hypotheses:

1. The dependent variable is of a multifaceted nominal level (degree of kinship), first cousin father's side, first cousin mother's side, second cousin father's side, second cousin mother's side, other relative father's side, other relative by marriage.
2. The independent variables include continuous, ordinal, and nominal types. They consist of the age of the marriage classified in 5-year groups, the type of place of residence, the region, the highest level of education, the wealth index, the current employment status of the respondent, and the level of education of the husband.

The statistical method used is multinomial logistic regression, which is a classification and generalization technique designed for multicategory problems where the categories of the dependent variable are mutually exclusive. Multinomial logistic regression is typically applied when the outcome variable is nominal with more than two categories that do not have an inherent order or rank. This model can accommodate any number of independent variables, categorical or continuous. In addition to these conditions, the method assumes the verification of several hypotheses, as described by [27]:

1. Independence of observations.
2. The categories of the outcome variable must be mutually exclusive and exhaustive.
3. There is no multicollinearity among the independent variables.

4. Linear relationships exist between the continuous variables and the logit transformation of the outcome variable.
5. Outliers or highly influential points are eliminated.

## 4. Data Sources:

The study is primarily based on data from EFHS 2021, conducted by the Central Agency for Public Mobilization and Statistics. A systematic random sample of 34,240 households was selected nationwide, comprising 47% from urban areas and 53% from rural areas. The sample focused on evermarried women aged 15-49 years who were eligible for individual interviews.

## 5. Research Conceptual Framework:

The conceptual framework of the study can be represented, including its variables, as shown in figure 1 below;

The conceptual framework for this study, as shown in Figure 1, outlines the hypothesized relationships between a set of demographic, socioeconomic and cultural contextual factors (independent variables) and the occurrence and types of consanguineous marriages (dependent variables). This framework provides a theoretical and visual basis for understanding how these factors collectively influence marriage patterns in the context of kinship. It also guides the formulation of research questions and hypotheses and subsequent data analysis by clearly defining the variables under study and their hypothesized causal pathways.

### *5.1. Independent Variables:*

Independent variables are the factors expected to influence the occurrence and characteristics of consanguineous marriages. These variables are generally classified into three main categories: demographic variables, socioeconomic variables, and cultural context.

#### 5.1.1. Demographic Variables:

Demographic variables relate to the characteristics of populations and individuals that can shape social behaviors, including marriage choices. Three main demographic factors are considered in this framework:

- **Age at marriage:** This variable refers to the age at which individuals enter their first marriage. Age at marriage can be influenced by many factors, including cultural norms, educational attainment, and economic preparedness. In many traditional societies, early marriage is common and may be associated with a higher likelihood of consanguineous marriages, as marriage decisions may be made by family elders who prioritize maintaining family ties. Conversely, delayed marriage, often associated with higher education and career aspirations, may lead to a broader choice of partners outside the immediate family circle and thus may reduce the incidence of consanguineous marriages [13].
- **Type of residence (urban/rural):** This variable distinguishes between urban and rural settings. The environment in which individuals live can significantly influence social structures, commu-

nity cohesion, and adherence to traditional practices. Rural areas often exhibit stronger community ties and a greater emphasis on preserving lineage and family traditions, which can contribute to a higher prevalence of consanguineous marriages. In contrast, urban settings, characterized by greater anonymity, diverse social interactions, and exposure to modern ideas, may experience lower rates of consanguineous marriages. Differences in access to education, healthcare, and economic opportunities between these settings can indirectly influence marriage patterns [1].

- **Region:** This variable takes into account broader geographic divisions within a country, recognizing that distinct cultural, historical, and socioeconomic contexts can influence marriage patterns. Different regions may have unique historical precedents, religious practices, or tribal structures that encourage or discourage consanguineous marriages. Analyzing regional differences allows for a more nuanced understanding of the local factors and cultural specificities that contribute to the prevalence and types of consanguineous marriages, beyond the simple urban-rural distinction [11].

#### 5.1.2. Socioeconomic Variables:

Socioeconomic variables reflect the economic and social status of individuals and families and are crucial determinants of life choices, including marriage decisions. Three main socioeconomic factors are included in this framework:

- **Educational level:** This variable refers to the highest level of formal education achieved by individuals, particularly spouses. Higher educational levels are generally associated with greater awareness of the health effects of kinship, greater economic independence, and expanded social networks. These factors combined can lead to a lower propensity for consanguineous marriages, as educated individuals may seek partners based on personal compatibility and shared interests rather than relying solely on kinship ties. Education can enable individuals to challenge traditional norms and make more independent choices regarding their marriage partners [2].
- **Employment (employment status):** This variable describes whether individuals are employed and, if so, the nature of their employment. Employment status, particularly for women, can significantly impact their independence and decision-making power within the household. The economic independence gained through employment can provide alternatives to traditional marriage arrangements, including those involving kinship, by reducing financial dependence on the extended family. Conversely, the lack of employment or economic dependence may reinforce traditional practices, including arranged kinship marriages, as individuals may have fewer options outside the family network [25].
- **Wealth Index:** This variable serves as an indicator of a household's economic status and is often constructed from family assets and amenities. Economic resources can influence various aspects of life, including access to education, healthcare, and social opportunities, all of which can indirectly influence marriage patterns. In some cultural contexts, consanguineous marriages may be preferred to keep wealth within the family, prevent its dispersal, or maintain social status within the lineage. However, in other settings, higher wealth may be associated with greater exposure to modern influences and a lower propensity for consanguineous marriages, as families may prioritize factors other than kinship in marriage choices [4].

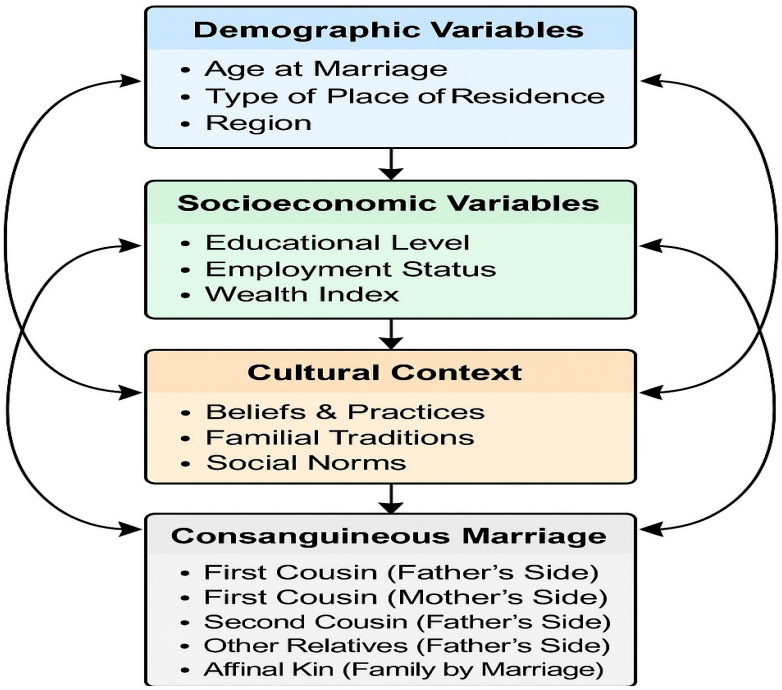


**Figure 1.** The impact of demographic, economic and social variables on consanguineous marriage in Egypt

5.1.3. Cultural Context:

Cultural context represents a set of intangible factors that shape the beliefs, practices, and values that influence marriage decisions. These factors are often deeply rooted in a society's history and traditions:

- **Beliefs and practices:** These include religious beliefs, social customs, myths, and everyday practices that influence a society's view of consanguineous marriage. For example, some religious beliefs or tribal customs may encourage marriage within the family to maintain family purity or strengthen family ties. These practices can significantly influence the acceptance and prevalence of consanguineous marriage.
- **Family traditions:** Family traditions refer to practices passed down across generations within families. These traditions can include a preference for marrying relatives to preserve property, strengthen family cohesion, or ensure the continuity of the lineage. Family traditions play a crucial role in shaping marriage choices, as individuals often adhere to the paths set by their ancestors.
- **Social norms:** Social norms represent the expectations and unwritten rules that govern behavior within a society. These norms can influence marriage decisions through social pressure or societal expectations. For example, in societies where consanguineous marriage is the norm, individuals who choose to marry outside the family may face social challenges or stigma. Social norms can significantly influence the prevalence of consanguineous marriage by shaping individuals' perceptions and choices.

### 5.2. *Dependent Variable:*

The primary dependent variable in this study is consanguineous marriage, which refers to marriages between individuals who are biologically related. This variable is further divided into specific categories to capture nuances of kinship ties:

- Paternal cousin: marriage between a man and his paternal niece (father's cousin).
- Maternal cousin: marriage between a man and his maternal niece (maternal cousin).
- Paternal second cousin: marriage between individuals whose fathers are first cousins.
- Maternal second cousin: marriage between individuals whose mothers are first cousins.
- Other paternal relatives: marriages involving other degrees of kinship through the paternal line (e.g., paternal aunt's daughter, paternal uncle's daughter).
- Other maternal relatives: marriages involving other degrees of kinship through the matrilineal line (e.g., maternal aunt's son, maternal cousin).
- Affinal Kin: This category refers to marriages in which individuals are related through a previous marriage rather than by blood. Although not biologically related, these marriages often occur within extended family networks and can be influenced by similar social and cultural factors that reinforce kinship. An example of this is marriage to a deceased spouse's brother or a close relative of the spouse.

### 5.3. *Relationships Between Variables:*

as illustrated in Figure 1, the conceptual framework assumes that the independent variables (demographic, socioeconomic, and cultural contextual factors) directly influence the dependent variable (consanguineous marriage). The arrows indicate the hypothesized direction of influence, indicating that changes or variations in the independent variables are expected to lead to corresponding changes in the prevalence and types of consanguineous marriages. For example, certain demographic characteristics, such as younger age at marriage or residence in rural areas, are hypothesized to increase the likelihood of consanguineous marriages. Similarly, socioeconomic factors, such as lower educational attainment or certain employment statuses, are expected to be associated with higher rates of consanguineous marriages. The cultural context, with its beliefs, traditions, and social norms, also plays a pivotal role in shaping these patterns, as it can either promote or limit the practice of consanguineous marriages [21].

Furthermore, the framework suggests that these independent variables may not only influence the overall incidence of consanguineous marriage but also differentially affect specific types of consanguineous marriages (e.g., patrilineal, matrilineal, or affinity). This nuanced approach allows for exploring how different factors promote certain forms of kinship over others, reflecting the diverse social and cultural dynamics that shape kinship-based marriage choices. The framework provides a robust foundation for empirical analysis, enabling researchers to identify the key drivers of consanguineous marriage patterns and inform potential public or social health interventions [22].

## 6. Research Questions:

The research mainly aims to answer the following questions:

1. What is the percentage of consanguineous marriage in Egypt at the national level and reginal levels?
2. What is the demographic, economic and social factors that contribute to the spread of the phenomenon of consanguineous marriage in Egypt?
3. What are the cultural practices and beliefs associated with consanguineous marriage in Egypt?
4. What are the potential health risks associated with consanguineous marriage?
5. What is the proposed awareness and prevention programs to confront the phenomenon of consanguineous marriage in Egypt?

## 7. Research Importance:

The phenomenon of consanguineous marriage in Egyptian is a multidimensional phenomenon with demographic, economic, social and cultural aspects. Statistics indicate that about a third of Egyptian marriages are consanguineous marriages (about 30%). Given the effect of the phenomenon on the general health of the society as a whole, studying it is of utmost importance for the following logical considerations. A scientific understanding of the phenomenon provides accurate insight into its causes, prevalence, geographic distribution, and public health impacts, as well as its links to economic and social factors. Additionally, analyzing population dynamics, cultural norms, and religious beliefs can support the development of effective awareness programs to address the issue.

1. Identifying the health problems resulting from the phenomenon; some studies indicate that consanguineous marriage may increase the chance of the emergence of genetic diseases as a result of genetic closeness.
2. Improving health and social policies; that contribute to reducing the spread of the phenomenon and improving the health of society as a whole.
3. Promoting social justice; some literature indicates that the phenomenon is more prevalent among deprived economic and social classes - with low demographic characteristics - which contribute to the exacerbation of social inequality problems. This reinforces the importance of studying the phenomenon from a social justice perspective and developing awareness programs to limit its spread among these classes in order to preserve social security.
4. Comparison with other countries; local studies of the phenomenon can be compared with other country studies and this enhances understanding of the variables and factors affecting its spread.

## 8. The Development of the Phenomenon of Consanguineous Marriage in Egypt:

Data from the 2014 Egypt Youth Survey showed that consanguineous marriage is most common in rural areas, with nearly a third of marriages taking place between relatives. This is particularly evident in rural Upper Egypt, where it reached 45.5% among females and 42.3% among males. The survey also showed that more educated youth were less likely to marry relatives. Among those who completed a university degree, 16.8% were married to relatives, compared to 32.2% of those who were illiterate. Also, while young people at the lowest levels of wealth were more likely to marry relatives. Although consanguineous marriage is still very common among young people, it has become less common among young people's marriages between 2004 and 2014; 24.9% of young people who were married between 2010 and 2014 were married to a relative, compared to 30.8% of those who married

before 2004. This decline may be due to the age at marriage of the survey sample; young people who married at a young age were more likely to marry a relative [26].

The results of the Demographic Health Survey (2014) showed the prevalence and spread of the phenomenon of consanguineous marriage in general, with its most important indicators being as follows:

1. 31% of previously married women stated that their current husbands or the last husband of divorced or widowed women are related to them, and more than half of the marriages between relatives are marriages between first-degree relatives, and in such marriages the husband is often a closer relative on the father's side than on the mother's side.
2. Consanguineous marriage is more prevalent in rural areas than in urban areas, as more than a third of marriages in rural areas are between blood relatives, and in urban areas about a quarter of women marry blood relatives. It was found that the highest rate of consanguineous marriage is in rural Upper Egypt, as half of the marriages are between blood relatives, and it is lowest in urban Lower Egypt (18%) and urban governorates (20%).
3. The chance of a woman marrying a blood relative decreases from 37% among women who have never been to school to 26% among women with a secondary education or higher. The chances of marrying a relative also increase among women who do not work for a financial return. In addition, the rate of marrying a blood relative decreases with increasing wealth levels, from 43% among women who belong to the group with the lowest level of the wealth index to 18% among women who belong to the group with the highest level of the wealth index [9].

The results of the Egyptian Family Health Survey (EFHS 2021) issued by the Central Agency for Public Mobilization and Statistics shown in Table No. 1 Indicate that about thirty out of every 100 married women are related to their current husbands, or the last husband for divorced and widowed women. While about 72% of marriages between relatives were first- or second-degree marriages, which are often on the father's side than on the mother's side (15% and 18% respectively). The results also showed that the phenomenon of consanguineous marriage was more prevalent in rural Egypt than in urban areas. A quarter of marriages in rural areas were between first- or second-degree relatives, compared to 17% of marriages in urban areas. As for the place of residence, the survey results indicated that the highest percentage of consanguineous marriages was in the Upper Egypt countryside. It was found that 47% of marriages took place between blood relatives, and the percentage of consanguineous marriages reaches its lowest possible in the urban areas of Lower Egypt at 18% and in the urban governorates at 20%, while the chance of a woman marrying a blood relative decreases from 40% among those who have never gone to school to about 26% among women who have a secondary education or higher.

In terms of work, the probability of marriage between blood relatives increases among women who do not work for a cash return compared to those who work for a cash return (32% and 21% respectively). Finally, with regard to the level of wealth, the probability of marriage between blood relatives decreases with the increase in the level of wealth from 41% of women belonging to the lowest level of the wealth index to 19% of women belonging to the highest level of the same index [7].

**Table 1.** Percent Distribution of Ever-Married Women Aged 15-49 years by Relationship to Their (Last) Husband, According to Background Characteristics, Egypt 2021

| | | Kind of Relationship | | | | | | | | total | Number of ever-married women |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Not related | First cousin father's side | First cousin mother's side | Second cousin father's side | Second cousin mother's side | Other relative father's side | Other relative mother's side | Relative by marriage | | |
| Age at marriage in 5-year groups | 15-19 | 60.4 | 12.8 | 4.1 | 6.6 | 3.4 | 8.7 | 2.4 | 1.6 | 100 | 397 |
| | 20-24 | 66.3 | 9.2 | 6.1 | 4.3 | 3.6 | 5.7 | 3.6 | 1.2 | 100 | 2220 |
| | 25-29 | 70.2 | 7.9 | 5.5 | 5.0 | 2.9 | 4.8 | 2.4 | 1.3 | 100 | 3247 |
| | 30-34 | 69.0 | 8.0 | 6.2 | 5.1 | 2.8 | 4.7 | 3.1 | 1.2 | 100 | 4091 |
| | 35-39 | 69.4 | 8.1 | 6.5 | 4.3 | 3.0 | 4.4 | 3.4 | 0.8 | 100 | 4207 |
| | 40-44 | 68.2 | 9.6 | 5.7 | 4.6 | 3.0 | 5.0 | 2.8 | 1.0 | 100 | 3595 |
| | 45-49 | 69.1 | 9.6 | 4.8 | 5.2 | 2.5 | 5.2 | 2.6 | 0.9 | 100 | 2723 |
| Type of place of residence | Urban | 76.5 | 6.0 | 5.2 | 3.6 | 2.3 | 3.1 | 2.2 | 1.2 | 100 | 7797 |
| | Rural | 63.9 | 10.4 | 6.3 | 5.5 | 3.3 | 6.2 | 3.5 | 1.0 | 100 | 12684 |
| Region | Urban governorates | 78.7 | 5.1 | 4.7 | 4.5 | 1.7 | 2.5 | 1.8 | 1.1 | 100 | 2989 |
| | Lower Egypt | 75.2 | 6.6 | 5.3 | 2.9 | 2.5 | 3.9 | 2.7 | 1.0 | 100 | 9266 |
| | LE Urban | 81.6 | 4.4 | 4.7 | 2.1 | 1.9 | 2.4 | 2.0 | 1.0 | 100 | 2308 |
| | LE Rural | 73.1 | 7.3 | 5.5 | 3.2 | 2.6 | 4.4 | 2.9 | 1.0 | 100 | 6958 |
| | Upper Egypt | 57.4 | 12.5 | 6.8 | 7.1 | 4.0 | 7.2 | 3.8 | 1.2 | 100 | 8000 |
| | UE Urban | 69.5 | 8.5 | 6.0 | 3.8 | 3.5 | 4.3 | 2.9 | 1.5 | 100 | 2346 |
| | UE Rural | 52.4 | 14.2 | 7.1 | 8.5 | 4.1 | 8.3 | 4.2 | 1.0 | 100 | 5655 |
| | Frontier governorates | 66.0 | 10.4 | 6.8 | 5.3 | 2.6 | 5.1 | 2.7 | 1.1 | 100 | 226 |
| Highest educational level | No education | 58.8 | 12.5 | 6.4 | 7.2 | 3.6 | 6.5 | 3.7 | 1.3 | 100 | 3362 |
| | Primary | 65.1 | 12.3 | 6.8 | 4.8 | 3.8 | 4.4 | 2.5 | 0.2 | 100 | 1026 |
| | Secondary | 64.8 | 10.1 | 5.9 | 5.8 | 3.2 | 6.0 | 3.0 | 1.3 | 100 | 4257 |
| | Higher | 73.2 | 6.8 | 5.6 | 3.8 | 2.6 | 4.2 | 2.8 | 1.0 | 100 | 11837 |

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Table1– *Continued from previous page*

| | | Kind of Relationship | | | | | | | | total | Number of ever-married women |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Not related | First cousin father's side | First cousin mother's side | Second cousin father's side | Second cousin mother's side | Other relative father's side | Other relative mother's side | Relative by marriage | | |
| Respondent currently working | Yes | 78.1 | 5.4 | 4.7 | 3.1 | 2.2 | 3.6 | 2.1 | 0.8 | 100 | 3381 |
| | No | 66.8 | 9.4 | 6.1 | 5.1 | 3.1 | 5.2 | 3.2 | 1.1 | 100 | 17100 |
| Wealth index | Poorest | 57.2 | 13.7 | 6.1 | 6.7 | 4.1 | 7.0 | 3.8 | 1.4 | 100 | 3727 |
| | Poorer | 64.0 | 10.8 | 6.9 | 5.0 | 2.8 | 6.4 | 3.1 | 0.9 | 100 | 3945 |
| | Middle | 68.0 | 8.0 | 5.8 | 5.7 | 3.1 | 5.2 | 3.2 | 1.0 | 100 | 4207 |
| | Richer | 72.1 | 7.2 | 5.9 | 4.0 | 2.8 | 4.0 | 2.9 | 1.1 | 100 | 4396 |
| | Richest | 80.3 | 4.8 | 4.5 | 2.8 | 1.9 | 2.7 | 2.1 | 0.9 | 100 | 4206 |
| Total | | 68.7 | 8.7 | 5.8 | 4.8 | 2.9 | 5.0 | 3.0 | 1.1 | 100 | 20481 |

## 9. Research Methodology:

The Multinomial Logistic Regression Model was used to identify the extent of the phenomenon of consanguineous marriage and to determine the most important economic and social variables affecting it in Egyptian society, to achieve this objective. The dependent variable is of the multifaceted nominal level (degree of kinship). First cousin father's side, first cousin Mother's side, second cousin father's side, second cousin Mother's side, Other relative father's side, Other Relative by marriage and the independent variables are continuous, ordinal, or nominal, which are (Age at marriage in 5-year groups, Type of place of residence, Region, Highest education level, wealth Index, Respondent currently working, Husband's level of Education). The following Table 2 shows the most important estimated parameters of the Multinomial Logistic Regression Model. The table presents odds ratios rather than probabilities or percentages, reflecting the relative likelihood of consanguineous marriage associated with each variable. Notably, wide confidence intervals for certain categories suggest significant variability and highlight areas where additional data collection would improve the statistical power and interpretability of results [10].

**Table 2.** Estimated Parameters of the Multinomial Logistic Regression Model

| Parameter Estimates | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Kind of relationship[a] | | B | Std. Error | Wald | Df. | Sig. | Exp(B) | 95% CI for Exp(B) | |
| | | | | | | | | Lower Bound | Upper Bound |
| | Intercept | 4.607 | 0.908 | 25.726 | 1 | 0.000 | | | |
| | [Age at marriage in 5-year groups=1] | 0.465 | 0.857 | 0.294 | 1 | 0.048 | 1.591 | 0.297 | 8.536 |

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Table2– *Continued from previous page*

| Parameter Estimates | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Kind of relationship[a] | | B | Std. Error | Wald | Df. | Sig. | Exp(B) | 95% CI for Exp(B) | |
| | | | | | | | | Lower Bound | Upper Bound |
| Not related | [Age at marriage in 5-year groups=2] | 0.767 | 0.751 | 1.044 | 1 | 0.037 | 2.153 | 1.494 | 6.379 |
| | [Age at marriage in 5-year groups=3] | 0.317 | 0.737 | 0.185 | 1 | 0.047 | 1.374 | 0.324 | 5.826 |
| | [Age at marriage in 5-year groups=4] | 0.428 | 0.742 | 0.333 | 1 | 0.064 | 1.534 | 0.358 | 6.571 |
| | [Age at marriage in 5-year groups=5] | 0.329 | 0.754 | 0.190 | 1 | 0.063 | 1.389 | 0.317 | 6.087 |
| | [Age at marriage in 5-year groups=6] | 0.387 | 0.819 | 0.223 | 1 | 0.037 | 1.472 | 0.296 | 7.330 |
| | [Region=0] | 0.560 | 0.332 | 2.849 | 1 | 0.051 | 1.750 | 0.914 | 3.352 |
| | [Region=2] | 0.577 | 0.357 | 2.604 | 1 | 0.037 | 1.780 | 0.884 | 3.586 |
| | [Region=3] | 1.178 | 0.372 | 10.058 | 1 | 0.002 | 3.249 | 1.568 | 6.729 |
| | [Region=5] | 1.121 | 0.386 | 8.430 | 1 | 0.004 | 3.069 | 1.440 | 6.542 |
| | [Region=6] | 0.460 | 0.350 | 1.727 | 1 | 0.189 | 1.583 | 0.798 | 3.142 |
| | [Highest educational level=0] | 0.064 | 0.301 | 0.044 | 1 | 0.833 | 1.066 | 0.590 | 1.923 |
| First cousin father's side | Intercept | 1.633 | 0.977 | 2.792 | 1 | 0.095 | | | |
| | [Age at marriage in 5-year groups=1] | 0.936 | 0.925 | 1.024 | 1 | 0.012 | 2.550 | 1.416 | 6.630 |
| | [Age at marriage in 5-year groups=2] | 1.278 | 0.820 | 2.431 | 1 | 0.019 | 3.591 | 2.720 | 7.906 |
| | [Age at marriage in 5-year groups=3] | 0.893 | 0.807 | 1.225 | 1 | 0.068 | 2.443 | 0.502 | 11.879 |
| | [Age at marriage in 5-year groups=4] | 0.768 | 0.812 | 0.896 | 1 | 0.044 | 2.156 | 0.439 | 10.590 |
| | [Age at marriage in 5-year groups=5] | 0.717 | 0.824 | 0.758 | 1 | 0.084 | 2.049 | 0.408 | 10.295 |
| | [Age at marriage in 5-year groups=6] | 0.818 | 0.888 | 0.848 | 1 | 0.057 | 2.266 | 1.397 | 5.914 |
| | [Region=3] | 0.111 | 0.387 | 0.082 | 1 | 0.075 | 1.117 | 0.523 | 2.388 |
| | [Region=5] | 0.999 | 0.399 | 6.256 | 1 | 0.012 | 2.716 | 1.241 | 5.940 |
| | [Region=6] | 0.573 | 0.363 | 2.489 | 1 | 0.015 | 1.774 | 0.870 | 3.614 |
| | [Highest educational level=0] | 0.633 | 0.316 | 4.003 | 1 | 0.045 | 1.883 | 1.013 | 3.498 |
| | [Highest educational level=1] | 0.451 | 0.345 | 1.702 | 1 | 0.192 | 1.569 | 0.797 | 3.088 |

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Table2– *Continued from previous page*

| Parameter Estimates | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Kind of relationship[a] | | B | Std. Error | Wald | Df. | Sig. | Exp(B) | 95% CI for Exp(B) | |
| | | | | | | | | Lower Bound | Upper Bound |
| | [Highest educational level=2] | 0.401 | 0.259 | 2.387 | 1 | 0.122 | 1.493 | 0.898 | 2.481 |
| | [Wealth index=2] | 0.040 | 0.376 | 0.011 | 1 | 0.915 | 1.041 | 0.499 | 2.173 |
| | [Wealth index=4] | 0.190 | 0.294 | 0.417 | 1 | 0.519 | 1.209 | 0.679 | 2.152 |
| First cousin mother's side | Intercept | 0.876 | 1.008 | 0.755 | 1 | 0.385 | | | |
| | [Age at marriage in 5-year groups=1] | 0.360 | 0.945 | 0.145 | 1 | 0.003 | 1.433 | 0.225 | 9.137 |
| | [Age at marriage in 5-year groups=2] | 0.701 | 0.832 | 0.710 | 1 | 0.049 | 2.016 | 1.395 | 7.305 |
| | [Age at marriage in 5-year groups=3] | 0.362 | 0.819 | 0.195 | 1 | 0.659 | 1.436 | 0.288 | 7.147 |
| | [Age at marriage in 5-year groups=4] | 0.415 | 0.824 | 0.254 | 1 | 0.614 | 1.514 | 0.301 | 7.614 |
| | [Age at marriage in 5-year groups=5] | 0.107 | 0.837 | 0.016 | 1 | 0.898 | 1.113 | 0.216 | 5.744 |
| | [Age at marriage in 5-year groups=6] | 0.455 | 0.903 | 0.254 | 1 | 0.034 | 2.576 | 1.269 | 8.248 |
| | [Region=0] | 0.547 | 0.367 | 2.222 | 1 | 0.136 | 1.728 | 0.842 | 3.550 |
| | [Region=2] | 0.234 | 0.398 | 0.345 | 1 | 0.557 | 1.263 | 0.579 | 2.754 |
| | [Region=3] | 1.135 | 0.432 | 6.914 | 1 | 0.009 | 3.110 | 1.335 | 7.246 |
| | [Region=5] | 1.309 | 0.415 | 9.934 | 1 | 0.002 | 3.703 | 1.641 | 8.358 |
| | [Region=6] | 1.092 | 0.410 | 7.095 | 1 | 0.008 | 2.980 | 1.334 | 6.654 |
| | [Type of place of residence=1] | 0.352 | 0.485 | 0.528 | 1 | 0.467 | 1.422 | 0.550 | 3.678 |
| | [Highest educational level=0] | 0.288 | 0.325 | 0.784 | 1 | 0.076 | 1.333 | 0.705 | 2.521 |
| | [Highest educational level=1] | 0.222 | 0.355 | 0.391 | 1 | 0.532 | 1.248 | 0.623 | 2.502 |
| | [Highest educational level=2] | 0.240 | 0.264 | 0.823 | 1 | 0.364 | 1.271 | 0.757 | 2.134 |
| | [Wealth index=2] | 0.120 | 0.385 | 0.098 | 1 | 0.755 | 1.128 | 0.530 | 2.398 |
| | [Wealth index=4] | 0.390 | 0.298 | 1.710 | 1 | 0.191 | 1.477 | 0.823 | 2.651 |
| | Intercept | 1.241 | 1.009 | 1.512 | 1 | 0.219 | | | |
| | [Age at marriage in 5-year groups=1] | 0.251 | 0.935 | 0.072 | 1 | 0.050 | 1.285 | 0.206 | 8.034 |
| | [Age at marriage in 5-year groups=2] | 0.335 | 0.823 | 0.166 | 1 | 0.684 | 1.398 | 0.279 | 7.017 |

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Table2– *Continued from previous page*

| Parameter Estimates | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Kind of relationship[a] | | B | Std. Error | Wald | Df. | Sig. | Exp(B) | 95% CI for Exp(B) | |
| | | | | | | | | Lower Bound | Upper Bound |
| Second cousin father's side | [Region=0] | 0.759 | 0.413 | 3.374 | 1 | 0.066 | 2.135 | 0.950 | 4.797 |
| | [Region=2] | 0.679 | 0.448 | 2.291 | 1 | 0.130 | 1.972 | 0.819 | 4.749 |
| | [Region=3] | 0.696 | 0.434 | 2.568 | 1 | 0.109 | 2.005 | 0.856 | 4.694 |
| | [Region=5] | 1.901 | 0.453 | 17.575 | 1 | 0.794 | 2.093 | 3.752 | 16.278 |
| | [Region=6] | 0.942 | 0.410 | 5.288 | 1 | 0.021 | 2.565 | 1.149 | 5.727 |
| | [Highest educational level=0] | 0.432 | 0.343 | 1.587 | 1 | 0.208 | 1.540 | 0.787 | 3.015 |
| | [Highest educational level=1] | 0.275 | 0.375 | 0.537 | 1 | 0.464 | 1.316 | 0.631 | 2.745 |
| | [Highest educational level=2] | 0.441 | 0.284 | 2.413 | 1 | 0.120 | 1.554 | 0.891 | 2.708 |
| | [Wealth index=1] | 0.089 | 0.389 | 0.052 | 1 | 0.819 | 1.093 | 0.510 | 2.340 |
| | [Wealth index=2] | 0.192 | 0.405 | 0.224 | 1 | 0.636 | 1.212 | 0.547 | 2.683 |
| | [Wealth index=3] | 0.086 | 0.384 | 0.050 | 1 | 0.824 | 1.089 | 0.513 | 2.312 |
| | [Wealth index=4] | 0.238 | 0.321 | 0.548 | 1 | 0.459 | 1.268 | 0.676 | 2.380 |
| Second cousin mother's side | Intercept | 0.109 | 1.220 | 0.008 | 1 | 0.929 | | | |
| | [Age at marriage in 5-year groups=1] | 0.454 | 1.147 | 0.157 | 1 | 0.692 | 1.574 | 0.166 | 14.917 |
| | [Age at marriage in 5-year groups=2] | 0.954 | 1.029 | 0.860 | 1 | 0.354 | 2.596 | 0.346 | 19.508 |
| | [Age at marriage in 5-year groups=3] | 0.284 | 1.018 | 0.078 | 1 | 0.780 | 1.329 | 0.181 | 9.772 |
| | [Age at marriage in 5-year groups=4] | 0.684 | 1.022 | 0.448 | 1 | 0.503 | 1.981 | 0.267 | 14.679 |
| | [Age at marriage in 5-year groups=5] | 0.453 | 1.036 | 0.191 | 1 | 0.662 | 1.573 | 0.207 | 11.979 |
| | [Age at marriage in 5-year groups=6] | 0.838 | 1.097 | 0.584 | 1 | 0.065 | 2.313 | 1.269 | 7.857 |
| | [Region=0] | 0.124 | 0.443 | 0.079 | 1 | 0.779 | 1.132 | 0.476 | 2.696 |
| | [Region=2] | 0.307 | 0.468 | 0.429 | 1 | 0.512 | 1.359 | 0.543 | 3.404 |
| | [Region=3] | 1.013 | 0.507 | 3.987 | 1 | 0.046 | 2.753 | 1.019 | 7.438 |
| | [Region=5] | 1.164 | 0.476 | 5.971 | 1 | 0.015 | 3.203 | 1.259 | 8.148 |
| | [Region=6] | 0.979 | 0.485 | 4.076 | 1 | 0.043 | 2.663 | 1.029 | 6.891 |
| | [Highest educational level=2] | 0.338 | 0.299 | 1.275 | 1 | 0.259 | 1.402 | 0.780 | 2.521 |
| | Intercept | 0.777 | 1.185 | 0.430 | 1 | 0.512 | | | |

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Table2– *Continued from previous page*

| Parameter Estimates | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Kind of relationship[a] | | B | Std. Error | Wald | Df. | Sig. | Exp(B) | 95% CI for Exp(B) | |
| | | | | | | | | Lower Bound | Upper Bound |
| Other relative father's side | [Age at marriage in 5-year groups=1] | 1.283 | 1.124 | 1.302 | 1 | 0.254 | 3.606 | 0.398 | 32.641 |
| | [Age at marriage in 5-year groups=2] | 1.435 | 1.027 | 1.951 | 1 | 0.163 | 4.198 | 0.561 | 31.434 |
| | [Age at marriage in 5-year groups=3] | 1.087 | 1.016 | 1.145 | 1 | 0.285 | 2.966 | 0.405 | 21.722 |
| | [Age at marriage in 5-year groups=4] | 1.230 | 1.020 | 1.453 | 1 | 0.228 | 3.420 | 0.463 | 25.248 |
| | [Age at marriage in 5-year groups=5] | 0.659 | 1.034 | 0.406 | 1 | 0.524 | 1.933 | 0.255 | 14.671 |
| | [Age at marriage in 5-year groups=6] | 1.295 | 1.089 | 1.415 | 1 | 0.234 | 3.651 | 0.432 | 30.838 |
| | [Region=3] | 0.698 | 0.457 | 2.336 | 1 | 0.126 | 2.010 | 0.821 | 4.918 |
| | [Region=5] | 0.929 | 0.432 | 4.637 | 1 | 0.031 | 2.533 | 1.087 | 5.902 |
| | [Region=6] | 1.227 | 0.432 | 8.057 | 1 | 0.005 | 3.413 | 1.462 | 7.965 |
| | [Type of place of residence=1] | 0.206 | 0.517 | 0.158 | 1 | 0.691 | 1.228 | 0.446 | 3.385 |
| | [Highest educational level=0] | 0.102 | 0.336 | 0.093 | 1 | 0.760 | 1.108 | 0.573 | 2.140 |
| | [Highest educational level=2] | 0.138 | 0.274 | 0.253 | 1 | 0.615 | 1.148 | 0.671 | 1.965 |
| Other relative mother's side | Intercept | -0.350 | 1.179 | 0.088 | 1 | 0.766 | | | |
| | [Age at marriage in 5-year groups=1] | 0.328 | 1.068 | 0.094 | 1 | 0.759 | 1.388 | 0.171 | 11.259 |
| | [Age at marriage in 5-year groups=2] | 0.869 | 0.944 | 0.849 | 1 | 0.357 | 2.385 | 0.375 | 15.165 |
| | [Age at marriage in 5-year groups=3] | 0.402 | 0.931 | 0.187 | 1 | 0.066 | 1.495 | 0.241 | 9.277 |
| | [Age at marriage in 5-year groups=4] | 0.464 | 0.936 | 0.246 | 1 | 0.620 | 1.591 | 0.254 | 9.965 |
| | [Age at marriage in 5-year groups=6] | 0.816 | 1.010 | 0.652 | 1 | 0.019 | 2.261 | 0.312 | 16.381 |
| | [Region=0] | 0.602 | 0.424 | 2.023 | 1 | 0.155 | 1.827 | 0.796 | 4.189 |
| | [Region=2] | 0.137 | 0.464 | 0.087 | 1 | 0.768 | 1.147 | 0.462 | 2.850 |
| | [Region=3] | 1.750 | 0.588 | 8.857 | 1 | 0.003 | 5.757 | 1.818 | 18.232 |
| | [Region=5] | 1.494 | 0.461 | 10.485 | 1 | 0.001 | 4.454 | 1.803 | 11.000 |

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Table2– *Continued from previous page*

| Parameter Estimates | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Kind of relationship[a] | | B | Std. Error | Wald | Df. | Sig. | Exp(B) | 95% CI for Exp(B) | |
| | | | | | | | | Lower Bound | Upper Bound |
| | [Region=6] | 1.978 | 0.569 | 12.079 | 1 | 0.746 | 7.227 | 2.369 | 22.047 |
| | [Type of place of residence=1] | 0.835 | 0.644 | 1.681 | 1 | 0.095 | 2.306 | 0.652 | 8.151 |
| | [Highest educational level=0] | 0.377 | 0.350 | 1.161 | 1 | 0.081 | 1.458 | 0.734 | 2.895 |
| | [Highest educational level=2] | 0.230 | 0.287 | 0.645 | 1 | 0.022 | 1.259 | 0.717 | 2.209 |
| | [Wealth index=2] | 0.019 | 0.418 | 0.002 | 1 | 0.063 | 1.019 | 0.449 | 2.314 |
| | [Wealth index=4] | 0.232 | 0.326 | 0.504 | 1 | 0.078 | 1.261 | 0.665 | 2.390 |
| a. The reference category is: Relative by marriage. | | | | | | | | | |

The observed wide confidence intervals indicate substantial uncertainty in certain estimates, reflecting limited precision likely due to sample size limitations. Consequently, caution is necessary when interpreting these results, as broader intervals may impact the robustness of derived conclusions. Future studies should aim for larger sample sizes or more targeted sampling strategies to improve the precision and reliability of findings. Interpretations of results must be approached cautiously, particularly for variables whose confidence intervals encompass the null value (1.0), indicating potential non-significance. Clear acknowledgment of this limitation enhances the transparency and accuracy of our conclusions [24].

Table 3 shows the logistic regression model fit analysis which was done and we find that; the goodness of fit of the logistic regression model was assessed using a set of standard statistical indicators, including the 2-log likelihood, the likelihood ratio test, and three Pseudo R-square measures. The 2-log likelihood for the intercept only model was 39504.309, while for the final model including the explanatory variables; it decreased to 38226.540, indicating a substantial improvement in model fit [15].

**Table 3.** Model Fitting Criteria

| Criteria | Value |
|---|---|
| 2-Log Likelihood (Intercept Only) | 39504.309 |
| 2-Log Likelihood (Final) | 38226.540 |

Tables 4 introduce the likelihood ratio test which showed a significant improvement in fit, with $\chi^2 = 39504.309 - 38226.540 = 1277.769$ accompanied by 35 degrees of freedom and a significance level (Sig.) of .000, suggesting that the inclusion of predictors significantly improved the model ($p < 0.001$).

Furthermore, three Pseudo R-Square statistics were calculated in table 5 to assess the explanatory power of the model. These values indicate that the model has strong explanatory adequacy. In particular, the Nagelkerke $R^2$ value of 0.79 suggests that the model explains approximately 79% of the

**Table 4.** Likelihood Ratio Test

| Model | Chi-Square | Degrees of Freedom (df) | Significance (Sig.) |
|---|---|---|---|
| Final vs Intercept Only | 1277.769 | 35 | .000 |

**Table 5.** Pseudo R-Square Measures

| Pseudo R-Square | Value |
|---|---|
| Cox and Snell $R^2$ | 0.74 |
| Nagelkerke $R^2$ | 0.79 |
| McFadden $R^2$ | 0.26 |

variance in the dependent variable. The McFadden $R^2$ value of 0.26 falls within the commonly accepted range (0.2 – 0.4), which is typically indicative of a well-fitting logistic regression model [20].

Based on these findings, it can be concluded that the model used in this study provides a high level of predictive performance and explains a statistically significant proportion of the variance in the dependent outcome.

The following table and figure show the receiver operating characteristic (ROC) curve analysis of the predictor variables. Figure 2 shows a set of receiver operating characteristic (ROC) curves that

**Table 6.** Area under the Curve

| Test Result Variable (s) | Area | Std. Error | Asymptotic Sig. | Asymptotic 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound |
| Wealth index factor score (5 decimals) | 0.779 | 0.004 | 0.000 | 0.366 | 0.392 |
| Age at marriage in 5-year groups | 0.676 | 0.003 | 0.001 | 0.462 | 0.490 |
| Type of place of residence | 0.763 | 0.002 | 0.000 | 0.549 | 0.576 |
| Region | 0.843 | 0.007 | 0.000 | 0.630 | 0.656 |
| Highest educational level | 0.616 | 0.001 | 0.000 | 0.402 | 0.429 |
| Respondent currently working | 0.678 | 0.005 | 0.002 | 0.464 | 0.491 |

evaluate the predictive performance of several independent variables (predictor variables) in distinguishing specific classes. ROC curves are a popular graphical tool for assessing the quality of binary classification models, as they plot the relationship between the true positive rate (TPR), also known as sensitivity, and the false positive rate (FPR), also known as (1- specificity) [16].

The attached figure presents a series of Receiver Operating Characteristic (ROC) curves used to evaluate the predictive performance of several independent variables (predictor) in distinguishing between specific outcome classes. ROC curves are widely used graphical tools for assessing the effectiveness of binary classification models. They illustrate the trade-off between the true positive rate (TPR), or sensitivity, and the false positive rate (FPR), which is equivalent to 1 minus specificity [17].

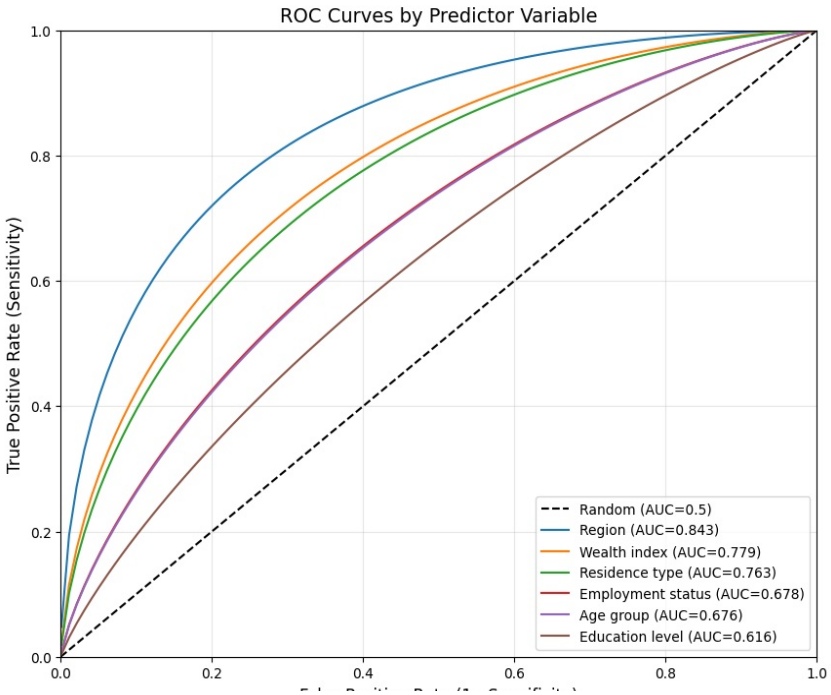


**Figure 2.** Receiver operating characteristic (ROC) curve analysis of predictor variables

## 10. Results and Discussion:

The analysis using the Multinomial Logistic Regression model revealed complex relationships between the dependent variable, degree of kinship, and the independent variables. The key findings are summarized as follows:

- **Overall Effects:**

All independent variables showed significant effects on consanguineous marriage, regardless of kinship degree. The age group 20-24 had the highest likelihood of consanguineous marriage odds ratio (OR) = 2.153, 95% CI [1.494–6.379]). Geographically, the urban areas of the lower part of Egypt and the upper part of Egypt showed higher odds (OR = 3.249, CI [1.568–6.729]; OR = 3.069, CI [1.440–6.542], respectively). Uneducated individuals were more prone to consanguineous marriages (OR = 1.066, CI [0.590–1.923]), while the wealth index did not show a significant effect.

- **First-Degree Kinship on Father's Side:**

The highest risk was observed in the 20-24 age group (OR = 3.5, CI [2.720–7.906]), followed by 15-19 (OR = 2.55, CI [1.416–6.63]), and older age groups 35-39 and 40-44 also showed elevated odds. The phenomenon appears across generations. Upper rural and urban Egypt, as well as lower rural areas of Egypt, showed higher odds (OR ranging from 1.117 to 2.716). Lower education levels were correlated with higher rates of consanguineous marriages, demonstrating an inverse relationship between education and this phenomenon. The results of the wealth index suggested a higher incidence among both poor and rich families, possibly due to trust and inheritance-related reasons [8].

- **First-Degree Kinship on Mother's Side:**

Similar trends were found, with highest odds in the 20-24 (OR = 2.016, CI [1.395–7.305]) and 40-44 (OR = 2.57, CI [1.269–8.248]) age groups. The geographical odds were highest in the urban, rural and rural areas of Upper Egypt (ORs around 3). The uneducated group again showed a higher probability (OR = 1.33), with weaker effects for other levels of education. The wealth index maintained the same pattern as on the father's side.

- **Second-Degree Kinship on Father's Side:**

The age groups 20-24 and 15-19 showed increased odds (OR ∼1.3–1.4). Upper Egypt rural area recorded the highest odds (OR = 2.565). Education level again showed an inverse relationship with consanguineous marriage, with uneducated and secondary education groups at higher risk. The wealth index indicated an increase in odds for both the poorer and the richer groups.

- **Second-Degree Kinship on Mother's Side:**

Higher odds were observed in Upper Egypt urban, Lower Egypt rural, and Upper Egypt rural (ORs ∼2.6–3.2). Secondary education was the most likely level of education related to consanguineous marriage (OR = 1.402). The wealth index did not have a significant effect here, possibly due to inheritance distribution patterns.

- **Other Kinship Ties:**

Variables such as age, geography, education and wealth index showed a limited influence on consanguineous marriages involving other kinship ties.

## 11. Summary and Conclusions:

The phenomenon of consanguineous marriage in Egypt, as in many other societies and cultures, is a marital union between two people who are related to each other at varying degrees. It is a phenomenon with deep roots in the Egyptian society throughout its long history, and its effects are evident in many aspects, including health, society, and culture.

From the previous narration of the research results, it is clear that the phenomenon of consanguineous marriage in Egypt is a complex phenomenon, strongly intertwined with several economic, social and demographic factors. On the economic level, it is found that the "wealth index", it was concluded that one of the main causes of consanguineous marriage is the low cost and burdens of marriage in the case of a low wealth index. However, consanguineous marriage acts as a safety valve to prevent the family's wealth from being circulated outside of it through inheritance in the case of a high wealth index. This in turn leads to the creation of a state of inequality and the inheritance and reinforcement of poverty "the rich get richer and the poor get poorer" because consanguineous marriage contributes to not breaking this cycle of stagnation [19].

The increase in rates can be attributed to economically deprive rural areas, because job opportunities are reduced, a social network is formed, and opportunities for acquaintance and social interaction are reduced, and consequently leading to the choice of choosing a life partner outside the family. This pattern continues to prevail even in the capitals of the governorates, whether in Upper or Lower Egypt, due to the flow of internal migration - in search of a livelihood - and better opportunities. However, if the individual wants to marry, he returns to his hometown in the village [18].

The phenomenon of consanguineous marriage is an important symptom of a more severe problem in family and society, which is the phenomenon of "early marriage." Due to the high margin of trust between consanguineous families, it is more likely that their daughters marry at an early age, under 18 years in most cases; which creates several social problems that help repeat the life cycle of the phenomenon of early marriage and invalidate any successful solution to the problem and its consequences. The top of these problems is school dropout, especially for women, which deprives them of completing their education and deprives the society from a qualified mother and wasted work energy [23]. Most of the literature indicates the existence of a close relationship between mothers' education and their children's education. In addition, the extension of the reproductive life span of young mothers resulting from early marriage as a direct result of consanguineous marriage, raising fertility rates in general, and exposing the young mother to the danger of early pregnancy. This then increases the possibility of miscarriage that threatens the mother's life and the lives of her children, especially since the phenomenon linked to the increasing rate of caesarean births is also due to the inability of new born women to bear the pain of labor. Fourth: The decline in demographic characteristics in general, including education, poor health and primary care, and low income as a result of not completing academic qualifications and the lack of a favorable enabling environment lead to the continuation and increase of the phenomenon of consanguineous marriage. Social factors play a significant role in supporting early marriage, especially among those with low education, income, and health levels who value family unity and believe that marrying relatives strengthens this bond and preserves inheritance. Those who oppose consanguineous marriage often face social pressures, including the risk of losing economic benefits like inheritance and family support. These pressures, such as the burden of marriage costs, can force even the most determined individuals to conform and marry within the family [5].

From a demographic perspective, the concentration of population in rural areas can contribute to higher rates of consanguineous marriage. This pattern is often attributed to the limited availability of suitable marriage partners outside of one's immediate village or region. In many cases, smaller family sizes further encourage marriage within the family to preserve family lineage and cohesion.
Consanguineous marriage is also associated with an increased risk of inherited genetic disorders. In addition, it is often associated with early marriage, which negatively affects female educational attainment. Early marriage often results in school dropout and subsequently restricts women's access to employment opportunities due to inadequate qualifications.

Finally, health and psychological problems may arise for children resulting from consanguineous marriage, especially for young mothers due to early marriage. They have a series impact on their quality of life, as a young mother who does not have sufficient education and is not qualified for the labor market. This will inevitably be the nucleus of a family that suffers from all economic, social and developmental problems [6].

The above discussion may lead us to stress the importance of introducing several interventions that the state must follow to break this vicious cycle related to consanguineous marriage. The necessity for the state to conduct awareness campaigns to raise the level of knowledge about the danger of the phenomenon of consanguineous marriage, its multiple developmental dimensions and its impact on the family and the society .The second of these measures is to conducting medical examinations before marriage with the aim of detecting possible genetic diseases. Also, this is to record the data in a health database available to researchers with the aim of continuously improving the health system in this regard. Finally, there is a need to make legislative changes or amendments to limit consanguineous

marriage, while being careful about the difficulty of implementation.

In conclusion: consanguineous marriage in Egypt is a highly complex phenomenon affected by multiple factors, including economic, social and demographic factors. This confirms that if there is a will to confront the phenomenon, a multi-dimensional approach must be followed due to the multiple dimensions of the problem. The foremost of these approaches are: (1) raising levels of awareness and culture through good education, (2) improving economic conditions, especially in areas and for population groups that are most deserving care, (3) providing the necessary psychological and social support at the level of individuals and families.

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**Declaration of competing interest:**

The authors declare that they have no conflicts of interest to report regarding the present study.

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