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MAPPING OF CANCER CASES IN THE REGION OF GREATER CASABLANCA

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KeyWords

standardized morbidity ratio, cancer mapping, relative risk, Morocco

Abstract

The objective of this study is to map of the cancer cases rate in the in the Region of Greater Casablanca using the Standardized Morbidity Ratio (SMR) Method and identify the high-risk districts. The data are obtained from the Greater Casablanca Cancer Registry (GCCR)[1].

4957 cancer cases have been mapped (2245 in men and 2712 in women). Cancer mapping allowed to represent the relative risk at the level of 32 communes in the greater Casablanca region. The high-risk areas are: Oulad salah, Ain Harrouda, Tit Melli and Anfa.

Analysis of the spatial distribution of cancer shows significant differences between different areas. However, a clear spatial autocorrelation is observed, which can be of great interest and importance to researchers for future epidemiological studies, and to policymakers for applying preventive measures.

Keywords : Region of the Greater Casablanca, cancer registry, spatial analysis

1. INTRODUCTION

Cancer is an important public health problem worldwide. According to Globocan estimates [2], there are an estimated 18.1 million new cases of cancer and 9.6 million cancer-related deaths in 2018. New cases of cancer are ever-increasing worldwide, and more than half of the cases are from low and middle income countries [3,4]. In Morocco, cancer is a major concern for decision-makers, managers and healthcare professionals. Every year, 35,000 new cases of cancer are registered. There are several risk factors that cause cancer which are alcohol use, physical inactivity, tobacco use and unhealthy diet are the main cancer risk factors, as well as some chronic infections.

In order to control and reduce incidence and mortality of cancer and also to carry epidemiological studies, geographical distribution of cancer is considered as an excellent monitoring tool [5]. Researchers have demonstrated that a strong link exists between health status and areas where people live in [6,7]. The characteristics of an area such as, industrial environment, climate, socioeconomic status, lifestyle, and racial groups have a strong effect on cancer incidence and health outcomes [6,7,8,9,10].

Mapping of cancer cases is a potentially powerful assessment tool to represent health data in a visual format by linking statistical and thematic data on maps. It can play a prominent role in helping public health authorities and policy makers for decision-making and planning in epidemiological studies [11,12,13,14]. A review of published literature shows that many studies have been conducted on cancer assessment by using Geographic information system (GIS) [6,8,15,16].

This study aims to map the cancer incidence in the Region of the Greater Casablanca, and to explore the spatial pattern trends or changes of disease over the period 2008-2012.

2. MATERIALS AND METHODS

Study area

Casablanca is the largest city of Morocco, located in the central-western part of the country on the Atlantic Ocean (33°32′N 7°35′W) with an urban population of 4.27 million inhabitants[17]. The Greater Casablanca consisted of two prefectures and two provinces: Prefecture of Casablanca; Prefecture of Mohammedia; Nouaceur Province and Mediouna Province.

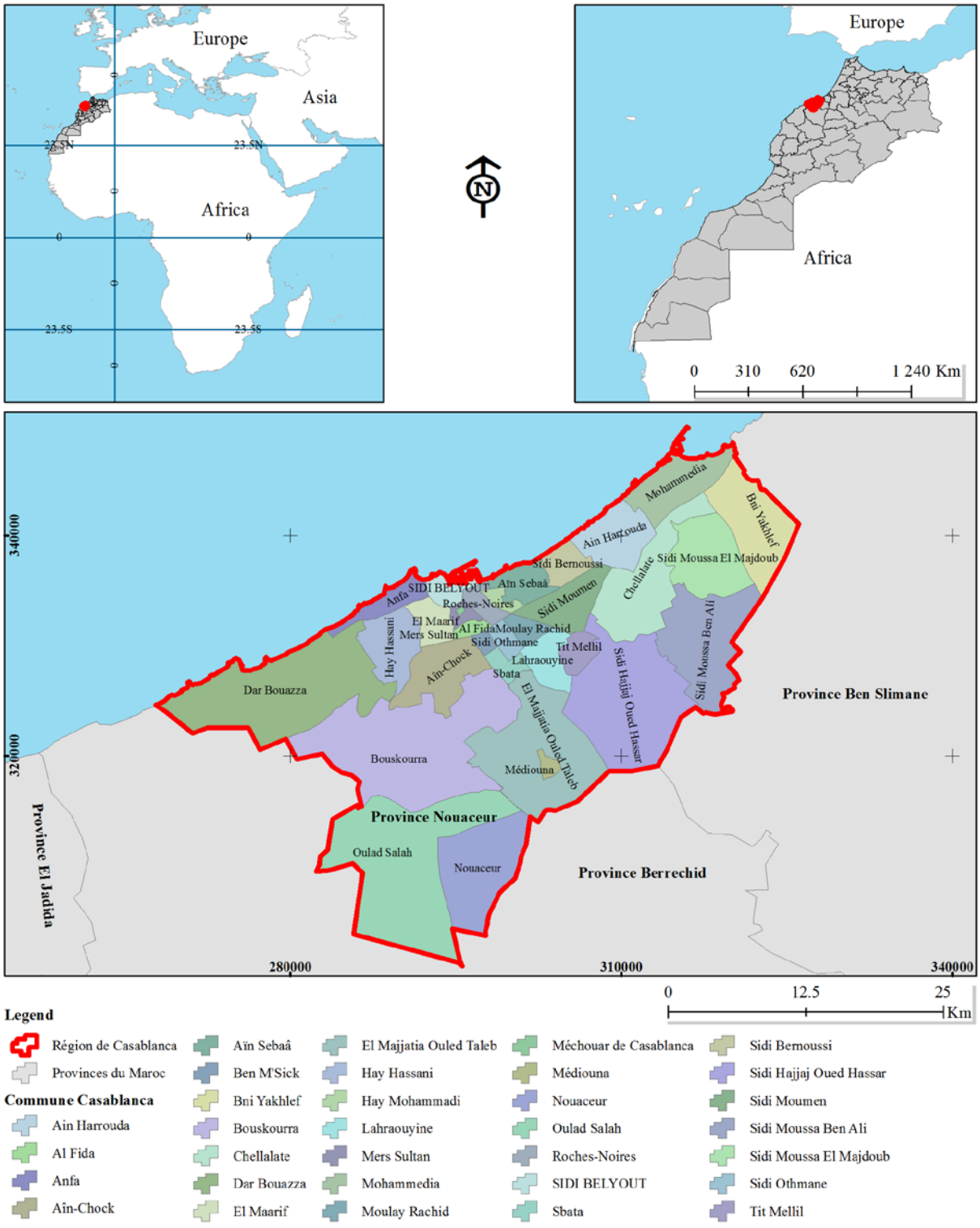

Fig 1 : Prefectures and provinces of the Region of the Greater Casablanca.

Cancer data

In this study, information of cancer cases is obtained from the cancer registry of the Region of the Greater Casablanca (GCCR) [18]. The GCCR was set up in 2004 and constitutes an epidemiological cancer surveillance system not only for the Region of the Greater Casablanca but also for the whole of Morocco. Our study involved a sample of 2957 cancer cases (2245 in mal and 2712 in female). The study sample represents all district (32 districts) of the RGC. The cancer cases involved in this study correspond to

residents who have an exact address belonging to one of the 32 districts of the Region of the Greater Casablanca.

Statistical analysis

In this spatial study, we used the *Standardized Morbidity Ratio (SMR*) Method. The main aim of the SMR is to estimate the RR of a certain disease in a certain map, which may be interpreted as the probability that a person within a specified region contracts the disease divided by the probability that a person in the population contracts the disease.

In our case, we suppose that O_i, where $i=1, 2,.., H$ (H indexes the different district of the RGC), indicates the observed cases of cancer, and let E_i represents the expected cases or expected number of cases. Using these values as obtained from the available data, we can calculate the relative risk θ_i for area i, which is the *SMR* defined as:

$$SMR = \theta i = \frac{Oi}{Ei}$$

For the expected value E_i, it could be calculated by using this formula:

$$\boldsymbol{Ei = Ni\frac{\sum_{i=1}^{H} Oi}{\sum_{i=1}^{H} Ni}} \quad \boldsymbol{and} \quad \boldsymbol{\theta i = \frac{Oi}{Ni\frac{\sum_{i=1}^{H} Oi}{\sum_{i=1}^{H} Ni}} = \frac{\left(\frac{Oi}{Ni}\right)}{\left(\frac{\sum_{i=1}^{H} Oi}{\sum_{i=1}^{H} Ni}\right)}}$$

Where N_i the is the population of district i. Here standardization is completed by the total population at risk, assuming everybody is equal at risk. Consequently, we estimate the relative risk using formula:

$$SMR = \theta i = \frac{(Oi/\boldsymbol{Ni})}{\left(\sum_{i=1}^{H} Oi/\sum_{i=1}^{H} \boldsymbol{Ni}\right)}$$

3. RESULTS

In 2010, the Region of the Greater Casablanca had 4,1 million inhabitants. The most populated district were: "Hay Hassani", "Sidi Moumen", "Ain Chock", "Moulay Rachid", "Sidi Othman" and "Mohammadia" districts with more than 200000 inhabitants (Figure 2). The less populated region were : "Oulad Salah", Sidi Moussa Ben Ali" and "Mechouar de Casablnaca" districts with less than 20000 inhabitants (Figure 2).

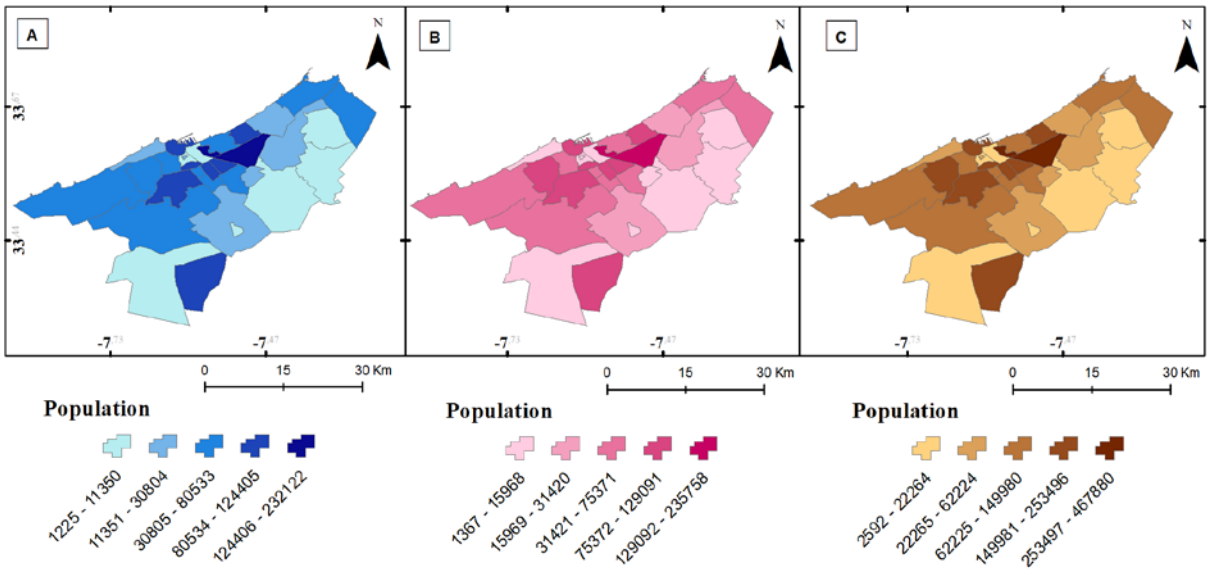

Fig 2. Population by districts. The Region of the Greater of Casablanca, 2010.

4957 cancer cases have been mapped (2245 in men and 2712 in women), representing 20% of all recorded cases over the period 2008-2012 in the Region of the Greater Casablanca[18]. Most cases of cancer were located in "Anfa", "Mers Sultan", "Sidi Bernoussi" and "Al Fida"(Figure 3).

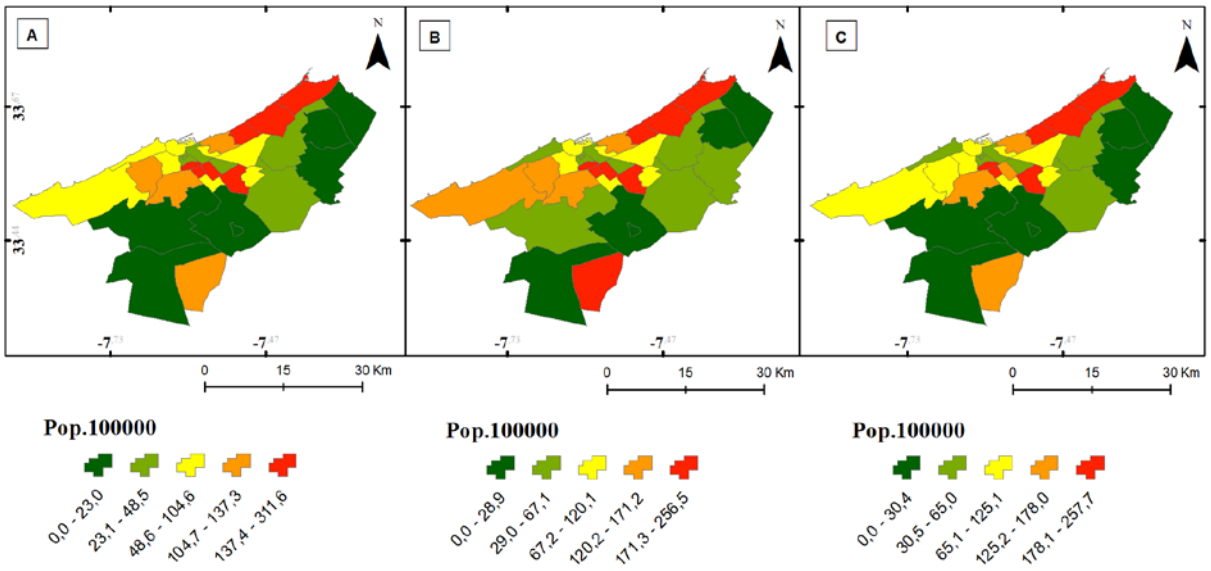

Fig 3. Population by districts. The Region of the Greater Casablanca, 2010.

The outcomes for the relative risk estimation using the SMR are presented in Table 1 and Figure 4. In man, two districts have value of relative risk equal to zero, in the absence of observed cases. These districts are "Mechouar de Casablanca" and "Sidi moussa majdoub". In women, we found just one relative risk equal to zero, in the absence of observed cases in the "Mechouar de Casablanca" district.

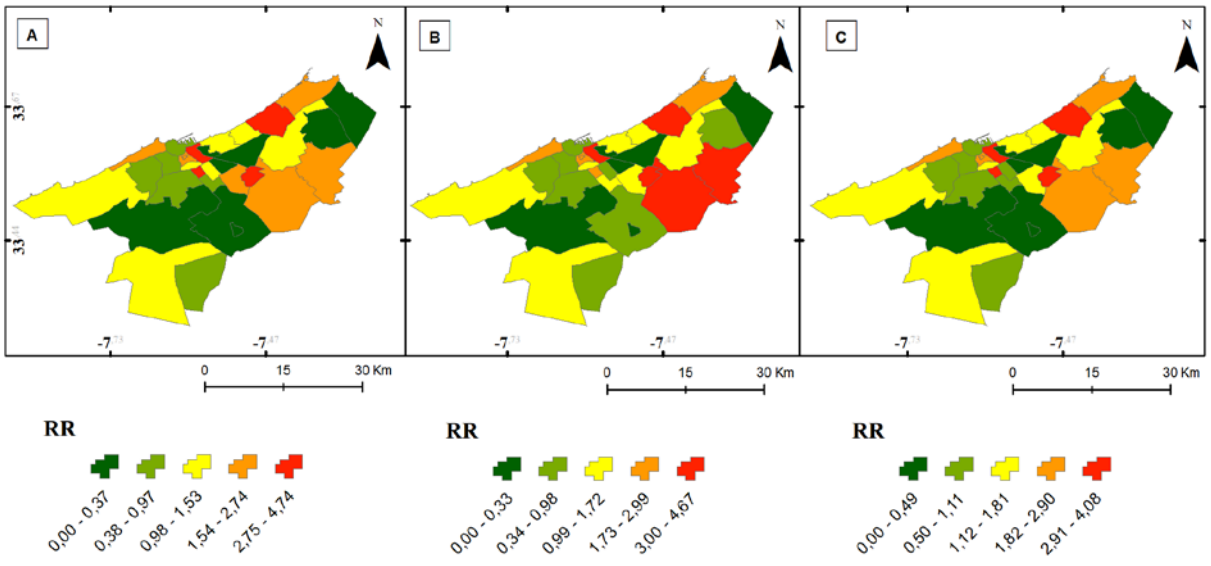

Fig 3. Distribution of the Cancer relative risk for men (A), (B) women and (C) both sexes. Region of the Greater Casablanca.

Based on SMR method, susceptible people within the district of "Oulad salah", "Ain harrouda", "Tit melil" and "Anfa" have the highest risk of contracting cancer, the corresponding values of relative risk are 4.076, 3,897, 3,540 and 3,466 respectively. While susceptible people within the "Lahraouyine ", "Assoukhour assawda ", "Sidi moumen", "Mohammadia", "Hay hassani" and "Mechouar de casablanca "districts have the lowest risk of stomach cancer when compared with people in the overall population. In addition we noted the relative risk was higher in male than Female in almost all districts except "Ain harrouda

", "Al Fida", "Al majjatia oulad taleb", "Anfa", "El maarif", "Hay mohammadi", "Sidi belyout" and "Sidi Othman" distrcits.

4. DISCUSSION

This study aimed to determine the RR distribution of cancer in the Region of the Greater Casablanca. The number of provinces with some levels of RR for the incidence of cancers was high. Therefore, we could detect a pattern of dispersion of cancer cases that can be used to fight against this pathology planning of screening, early detection and treatment strategy.

The distribution of the RR of cancer cases was the first of its kind in the Region of the Greater Casablanca region. In this study, we found that the districts of "Oulad salah", "Ain harrouda", "Tit melil" and "Anfa" have the highest risk of contracting cancer. This is a surprising outcome, Indeed, other more industrialized and more populated regions should have a high relative risk. These results can be explained by the fact that the data related to cancer cases involved in this study are not exhaustive. The differences in the incidence of cancer in the different geographical areas are likely to vary due to the dominant risk factors. For example, diet and nutritional status, as well as the existence of different levels of the expositions to the atmospheric pollution [19-21]. The spatial analysis is a helpful tool to generate hypothesis and to identify areas for intervention. It could be important for public health policymakers to promote strategies for cancer. Further studies are needed to provide accurate and easily accessible information for implementation of preventive activities in community health.

Table 1. Representation of Relative Risk Estimates Based Cancer cases in the Region of the Greater Casablanca.

N°	District	Observed cases (O_i)			Estimated Cases (E_i)			Relative Risk (RR)		
		M	F	H+F	M	F	H+F	M	F	H+F
1	Ain chock	124	152	138	139	171	309	0,676	0,699	0,691
2	Ain harrouda	179	204	191	34	42	76	3,936	3,854	3,897
3	Ain sebaa	135	171	153	81	100	181	1,254	1,350	1,310
4	Al fida	198	219	209	103	125	228	1,462	1,376	1,418
5	Al majjatia oulad taleb	67	63	65	18	21	39	2,743	2,386	2,555
6	Anfa	312	209	258	50	66	115	4,742	2,506	3,466
7	Assoukhour assawda	7	7	7	63	78	140	0,086	0,069	0,077
8	Ben m'sik	23	38	30	73	88	161	0,240	0,335	0,292
9	Bni yakhlef	45	67	56	27	32	59	1,247	1,671	1,465
10	Bouskoura	101	132	116	58	64	122	1,322	1,618	1,466
11	Dar bouazza	79	96	87	85	97	183	0,699	0,779	0,738
12	Ech-challalate	15	27	21	30	35	65	0,373	0,596	0,489
13	El maarif	115	134	125	90	119	208	0,974	0,885	0,931
14	Hay hassani	90	114	102	259	311	571	0,263	0,287	0,276
15	Hay mohammadi	189	205	197	75	93	169	1,902	1,723	1,809
16	Lahraouyine	48	57	53	18	21	39	1,995	2,147	2,068
17	Mechouar de casablanca	0	0	0	1	2	3	0,000	0,000	0,000
18	Mediouna	44	55	49	13	14	27	2,636	2,994	2,814
19	Mers sultan	194	257	225	71	86	157	2,058	2,342	2,215
20	Mohammadia	43	50	47	114	140	253	0,287	0,283	0,285
21	Moulay rachid	137	191	164	136	164	300	0,766	0,915	0,848
22	Nouacer	18	29	23	12	14	26	1,101	1,649	1,371
23	Oulad salah	39	56	47	9	9	18	3,507	4,672	4,076
24	Sbata	83	120	102	65	77	142	0,970	1,225	1,107
25	Sidi belyout	105	107	106	105	126	230	0,758	0,671	0,712
26	Sidi bernoussi	192	228	211	95	116	211	1,533	1,547	1,544
27	Sidi hajjaj oued hassar	29	52	41	11	13	24	1,959	3,268	2,605
28	Sidi moumen	73	88	81	250	302	553	0,220	0,230	0,226
29	Sidi moussa ben ali	17	36	26	7	7	14	1,986	3,795	2,904
30	Sidi moussa majdoub	0	10	5	12	13	25	0,000	0,596	0,307

31	Sidi othmane	171	185	178	121	147	268	1,075	0,985	1,028
32	Tit melil	89	94	92	19	21	40	3,603	3,497	3,540

CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest. This study was carried out as part of a thesis topic at the Faculty of Medicine and Pharmacy of Fez, Morocco.

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