RESEARCH ARTICLE

Spatial analysis of Relative Risks for skin cancer morbidity and mortality in Iran, 2008 - 2010

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Abstract

Background: One of the most prevalent cancers in whole world is skin cancer and its prevalence is growing. The present research sought to estimate relative risk of morbidity and mortality due to skin cancer. Materials and Methods: In this cross-sectional study. The required data were gathered from the registered cancer reports of Cancer Control Office in the Center for Non Communicable Disease of the Iranian Ministry of Health (MOH). The data were extracted at province level in the time span of 2008-10. WINBUGS software was used to analyze the data and to identify high risk regions. ArcGIS10 was utilized to map the distribution of skin cancer and to demonstrate high risk provinces by using classic and fully Bayesian models taking into account spatial correlations of adjacent regions separately for men and women. Results: Relative risk of morbidity for women in Yazd and for men in Kurdistan and relative risk of mortality for women in Bushehr and for men in Kohgiluyeh were found to be the highest. Bayesian model due to regarding adjacent regions correlation, have precise estimation in comparing to classical model. More frequent epidemiological studies to enact skin cancer prevention programs. Conclusions: High risk regions in Iran include central and highland regions. Therefore it is suggested that health decision makers enact public education, using anti UV creams and sunglasses for those parts as a short preventing program.

Keywords: Skin cancer - relative risk -fully Bayesian model - spatial correlation - geographical distribution - mapping

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Introduction

Skin is the widest organ of body. Its roles includemechanical protection against environment, thermoregulation, sensing of environmental events, liquids control, immunological protection and ultraviolet (UV) radiation protection. Any inadequacy in latter will lead to a band of different skin disease from benignity to malignity and cancer. Skin cancer is one of the most prevalent cancers in the world, individually in the blond people and its prevalenceis growing in the whole world. Skin cancer incidence yearly in the USA is more than 2 Millionpeopleand its mortality is more than 50000 (Arora and Attwood, 2009). According to the last registered report from Iranian Health Ministry, in the recent decade, skin cancer was the most prevalent cancer (http://www.ircancer.ir).

In one of the researches done on determining frequency of skin cancer variety in the west part of Iran, for checking effect of sunshine on variety of cancer, it is obviously seen that the most prevalent cancer was skin cancer and significantlynumber of men patient is more than women patient and the most involvement organs were head and neck (Valavi et al., 2013). Skin cancer is due to various factors which are divided to environmental and host factors. Host factors include genome symptoms and preformed tolls (such as infection with HIV virus). Environmental factors include exposure with UV, chemical materials (such as Arsenic). It has been shown in researches that some other factors such as air temperature, pressure, number of sunshine duration, smoking, using of chemical dungs are involved on mortality of skin cancer (Daniels et al., 2000).

Generally, skin cancers are divided to non-melanoma and melanoma. Non-melanoma usually occurs in people which have white skin and are without melanine. Occurrence of melanoma prevalence which is from skin melanocyte usually is related to skin colure and geographical area (Arora and Attwood, 2000). The study of geographical situation, in survey of disease is very important, because occurrence of disease is related to geographical situation. Presence of mountain and sea surfaces, on the other hand, relativity of disease to geographical and climatic condition, will lead to restriction of disease to special part of the world. Hence, in investigation of disease, geography and location is important (Raiesi and Bayati, 2013).

For identifying causes of mortality and accessing

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method for increasing longevity and population health, many researches has been done but the estimation of spatial risk of this cancer is less attended. As tolled earlier, climatic and geographical situation are involved on the rate of cancer morbidity and mortality.Therefore, skin cancer Relative Risk (RR), is depended on geographical position of each area and differ with variety of climate. So in this paper we want to estimate RR for skin cancer mortality and secondly estimate RR for skin cancer morbidity in Iran with regard to geographical situation.

One of the main needs for health decisions makers is disease pursuit and control due to geographical variation and in the aspect of number of patient. Geographical aspect is always important inmanaging and designing problem for general health issues. Therefor it is possible by using GIS and spatial interpretation, to show area with high risk on maps. In the last decade, in traditional methods, the raw or standardized data were used for mapping. Now, these methods had much progressed and lead to maps precision (Melnick and Fleming, 1999).

One of the best approaches for mapping is Bayesian statistical model. The Bayesian technics are methods witch combine prior information from population, with sample data extracted from population, to improveinformation, and so the estimate population parameters will be precise (Bell and Broemeling, 2000).

In the studies that RRof disease is going to be estimated, usually liner and empirical Bayesian are used, and RR may be estimated with assumption that, the adjacent areas are independent. But actually RRwill be affected from geographical and local situation.With regard to the fact that, the location ofdata, may produce spatial correlation among them, so it is better to introduceRRs in the group of spatial data. For interpretation of this type of data, we can use the spatial statistical methods.

In classical statistics, it is generally suppose that the observations extracted from samples, are not independent. But actually, in the most of health variables, this assumption is not confirmed. The observations that their correlation is due to their geographical position in the study span, are called spatial data. According to non-independency among the spatial data, using classical statistical methods are not suitable, and so in latter decade a branch of spatial statistics is developed.

The first statements on using spatial data are related to Hadly in 1686. He used maps of deferent parts of world closetogether to study the monsoon winds And the first spatial disease mapping is belong to John Snow in 1855 where by using epidemicalmaps of Cholera, displayed that the most prevalent factor of Cholera was septic water (Snow, 1855). In 1976 Besag used Conditional Autoregressive (CAR) model for analyzing spatial data and by this model the effect of adjacent points were regarded (Besag and Moran, 1976). In 1993 Cressie in his book widely described spatial statistics issues and made a great improvement in spatial analyzing (Cressie, 1993) and then Pettit and et al, Banerjee et al. (2004) did more study. They tried by using hierarchical Bayesian approach, to estimate parameters of CAR model in multivariate situation (Banerjee et al., 2004).

As yet, so many studies about cancer and its relation to environment by using spatial analysis have been done. Relativity of breath cancer and toxic material exposure (Brody et al., 2004), danger of cancer due to living in petrochemical factories nearby (Belli et al., 2004),are examples for dependence of cancer to geographical position. Also, in 2014kavousi and et al., identified high risk clusters of Gastric cancer in Iran (Kavousi et al., 2014), Shah and et al., described the distribution of colorectal cancer in kualaLampur (Shah et al., 2014) and katayama et al. (2014) clustered of Breast Cancer in Kanagawaet al. (2014) by using spatial statistics.

With spatial statistical approach, it is possible to involve the adjacent area correlation andalso the effect of adjacent point with each other (Mehrabi et al., 2014). According to above discussion, this paper is trying with the aid offully Bayesian method, to mapping RR of morbidity and RR of mortality for skin cancer for each sex in Iran. Also determining places with high risk for interpretation of causes and prevention of skin cancer is another aim.

Materials and Methods

In this descriptivestudy all the cases of morbidity and mortality due to skin cancer, separately for men and women were collected according to the International Classification of Diseases (ICD-10) in 30 province of Iran and were obtained from the recorded skin cancer reports of the Bureau of Cancer Center for Non communicable disease of the Ministry of health and medical education: (http://www.ircancer.ir) for years 2008-2010. Also the number of population for each province was prepared from registered reports of Iranian Statistical Center (http://www.amar.org.ir).

For the first step, it is better to evaluate how many incidence of disease for each area is expected and then compare observed cases with expected one. In using this procedure, map is divided to nnoninterference (e.g separated region) adjacent region (i=1,2,…,n). The number of observed and expected events in each region are shown respectively by o_i, E_i. Where E_i is assumes to be constant and is calculated with a method which is known as internal standardized. In this study with the aid of internal standardized method and by following formula, number of expected morbidity and expected mortality with respect to sex were calculated:

$$E_i = n_i \frac{(\Sigma\ o_i)}{(\Sigma\ n_i)},\ i = 1,2,\ldots,n$$

Where n is number of population of province (Table1)

The ratio of observed value of mortality or morbidity to expected value of mortality or morbidity is known as SMR[2]. This ratio is the estimatedRR maximum likelihood in each area. The estimate of maximum likelihood is as follow:

$$\hat{\theta} = n_i \frac{o_i}{E_i},\ i = 1,2,\ldots,n$$

Where θ_i is RR in itharea

In present paper with the aid of the above formula, SMRs for men and womenwere separatelycalculated and shown as tables 2 and 3. But using this method has some problem: *i)* Since SMRis the ratio of two values, if one of them and specially expected value be very small, any small variation in number of incidence will lead to a large variation in SMR *ii)* If expected values tend to zero, SMR will be much bigger *iii)* If SMR=0 variation of expected values will be not shown (Lawson et al., 2000).

For overcoming the above problems some procedures such as smoothing, liner and empirical Bayesian are suggested but they do not regard spatial correlation, and whileRRs data is spatial data, it is necessary to pay attention to the information of neighborhood. In this study, estimation of RR is done by using fully Bayesian and also the neighborhood information of each province is used as follow:

In mapping according to fully Bayesian it is assumed that the number of events through the adjacent regions are independent and there distribution can be considered Poisson with mean $E_i\ \theta_i$. This model was suggested by Caldor (1976) and developed by Besag et al. (1991). The formula will be:

$$\log(\theta_i) = \alpha + u_i + \nu_i \quad , i=1,2,\ldots,n$$

Where α is especialintercept for each disease that showing the amount of RR universality and in Bayesian procedureN(0,1000) is used for prior distribution for this parameter and u_i is over-dispersion spatial correlation or spatial correlated non-heterogeneous which introduce in model to use RR correlation for neighbourhoods. For this component, spatial correlation structure is so that,RR estimation in each area depends to its neighbourhood. ThereforConditional Autoregressive (CAR) model by Besag and et al is employed as a suitable prior distribution:

$$[u_i|u_j\ , i \neq j\ ,\tau^2] \sim N(\bar{u}_i, \tau_i^2)$$

$$\tau_i^2 = \frac{\tau_i^2}{(\Sigma_j w_{ij})}\ , \bar{u}_i = \frac{1}{(\Sigma_j u_j w_{ij} \Sigma_j w_{ij})}$$

Where w_{ij} is the weight which denote the association between i and j region (if i,j are adjacent w_{ij}=1 and other w_{ij}=0)

ν_i is non-spatial over-dispersion component or spatial non-correlation non-heterogeneous and $N(0,\delta^2)$ for prior density is used where $\delta \sim N(0,1000)$ (Kavousi et al., 2009).

Finally, according to the above discussion, for estimation of morbidity and mortality RRs for each sex, specification of prior density on parameters and updating their densities via the likelihood,posterior estimations of the model parameters is done by 1000 samples using

Table 1. Observed and Expected Number of Morbidity and Mortality due to Skin Cancer in Provinces of IRAN from 2008 to 2010

Province	number of morbidity				number of mortality			
	observed		expected		observed		expected	
	women	men	women	men	women	men	women	men
E-Azerbaijan	560	674	504.15	586.07	28	35	17.2	28.49
W- Azerbaijan	354	378	407.99	474.24	19	28	10.87	15.97
Ardabil	113	110	169.63	199.17	9	15	3.47	4.65
Esfahan	859	1104	643.65	755.67	12	33	26.39	46.66
Ilam	84	112	75.61	88.83	3	6	2.58	4.73
Bushehr	91	85	120.06	162.81	8	8	2.79	3.59
Tehran	2066	2475	1916.92	2228.65	8	24	63.47	104.6
Chaharmahal	100	122	102.86	119.57	6	5	3.07	5.16
S-khorasan	84	94	89.65	103.24	5	8	2.58	3.97
R- khorasan	778	933	801.66	913.72	22	40	23.9	39.43
N- khorasan	101	91	116.81	131.76	8	15	3.1	3.85
khuzestan	687	605	604.03	702.14	14	18	21.1	25.57
Zanjan	108	174	136.62	157.2	5	10	3.32	7.35
semnan	111	136	83.7	97.31	6	6	3.4	5.75
Sistan	81	78	342.7	390.5	2	1	2.49	3.3
Fars	759	822	611.94	711.37	25	25	23.32	34.74
Qazvin	191	218	160.05	187.83	7	16	5.87	9.21
Qom	90	111	148.7	176.28	6	8	2.76	4.69
Kordistan	239	567	201.44	234.26	7	17	7.34	23.96
Kerman	354	305	381.77	443.82	11	25	10.87	12.9
Kermanshah	313	323	263.1	306.23	17	15	9.68	13.65
Kohgiluyeh	111	108	89.74	102.29	4	19	3.4	4.56
Golestan	118	153	234.27	267.01	6	7	3.62	6.47
Gilan	324	339	340.75	384.46	16	13	9.95	14.33
loristan	257	297	239.1	277.93	9	5	7.89	12.55
Mazandaran	370	349	413.85	476.47	16	12	11.37	14.75
Markazi	202	263	189.81	220.59	10	33	6.2	11.11
Hormozgan	56	64	201.07	238.39	3	9	1.72	2.7
Hamadan	261	350	239.38	275.6	5	22	8.02	14.8
Yazd	202	201	138.48	167.27	11	14	6.2	8.49

Table 2. Estimation of RR for skin cancer *morbidity* according to Classic and fully Bayesian methods in IRANIAN provinces, 2008-2010

Province	Bayesian						Classic					
	men			women			men			women		
	RR	(SE)	95%CI	RR	(SE)	95%CI	RR	(SE)	95% CI	RR	(SE)	95% C
E-Azerbaijan	1.15	(0.04)	(1.07,1.24)	1.11	(0.10)	(1.02,1.21)	1.15	(0.00)	(1.07,1.24)	1.11	(0.00)	(1.02,1.21)
W- Azerbaijan	0.80	(0.04)	(0.72,0.88)	0.87	(0.07)	(0.78,0.96)	0.80	(0.00)	(0.72,0.88)	0.87	(0.00)	(0.78,0.96)
Ardabil	0.55	(0.05)	(0.45,0.66)	0.67	(0.04)	(0.55,0.80)	0.55	(0.00)	(0.46,0.66)	0.67	(0.00)	(0.55,0.80)
Esfahan	1.46	(0.04)	(1.38,1.55)	1.33	(0.73)	(1.25,1.42)	1.46	(0.00)	(1.38,1.55)	1.33	(0.00)	(1.25,1.43)
Ilam	1.26	(0.12)	(1.39,1.51)	1.11	(0.05)	(0.89,1.34)	1.26	(0.01)	(1.05,1.52)	1.11	(0.01)	(0.90,1.37)
Bushehr	0.52	(0.06)	(0.43,0.64)	0.76	(0.07)	(0.61,0.92)	0.52	(0.00)	(0.42,0.64)	0.76	(0.01)	(0.62,0.93)
Tehran	1.11	(0.02)	(1.06,1.16)	1.08	(0.05)	(1.03,1.13)	1.11	(0.00)	(1.07,1.15)	1.08	(0.00)	(1.03,1.12)
Chaharmahal	1.02	(0.09)	(0.84,1.21)	0.97	(0.05)	(0.79,1.17)	1.02	(0.01)	(0.085,1.22)	0.97	(0.01)	(0.80,1.18)
S-khorasan	0.91	(0.09)	(0.75,1.11)	0.94	(0.11)	(0.76,1.13)	0.91	(0.01)	(0.74,1.11)	0.94	(0.01)	(0.76,1.16)
R- khorasan	1.02	(1.03)	(0.96,1.09)	0.97	(0.07)	(0.90,1.04)	1.02	(0.00)	(0.96,1.09)	0.97	(0.00)	(0.90,1.04)
N- khorasan	0.69	(0.07)	(0.56,0.84)	0.86	(0.05)	(0.70,1.04)	0.69	(0.00)	0.56,0.85)	0.86	(0.01)	(0.71,1.05)
khuzestan	0.86	(0.03)	(0.79,0.93)	1.14	(0.07)	(1.05,1.22)	0.86	(0.00)	(0.79,0.93)	1.14	(0.00)	(1.05,1.22)
Zanjan	1.11	(0.09)	(0.95,1.28)	0.79	(0.06)	(0.65,.94)	1.11	(0.01)	(0.95,1.28)	0.79	(0.00)	(0.65,0.95)
Semnan	1.39	(0.12)	(1.17,1.63)	1.32	(0.09)	(1.09,1.57)	1.40	(0.01)	(1.18,1.65)	1.32	(0.01)	(1.10,1.60)
Sistan	0.20	(0.02)	(0.16,0.25)	0.23	(0.03)	(0.19,0.29)	0.20	(0.00)	(0.16,.25)	0.24	(0.00)	(0.19,0.29)

CI: confidence interval, RR: relative risk

Table 2. Estimation of RR for Skin Cancer Morbidity According to Classic and fully Bayesian Methods in IRANIAN Provinces, 2008-2010 (Continue)

Province	Bayesian						Classic					
	Men			Women			Men			Women		
	RR	(SE)	95% CI	RR	(SE)	95% CI	RR	(SE)	95% CI	RR	(SE)	95% CI
Fars	1.16	(0.04)	(1.08,1.24)	1.24	(0.04)	(1.16,1.33)	1.15	(0.00)	(1.08,1.24)	1.24	(0.00)	(1.15,1.33)
Qazvin	1.18	(0.08)	(1.03,1.35)	1.20	(0.09)	(1.02,1.36)	1.16	(0.01)	(1.02,1.32)	1.19	(0.01)	(1.03,1.37)
Qom	0.63	(0.06)	(0.52,0.76)	0.61	(0.06)	(0.49,0.74)	0.63	(0.00)	(0.52,0.76)	0.60	(0.00)	(0.49,0.74)
Kordistan	2.42	(0.10)	(2.22,2.61)	1.18	(0.07)	(1.04,1.34)	2.42	(0.01)	(2.23,2.63)	1.19	(0.00)	(1.04,1.35)
Kerman	0.69	(0.04)	(0.61,0.77)	0.93	(0.05)	(0.83,1.03)	0.69	(0.00)	(0.61,0.77)	0.93	(0.00)	(0.83,1.03)
Kermanshah	1.05	(0.06)	(0.94,1.17)	1.19	(0.07)	(1.07,1.33)	1.05	(0.00)	(0.94,1.18)	1.20	(0.00)	(1.07,1.34)
Kohgiluyeh	1.06	(0.10)	(0.86,1.26)	1.24	(0.11)	(1.03,1.47)	1.05	(0.01)	(0.87,1.27)	1.24	(0.1)	(1.03,1.49)
Golestan	0.57	(0.05)	(0.48,0.67)	0.50	(0.05)	(0.42,0.60)	0.57	(0.00)	(0.49,0.67)	0.50	(0.00)	(0.42,0.60)
Gilan	0.88	(0.05)	(0.79,0.97)	0.95	(0.05)	(0.85,1.05)	0.88	(0.00)	(0.79,0.98)	0.95	0.00)	(0.85,1.06)
loristan	1.07	(0.06)	(0.95,1.20)	1.07	(0.07)	(0.95,1.21)	1.07	(0.00)	(0.95,1.20)	1.07	(0.00)	(0.95,1.21)
Mazandaran	0.73	(0.03)	(0.66,0.81)	0.89	(0.05)	(0.81,0.99)	0.73	(0.00)	(0.66,0.81)	0.89	(0.00)	(0.81,0.99)
Markazi	1.19	(0.07)	(1.06,1.35)	1.06	(0.07)	(0.93,1.22)	1.19	(0.00)	(1.06,1.34)	1.06	(0.00)	(0.93,1.22)
Hormozgan	0.27	(0.03)	(0.21,0.34)	0.28	(0.04)	(0.21,0.36)	0.27	(0.00)	(0.21,0.34)	0.28	(0.00)	(0.21,0.36)
Hamadan	1.27	(0.07)	(1.13,1.41)	1.09	(0.07)	(0.96,1.21)	1.27	(0.00)	(1.14,1.41)	1.09	(0.00)	(0.96,1.23)
Yazd	1.20	(0.08)	(1.04,1.37)	1.46	(0.10)	(1.26,1.67)	1.20	(0.01)	(1.05,1.38)	1.46	(0.10)	(1.27,1.67)

CI: confidence interval, RR: relative risk

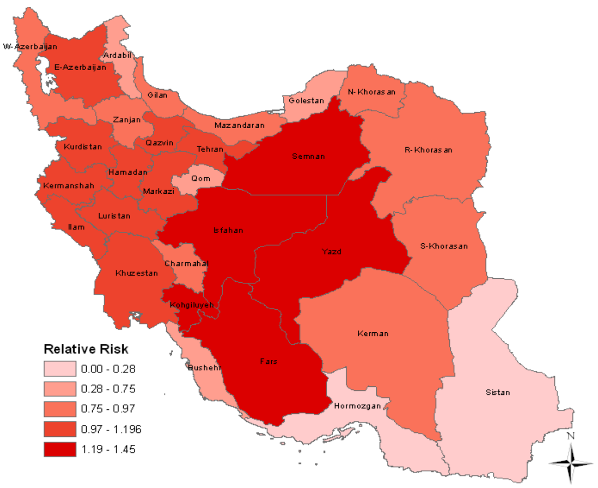

Figure 1. The Map of Relative for Skin Cancer Morbidity in Women, 2008-2010

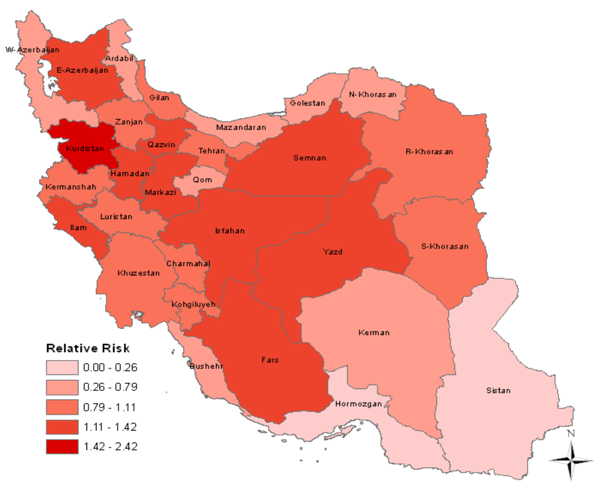

Figure 2. The Map of RR for Skin Cancer Morbidity in Men, 2008-2010

iterative Marcov Chain Monte Carlo (MCMC) technics (Gelfan, 1996). Then by using fully Bayesian method, the RRs mapping were done (Maps 1-4). For interpretation ofdata the WINBUGS program and for mapping ArcGIS10 are used (Spiegelhalter et al., 2003).

Results

As the result of this paper, with using classically model (e.g SMR), the Yazd province has the highest risk (1.45) of morbidity for women and then Isfahan, Semnan and Fars respectively have a high RR. For men Kurdistan province is first (2.42) and then Isfahan, Semnan Hamadan are respectively.

In the sense of RR of mortality due to skin cancer for women Bushehr province is the first (2.86) and then Ardabil, N-Khorasan and Qom are respectively. For men the most dangerous is Kohgiluyeh (4.16) and then are N-Khorasan, Hormozgan, Ardabil (Tables 2&3).

By using fully Bayesian procedure, the results show that in the population of women, the maximum RR of skin cancer morbidity (1.45) belongs to Yazd (%95 CI:(1.26-1.67)) and the minimum (0.23) belongs to Sistan (%95 CI:(1.8-0.29)). As it is shown in Tables 2, 3.

In the men population the maximum RR of skin cancer morbidity (2.42) belongs to Kurdistan (95%CI:(2.21-2.61)) and minimum (0.19) belong to Sistan, (%95 CI:(0.15-0.24)). In the women population the maximum RRof skin cancer mortality (2.20) belongs to Bushehr (95%CI:(0.06-3.33)) and minimum (0.12) belongs to Tehran (95%CI:(0.09 -2.32)). In the men population the maximum RR of skin cancer morbidity (4.08) with (%95 CI:(2.47-6.07)) and minimum (0.22) with (%95 CI:(0.14-0.32)) is respectively for Kohgiluyeh and Tehran.

Table 3. Estimation of RR for skin cancer *mortality* according to Classic and fully Bayesian Methods in IRANIAN provinces, 2008-2010

Province	Bayesian						Classic					
	men			women			men			women		
	RR	(SE)	95%CI	RR	(SE)	95%CI	RR	(SE)	95% CI	RR	(SE)	95% C
E-Azerbaijan	1.23	(0.02)	(0.88,1.70)	1.62	(0.30)	(1.07,2.29)	1.23	(.04)	(.88,1.71)	1.63	(0.09)	(1.12,2.36)
W- Azerbaijan	1.76	(0.03)	(1.16,2.41)	1.77	(0.40)	(0.57,1.38)	1.75	(0.11)	(1.21,2.54)	1.74	(0.16)	(1.11,2.74)
Ardabil	3.23	(0.85)	(1.77,5.16)	2.61	(0.88)	(1.15,4.58)	3.23	(0.69)	(1.94,5.35)	2.59	(0.75)	1.35,4.98)
Esfahan	0.70	(0.12)(048,0.96)		0.46	(0.13)	(0.35,1.03)	0.71	(0.01)	(0.50,0.99)	0.45	(0.02)	(0.26,0.80)
Ilam	1.27	(0.52)	(0.45,2.38)	1.16	(0.67)	(0.51,3.03)	1.27	(0.27)	(0.57,2.82)	1.16	(0.45)	(0.37,3.60)
Bushehr	2.20	(0.77)	(0.93,3.90)	2.92	(1.10)	(0.68,3.33)	2.23	(0.62)	(1.11,4.45)	2.86	(1.02)	(1.43,5.72)
Tehran	0.23	(0.05)	(0.14,0.33)	0.12	(0.04)	(0.09,2.32)	0.23	(0.00)	(1.15,0.34)	0.13	(0.00)	(0.06,0.25)
Chaharmahal	0.98	(0.45)	(0.34,2.03)	1.20	(0.82)	(1.09,2.67)	0.97	(0.19)	(0.40,2.33)	1.95	(0.63)	(0.88,4.35)
S-khorasan	2.01	(0.73)	(0.85,3.71)	1.96	(0.89)	(1.18,4.70)	2.01	(0.51)	(1.01,4.03)	1.94	(0.75)	(0.81,4.65)
R- khorasan	1.01	(0.16)	(0.73,1.33)	0.92	(0.20)	(0.24,0.74)	1.01	(0.02)	(0.74,1.38)	0.92	(0.04)	(0.61,1.40)
N- khorasan	3.84	(0.96)	(2.16,6.02)	2.58	(0.87)	(0.26,2.77)	3.90	(1.01)	(2.35,6.47)	2.58	(0.83)	(0.39,5.15)
khuzestan	0.70	(0.16)	(0.42,1.04)	0.66	(0.18)	(1.33,5.52)	0.70	(0.03)	(0.44,1.12)	0.66	(0.03)	(0.63,3.62)
Zanjan	1.35	(0.41)	(0.69,2.28)	1.50	(0.67)	(0.05,0.23)	1.36	(0.18)	(0.73,2.53)	1.51	(0.45)	(0.79,3.92)
Semnan	1.03	(0.42)	(0.38,1.94)	1.78	(0.70)	(0.77,4.03)	1.04	(0.18)	(0.47,2.32)	1.76	(0.52)	(0.20,3.21)
Sistan	0.31	(0.31)	(0.01,1.20)	0.79	(0.59)	(0.63,4.13)	0.30	(0.09)	(0.04,0.15)	0.80	(0.32)	(0.72,1.59)

CI: confidence interval, RR: relative risk

Table 3. Estimation of RR for Skin Cancer Mortality According to Classic and Fully Bayesian Methods in IRANIAN Provinces, 2008-2010 (Continue)

Province	Bayesian					Classic					
	men			women		men			women		
	RR	(SE)	95% CI	RR (SE)	95%CI	RR	(SE)	95% CI	RR	(SE)	95% CI
Fars	0.72	(0.14)	(0.46,1.02)	1.076	(0.70,1.54)	0.72	(0.02)	(0.49,1.06)	1.07	(0.05)	(0.57,2.50)
Qazvin	1.77	(0.44)	(1.01,2.71)	1.203	(0.51,2.27)	1.74	(0.19)	(1.06,2.83)	1.19	(0.20)	(1.11,2.74)
Qom	1.7	(0.59)	(0.72,3.06)	2.148	(0.84,4.16)	1.70	(0.36)	(1.85,3.41)	2.17	(0.78)	(0.97,4.83)
Kordistan	0.72	(0.17)	(0.42,1.10)	0.9555	(0.38,1.83)	0.71	(0.03)	(0.44,1.14)	0.95	(0.13)	(0.45,2.00)
Kerman	1.92	(0.39)	(1.21,2.78)	1.023	(0.51,1.69)	1.94	(0.15)	(1.31,2.87)	1.01	(0.09)	(0.56,1.83)
Kermanshah	1.10	(0.28)	(0.62,1.67)	1.75	(1.01,2.69)	1.10	(0.80)	(0.66,1.82)	1.76	(0.18)	(1.09,2.83)
Kohgiluyeh	4.08	(0.92)	(2.48,6.07)	1.198	(0.33,2.68)	4.16	(0.91)	(2.65,6.52)	1.17	(0.34)	(0.44,3.12)
Golestan	1.06	(0.40)	(0.44,2.03)	1.656	(0.62,3.28)	1.08	(0.17)	(0.52,2.27)	1.65	(0.46)	(0.74,3.68)
Gilan	0.91	(0.25)	(0.50,1.49)	1.594	(0.87,2.50)	0.91	(0.06)	(0.53,1.56)	1.61	(0.16)	(0.98,2.62)
loristan	0.40	(0.18)	(0.13,0.83)	1.135	(0.40,1.97)	0.40	(0.03)	(0.16,0.96)	1.14	(0.14)	(0.59,2.19)
Mazandaran	0.81	(0.23)	(0.41,1.32)	1.404	(0.82,2.20)	0.81	(0.85)	(0.46,1.43)	1.41	(0.12)	(0.86,2.98)
Markazi	2.98	(0.52)	(2.01,4.05)	1.603	(0.72,2.76)	2.97	(0.27)	(2.11,4.18)	1.61	(0.26)	(0.87,2.99)
Hormozgan	3.34	(1.12)	(1.61,5.88)	1.713	(0.37,3.94)	3.33	(1.23)	(1.73,6.39)	1.74	(1.01)	(0.56,5.41)
Hamadan	1.49	(0.42)	(0.94,2.20)	0.6251	(0.19,1.25)	1.49	(0.10)	(0.98,2.26)	0.62	(0.08)	(0.26,1.50)
Yazd	1.65	(0.46)	(0.86,2.58)	1.74	(0.88,2.92)	1.65	(0.19)	(0.98,2.78)	1.77	(0.28)	(0.98,3.20)

CI: confidence interval, RR: relative risk

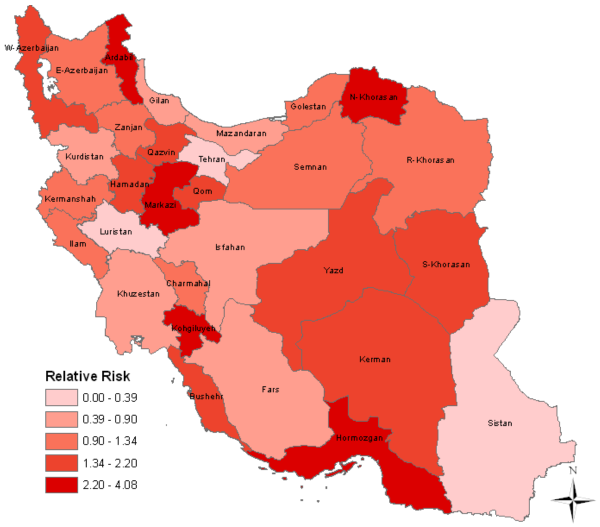

Figure 4. The Map of RR for Skin Cancer Mortality in Men, 2008-2010

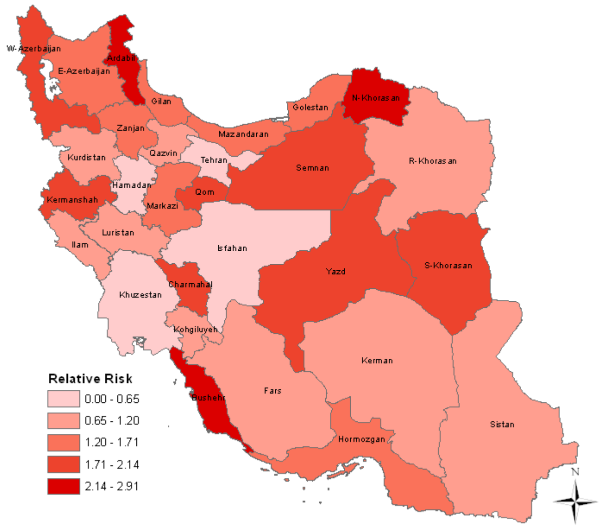

Figure 3. The Map of RR for Skin Cancer Mortality in Women, 2008-2010

In comparing classical and Bayesian method, the last one makes thin confidence intervals therefore it is the suitable and precise.

Discussion

In this research, mapping for RR of skin cancer morbidity and for RR of skin cancer mortality is done separately for each sex and the results are shown in figures 1-4.

It is clear that, climate, environment situation, etiquette and feeding custom, change with different living places, thus the rate of disease may vary with geographical situation. Accessing the rate of disease prevalence with regard to situation makes a great aid in identifying the nature of affection of environmental situation to reducing disease (Dirk et al., 2008). In this study the relative risk of disease with respect to geographical situation, climate and affection of adjacent regions was estimated, while in the others, spatial correlation usually is neglected. Finally comparing of classical and Bayesian methods indicates that due to employing additional information and using spatial correlation by Bayesian this model is more suitable.

Researches on solar radiation and its effect on skin, show that there is a significant relation between sunshine and skin cancer. Also sunburn is a risk factor for the skin cancer. Meta analyses studies denote that by decreasing sunshine exposure, the rate of skin cancer will decrease. On the other hand those parts of body that are frequently exposed to sunshine have more melanoma disease (Wehner et al., 2012).

Mapping from this study indicate that in Iran, insome regionswitch have more sunshine duration (such as Yazd, Isfahan, Semnan, Fars, Bushehr and Hormozgan) the risk of skin cancer is more than the others and also mortality of this cancer in the south parts of Iran (such as Bushehr and Hormozgan) is greater. Moreover the maps indicate that,cancer RR decreases by reducing latitude and this was emphasized on earlier studies (Chang et al., 2009). It has been noticed that in the west parts of Iran (such as Kurdistan, Ilam, Hamedan and Kohgiluyeh) the risk of morbidity and mortality is greater than the other western part, and this maybe due to mountainous nature of these parts. Perhaps in highland places the agricultural efforts are less mechanized and this cause to more sunshine receiving. As a next result, by comparing maps with each other, it assumes that the risk of morbidity in women is more than men while the risks of mortality in men population is more than women.

One restriction of this research is that diagnosis of skin cancers because of variety in exterior shape, morphology and contexture for skin cancer, the ability to biology of them from there inactivity to action morbidity is variable. Description of rate of incidence and trend of this disease is difficult because sometimes this cancer maybe hidden and some clinic do not register the treatment of patient.

Since by reducing and controlling the environmental danger factors, one may decrease risk of skin cancer(Van Dam and Huang, 1999)Though, for prevention of morbidity it is suggested to improve notification about suitable feeding, sporting, using anti UV creams and sunglasses for central part leaving people of Iran.

References

Arora A, Attwood J (2009). Common skin cancers and their precursors. *Surg Clin North Am*, **89**, 703-12.

Banerjee S, Bradely P, Gelfand A (2004). Hierarchical Modeling and Analysis for Spatial Data. Chapman and Hall, Londen.

Bell S, Broemeling L (2000). A Bayesian analysis for spatial process with application to disease mapping. *Stat Med*, **19**, 957-74.

Belli S, Benedetti M, Comba P, et al (2004). Case-control study on cancer risk associated to residence in the neighbourhood of a petrochemical plant. *Eur J Epidemiol*, **19**, 49-54.

Besag J, Moran PAP (1976). On the estimation and testing of spatial interaction in gussianlaiiice processes. *Biometrica*, **62**, 555-62.

Besag J, York J, Mollie A (1991). Bayesian image restoration with two application in spatial statistics. *Ann Inst Statist Math*, **43**, 1-59.

Brody JG, Aschengrau A, McKelvey W (2004). Breast cancer risk and historical exposure to pesticides from wide-area applications assessed with GIS. *Environ Health Perspect*, **112**, 889-97.

Chang Y, Anewton J (2009). A Pooled Analysis of Melanocytic Naevus Phenotype and the Risk of Cutaneous Melanoma at Different Latitudes. *Int J cancer*, **124**, 420-8.

Cressie N (1993). Statistics for Spatial Data, New York, Wiley.

Daniels F, Brophy D, Lobitz WC (2000). Histolochemical responses of human skin following ultraviolet irradiation. *Photodermotolog*, **49**, 352-8.

Dirk UP, et al (2008). Spatial analysis epidemiology. Oxford university press, 97-100.

Gelfan A (1996). Model determination using sampling based methods in markov chain monte carlo in practice. Chapman and Hall/CRC, Boca Raton, FL, 145-57.

Kavousi A, Bashiri Y, Mehrabi Y, Etemad K, Teymourpour A (2015). Identifying High- Risk Clusters of Gastric Cancer Incidence in Iran, 2004-2009. *Asian Pac J Cancer Prev*, **15**, 10335-8.

Kavousi A, meshkani MR, Mohammadzadeh M (2009). Spatial analysis of relative risk of lip cancer in Iran: a bayasian approach. *Environmetrics*, **20**, 347-59.

Katayama K, Yakoyama K, Yako-Suketomo H, et al (2014) Breast Cancer Clustering in Kanagawa, Japan: AGeographic Analysis. *Asian Pac J Cancer Prev*, **15**, 455-60.

Lawson A, Biggeri A, Boehning D, et al (2000). Disease mapping models: An empirical evaluation. Disease Mapping Collaborative Group. *Stat Med*, **19**, 17- 41.

Mehrabi Y, Mahaki B, Kavousi A(2014). Mapping spatial variation of disease using classic and Bayesian models. *J Health Syst Res*, **10**, 201-11.

Melnick AL, Fleming DW (1999). Modern geographic information system: promise and pitfalls. *J Public Health Manag Pract*, **5** , 8-10.

Raiesi R, Bayati A (2013). Spatial distribution of multiple sclerosis disease in ChaharmahalvaBakhtiari province in 20-years period. *J ShahrekordUniv Med Sci*, **15**, 73-82.

Shah SA, Neoh H, Sharizman S, et al (2014). Spatial Analysis of Colorectal Cancer Cases in Kuala Lumpur. *Asian Pac J Cancer Prev*, **15**, 1149-54.

Snow J (1855). On the Mode of Communication of Cholera. 2 ed. London, UK: John hurchill, 162.

Spiegelhalter D, Thomas A, Best N(2003). winBugs user manual, version 1.4, MRC Biostatistics Unit, Cambridge, available atwww.mrc-bsu.cam.ac.uk/bugs/winbugs/contents.shtml.

Valavi E, RafieSh, Pakseresht P, Siadat S (2013). Prevalence of skin cancer in southwest of Iran. *Koomesh*, **15**, 83-8.

van Dam RM1, Huang Z, Rimm EB, et al (1999). Risk factors for basal cell carcinoma of the skinin men:results from the health professionals follow-up study. *Am J Epidemiol*, **150**, 459-68.

Wehner M, Shive M, Chren M, et al (2012). Indoor tanning and non-melanoma skin cancer: systematic review and meta-analysis, *BMJ*, **345**, 5909.