



Original Article

Trends in Skin Cancer Among Older Adults in Iran: A National Registry-Based Study

Akbar Eslami ^{1#}, Nilufar Marufi ^{2,3#}, Ali Gholami ^{4,5*} 

¹ Environmental and Occupational Hazards Control Research Center, Research Institute for Health Sciences and Environment, Shahid Beheshti University of Medical Sciences, Tehran, Iran

² Department of Environmental Health Engineering, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran

³ Workplace Health Research Center, Neyshabur University of Medical Sciences, Neyshabur, Iran

⁴ Noncommunicable Diseases Research Center, Neyshabur University of Medical Sciences, Neyshabur, Iran

⁵ Healthy Ageing Research Centre, Neyshabur University of Medical Sciences, Neyshabur, Iran

These authors contributed equally to this work.

Corresponding Author

Ali Gholami, Ph.D.

Noncommunicable Diseases Research
Center, Neyshabur University of
Medical Sciences, Neyshabur, Iran

✉ aagholami80@yahoo.com

☎ +985143306201

 0000-0003-0338-9368

Article History

Received: Jul. 31, 2026

Accepted: Aug. 8, 2026

Published: Sep. 30, 2026

Keywords

Skin Cancer, Melanoma, Non-Melanoma Skin Cancer, Elderly, Iran

Publisher

Neyshabur University of Medical Sciences

ABSTRACT

Background: Skin cancer (SC) is one of the most common cancers in the elderly population, but limited national data exist on the temporal and spatial trends of SC in Iran. This study aimed to estimate the incidence of SC among Iranian people aged ≥ 60 years during 2014–2019.

Methods: Data were obtained from the Iranian National Cancer Registry. Age-specific incidence rates (ASIRs) were calculated per 100,000 population. Normalized age-standardized incidence rates (NASRs) were estimated by direct standardization after renormalizing standard population weights for adults aged ≥ 60 years. National temporal trends were assessed using multivariable negative binomial regression with population size included as an offset. Province-specific NASR trends were explored using simple linear regression.

Results: There were 51,638 documented SC cases, with 63.6% in males. The overall NASR decreased from 109.82 per 100,000 in 2014 to 104.27 in 2015, increased to 114.64 in 2018, and then decreased to 106.73 in 2019. Age-standardized incidence rates increased with increasing age and peaked at age ≥ 80 years. The prevalence was higher among males compared to females. Yazd and Isfahan provinces had the highest mean NASRs, and Sistan and Baluchistan and Hormozgan provinces had the lowest mean NASRs. In the adjusted model, the annual increase in incidence was significant, and the province-specific analyses revealed significant temporal differences in nine provinces.

Conclusion: SC incidence among the elderly in Iran differed by age, sex, province, and calendar year during 2014–2019. These findings will help to develop focused prevention efforts, early detection programs, and healthcare aging planning in Iran.

Introduction

One of the most common malignancies in Iran and the world is skin cancer (SC), which is caused by the abnormal and uncontrolled growth of skin cells (1, 2). Its incidence has been continuously increasing in recent decades, such that the incidence of this disease in Iran has reached an epidemic stage (1, 3). SCs are generally divided into two groups: melanoma and non-melanoma skin cancers (NMSC) (2). According to 2020 reports, NMSC accounts for 78% of all SC cases, with nearly 1.2 million new cases and about 63,700 deaths recorded worldwide (4). Compared with that, about

57,000 individuals died from melanoma (5).

SC risk may vary depending on skin type, family history, place of residence, climate, air pollution, and level of ultraviolet (UV) radiation exposure (6-8). Among these factors, cumulative and long-term exposure to sunlight is one of the most important known factors, and the damage it causes can increase throughout life (6, 9). Further, the gradual decrease in cellular repair capacity and weakening of immune surveillance in older age may increase the skin's susceptibility to carcinogens (9, 10). Accordingly, aging has also been suggested in various studies as one of the factors



associated with an increased risk of SC (2, 10, 11).

The world's population structure is aging, and the number and proportion of adults aged 60 years and above are steadily increasing (12, 13). This transition may increase the burden of chronic non-communicable diseases such as cancer (12, 14). SC seems to follow the same pattern (11, 14). For example, a study in Japan has shown that the proportion of SC patients aged 70 years of age or older rose from 44% in 1989 to 74% in 2021 (15).

Due to their numerous medical illnesses, cognitive or functional impairments, and decreased treatment tolerance, managing SC in older persons can be challenging (16, 17). On the other hand, delay in diagnosis or treatment can lead to tissue damage, loss of function, and deformity. They can impose adverse effects on the individual and the healthcare system (2, 16). Therefore, prevention and early diagnosis can reduce the demand for complex care, improve patient outcomes, and reduce the burden on health services (16).

Despite the high occurrence of SC among older adults, nationwide evidence describing its epidemiology in the older Iranian population remains limited (18). Previous studies have provided information on SC in Iran, but less is known about how incidence among older adults has changed over time and whether these patterns differ by age, sex, and geographic area (1, 11, 18). Analysis of national cancer registry data can provide a more detailed description of these temporal and geographic patterns. Therefore, the present study aimed to investigate temporal trends in SC among the elderly in Iran using data from the National Cancer Registry System of Iran over 6 years.

Methods

This ecological study was designed based on the Iranian National Cancer Registry data. We examined data from all individuals aged 60 years or over diagnosed with SC between 2014 and 2019 according to the Third Edition of the International Classification of Diseases for Oncology (ICD-O-3). Sex (male or female), age (categorized as 60–64, 65–69, 70–74, 75–79, and ≥ 80 years), calendar year, and province of residence of all patients were collected. Annual population data stratified by age, sex, and province were obtained from the Statistical Center of Iran and used as population denominators.

Age-specific incidence rates (ASIRs) were calculated as the number of incident SC cases in each age-, sex-, province-, and year-specific stratum divided by the corresponding population and expressed per 100,000 population. Normalized age-standardized incidence rates (NASRs) were calculated by direct standardization using the Segi world standard population. Because the study population was restricted to adults aged ≥ 60 years, standard population weights for age groups younger than 60 years were excluded, and the remaining weights were proportionally renormalized to sum to 1. The two oldest age groups in the Segi standard population (80–84 and ≥ 85 years) were combined to correspond to the ≥ 80 -year age group available in the study data, resulting in a combined original standard weight of 0.010. NASRs were calculated by multiplying each age-specific incidence rate by its corresponding renormalized standard weight and summing across the five age groups. Sex-, year-, and province-specific NASRs were then

estimated using the same procedure.

National temporal trends in SC incidence were assessed using negative binomial regression, with the number of incident cases as the outcome and the logarithm of the corresponding population included as an offset. The negative binomial model was selected because the count data showed overdispersion and the model provided a better fit than Poisson regression, as indicated by lower Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values and a significant likelihood ratio test (Table 1). Age, sex, and calendar year were included in the multivariable model.

Annual NASRs were also examined to describe changes in age-standardized incidence over the study period. Province-specific temporal patterns were explored by fitting a separate simple linear regression to the six annual NASRs available for each province, with calendar year as the predictor. The regression slope represented the estimated average annual absolute change in NASR (cases per 100,000 population per year). These slopes were mapped to show the geographic distribution of increasing and decreasing patterns. Given that each province contributed only six annual observations, the province-specific regression results were treated as exploratory and were not interpreted as evidence of sustained long-term trends.

All statistical analyses were performed using R version 4.5.1 and Python version 3.14. Statistical tests were two-sided, and $P < 0.05$ was considered statistically significant.

Table 1. Comparison of model fit statistics for Poisson and Negative Binomial regression models

Model	AIC	BIC	Likelihood Ratio (LR χ^2)	P-value
Poisson	12,265.16	12,469.41	-	-
Negative Binomial	11,547.25	11,757.02	719.91	<0.001

Results

The results of this study indicated that the incidence of SC among adults aged 60 years and older was different by age, sex, and year of diagnosis. The NASR of SC fluctuated between 2014 and 2019 in both sexes and across age groups, with no consistent upward trend (Figure 1). According to Table 2, from 2014 to 2019, a total of 51,638 cases of SC were recorded in this age group in Iran, of which 32,833 (63.6%) were in men and 18,805 (36.4%) in women. The number of recorded cases increased from 7,787 in 2014 to 9,540 in 2018 and then decreased to 9,193 in 2019.

With increasing age, the IR of SC also increased, and across all years of the study, the highest IR was observed in the age group of 80 years and older. Thus, this rate increased from 204.37 per 100,000 people in 2014 to 224.67 per 100,000 people in 2019. The NASR was also higher in men than in women across all years of the study, and the male-to-female incidence ratio ranged from 1.47 to 2.25 across age groups.



Table 2. Age-specific and age-standardized incidence of SC among adults aged ≥ 60 years in Iran by sex, age group, and year, 2014-2019.

Year	Age_Group	Cases			Population			Incidence Rate			Age-specific Incidence ^a			Normalized Age-standardized Incidence ^b			
		Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	M/F ratio
2014	60-64	1012	643	1655	1086000	1157000	2243000	93.19	55.57	73.79	3.73	2.22	2.95	33.89	20.21	26.83	1.68
	65-69	927	570	1497	704000	807000	1511000	131.68	70.63	99.07	3.95	2.12	2.97	35.91	19.26	27.02	1.86
	70-74	879	481	1360	526000	572000	1098000	167.11	84.09	123.86	3.34	1.68	2.48	30.38	15.29	22.52	1.99
	75-79	939	466	1405	431000	426000	857000	217.87	109.39	163.94	2.18	1.09	1.64	19.81	9.94	14.90	2.00
	≥ 80	1272	598	1870	452000	463000	915000	281.42	129.16	204.37	1.41	0.65	1.02	25.58	11.74	18.58	2.17
	Total	5029	2758	7787	3199000	3425000	6624000	—	—	—	14.61	7.76	11.06	145.55	76.45	109.82	1.88
2015	60-64	993	624	1617	1160000	1220000	2380000	85.60	51.15	67.94	3.42	2.05	2.72	31.13	18.60	24.71	1.67
	65-69	875	532	1407	737000	855000	1592000	118.72	62.22	88.38	3.56	1.87	2.65	32.38	16.97	24.10	1.90
	70-74	862	543	1405	529000	587000	1116000	162.95	92.50	125.90	3.26	1.85	2.52	29.63	16.82	22.89	1.76
	75-79	815	437	1252	418000	429000	847000	194.98	101.86	147.82	1.95	1.02	1.48	17.73	9.26	13.44	1.91
	≥ 80	1304	611	1915	443000	466000	909000	294.36	131.12	210.67	1.47	0.66	1.05	26.76	11.92	19.15	2.23
	Total	4849	2747	7596	3287000	3557000	6844000	—	—	—	13.67	7.44	10.42	137.64	73.55	104.27	1.84
2016	60-64	1089	659	1748	1252663	1289910	2542573	86.93	51.09	68.75	3.48	2.04	2.75	31.61	18.58	25.00	1.71
	65-69	1004	682	1686	808910	902554	1711464	124.12	75.56	98.51	3.72	2.27	2.96	33.85	20.61	26.87	1.64
	70-74	948	588	1536	571112	606513	1177625	165.99	96.95	130.43	3.32	1.94	2.61	30.18	17.63	23.71	1.71
	75-79	886	456	1342	451419	434973	886392	196.27	104.83	151.40	1.96	1.05	1.51	17.84	9.53	13.76	1.87
	≥ 80	1469	657	2126	574301	521736	1096037	255.79	125.93	193.97	1.28	0.63	0.97	23.25	11.45	17.63	2.03
	Total	5396	3042	8438	3658405	3755686	7414091	—	—	—	13.76	7.93	10.80	136.73	77.82	107.00	1.74

2017	60-64	1030	698	1728	1326860	1351411	2678271	77.63	51.65	64.52	3.11	2.07	2.58	28.23	18.78	23.46	1.50
	65-69	1103	771	1874	841920	942914	1784834	131.01	81.77	105.00	3.93	2.45	3.15	35.73	22.30	28.64	1.60
	70-74	1022	653	1675	573016	615996	1189012	178.35	106.01	140.87	3.57	2.12	2.82	32.43	19.27	25.61	1.68
	75-79	905	496	1401	446140	434714	880854	202.85	114.10	159.05	2.03	1.14	1.59	18.44	10.37	14.46	1.78
	≥80	1652	754	2406	597133	534290	1131423	276.66	141.12	212.65	1.38	0.71	1.06	25.15	12.83	19.33	1.94
	Total	5712	3372	9084	3785069	3879325	7664394	—	—	—	14.01	8.49	11.20	140.00	83.55	111.55	1.65
2018	60-64	1120	717	1837	1401061	1412903	2813964	79.94	50.75	65.28	3.20	2.03	2.61	29.07	18.45	23.74	1.58
	65-69	1169	827	1996	874936	983276	1858212	133.61	84.11	107.42	4.01	2.52	3.22	36.44	22.94	29.30	1.59
	70-74	1148	676	1824	574928	625481	1200409	199.68	108.08	151.95	3.99	2.16	3.04	36.30	19.65	27.63	1.85
	75-79	937	501	1438	440862	434456	875318	212.54	115.32	164.28	2.13	1.15	1.64	19.32	10.48	14.93	1.85
	≥80	1644	801	2445	619958	546846	1166804	265.18	146.48	209.55	1.33	0.73	1.05	24.11	13.32	19.05	1.82
	Total	6018	3522	9540	3911745	4002962	7914707	—	—	—	14.65	8.60	11.56	145.27	84.82	114.64	1.70
2019	60-64	1042	728	1770	1450000	1491000	2941000	71.86	48.83	60.18	2.87	1.95	2.41	26.13	17.76	21.88	1.47
	65-69	1200	746	1946	987000	1076000	2063000	121.58	69.33	94.33	3.65	2.08	2.83	33.16	18.91	25.73	1.75
	70-74	1078	670	1748	613000	706000	1319000	175.86	94.90	132.52	3.52	1.90	2.65	31.97	17.25	24.10	1.85
	75-79	878	501	1379	412000	446000	858000	213.11	112.33	160.72	2.13	1.12	1.61	19.37	10.21	14.61	1.90
	≥80	1631	719	2350	526000	520000	1046000	310.08	138.27	224.67	1.55	0.69	1.12	28.19	12.57	20.42	2.25
	Total	5829	3364	9193	3988000	4239000	8227000	—	—	—	13.72	7.75	10.62	138.82	76.73	106.73	1.77

a : The number of new cases in a given age group, divided by the population of that age group, usually per 100,000 people.

b : Normalized Age-standardized incidence rates (NASR) are calculated by weighting the specific incidence rate of each age group by that group's share in a population, allowing comparisons of populations with different age assessments.

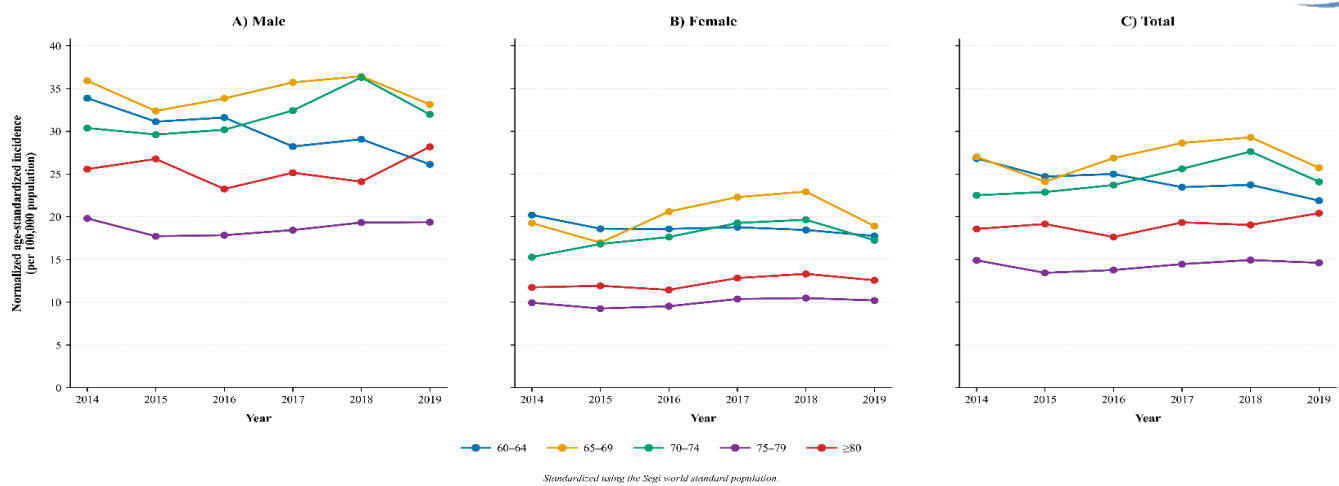


Figure 1. Trends in age-standardized incidence rates of SC among adults aged ≥ 60 years in Iran from 2014 to 2019 by sex and for the total population (per 100,000 population).

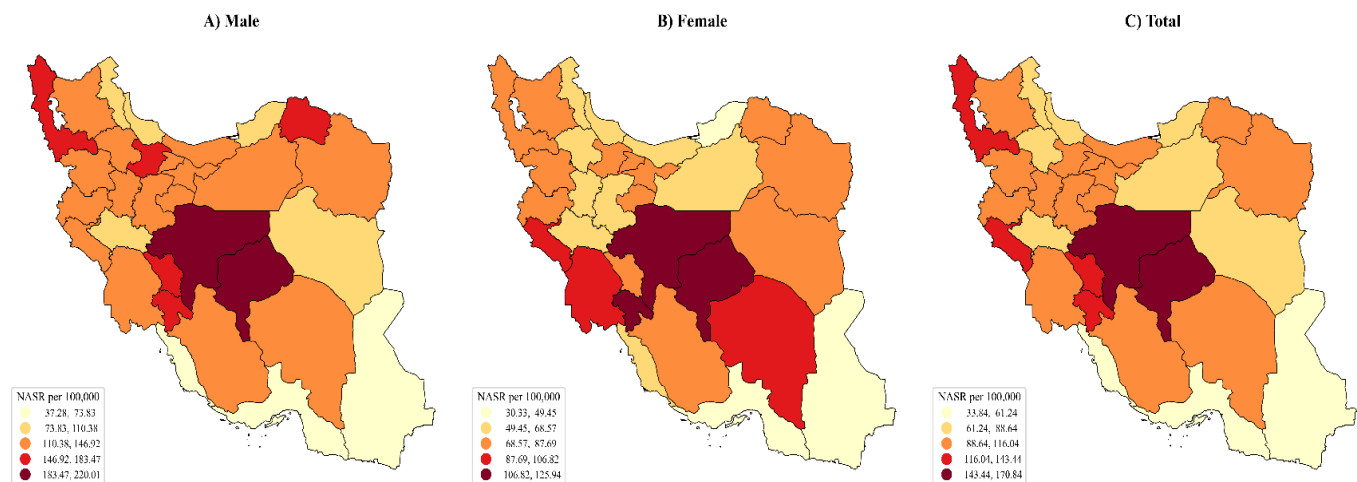


Figure 2. Provincial distribution of the mean normalized age-standardized incidence rates of SC among adults aged ≥ 60 years in Iran during 2014-2019.

As shown in Figure 2, trends in NASRs were similar in men, women, and the total population. After decreasing in 2015, the rates increased until 2018, then decreased again in 2019. Overall, the NASRs increased from 109.82 per 100,000 in 2014 to 114.64 per 100,000 in 2018, then decreased to 106.73 per 100,000 in 2019.

The geographic pattern of the average NASR rate for SC across the country's provinces during 2014-2019 is shown in Figure 2. The average incidence rates among men, women, and the total population varied across provinces. In all three gender groups, the highest values were observed in the provinces of Yazd, Isfahan, and Kohgiluyeh and Boyer-Ahmad, and the lowest values were observed in the provinces of Sistan and Baluchestan and Hormozgan. In most provinces, the average incidence rate in men was higher than in women. Also, the geographical distribution of the total population was largely similar to that of men (Figure 2).

The annual changes in the NASR by province and sex during the years 2014-2019 are presented in Figure 3. Differences in incidence rates between provinces were observed in all years of the study in both sexes. In most provinces, the incidence rate in men was higher than in women in all years of the study. NASRs varied substantially across provinces in both males and females throughout the study period. Although modest year-to-year fluctuations were observed, provinces with relatively high incidence generally remained among the highest-incidence provinces. In contrast, provinces with lower incidence consistently exhibited lower rates over time. In addition, as regards nearly all provinces, incidence rates were higher among males than females (Figure 3).



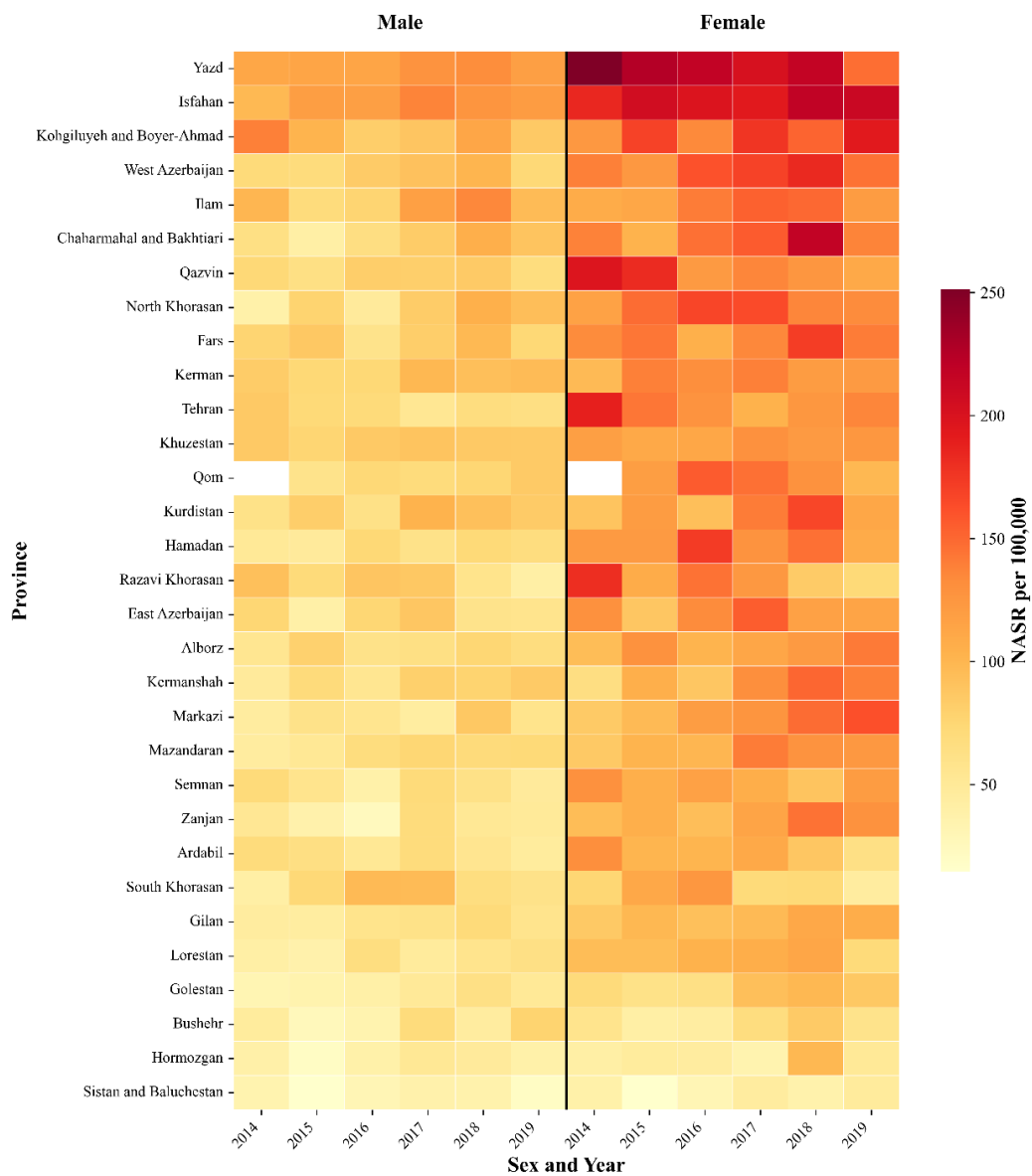


Figure 3.Temporal patterns of normalized age-standardized SC incidence rates among Iranian provinces by sex, 2014–2019.

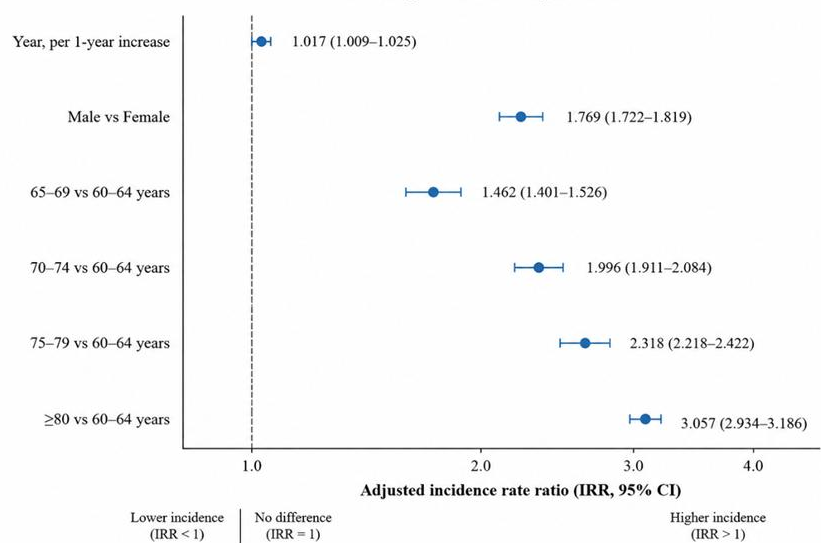


Figure 4. Adjusted incidence rate ratios (IRRs) for SC incidence among adults aged ≥60 years, Iran, 2014–2019.



The geographic pattern of the average NASR rate for SC across the country's provinces during 2014-2019 is shown in Figure 2. The average incidence rates among men, women, and the total population varied across provinces. In all three gender groups, the highest values were observed in the provinces of Yazd, Isfahan, and Kohgiluyeh and Boyer-Ahmad, and the lowest values were observed in the provinces of Sistan and Baluchestan and Hormozgan. In most provinces, the average incidence rate in men was higher than in women. Also, the geographical distribution of the total population was largely similar to that of men (Figure 2).

The annual changes in the NASR by province and sex during the years 2014-2019 are presented in Figure 3. Differences in incidence rates between provinces were observed in all years of the study in both sexes. In most provinces, the incidence rate in men was higher than in women in all years of the study. NASRs varied substantially across provinces in both males and females throughout the study period. Although modest year-to-year fluctuations were observed, provinces with relatively high incidence generally

remained among the highest-incidence provinces. In contrast, provinces with lower incidence consistently exhibited lower rates over time. In addition, as regards nearly all provinces, incidence rates were higher among males than females (Figure 3).

In multivariable negative binomial regression analysis, the incidence of SC increased significantly during the study period, with an increase in incidence rate of approximately 1.7% per year ($IRR = 1.017$, 95% CI: 1.009–1.025). Compared with females, males had a 76.9% higher incidence rate ($IRR = 1.769$, 95% CI: 1.722–1.819). Incidence increased progressively with age. Relative to individuals aged 60–64 years, the IRRs were 1.462 (95% CI: 1.401–1.526) for those aged 65–69 years, 1.996 (95% CI: 1.911–2.084) for those aged 70–74 years, 2.318 (95% CI: 2.218–2.422) for those aged 75–79 years, and 3.057 (95% CI: 2.934–3.186) for individuals aged ≥ 80 years (Figure 4).

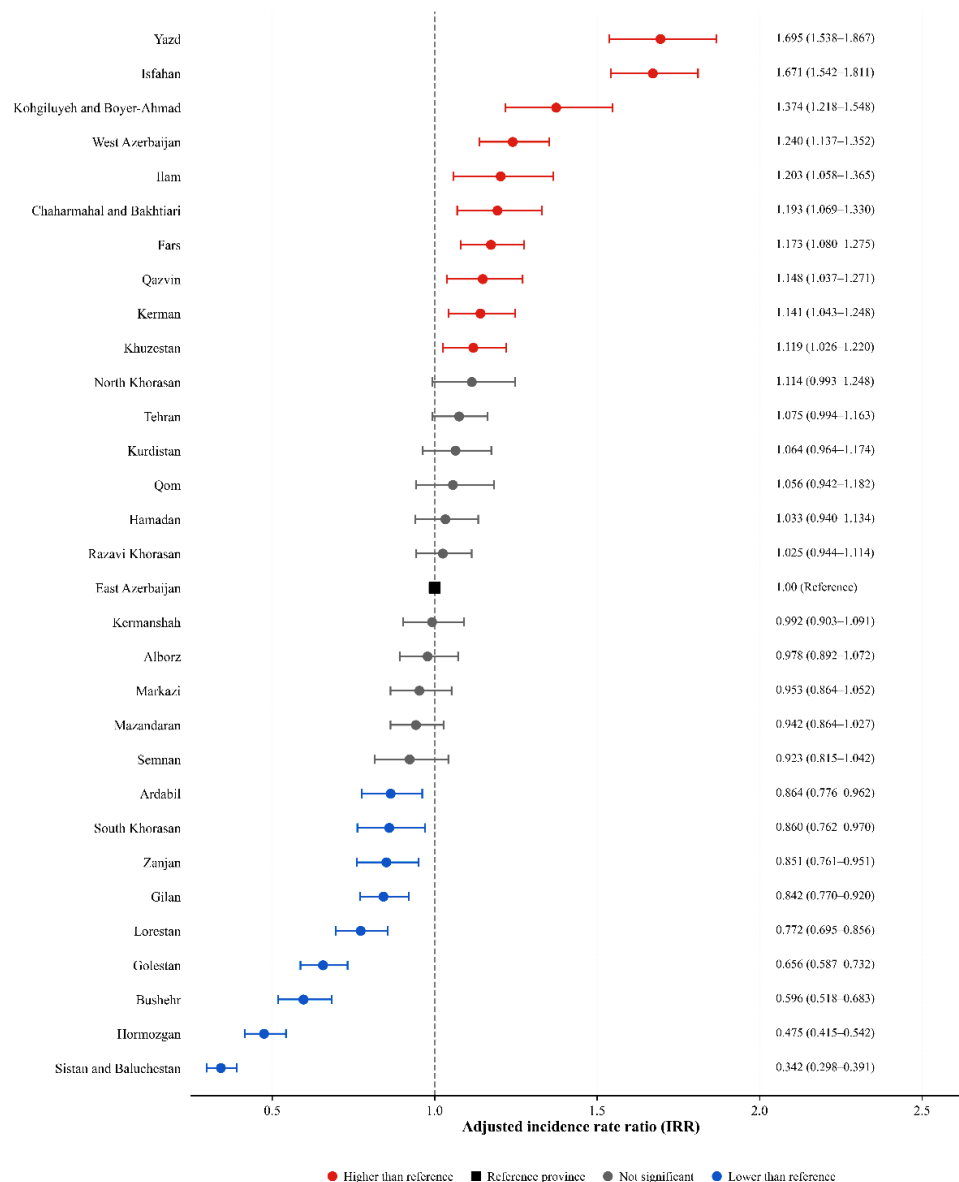


Figure 5. Province-specific adjusted incidence rate ratios (IRRs) for SC incidence among adults aged ≥ 60 years in Iran.



Substantial geographic variation in adjusted incidence rate ratios (IRRs) was observed across provinces (Figure 5). Using East Azerbaijan as the reference province, significantly higher IRRs were observed in Yazd, Isfahan, Kohgiluyeh and Boyer-Ahmad, West Azerbaijan, Ilam, Chaharmahal and Bakhtiari, Fars, Qazvin, Kerman, and Khuzestan. In contrast, significantly lower IRRs were observed in Ardabil, South Khorasan, Zanzan, Gilan, Lorestan, Golestan, Bushehr,

Hormozgan, and Sistan and Baluchestan, while no statistically significant differences were found for the remaining provinces. Overall, statistically significant temporal trends were observed in only nine provinces, while no significant temporal changes were detected in the remaining 22 provinces during the study period.

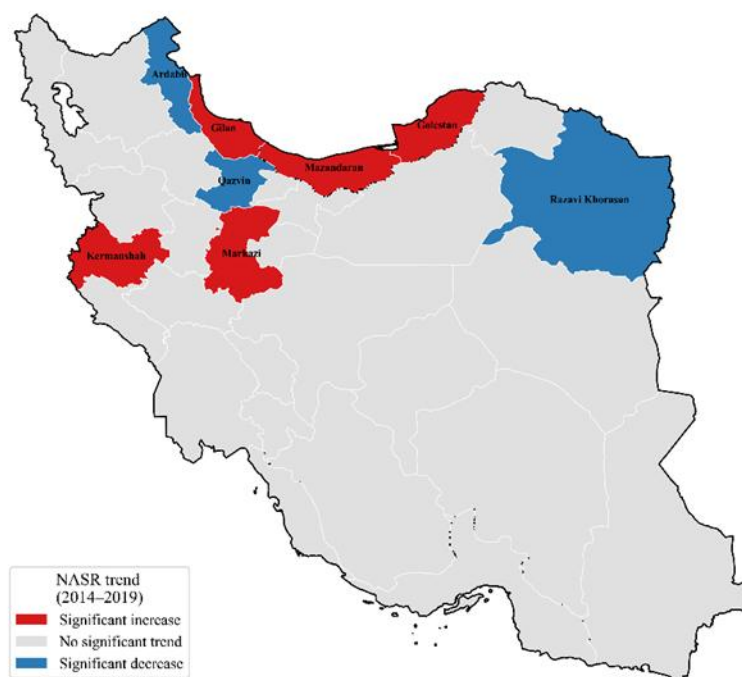


Figure 6. Spatial distribution of temporal trends in NASR rates of SC across Iranian provinces, 2014-2019

Discussion

This registry-based study of older adults in Iran showed a modest increase in the incidence of SC with significant differences by age, sex, and province of residence. The highest incidence was among the elderly aged 80 years and above, and men had a higher rate than women in all years of the study. Also, geographic variation was evident in both the magnitude of incidence and temporal patterns across provinces. Although the national model indicated a modest increase in incidence over the study period, province-specific patterns were heterogeneous, with significant changes observed in only a subset of provinces.

After adjustment for age, sex, province, and population at risk, SC incidence increased by an average of 1.7% per year during the study period. This finding is consistent with an earlier analysis of the Iranian National Cancer Registry, although the increase reported in that study was greater (1). In contrast, other long-term studies from Iran have described stable or declining trends (18, 19). These differences constitute discrepancies due to variations in the time period, the population studied, the completeness of cancer registry data, and the statistical methods (1, 18, 20). The observed rise may also be attributed to the better detection of cases,

increased access to diagnostic services and the wider coverage of the registration system (21).

In the present study, the use of a negative binomial model and simultaneous adjustment of variables yielded an adjusted estimate of the temporal trend. Although this model showed an overall increase, annual NASRs fluctuated slightly. This trend may be typical random variation, changes in the population structure, or variances in the identification and reporting of cases (20, 21). The decrease in NASR in 2019 may reflect a short-term fluctuation rather than a permanent change, as a similar short-term decline was documented in a provincial study in Iran (19). Therefore, it would not be described as a change in the broader trend (19).

Incidence rates increased in each age group compared with the previous one, reaching their highest values in those aged 80 years and older. This finding is consistent with population-based studies and global estimates that the burden of melanoma and NMSC is concentrated in the elderly population (11, 14). Aging is associated with increased exposure to sunlight, accumulation of UV damage over the life course, increased cellular mutations, decreased DNA repair capacity, increased risk of comorbidities, and immunosuppression (22, 23). Thus, the association with age may be a combination of cumulative exposure and biological



changes associated with aging (6).

SC incidence was also significantly higher in men than in women, and the difference remained after adjustment for age, province, calendar year, and population at risk. Similar sex differences have been reported in previous Iranian studies and in studies of older populations elsewhere (24, 25). Higher occupational exposure to sunlight, employment in agriculture or other outdoor occupations, differences in clothing patterns, and lower use of protective methods may explain part of this difference (22, 26). Studies among Iranian farmers have reported limited use of sunscreen, hats, gloves, and protective clothing (27). These explanations are plausible but could not be tested directly because individual occupational histories and sun-protection behaviors were unavailable in the registry data.

Substantial geographic variation in SC incidence was observed across Iran. Yazd and Isfahan had among the highest average NASRs, whereas Sistan and Baluchestan and Hormozgan had among the lowest. Previous Iranian studies have similarly reported relatively high incidence in some central provinces (1, 28). The observation of a similar pattern across different time periods suggests the possibility of relatively stable environmental, demographic, or detection- and registration-system-related differences (1, 18). UV radiation may be another possible reason for this heterogeneity, and ecological studies in Iran have reported its association with the incidence of NMSCs (23, 24). However, UV intensity alone does not appear sufficient to explain the observed distribution, since some southern provinces with high solar radiation had comparatively low recorded incidence. Differences in skin phenotype, clothing, occupational and recreational sun exposure, access to dermatology and pathology services, and completeness of cancer registration are other possible explanations (1, 23). These factors were not measured in the present study and therefore cannot be distinguished using the available data.

Provincial differences remained after adjustment for age, sex, calendar year, and population at risk, suggesting that differences in the measured demographic composition did not fully account for the geographic variation. This finding should not, however, be interpreted as evidence that specific provincial characteristics caused the observed differences. Linking cancer registry data with information on UV radiation, altitude, climate, occupational structure, socioeconomic conditions, access to diagnostic services, and indicators of registry completeness would allow these geographic patterns to be examined more directly (1, 6, 27). Temporal patterns also differed across provinces. Significant increases or decreases were identified in a limited number of provinces, whereas most showed no statistically significant change. The national increase therefore should not be interpreted as evidence of a uniform increase across the country.

Strengths and Limitations

This study used nationwide cancer registry data and age- and sex-specific population denominators to examine temporal and geographic patterns of SC incidence among older adults across all Iranian provinces. Several limitations should be considered. NMSC may be underreported, particularly when low-risk lesions are treated in outpatient

settings without complete registration. This may have resulted in underestimation of incidence and, if the degree of underreporting varied across provinces or over time, may also have affected geographic and temporal comparisons. Differences in access to diagnostic services, case ascertainment, and registry completeness across provinces and years may likewise account for part of the observed variation. The most recent year for which complete national registry data were available was 2019; therefore, the findings describe SC epidemiology during 2014–2019 and may not represent more recent patterns. The registry did not contain individual-level information on UV exposure, occupation, skin phenotype, or sun-protective behaviors, preventing direct assessment of these factors and limiting causal interpretation of the geographic differences. Finally, melanoma and NMSC were analyzed together because the study aimed to describe the overall pattern of SC among older adults. Because melanoma and NMSC differ in their aetiology and incidence patterns, the combined estimates may conceal subtype-specific temporal or geographic variation. Future studies should therefore examine these cancers separately.

Conclusion

The findings of the present study indicated a moderate increase in the registered incidence of SC among the elderly population in Iran. The rise was linked to significant differences by age, sex and province. The distribution of disease varies geographically and cannot be generalized to all provinces. However, these differences may partly reflect differences in registration, access to diagnostic services and completeness of case reporting. Further population-based surveillance and improvements in the quality of cancer registry data are needed to investigate and explain these trends. The findings could also help to identify populations and areas that need more detailed and preventive screening according to geographical conditions. Future studies with longer follow-up periods, differentiation of histological types, and investigation of environmental, occupational, and health service-related factors will provide more precise evidence for prevention and control of SC in the growing elderly population of Iran.

Acknowledgment

The authors thank the Cancer Office of the Non-Communicable Diseases Management Center, Ministry of Health and Medical Education, Iran, for providing access to national cancer registry data used in the current study. The authors are grateful for their valuable support and cooperation in data acquisition.

Funding

This study was conducted as part of a thesis at Shahid Beheshti University of Medical Sciences and received no specific financial support from any funding agency in the public, commercial, or not-for-profit sectors.



Ethical Approval

Ethical approval was obtained from the Ethics Committee of the School of Public Health and the Neuroscience Research Center, Shahid Beheshti University of Medical Sciences (IR.SBMU.PHNS.REC.1403.048). All analyses were conducted using anonymized data.

Conflict of Interests

The authors declare no conflicts of interest.

References

1. Razi S, Enayatradd M, Mohammadian-Hafshejani A, Salehiniya H, Soltani S. The epidemiology of skin cancer and its trend in Iran. *International journal of preventive medicine*. 2015;6:64. <https://doi.org/10.4103/2008-7802.161074>.
2. Garcovich S, Colloca G, Sollena P, Bellieni A, Balducci L, Cho WC, et al. Skin cancer epidemics in the elderly as an emerging issue in geriatric oncology. *Aging and disease*. 2017;8(5):643-62. <https://doi.org/10.14336/ad.2017.0503>.
3. Asadi LK, Khalili A, Wang SQ. The sociological basis of the skin cancer epidemic. *International Journal of Dermatology*. 2023;62(2):169-76. <https://doi.org/10.1111/ijd.15987>.
4. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*. 2021;71(3):209-49. <https://doi.org/10.3322/caac.21660>.
5. Arnold M, Singh D, Laversanne M, Vignat J, Vaccarella S, Meheus F, et al. Global burden of cutaneous melanoma in 2020 and projections to 2040. *JAMA dermatology*. 2022;158(5):495-503. <https://doi.org/10.1001/jamadermatol.2022.0160>.
6. Narayanan DL, Saladi RN, Fox JL. Ultraviolet radiation and skin cancer. *International journal of dermatology*. 2010;49(9):978-86. <https://doi.org/10.1111/j.1365-4632.2010.04474.x>.
7. Abolhasani R, Araghi F, Tabary M, Aryannejad A, Mashinchi B, Robati RM. The impact of air pollution on skin and related disorders: a comprehensive review. *Dermatologic therapy*. 2021;34(2):e14840. <https://doi.org/10.1111/dth.14840>.
8. Kaur G, Yusuf N. The epidemiology of skin cancer worldwide. *Skin Cancer: Pathogenesis and Diagnosis*: Springer; 2021. p. 69-77.
9. Goukassian DA, Gilchrist BA. The interdependence of skin aging, skin cancer, and DNA repair capacity: a novel perspective with therapeutic implications. *Rejuvenation research*. 2004;7(3):175-85. <https://doi.org/10.1089/rej.2004.7.175>.
10. Rembielak A, Yau T, Akagunduz B, Aspeslagh S, Colloca G, Conway A, et al. Recommendations of the International Society of Geriatric Oncology on skin cancer management in older patients. *Journal of Geriatric Oncology*. 2023;14(4):101502. <https://doi.org/10.1016/j.jgo.2023.101502>.
11. Zhang W, Zeng W, Jiang A, He Z, Shen X, Dong X, et al. Global, regional and national incidence, mortality and disability-adjusted life-years of skin cancers and trend analysis from 1990 to 2019: an analysis of the Global Burden of Disease Study 2019. *Cancer medicine*. 2021;10(14):4905-22. <https://doi.org/10.1002/cam4.4046>.
12. Organization WH. Ageing and health 2025 [Available from: <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>].
13. Beard JR, Bloom DE. Towards a comprehensive public health response to population ageing. *Lancet*. 2015;385(9968):658-61. [https://doi.org/10.1016/S0140-6736\(14\)61461-6](https://doi.org/10.1016/S0140-6736(14)61461-6).
14. Wang R, Chen Y, Shao X, Chen T, Zhong J, Ou Y, et al. Burden of skin cancer in older adults from 1990 to 2021 and modelled projection to 2050. *JAMA dermatology*. 2025;161(7):715-22. <https://doi.org/10.1001/jamadermatol.2025.1276>.
15. Nakamura A, Kataoka K, Takatsuka S, Takenouchi T. Aging trends in skin cancer: a long-term observational study in Japan. *JAAD international*. 2023;13:32-4. <https://doi.org/10.1016/j.jdin.2023.07.003>.
16. Wildiers H, Heeren P, Puts M, Topinkova E, Janssen-Heijnen ML, Extermann M, et al. International Society of Geriatric Oncology consensus on geriatric assessment in older patients with cancer. *Journal of clinical oncology*. 2014;32(24):2595-603. <https://doi.org/10.1200/jco.2013.54.8347>.
17. Mohile SG, Dale W, Somerfield MR, Schonberg MA, Boyd CM, Burhenn PS, et al. Practical assessment and management of vulnerabilities in older patients receiving chemotherapy: ASCO guideline for geriatric oncology. *Journal of clinical oncology*. 2018;36(22):2326-47. <https://doi.org/10.1200/jco.2018.78.8687>.
18. Shokri Varniab Z, Saeedi Moghaddam S, Pourabhari Langroudi A, Azadnajibabad S, Mortazavi SS, Sheidaei A, et al. The levels and trends of cancer incidence in the elderly population at national and sub-national scales in Iran from 1990 to 2016. *Cancer Reports*. 2024;7(1):e1937. <https://doi.org/10.1002/cnr2.1937>.
19. Sobhani S, Masinaei M, Fattahi N, Moghaddam SS, Naderimagham S, Rezaei N, et al. National and provincial population-based incidence and mortality of skin cancer in Iran; 1990–2016. *Asia-Pacific Journal of Clinical Oncology*. 2021;17(5):e162-e9. <https://doi.org/10.1111/ajco.13376>.
20. Zanetti R, Schmidtman I, Sacchetto L, Binder-Foucard F, Bordoni A, Coza D, et al. Completeness and timeliness: cancer registries could/should improve their performance. *European journal of cancer*. 2015;51(9):1091-8. <https://doi.org/10.1016/j.ejca.2013.11.040>.
21. Bray F, Parkin DM. Evaluation of data quality in the cancer registry: principles and methods. Part I: comparability, validity and timeliness. *European journal of cancer*. 2009;45(5):747-55. <https://doi.org/10.1016/j.ejca.2008.11.032>.
22. Armstrong BK, Kricke A. The epidemiology of UV induced skin cancer. *Journal of photochemistry and photobiology B: Biology*. 2001;63(1-3):8-18. [https://doi.org/10.1016/S1011-1344\(01\)00198-1](https://doi.org/10.1016/S1011-1344(01)00198-1).
23. Kya MA. Geospatial patterns of non-melanoma skin cancer in relation to climate changes in Iran. *Asian Pacific Journal of Cancer Prevention: APJCP*. 2024;25(3):1053. <https://doi.org/10.31557/apjcp.2024.25.3.1053>.
24. Kiani B, Tabari P, Mohammadi A, Mostafavi SM, Moghadami M, Amini M, et al. Spatial epidemiology of skin cancer in Iran: separating sun-exposed and non-sun-exposed parts of the body. *Archives of Public Health*. 2022;80(1):35. <https://doi.org/10.1186/s13690-022-00798-2>.
25. Bhatt VR, Shrestha R, Krishnamurthy J, Mosalpuria K, Loberiza Jr FR, Ganti AK, et al. Clinicopathologic characteristics and management trends of cutaneous invasive and in situ melanoma in older patients: a retrospective analysis of the National Cancer Data Base. *Therapeutic Advances in Medical Oncology*. 2015;7(1):4-11. <https://doi.org/10.1177/1758834014559936>.
26. Slavinsky V, Helmy J, Vroman J, Valdebran M. Solar ultraviolet radiation exposure in workers with outdoor occupations: a systematic review and call to action. *International Journal of Dermatology*. 2024;63(3):288-97. <https://doi.org/10.1111/ijd.16877>.
27. Moeini B, Ezati E, Barati M, Rezapour-Shahkolai F, Mohammad Gholi Mezerji N, Afshari M. Skin cancer preventive behaviors in Iranian farmers: applying protection motivation theory. *Workplace health & safety*. 2019;67(5):231-40. <https://doi.org/10.1177/2165079918796850>.
28. Faramarzi S, Kiani B, Faramarzi S, Firouraghi N. Cancer patterns in Iran: a gender-specific spatial modelling of cancer incidence during 2014–2017. *BMC cancer*. 2024;24(1):191. <https://doi.org/10.1186/s12885-024-11940-4>.

