



The prediction incidence of the three most common cancers among Iranian military community during 2007-2019: a time series analysis

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Keywords

Time series • Cancer • Iranian military community

Summary

Objective. Cancers are one of the most important public health problems in Iran. Because of the importance of cancers, the purpose of the current study was to the prediction of the future incidence of the most common cancers among Iranian military community (MC) by using the time series analysis during 2007 to 2019.

Methods. In the current cross-sectional study, all registered cancers among Iranian MC entered the study. To select the best model of prediction, various methods including autocorrelation function (ACF), partial autocorrelation function (PACF), and Akaike

information criterion (AIC) statistics were used. All analysis was performed by using ITSM, stata14, and Excel2010 software.

Results. The most prevalent cancers among Iranian MC were breast, prostate, and colon cancers respectively. The time series analysis was shown that the trend of all mentioned cancers in Iranian MC will increase in the coming years.

Conclusions. The trend of most prevalent cancers among Iranian MC was increasing but the different factors like the growth of population size and improving the registration system should be regarded.

Introduction

In recent decades, the Non-communicable diseases such as cancers have become a public health concern globally. Different factors such as population aging, change in lifestyle and increase unhealthy behaviors such as increasing cigarette smoking, lack of physical activity, unhealthy diet has an important role in increasing this problem [1]. According to researches, lung, breast, and colorectal cancers are the most common cancers in the world [2]. In 2000, cancers were the cause of death for over 7 million cases in the world (13% of total mortality). In 2008 the estimation showed that 169.3 million years of healthy life in all people were lost due to cancers like as Colorectal, lung, breast, and prostate cancers. Also, those mentioned cancers were caused about the 18–50% of the total burden of cancers and the main cause of total Disability-Adjusted Life Year (DALY) in different countries [3]. In 2014 about 1,665,540 of new cancer cases and 585,720 cancer deaths occurred in the United States [4]. More than 60% of deaths due to cancers and approximately half of new cases occurs in developing countries [5]. In Iran such as other developing countries, cancers are one of the main public health problems. Due to the change in lifestyle and increas-

ing the risk factors, the incidence of cancers in Iran is increasing [6]. According to the last reports of the Iranian ministry of health, cancers are the third cause of death after coronary heart disease and injuries [7, 8] and it was the second cause of no traumatic death in the population during the last 30 years [9]. The most common cancers among Iranian general population in both sexes is stomach, esophagus, breast, prostate and colon cancer Due to the type of the job, the military community and their family are more prone than other groups to the risk of the chronic diseases. The level of anxiety in the military population is high. So this factor can have an important role in determining the health status of this population [10-12]. The prediction of the future pattern of cancers by using current pattern can play an important role in identifying future trends of cancers and designing the prevention programs. Due to lack of similar study in Iranian population especially in the military community (active, retired, family, veterans) = MC the purpose of the current research was to determine the most prevalent cancers among Iranian MC and Forecasting incidence of them in the coming years by using time series methods.

Methods

In this cross-sectional study, the required data were extracted from the registered cases in the insurance organization of the Iranian MC. These data included variables such as age, gender, type of cancer, time of diagnosis (month - year) and the last status of patients (death or live).

INCLUSION CRITERIA

All registered cancers in the Iranian MC (active, retired, family, veterans) which have been diagnosed and registered during the March 2007 to March 2017 entered in this study.

DATA ANALYSIS

First, all data entered into Excel, and after cleaning they provided to the main analysis.

REMOVING NON-STATIONARY IN DATA

One of the pre-assumption for performing the time-series analysis on data is stationary of mean and variance in data in over time. Due to the non-stationary nature of the data, in the mean and variance terms, the needed transformation performed for stationary of data to remove of Non-stationary variance and mean, Box-Cox transformation and differencing were used respectively.

SELECTION OF MODELS

To select the best forecasting model, time series graphs such as partial autocorrelation function (PACF) and autocorrelation function (ACF) were used to determine Autoregressive (AR) (p) and Moving Average (MA) (q) parameters. So the best model for prediction was determined by using the PACF and ACF graphs with minimum Akaike information criterion (AIC) statistic that was earned from comparing among different models. AIC is a statistical technique that used for selection of a good model. The best model is the model that has the minimum AIC among all models [13].

ASSESSING THE FITNESS OF THE SELECTED MODELS

For assessing the fitness of the selected models for forecasting, we used tests of randomness on residuals such as Ljung - Box statistic, McLeod - Li statistic, Turning points, Diff sign points, Rank test statistic, Jarque-Bera test statistic (for normality) and the schematic checking of the residual graph.

PREDICTION

After selecting the best model according to minimum AIC and assessing the fitness of the selected models using different tests the ARIMA (p, d, q) model were used to the prediction of the future trend of cancers by using current data. The p and q parameters were extracted from the PACF and ACF graphs and d parameter shows the order of differences for setting the stationary in the mean. By considering monthly time intervals, 120 months from 21 March 2007 to 20 March 2017 were accounted for the time series model and the prediction was made from

March 21, 2017, to 20 August 2019. Subsequently, time series analysis methods were used to analyze the data. Data analyses were conducted using the ITSM (Interactive Time Series Modeling) software, STATA14, and Excel 2010 at the significance level of 0.05.

Results

The total registered cancers in the Iranian MC from April 2007 to March 2016 were about 29057 cases. The mean age of registered cancers was 63.36 ± 15.20 . Overall 53.04% of total cases were females and 46.96% of cancer cases were males (Tab. I). The most prevalent cancers among Iranian MC during these years were breast 8,244 (28.37%), prostate 2876 (9.90%) and colon cancers 2,118 (7.29%) respectively (Tab. II).

In the prediction of the incidence of breast cancer, the results showed an increasing trend in this cancer for the coming years (Fig 1). For prediction of the trend of this cancer the autoregressive integrated moving average (ARIMA) model with AR = 7, MA = 6, and Akaike information criterion statistics (AIC) = 350 were used [2, 6, 7]. In the prediction of the incidence of prostate cancer in the Iranian MC, the results of time series analysis showed an increasing trend in the incidence of this cancer for the coming years (Fig. 2). For prediction of the trend of this cancer the autoregressive integrated moving average (ARIMA) model with AR = 12, MA = 1, and Akaike information criterion statistics (AIC) = 275 were used [1, 2, 12].

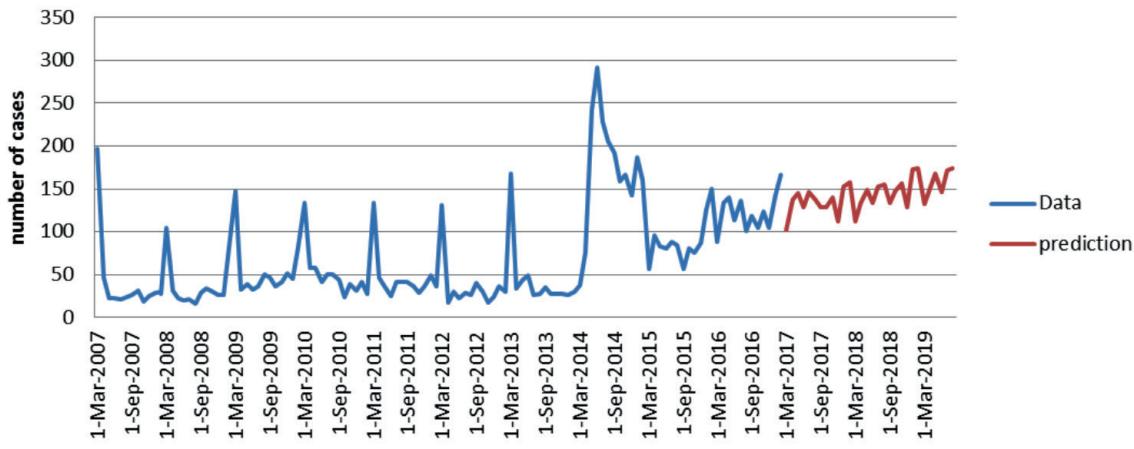
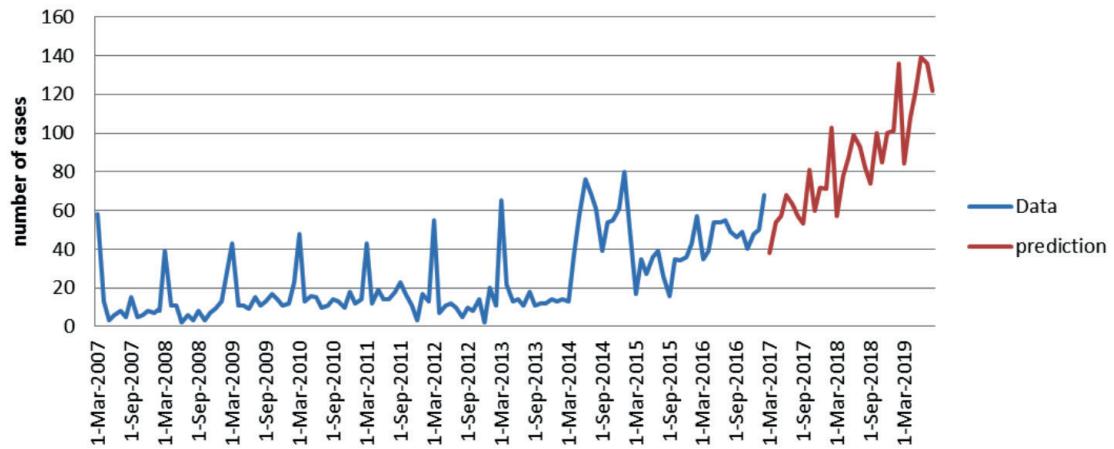
In the prediction of the incidence of colon cancer, the results of time series analysis showed an increasing trend in the incidence of this cancer for the coming years

Tab. I. Descriptive characteristic of cancer patients among Iranian military community during 2007-2017.

	N (%)
Sex	
• Female	15,413 (53.04%)
• Male	13,644 (46.96%)
Job	
• Retired	16,927 (58.26%)
• Pensioner	7,418 (25.53%)
• Employed	3,724 (12.82%)
• Soldier	184 (0.63%)
• Other	803 (2.76%)
Total	29057

Tab. II. The most prevalent cancers among the Iranian military community during 2007-2017.

Type of cancer	N (%)
Breast cancer	8,244 (28.37%)
Prostate cancer	2,876 (9.90%)
Colon cancer	2,118 (7.29%)
Stomach cancer	1,741 (5.99%)
Bladder cancer	1,640 (5.64%)
Non-Hodgkin's lymphoma	977 (3.36%)
Liver cancer	948 (3.26%)
Other cancers	10,513 (36.18%)

Fig. 1. The trend of **breast cancer** and predicted value among Iranian military community during 2007-2019.Fig. 2. The trend of **prostate cancer** and predicted value among Iranian military community during 2007-2019.

(Fig. 3). For prediction of the trend of this cancer the autoregressive integrated moving average (ARIMA) model with AR = 12, MA = 1, and Akaike information criterion statistics (AIC) = 353 were used [1, 2, 12].

In the prediction of the incidence of colon cancer among male and female, the results of time series analysis showed an increasing trend in the incidence of this cancer for the coming years (Fig. 4). For the prediction of the trend of this cancer among males the autoregressive integrated moving average (ARIMA) model with AR = 11, MA = 11, and Akaike information criterion statistics (AIC) = 664 were used [2, 11] And for females the autoregressive integrated moving average (ARIMA) model with AR = 11, MA = 11, and Akaike information criterion statistics (AIC) = 663 were used [2, 11, 12]. All the Related coefficients for prediction incidence of cancers among Iranian MC were shown in Table III.

Discussion

According to results of the current study, the most prevalent cancers among Iranian MC were breast, prostate, stomach and bladder cancers respectively. It seems

the pattern of cancers among the Iranian population is changing and with the aging population, it is expected to have an increasing trend of cancers such as prostate and breast cancers in the population.

The increasing trend of breast cancer among women had been shown in many reports [14-16]. These results are similar to the current study results. In fact, the time series analysis results showed that the incidence cases of breast cancer among Iranian MC have an increasing trend. It can be due to improving cancer registration system. Also, different factors like changing in lifestyle, increasing the risk factors such as obesity, aging, decreasing parity, changes in menstrual and reproductive patterns among women and using menopausal hormone therapy should be regarded. Furthermore, the role of screening programs such as self-examination and mammography should not be neglected because using these methods can increase the number of diagnosed new cases in the early stage of the diseases [17-23].

The pattern of prostate cancer is different between countries [24, 25]. Although the lowest incidence and mortality rates of prostate cancer were reported in Asian countries [26], these indicators for mentioned cancer is increasing in many Asian countries [27]. The incidence

Fig. 3. The trend of colon cancer and predicted value among Iranian military community during 2007-2019.

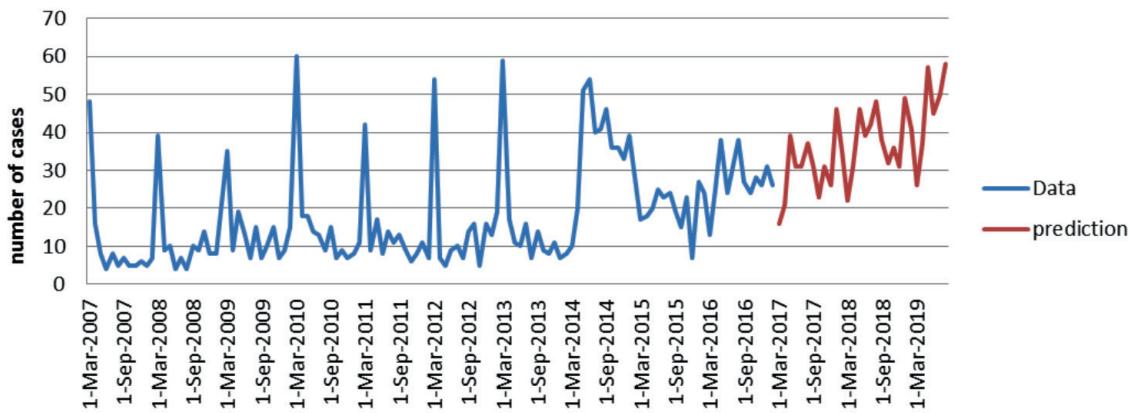
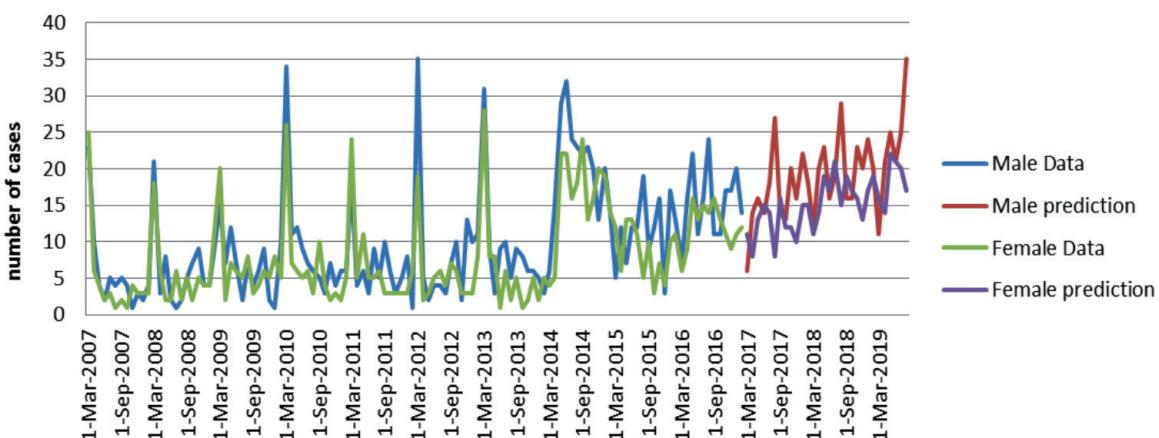


Fig. 4. The trend of colon cancer and predicted value according to the gender, among Iranian military community during the 2007-2019.



cases of prostate cancer in Iran is similar to some Asian countries such as China and Kuwait but In comparison with the western countries like the USA, Iran has the lower incidence rate of prostate cancer [28]. The results of the current study showed that the reported cases of prostate cancer in Iranian MC are increasing and we will have more cases of prostate cancer in Iranian men in the future. The Increasing trend of prostate cancer among Iranian MC may be due to many different factors such as increasing the use of PSA testing [29], duration of the occupational physical activity, intensity of occupational physical activity, body mass index, marriage status, dietary meat consumption, and aging [30, 31]. Indeed improving cancers registry system in Iranian public health system especially in MC should be regarded.

According to the different reports, the incidence of colon cancer in Asian countries and among the Iranian popula-

tion is increasing [32-36]. These results are close to the current study results. According to time series analysis in the prediction of colon cancer among Iranian MC the trend of reported colon cancer among this group is increasing. Some part of this increasing trend may be due to carrying out some screening program like as fecal occult blood tests (FOBT), flexible Sigmoidoscopy (FS) and total colonoscopy [37]. Other reasons for this increase may be related to factors such as behavioral and lifestyle changes, toward urbanization, high consumption of total energy and animal fat, lower dietary fiber and other factors [38]. Also according to our prediction results, the number of the incidence of colon cancer among males was higher than females. This result is similar to other study results [39, 40]. The difference between two genders may be related to different reasons like different environment and lifestyle factors such as food consump-

Tab. III. The related coefficients for prediction incidence of cancers among Iranian military community.

	Breast cancer	Prostate cancer	Colon cancer	Male colon cancer	Female colon cancer
Box COX	200	200	300	500	900
AR	7	12	12	11	12
MA	6	1	1	11	11
AIC	0.350984E + 03	0.275184E + 03	0.353478E + 03	0.664421E + 03	0.663679E + 03

tion pattern, smoking, and physical activity [41, 42]. These mentioned risk factors in men were higher than women, for example, using more meat among men so the incidence of cancer among men is more than women. Finally, the current study was according to the registered cancers in the Insurance organization of Iranian MC and we don't have any information about the total size of Iranian MC Population to calculate the incidence rate of cancers, so the quality of all analysis is dependent on the quality of registered data.

Conclusions

According to the time series analysis, the trend of most prevalent cancers among Iranian MC was increasing. But it's maybe because of increasing Iranian MC Population or improving in quality and quantity of data registration in Iranian military medical services. So these two important factors should be regarded in future studies.

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Conflict of interest statement

None declared.

Authors' contributions

All Authors have made a substantial contribution to the conception, design, analysis, and interpretation of data, drafting the article and revising it critically for intellectual content; all Authors approve the final version submitted to the Journal of Preventive Medicine and Hygiene.

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