# Geriatric cancer trends in the Middle-East: Findings from Lebanese cancer projections until 2025

Fady G.H. Haddad [a],*, Joseph Kattan [a], Hampig R. Kourie [a], Elie El Rassy [a], Tarek Assi [a], Salim M. Adib [b]

[a] Hematology-Oncology Department, Faculty of Medicine, Saint Joseph University, Beirut, Lebanon
[b] Epidemiology and Population Health Department, Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon

## ARTICLE INFO

## ABSTRACT

*Objective:* By 2020, 70% of all cancers will occur in patients aged 65 years and older, causing an increase in related morbidity, mortality, and cost. This study projects cancer trends in the elderly population in Lebanon, a country experiencing accelerating aging trends. Findings will guide future policy decisions regarding geriatric oncology in Lebanon and the surrounding Arab world.

*Materials and Methods:* Cancer incidence rates were derived for men and women 65 years and above, divided into three age groups: 65–69 years, 70–74 years, and 75 years and above. Raw data were obtained from the National Cancer Registry reports 2003–2010. The eight consecutive year data were used to project the incidence until 2025 using a logarithmic model. The Average Annual Percent Change in incidence rates was calculated to determine whether it would significantly increase, decrease, or remain stable over time.

*Results:* Incidence rates are projected to increase significantly in all age groups of both genders until 2025. In men, the fastest rise is expected in prostate cancer, followed by bladder, lung, colorectal, and NHL. In women, the rise will be fastest in breast, followed by colorectal, lung, NHL, and ovary. Projected rates increase faster in the "younger" age group 65–69 compared to the "oldest" ≥75, both in men and women. Only kidney and liver cancers continue to rise significantly after 75.

*Conclusions:* Cancer incidence is projected to increase in individuals between 65 and 74 years of age. Lebanese and Middle Eastern physicians must implement adapted therapeutic strategies in the management of the increasing caseload among frail, elderly patients.

© 2017 Elsevier Ltd. All rights reserved.

## 1. Introduction

Population aging is a recent and rapidly evolving phenomenon. Today, 12.3% of the world's population is aged 60 years and older, and this number is expected to rise to almost 22% in 2050. Life expectancy has increased during the last two decades by 5.2 years around the world, to reach 70 years. This development is due to better nutrition, improved healthcare and education, and economic well-being. However, age is a major non-preventable risk factor for cancer as a result of immune-senescence and enhanced cytokine production. Other important factors accountable for the age-related rise in cancer incidence are the duration of carcinogenesis, the increased susceptibility of older tissues to late-stage exposure, and unhealthy lifestyle during adolescence especially with regard to four major components: smoking, poor nutrition, inactivity, and alcohol abuse. Consequently, as the world population ages, the burden of cancer in the elderly population is likely to increase [1–4]. Worldwide, 70% of all cancers will occur in patients aged 65 years and older by 2020, causing an increase in cancer related-morbidity, cost, and mortality in this population. Moreover, 70% of mortality in people older than 65 years will be attributed to cancer in the US within the next two decades [5,6].

In Lebanon, detailed population-based cancer-incidence data has been provided by the Lebanese National Cancer Registry (NCR) for eight consecutive years (2003–2010) [7]. Figures indicate a consistent year-to-year increase in incidence rates at the national level. Cancer incidence in Lebanon is currently at the highest level among Arab nations, but still short of reaching levels found in Western Europe or North America. The latest reported rate of incidence (2010) was 2273/100,000 men and 1396/100,000 women [7]. Projections to 2018 based on trends from 2003 to 2008 have been published, suggesting that overall incidence will increase by 50% over the 15-year interval [8]. There was no attempt to project trends specifically in the elderly population, despite accelerating trends towards aging in the Lebanese population.

Recently, health and social problems associated with aging have started to slowly attract the attention of public health experts in Lebanon. Among the 4.5 million Lebanese citizens, the proportion of those aged ≥65 was estimated at 7%, or about 450,000 persons, in 2005 [7]. The relative size of the elderly subgroup is increasing faster than that of the general population. By 2016, almost 10% of the

* Corresponding author.
  E-mail address: fadyhaddad.fh@gmail.com (F.G.H. Haddad).

population was already above the age of 65 years. By 2030, this number is expected to increase to 12% [9]. This fast increase is largely due to a continued drop in the fertility rate, coupled with a major wave of emigration that has affected mostly adults in active ages since the early 1990s, with a proportion of young adults leaving the country in the search for job opportunities abroad; thus creating a relative increase in the proportion of the elderly population. At the same time, life expectancy has been increasing steadily in Lebanon like in almost every other country in the world. Women's life expectancy was estimated in 2014 at about 81 years, and that of men 78 [10]. However, specialized care for the unique health needs of the elderly is almost non-existent, and geriatric services and geriatricians are rare as well. We believe that our study can be used to guide future policy decisions regarding geriatric care in general and geriatric oncology in particular in Lebanon and in the surrounding Arab world.

## 2. Methodology

### 2.1. Sources of Data

Cancer incidence rates for the major cancer types were derived for men and women 65 years and above, divided into three age groups: 65–69 years, 70–74 years, and 75 years and above. Raw data were obtained from the National Cancer Registry (NCR) reports 2003–2010. More recent data were not yet available at the time of writing.

### 2.2. Plan of Analysis

Data from the eight consecutive years were used to create projections onto 2025. Linear and logarithmic models were found equivalent in terms of projections estimation, and the logarithmic model was adopted to visually magnify small changes. The software used in generating the projections was SPSS Statistics version 20. To determine whether a specific incidence was significantly increasing, decreasing, or remaining stable over time, an Average Annual Percent Change (AAPC) in incidence rates was calculated for each cancer type in every age group in both male and female populations. The AAPC is a summary measure of the trend over a specific interval that describes the average of numerous annual percent changes over a period of multiple years in which cancer rates are assumed to change at a constant percentage of the rate of the previous year [11]. Characterizing the observed trends is based on the value of the AAPC and the corresponding 95% confidence interval (95% CI) as follows: if the AAPC is positive (>0) with a significant CI not containing the "0" value, then the trend was judged to be rising; if the AAPC is negative (<0) with a significant CI not containing the "0" value, then the trend was judged to be falling; and if the CI contained the "0" value, irrespective of the AAPC value, then the trend was judged to be non-significant and was therefore considered stable. AAPC values were calculated using the Joinpoint Regression Program.

## 3. Results

In the subgroup of men aged 65–69 years, cancer incidence increased from 647.2 per 100,000 in 2003 to 1315.1 in 2010, and is predicted to reach 2977.7 in 2025. This rise was statistically significant with an AAPC of 6.3 (95% CI; 5.3–7.3). Prostate cancer is the most frequently diagnosed cancer in Lebanese men, rising from 158.4 per 100,000 in 2003 to 284.4 in 2010, to 618.2 in 2025, according to the projections, with an AAPC of 4.9 (95% CI; 4.1–5.6). Bladder cancer comes in second place with an incidence of 116.3 and 194.6 in 2003 and 2010, respectively, and is estimated to reach 440 per 100,000 in 2025, a significant increase with an AAPC of 5.1 (95% CI; 4.5–5.6). The third most diagnosed cancer is lung cancer, with an increasing incidence from 105.4 in 2003 to 220.3 in 2010, and an estimated rate of 467.4 in 2025, with an AAPC of 6.2 (95% CI; 5.2–7.2). Colorectal cancer and

non-Hodgkin lymphoma (NHL), the fourth and fifth diagnosed cancers in men, respectively, are also expected to rise in this age group (Fig. 1).

In elderly men aged between 70 and 74 years, cancer incidence is estimated to increase from 431.5 per 100,000 in 2003 to 4813.5 in 2025, with a significant AAPC value of 12.6 (95% CI; 8–17.4). Prostate cancer ranks first, with an incidence of 105.6 per 100,000 in 2003, 385.4 in 2010 and a projected incidence of 1079.5 in 2025, with an AAPC of 12.1 (95% CI; 5.6–19). Following in the ranking is bladder cancer, with a rising incidence from 77.5 in 2003 to 272.5 in 2010 and an estimated incidence of 807.9 in 2025 associated with an AAPC value of 8.4 (95% CI; 7–9.8). Lung cancer is the third most diagnosed cancer in this age group, with an incidence that increased from 70.3 to 282.3 per 100,000 between 2003 and 2010, and is expected to rise to 703.9 per 100,000 according to 2025 projections, with an AAPC of 11.3 (95% CI; 8.5–14.2). Colorectal cancer and NHL are also expected to rise in this age group (Fig. 2).

In the age group 75 years and above, cancer incidence in men varied from 1682.6 per 100,000 in 2003 to 2273 in 2010, with projections showing a rise to 3305.2 in 2025, and a significant AAPC value of 3.2 (95% CI; 2.8–3.7). Prostate cancer incidence increased from 424.9 in 2003 to 547.6 in 2010, and is estimated to increase to 799.1 in 2025, with an AAPC of 3 (95% CI; 2.4–3.6). Similarly, the incidence of bladder cancer rose from 311.6 to 351.7 per 100,000 between 2003 and 2010, and expected to reach 448.3 in 2025, and is associated with a significant AAPC of 1.9 (95% CI; 1.5–2.4). However, for lung cancer, incidence rates are expected to decrease over time, going from 280.4 per 100,000 in 2003 to 234.4 in 2010, and 139.5 in 2025, with a significant AAPC of −2.4 (95% CI; −3.2 to −1.6). In this most elderly age group, colorectal cancer and NHL are also rising (Fig. 3).

Cancer incidence is expected to also increase in women. Overall cancer incidence in women aged 65–69 years rose from 434.3 and 951.8 per 100,000 in 2003 and 2010, respectively, to 2278 per 100,000 in 2025 with and AAPC of 7.1 (95% CI; 6.2–8.1). Breast cancer is the most frequently diagnosed cancer, with incidence rising from 157.2 per 100,000 to 324.4 between 2003 and 2010, and growing to 695 in 2025, with a corresponding AAPC of 6.9 (95% CI; 6–7.8). Colorectal cancer ranks second, with an estimated increase in incidence from 48.9 to 102.2 per 100,000 between 2003 and 2025 with an AAPC of 6.7 (95% CI = 5.6–7.8). Following in the ranking is lung cancer, whose incidence was estimated to increase from 72.8 to 115.4 per 100,000 from 2003 to 2025, with an AAPC equal to 3 (95% CI; 2.2–3.8). NHL and ovarian cancer, the fourth and fifth diagnosed cancers in women, respectively, are expected to rise in this age group (Fig. 4).

Among those aged 70–74 years, cancer incidence is estimated to grow from 289.5 and 879.7 per 100,000 in 2003 and 2010 respectively, to 3141.3 in 2025, with a significant AAPC of 12.4 (95% CI; 8.1–17). The incidence of breast cancer rose from 104.8 per 100,000 to 223.6 between 2003 and 2010, and is estimated to reach 773.8 in 2025. This rise is significant as shown by the AAPC value of 10 (95% CI; 5.7–14.4).
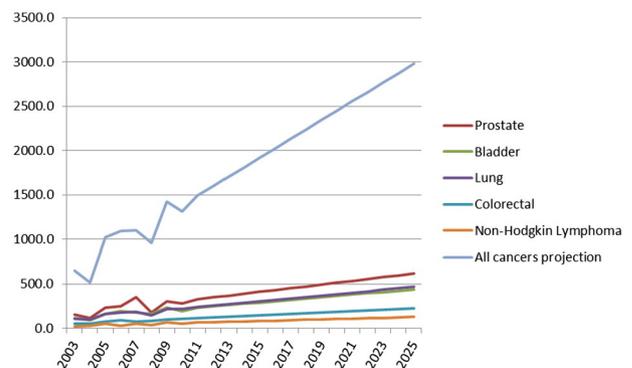


Fig. 1. Trend variation in incidence rates of the five most common cancers and "all cancers" in Lebanese men aged 65–69 (2003–2025).
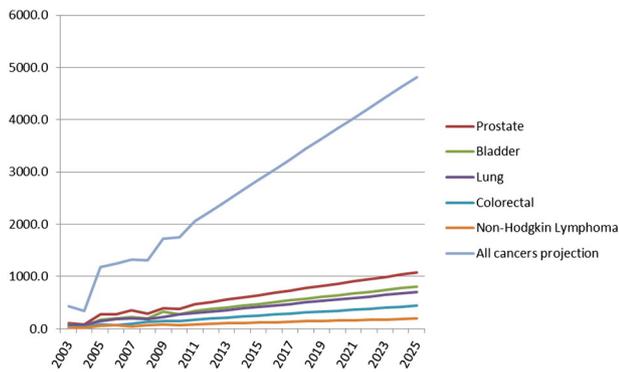
Fig. 2. Trend variation in incidence rates of the five most common cancers and "all cancers" in Lebanese men aged 70–74 (2003–2025).



Fig. 4. Trend variations for the five most common cancers and "all cancers" in Lebanese women aged 65–69 (2003–2025).

The incidence of colorectal cancer is also estimated to rise from 32.7 in 2003, reaching 267 per 100,000 in 2025, with an AAPC of 6.5 (95% CI; 5.7–7.4). Lung cancer increased from 48.6 per 100,000 in 2003 to 67.2 in 2010 and is expected to reach 188.1 in 2025, with an AAPC value of 9.3 (95% CI; 7.8–10.9). NHL and ovarian cancer are also expected to rise in this age group (Fig. 5).

Among women 75 years and above, cancer incidence rates are expected to double, from 1078.5 per 100,000 in 2003 to a projected 2040.4 per 100,000 in 2025, with an associated AAPC of 3.3 (95% CI; 2.9–3.7). Breast cancer is the most frequent diagnosed type going from 71.7 per 100,000 in 2003 to 282.7 in 2010, and increasing to 617.2 in 2025 with an AAPC of 5.2 (95% CI; 4.6–5.8). Following is colorectal cancer, with a trend towards a decrease in incidence from 154.5 in 2003 to 135.6 in 2025, but this trend was statistically stable. Lung cancer increased from 12.3 in 2003 to 111.1 in 2010, and is estimated to reach 278.2 in 2025, with a significant AAPC value of 14.2 (95% CI; 10.4–18.2). In this most elderly age group, NHL and ovarian cancers are also rising (Fig. 6).

## 4. Discussion

Projections based on actual age-specific incidence rates from the NCR covering years 2003–2010 indicate continued major increases in cancer incidence and subsequent caseloads in men and women aged 65 and older. The projected rates seem to increase faster in the "younger" age group of 65–69 compared to the "oldest", comprised of those ≥75 in both men and women. The slower increase pace in oldest old may be attributable to a "healthy surviving effect" of those most fit genetically and/or environmentally. This effect is found, for example, in life expectancies that tend to get longer as people live longer [12]. Of all cancers, the only ones which continue to rise significantly after 75 are kidney and liver (data not shown in figures). Those organs
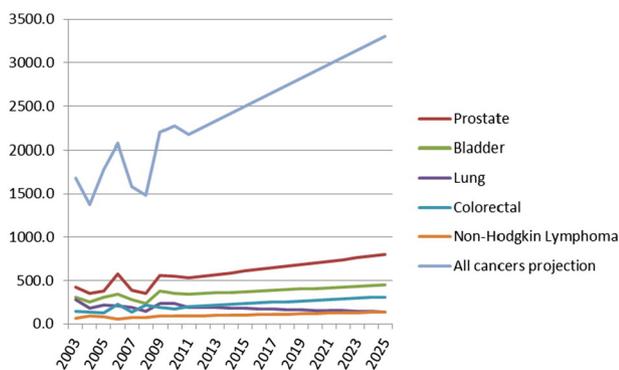
which escape the slowing trend are the "strainer" organs, with lifelong uninterrupted purification workloads. Decades of "wear and tear" end up being relentlessly expressed in oncogenic changes.

The fastest growing cancers in both men and women are also those that affect the Lebanese population at all ages. In men, these were prostate, bladder, lung, colorectal, and NHL. In women they were breast, colorectal, lung, NHL and ovary [8]. Prostate cancer is often diagnosed incidentally while surgically treating age-related prostatic hyperplasia or through routine PSA (prostate-specific antigen) testing. While routine PSA screening was previously adopted in men starting the age of 50, most recent recommendations have stopped calling for routine PSA screening of all men from age 50. Instead, physicians are invited to discuss with their clients the adequacy of the test in view of their clinical context and expectations [13]. As physicians in Lebanon conform their practice to these recommendations, the rise in prostate cancer incidence may slow down or even stabilize in the coming years. Also, in both genders, there is a rise in tobacco-related cancers such as lung, bladder, head and neck, and others. The burden of unbridled increase, based on recent upward trends in cancer cost [14], clearly indicates that tobacco control policies, currently poorly implemented in Lebanon, should finally be seriously enforced in all circumstances. The sustained upward surge in breast cancer incidence emphasizes once more the importance of obtaining a larger adherence to screening recommendations among aging women, which has not been the case so far [15]. Findings also clearly underline the importance of adopting national guidelines for colorectal cancer screening as one approach to control rising incidence and costs.

## 5. Conclusions

The incidence of cancer in Lebanon is expected to increase with age especially in individuals between 65 and 74 years, compared to those



Fig. 3. Trend variation in incidence rates of the five most common cancers and "all cancers" in Lebanese men aged 75 and above (2003–2025).
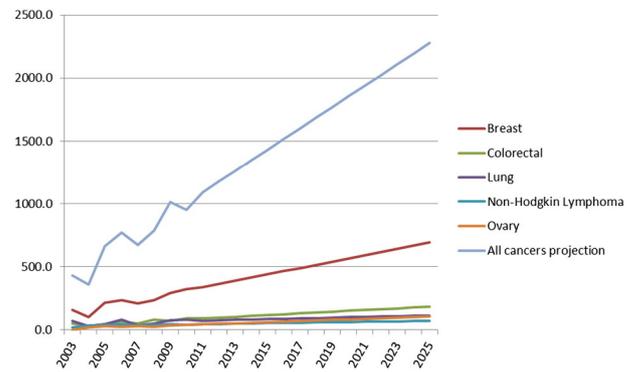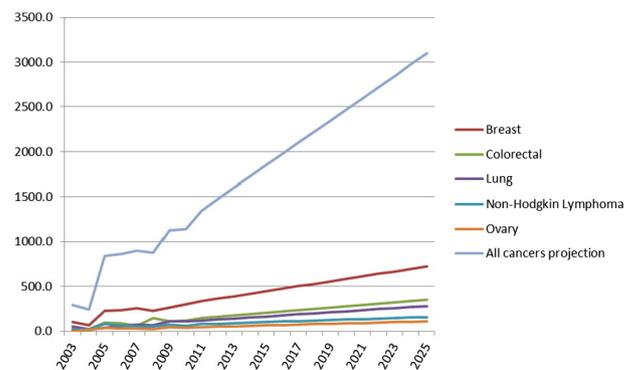


Fig. 5. Trend variations for the five most common cancers and "all cancers" in Lebanese women aged 70–74 (2003–2025).
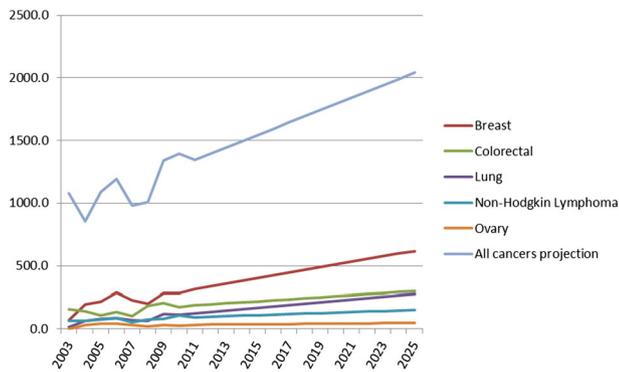
**Fig. 6.** Trend variations for the five most common cancers and "all cancers" in Lebanese women aged 75 and above (2003–2025).

above 75. Awareness should be directed and maintained towards cancer prevention and early detection among the elderly population. Future directions of Lebanese and Middle Eastern physicians must be focused on the implementation of adapted and personalized therapeutic strategies in the management of the growing caseload of frail, elderly cancer patients.

## Disclosures and Conflict of Interest Statements

All authors disclose no actual or potential conflicts of interest, including any financial, personal or other relationships with other people or organization that could influence this work.

## Author Contributions

Manuscript writing and approval: F. GH. Haddad, J. Kattan, Salim M. Adib
Review of literature: H. R. Kourie, E. El Rassy

## References

[1] Ageing|UNFPA—United Nations Population Fund. [Online]. Available: http://www.unfpa.org/ageing, Accessed date: 28 August 2016.
[2] Gosney MA. Clinical assessment of elderly people with cancer. Lancet Oncol Oct. 2005;6(10):790–7.
[3] Balducci L, Beghé C. Cancer and age in the USA. Crit Rev Oncol Hematol Feb. 2001;37(2):137–45.
[4] How has the world changed in the last 20 years?|UNFPA—United Nations Population Fund. [Online]. Available: http://www.unfpa.org/news/how-has-world-changed-last-20-years, Accessed date: 28 August 2016.
[5] Balducci L, Extermann M. Cancer and aging. An evolving panorama. Hematol Oncol Clin North Am Feb. 2000;14(1):1–16.
[6] Lichtman SM. Therapy insight: therapeutic challenges in the treatment of elderly cancer patients. Nat Clin Pract Oncol Feb. 2006;3(2):86–93.
[7] moph. [Online]. Available: http://www.moph.gov.lb, Accessed date: 12 June 2016.
[8] Shamseddine A, Saleh A, Charafeddine M, Seoud M, Mukherji D, Temraz S, et al. Cancer trends in Lebanon: a review of incidence rates for the period of 2003–2008 and projections until 2018. Popul Health Metr 2014;12(1):4.
[9] Palliative care for older adults: state of the art in Lebanon — JML/LMj. [Online]. Available: http://www.lebanesemedicaljournal.org/lmj/2016/04/06/palliative-care-for-older-adults-state-of-the-art-in-lebanon/, Accessed date: 18 December 2016.
[10] Lebanon — life expectancy at birth 2016|countryeconomy.com. [Online]. Available: http://countryeconomy.com/demography/life-expectancy/lebanon, Accessed date: 28 September 2016.
[11] Average annual percent change (AAPC) — Joinpoint Help System 4.3.1.0. [Online]. Available: https://surveillance.cancer.gov/help/joinpoint/setting-parameters/advanced-tab/average-annual-percent-change-aapc, Accessed date: 9 August 2016.
[12] National Vital Statistics Reports March 16, 2011;Vol. 59(4) (nvsr59_04.pdf).
[13] Final recommendation statement: prostate cancer: screening — US Preventive Services Task Force. [Online]. Available: https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/prostate-cancer-screening, Accessed date: 18 December 2016.
[14] Financial burden of cancer drug treatment in Lebanon — PubMed-NCBI. [Online]. Available: https://www.ncbi.nlm.nih.gov/pubmed/27509947, Accessed date: 18 December 2016.
[15] Haddad FG, Kourie HR, Adib SM. Trends in mammography utilization for breast cancer screening in a middle-eastern country: Lebanon 2005–2013. Cancer Epidemiol Dec. 2015;39(6):819–24.