Prediction of the Global Stomach Cancer Mortality in 2024

Jinyang Luo

University of Birmingham Joint Institute, Jinan University, Guangzhou, China

Keywords: Stomach Cancer, Incidence, Mortality, Prevention, Survival, Predictive Factors, Death Rate.

Abstract: Despite a huge decrease in stomach cancer incidence and mortality over recent decades, it remains a significant global health challenge. Stomach cancer was the fifth most typical factor contributing to cancer-related fatalities globally in 2020. This study employs linear regression to forecast stomach cancer mortality rates for 2024, considering historical data and various socio-economic and healthcare factors. The findings suggest a favorable trend in stomach cancer mortality for most countries, with notable declines in the number of deaths, and age-standardized death rate. At the same time, the percentage of stomach cancer deaths out of total deaths is increasing. The research highlights the impact of advancements in technology and medical treatments on reducing mortality rates and underscores the importance of early detection and prevention efforts. While predicting results. The COVID-19 pandemic's limitations and potential impacts on cancer detection and therapy are acknowledged in the report.

1   INTRODUCTION

Stomach cancer, also known as gastric cancer, was the fifth most common cause of death from cancer in both sexes and the world's fourth leading cause of cancer mortality in 2020 (WHO, 2020). As a result, stomach cancer continues to pose a serious threat to global health. Despite the medical knowledge and healthcare infrastructure have improving these years, the prognosis for stomach cancer patients continues to be grim, especially in cases when the disease is discovered at a terminal stage. To lessen the impact of this terrible disease, prompt intervention and effective prevention measures are important. In this situation, predictive modeling can be extremely useful for forecasting future trends in stomach cancer mortality rates.

A comprehensive review of historical trends should serve as the foundation for any projections of future mortality rates. The research examines current trends in stomach cancer mortality from 2017 to 2021 to determine whether death is declining or increasing. Additionally, despite variations in the overall levels of stomach fatality rates, this research examined whether the rate of decreases was similar for all eight nations worldwide.

The goal of this study is to use the linear regression method to forecast the mortality rate from stomach cancer worldwide in 2024. This research wants to construct a complete model that can offer predictions based on the death rates for this specific year using historical data as well as numerous socio-economic and healthcare indices. This forecast will be a useful tool for academics, healthcare workers, and policymakers as they develop plans and decide how best to use available funding to fight stomach cancer on a worldwide scale.

2   MATERIALS AND METHODS

The population statistics and official death certificates are taken from the WHO database for the years 2017 through 2021. This research considered the mortality of stomach cancer and other major cancers. After all, the number of deaths, age-standardized mortality rates, and mortality rate per 100,000 people for the year 2023 are estimated.

Forecasts of future changes in stomach cancer mortality were made in several research, some of which aimed at Europe and others at South America (Kuzmickiene and Everatt 2021, Thuler 2022, Ilic and Ilic 2022 & Santucci et al 2023). In general, lower mortality rates were expected. One research predicted a further decline of 9% for males and 4% for women in 2023 based on trends in cancer mortality in Latin America from 2015 to 2019 (Santucci et al 2023).

Some official death certification data for the

different country sites are considered: Iceland, Czechia, Spain, UK, Austria, Armenia, Australia, as well as the United States. For each country considered, the Death rate per 100,000 population from 1970 up to the most recent available year are included.

By comparing actual and anticipated deaths to those anticipated countries based on the Age-standardized death rate for 2017, this study calculated the number of deaths that might have been prevented for each nation from 2017 to 2021. All analyses were performed using the software Anaconda Navigator 2.4.2 and the Python platform jupyter lab 3.5.3.

Linear regression is a fundamental statistical method used for analyzing and modeling the relationship between two or more variables. It aims to establish a linear equation that best describes how

changes in one variable are associated with changes in another. The method assumes a linear relationship of the form $Y = aX + b$, where Y represents the dependent variable, while X denotes the independent variable, 'a' be the rate of change, and 'b' is the starting point. Through a process of fitting the line to observed data points, linear regression quantifies this relationship, allowing for predictions, trend analysis, and understanding the impact of variables on each other.

The linear programming has a short but rich history. It was first developed in the 1940s to solve planning problems in wartime operations that are too complicated. It was discovered three times independently, and each time differently because of

Table 1: Eight countries data set.

Country Name	Year	Number of Deaths	Percentage of stomach cancer deaths out of total deaths	Age-standardized death rate per 100,000 standard population	Death rate per 100000 population
Armenia	2021	432	1.25625218	9.78090325	14.55463328
Armenia	2020	367	1.01465303	8.52479372	12.38507946
Armenia	2019	420	1.60397174	9.69124847	14.17730133
Armenia	2018	418	1.62323793	9.83644899	14.07880967
Armenia	2017	478	1.76221198	11.22876509	16.40964516
Australia	2021	1208	0.70450052	2.46263015	4.7025704
Australia	2020	1182	0.73279603	2.51606686	4.60723713
Australia	2019	1184	0.70074928	2.58788842	4.6724146
Australia	2018	1140	0.71852664	2.52897275	4.56609245
Australia	2017	1161	0.72074645	2.67074956	4.7206248
Austria	2021	691	0.75139732	3.3488901	7.71935939
Austria	2020	753	0.82206138	3.67199341	8.44469092
Austria	2019	732	0.8778452	3.77525779	8.24543738
Austria	2018	750	0.89312295	3.88081335	8.48636417
Austria	2017	822	0.98715023	4.27446178	9.34614187
Czechia	2021	973	0.69554153	4.39508836	9.26591657
Czechia	2020	974	0.75335102	4.39986262	9.10267188
Czechia	2019	984	0.87574091	4.36877318	9.22270239
Czechia	2018	1014	0.89798087	4.6694277	9.54224514
Czechia	2017	973	0.87309207	4.5704224	9.18832439
Spain	2021	4838	1.07333653	4.35576109	10.22156521
Spain	2020	4917	0.99579566	4.42807411	10.38312529
Spain	2019	5011	1.19679104	4.58566779	10.63785523
Spain	2018	5053	1.18137758	4.67937252	10.81345609
Spain	2017	5154	1.2140685	4.86953496	11.07604152
United Kingdom	2020	3996	0.58013432	2.76250152	5.95719638
United Kingdom	2019	4110	0.68111876	2.84163165	6.15298872
United Kingdom	2018	4220	0.68652491	3.06572065	6.5371719
United Kingdom	2017	4318	0.71248364	3.06265292	6.53843887
Iceland	2021	11	0.47169811	1.80880867	2.95286159
Iceland	2020	17	0.73752711	2.79330877	4.63894036
Iceland	2019	20	0.8783487	3.42760116	5.54688085
Iceland	2018	13	0.57573074	2.37763498	3.68563778
Iceland	2017	14	0.62611807	2.40406606	4.07688421
United States of America	2020	11233	0.33197103	1.9405988	3.39362841
United States of America	2019	11092	0.38853343	1.94450844	3.37076347
United States of America	2018	11043	0.38894691	1.97765217	3.37607034
United States of America	2017	11158	0.39658746	2.02720808	3.43233566

155

the circumstances. The three discoverers were Leonid Vitalyevich Kantorovich, Tjalling Charles Koopmans, and George Bernard Dantzig. Then, in 1947, Dantzig invented the simplex method. In the same year, John von Neumann established the concept of duality. After all, it is widely applied in fields such as economics, finance, science, and machine learning for its simplicity and interpretability.

3 PREDICT RESULTS AND ANALYSIS

Table 1 compares observed data for the period of 2017–2019 with the percentage of cause-specific deaths out of all deaths from stomach cancer in the eight chosen countries for the year 2020–2021 (some countries' data are only from 2017 through 2020 due to the absence of data for 2021).

The options contain the number of deaths, Percentage of stomach cancer deaths out of total deaths, Age-standardized death rate per 100,000 standard population, and Death rate per 100,000 population.

- The eight nations under investigation are projected to have favorable mortality rates from stomach cancer overall, with falls in the number of deaths between 2017 and 2021 ranging from −46 in Armenia and −131 in Austria (Figure 1 and Figure 2). At the same time, the US showed the highest rates in both periods, with several deaths 11233 in 2020 and a projected 75 more than in 2017, while Iceland reported the lowest ones, 14 people in 2017 and 11 in 2021.

- Table 1 reports the age-standardized death rate per 100,000 standard population from stomach cancer in both sexes at all ages in 2017-2021. Downward trends were observed and predicted in both sexes in most countries (Lin et al 2021).

- Figure 2 below shows the number of deaths trend between 2017 and 2021 for eight different countries. During the 21 years considered, it is observed that a total of nearly 11,000 deaths in the US in 2020, which has decreased by 8.3% compared to the number in 2000. At the same time, the UK and Spain showed a similar downward pattern during the period, with 2,500 deaths and 1,000 deaths dropped respectively in the UK and Spain.
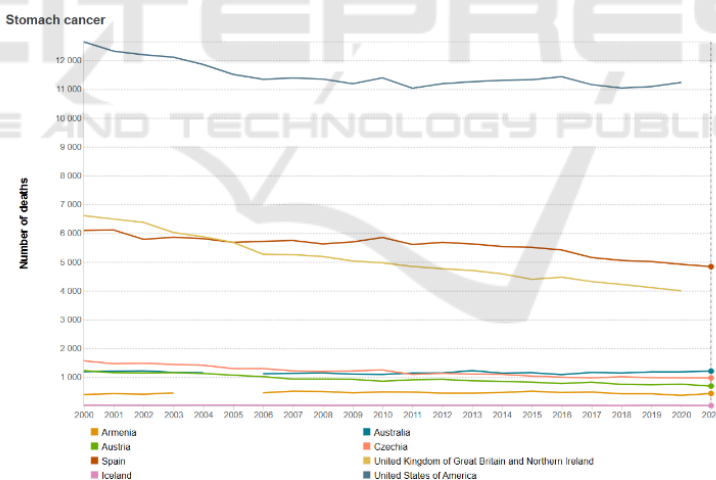

Figure 1: Eight countries' number of deaths trend.

Table 2: The Prediction Data in 2024 for Eight Different Countries.

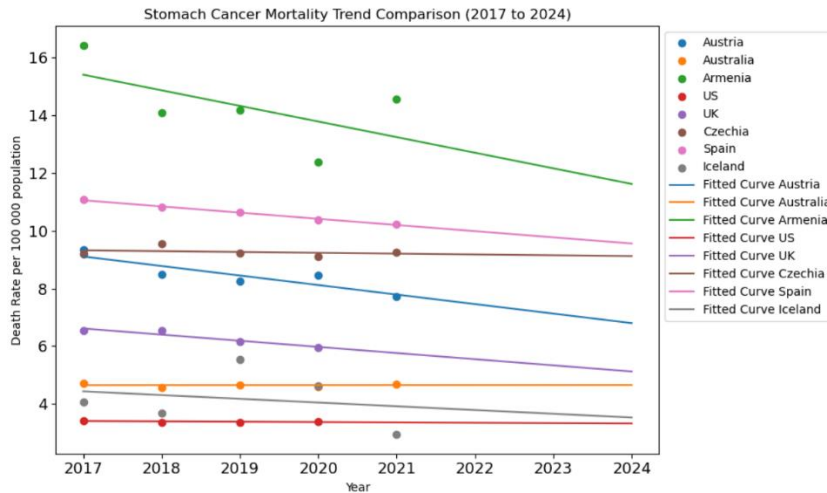| Region	prediction in 2024	Actual Death Rate in 2021
Austria	6.80%	7.72%
Australia	4.66%	4.70%
Armenia	11.62%	14.55%
US	3.33%	3.39%
UK	5.13%	5.96%
Czechia	9.12%	9.27%
Spain	9.56%	10.22%
Iceland	3.53%	2.95%

Figure 2: Eight countries' death rate figure prediction per 100,000 population in 2024.

4 DISCUSSION

1) Except for Australia and Czechia, all of the countries under consideration are expected to have a decline in the overall mortality from stomach cancer according to Table II. The US showed the lowest death rate per 100000 population: 3.39% in 2020 and 3.33% predicted in 2024 while Armenia had the highest ones, 14.55% in 2021 and 11.62% estimated in 2024.

2) Except for Australia and the US, all nations expect a lower death rate in 2024 compared to 2017-2021 (Sung et al 2021). The UK showed the largest decrease in the absolute number of cancer deaths, almost 7.4% since 2017-2021, while Australia had the largest percent increase, over 4%.

3) No matter how high or low the baseline risk for stomach cancer was, the incidence and death trends for the disease in both teenagers and adults are practically unanimous. In a few nations, stomach cancer mostly affects the elderly, with approximately 90% of cases being discovered beyond the age of 55. In both sexes, the death rate from stomach cancer rises steadily with age and is double in those over 70 (Anderson et al 2018). It should be noted that these projections only consider the demographic changes expected to occur in the mentioned countries.

4) However, a slightly reduced risk is linked with higher levels of education and overall fruit and vegetable consumption. The drop in stomach cancer mortality that has been seen and expected across all age groups and nations taken into account is due to beneficial changes in these risk variables, including a decline in the advancements in food preservation and storage (Yoo et al 2020).

Few studies have looked at long-term changes in the incidence rates of stomach cancer from a worldwide viewpoint. Data from 108 cancer registries across 43 nations on five continents were recently evaluated, and the results showed that 41 of the 43 countries under study had declining incidence rates through 2030 (Sung et al 2021). Other writers have issued a warning over a rise in newly diagnosed instances of stomach cancer in individuals under 50 who reside in industrialized nations, with Helicobacter pylori infection being the primary cause (Arnold et al 2020 & Waldum et al 2018).

5) Predicted results should be evaluated cautiously due to the model's limitations, which include its inability to identify significant long-term cohort effects or very recent changes in trends. However, because the research is restricted to large countries, this problem of excessive random variation is less of an issue. Except for the US and the UK, errors in our estimates were less than 5% for all cancers combined. This is due to the WHO database's integrity of observed cancer deaths for 2021.

6) The estimations presented here do not account for the effects of the coronavirus causing severe acute respiratory syndrome. While the full extent of the coronavirus disease (COVID) 2019 pandemic's effects in various parts of the world is currently unknown, delays in diagnosis and treatment are anticipated to first lead to a brief reduction in cancer incidences followed by an increase in the number of advanced-stage diagnoses and cancer mortality (Bonequi et al 2013 & Heer et al 2020).

5 CONCLUSION

7) Stomach cancer, which ranks fifth for incidence and fourth for fatality globally, will continue to be a major cancer in the globe in 2020, with over 1 million new cases and an estimated 769000 deaths.

8) Total stomach cancer mortality is predicted to decrease in all countries considered, except Czechia and Australia. The US showed the lowest death rate per 100000 population: 3.39% in the number of cancer deaths, almost 7.4% since 2017-2021, while Australia had the largest percent increase, over 4%.

9) Compared to other areas worldwide, the US ranked first for stomach cancer's number of deaths (with death rates around 3.39%, which ranked fourth), following Spain's 4838 individuals (with death rates of 10.22%, which ranked third) and the UK people ranked third in number of death.

10) Moreover, trends in all countries showed a downward movement during the 2000-2021 period, which means that advancements in both technology and medical treatments have led to a significant decline in the mortality rate and number of deaths associated with stomach cancer. Higher technologies such as enhanced early detection methods, more precise surgical techniques, and innovative therapies have collectively contributed to this positive trend. As a result, fewer lives are being lost to this devastating disease.

REFERENCES

I. Kuzmickiene, R. Everatt, Trends and age-period-cohort analysis of upper aerodigestive tract and stomach cancer mortality in Lithuania, Public Health, 2021, vol.196, pp.62-68.

LCS Thuler, The Epidemiology of Stomach Cancer.In: Morgado-Diaz JA, editor. Gastrointestinal Cancers. Brisbane (AU): Exon Publications, 2022.

M. Ilic, I. Ilic. Epidemiology of stomach cancer. World J Gastroenterol. 2022, vol.28, no.12, pp.1187-1203.

C. Santucci, M. Malvezzi, F. Levi, et al. Cancer mortality predictions for 2023 in Latin America with focus on stomach cancer. Eur J Cancer Prev. 2023, vol.32, no.4, pp.310-321.

Y. Lin, Y. Zheng, HL. Wang, et al. Global Patterns and Trends in Gastric Cancer Incidence Rates (1988–2012) and Predictions to 2030. Gastroenterology, 2021, vol. 161, no. 1, pp.116–127.e8.

H. Sung, J. Ferlay, RL. Siegel, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin, 2021, vol.71, pp.209–249.

WF. Anderson, CS. Rabkin, N. Turner, et al. The changing face of noncardia gastric cancer incidence among US non-Hispanic Whites. J Natl Cancer Inst, 2018, vol.110, pp.608–615.

JY. Yoo, HJ. Cho, S. Moon, et al. Pickled Vegetable and Salted Fish Intake and the Risk of Gastric Cancer: Two Prospective Cohort Studies and a Meta-Analysis. Cancers (Basel), 2020, vol.12.

M. Arnold, JY. Park, MC. Camargo, et al. Is gastric cancer becoming a rare disease? A global assessment of predicted incidence trends to 2035.

HL. Waldum, R. Fossmark. Types of Gastric Carcinomas. Int J Mol Sci \, 2018, pp.19.

P. Bonequi, F. Meneses-Gonzalez, P. Correa, et al. Risk factors for gastric cancer in Latin America: a meta-analysis. Cancer Causes Control, 2013, vol.24, pp.217–231.

EV. Heer, AS. Harper, H. Sung, et al. Emerging cancer incidence trends in Canada: the growing burden of young adult cancers. Cancer. 2020, vol.126, pp.4553–4562.