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ABSTRACT

This article provides a comprehensive overview of the current landscape of gastrointestinal cancer in Guatemala. Authored by leading specialists in oncology and hematology at the Guatemalan Social Security Institute, it highlights the significant public health burden posed by gastrointestinal malignancies, particularly within vulnerable communities. The report examines the prevalence, risk factors, and mortality associated with major cancer types such as gastric, liver, colon, pancreatic, and esophageal cancers. With a high rate of Helicobacter pylori infection and environmental exposures contributing to increased risk, the analysis underscores the central roles of national institutions like IGSS and INCAN in addressing diagnosis, treatment, and follow-up. Despite strategic efforts, access to specialized care remains a challenge, resulting in late diagnoses and high mortality. The article concludes by reviewing current strategies, institutional responses, and the urgent need for improved prevention, early detection, and comprehensive care to mitigate the disease's impact nationwide.

INTRODUCTION

Gastrointestinal cancer represents a significant public health problem in Guatemala due to its high incidence and high mortality rate[1,2]. This disease disproportionately affects the most vulnerable populations, such as rural and low-income communities, where limitations in access to specialized medical services make it difficult to diagnose it early and treat it in a timely manner[3]. Among the most prevalent types are gastric, liver, colon, pancreatic, and esophageal cancers, each with specific risk factors including Helicobacter pylori infection, excessive alcohol consumption, improper diet, and exposure to pollutants such as aflatoxins and wood smoke[4].

In response to this crisis, Guatemala has implemented various strategies through key institutions such as the Guatemalan Social Security Institute (IGSS) and the National Cancer Institute (INCAN)[5]. These entities play a central role in the diagnosis, treatment, and follow-up of cancer patients, although they face significant challenges due to the growing demand for cancer services. This document analyzes the

current situation of gastrointestinal cancer in Guatemala, addressing its epidemiology, risk factors, challenges in diagnosis and treatment, as well as the prevention strategies necessary to mitigate its impact on the population.

CURRENT GASTROINTESTINAL CANCER TREATMENT IN GUATEMALA

Gastrointestinal cancer in Guatemala represents a significant public health concern, with an associated high incidence and mortality. According to data from the National Institute of Statistics (INE), gastric cancer is one of the leading causes of cancer death in the country, especially in men over 35 years of age[6].

Infection by Helicobacter pylori, a bacterium associated with the development of gastric cancer, has a prevalence of 65% in the Guatemalan population. Studies indicate that infected patients have a double risk of developing intestinal gastric cancer compared to the diffuse type[7].

In terms of mortality, an increase in the years of life potentially lost due to gastric and liver cancer has been observed, representing more than 35% of cancer deaths in the period analyzed[8].

To address this problem, Guatemala has several institutions specialized in the diagnosis and treatment of gastrointestinal cancer, including the Guatemalan Social Security Institute.

The Guatemalan Social Security Institute (IGSS) serves approximately 18% of the Guatemalan population. The institution has a network of medical units nationwide that offer General Medicine and Internal Medicine services. In cases of suspected cancer, patients are referred to specialized units with diagnostic capacity in oncology. Specialized care is centralized in the Outpatient Disease Unit, which treats approximately 7,000 patients a year, with an average of 130 patients per day.

Of the total number of cancer patients, 40% are in active treatment through chemotherapy, radiotherapy and targeted therapies, while the remaining 60% are in follow-up protocols that can be extended up to five years after completing treatment[5].

Since 2022, the IGSS has been operating a Modular Unit adjacent to the Peripheral Unit of Zone 11, in Guatemala City. This specialized center is designed to care for patients with cancer, solid and hematologic malignancies. The unit has high-tech beds and equipment, as well as a multidisciplinary team made up of specialists in oncology, hematology, nursing, psychology, social work and diagnostic support personnel. This comprehensive care model reinforces the Institute's commitment to specialized and humanized cancer management, significantly improving the quality of life of its members[9].

FROM THE ANALYSIS OF IGSS CANCER CARE IN THE PERIOD 2019 – 2024

During the period analyzed, the Guatemalan Social Security Institute (IGSS) treated an annual average of 44,000 patients diagnosed with different types of cancer, as detailed in Table 1. In the years 2022, 2023 and 2024, a significant increase in the number of patients treated was observed, increasing from 46,000 to 54,000, which represents a growth of 17% in that period.

In cumulative terms, between 2019 and 2024, 983,000 consultations were made to beneficiaries diagnosed with cancer, reflecting a 23% increase in the volume of consultations between 2022 and 2024. This increase shows a positive trend towards the recovery of pre-pandemic levels of care, increasing from 46,000 to 54,000, which represents a growth of 17% in that period[10].

The health emergency caused by the COVID-19 pandemic forced the Government to implement measures aimed at reducing infections, including the temporary closure of outpatient consultations in the IGSS medical units for several months. This situation significantly affected the registration of new patients, causing a decrease in the number of cancer diagnoses during the years 2020 and 2021[11].

In 2022, the full reopening of outpatient clinics throughout the country allowed the IGSS to resume pre-pandemic levels of care. This translated into an increase in the detection

and follow-up of cancer patients, marking a recovery in the services provided and the scope of cancer care programs. These data reflect both the impact of the health crisis on medical care and the resilience of the system to ensure continuity in cancer diagnosis and treatment.

So far in 2024, these specialized units attended between 13% and 15% of the total consultations related to cancer diagnoses that the IGSS has provided in the period 2019-2023. This percentage shows the importance of these facilities within the Institute's cancer care structure, as well as their contribution to the management and follow-up of patients who are entitled to this disease. The strategic distribution of these units guarantees access to specialized services and reinforces the IGSS's capacity to efficiently meet the growing demand in oncology[11].

The number of new patients diagnosed with cancer showed an approximate increase of 24% during the period 2021-2024. This increase is reflected in the volume of first consultations provided, indicating an improvement in the detection and registration of new cases, as well as a greater response capacity on the part of the IGSS's specialized oncology medical units.

In relation to the types of cancer diagnoses, the main cause of medical attention was for benign tumors, followed by breast cancer. During the first 10 months of 2024, these diagnoses represented 54% and 16%, respectively, of the total care provided. Together, the ten main causes of care accounted for 67% of the total number of consultations related to the diagnosis and treatment of cancer in that year, highlighting the importance of these pathologies in the demand for cancer services[12].

Table 1: The incidence and mortality of gastrointestinal cancer in Guatemala as of 2022

Reference [3]

Incidence	**n**	**%**
Liver	2118	40%
Stomach	1766	33%
Colon	894	17%
Pancreas	350	7%
Esophagus	150	3%
Total	5278	
Mortality	**n**	**%**
Liver	2036	44%
Stomach	1556	34%
Colon	544	12%
Pancreas	321	7%
Esophagus	139	3%
Total	4596	

LIVER CANCER IN GUATEMALA: A WORRYING OUTLOOK

Liver cancer is one of the main causes of cancer mortality in Guatemala, associated with specific risk factors that disproportionately affect the population. This type of cancer, also known as hepatocellular carcinoma (HCC), is the most common of the primary liver tumors and represents a significant challenge to the nation's health system[13].

Epidemiology in Guatemala

In Guatemala, the prevalence of liver cancer is closely linked to factors such as the high incidence of chronic hepatitis B (HBV) and hepatitis C (HCV) infections, excessive alcohol consumption, and exposure to aflatoxins present in poorly stored foods, such as corn and beans. These risk factors are more common in rural and marginalized communities, where lack of access to medical services makes early detection and treatment difficult[14].

According to data from the Ministry of Public Health and Social Assistance (MSPAS), liver cancer is one of the main causes of cancer mortality in men over 40 years of age. Statistics show that many patients are diagnosed in advanced stages, complicating treatment and increasing mortality rates[15].

Risk Factors

Liver cancer in Guatemala is strongly influenced by the prevalence of chronic hepatitis B and C virus infections. Lack of adequate vaccination against hepatitis B, especially in rural areas, contributes significantly to the development of this disease. In addition, alcohol consumption is a major risk factor, particularly in men, as it can lead to liver cirrhosis, a precursor condition to hepatocellular carcinoma[16].

Another significant factor is exposure to aflatoxins, carcinogens produced by fungi that contaminate staple foods. Poverty and inadequate agricultural practices perpetuate this exposure in vulnerable communities[16].

Challenges in Diagnosis and Treatment

Limited access to specialized health services is one of the biggest obstacles to fighting liver cancer in Guatemala. Diagnostic methods, such as abdominal ultrasounds and alpha-fetoprotein (AFP) tests, are not widely available, especially in rural areas. This causes patients to be diagnosed in advanced stages, when treatment options are more limited[17].

Treatment of liver cancer in Guatemala includes surgery, chemoembolization and, in selected cases, liver transplantation. However, these procedures are expensive and are only available in medical centers in the capital. In addition, the lack of awareness campaigns about risk factors contributes to the widespread lack of knowledge about the disease.

Prevention and Recommendations

To address this problem, it is essential to implement prevention strategies, such as expanding vaccination against hepatitis B, improving food storage to avoid exposure to aflatoxins, and promoting alcohol consumption reduction programs. It is also crucial to strengthen early detection systems and ensure equitable access to treatment[13].

In summary, liver cancer in Guatemala reflects a public health crisis rooted in structural inequalities. Investing in prevention, early diagnosis and access to treatment is vital to reduce the burden of this disease in the country.

GASTRIC CANCER IN GUATEMALA

Gastric cancer is one of the leading causes of cancer mortality in Guatemala and represents a significant public health problem. This disease mainly affects men over 40 years of age and is characterized by high mortality due to late diagnosis and limitations in access to specialized health services[18].

Epidemiology

In Guatemala, gastric cancer is one of the most prevalent cancers, particularly in rural areas and among low-income populations. According to data from the Guatemalan Institute of Social Security, gastric cancer is one of the leading causes of cancer death in men, with rates that exceed those of other types such as lung and prostate cancer. The incidence is notably higher in indigenous and rural communities, where risk factors are more present and medical resources are limited[19].

Risk Factors

Gastric cancer in Guatemala is closely related to socioeconomic, dietary, and genetic factors. Helicobacter pylori infection is one of the main risk factors, and its prevalence in the Guatemalan population is alarmingly high, reaching figures of 65%. This bacterium, associated with chronic inflammation of the stomach, can evolve into precancerous conditions and, eventually, gastric cancer[20].

In addition, diets rich in salty, fermented and smoked foods, common in rural areas, contribute significantly to the development of this disease. Other risk factors include smoking, alcohol consumption and exposure to pollutants such as wood smoke, widely used in rural areas. Genetics and family history also play an important role in the predisposition to gastric cancer[21].

Challenges in Diagnosis and Treatment

Early diagnosis of gastric cancer is a major challenge in Guatemala. Many people mistake initial symptoms, such as indigestion, heartburn, or abdominal pain, for common, less serious illnesses, delaying seeking medical attention. In addition, diagnostic services, such as upper endoscopies and biopsies, are scarce and expensive, especially in rural areas[7].

Treatment for gastric cancer includes surgery, chemotherapy, and, in some cases, radiation therapy. However, most patients arrive at health services in advanced stages, when treatment options are limited and less effective. Institutions such as INCAN are the main care centers for cancer patients, but their capacity is insufficient to meet the high demand, which leaves many patients without adequate treatment[22].

Prevention and Recommendations

Gastric cancer prevention in Guatemala requires a comprehensive approach that includes the eradication of Helicobacter pylori, education campaigns to encourage healthy eating habits, and access to preventive medical services. It is also essential to strengthen the health system to ensure early diagnosis and improve access to treatment[23].

In conclusion, stomach cancer in Guatemala reflects a combination of social, economic, and health challenges. To reduce its impact, it is critical to address both risk factors and inequalities in access to health care.

COLON CANCER IN GUATEMALA: A GROWING PROBLEM

Colon cancer is one of the most common oncological diseases in Guatemala and a public health problem that affects both men and women, mainly from the age of 50. Its increasing incidence is linked to factors such as population ageing, inadequate eating habits and sedentary lifestyles, aggravated by limitations in access to health care, especially in rural and marginalised communities[18].

Epidemiology

In Guatemala, colon cancer ranks high among the leading causes of cancer mortality. According to data from Globocan, this disease predominantly affects older people, although cases have also been reported in young people with genetic predisposition or inflammatory bowel diseases. Incidence and mortality rates are higher in rural areas, where lack of access to health services and early detection programs contributes to diagnosis in advanced stages[24].

Risk Factors

The development of colon cancer is influenced by several risk factors, both modifiable and non-modifiable. Among the modifiable factors are:

1 . Unhealthy diet: Excessive consumption of red and processed meats, along with a low intake of fiber and vegetables, increases the risk of this disease.

2 . Sedentary lifestyle: Lack of regular physical activity contributes to obesity, a major risk factor.

3 . Alcohol and tobacco use: Both are linked to an increased risk of colorectal cancer.

On the other hand, non-modifiable factors include a family history of colorectal cancer, genetic predisposition, and the presence of diseases such as ulcerative colitis or Crohn's disease[25].

Diagnosis and Treatment

Early diagnosis of colon cancer is critical to improving survival rates. However, in Guatemala, screening programs are limited. Screening tests, such as fecal occult blood and colonoscopy, are not widely available in the public health system, leading to delayed diagnosis in most cases[26].

Treatment depends on the stage of the disease. In early stages, surgery to resect the affected segment of the colon is the main option. In advanced stages, it is combined with chemotherapy and, in some cases, radiation therapy. Institutions such as INCAN and the Guatemalan Social Security Institute (IGSS) offer specialized care, although the capacity of these centers is limited in the face of high demand[25].

Prevention and Challenges

Colon cancer prevention in Guatemala requires a comprehensive strategy that includes:

1 . Promotion of healthy diets rich in fiber, fruits and vegetables.

2 . Education about the importance of physical activity and reducing tobacco and alcohol use.

3 . Implementation of early detection programs to identify precancerous polyps and treat the disease in its early stages.

Despite these efforts, significant challenges remain, including a lack of public awareness, unequal access to medical services, and a shortage of resources in the health system[27].

PANCREATIC CANCER IN GUATEMALA: CHALLENGES AND REALITY

Pancreatic cancer is one of the most aggressive and lethal malignancies in Guatemala, characterized by its late diagnosis and high mortality. Although it is not as common as other types of cancer, its impact is significant due to the difficulty of detecting it in early stages and the limited effectiveness of treatments in advanced stages. This cancer represents a challenge for the country's health system and a growing concern in terms of prevention and medical care[28].

Epidemiology

In Guatemala, pancreatic cancer occupies an important place among the malignant gastrointestinal diseases. Its incidence has been increasing in recent years, especially among people over 50 years of age. Although it affects both men and women, the prevalence tends to be slightly higher in men. Most diagnosed cases occur in advanced stages due to the absence of specific symptoms in the early stages[29].

Risk Factors

Pancreatic cancer is associated with multiple risk factors, including:

1 . Genetic factors: A family history of pancreatic cancer or genetic syndromes increases the risk.

2 . Lifestyle habits: Smoking is one of the main modifiable risk factors, along with excessive alcohol consumption. Obesity and type 2 diabetes are also associated with an increased risk.

3 . Diet and sedentary lifestyle: A diet high in fat and processed foods, combined with little physical activity, increases the likelihood of developing this disease.

4 . Chronic inflammation: Chronic pancreatitis, a prolonged inflammation of the pancreas, is an important predisposing factor[30].

Diagnosis and Treatment

Diagnosing pancreatic cancer is challenging in Guatemala due to the lack of specific symptoms and the limited availability of advanced diagnostic technologies in rural areas. The main tools include computed tomography (CT), magnetic resonance imaging (MRI), and endoscopic ultrasonography, but their access is restricted to urban centers and specialized hospitals such as the National Cancer Institute (INCAN)[31].

Treatment depends on the stage of the disease at the time of diagnosis:

1 . Surgery: It is the only curative option, but it is only viable in a minority of cases due to late diagnosis.

2 . Chemotherapy: It is used as a palliative treatment or complementary to surgery in more advanced stages.

3 . Palliative care: In more advanced cases, the focus is on relieving symptoms and improving the patient's quality of life.

Prevention and Challenges

Pancreatic cancer prevention in Guatemala requires a comprehensive approach that includes promoting healthy lifestyles, such as avoiding tobacco and alcohol use, maintaining a healthy weight, and properly treating diabetes and chronic pancreatitis.

Major challenges include a lack of public awareness of risk factors, unequal access to medical services, and the limited capacity of the health system to offer advanced diagnostics and treatments.

Implementing early detection strategies and promote education on healthy lifestyle habits to reduce their impact on the population[32].

ESOPHAGEAL CANCER IN GUATEMALA: A PUBLIC HEALTH CHALLENGE

Esophageal cancer is one of the most aggressive malignancies of the digestive tract and, although its incidence in Guatemala is lower compared to other types of gastrointestinal cancer, it represents a significant problem due to its high mortality. This type of cancer is usually diagnosed in advanced stages, which makes it difficult to treat and significantly reduces survival rates[33].

Epidemiology in Guatemala

Esophageal cancer in Guatemala mainly affects men over 50 years of age, although cases have also been reported in women. Most patients come from rural areas, where risk factors are more prevalent and access to specialized health services is limited.

There are two main types of esophageal cancer: squamous cell carcinoma, which is more common in Guatemala and is associated with tobacco and alcohol use, and adenocarcinoma, which is associated with chronic gastroesophageal reflux and obesity[7].

Risk Factors

The development of esophageal cancer is related to several factors, some of which are prevalent in Guatemala:

1 . Tobacco and alcohol use: Both factors are the main causes of squamous cell carcinoma. In rural areas, where artisanal alcohol consumption is frequent, the risk is even greater.

2 . Gastroesophageal reflux and Barrett's esophagus: Prolonged exposure to stomach acid can lead to precancerous changes in the lining of the esophagus, increasing the risk of adenocarcinoma.

3 . Diet and nutrition: Vitamin and mineral deficiency, along with a diet low in fruits and vegetables, contribute to the risk of developing this disease.

4 . Exposure to wood smoke: In Guatemala, the use of firewood for cooking in enclosed spaces can be an additional factor in rural communities.

5 . Genetic factors: Although less common, family history may also play a role in the predisposition to esophageal cancer[34,35].

Diagnosis and Treatment

Early diagnosis of esophageal cancer is rare in Guatemala, as early symptoms, such as difficulty swallowing (dysphagia), weight loss, and chest pain, are often mistaken for other conditions. Tests such as endoscopy and biopsies are essential for an accurate diagnosis, but access to them is limited in rural areas and in public institutions[36].

Treatment depends on the stage of the disease at the time of diagnosis:

1 . Surgery: This is the main option in early stages and may include partial or total resection of the esophagus.
2 . Chemotherapy and radiation therapy: In advanced stages, these treatments are used to shrink the tumor and relieve symptoms.

3 . Palliative care: In terminal cases, the focus is on improving the patient's quality of life,

relieving pain and facilitating food intake through esophageal stents[36].

Prevention and Challenges

Esophageal cancer prevention in Guatemala requires a comprehensive approach that addresses risk factors:

. Awareness campaigns: Educate the population about the effects of tobacco, alcohol and chronic acid reflux.

. Promotion of healthy diets: Encourage the consumption of fruits and vegetables rich in antioxidants.

. Improving access to medical services: Implementing early detection programs and ensuring the availability of diagnostic technologies such as endoscopy in public hospitals[37].

Awareness campaigns: Educate the population about the effects of tobacco, alcohol and chronic acid reflux.

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Improving access to medical services: Implementing early detection programs and ensuring the availability of diagnostic technologies such as endoscopy in public hospitals[37].

CONCLUSIONS

Gastrointestinal cancer represents one of the greatest challenges for the health system in Guatemala due to its high incidence and mortality. Social and economic inequalities exacerbate this situation, especially in rural and marginalized communities, where access to medical services is limited. Among the most prevalent cancers are gastric, liver, pancreatic, and esophageal, each with specific risk factors such as Helicobacter pylori infection, excessive alcohol consumption, unhealthy diets, and exposure to environmental pollutants[38].

Despite the efforts of institutions such as the Guatemalan Social Security Institute (IGSS) and the National Cancer Institute (INCAN), significant challenges persist in the early detection, diagnosis, and treatment of these diseases. The COVID-19 pandemic exacerbated these difficulties, but recovery strategies have shown positive advances in the capacity to care for and detect cases.

It is essential to strengthen prevention initiatives through education campaigns on risk factors, improvement in socioeconomic conditions and the implementation of effective screening programs. In addition, a comprehensive approach is required that ensures equitable access to specialized services and the use of advanced technologies for diagnosis and treatment.

Finally, investment in medical infrastructure and the training of personnel trained in oncology are key elements to reduce the burden of gastrointestinal cancer in Guatemala. Addressing this problem from a multidimensional approach is essential to improve health outcomes and the quality of life of patients in the country.

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REFERENCES

1 . De García M, León D. Caracterización del cáncer gástrico en Guatemala. 2015

2 . Instituto Nacional de Estadística. Resultados de la búsqueda de «CANCER GASTRICO». Accessed: Jun. 23, 2025.

3 . National Institute of Statistics (Guatemala)
World Health Organization (WHO). Guatemala Source: Globocan 2020.

4 . WHO
Karimi P, Islami F, Anandasabapathy S, Freedman ND, Kamangar F. Gastric cancer: Descriptive epidemiology, risk factors, screening, and prevention. Cancer Epidemiol Biomarkers Prev. 2014;23(5):1003-1012. doi:10.1158/1055-9965.EPI-13-1057

5 . Instituto Guatemalteco de Seguridad Social (IGSS). Informe Anual de Labores 2023. [Internet]. Accessed: Jun. 23, 2025.

6 . Show Citations
IGSS Guatemala
SEER Cancer Statistics. Cáncer de estómago: datos estadísticos sobre el cáncer. \[Internet]. Accessed: Jun. 23, 2025.

7 . National Institute of Statistics
Vista de Caracterización del cáncer gástrico en Guatemala [Internet]. Accessed: Jun. 23, 2025.

8 . University of San Carlos of Guatemala
Mamun TI, Younus S, Rahman MH. Gastric cancer—Epidemiology, modifiable and non-modifiable risk factors, challenges and opportunities: An updated review. Cancer Treat Res Commun. 2024;41:100845. DOI:10.1016/J.CTARC.2024.100845

9 . Instituto Guatemalteco de Seguridad Social (IGSS). El Hospital Modular Zona 11 pone a disposición de los pacientes dos nuevos quirófanos – Noticias IGSS. [Internet]. Accessed: Jun. 23, 2025.

10 . IGSS Guatemala
Instituto Guatemalteco de Seguridad Social (IGSS). El IGSS es todo un referente en la atención oncológica – Noticias IGSS. [Internet]. Accessed: Jun. 23, 2025.

11 . IGSS Guatemala
Instituto Guatemalteco de Seguridad Social (IGSS). Boletín Estadístico de Prestaciones en Salud. [Internet]. Accessed: Jun. 23, 2025.

12 . IGSS Guatemala
Instituto Guatemalteco de Seguridad Social (IGSS). La detección temprana del cáncer de mama es fundamental para la ganar la batalla a esta enfermedad – Noticias IGSS. [Internet]. Accessed: Jun. 23, 2025.

13 . IGSS Guatemala
Kihn-Alarcón AJ, Toledo-Ponce MF, Velarde A, Xu X. Liver cancer in Guatemala: An analysis of mortality and incidence trends from 2012 to 2016. J Glob Oncol. 2019;5(5)\:JGO.18.00179. DOI: 10.1200/JGO.18.00179

14 . Alvarez CS, et al. Aflatoxin B1 exposure and liver cirrhosis in Guatemala: a case–control study. BMJ Open Gastroenterol. 2020;7(1)\:e000380. DOI: 10.1136/BMJGAST-2020-000380

15 . Distribution of liver cancer deaths in Guatemala from 2012 to 2016. [Internet]. Accessed: Jun. 23, 2025.

16 . Liver cancer deaths
Aflatoxins and other risk factors for liver cancer, in Guatemala. [Internet]. Accessed: Jun. 23, 2025.

17 . Institute of Nutrition of Central America and Panama
Pages J, et al. Hepatocellular carcinoma surveillance: Current challenges in Latin America. Ann Hepatol. 2025;101935. DOI: 10.1016/J.AOHEP.2025.101935

18 . Ferlay J. Statistics at a glance, 2022 Top 5 most frequent cancers: Number of new cases 17,801. Global Cancer Observatory: Cancer Today. Lyon, France: International Agency for Research on Cancer; [cited 2025 Jun 23].

19 . International Agency for Research on Cancer
Tso J, Al-Qaraghli M, Galeas S, Abidalhassan MF, Gaskill CE. Gastric cancer in Central America: a scoping review. Ecancermedicalscience. 2025;19:1834. DOI:

10.3332/ECANCER.2025.1834

20 . Fernandez-Botran R, et al. Seroprevalence of Helicobacter pylori/CagA antibodies in Guatemalan gastric cancer patients: Association of seropositivity with increased plasma levels of pepsinogens but not soluble urokinase plasminogen activator receptor. Am J Trop Med Hyg. 2020;103(1):260. DOI: 10.4269/AJTMH.19-0934

21 . Ng R, Sutradhar R, Yao Z, Wodchis WP, Rosella LC. Smoking, drinking, diet, and physical activity—modifiable lifestyle risk factors and their associations with age to first chronic disease. Int J Epidemiol. 2019;49(1):113. DOI: 10.1093/IJE/DYZ078

22 . American Cancer Society. Stomach cancer treatment choices by stage. [Internet]. Accessed: Jun. 23, 2025.

23 . American Cancer Society
Xu X, Hu Y, Lv N. Eradication of Helicobacter pylori reduces gastric cancer risk by preventing gastric mucosal atrophy and intestinal metaplasia. [Internet]. Xiahe Publishing; Dec. 2024;3(4):227-229.

24 . Xiahe Publishing
Sawicki T, Ruszkowska M, Danielewicz A, Niedźwiedzka E, Arłukowicz T, Przybyłowicz KE. A review of colorectal cancer in terms of epidemiology, risk factors, development, symptoms, and diagnosis. Cancers (Basel). 2021;13(9):2025. DOI: 10.3390/CANCERS13092025

25 . Flores Münchmeyer MW, Calel Anaya ME, Ajché J. Caracterización epidemiológica del cáncer colorrectal en el Instituto Guatemalteco de Seguridad Social (IGSS). REV GUATEM CIR. 2020. [Internet]. Accessed: Jun. 23, 2025.

26 . Colorectal cancer screening in the Americas: Situation and challenges. [Internet]. [cited 2025 Jun 23].

27 . Pan American Health Organization
Cama A, Kim H, Melio A, Simianu V, Mankaney G. Challenges and opportunities for colorectal cancer prevention in young patients. Cancers. 2025;17(12):2043. DOI: 10.3390/CANCERS17122043

28 . Pancreas cancer in Guatemala. [Internet]. Accessed: Jun. 23, 2025.

29 . World Health Rankings
Rawla P, Sunkara T, Gaduputi V. Epidemiology of pancreatic cancer: Global trends, etiology, and risk factors. World J Oncol. 2019;10(1):10. DOI: 10.14740/WJON1166

30 . Capasso M, et al. Epidemiology and risk factors of pancreatic cancer. Acta Bio Medica: Atenei Parmensis. 2018;89(Suppl 9):141. DOI: 10.23750/ABM.V89I9-S.7923

31 . Kikuyama M. A novel diagnostic imaging method for the early detection of pancreatic cancer. Diagnostics. 2023;13(12):2080. DOI: 10.3390/DIAGNOSTICS13122080

32 . Winship Cancer Institute of Emory University. Pancreatic cancer prevention. [Internet]. Accessed: Jun. 23, 2025.

33 . Winship Cancer Institute of Emory University
Wang Y, Mukkamalla SKR, Singh R, Lyons S. Esophageal cancer. Essence of Anesthesia Practice E-Book. 2024;65. DOI: 10.1016/B978-1-4377-1720-4.00056-X

34 . Rock CL, et al. American Cancer Society guideline for diet and physical activity for cancer prevention. CA Cancer J Clin. 2020;70(4):245-271. DOI: 10.3322/CAAC.21591

35 . Esophageal cancer screening (PDQ®). PDQ Cancer Information Summaries. 2022. [Internet]. Accessed: Jun. 23, 2025.

36 . National Library of Medicine
Wang Y, Mukkamalla SKR, Singh R, Lyons S. Esophageal cancer. Essence of Anesthesia Practice E-Book. 2024;65. DOI: 10.1016/B978-1-4377-1720-4.00056-X

37 . Yang J, Liu X, Cao S, Dong X, Rao S, Cai K. Understanding esophageal cancer: The challenges and opportunities for the next decade. Front Oncol. 2020;10:546072. DOI: 10.3389/FONC.2020.01727/XML/NLM

38 . Tso J, Al-Qaraghli M, Galeas S,

Abidalhassan MF, Gaskill CE. Gastric cancer in Central America: A scoping review. Ecancermedicalscience. 2025;19:1834. DOI: 10.3332/ECANCER.2025.1834