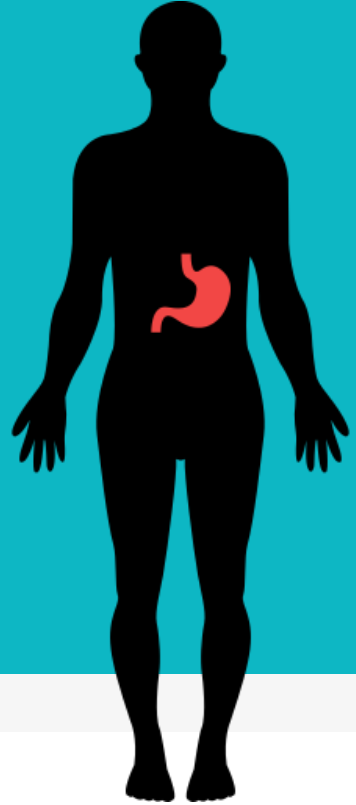


Stomach Cancer Research Project



Team Name: 4Cure Stomach Cancer

Participants:

Rishyendra Medamanuri¹, Nithin Nallapati², Adya Nataraj², Kasyap Mukkara³

School:

Central Cabarrus High School¹, Cox Mill High School², Lake Norman Charter³



Age: 13-14 years

*Corresponding author:
Dr. Lopamudra Das Roy
Questions, please reach out:
lopa@breastcancerhub.org*

Abstract

3

Stomach cancer, also known as **gastric cancer**, is a type of cancer which affects the organ, stomach. Even though the number of annual cases of stomach cancer is **decreasing**, stomach cancer is still very deadly. The goal of our research was to help **spread the word** on stomach cancer. We've used a variety of resources which include medical schools, PubMed, reliable cancer institutes, and other non-profit organizations' websites. What we found interesting was that **Nitrates/Nitrites** and **H. Pylori** can cause stomach cancer. It's recommended to eat vegetables and reduce consumption of **high-salty foods** and **preserved meats**. **Sanitation** also plays an important role in the development of stomach cancer, so try to keep your house clean.

Introduction

4

Stomach cancer, also known as **gastric cancer**, is cancer located in the stomach organ. The stomach's part of the human **digestive system**. The stomach stores and starts digesting food by producing an acidic substance called gastric juice. Gastric cancer **originates in the stomach**. The likeliness of getting it has significantly decreased over the past two decades, but gastric cancer is still one of the **most common cancers**. The most common type of stomach cancer is adenocarcinoma, one that starts from the inner lining. There are other types of the stomach can but they are unusual. [2,3]

5 Parts of the Stomach:

- ▶ Cardia
- ▶ Fundus
- ▶ Body (corpus)
- ▶ Antrum
- ▶ Pylorus [3]

5 Stomach Wall Layers:

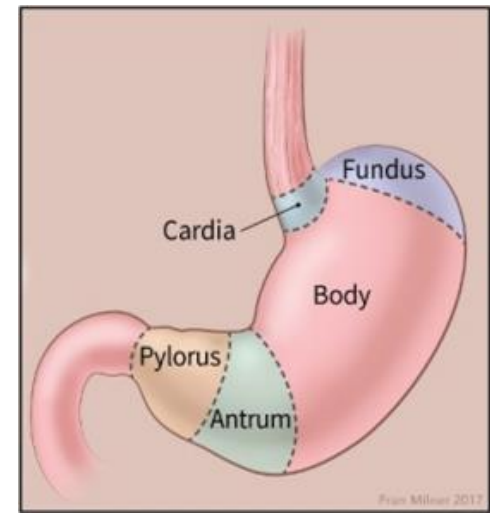
- ▶ **Mucosa**
- ▶ Submucosa
- ▶ Muscularis Propria
- ▶ Subserosa
- ▶ Serosa [3]

5 Parts of the Stomach:

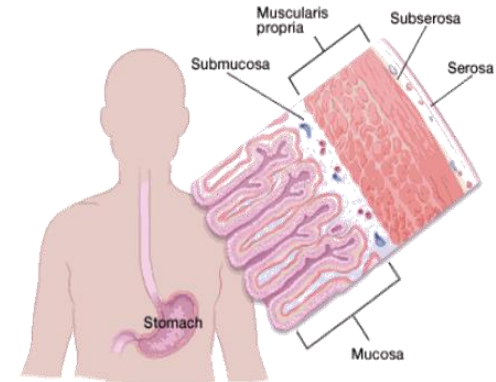
- ▶ **Cardia:** The part of the stomach where the esophagus and stomach meet.
- ▶ **Fundus:** The higher part of the stomach next to the cardia.
- ▶ **Body (corpus):** The main part of the stomach located between the fundus and antrum.
- ▶ **Antrum:** Located between the pylorus and body in the lower part of the stomach, and is where the food is mixed with gastric juice.
- ▶ **Pylorus:** Last part of the stomach which is located at the intersection between the intestine and the stomach. Acts as a valve to control when and how-much digested food enters the intestine. [3]

5 Stomach Wall Layers

- ▶ **Mucosa (Innermost):** The deepest layer of the stomach wall. Stomach acid and digestive enzymes are produced in this layer. The majority of stomach cancers start in this layer.
- ▶ **Submucosa:** The second deepest layer which supports the mucosa and has an abundant amount of blood vessels.
- ▶ **Muscularis Propria:** The middle layer which contains thick muscles used to mix food with digestive juices.
- ▶ **Subserosa:** Contains supporting tissues for the serosa.
- ▶ **Serosa (Outermost):** Linings that wrap around the stomach to restrict it. [3]



<https://www.cancer.org/cancer/stomach-cancer/about/what-is-stomach-cancer.html>



Symptoms normally don't show until **mid-late stages** of stomach cancer. Therefore, only **1 in 5 cases** of stomach cancer is detected in early stages, making treatment difficult. Some early symptoms could be mild belly pain and fatigue. [1]

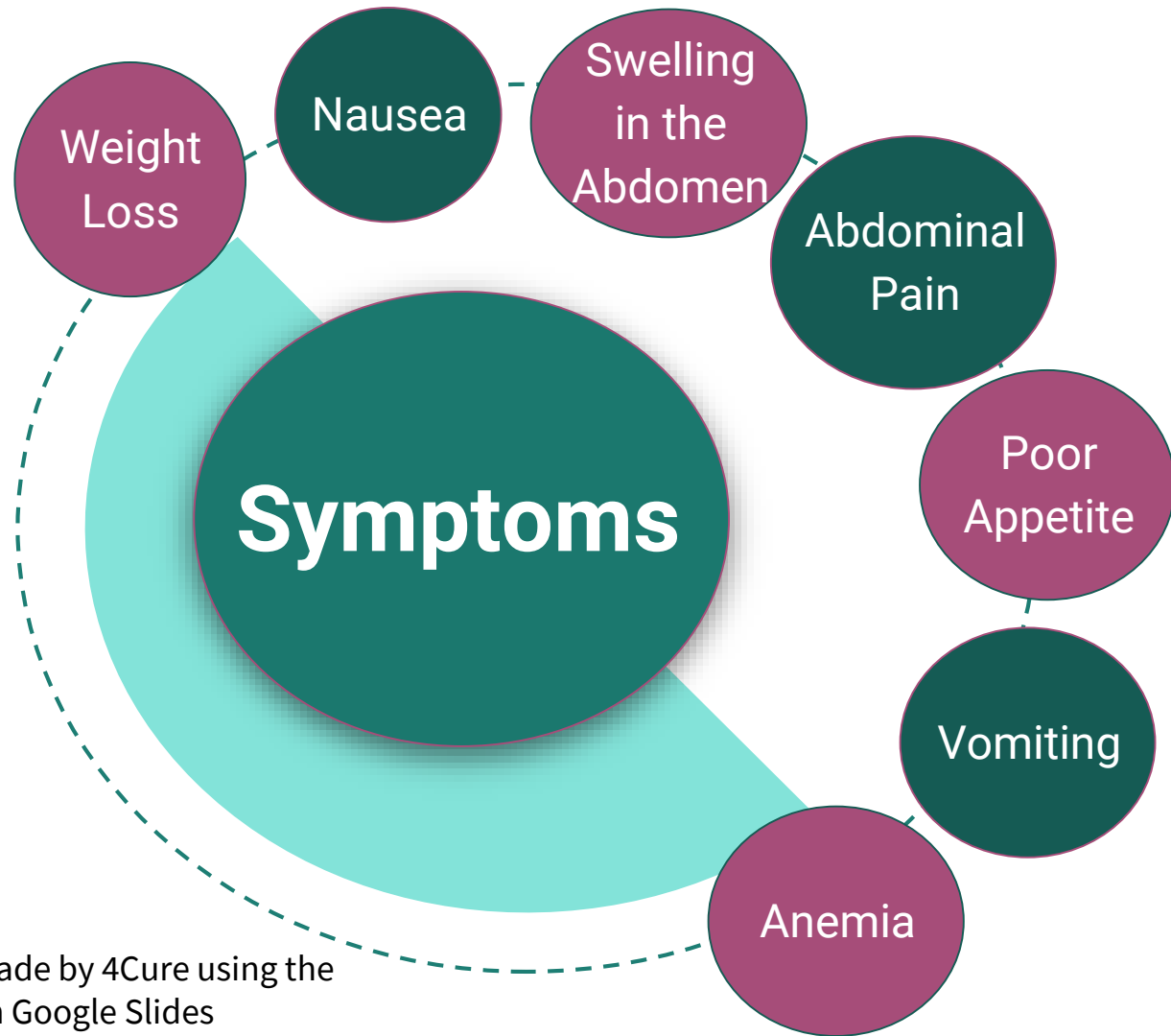


Diagram was made by 4Cure using the diagram tool on Google Slides

Stomach Cancer Risk Factors

7

- ▶ **Gender:** Men have a higher chance of being diagnosed with stomach cancer than women.
- ▶ **Age:** People over the age of 50 (primarily between their 60s and 80s) have the highest chance of being diagnosed with stomach cancer.
- ▶ **Ethnicity:** In the United States, stomach cancer is more common in Hispanic Americans, Native Americans, and Asian/Pacific Islanders than non-Hispanic Whites.
- ▶ **Type A blood:** People with blood type A have a higher risk of getting stomach cancer, while people with blood type O have a reduced chance of getting stomach cancer.
- ▶ **Family History:** People with **first-degree relatives** (parents, siblings, or children) who have or had stomach cancer have a higher chance of getting this disease.

- ▶ **Geography:** Japan, China, Southern Europe, Eastern Europe, South America, Central America have more cases of stomach cancer compared to other geographical locations. Northern Africa, Western Africa, South Central Asia, and North America have the least cases compared to the rest of the world.
- ▶ **Helicobacter Pylori Infection:** Helicobacter Pylori, also known as **H. Pylori**, bacteria is a major cause of stomach cancer, especially in the distal stomach. (Refer to future pages for more info).
- ▶ **Stomach Lymphoma:** People who've had *mucosa-associated lymphoid tissue (MALT)* lymphoma have a higher chance of being diagnosed with adenocarcinoma stomach cancer. MALT lymphoma is caused by an H. Pylori infection.
- ▶ **Diet:** Consuming excess amounts of **smoked foods, salted fish, salted meat**, and **pickled vegetables** increase your chance of getting stomach cancer. Eating plenty of **fresh fruits** and **vegetables** can reduce the chance of getting stomach cancer. [7]

- ▶ **Smoking:** Increases the chance of getting stomach cancer. The **rate** of getting cancer is **doubled** in smokers.
- ▶ **Certain Occupations:** Working with coal, metal, and rubber often can increase your chance of getting stomach cancer. [7,9]
- ▶ **Overweight (obese):** Obesity is a possible cause of cancers in the cardia (upper part of the stomach).
- ▶ **Previous stomach surgeries:** The risk of stomach cancer is higher in those who've had part of their stomach removed to treat **non-cancerous diseases** such as ulcers.
- ▶ **Pernicious Anemia:** Parietal cells in the stomach lining produce a glycoprotein known as **Intrinsic Factor** (IF). The Intrinsic Factor is used to absorb **vitamin B12** from food. A vitamin B12 deficiency can affect the production of red blood cells and increase the risk of stomach cancer. [7,8]

Stomach Cancer Statistics

10

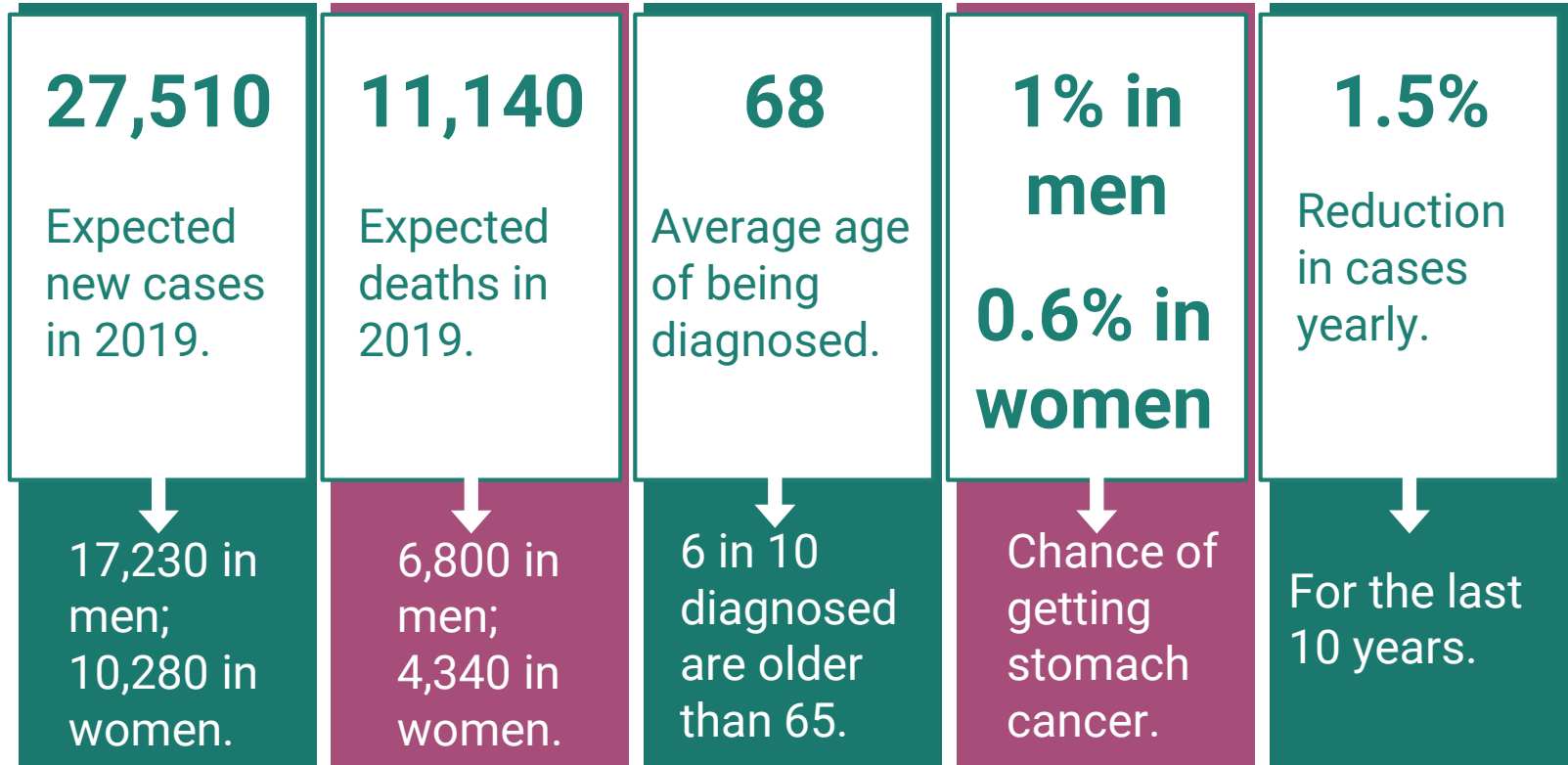
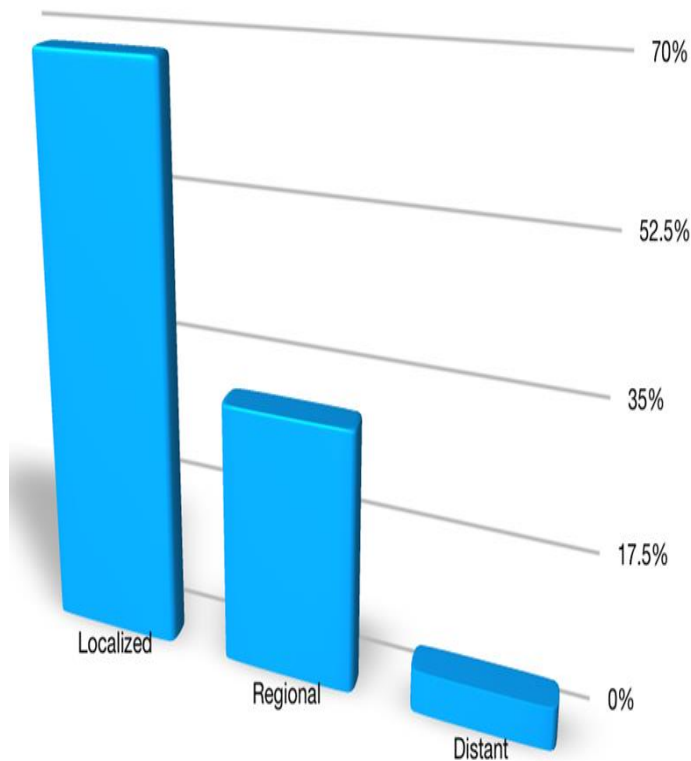


Diagram was made by 4Cure using the diagram tool on Google Slides. Information: [\[4, 5\]](#)

Stomach Cancer Survival Rates (5-years)

11

- **Localized** (Cancer has not spread out of the stomach): **68%** 5-year survival rate compared to the overall population.
- **Regional** (Cancer has spread outside the stomach to nearby locations): **31%** 5-year survival rate compared to the overall population.
- **Distant** (Cancer has spread to distant places in the body): **5%** 5-year survival rate compared to the overall population. [6]



This graph was created using the app Numbers.

Treatment for Stomach Cancer

- ▶ There are different types of treatment for patients with gastric cancer.
- ▶ Seven types of standard treatment are used:
 - ▶ Surgery
 - ▶ Endoscopic mucosal resection
 - ▶ Chemotherapy
 - ▶ Radiation therapy
 - ▶ Chemoradiation
 - ▶ Targeted therapy
 - ▶ Immunotherapy
- ▶ New types of treatment are being tested in clinical trials.
- ▶ Treatment for gastric cancer may cause side effects.
- ▶ Patients may want to think about taking part in a clinical trial.
- ▶ Patients can enter clinical trials before, during, or after starting their cancer treatment.
- ▶ Follow-up tests may be needed.

Nitrates Effect on Stomach Cancer

13

- Nitrates and Nitrites are normally found in **processed/cured meats** and some **vegetables** because they're used in **fertilizers, pesticides, and preservatives**.
- When nitrates are exposed to **heat** between 99 °C and 185 °C, in the presence of amino acids, they turn into nitrosamines.
- **Nitrosamines** are also found in **tobacco** and are one of the leading causes of cancer from tobacco.
- Frying and cooking have a higher rate of nitrosamines.
- **Lean** meat tends to have fewer nitrosamines compared to **fat** meat. [10-12]

Stomach Cancer Incidence Rates Worldwide

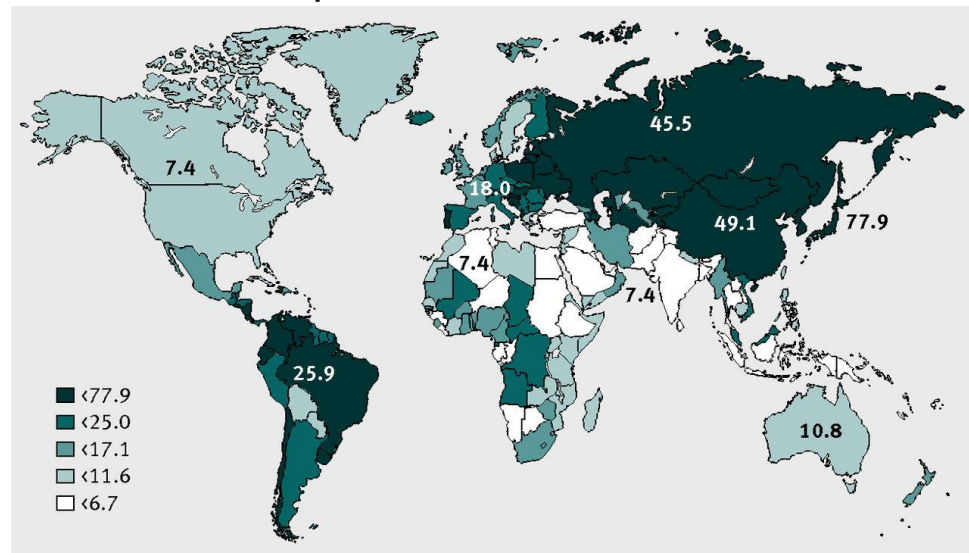
14

Rate of stomach cancer in various countries via 2013 (in 10,000):

1. **South Korea**- 39.6
2. Mongolia - 33.1
3. **Japan**- 27.5
4. China - 20.7
5. Bhutan - 19.4
6. Kyrgyzstan - 18.6
7. Chile - 17.8
8. Belarus - 16.5
9. Peru - 16.1
10. Vietnam - 15.9

[20-22]

Graph shows # of cases in 2008.



<https://www.bmj.com/content/347/bmj.f6367>

Out of the top 20 countries that have the highest cancer rates, only **2 are developed.**

Primary Cause: Helicobacter Pylori Infection

15

- ▶ One of the **main causes** for stomach cancer is an Helicobacter Pylori (H. Pylori) infection.
- ▶ H. Pylori thrives in **low** to **medium pH** level environments.
- ▶ This bacteria doesn't grow well in **nutrient-rich environments**.
- ▶ Spreads through **saliva** and **fecal contamination** of food & water.

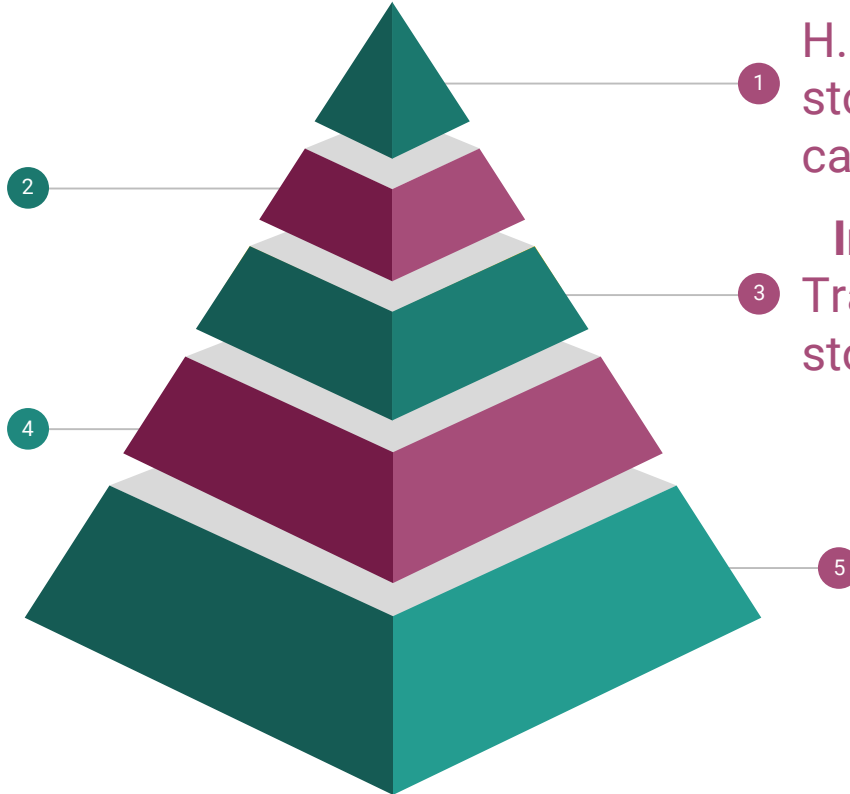
- ▶ Once infected, the infection will prolong for a lifetime unless treated.
- ▶ It can be treated using **antibiotics** and **acid-reducing** medications.
- ▶ Symptoms include stomach pain, food intolerances from chronic inflammation, and infrequent bleeding from gastric ulcers.
- ▶ If you have a family history of a H. Pylori infection, it's recommended to frequently check through blood and breath tests. [30-32]

Atrophic Gastritis

Stomach cells loss
and impaired
digestive system.

Dysplasia

Beginning stages
of stomach cancer.



Chronic Gastritis

H. Pylori burrows in the
stomach lining and
causes inflammation

Intestinal Metaplasia

Transformation of the
stomach lining.

Stomach Cancer

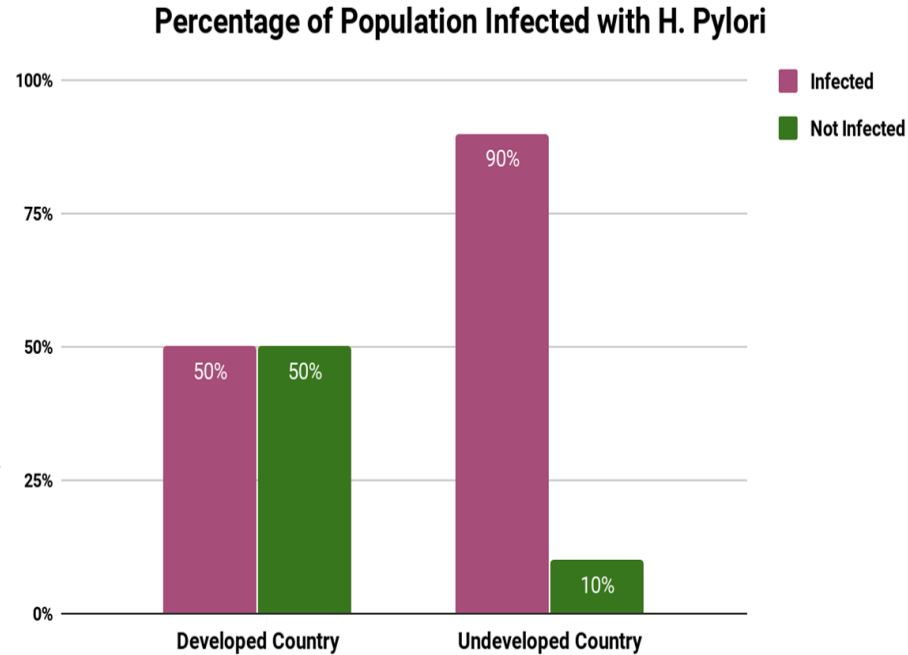
Gastric
adenocarcinoma is
formed.

Developed vs. Developing Countries

17

There isn't significant evidence proving whether developed or developing countries have higher stomach cancer rates.

- ▶ Out of the top 20 countries based on incidence rates of stomach cancer, only 2 countries are developed countries.
- ▶ Undeveloped countries typically aren't sanitary, increasing the chance of stomach cancer.
- ▶ Children have the highest risk of getting an H. Pylori infection. [23,32]



The chart was made by 4Cure using the diagram tool on Google Slides.

Research Links

18

- ▶ <https://www.cancer.org/cancer/stomach-cancer/detection-diagnosis-staging/signs-symptoms.html> [1]
- ▶ <https://www.urmc.rochester.edu/encyclopedia/content.aspx?contentTypeid=34&contentid=17785-1> [2]
- ▶ <https://www.cancer.org/cancer/stomach-cancer/about/what-is-stomach-cancer.html> [3]
- ▶ <https://www.cancer.org/cancer/stomach-cancer/about/key-statistics.html> [4]
- ▶ <https://www.wcrf.org/dietandcancer/cancer-trends/worldwide-cancer-data> [5]
- ▶ https://www.cancer.org/cancer/stomach-cancer/detection-diagnosis-staging/survival-rates.html#written_by [6]
- ▶ <https://www.cancer.org/cancer/stomach-cancer/causes-risks-prevention/risk-factors.html> [7]
- ▶ <https://ods.od.nih.gov/factsheets/VitaminB12-Consumer/> [8]
- ▶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3497328/> [9]
- ▶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4609975/> [10]
- ▶ <https://www.healthline.com/nutrition/are-nitrates-and-nitrites-harmful#section5> [11]
- ▶ <https://meatscience.org/TheMeatWeEat/topics/processed-meats/article/2015/07/24/non-meat-ingredients-sodium-nitrate-salt-phosphate-etc.-what-are-they-and-what-purpose-do-they-serve> [12]
- ▶ <https://www.cancer.gov/about-cancer/causes-prevention/risk/obesity/obesity-fact-sheet> [13]
- ▶ <https://link.springer.com/article/10.1007%2Fs10120-014-0425-4> [14]
- ▶ <https://www.ncbi.nlm.nih.gov/pubmed/25421687> [15]
- ▶ <https://www.mayoclinic.org/diseases-conditions/stomach-cancer/symptoms-causes/syc-20352438> [16]
- ▶ https://www.cancer.org/cancer/stomach-cancer/causes-risks-prevention/what-causes.html#written_by [17]
- ▶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4394105/> [18]
- ▶ <https://www.cancercenter.com/cancer-types/leukemia/stages> [19]
- ▶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5826592/> [20]
- ▶ <https://www.wjgnet.com/1007-9327/full/v20/i33/11546.htm> [21]
- ▶ <https://www.ajmc.com/journals/supplement/2017/the-current-and-future-management-of-gastric-cancer/gastric-cancer-local-and-global-burden> [22]
- ▶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1116392/> [23]
- ▶ [https://www.who.int/bulletin/archives/79\(5\)455.pdf](https://www.who.int/bulletin/archives/79(5)455.pdf) [24]
- ▶ <https://www.uclahealth.org/core-kidney/hyponatremia-and-cancer> [25]
- ▶ <https://www.sharecare.com/health/sodium/salt-sodium-same-thing> [26]
- ▶ <https://www.wcrf.org/int/blog/articles/2016/04/salt-shaking-link-stomach-cancer> [27]
- ▶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2682234/> [28]
- ▶ <https://onlinelibrary.wiley.com/doi/epdf/10.1046/j.1365-2036.11.s1.5.x> [29]
- ▶ <https://my.clevelandclinic.org/health/articles/8107-helicobacter-pylori-and-stomach-cancer> [30]
- ▶ <https://publichealth.arizona.edu/outreach/health-literacy-awareness/hpylori/transmission> [31]
- ▶ [https://www.who.int/bulletin/archives/79\(5\)455.pdf](https://www.who.int/bulletin/archives/79(5)455.pdf) [32]
- ▶ <https://www.mayoclinic.org/tests-procedures/chemotherapy/about/pac-20385033> [33]
- ▶ <https://www.cancer.net/cancer-types/stomach-cancer/types-treatment> [34]