Chapter 17
Human Health and Environmental Risks

1. What do you think of when you consider/think of **Environmental health risks**?
2. Define the word **CHEMICAL**, create a list of "chemicals they you/your parents have used/come in contact in the last 24 hours?
3. Imagine living blocks away from a **chemical plant & oil refinery,** any concerns one should consider or be aware of?!?!

1. Environmental health is the way that different parts of the environment affect our health and the way we live (biological, physical, social/chemical).

Ex. Smoking/drinking/drugs, traffic accidents/violence, tanning salons *(unprotected UV radiation),* poor diet, physical activity/exercise, mental health/stress/diseases…etc

2. Chemical is any substance that can have different effects on organisms *(positive or negative).*

Ex. Soap, detergent, make-up, lotions, deodorant, medication, foods *(what is sprayed on/injected, GMO, pesticides, contaminated),* household cleaners, hand sanitizer…etc

3. Some health concerns could be…

~Respiratory illnesses

~Cancer (carcinogens)

~Birth defects

Three categories of human health risks

1. **Physical** – include environmental factors such as natural disasters (*cause injury or loss of life),* excessive exposure to UV radiation from the sun *(sunburns, cancer, radioactive substances such as radon).*
2. **Biological** – diseases *(any impaired function of the body with a characteristics set of symptoms)*
3. **Chemical/Social** – exposure to chemicals ranging from naturally occurring *(arsenic)* to synthetic chemicals *(pesticides)*

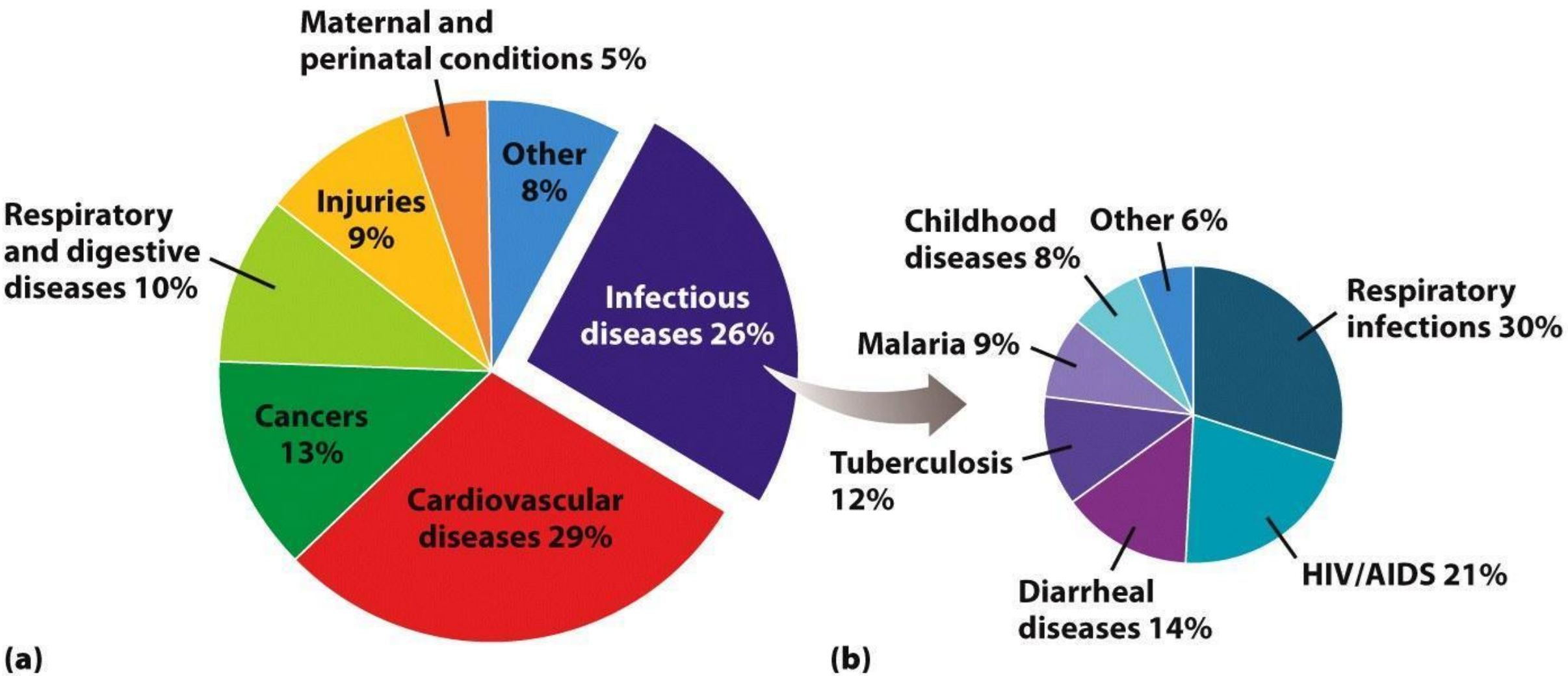
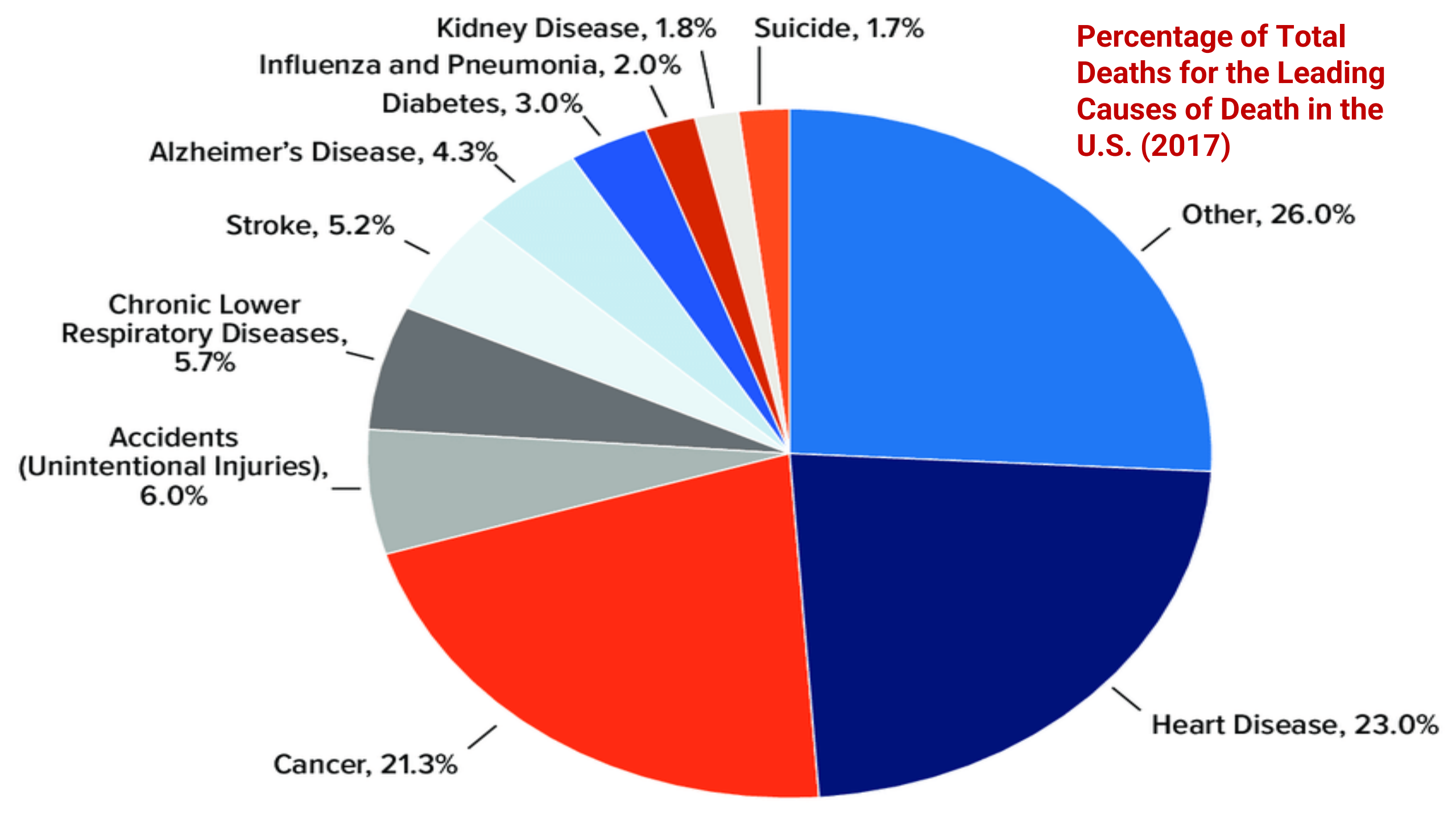


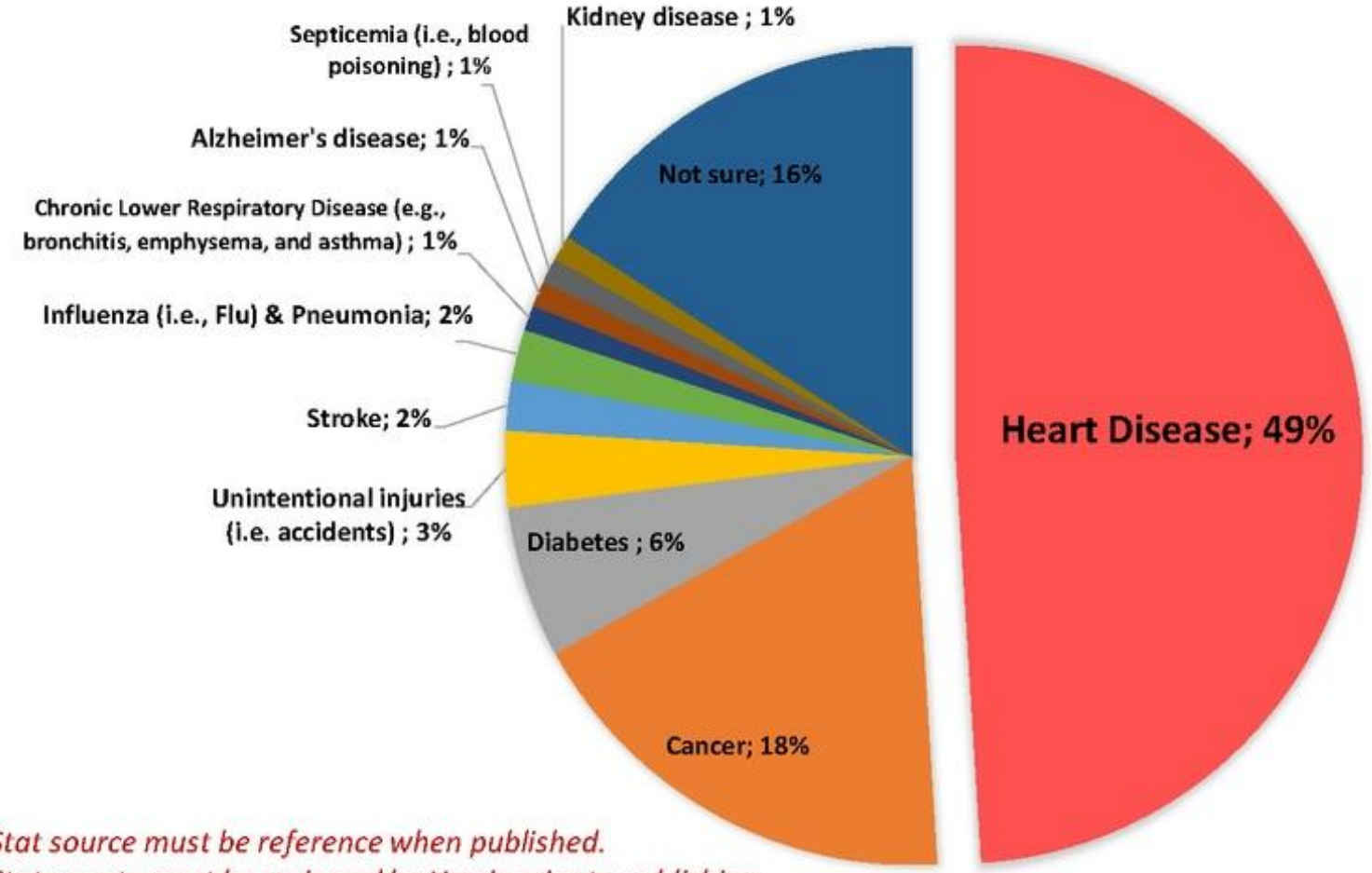
Figure 17.1
Environmental Science

Among all 3 human health risks…*Biological* risk cause the most human deaths (cardiovascular disease). **More than ¾'s of all world deaths are cause by diseases.**


Percentage of Total Deaths for the Leading Causes of Death in the U.S. (2017)
Kidney Disease, 1.8%
Suicide, 1.7%
Influenza and Pneumonia, 2.0%
Diabetes, 3.0%
Alzheimer's Disease, 4.3%
Stroke, 5.2%
Other, 26.0%
Chronic Lower Respiratory Diseases, 5.7%
Accidents (Unintentional Injuries), 6.0%
Heart Disease, 23.0%
Cancer, 21.3%

Knowledge of the Leading Cause of Death

"As far as you know, what is the leading cause of death for all US adults? Please select one."



- Heart Disease
- Cancer
- Diabetes
- Unintentional injuries (i.e. accidents)
- Stroke
- Influenza (i.e., Flu) & Pneumonia
- Chronic Lower Respiratory Disease (e.g., bronchitis, emphysema, and asthma)
- Alzheimer's disease
- Septicemia (i.e., blood poisoning)
- Kidney disease
- Not sure

Stat source must be reference when published.
Statements must be reviewed by Harris prior to publishing.

Source: AHA Harris Poll (sample size = **6,077 US adult 18+)**
data collection dates = **2023 November 16-21**, online omnibus survey.

Answer choices selected from the US CDC Leading Cause of Death Reported Top 10 (2022) + Not Sure Answer Option

Total deaths in the United States from COVID-19 and other leading causes, 2020-2022

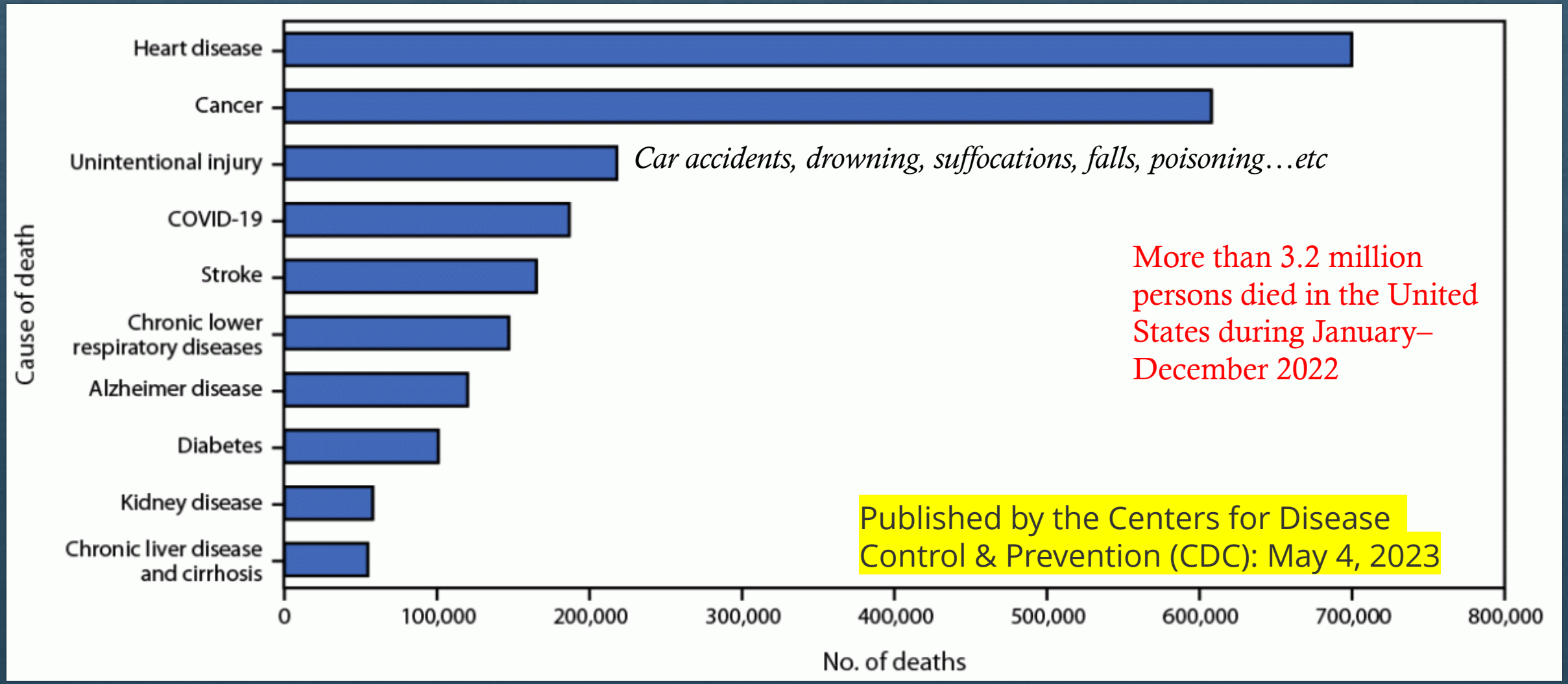
	Category	Total deaths (Jan.-Sept. 2022)	Total deaths (2021)	Total deaths (2020)
1	Heart disease	572,336	767,937	764,512
2	Cancer	454,176	604,358	599,607
3	COVID-19	234,434	475,059	343,566
4	Accidents	170,166	226,987	203,033
5	Stroke	123,215	162,769	159,248
6	Chronic respiratory	107,559	141,906	152,051
7	Alzheimer	87,866	119,442	134,271
8	Diabetes	74,716	103,197	101,355
9	Other respiratory	50,635	66,381	66,053
10	Renal failure	42,596	53,057	51,221

Notes: For 2022, the total death sum for each category is for January 1 - September 30, 2022, except deaths from accidents and suicides are from January - September 2021. Chronic respiratory is chronic lower respiratory disease.

Source: KFF analysis of CDC mortality and KFF COVID-19 tracker data

Peterson-KFF
Health System Tracker

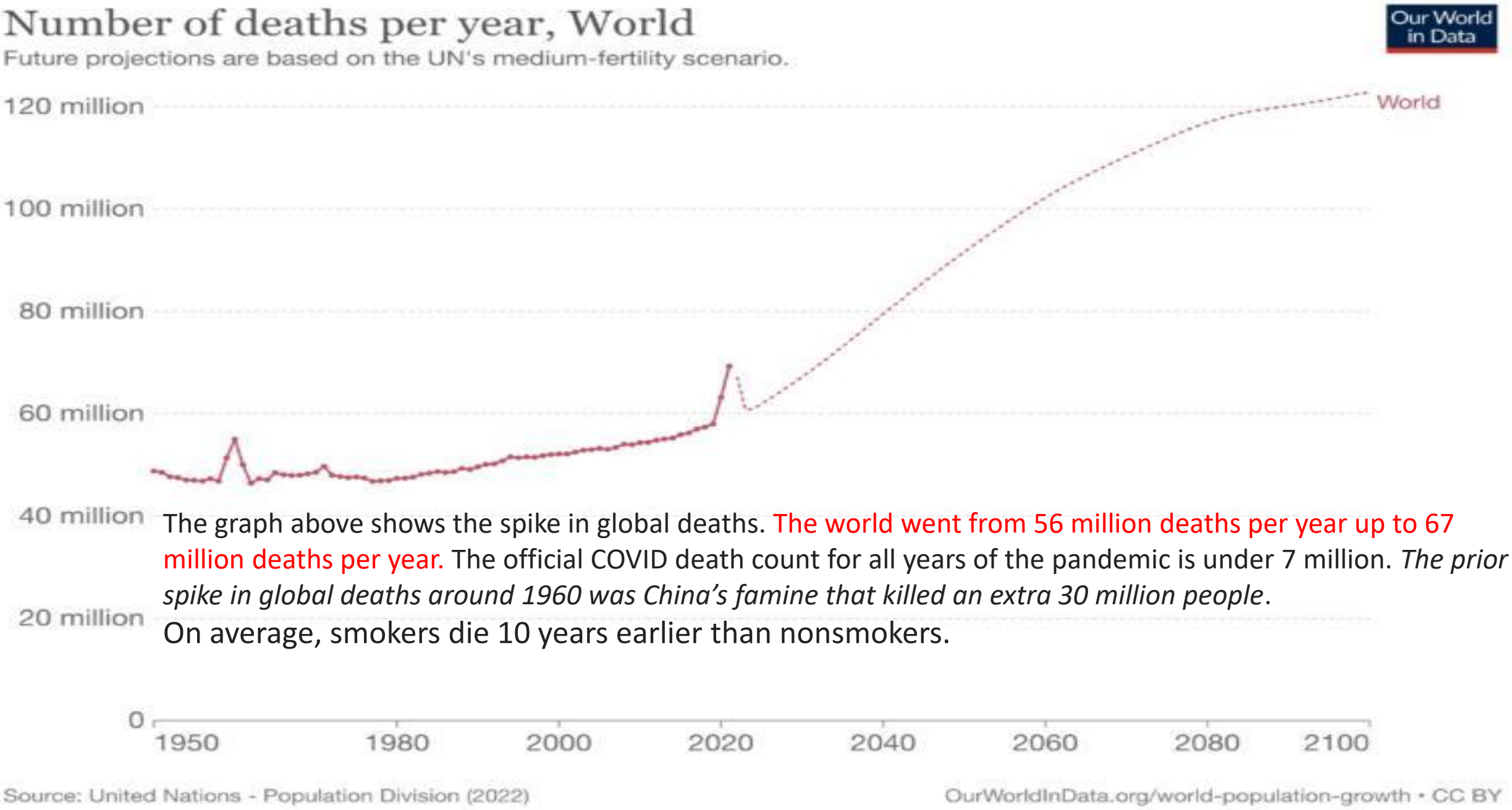
Leading underlying causes of death- National Vital Statistics System, United States, 2022



Car accidents, drowning, suffocations, falls, poisoning…etc

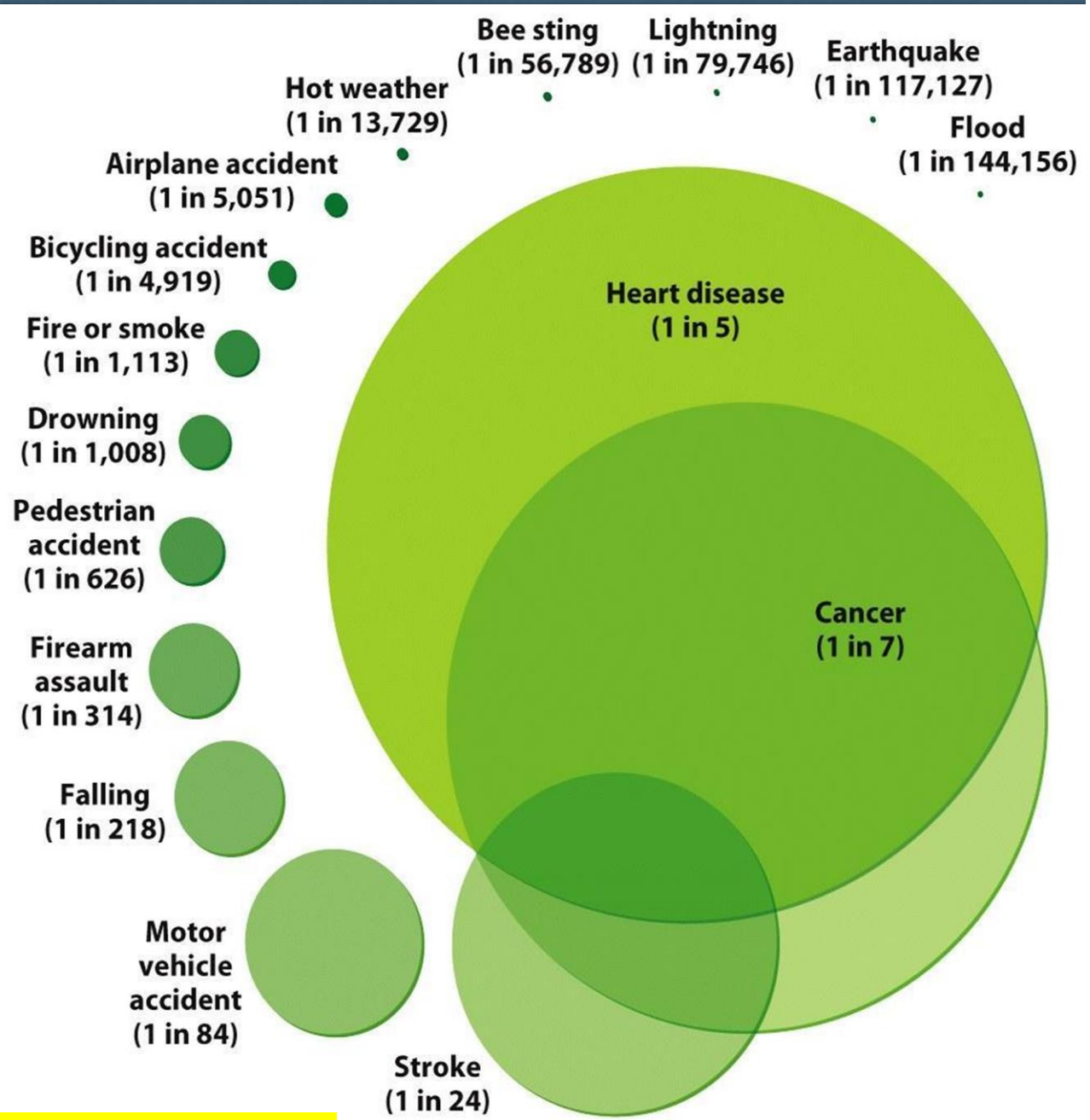
More than 3.2 million persons died in the United States during January–December 2022

Published by the Centers for Disease Control & Prevention (CDC): May 4, 2023

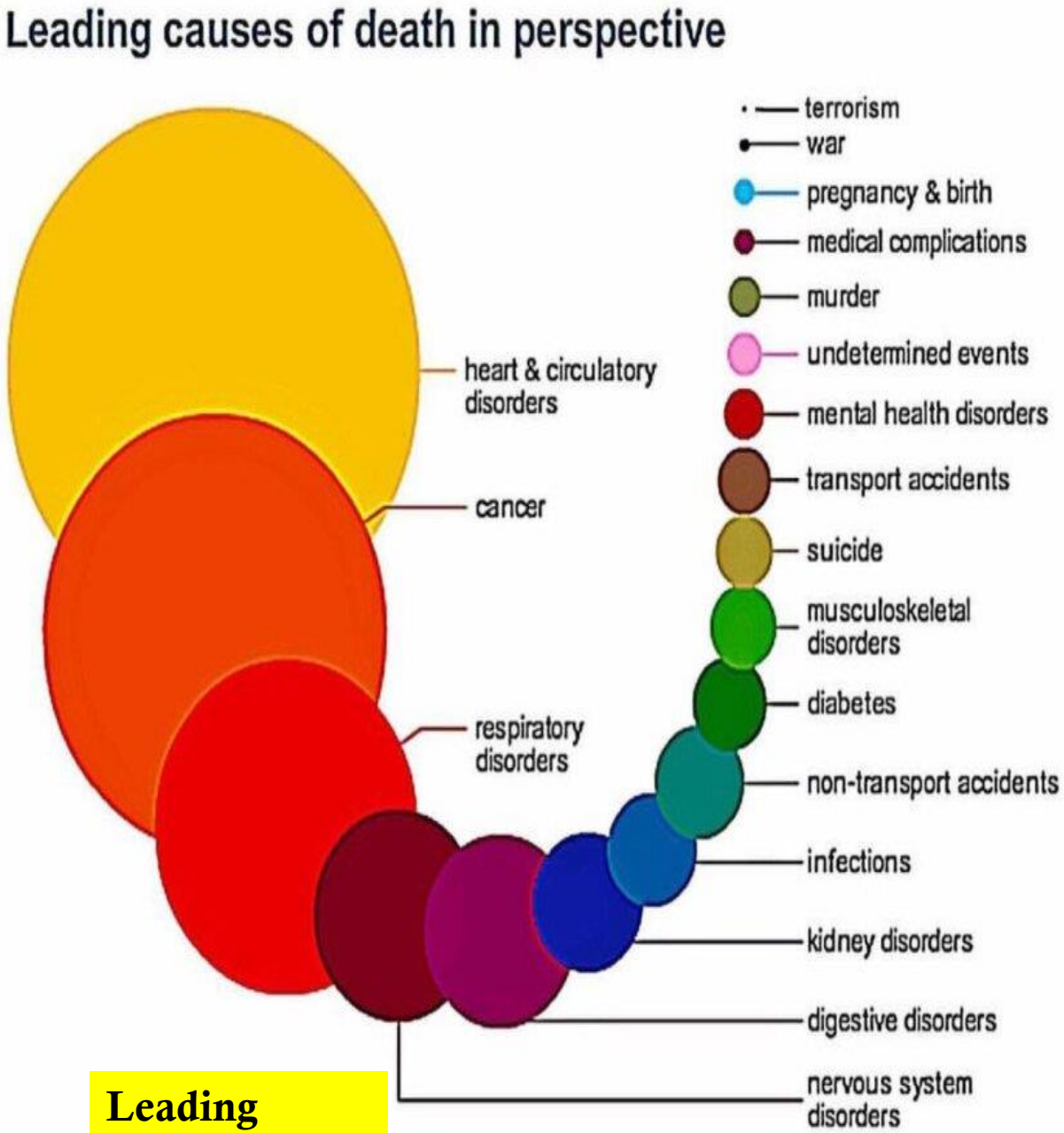


The graph above shows the spike in global deaths. The world went from 56 million deaths per year up to 67 million deaths per year. The official COVID death count for all years of the pandemic is under 7 million. *The prior spike in global deaths around 1960 was China's famine that killed an extra 30 million people*.

On average, smokers die 10 years earlier than nonsmokers.



Leading causes of death 2012



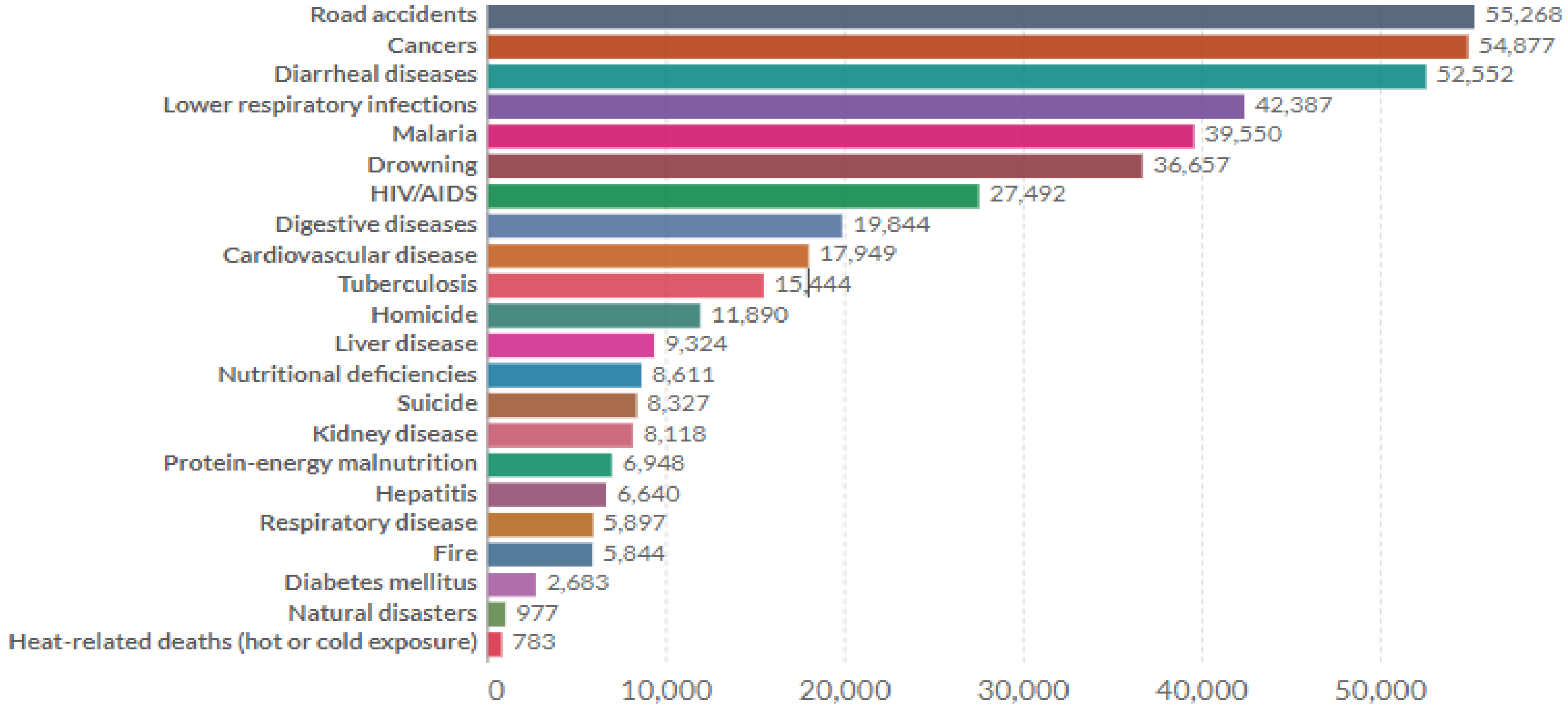
Leading causes of death 2021

Causes of deaths for children between 5 and 14, World, 2019

Annual number of deaths – by cause – for children between 5 and 14 years old.

Our World in Data

Change country



Leading Health Risks for High-income vs. Low-income countries

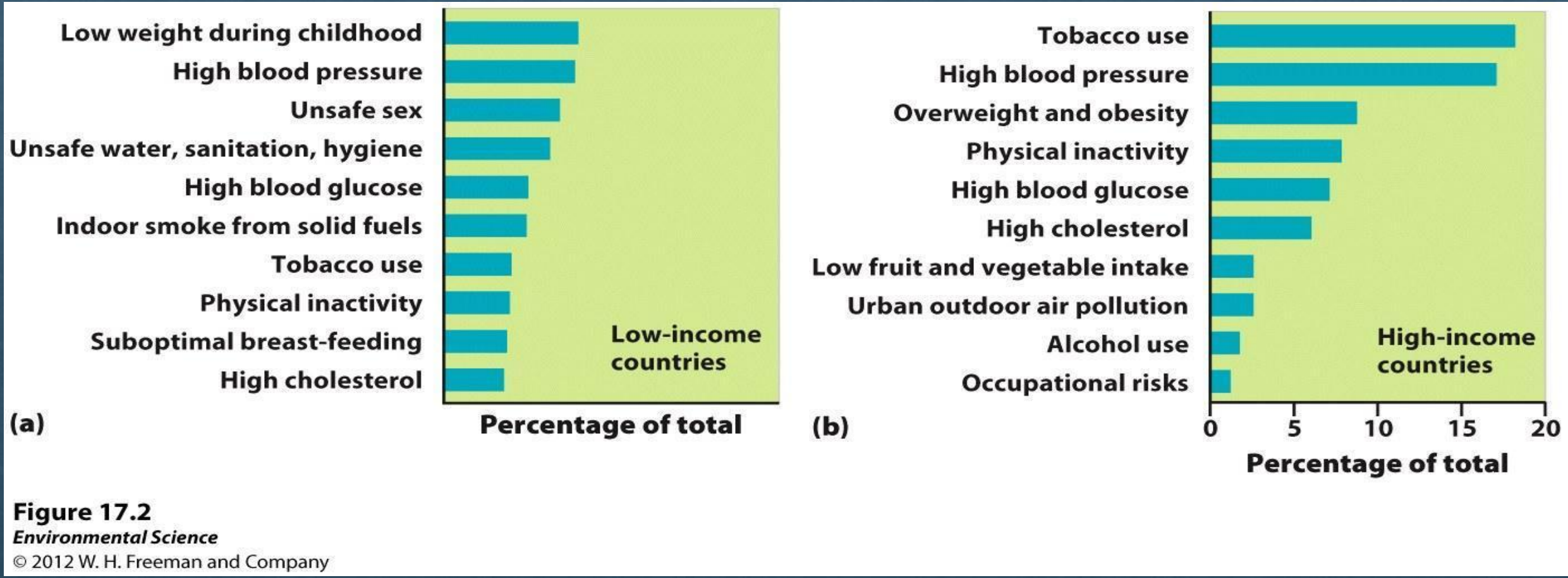
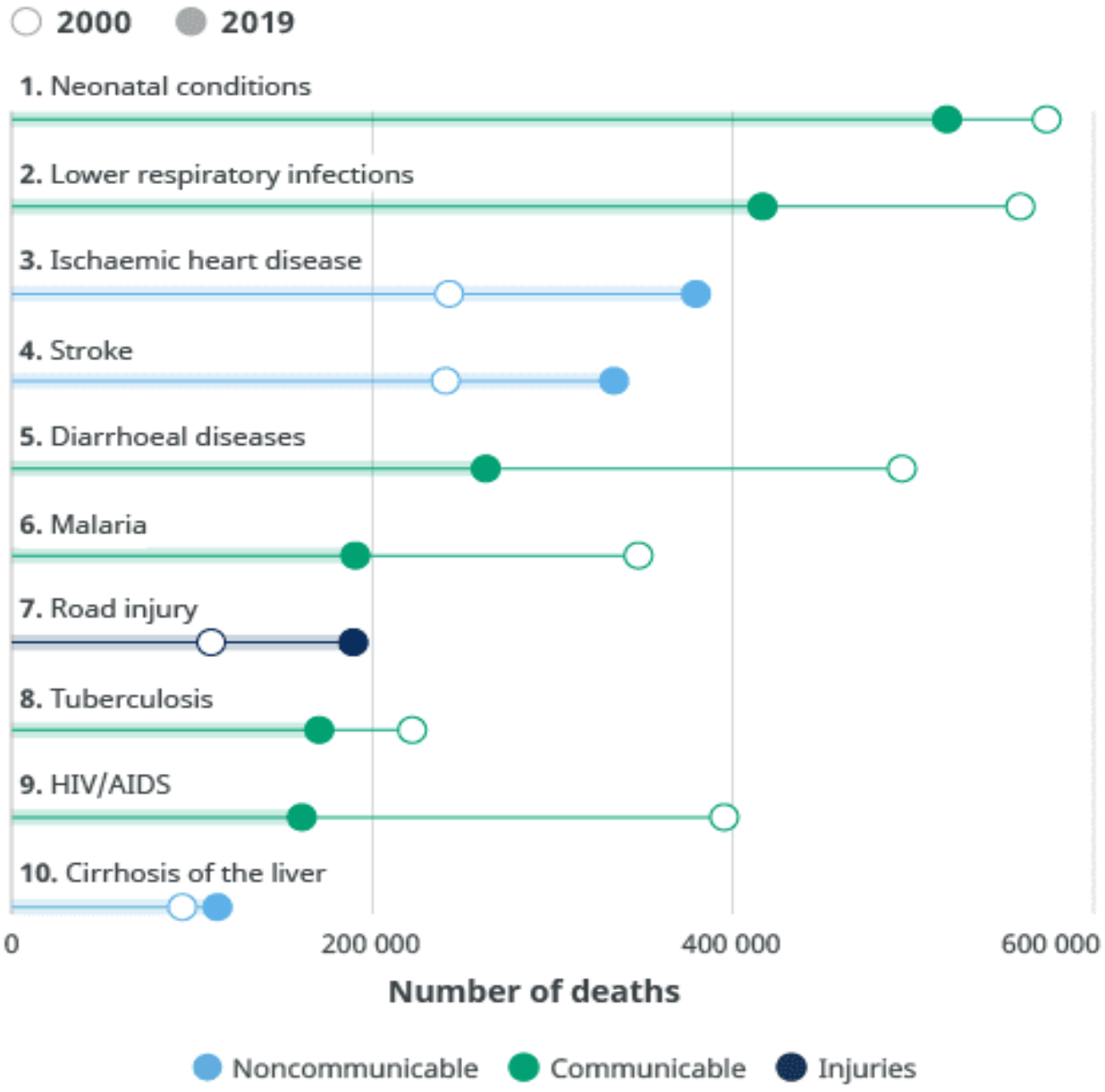


Figure 17.2
Environmental Science

Transition in economic development affects leading health risks...

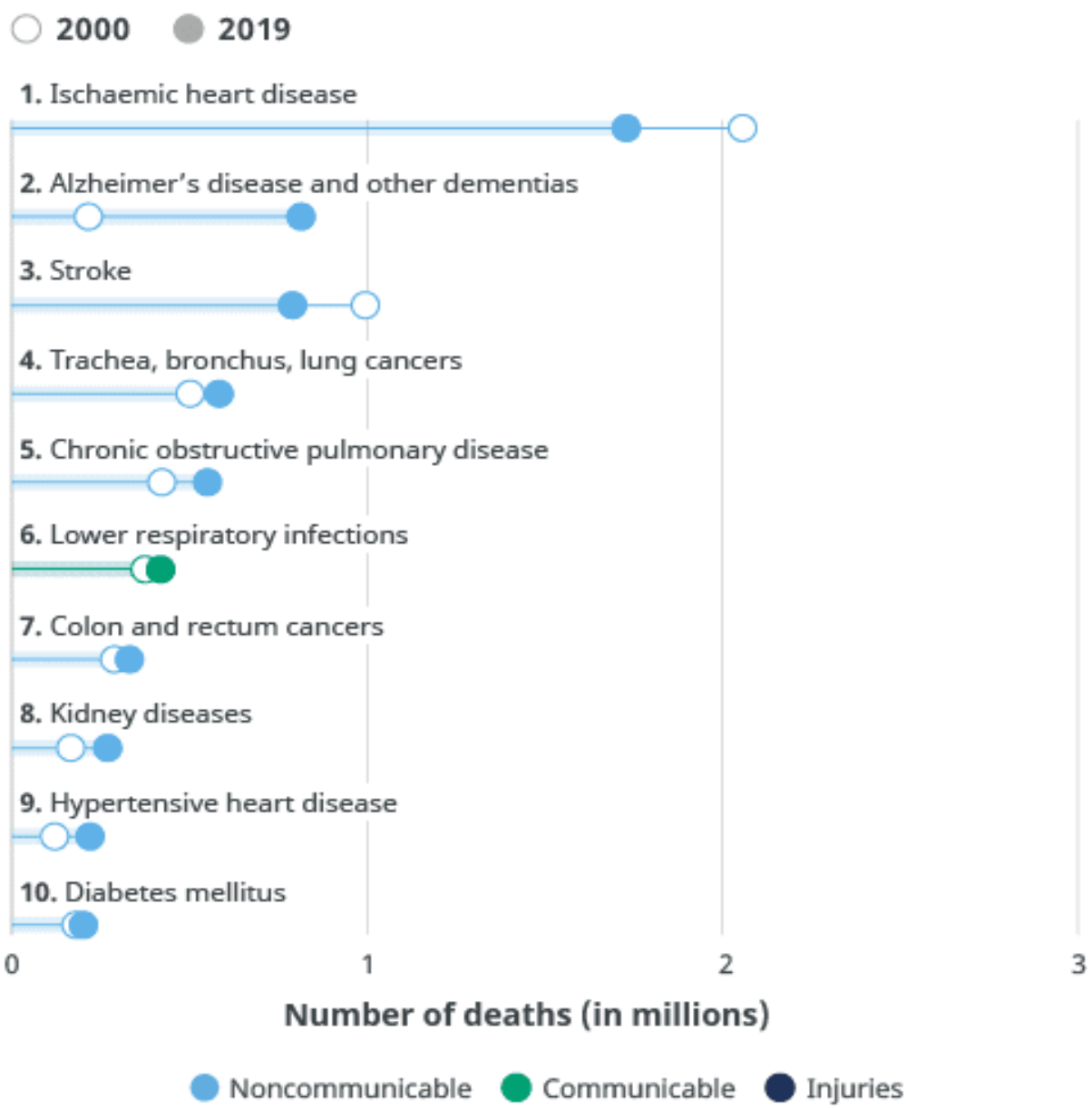
Leading cause for Low-income = low nutrient (lack of food) & poor sanitation
Leading cause for high-income = inactivity, obesity, tobacco use

Leading causes of death in low-income countries



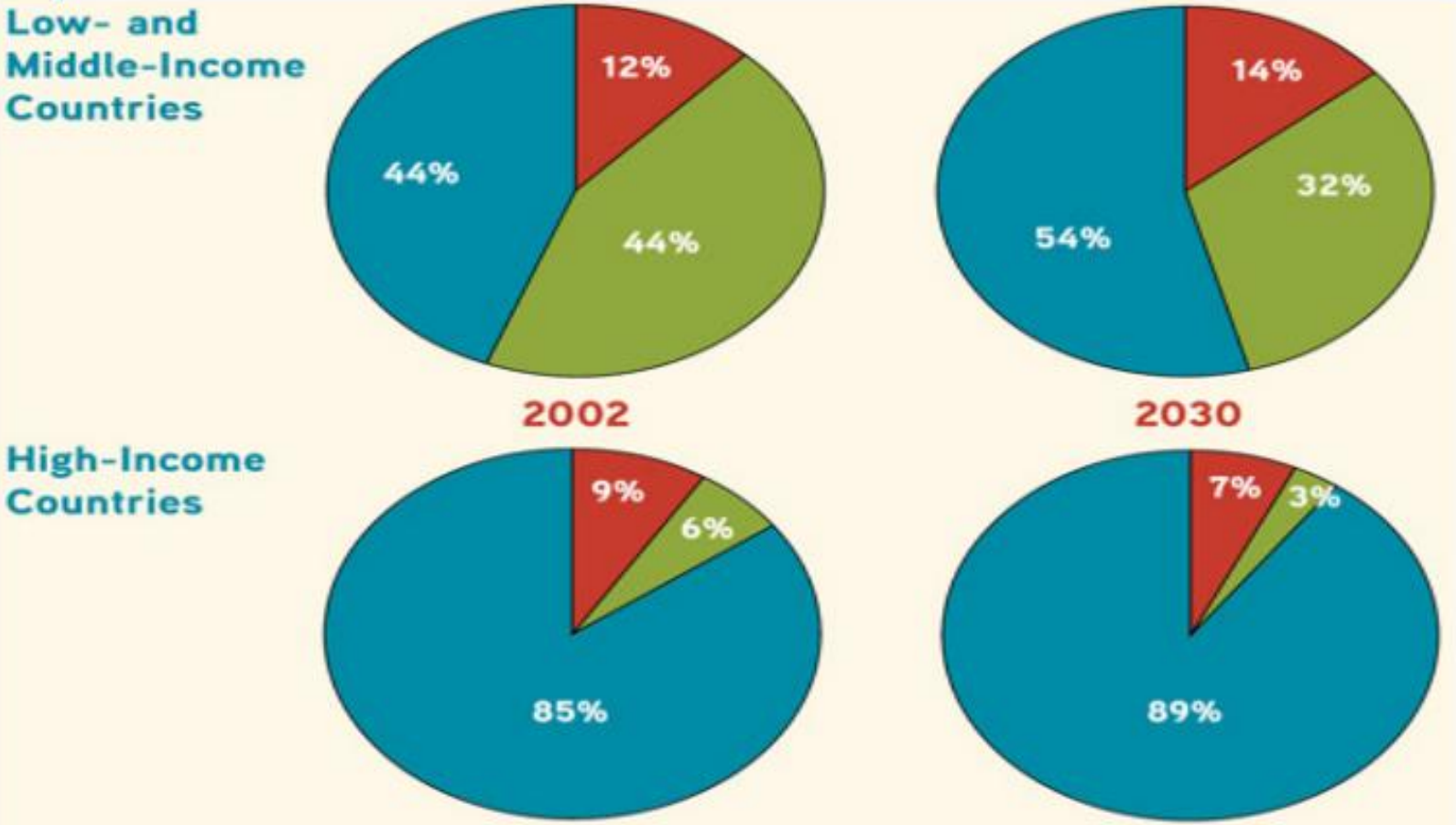
Source: WHO Global Health Estimates. Note: World Bank 2020 income classification.

Leading causes of death in high-income countries



Source: WHO Global Health Estimates. Note: World Bank 2020 income classification.

The Increasing Burden of Chronic Non-Communicable Diseases: 2002-2030



Source: P01 AG 017625 (PI Murray)

Lopez, et al. *Global Burden of Disease by Risk Factors.*(2006)

Communicable diseases comprise infectious diseases such as tuberculosis and measles, while **non-communicable diseases** (NCDs) are mostly chronic diseases such as cardiovascular diseases, cancers, and diabetes.

1 in 6 youths (ages 6-17) & 1 in 4 adults experience mental health disorder each year

EVERY

2 HOURS & 11 MINUTES

a person under the age of 25 dies by suicide

THAT'S

10 PEOPLE EVERY DAY

Suicide is the 10th leading cause of death in the United States, with an average of 132 deaths per day.

SUICIDE IS THE

3RD LEADING CAUSE

of deaths for youth aged 10-24, resulting in about

4600 DEATHS per year

1 IN 7

high school students have **CONSIDERED SUICIDE** within the past school year

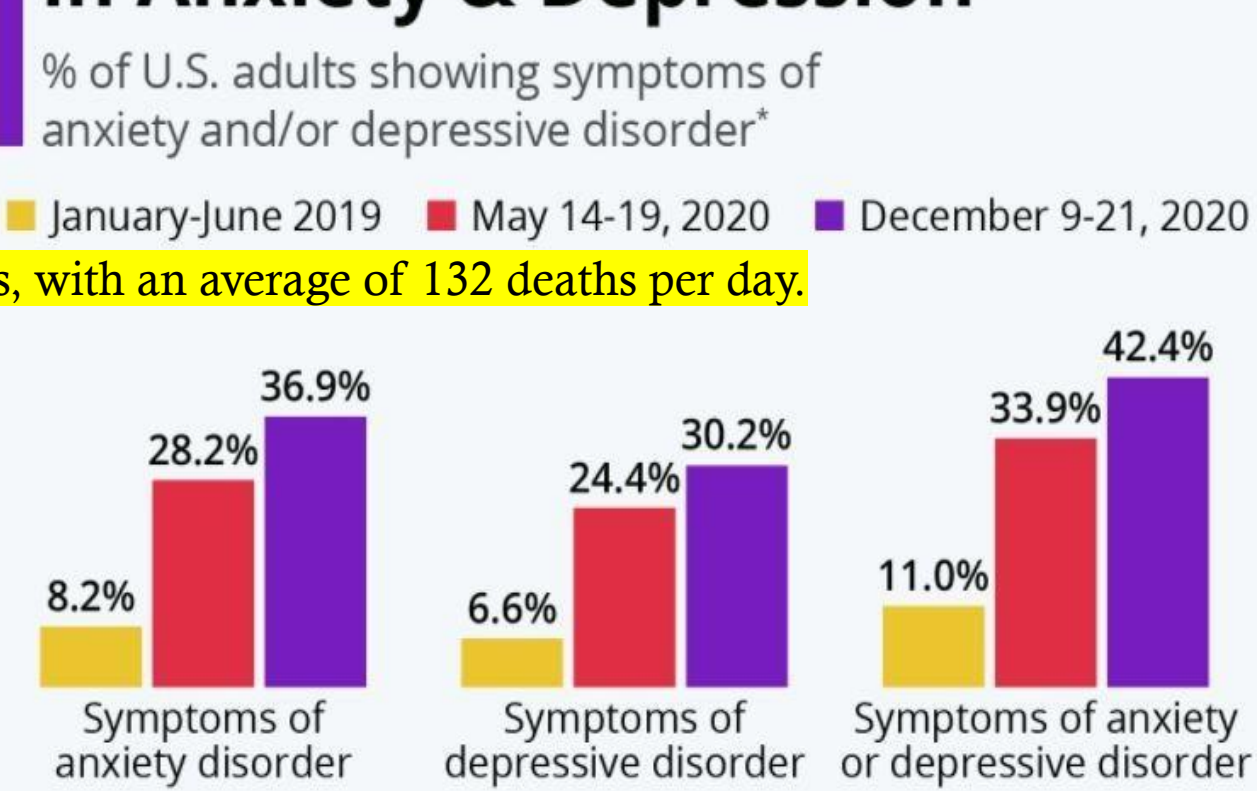
1 IN 14

high school students have **ATTEMPTED SUICIDE** within the past school year

90% of people who **DIE BY SUICIDE** have a **DIAGNOSABLE & TREATABLE** psychiatric disorder at the time of their death

Pandemic Causes Spike in Anxiety & Depression

% of U.S. adults showing symptoms of anxiety and/or depressive disorder*



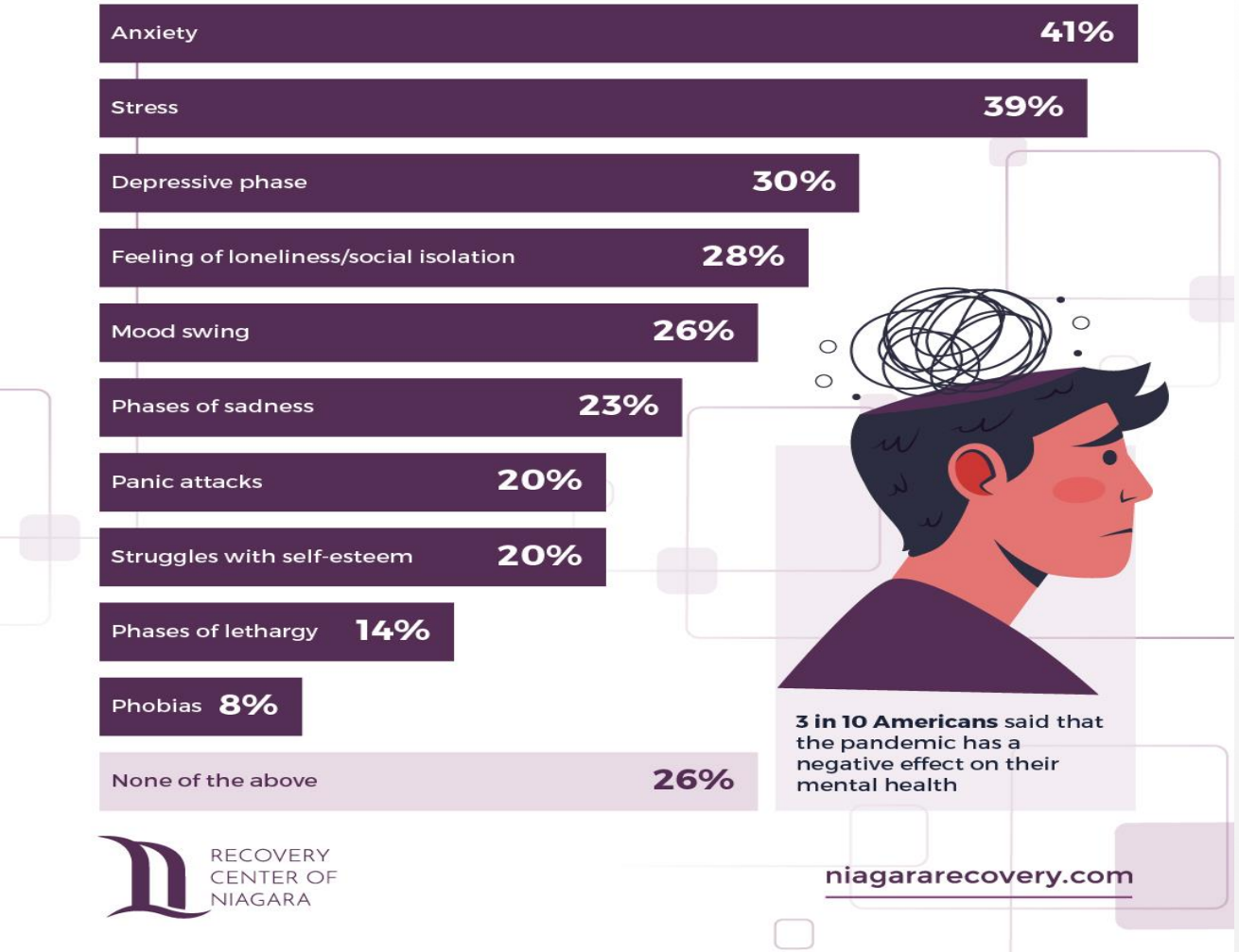
* Based on self-reported frequency of anxiety and depression symptoms. They are derived from responses to the first two questions of the eight-item Patient Health Questionnaire (PHQ-2) and the seven-item Generalized Anxiety Disorder (GAD-2) scale.

Sources: CDC, NCHS, U.S. Census Bureau

statista

Majority of Americans Have Struggled With Mental Health

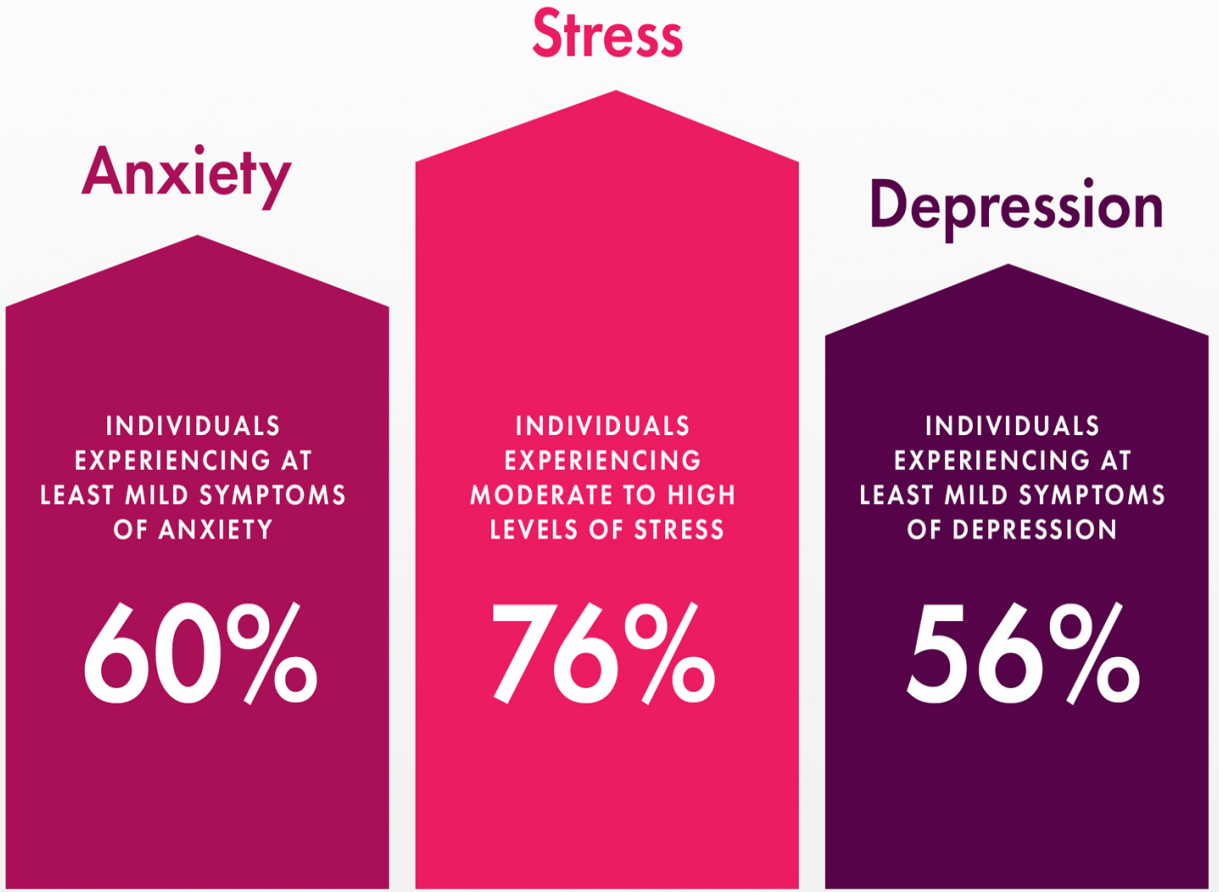
% of U.S. respondents who have experienced the following mental health issues in the past 12 months.



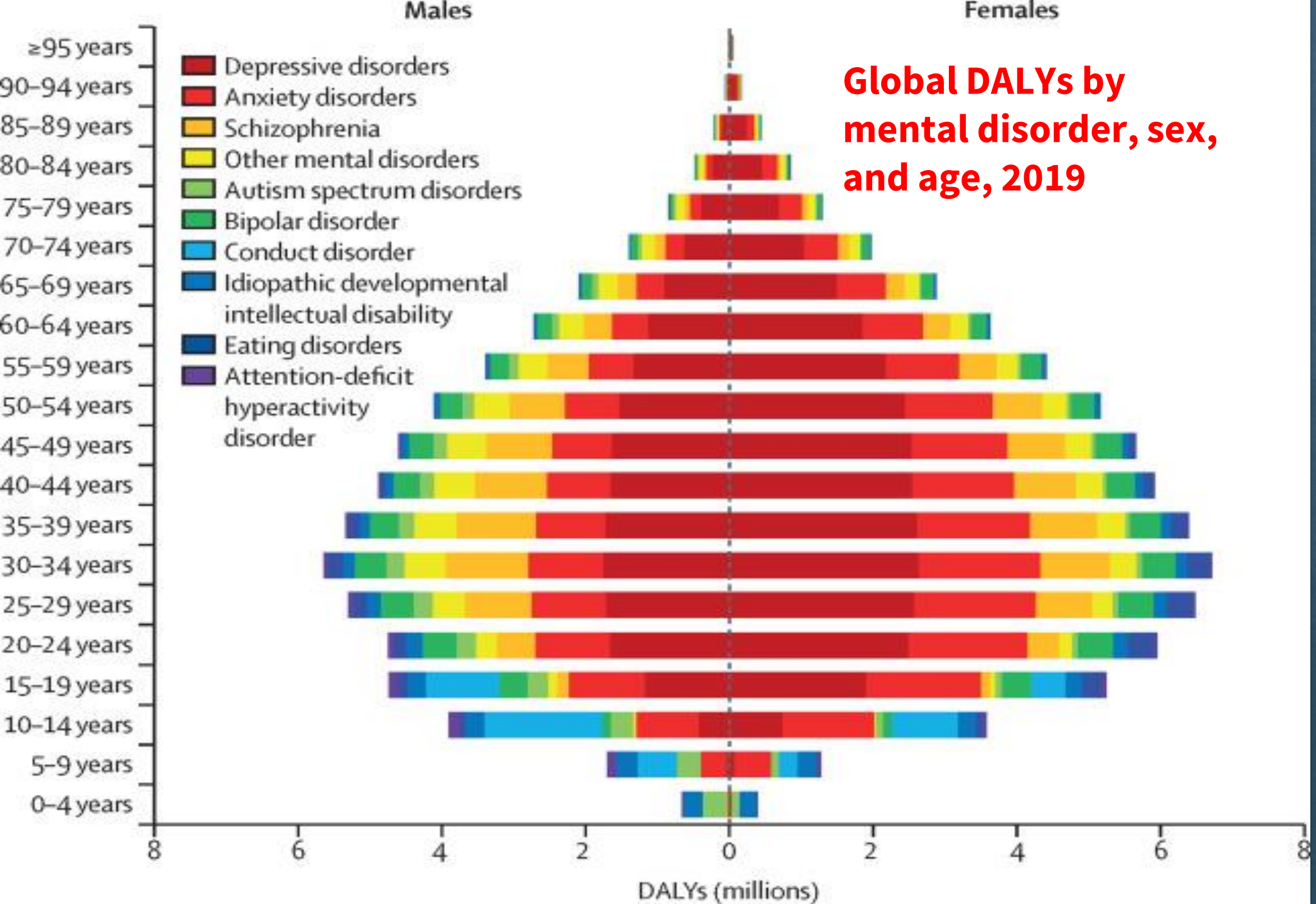
Based on an online survey of 2,049 U.S. adults conducted between July 26 and August 10, 2021
Source: Statista Global Consumer Survey

Globally, an estimated 450 million people suffer from mental or neurological disorders.

Mental Health & Wellbeing in 2023



Data from Champion Health. Sample size: 4170 individuals.



Global DALYs by mental disorder, sex, and age, 2019

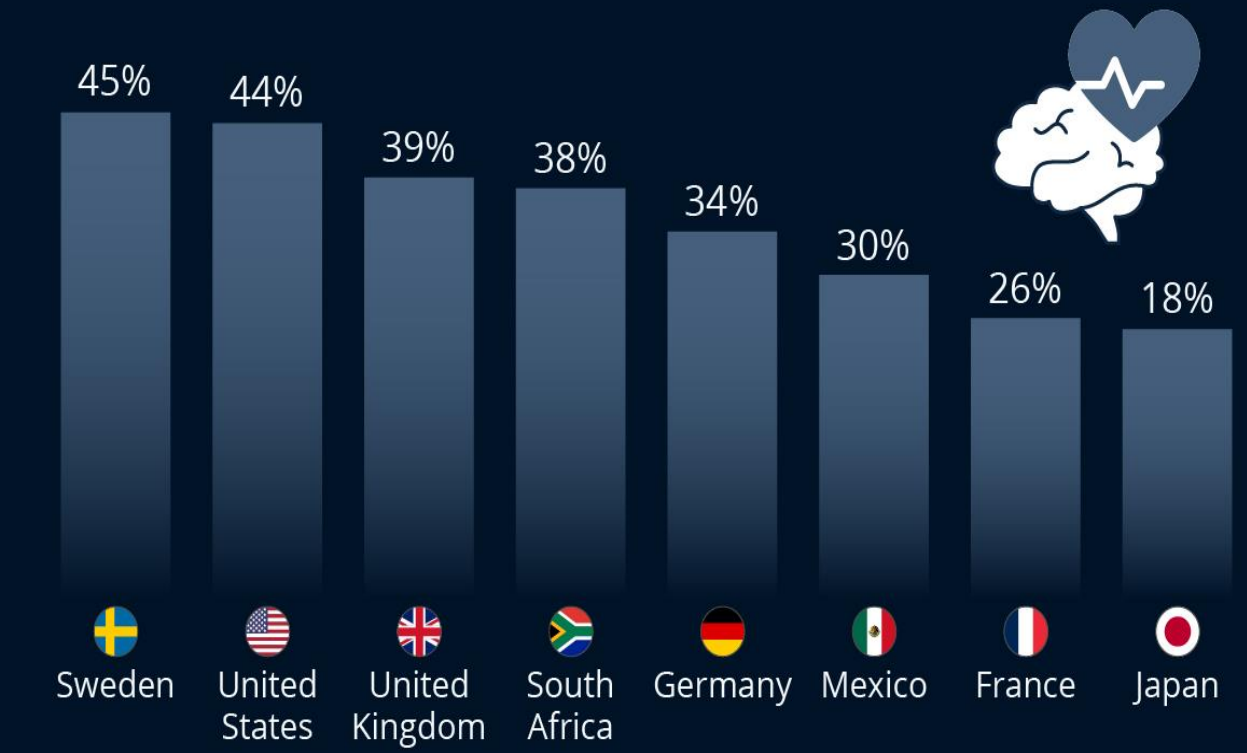
Globally, mental disorders were the 13th leading cause of DALYs in 1990…

7th in 2019

DALYs=disability-adjusted life-years.

How Widespread Are Stress, Depression and Anxiety?

Share of respondents in selected countries who have experienced mental health problems in the last 12 months



1,000-10,000 respondents (18-64 y/o) surveyed per country Jul. 2022-Jun. 2023

Source: Statista Consumer Insights

statista

Most Common Causes of Mental Health Disorders

Genetics	While the exact role genetics play in mental illness is not fully understood, it is estimated that genetics account for approximately 30-60% of the risk for developing mental illness.	1
Trauma and Abuse	Experiencing trauma or abuse, such as physical or sexual assault, can increase the risk of developing mental illness by up to five times.	2
Environmental Factors	Exposure to environmental toxins, such as lead or mercury, has been linked to an increased risk of developing mental illness.	3
Chronic Illness	Individuals with chronic illnesses, such as cancer or diabetes, are at a higher risk of developing depression and anxiety.	4
Substance Use	Substance use disorders often occur alongside mental illness, with an estimated 50% of individuals with a substance use disorder also experiencing a co-occurring mental health disorder.	5
Stressful Life Events	Stressful life events, such as divorce or job loss, can trigger the onset of mental illness in susceptible individuals.	6

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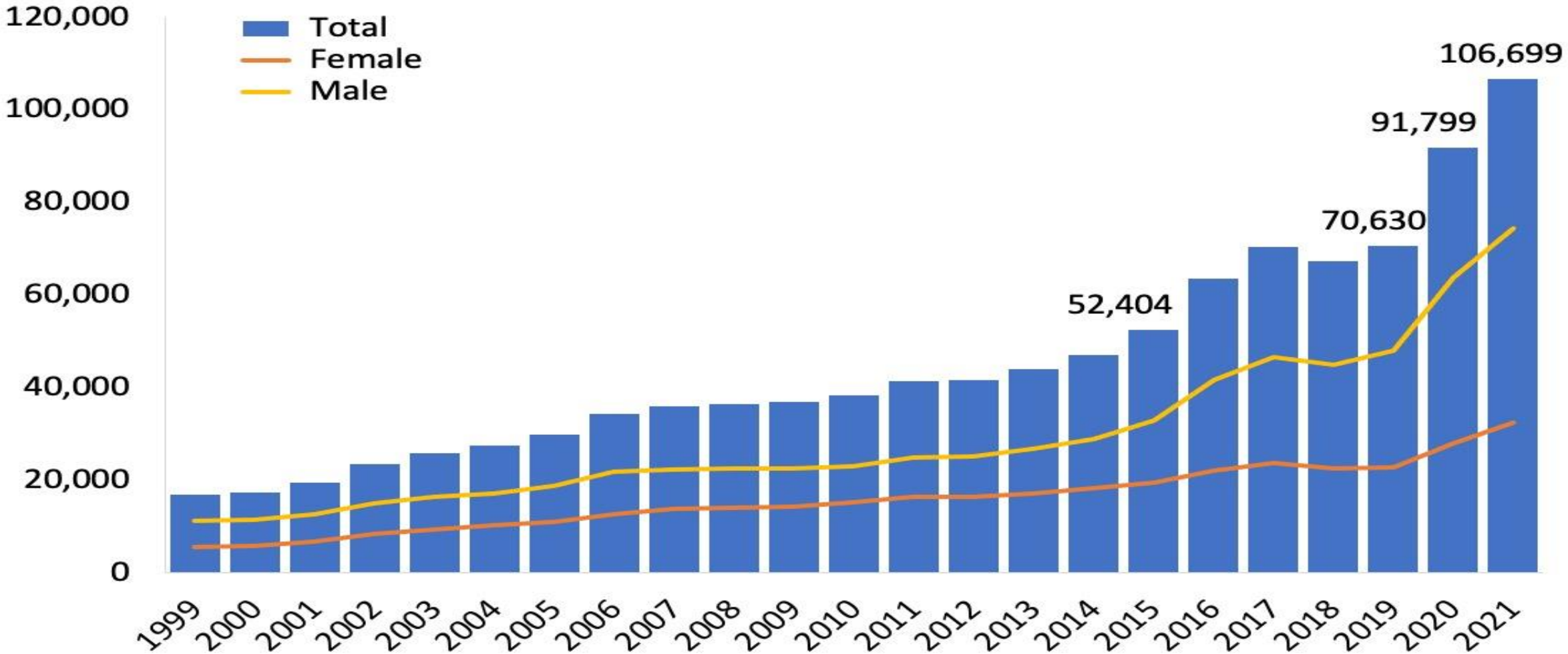
niagararecovery.com

Figure 1. National Drug-Involved Overdose Deaths*, Number Among All Ages, by Gender, 1999-2021



*Includes deaths with underlying causes of unintentional drug poisoning (X40–X44), suicide drug poisoning (X60–X64), homicide drug poisoning (X85), or drug poisoning of undetermined intent (Y10–Y14), as coded in the International Classification of Diseases, 10th Revision.
Source: Centers for Disease Control and Prevention, National Center for Health Statistics. Multiple Cause of Death 1999-2021 on CDC WONDER Online Database, released 1/2023.

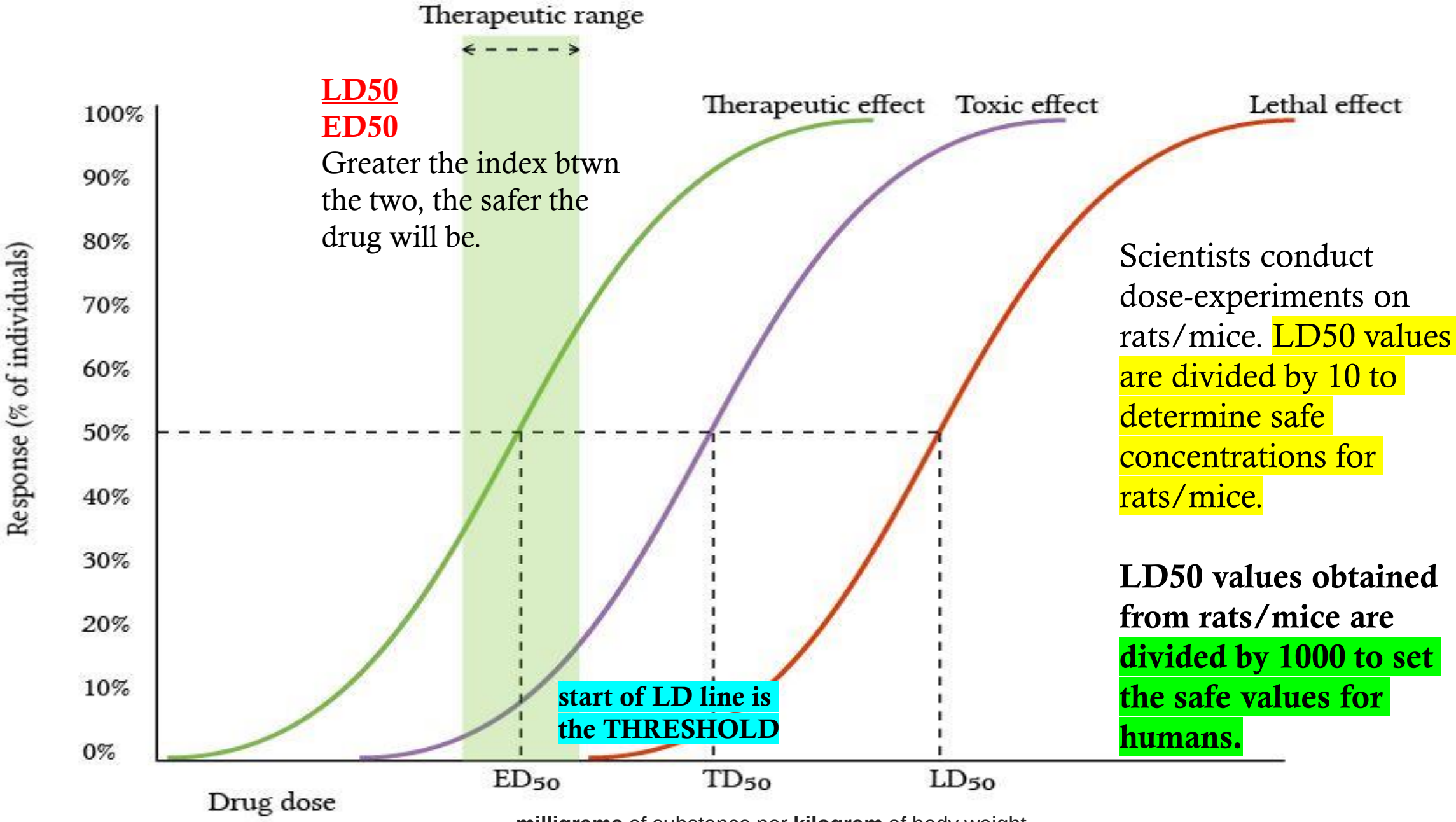
Dose-Response Studies-

-Expose animals or plants to different amounts of a chemical and then observe a variety of possible responses including mortality or changes in behavior or reproduction. (Experimental Testing)

- To assess the risk a chemical poses to any organism, scientist need to determine the concentration that cause harm in the air, water or food.
  - Measured as the dose of a chemical, amt. of chemical that is absorbed or consumed.

- **LD50**- lethal dose (divided by 10 to determine safe concentrations for wildlife, divide by 1000 for safe values for humans) that kills 50% of the individuals

- **ED50**- effective dose that causes 50% of the animals to display the harmful but nonlethal effect



LD50
ED50

Greater the index btwn the two, the safer the drug will be.

start of LD line is the THRESHOLD

Scientists conduct dose-experiments on rats/mice. LD50 values are divided by 10 to determine safe concentrations for rats/mice.

LD50 values obtained from rats/mice are divided by 1000 to set the safe values for humans.

milligrams of substance per **kilogram** of body weight.

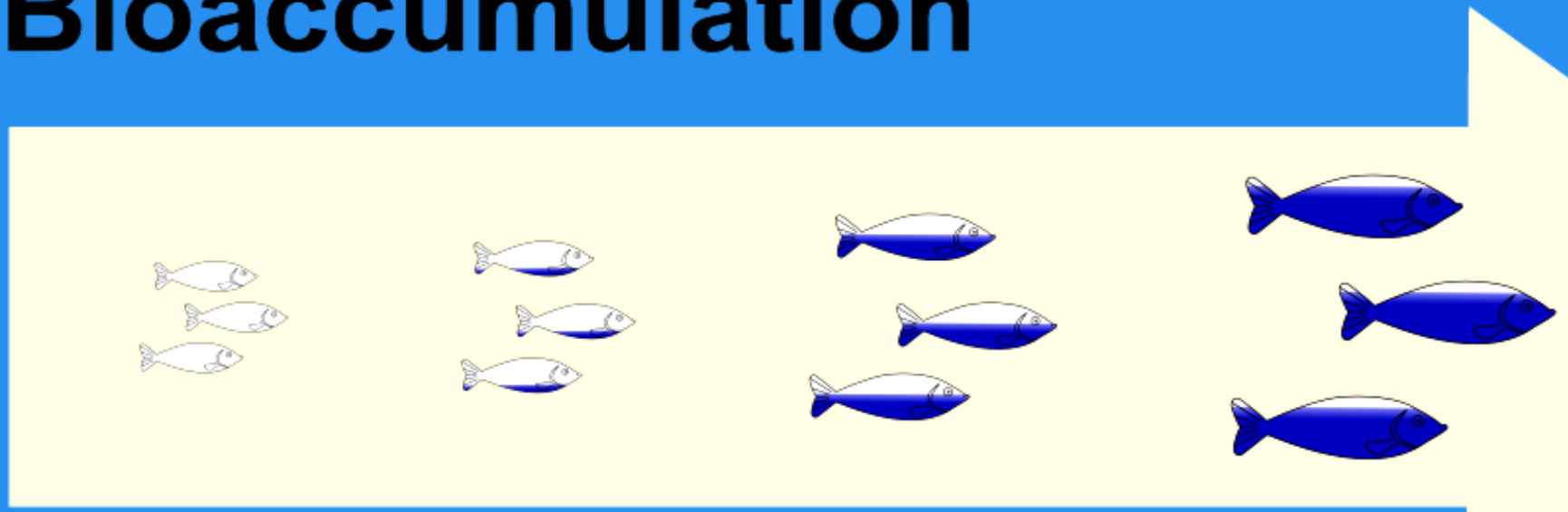
Acute toxicity

Life-threatening one-time doses

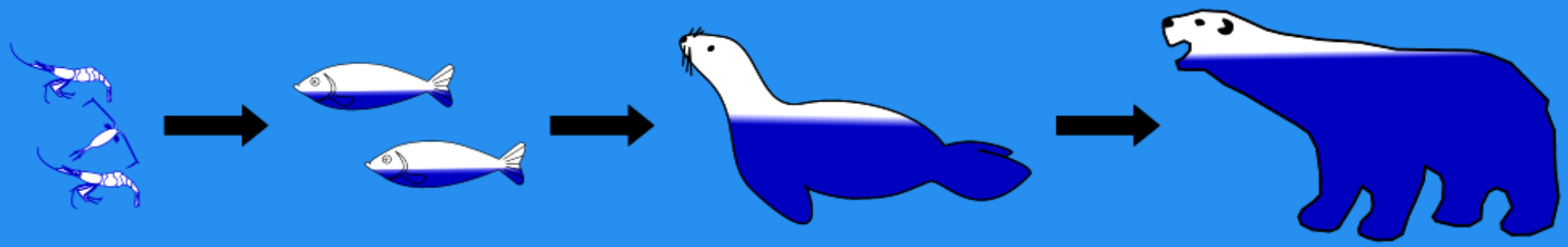
SUBSTANCE	FOUND IN	Lethal dose (LD50 mg/kg)	CATEGORY
Water	... Water	90000	Practically non-toxic
Sucrose	Table sugar	30000	
Monosodium glutamate	Flavor enhancer, soy, cheese	16000	
Ethanol	Alcoholic beverages	7000	
Glyphosate	Herbicide (RoundUp)	5600	
Aluminum hydroxide	Antacid, vaccine adjuvant	>5000	
Fructose	Fruits, component of sucrose	4000	Slightly toxic
Spinosad	Organic insecticide	3700	
Sodium chloride	Table salt	3000	
Eugenol	Clove oil, organic pesticide	2700	
Paracetamol (acetaminophen)	Tylenol, Panadol	2400	
Vanillin	Vanilla bean, vanilla sugar	1600	
Hydrogen peroxide 70%	Bleach, disinfectant	1000	
Theobromine	Chocolate, tea, guarana	950	
Copper sulfate	Organic fungicide	300	Moderately toxic
Chlorpyrifos	Organophosphate insecticide	230	
Caffeine	Natural pesticide, coffee plant	190	
Lead	Batteries, cables, paints	155*	
DDT	Restricted insecticide	100	
Rotenone	Restricted organic pesticide	60	
Vitamin D3	Supplements, fish, mushrooms	37	Highly toxic
Nicotine	Natural pesticide, tobacco	10	
Mycotoxin T2	Plant pathogen, moldy grain	5	
Aflatoxin	Soil fungus, moldy foods	5	
Hydrogen cyanide	Fruit pits, bitter cassava	4	
Botulinum toxin	Botox, Clostridium botulinium	0.001	

mg/kg = milligrams of substance per kilogram of body weight (1kg =2.2lbs).

Bioaccumulation



an increased concentration of a chemical within an organism over time



Biomagnification

the increase in a chemical concentration in animal tissues as the chemical moves up the food chain.

Persistence

-how long a chemical remains in the environment

Persistence depends on temperature, pH, whether chemical is in water or soil, degrades by sunlight, and/or can be broken down by microbes.

Measure by the time needed for a chemical to degrade to half its original concentration, *half life of the chemical*

TABLE 17.2 The persistence of various chemicals in the environment, measured in terms of their half-life

Chemical	Half-life
Malathion insecticide	1 day
Radon	4 days in air
Vinyl chloride	4.5 days in air
Phthalates	4.5 days in water
Roundup herbicide	7 to 70 days in water
Atrazine herbicide	224 days in wetland soils
Polychlorinated biphenyls (PCBs)	8 to 15 years in water
DDT	30 years in soil

Source: Hazardous Substances Data Bank, http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB/.

Table 17.2
Environmental Science

The concentration off chemical exposure depends on….Persistence & solubility of the chemical

Risk Analysis

Environmental hazard – anything in our environment that can potentially cause harm.

~Hazards include pollutants (air pollution), chemical contaminants, human activities such as draining swamps, logging & smoking or natural disasters (volcanos & earthquakes)

Assessing the risk of different hazards, agencies, environmental scientists, & policy makers follow 3 steps…

1.

Qualitative vs. Quantitative

2. Level of risk we can tolerant, hardest of the 3 to determine (consequences)

3. Balance possible harm against other considerations

Stockholm Convention

- In 2001, a group of 127 nations gathered in Stockholm, Sweden, to reach an agreement on restricting the global use of some chemicals
- **12 chemicals were to be banned, phased out, or reduced *("dirty dozen")***
- These include *DDT, PCBs*, and certain chemicals that are by-products of manufacturing processes (caused endocrine disruptors)
- In 2009, 9 additional chemicals were added to the *"dirty dozen"*
- **REACH** – *(**R**egistration, **E**valuation, **A**uthorization (approval), **CH**emical (restriction of)*...agreement embraces the precautionary principle by putting more responsibility on the chemical companies to confirm that chemicals used in the environment pose to risk to people or the environment.