

Chapter 4

RISK QUANTIFICATION

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“The prudent see danger and take refuge, but the simple keep going and pay the penalty.”
Proverbs 27:12

“Absence of evidence is not evidence of absence.”

“There are three classes of people. Those who see. Those who see when they are shown. Those who do not see.”
Leonardo Da Vinci, 1400s

"All that is required for evil to triumph is for good men to do nothing."
"Nobody made a greater mistake than he who did nothing because he could do only a little."
Edmund Burke

"The world is a dangerous place to live; not because of the people who are evil, but because of the people who do nothing about it."
Albert Einstein

“Better to live a day as a lion than 100 years as a sheep.”
Benito Mussolini (1883 – 1945)
USA President Donald Trump retweet on Feb. 28, 2016

“But little Mouse, you are not alone,
In proving foresight may be vain:
The best laid schemes of mice and men
Go often awry,
And leave us nothing but grief and pain,
For promised joy!”

‘To a Mouse, on Turning Her up in Her Nest with the Plough,’ Robert Burns, 1785

4.1 INTRODUCTION

Probabilistic Risk Assessment, also designated as PRA, is a formal analytical method used for the protection of the public’s health and safety. Its goal is the development of methods for predicting or “anticipating” safety concerns before they become manifest through the possible processes of:

1. Loss,
2. Injury,
3. Death.

Probabilistic Risk management, on the other hand, is not about enhancing success; it is about avoiding the failures that are unacceptable.

Understanding the distinction between risk and uncertainty is crucial in all aspects of life. A risky decision is when one has a good sense of the odds and the pay-offs of some action. It lends itself to statistical analysis and econometrics, particularly if it is a decision one will have the opportunity to make multiple times.

An uncertain decision is when one does not have a good sense of odds and pay-offs. Statistical analysis in this case may very well kill the individual, particularly if he is not going to get multiple cracks at the game, or if he does not know how many times he will be allowed to make a choice. Game theory is needed to make sense of decisions made under uncertainty.

Risk may be quantified and described in probabilistic and possibilistic terms, and analysts can factor this into their valuation models. However, uncertainty is different and hard to quantify because it refers to future events that cannot be fully understood nor quantified.

Risk is calculated using mathematical representations and building models. In this context one must distinguish between:

- a) Calculated risk,
- b) Perceived risk.

Accidents are the leading cause of death for people in the age group 1-41 years in the USA, and they are the fifth leading cause of death overall. One person dies every 5 minutes as the result of an accident. One death occurs every 11 minutes as a result of a motor vehicle accident; half of them as a result of driving under the influence of alcohol or drugs. Accidents claim the lives of 13 people every hour on every day of the year, and one out of every 10 fatal accidents occurs on the job.

4.2 QUANTIFIED RISK

It is not sufficient to describe risk in terms of smart sayings like the one advanced by financier Warren Buffet: "Risk is not knowing what you are doing." A quantification of the level of risk is necessary for objective decision making.

Risk is related to the following concepts of:

1. Safety,
2. Danger,
3. Hazard,
4. Loss,
5. Injury,
6. Death,
7. Toxicity,
8. Peril,
9. Vulnerability.

From this perspective, risk can have two possible meanings:

1. It could mean: "hazard, peril, exposure to injury or loss." In this context it refers to an unrealized potential for harm. It is most important to notice that *once* the danger becomes realized it is *no longer* risk: it becomes injury, loss or death.

2. Risk could be considered as the “chance” of loss, injury, or death. Chance, likelihood and probability are all related words for an underlying random process described by the laws of “Probability Theory.”

Managing risk uses the tools of Probability Theory and Possibility Theory. For instance, if one wants to keep a stash of 6 dollars in one’s possession; no more, no less, what would be the bet on each roll of a die? The answer is 1 dollar, since the probability of rolling a specific number in the long run is 1/6, and the expected value of the bet outcome can be calculated as:

$$E = \left(\frac{1}{6} \times 1\right) + \left(\frac{1}{6} \times 1\right) = 1.$$

Risk is associated with uncertainty. However according to Nassim Taleb:

“Uncertainty should not bother you. We may not be able to forecast when a bridge will break, but we can identify which ones are faulty and poorly built. We can assess vulnerability.”

4.3 ACTUARIAL OR LINEAR RISK

If we accept the definition of risk as the chance of loss, injury, or death one can thus quantify it using the power of mathematics in the following way:

$$\text{Risk} = \text{Probability} \times \text{Consequence}$$

or in symbolic form:

$$R = p.C \tag{1}$$

where: p is the probability of occurrence,
C is the consequence from the occurrence.

“Insurance” using the concept of the actuarial risk was invented in the 15-th century by the Genoese merchants to protect against catastrophic losses to their trading ships through storms or piracy by sharing the involved risk.

In this case, the insurer collects a “premium” of a certain amount of cash per ship:

$$R \left[\frac{\$}{\text{insured ship}} \right],$$

to insure a total number of ships per year of:

$$N \left[\frac{\text{insured ships}}{\text{year}} \right].$$

If the ships lost per year are:

$$n \left[\frac{\text{lost ships}}{\text{year}} \right],$$

The award paid per lost ship is:

$$C \left[\frac{\$}{\text{lost ship}} \right].$$

For the established insurance company to break even, the following balance relationship must hold:

$$N.R = n.C \quad (2)$$

This defines the break even premium collected by the insurance company as:

$$R = \frac{n}{N} . C \left[\frac{\$}{\text{insured ship}} \right] \quad (3)$$

As the number of insured ships becomes large:

$$N \rightarrow \infty ,$$

the ratio n/N tends to a probability p :

$$\lim_{N \rightarrow \infty} \frac{n}{N} = p \quad (4)$$

Comparing Eqns. 3 and 4 we can write:

$$R = p.C$$

which corresponds to the definition given in Eqn. 1.

EXAMPLE 1

As a numerical example, let us consider a person in a certain age group with a 1 percent probability of dying in a year:

$$p = 0.01$$

He purchases a life insurance policy with a payoff value of \$ 100,000:

$$C = \$ 100,000.$$

To break even, or for the net income to the insurance company to be equal to the net award that it must pay, the insurance company must have him pay the following annual premium according to Eqn. 1:

$$R = p.C = 0.01 \times 100,000 = 1,000 \left[\frac{\$}{\text{year}} \right]$$

In practice, insurance companies incur an overhead in managing the insurance business, so to cover the overhead, either that the probability of death p must be lower, or the insurance company must charge a larger premium $R' > R$ to cover its overhead cost.

4.4 TECHNOLOGICAL RISK

Technological risk is an application of the actuarial risk to the technological realm. Let us consider a world with a large chemical or nuclear plant population N , with all plants being identical. We also assume the same demography and geology. Let us also consider the plants to be separated in such a way that they are independent and do not affect each other.

Each year let us consider that n_i plants fail in the i -th failure mode, and that these failures lead to the release of chemical pollutants or radiation leading to a population dose d_i due to the i -th failure mode.

We can state that the population dose d_i is proportional to the number of plants failing n_i or:

$$d_i \propto n_i.$$

We can replace the proportionality sign with an equality sign if we use the proportionality constant c_i as:

$$d_i = c_i \cdot n_i \tag{5}$$

where the proportionality constant c_i can be identified as the average population chemical or radiation dose per plant due to the i -th failure mode.

Over all the failure modes M , the total population dose is the summation:

$$D = \sum_{i=1}^M d_i = \sum_{i=1}^M c_i \cdot n_i \tag{6}$$

The probability of occurrence of the i-th failure mode in the limit of a large number of plants is:

$$p_i = \lim_{N \rightarrow \infty} \frac{n_i}{N} \quad (7)$$

The plant risk can be taken as population dose per plant as:

$$\begin{aligned} R &= \text{Plant Risk} = \text{Population dose per plant} \\ &= \lim_{N \rightarrow \infty} \frac{D}{N} \end{aligned} \quad (8)$$

Substituting for the population dose D from Eqn. 6, we get:

$$R = \lim_{N \rightarrow \infty} \frac{\sum_{i=1}^M c_i \cdot n_i}{N} = \sum_{i=1}^M c_i \cdot \lim_{N \rightarrow \infty} \frac{n_i}{N} = \sum_{i=1}^M c_i \cdot p_i \quad (9)$$

This suggests that risk is the “*expected consequence*” in the same sense that an insurance premium is the expected consequence of the awards.

Risk as the product of the probability of occurrence (p_i) and the consequence (c_i) is the “expectation value,” or the “mathematical expectation,” or simply the “mean value” of the consequence. This leads to the important observation that:

“Risk is the premium paid by society for the benefit of using a given technology.”

4.5 RISK EXPRESSION

The simplest expression of risk is in terms of frequency or likelihood of occurrence of a certain event (Table 1)

Table 1. Risk as frequency of occurrence or likelihood.

Event	Frequency or likelihood of death
Heart disease	1:5
Cancer	1:7
Water related disease	1:20
Car accident	1:84
Plane crash	1:5,051
Legal execution	1:62,468
Lightning strike	1:79,746

Risk can be expressed in practice in many different ways. In one approach it is expressed as a ratio:

$$\left[\frac{\text{Monetary losses, injuries, deaths}}{\text{person. year}} \right]$$

The monetary losses, injuries or deaths can further be specified, for instance as cancer occurrences per person per year. Table 2 shows estimates of such a risk for a variety of societal causes.

Table 2. Cancer occurrence risks from different causes.

Source of Risk	Risk [cancer occurrences/(person.year)]
Cosmic radiation risks	
One transcontinental flight/year	1/2,000,000
Airline pilot, 50 hours/month at 30,000 ft	1/20,000
Frequent airline passenger	1/65,000
Living in Denver, Colorado (1 mile elevation), instead of New York at sea level	1/100,000
Four months (one summer) camping at 15,000 ft	1/100,000
Other radiation sources	
Average USA medical diagnostic x-rays	1/100,000
Living in a brick building (radon gas) rather than a wood structure (C ¹⁴)	1/200,000
Natural radiation background at sea level	1/65,000
Food and Drink	
A single diet drink per day from saccharin sweetener	1/100,000
Average USA saccharin consumption	1/500,000
Four tablespoons of peanut butter per day from aflatoxin	1/25,000
One pint of milk per day from aflatoxin	1/100,000
Miami or New Orleans drinking water	1/800,000
Cancer risk from ½ lb charcoal broiled steak per week	1/2,500,000
Alcohol averaged over nonsmokers and smokers	1/20,000
Tobacco consumption	
Smoker, cancer only	1/800
Smoker, all effects including heart disease	1/300
Person in same room as smoker, second-hand smoke	1/100,000
Other Causes	
Regular use of contraceptive pills	1/50,000
Curable skin cancer from sunbathing, and other outdoor activities	1/200

Another way of expressing risk is in terms of the average loss of life expectancy in days lost due to various causes as shown in Table 3.

Table 3. Average loss of life expectancy due to different causes.

Cause	Average Loss in Life Expectancy [Days]
Being male and unmarried	3,500
Cigarette smoking, male	2,250
Heart disease	2,100
Being female and unmarried	1,600
Obesity at 30 percent overweight	1,300
Being a coal miner	1,100
Cancers	980
Being 20 percent overweight	900
Cigarette smoking, female	800
Strokes	520
Dangerous jobs, accidents	300
Pipe smoking	220
Increasing food intake by 100 cal/day	210
Motor vehicles accidents	207
Alcohol drinking, USA average	130
Accidents in homes	95
Suicides	95
Being murdered, homicide	90
Legal drugs misuse	90
Average job, accidents	74
Drowning	41
Jobs involving radiation exposure	40
Accidental falls	39
Accidents to pedestrians	37
Safest jobs, accidents	30
Fire, burns	27
Energy generation	24
Illicit drug use, USA average	18
Firearms accidents	11
Natural radiation, Biological Effects of Ionizing Radiation (BEIR) Report	8
Medical x-rays	6
Drinking coffee	6
Oral contraceptives use	5
All catastrophes combined	3.5
Diet drinks	2
Reactor accidents, assuming all USA electrical power is nuclear, Union of Concerned Scientists.	2
Reactor accidents, Rasmussen Wash-1400 report	0.02

Radiation from nuclear industry, assuming all USA electrical power is nuclear, Union of Concerned Scientists.	0.02
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The risk associated with energy generation is shown in Table 4, in terms of the average loss of life expectancy among the public.

Table 4. Average loss of life expectancy among members of the public due to different modes of energy generation.

Energy Source	[Fatalities/year]	Average years lost	Life expectancy reduction [days]
Coal			
Air pollution	11,000	10	11.5
Transportation accidents	300	35	1.0
Sum			12.5
Oil			
Air pollution	2,000	10	2.2
Fires	500	35	2.0
Sum			4.2
Natural Gas			
Air pollution	200	10	0.2
Explosions	100	35	0.4
Fires	100	35	0.4
Asphyxiation	500	25	1.5
Sum			2.5
Hydroelectric			
Dam failures	50	35	0.2
Nuclear Energy (400 GWatts capacity)			
Routine emissions	8	20	0.018
Accidents	8	20	0.018
Transportation	<0.01	20	-
Waste	0.4	20	0.01
Plutonium toxicity	<0.01	20	-
Sum			0.037
Electrocution	1,200	35	5.0
Total			24

In Table 5 the risk is expressed in terms of fatalities per 100,000 persons per year, for different professional activities.

Table 5. Occupational fatality rates for some professions.

Occupation	Fatality rate [fatalities/(100,000 persons.year)]
Logging workers	92.4
Aircraft pilots and engineers	92.4
Fishermen and related workers	86.4
Structural iron and steel workers	47.0
Refuse and recycling collectors	43.2
Farmers and ranchers	37.5
Roofers	34.9
Power lines installers and repairers	30.0
Sales workers and truck drivers	27.6
Taxi drivers (homicides) and chauffeurs	22.7
All occupations	4.1

4.6 PERCEIVED VERSUS REAL RISK

Some observations can be made about different sources of risks. It must first be admitted that many accidents have trivial and complacency causes and can be averted.

The refuse and recycling of trash mortality rate is caused primarily by impatient drivers trying to pass garbage collection trucks and hitting the workers in the process.

Given the few airline crashes, the rate for aircraft pilots and engineers seems too high, but is in fact caused by occurrences in small aircraft such as dare-devil crop dusters “buying the farm.”.

The USA has one of the highest fire deaths rates in the industrial world. For the year 1997, it was 15.2 deaths / million people. The National Fire Data Center reported 4,050 deaths and 23,750 injuries due to fires in 1997. These were the result of 1,750,000 fires that occurred in 1997. Fully 84 percent of the fatalities occurred in the home. Housing uses primarily flammable materials such as wood. Children with age 5 and under were at the greatest risk of home fire related deaths. They panic and do not know what to do in the case of a fire, hiding behind a bed or in a closet instead of attempting an escape. Ninety percent of children fire deaths occur in homes that are not equipped with fire and smoke detectors. Some of these fires are preventable resulting from the use of matches, unnecessary candles and cigarette smoking.

About 1/3 of all house fires in the USA occur during the cold home heating season of December, January and February. According to the National fire Protection Association (NFPA), the major cause of these winter fires can be attributed to faulty and improper use and maintenance of supplemental heating equipment such as space heaters. Some cities have banned the use of many types of portable space heaters.

Live and artificial Christmas trees are the ignition source of 300 reported USA home structure fires each year resulting in 14 fatalities, 21 injuries and \$16.8 million in property damage.

Farming is perceived as an idyllic, healthy, low risk profession, but in fact it involves substantial risk. In addition to exposure to pesticides and farm chemicals, more farmers and rural residents are involved in farm and road accidents. Non highway vehicle

accidents such as tractor overturns accounted for 40 percent of the farmer and ranchers deaths.

The National Safety Council estimates that each year more than 700 farmers and ranchers perish in work related accidents. Another 120,000 sustain disabling injuries. About 387,000 agricultural producers have disabilities and chronic health conditions limiting their daily activities.

Tractors are responsible for 41 percent of the accidental farm deaths of children under age 15; yet 4 out of 5 farm children ride tractors with family members.

From farm tractor rollovers to roadway accidents involving farm machinery, agriculture is one of the most risky occupations in the USA.

4.7 SYSTEMIC RISK AND RANDOM RISK

Systemic risk depends on predictable events whereas random risk depends on possible or random events. Random risk can be insured against, whereas systemic risk cannot.

As an example, the price of an agricultural commodity such as corn involves a systemic risk. The price of corn affects all farmers across the nation without regard to their management ability or agronomic skills. Farmers cannot affect the supply and demand situations that result in lower or higher prices for their crop; they are price takers not price makers.

Systemic risk is unsuitable for insurance. First, if the price of the corn goes down, it does so for all farmers, which is similar to all houses in the country burning down in a given year. Second, if prices enter into a multiyear decline, insurance would provide less and less protection as the price falls. At some point, the expected price that is offered in an insurance contract would become below the cost of production and thus offers no protection whatsoever, and guarantees a loss on the produced crop.

Insurance companies offering insurance against systemic risk would go bankrupt if the risk is realized. These companies become unstable and must receive some form of government subsidy to remain in business, or they must raise their premiums to unpalatable levels to the insured.

On the other hand, the crop yield is a random event and can be insured against. Yield depends on the weather, precipitation distribution, localized drought and disease incidence in different parts of the country. It would be a rare event that all farmers across the nation would be subject to the same yield loss in a given year. Such random risk can be insured against if different regions of the country are rated as to their different probabilities of yield loss. This is similar to offering lower fire insurance rates for a building equipped with a sprinkler system.

4.8 SOCIETAL RISKS

COMMON FOODS RISKS

Raw uncooked meats are not the only foods posing risks of disease through pathogens such as listeria, salmonella and E coli.

Raw unpasteurized bee honey carries botulism spores that can affect young children.

While rhubarb stems are safe to eat after boiling them, the leaves contain a toxin that can cause kidney damage.

The eyes of potatoes, especially if sprouted, can cause severe gastrointestinal pain.

Improper heating of castor beans can leave behind a powerful ricin toxin in the extracted castor oil.

Ingestion of large quantities of the nutmeg spice can cause hallucinations and even death.

Brazil nuts concentrate small amounts of thorium from the soil and are comestible, but their shells are highly carcinogenic.

IONIZATION VS. PHOTOELECTRIC SMOKE DETECTORS

Four decades of use suggest that the most popular smoke alarm in ninety percent of homes in the USA, based on ionization, fails at a fifty percent rate compared with the more expensive high-tech photo-electric/heat type in a smoldering smoky fire. The ionization alarms are meant for fast moving flames such as a fire in a kitchen and pose an unwarranted risk in that they generate an alert several minutes slower than the more sensitive photo-electric type in the early stage of the more common smoldering smoky fires. They are also more prone to nuisance false alarms from ordinary cooking and steam from showers. Most fatal fires have a long smoldering phase. Photoelectric alarms can activate an hour or more before ionization alarms in smoldering fires. They detect hot, invisible particles from cooking or an open flame. They do not detect visible smoke, even though they may appear to. Slow smoldering fires emit cool, visible smoke particles, but usually not enough of the hot invisible particles to activate ionization alarms. They will almost always remain silent during the smoldering stage of a fire, until the fire bursts into flame, after which it is often too late to safely escape.

When fire-fighters are called out to homes with fires resulting from smoke alarm activations, the type of smoke alarm used is critical for public and fire-fighter safety. If the alarm is activated by a fire in the flaming stage, the difference between ionization and photoelectric alarms is only a matter of a difference of seconds, if it has not been disconnected and if it is in the room of fire origin. However, most fatal fires have a long smoldering phase. Photoelectric alarms can activate an hour or more before ionization alarms in smoldering fires. When this happens, in many cases consumers can safely put the fire out without any risk to themselves or fire fighters.

When firefighters are called out to a fire, if photoelectric alarms are installed, everyone should have already exited the home. When fires have not reached the flaming stage, the risk to fire fighters is dramatically reduced.

Interconnected wired or wireless smoke detectors will all sound an alarm when one of them is triggered. The ionization type uses radioactive isotopes such as Americium²⁴¹ posing a radiation dose hazard if improperly emplaced in high traffic areas in home and a disposal hazard in landfills when retired from service. The alpha particle decay of Americium²⁴¹ ionizes the air in a gap between two electrodes, causing a small electrical current to flow between them. When a sub-micron size of smoke particulates from burning

in a kitchen enters the space between the electrodes, the alpha radiation is absorbed by the smoke particle, the current is interrupted, and the alarm is activated.

ALCOHOL-DRINKING RISKS

A study published in the international medical journal *The Lancet*, shows that in 2016 almost 3 million deaths worldwide were attributed to alcohol consumption, including 12 percent of deaths in men between 15 and 49 years. There are convincing correlations between drinking and premature death, cancer and cardiovascular problems. The study, part of the annual Global Disease Burden (GBD), assesses the results and health patterns related to alcohol between 1990 and 2016 for 195 countries and territories and by age and sex.

The study does not distinguish between beer, wine and liquor. The “average consumption” refers to a standard drink, defined in the study as 10 grams of pure alcohol, consumed by one person daily, approximately the equivalent of: A small glass of red wine (100 ml) with 13 percent alcohol by volume; or a can or bottle of beer (375 ml) with 3.5 percent alcohol by volume; or a glass of whiskey or other liquors (30 ml) with 40 percent alcohol by volume. The study used 694 data sources on alcohol consumption at the individual and population levels, along with 592 prospective and retrospective studies on the risk of alcohol consumption. More than 500 GBD collaborators, researchers, academics and others from more than 40 nations contributed to the study. There is a pressing and urgent need to review policies to encourage the decline of alcohol consumption levels or to abstain altogether. The myth that one or two drinks a day is good for you is just that: a myth. This study collapses that myth.

For every ten fatalities of working-age adults, one is attributable to excessive alcohol consumption according to a study by researchers with the USA Centers for Disease Control and Prevention (CDC). Between 2006 and 2010 some 88,000 deaths could be attributed to excessive drinking. Each of these lost lives was cut short by an average of 30 years. Six Americans on-average die each day from drinking too much alcohol. Over a full year, the toll from fatal intoxications passes 2,220, according to the CDC. Binge drinking accounts for most of those lethal events.

What is noticeable about the death rate is that the vast majority of cases do not involve college-aged young adults, the group most often associated with binge drinking, but it is middle-aged white males. The CDC reported that more than 75 percent of those 2,220 alcohol poisoning deaths occur among adults between the ages of 35 and 64. More than 75 percent of people who die from alcohol poisoning deaths are men, and nearly 70 percent are white people.

The researchers urged that all USA residents be more aware that even one night of alcohol overindulgence can turn deadly. Too much alcohol in the body suppresses breathing. Binge drinking is defined as drinking enough to bring the blood alcohol level to 0.08 percent, which puts drivers past the limit in all 50 states. Once one gets above that level of consumption, the risk of death from alcohol poisoning really goes up.

Geographically, clear patterns emerged from the numbers illustrating what might be called America's bingeing belt. Among the 10 states with the highest average annual number of alcohol poisoning deaths, eight are in the West:

Alaska (46.5),

New Mexico (32.7),
Arizona (18.7),
Wyoming (17.7),
South Dakota (17.0),
Utah (16.7),
Colorado (14.4), and
Oregon (12.7).

In some areas, binge drinking behavior is strongly influenced by state and local laws governing the price and availability of alcohol, as well as other cultural and religious factors. Policies that boost prices and cut the clusters of retailers that make alcoholic beverages more available and accessible have been shown to reduce binge drinking in states. Living in geographically isolated rural areas might increase the likelihood that a person with alcohol poisoning will not be found before death or that timely emergency medical services will not be available.

In addition to using blood alcohol levels, health experts define binge drinking as consuming four or more alcoholic beverages in one session for women and five or more for men. The drinks may include shots of liquor, glasses of wine or cans of beer. More than 38 million American adults report they engage in binge drinking, on average, four times per month, and guzzle an average of eight drinks per spree. Most of the alcohol overdoses examined involved people for whom alcohol dependence was not listed as a contributing cause.

Roughly two-thirds of people who admitted binge-drinking 10 or more times per month were not alcohol dependent, another recent study found. All totaled, Americans lose approximately 2.56 million years of life each year due to alcohol-related deaths. And though most expect alcohol related deaths to be caused by car crashes and liver failure, excessive drinking leads to all kinds of fatal consequences: acute pancreatitis, psychosis, esophageal cancer, breast cancer, oral cancer, falling injuries, suicide and drowning. Alcohol intake plays a role in at least 54 different conditions linked to death. The victims are often middle-aged wage-earners. It is not just a loss of life, but a major hit to the economy. This lost potential saps some \$224 billion a year from the USA economy.

From 2006 to 2010, the highest percentage of alcohol related deaths among citizens aged 20 to 64 occurred in Western locales. Sixteen percent of working-age adult fatalities in New Mexico are attributable to alcohol followed by Alaska, Colorado, Wyoming, Arizona, Montana, California, Nevada, Oregon and Idaho. The top three states least plagued by excessive drinking deaths are Maryland, New Jersey and New York, where just above 7 percent of working-age deaths are related to alcohol.

Researchers from the Boston University School of Medicine and Boston University School of Public Health have found that alcohol is a “major” contributor to cancer deaths in the USA, even when consumed in small amounts: “Alcohol remains a major contributor to cancer mortality and YPLL [Years of Potential Life Lost]. Higher consumption increases risk but there is no safe threshold for alcohol and cancer risk. Reducing alcohol consumption is an important and underemphasized cancer prevention strategy.”

Previous research has consistently shown that alcohol consumption is a significant risk factor for cancers of the mouth, throat, esophagus and liver. More recent research has demonstrated that alcohol consumption also increases the risk of cancers of the colon, rectum and female breast.

The study used 2 methods to calculate population-attributable fractions. It based relative risks on meta-analyses published since 2000, and adult alcohol consumption on data from the 2009 Alcohol Epidemiologic Data System, 2009 Behavioral Risk Factor Surveillance System, and 2009–2010 National Alcohol Survey. The researchers found that alcohol led to approximately 20,000 cancer deaths annually, indicating that alcohol contributes to about 3.5 percent of all cancer deaths in the USA [2].

Breast cancer was the most common cause of alcohol-attributable cancer deaths in women or about 15 percent of all breast cancer deaths. In men, they found that cancers of the mouth, throat and esophagus were common causes of alcohol-attributable cancer deaths or about 6,000 deaths annually.

Each alcohol-related cancer death resulted in an average of 18 years of potential life lost. Average consumption of 1.5 drinks / day or less made up 30 percent of all alcohol-attributable cancer deaths. Higher levels of alcohol consumption were associated with a higher cancer risk.

Dr. Timothy Naimi from the Department of Medicine at Boston University School of Medicine suggests that: “The relationship between alcohol and cancer is not widely appreciated by the public and underemphasized by physicians.”

A UK Lancet study of 600,000 drinkers estimated that having 10 to 15 alcoholic drinks every week could shorten a person's life by between one and two years. People who drink more than 18 drinks a week could lose four to five years of their lives.

Scientists, who compared the health and drinking habits of alcohol drinkers in 19 countries, modelled how much life a person could expect to lose if they drank the same way for the rest of their lives from the age of 40. They found people who drank the equivalent of about five to 10 drinks a week could shorten their lives by up to six months. The study's authors also found drinking increased the risk of cardiovascular illness, with every 12.5 units of alcohol people drank above the guidelines raising the risk of:

Stroke: 14%

Fatal hypertensive disease: 24%

Heart failure: 9%

Fatal aortic aneurysm: 15%

Drinking alcohol was linked with a reduced risk of non-fatal heart disease, but scientists said this benefit was wiped out by a higher risk of other forms of the illness. Previous studies have suggested that drinking red wine can be good for our hearts, although some scientists have suggested these benefits may be overhyped. A Danish study found drinking three to four times a week was linked to a lower risk of type 2 diabetes.

On balance there are no health benefits from drinking alcohol, which is usually the case when things sound too good to be true. Although non-fatal heart attacks are less likely in people who drink, this benefit is swamped by the increased risk of other forms of heart disease including fatal heart attacks and stroke. The key message of the research is that, if you already drink alcohol, drinking less may help you live longer and lower your risk of several cardiovascular conditions.

COLORECTAL CANCER RISK

The risk factors for colorectal cancer are age, Inflammatory Bowel Disease or Crohn's Disease, family history of colorectal polyps or cancer, lack of regular physical

activity, low fruit and vegetable intake, low fiber/high fat diet, obesity, alcohol consumption and tobacco use.

Colorectal cancer is the 3rd leading of cancer deaths in the USA, and is the 3rd most common kind of cancers in men and women. Yet, if detected early, it is quite curable. The disease develops slowly over a period of several years in the colon or rectum, possibly from a benign polyp.

About 141,000 cases are diagnosed per year, and 49,000 die of it. A colonoscopy is recommended every 10 year beginning at age 50 using a colonoscope. A Fecal Immunochemical Test (FIT) is recommended yearly.

TRAFFIC AND PEDESTRIAN FATALITIES

There were 33,561 traffic fatalities in 2012, according to the Department of Transportation (DOT) National Highway Traffic safety Administration. This is a 3.3 percent increase of 1,082 deaths over 2011. Driving Under the Influence (DUI) fatalities increased by 4.6 percent.

Most of the increase involved motorcyclists, cyclists, large-truck occupants, in crashes involving drunken drivers and pedestrians.

MOSQUITOES RISK

Mosquitoes kill 1 million people each year according to the World Health Organization (WHO). They also pose a threat to livestock. As the deadliest animal to humans in the world, it spreads diseases such as malaria, dengue fever, chikungunya, West Nile Virus and yellow fever. A mosquito weighs only 2.5 mg and lives for only 4-6 weeks. Mosquitoes have existed since 400 million years and are the greatest transmitted disease insect vector challenge to the human race. Fleas and ticks are other challenges.

About 176 species of mosquitoes have been identified in the USA. The tree-hole mosquito can spread encephalitis. The inland flood water mosquito has a range of 30-60 miles from its breeding site. The latter hatch in the spring and need warm water with a temperature around 70 °F from spring showers and warming temperatures. Other species do best in hot dry weather and appear in mid-summer.

Mosquitoes can breed in house gutters and places where rain water can collect such as tires, bird baths and empty containers. They are attracted to the microbes and the foul odors from standing water to lay their eggs.

FIRST AND SECOND HAND SMOKING RISKS

OVERVIEW

Cigarette smoking in the USA causes an estimated 443,000 deaths each year, including approximately 49,400 deaths due to exposure to secondhand smoke. One out of five Americans or more than 46 million people do smoke. People who smoke are up to six times more likely to suffer a heart attack than nonsmokers, and the risk increases with the number of cigarettes smoked. Smoking also causes most cases of chronic lung disease. It also causes a host of other cancers including throat, mouth, nasal cavity, esophagus, stomach, pancreas, kidney, bladder, cervix, and acute myeloid leukemia.

THE CIGARETTE COMPANY

BELIEVE IN YOURSELF!



Don't test one brand alone ... compare them all!

TRY THIS TEST!
Take a 1000 mg. pack of any other brand. Then, take a 1000 mg. pack of Philip Morris. Compare the two. You'll find that Philip Morris is the only brand that gives you a real cigarette hangover.



Unlike others, we never ask you to test our brand alone. We say ... compare Philip Morris ... watch your mood ... Judge your mood against any other brand! Then make your own choice! Remember

NO CIGARETTE HANGOVER
... AND MORE SMOOCHING PLEASURE!

CALL FOR **PHILIP MORRIS**

Figure 1. Female smokers were induced to “Believe in Yourself!” and “Don’t test one brand alone ... compare them all!” and smoke “Victory Sticks.” Source: Video grab.



Figure 2. Flock or herd behavior associating glamor to smoking risk.

On January 11, 1964, USA Surgeon General Luther Terry released a 387-page report that linked cigarettes to cancer. It became a ground-breaking report that health advocates say saved the lives of 8 million Americans, and became one of the greatest public health successes of the 20th century. The Surgeon General and his committee had waded through 7,000 documents and put together a report that was a culmination of research on tobacco and smoking with the result that cigarettes could kill. People slowly took notice, and within 50 years, smoking has substantially decreased nationwide.

**SWEDISH NATIONAL BOARD OF HEALTH AND WELFARE, BLOOMBERG
PHILANTHROPIES**

Globally, the mortalities from second-hand smoke add to an estimated 5.1 million deaths / year linked to first-hand smoking among the world's 1 billion smokers.

Second-hand smoke may have killed more than 600,000 people in 2004, causing one in every 100 deaths.

According to a study published in the British medical journal: The Lancet, the main causes of death were heart disease, lower respiratory infections, asthma, and lung cancer. Women accounted for 47 percent of the deaths, children 28 percent and men 26 percent. Deaths in adults were spread evenly across the globe. The research was led by Annette Pruess-Ustuen of the World Health Organization (WHO), in Geneva, Switzerland.

The 1 billion smokers in the world are exposing billions of non-smokers to second-hand smoke, a disease-causing indoor air pollutant. Few sources of indoor-air pollution can be completely eliminated. However, smoking indoors can be eliminated with substantial benefits.

The researchers used 2004 data gathered in 192 countries to estimate deaths and years of good health lost. The study estimates that 10.9 million persons-years of good health were lost.

The research was funded in part by the Swedish National Board of Health and Welfare and Bloomberg Philanthropies.

USA SURGEON GENERAL REPORT

More than 440,000 deaths per year in the USA are attributed to smoking and exposure to second hand smoke. Occasional smoking or second-hand smoke causes immediate damage to one's organs and poses risk of serious illness or death. There is no risk-free level of exposure to tobacco smoke.

A December 2010 report: "How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease" issued by Surgeon General Regina Benjamin describes tobacco smoke's assault on the body. The chemicals in tobacco smoke reach the lungs quickly every time a smoker inhales causing damage immediately. Inhaling even the smallest amount of tobacco smoke can also damage the DNA, which can lead to cancer.

Tobacco smoke is made up of more than 7,000 chemicals. Hundreds are toxic, and at least 70 are carcinogenic. One of these toxic chemicals is benzo-a-pyrene.

In addition to chemical toxicity, tobacco smoke is radiologically toxic. It contains daughters arising from the decay of Radon²²² deposited in the fields on the leaves of the tobacco plant. Pb²¹⁰ and Po²¹⁰ are deposited in the lung's alveoli and can eventually cause the generation of cancerous tumors by their emitted radiation.

Smoking is responsible for more than 85 percent of lung cancers; but there are a host of other chronic diseases directly related to exposure to tobacco smoke. It is also a major cause of heart disease, stroke, aortic aneurysm and Peripheral Arterial Disease, PAD.

The report suggests that even low levels of exposure, like occasional smoking; having just a few cigarettes a day and second hand smoke are enough to increase the risk of a cardiovascular event. The report links smoking directly to 13 different cancers including esophagus, trachea, stomach, pancreas, kidney, bladder, cervix and acute myeloid leukemia.

It ties smoking to more than a dozen chronic diseases like stroke, blindness, periodontitis, heart disease, pneumonia; reproductive problems like diminishing fertility; Chronic Obstructive Pulmonary Disease (COPD), asthma and other respiratory illnesses.

Second-hand smoke affects adults and children differently. According to the report, children exposed can suffer middle ear infections, impaired lung function and are more susceptible to sudden infant death syndrome.

Adults are at risk for lung cancer, nasal irritation, heart disease and reproductive problems like low birth weight deliveries.

Casual smokers think they are improving their health by cutting back, but there is no safe level. It affects people's DNA immediately, and their heart and blood vessels literally seconds to minutes after being exposed.

Second hand smoke is no less dangerous than smoking. It inflames and irritates the lining of blood vessels, making the blood more prone to clotting and the combination of inflammation, irritation and increased clotting can literally cause a heart attack even from the kind of exposure from walking into a smoky restaurant.

Today's tobacco products are designed to be more attractive to smokers, and they are more addictive. They deliver nicotine faster making them more subject to abuse than in the past.

Additives like ammonia NH_3 are added to cigarettes. It converts the nicotine, making it easier to pass through the blood to brain barrier. Other additives like moisture enhancers and sugar reduce the harshness of the smoke and that enhances the taste. This allows smokers to tolerate the smoke and pull it deeper into their lungs.

Efforts over the last 20 to 30 years to put out “filtered,” “low-tar” and “light” products have not reduced the overall risk of disease. None of these changes have been effective in making the products safer.

The USA Food and Drug Administration, FDA, has been given more regulatory authority over tobacco products, which were totally unregulated. In October 2010, it announced that graphic warning labels would be added to cigarette packs.

Quitting smoking at any time gives the body a chance to heal the damage caused by smoking. It is never too late to quit, and the sooner it is done, the better.

ELECTRONIC CIGARETTES RISK, ELECTRONIC NICOTINE DELIVERY SYSTEMS (ENDS)

Electronic cigarettes or Electronic Nicotine Delivery Systems (ENDS) are devices whose function is to vaporize and deliver to the lungs of the user a chemical mixture typically composed of nicotine, propylene glycol and other chemicals, although some products claim to contain no nicotine. Each device contains an electronic vaporization system, rechargeable batteries, electronic controls and cartridges of the liquid that is vaporized. The manufacturers report that the cartridges typically contain between 6 and 24 mg of nicotine, but sometimes can contain more than 100 mg [10].

As part of the Tobacco Free Initiative (TFI), the World Health Organization (WHO) states that: “The safety of ENDS has not been scientifically demonstrated. The potential risks they pose for the health of users remain undetermined. Furthermore, scientific testing indicates that the products vary widely in the amount of nicotine and other chemicals they deliver and there is no way for consumers to find out what is actually delivered by the product they have purchased.”

The risk due to the presence of large concentrations of propylene glycol in e-cigarettes is pointed out, considering that the chemical is a known irritant when inhaled. The risk of nicotine poisoning also exists, particularly to certain populations like children if they were to swallow the contents of a nicotine cartridge.

The WHO also asserts: “ENDS are often touted as tobacco replacements, smoking alternatives or smoking cessation aids. But we know that for smoking cessation products to be most effectively and safely used, they need to be used according to instructions developed for each product through scientific testing. There are no scientifically proven instructions for using ENDS as replacements or to quit smoking. The implied health benefits associated with these claims are unsubstantiated or may be based on inaccurate or misleading information.” The WHO concludes that consumers should be strongly advised not to use any of these products, including electronic cigarettes [10].

INHERITED PREDISPOSITION TO SMOKING RISK

A study published in the journal “Pediatric” suggests that the children of people who smoked only in their teenage years were still 3.2 times more likely to also pick up the habit, compared to children whose parents had never smoked. Researchers gathered data from a sample of ninth grade students in St. Paul, Minnesota and followed this group from 1988 through age 38, and then also gathered data from the children of that cohort, starting at age 11.

The rate of smoking was 23-29 percent among kids ages 11 and older whose parents had once smoked or currently smoked, compared with 8 percent among children of parents who had never smoked. Children who had older siblings who smoked were also more likely to smoke.

Dr. John Spangler, a family and community medicine specialist at Wake Forest Baptist Medical Center in Winston-Salem, North Carolina stated: “We do not know exactly what is going on here, but my hypothesis is that there is a genetic predisposition toward smoking. Whether it is a genetic predisposition toward risk taking behavior, genetic disposition toward experimentation of substances, or even a genetic disposition toward nicotine addiction itself.”

Dr. John Spangler noted that parents can still take action to prevent their children from taking up the unhealthy habit: “A parent should take the opportunity to make it a teachable moment. There is nothing you can do about your past history of smoking; there is something you can do about your current history of smoking. But if you talk and engage the child in a healthy lifestyle, it may make you more likely to quit and also make the child less likely to start smoking.”

The authors of the study noted that their research had some limitations including: relatively low levels of education, the fact that only one parent provided information on their smoking history and the inability to determine exactly what caused the link.

RADON GAS RISK

According to the EPA, radon-induced cancer kills 21,000 Americans per year. A study by Harvard University ranks radon gas as America’s leading in-home hazard. Radon gas is considered as the leading cause of lung cancer among non-smokers. It caused more American fatalities in 2013 than carbon monoxide poisoning, fires and handguns combined. The American Lung Association, Center for Disease Control and National Cancer Institute all agree that radon gas is a national health problem and encourage radon testing in newly purchased homes.

Radon is a naturally occurring, invisible and odorless radioactive gas emitted from the decay chains of uranium and thorium. One out of every 15 American homes contains high levels of radon gas, and millions of Americans are unknowingly exposed to this health hazard. Radon gas problems have been detected in every county of the USA.

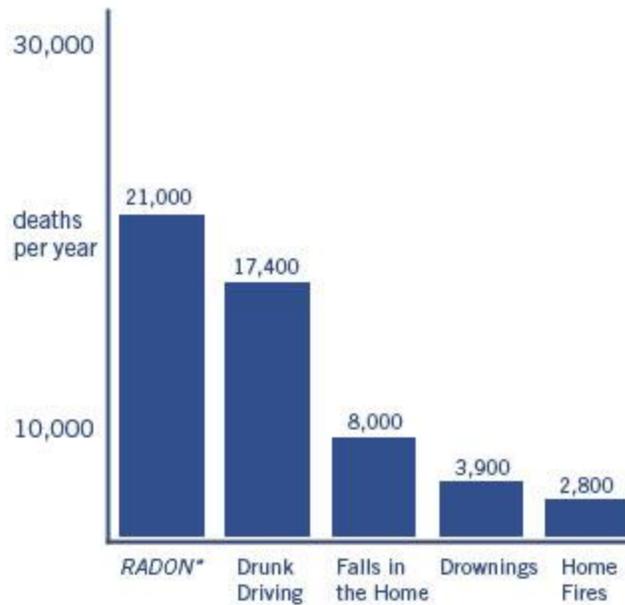


Figure 3. Yearly fatalities from radon gas. Radon is estimated to cause about 21,000 lung cancer deaths per year, according to EPA's 2003 Assessment of Risks from Radon in Homes (EPA 402-R-03-003). The numbers of deaths from other causes are taken from the Center for Disease Control and Prevention's 2005-2006 National Center for Injury Prevention and Control Report and 2006 National Safety Council Reports. Source: EPA.

CANCER RISK

One in three Americans are expected to be afflicted by some form of cancer in their lifetime, according to the American Cancer Society. The National Institute of Health estimates that cancer costs Americans \$78.2 billion per year in medical bills. The average cost of a single hospital stay is \$8,793.

In the 1930's about 1 in four people with cancer had a chance of surviving for at least 5 years. Today the five-year cancer treatment survival rate has risen to 66 percent.

Over 1.5 million new cases of cancer were diagnosed in 2010 of the types shown in Table 6. These do not include another 1 million cases of basal cell and squamous cell carcinoma skin cancers, for a total of about 2.4 million new cases per year.

Table 6. Types of cancer cases diagnosed in 2010.

Cancer Type	Cases
Lung and Bronchus	222,520
Prostate	217,730
Female Breast	207,090
Colon and Rectum	142,570
Urinary Bladder	70,530
Non-Hodgkin Lymphoma	65,540

Melanoma of the skin	68,130
Leukemia	43,050
Uterine Corpus	43,470
Uterine Cervix	12,200

SKIN CANCER RISK

Ultraviolet (UV) light exposure from the sun, or from indoor tanning devices, increase the risk of developing skin cancer. The chance of developing skin cancer increases with age and a history of severe sunburns at childhood.

Other less common conditions can predispose a person to skin cancer: organ transplantations, chronic skin ulcers, prior x-ray treatment for acne in the 1950s, arsenic ingestion, smoking and toxic exposure to tars and mineral oils.

Ultraviolet light avoidance is the primary form of prevention and is important at all ages. Solar radiation is at its peak from 10 am to 4 pm. Wide brimmed hats, sunglasses long-sleeved shirts and protective clothing must be used. Broad spectrum sunscreen blocks for both ultraviolet A (UVA) and ultraviolet B (UVB) with a Sun Protection Factor (SPF) of 15 or higher should be applied to the skin even over short periods of sun exposure, and reapplied every 2 hours. Indoor tanning devices should be strictly avoided.

SQUAMOUS CELL CARCINOMA

Squamous cell carcinoma is the second most common skin cancer with more than 250,000 new cases diagnosed per year in the USA. Middle-age and elderly person, especially those with fair complexions and frequent sun exposure are at risk.

These appear as crusted or scaly patches on the skin with a red inflamed base, a growing tumor, or a non-healing ulcer. They occur in the sun exposed areas like the face, neck, arms scalp, backs of the hands and ears. It can occur on the lips, inside the mouth, on the genitalia, or anywhere on the body.

The cancer develops in the epithelium or the outer layer of the skin. Some carcinomas develop from small sandpaper-like lesions called solar or actinic keratosis. It is possible for squamous cell carcinomas to spread to other body parts, necessitating early treatment. If left untreated, they can destroy much of the local tissue surrounding the tumor and could result in the loss of an ear or nose. Aggressive types, especially on the lips or ear can spread to the lymph nodes and other organs resulting in 2,500 deaths / year in the USA. Surgical excision to remove the entire cancer is the most common treatment.

MELANOMAS

The lifetime risk of a person in the USA to develop melanoma is 1 in 75. They appear as moles different than others, with a changing appearance, itches, or bleed. Melanomas are identified by the so-called ABCDD features:

Assymetry: One half does not match the other half in size, shape, color or thickness.
Border irregularity: The edges are ragged, scalloped or poorly defined.

Color: The pigmentation is not uniform with shades of tan, brown and black present. Dashes of red, white, and blue add to the mottled appearance.

Diameter: Melanomas are usually larger than 6 mm in diameter or the size of pencil eraser.

FIREWORKS RISKS

During the 4th of July Independence Day holiday of 2008, about 5,000 Americans were sent to emergency rooms because of injuries due to fireworks. Ninety percent of fireworks injuries that required emergency medical care were approved by Federal regulation agencies. In addition, fireworks injure bystanders more often than those setting them off.

According to the USA Consumer Product Safety Commission, CPSC, about 1,000 of these injuries were to the eyes, including contusions, lacerations, debris in the eyes, as well as burns. Young people under the age of 14 accounted for 40 percent of the total injuries.

The organization “Prevent Blindness in America” supports the development and enforcement of restrictions on the importation, sale and use of fireworks and sparklers, except for those used in authorized public displays by competent licensed operators. The organization advocates the idea that a ban would be an effective way of eliminating the social and economic impact of fireworks-related trauma and damage.

Five USA states ban all consumer sales of fireworks: Delaware, Massachusetts, New Jersey, New York and Rhode Island.

SPACE HEATERS FIRE RISK

The National Fire Protection Association, NFPA reports that in 2007, USA fire departments responded to 66,400 home structures fires that involved heating equipment. These fires resulted in 580 deaths, injured another 1,850, and were responsible for \$608 million in direct property damage.

Electric Space Heaters that meet voluntary safety standards in their construction and performance are certified with a label from a recognized testing laboratory such as Underwriters Laboratory (UL), Intertek (ETL) or the Canadian Standards Association (CSA).

It is recommended that people purchase electric heaters with automatic shutoffs when tipped over. Heaters must be turned off when people leave the heated room or go to sleep. Power cords must be plugged directly into power outlets and never into an extension cord. A large load on an extension cord can cause it to overheat setting the surrounding furniture or carpeting on fire. Broken plugs, loose connections, cracked or damaged outlets or cords must be regularly checked or replaced before being used.

MEDICAL RADIATION PROCEDURES RISK

A rule of thumb is that anyone who is given a standard x-ray is exposed to roughly 0.05 centiSievert (cSv) or rem of “effective dose” or “dose equivalent.” Anyone who is examined using computer tomography is exposed to 1.0 cSv or 1 rem of radiation.

Medical doctors in the USA ordered Computed Tomography (CT) scans at a rate of 149 tests per 1,000 patients in 2010, nearly triple the rate of 52 scans per 1,000 patients in 1996.

Table 7. Age distribution of medical imaging radiation doses of 2 cSv (rem) or more.
Data: Journal of the AMA.

Age group [years]	1996 [percent]	2010 [percent]
0-14	0.1	0.3
15-44	0.8	1.5
45-64	2.4	5.2
> 65	6.4	11.5
Total	1.8	3.9

The use of Computed tomography (CT), Magnetic resonance Imaging (MRI) and other medical imaging tests has increased over the last 15 years, raising the issue of cost-benefit considering the potential risk from radiation exposure as well as the cost to the healthcare system.

Data from patients enrolled in six large Health Maintenance Organizations (HMOs) found that medical doctors ordered CT scans at a rate of 149 tests per 1,000 patients in 2010, nearly triple the rate of 52 scans per 1,000 patients in 1996. MRI use nearly quadrupled during the period, jumping from 17 to 65 tests per 1,000 patients according to the Journal of the American Medical Association (AMA).

The proportion of patients who had any amount of radiation exposure from CT scans rose from 28.5 percent in 1996 to 36.2 percent in 2010. Their average exposure jumped from 0.48 cSv (rem) to 0.78 cSv (rem). At the top end of the spectrum, the proportion of patients in the study who got radiation at high or very high levels rose from 1.8 percent to 3.9 percent.

Computed Tomography (CT) scans combine a series of x-rays into a detailed three-dimensional image. Magnetic Resonance Imaging (MRI) machines detect energy emitted by hydrogen atoms in the body and convert that into pictures. Both tests can reveal blockages in arteries, bleeding in the brain, tumors and other life-threatening conditions.

MRIs do not use ionizing radiation, but CTs do. A number of recent studies have linked increases in medical imaging to higher rates of radiation-induced cancers, including a report in the British Lancet journal suggesting a correlation between CT scans in children and their subsequent risk of developing brain tumors or leukemia.

Advanced imaging adds about \$100 billion to the USA medical bills each year. There is an agreement in the medical community that imaging tests are being over-utilized, particularly CT scans. In April 2012, the American Board of Internal Medicine released a report that asked medical doctors from numerous medical specialties to list five procedures they felt were used too much. All of them, including cardiologists, oncologists and family physician, listed CT scans among their top five.

The increase in testing may be related to unrealistic expectations about the ability of CTs and MRIs to show what is wrong with a patient and doctors fear that if they do not order the tests, they will miss something that could lead to a malpractice lawsuit.

About 2.5 percent of the patients in six HMOs were exposed to between 2.0 and 5.0 cSv (rem) of radiation in 2010, a level that the International Commission on Radiological Protection (ICRP) says exceeds the safe limit. Another 1.4 percent of the patients were exposed to more than 5.0 cSv (rem) of radiation in 2010, which exceeds the USA Nuclear Regulatory Commission limit for occupational workers. Patients and medical professionals must jointly weigh the risks against the benefits for each situation at hand.

DENTAL X-RAYS RISKS

Dental x-rays are essential for detecting serious oral and systemic health problems, and generally the amount of radiation is very low. The radiation from a dental x-ray is equivalent to that received from the potassium-40 K^{40} radioactive isotope from eating 8 bananas.

The notion of dental x-rays to be administered every year and a full set of x-rays every three years for every patient is being abandoned [12]. Dentists strive to minimize unnecessary exposure, particularly to radiation-sensitive youngsters.

The effective radiation dose administered depends on how it is taken. If the dentist uses slow film and round collimation, a person gets approximately double the dose from digital imagery and rectangular collimation.

Dentists follow the As Low As Reasonably Achievable (ALARA) radiation exposure principle. Dentists who have not switched to digital imagery can reduce patients' risk by opting for faster film. Another important factor is that the technician who is taking the images should be well-trained and skilled, which reduces the amount of re-exposures. For round collimation, the problem is that it exposes more tissue, including the salivary glands, which are sensitive to radiation. Changing to rectangular collimation is not a big expense and systems can be converted for a few hundred dollars.

X-rays exposure is especially worrisome for children because their developing tissue is more vulnerable. There is concern about a new trend in orthodontics as popularity grows for cone-beam CT scanners, used to create 3-D images. Radiation doses from these machines can vary dramatically, depending on the manufacturer and settings.

Whenever any kind of dental X-ray is done, patients should wear protective lead aprons with thyroid collars. The aprons do not shield from internal radiation scattering, especially with sensitive tissue like the thyroid gland. That is why it is important to reduce the x-ray beam to the smallest size that provides necessary information.

Dental x-rays made news in 2012 after the American Cancer Society journal Cancer published a study saying that people with one type of brain tumor remembered having twice as many dental x-rays as individuals in the control group, who did not have brain tumors. Dental x-rays are administered only when medically indicated, tailored to each patient's health needs [12].

DIESEL FUEL EXHAUST FUMES RISK

Diesel exhausts are a cancer risk according to the World Health Organization (WHO). The International Agency for Research on Cancer, part of the WHO, elevated diesel exhaust from the "probable carcinogen" to the "known carcinogen" level, a move that could help exhaust be seen as a more serious public health threat. It is on the same order of magnitude as passive smoking.

One of the biggest concerns is the large number of people exposed to diesel fuel exhaust. Affected groups include farmers, street pedestrians, ship passengers and crew, railroad workers, truck drivers, mechanics, miners, and people who operate heavy machinery. Diesel is as of 2012 in the same category as other known health risk hazards such as asbestos, alcohol, and ultraviolet radiation.

PASSIVE SMOKING RISK

A study published in the American Journal of Preventive Medicine of 70,900 non-smoking men and women led by the American Cancer Society suggests that non-smoking adults have a higher risk of dying from serious lung disease if they grew up with parents who smoked. Researchers said childhood passive smoking was "likely to add seven deaths to every 100,000 non-smoking adults dying annually". The best way to protect children was to quit smoking.

If participants lived with a smoker during adulthood, there were other health implications. Smoke exposure of 10 or more hours every week increased their risk of death from ischemic heart disease by 27 percent, stroke by 23 percent and chronic obstructive lung disease by 42 percent compared to those who lived with non-smokers.

The participants were questioned about their exposure to smoking throughout their lives, and then their health was tracked over the next 22 years. The study shows that the effects of childhood smoke exposure persist into adulthood, resulting in chronic obstructive lung disease.

PROCESSED MEAT RISKS

Americans eat 16 billion hot dogs per year, according to the National Hot Dog and Sausage Council. Roughly 1.1 million hot dogs were served up to hungry NASCAR fans at the speedway in 2010. Americans consume on average about 60 hotdogs between the Memorial and Labor Day holidays. During the Fourth of July weekend, the nation consumes about 150 million hot dogs, which is enough to stretch from Washington D.C. to California more than five times. Chicago's O'Hare International Airport sells more hot dogs than any other location in the USA; over 2 million a year.

President Franklin D. Roosevelt, and his wife, Eleanor Roosevelt, wanting to introduce something truly American to the visiting King George VI of England and his queen, served the royal guests Nathan's hot dogs at a picnic at their estate in Hyde Park, New York on June 11, 1939. The press made a great deal about the hotdogs, and the picnic menu made the front page of The New York Times. The King was so pleased with "this delightful hot-dog sandwich" that he asked Mrs. Roosevelt for seconds.

However, health officials say eating processed meat is a really bad idea because it can cause colon cancer. That is the message leaders at the Cancer Project of the group Physicians Committee for Responsible Medicine (PCRM) want to get out. PCRM installed

the giant sign and the graphics draws national attention. It features an image of hot dogs sticking out of a cigarette pack with the skull and crossbones stamped on the front. The billboard reads: "Warning: Hot dogs can wreck your health." Processed meats like hot dogs can increase the risk for diabetes, heart disease, and various types of cancer.

The American Institute for Cancer Research suggests one 50-gram serving of processed meat (about the amount in one hot dog) consumed daily increases the risk of colorectal cancer by more than 20 percent. Those who regularly eat processed meats increase their risk for diabetes by about 41 percent.

Cancer researchers report that every year about 143,000 Americans are diagnosed with colorectal cancer and approximately 53,000 die of it. A "hot dog" campaign was initiated by the American Institute for Cancer Research and the World Cancer Research Fund after both organizations reached the conclusion that eating processed meats is as risky as smoking cigarettes. Like cigarettes, hot dogs deserve to come with a warning label that helps consumers understand the associated health risk.

OCCUPATIONAL FATALITIES, INJURIES AND ILLNESSES RISKS

The farming profession is one of the riskiest ones in terms of rotating farm machinery and tractors overturns. The rate of fatal occupational injuries for farmers and ranchers is 38.5 per 100,000 full-time workers, versus 4.4 for firefighters, and 13.1 for police and sheriff's patrol officers, according to The USA Labor Department data for 2009.

The rate of fatal injuries for aircraft pilots and flight engineers is 57.1, and for fishermen and related fishing workers it is 200. Among civilian workers, the military, volunteers and those under 16 being excluded, the fatality rate is an average of 3.3.

Other workers face higher-than-average rates of nonfatal occupational injuries and illnesses involving days away from work. State psychiatric aides have an injury and illness rate that is more than twice the rate for local police and sheriff's patrol officers. Other jobs with surprisingly high incidence rates are: flight attendants, housekeeping workers and bus drivers.

The average incidence rate of nonfatal occupational injuries and illnesses, requiring days away from work, was 117 per 10,000 full-time workers in 2009. Police and sheriff's patrol officers have a rate of 676, and firefighters, with a rate of 512. Local government transit and intercity bus drivers have an incidence of rate is 892. Bus drivers are exposed to a lot of force and vibrations when they are driving.

Some health-care workers, including registered nurses, nursing aides, orderlies and attendants, also have higher-than-average rates of illness or injury, though the rates for these jobs are higher for government versus private workers. Being stuck by a needle can be a problem, lifting or moving hospital patients, is another issue.

Some workers spend a lot of time maintaining awkward physical positions at work such as dental hygienists, who may assume contorted positions as they work hard on plaque-covered teeth.

Other workers lift heavy objects, often repetitively causing an impact on the musculoskeletal system, the nerves, and on the vascular system.

The incident rates for injuries and illnesses are higher for public than private workers: the average private incident rate was about 106, compared with 180 for state governments and 185 for local governments.

The incident rate for local government police and sheriff's patrol officers was about 676, versus 2,041 for athletes and sports competitors, and two for computer programmers. Surgeons have a rate of about four; butchers and meat cutters have a rate of 266.

Lawyers have a rate of about two, while personal financial advisers have a rate of three, and accountants and auditors weigh in at about seven, but they can still have problems. For employees who log many hours at a workstation, ergonomic-related problems resulting in musculoskeletal disorders may be an issue, such as back, neck and chronic shoulder pain.

Some of these statistics can be biased by extraneous factors. For instance, in the city of Parma, Ohio, the police force had a "sick day scam" going. Because of a provision in their union contract, one officer would call in sick, so a fellow officer would have to take "call" and work his shift for "time and a half." They could then "rotate" the sick days scams to the point that one patrol sergeant is reported to have made \$230,000 as an annual salary.

Table 8. Occupational fatal injuries incidence rate involving days away from work, for full-time employees. USA Labor Department, 2009.

Occupation	Fatalities / 100,000 full-time workers
Fishermen and related fishing workers	200.0
Aircraft pilots and engineers	57.1
Farmers and ranchers	38.5
Police and sheriff's patrol officers	13.1
Firefighters	4.4
Civilian workers (excluding volunteers, the military and those under 16 years of age)	3.3

Table 9. Nonfatal occupational injuries and illnesses incidence rate involving days away from work, for full-time employees, 2009.

Occupation	Injuries and illnesses / 10,000 full-time employees
Athletes and sports competitors	2,041
State psychiatric aides	1,459
Local government bus drivers, transit and intercity local government emergency medical technicians and paramedics	892
Private tree trimmers and pruners	712
Police and sheriff's patrol officers	676
Local governments nursing aides, orderlies and attendants	646
Private shuttle car operators	610
Local government dieticians and nutritionists	589

Local governments house-keeping workers	570
Firefighters	512
Butchers and meat cutters	266
Local government employees	185
State government employees	180
Average rate	117
Private sector employees	106
Accountants and auditors	7
Surgeons	4
Personal financial advisers	3
Computer programmers	2
Lawyers	2

YOUNG-DRIVER DRIVING RISKS

In 2007, 19 percent of the fatalities in the USA were related to young-driver crashes. In the same year, only 6 percent of licensed drivers were 20 or younger.

Car crashes in the USA injure about 300,000 teenagers / year and cause the death of about 6,000 of them per year. Being a teenager is a risky period in each person's life. People must be aware of the situation to safely sail through that treacherous period. The statistics are that 16-year old drivers have crash rates that are 3 times higher than 17-year olds and 5 times higher than 18-year olds. Insurance companies hence impose higher rates for insuring families with teenage drivers. Car rental companies have policies against car rentals to young drivers.

The adolescence period entails a significant risk as well as to the rest of society. It is not the fault of bright and mature teenagers when they sometimes commit what is considered by adults as reckless actions. The medical professionals suggest that the reason is that their brains are still in the development stage in the dorsal lateral prefrontal cortex. This part of the brain plays a critical role in decision making, problem solving and understanding future consequences of the present actions. It does not fully develop until they age into the twenties.

The surge during the teenage years in anxiety and fearfulness is attributed to a quirk of brain development. Adolescents, on average, experience more anxiety and fear and have a harder time learning how not to be afraid than either children or adults. Different regions and circuits of the brain mature at very different rates.

It turns out that the amygdala which are the brain circuit for processing fear is precocious and develops way ahead of the prefrontal cortex, the seat of reasoning and executive control. This means that adolescents have a brain that is wired with an enhanced capacity for fear and anxiety, but is relatively underdeveloped when it comes to calm reasoning: "The amygdala is a region buried deep beneath the cortex that is critical in evaluating and responding to fear. It sends and receives connections to our prefrontal cortex alerting us to danger even before we have had time to really think about it. Think of that split-second adrenaline surge when you see what appears to be a snake out on a hike in the woods. That instantaneous fear is your amygdala in action. Then you circle back, take another look and this time your prefrontal cortex tells you it was just a harmless stick [16]."

The brain's reward center, just like its fear circuit, matures earlier than the prefrontal cortex. That reward center drives much of teenagers' risky behavior. This also explains why adolescents are particularly prone to injury and trauma. The top three killers of teenagers are: accidents, homicide and suicide [16].

Most adolescents do not develop anxiety disorders, but acquire the skill to modulate their fear as their prefrontal cortex matures in young adulthood, at around age 25. But up to 20 percent of adolescents in the USA experience a diagnosable anxiety disorder, like generalized anxiety or panic attacks, probably resulting from a mix of genetic factors and environmental influences [16]. The fear circuit is a two-way street. While we have limited control over the fear alarm from our amygdala, our prefrontal cortex can effectively exert top-down control, giving us the ability to more accurately assess the risk in our environment. Because the prefrontal cortex is one of the last brain regions to mature, adolescents have far less ability to modulate emotions [16].

“Adolescents are not just carefree novelty seekers and risk takers; they are uniquely vulnerable to anxiety and have a hard time learning to be unafraid of passing dangers. Parents have to realize that adolescent anxiety is to be expected, and to comfort their teenagers, and themselves, by reminding them that they will grow up and out of it soon enough [16].”

USE OF CANNABIS RISK

Research published in the USA's Proceedings of the National Academy of Sciences, found that: "Persistent cannabis use over 20 years was associated with neuropsychological decline, and greater decline was evident for more persistent users." Collectively, these findings are consistent with speculation that cannabis use in adolescence, when the brain is undergoing critical development, may have neurotoxic effects.

Young people who smoke cannabis for years run the risk of a significant and irreversible reduction in their IQ, according to a study of around 1,000 people Dunedin in New Zealand, over 20 years. An international team found those who started using cannabis below the age of 18, while their brains were still developing, suffered a drop in IQ. People who use the drug often seem to under-achieve.

The subjects were assessed as children, before any of them had started using cannabis, and then re-interviewed them repeatedly, up to the age of 38. Taking into account other factors such as alcohol or tobacco dependency or other drug use, as well the number of years spent in education, it was found that those who persistently used cannabis - smoking it at least four times a week year after year through their teens, 20s and, in some cases, their 30s - suffered a decline in their IQ. The more that people smoked, the greater the associated loss in their IQ.

Researchers found that individuals who started using cannabis in adolescence and then carried on using it for years showed an average eight-point IQ decline. Stopping or reducing cannabis use failed to fully restore the lost IQ.

ALL TERRIAN VEHICLES, ATV RISK

The Consumer Product Safety Commission reports that 4,541 deaths were associated with ATVs from 1982 to 2001. During that same period, 37 percent of the injuries occurred to youth under the age of 16. Interestingly, 95 percent of the injured drivers under 16 rode adult-sized machines.

INFLUENZA, FLU RISK. GREAT FLU EPIDEMIC

The flu causes the death of 3,000-49,000 people in the USA every year, and about 500,000 globally. On average, about 24,000 Americans die each flu season, according to the Centers for Disease Control and Prevention (CDC). The dreaded H3N2 strain of the influenza A virus causes more health complications and is more difficult to prevent. H3N2 hits people harder than other seasonal flu strains and can be especially deadly among vulnerable groups like the elderly and children. Researchers still are not sure why, but they have found that a flu season involving the H3 virus is generally nastier with more hospitalizations and flu-related deaths than seasons involving mostly H1N1 or influenza B viruses. In recent years, two different bird influenza viruses have been infecting people directly: the H5N1 strain has struck in many nations, while H7N9 is still limited to China [26].

The B/Yamagata type, and H3N2, a particularly aggressive strain known as “Aussie flu,” were prevalent in 2018. Health officials have noted that over 55,000 surgeries have had to be canceled because of the “extreme” additional pressure placed on hospitals by the flu outbreak. Meanwhile, dozens of hospitals have warned that there are no free beds available for new patients.

According to Scientific American, it is not the flu that kills people, but the body’s attempt to heal itself. After entering someone’s body, usually via the eyes, nose or mouth, the influenza virus begins hijacking human cells in the nose and throat to make copies of itself. The overwhelming viral hoard triggers a strong response from the immune system, which sends battalions of white blood cells, antibodies and inflammatory molecules to eliminate the threat. The T cells attack and destroy tissue harboring the virus, particularly in the respiratory tract and lungs where the virus tends to take hold. In most healthy adults this process works, and they recover within days or weeks. But sometimes the immune system’s reaction is too strong, destroying so much tissue in the lungs that they can no longer deliver enough oxygen to the blood, resulting in hypoxia and death.

In other cases it is not the flu virus itself that triggers an overwhelming and potentially fatal immune response but rather a secondary infection that takes advantage of a taxed immune system. Typically, bacteria; often a species of Streptococcus or Staphylococcus, infect the lungs. A bacterial infection in the respiratory tract can potentially spread to other parts of the body and the blood, even leading to septic shock: a life-threatening, body-wide, aggressive inflammatory response that damages multiple organs. Based on autopsy studies, Kathleen Sullivan, chief of the Division of Allergy and Immunology at The Children’s Hospital of Philadelphia, estimates about one third of people who die from flu-related causes expire because the virus overwhelms the immune system; another third die from the immune response to secondary bacterial infections, usually in the lungs; and the remaining third perish due to the failure of one or more other organs.

Social isolation is the best way to keep healthy, but in a world where we work and go to school, this is not always possible. A strict handwashing regimen can also help lessen the likelihood of contracting the flu.

A vaccine is designed to anticipate the three (trivalent) to four (quadrivalent) most active strains for an upcoming flu season, though scientists sometimes get stumped by the rapidly mutating influenza viruses. Vaccination can make a person about 60 percent less likely to get sick. Even when the shot fails to prevent a bout of flu, it can make it much less severe extending over a few days of moderate sickness compared with up to two weeks otherwise.

For more than 30 years, the vaccine has offered protection against only three influenza strains: two common Type A strains called H1N1 and H3N2, and one strain of Type B. Flu strains continually evolve, and the recipe for each year's vaccine includes the subtypes of those strains that experts consider most likely to cause illness that winter. Certain quadrivalent vaccines will guard against four strains of flu rather than the usual three. They may prove more popular for children than their parents. That is because young people tend to catch the newly added strain more often.

Type A flu causes more serious disease and deaths, especially the H3N2 form that made 2012 a nasty flu season. But the milder Type B flu does sicken people every year as well, and can kill. Two distinct Type B families circulate the globe, making it difficult to know which to include in each year's vaccine. Adding both solves the guesswork, and a CDC model estimates it could prevent as many as 485 deaths a year depending on how much Type B flu is spreading.

Traditional flu vaccine is made from viruses grown in eggs, and specialists say it is usually not a problem unless someone has a serious egg allergy. The FluBlok vaccine eliminates that concern because it is made with cell technology, like many other non-flu vaccines.

The Fluzone High-Dose for seniors vaccine protects against the traditional three strains of flu, but it quadruples the standard vaccine dose in an effort to rev-up age-weakened immune systems that do not respond as actively to regular flu shots. The pharmaceutical company Sanofi Pasteur said initial results from a study of 30,000 seniors vaccinated over two flu seasons suggest the high-dose shot is about 24 percent more effective.

The flu costs USA employers \$10.4 billion in direct costs of hospitalization and outpatient visits per year. Americans are not very good about going in for checkups or for getting the recommended shots. About 37 percent get vaccinated by November, when the outbreak starts to pick up and then peaks in the January-February time frame. It takes two weeks for the vaccine to take full effect.

Influenza is present not only in humans, but also in other animals like birds (bird flu) and pigs (swine flu). Sometimes, a virus jumps between species or combine its genes with a human-specific version, creating a deadly and highly infectious new variety. New strains constantly emerge to which humans have not developed immunity. Early fall is ideal for vaccination, as it is impossible to predict when flu will start spreading and it takes about two weeks for protection to kick in. Later vaccination is not too late as the flu season typically peaks in January or February.

Scientists today understand that bird influenza viruses, like human influenza viruses, can also infect hogs, and when a bird virus and a human virus infect the same pig

cell, their different genes can be shuffled and exchanged like playing cards, resulting in a new, perhaps especially lethal, virus. The influenza virus mutates rapidly, changing enough that the human immune system has difficulty recognizing and attacking it even from one season to the next. A pandemic occurs when an entirely new and virulent influenza virus, which the immune system has not previously seen, enters the population and spreads worldwide. Ordinary seasonal influenza viruses normally bind only to cells in the upper respiratory tract—the nose and throat—which is why they transmit easily. The 1918 pandemic virus infected cells in the upper respiratory tract, transmitting easily, but also deep in the lungs, damaging tissue and often leading to viral as well as bacterial pneumonias.

Some researchers argue that the 1918 pandemic began in France in 1916 or China and Vietnam in 1917. The Australian immunologist and Nobel laureate Macfarlane Burnet, who spent most of his career studying influenza, concluded the evidence was “strongly suggestive” that the disease started in the USA and spread to France with “the arrival of American troops.” Army Camp Funston, Kansas had long been considered as the site where the pandemic started until research pointed to an earlier outbreak in Haskell County, Kansas, in the southwest corner of the state, near Oklahoma and Colorado. In 1918 sod houses were still common, barely distinguishable from the treeless, dry prairie they were dug out of. It had been cattle country but Haskell farmers also raised hogs, which is one possible clue to the origin of the crisis. Another clue is that the county sits on a major migratory flyway for 17 bird species, including sand hill cranes and mallard ducks [26].

Wherever it began, the 1918 “Spanish flu” pandemic lasted just 15 months but was the deadliest disease outbreak in human history, killing between 50 million and 100 million people worldwide. An exact global number is unlikely ever to be determined, given the lack of suitable records in much of the world at that time. But it is clear the pandemic killed more people in a year than AIDS has killed in 40 years, and more than the bubonic plague killed in a century. The impact of the pandemic on the United States is sobering to contemplate: Some 670,000 Americans died [26].

The flu epidemic, misdiagnosed as meningitis, swept through Spain, and sickened the king; the press in Spain, which was not at war, wrote at length about the disease, unlike the censored press in warring countries, including the USA. Hence it became known as “Spanish flu.”

Secondary bacterial infections are a problem, especially pneumonia. There are definitive indications that the flu has evolved into pneumonia. Afflicted people experience chills so severe their teeth chatter and experience fever up to 105 degrees Fahrenheit. Labored or rapid breathing is another indication the flu has turned into pneumonia. The cough will be severe and dry and is often accompanied by tightness in the chest. The coughing and chest pain of pneumonia typically become worse after 12 to 36 hours, and the fever lingers beyond the usual three to four days that accompanies the flu.

The cytokine response induced by Influenza; the so-called "Cytokine Storm" that is responsible for the high mortality in high risk groups, such as young individuals, also appears to inhibit bacterial colonization. It is interesting to note that the long-term *Pseudomonas* lung colonization in Cystic Fibrosis patients increases their mortality risk from Influenza, mainly owing to bio-film gene induction changes in response to interferon levels.

By June influenza reached from Algeria to New Zealand [26]. The pandemic probably killed about 670,000 people in the USA. Worldwide, estimates have ranged from 20 million to 40 million. World War I deaths were 8.5 million in comparison.

According to historian John M. Barry [26]:

“The killing created its own horrors. Governments aggravated them, partly because of the war. For instance, the U.S. military took roughly half of all physicians under 45—and most of the best ones.

“What proved even more deadly was the government policy toward the truth. When the United States entered the war, Woodrow Wilson demanded that “the spirit of ruthless brutality...enter into the very fiber of national life.” So he created the Committee on Public Information, which was inspired by an adviser who wrote, “Truth and falsehood are arbitrary terms....The force of an idea lies in its inspirational value. It matters very little if it is true or false.”

At Wilson’s urging, Congress passed the Sedition Act, making it punishable with 20 years in prison to “utter, print, write or publish any disloyal, profane, scurrilous, or abusive language about the form of government of the United States ...or to urge, incite, or advocate any curtailment of production in this country of anything or things...necessary or essential to the prosecution of the war.” Government posters and advertisements urged people to report to the Justice Department anyone “who spreads pessimistic stories...cries for peace, or belittles our effort to win the war.”

Against this background, while influenza bled into American life, public health officials, determined to keep morale up, began to lie.

Early in September, a Navy ship from Boston carried influenza to Philadelphia, where the disease erupted in the Navy Yard. The city’s public health director, Wilmer Krusen, declared that he would “confine this disease to its present limits, and in this we are sure to be successful. No fatalities have been recorded. No concern whatever is felt.”

The next day two sailors died of influenza. Krusen stated they died of “old-fashioned influenza or grip,” not Spanish flu. Another health official declared, “From now on the disease will decrease.”

The next day 14 sailors died—and the first civilian. Each day the disease accelerated. Each day newspapers assured readers that influenza posed no danger. Krusen assured the city he would “nip the epidemic in the bud.”

By September 26, 1918 influenza had spread across the country, and so many military training camps were beginning to look like Camp Devens, an Army training base 35 miles from Boston, that teemed with 45,000 soldiers, that the Army canceled its nationwide draft call. An internal American Red Cross report concluded: “A fear and panic of the influenza, akin to the terror of the Middle Ages regarding the Black Plague, [has] been prevalent in many parts of the country [26].”

By 1916 generic aspirin was made by the ton and distributed worldwide by the new upstart Monsanto Company. A Federal appeals court earlier that year ruled that only the USA Bayer could say it was a pain reliever but everyone else could say aspirin was a fever reducer. The flu-infected patients were taking many grams (grains then) of aspirin per day, worldwide. Treating fever with anti-pyretics is like putting a fire out with kerosene. All the bodily functions that create fever is an evolved response. Aspirin in those quantities was possible to kill those who took large doses.

Victor Vaughan, formerly the dean of the University of Michigan's Medical School, was not a man to resort to hyperbole. Now the head of the Army's communicable disease division, he jotted down his private fear: "If the epidemic continues its mathematical rate of acceleration, civilization could easily disappear...from the face of the earth within a matter of a few more weeks [26]."

In an average year, the flu lands 200,000 Americans in the hospital. In adults, it imposes an economic burden of \$83 billion per year in the USA, a number equal to the annual budget for the state of Florida.

RISK OF FLU VACCINES

The influenza vaccines are not as effective as most people assume. The effectiveness of the flu shot each year varies significantly and across age groups. That is because the shot is meant against last year's flu strains. In the flu year of 2012–13, the shot was estimated to be effective for only 32 percent of those above the age of 65.

An article in "Morbidity and Mortality Weekly Report" in 2014 shows that this year's vaccine was protecting an average of 61 percent of the population. For children aged 6 months to 17, the vaccine was proving to be 67 percent effective. For adults 18–64, it is 60 percent effective, and for people over 65, it is 52 percent effective.

Although many who get flu shots may still get ill, those who do not get flu shots are far more likely to end up in a hospital, and even intensive care units, fighting for their lives. A study from Duke University published in the American Journal of Respiratory and Critical Care Medicine that looked at flu patients admitted to intensive care, shows that only two of 22 had gotten their shot.

The Center for Disease Control and Prevention (CDC) reported in December 2013 that less than 45 percent of eligible Americans got a flu shot in the 2012–13 season, but estimated those shots prevented 6.6 million cases of influenza and kept 79,000 people out of the hospital.

The compositions of the vaccines vary from year to year. The 2013-2014 season's vaccine dose contained protection against an H1N1 strain, an H3N2 strain and a virus known as B/Massachusetts/2/2012. The FDA committee advised adding a fourth strain known as B/Brisbane/60/2008 to the mix for 2014–15.

DOG BITES RISK

Dog bite losses exceed \$1 billion per year. There have been 30 to 35 fatal dog attacks in the USA annually. Each year, more than 350,000 dog bite victims are seen in emergency rooms, and approximately 850,000 victims receive some form of medical attention. That is about 1,000 USA citizens per day. Based on data collected in the USA

between 2001 and 2003, the CDC concluded that there were 4.5 million dog bite victims per year, and that figure appears to be rising. Utility workers and postmen are frequent targets of these attacks.

One of five dog bites results in injuries that require medical intervention and treatment. Even for those who escape being bitten, they sometimes get hurt in the process of getting away from a dog. Even a friendly dog could become frightened or aggressive around strangers.

According to the American Society for the Prevention of Cruelty to Animals (ASPCA), ½ of all American children suffer at least one dog bite before the age of 12. Most of these bites are not from strange animals. It is usually the family pet or a friend or neighbor's dog that does the biting.

The dog strains responsible for serious injury and death are pit bulls, rottweilers, their close mixes and wolf hybrids. Dog bites occur every 75 seconds in the USA.

TELEVISION AND FURNITURE TIP-OVER RISK

The USA Consumer Product Safety Commission (CPSC) estimates about 43,000 people are injured in a television or furniture tip-over related incident each year, more than 25,000, or 59 percent, of whom are children. Examples are falling dressers, wall units or 50- to 100-pound television units.

The statistics show that 349 people were killed between 2000 and 2011 by a falling television, appliance or piece of furniture, 84 percent of them were kids younger than 9 years old. Falling televisions were more deadly, accounting for 62 percent of these fatalities. In 2011, a record 41 tip-over related fatalities occurred.

Three children are injured by a tip-over every hour, or 71 children per day, and one child is killed every two weeks. Seventy percent of injuries involving children were caused by televisions, followed by 26 percent caused by furniture like dressers or tables.

Known causes of tip-overs included climbing (36 percent of cases involving children), hitting or kicking (14 percent) or playing nearby (7 percent). Some of these incidents are occurring as families swap out their heavier, older TVs for flat-screen models. The CPSC received reports that older, heavier television were moved to other areas of the house like the bedroom, where they were placed without a proper stand or anchoring device.

Children younger than 3 years are especially likely to be curious and reach for or try to hold onto a television. Potential injuries include traumatic brain injuries, neck injuries and abdominal trauma such as to the liver or spleen. The CPSC also reported incidents of fractures, bruises and cuts caused by the tip-overs.

If a TV cannot be anchored or mounted on a wall properly, then it's safer to place the TV on a low sturdy base. Other recommendations from the CPSC include keeping remote controls, toys and other items that might attract children off of television stands and furniture and making sure cords and cables are out of reach. Anti-tip brackets should also be installed on televisions and freestanding kitchen ranges, ovens and other appliances.

HYPOTHERMIA RISK

Hypothermia occurs when the normal body temperature of 98.6 °F or 37 °C falls below 95 °F or 35 °C. It follows exposure to low temperatures, high winds or wet clothing. Body heat would be lost at a higher rate than it is produced using up the body's stored energy.

A number of symptoms to hypothermia appear as fatigue, drowsiness, uncontrolled shivering, slurred speech, clumsy movements, irritability, irrational behavior or general confusion. The low body temperature affects the human brain making it difficult to think clearly or move well.

A person affected by hypothermia should be moved to a warm dry area, with any wet clothing removed as immediate medical assistance is invoked. The wet clothing would be replaced and the affected person wrapped in a blanket or material that will retain the body heat. To warm the body's core temperature the affected person should be encouraged to move his legs and arms to generate heat from muscle movement. Caffeinated drinks should be avoided as they cause dehydration.

Health conditions including cardiovascular disease, diabetes, hypertension, or taking medicines make people more susceptible to health hazards associated with cold exposure.

FROSBITE RISK

Frosbite is the freezing of the layers of skin and tissue if people are not dressed properly in cold weather. The ensuing symptoms include pale or waxy white skin color and numbness. It usually affects the extremities such as the fingers, toes, feet, ears and nose. It can damage body tissues permanently and in the extreme require amputation of the affected parts if gangrene is generated.

An affected person should be moved to a dry area and any wet or constrictive clothing affecting the blood supply to the affected area should be removed. Warm water can be applied to the affected area.

Heating pads, hot water, heat lamps and radiators are not recommended as the areas that are numb can be easily burnt. The affected areas should not be rubbed as it can cause further tissue damage.

SUGARY DRINKS RISK

Sugar-sweetened beverages are linked to more than 180,000 obesity-related deaths worldwide each year, according to research presented at an American Heart Association conference. This means about one in every 100 deaths from obesity-related diseases is caused by drinking sugary beverages.

Among the world's 35 largest countries, Mexico had the highest death rates from sugary drinks, and Bangladesh had the lowest. The USA ranked third. The American Beverage Association dismissed the research as "more about sensationalism than science."

When people drink too many beverages containing added sugar, such as soft drinks, fruit drinks, energy or sports beverages, they tend to put on weight. These added pounds increase the risk of developing diabetes, cardiovascular disease and some cancers; conditions often referred to as obesity-related diseases.

Researchers at Harvard University wanted to find out how often people around the globe drank sugar-sweetened beverages looked at 114 national dietary surveys covering more than 60 percent of the world's population. They also used evidence from studies published in medical journals that discussed sugary drinks and other dietary habits. Their data was included in the 2010 Global Burden of Disease Study, which looks at the health and mortality of populations across the world.

The researchers looked at factors that can affect weight such as TV watching, changes in physical activity levels, smoking and the consumption of all kinds of food and drink. When the researchers controlled for these factors, they were able to determine what percentage of deaths from diabetes, heart disease and cancer were linked to sugary drinks.

The investigators examined changes in sugar-sweetened beverage consumption and then its association with change in body fatness or Body Mass Index (BMI), and subsequent deaths from cardiovascular disease, diabetes and cancer. Scientists found that more people died from diabetes, heart disease and cancer in parts of the world where consumption of sugary drinks is high.

Of the nine world regions in 2010, Latin America and the Caribbean had the most diabetes deaths linked to sugary drinks with 38,000. East and Central Eurasia had the most cardiovascular deaths at 11,000. In the USA, sugary drinks were linked to the deaths of 25,000 people from diabetes and other obesity-related diseases. As in many other countries, the death rates were highest in young adults under age 45, with one in 10 obesity-related deaths associated with sugary beverages.

Almost 3/4 of the deaths caused by sugary drinks are in low and middle income countries. The average consumption of sugar-sweetened beverages in Mexico, the country with the highest death rates among larger nations, was 24 ounces per day.

The body does not seem to detect fullness as well when you drink sugary drinks. That is one explanation for why sugar-sweetened beverages are associated with obesity.

The American Heart Association (AHA) came out with a scientific statement about sugar intake and heart health because it says there is new evidence about the relationship between the two. The statement says some research has found a link between sugar consumption and cardiovascular disease, while other research has not found a direct link. The AHA says that the best way to maintain a healthy weight and to decrease the risk of heart disease is to eat a healthy diet and to limit added sugar to no more than 100 calories a day for women and 150 calories for men.

Soft drinks and other sugar-sweetened beverages are the main source of added sugars in the American diet. One 12-ounce regular soda contains the equivalent of 10 teaspoons of sugar and has about 140 calories.

“ADDED SUGAR” RISK

The “added sugar” hidden in many processed foods substantially raises the risk of dying prematurely from heart problems by nearly three times greater than for people who eat only foods with little added sugar. Someone who normally eats 2,000 calories daily, even if consuming two 12-ounce or 340-gram cans of soda substantially increases the risk. For American adults, sodas and other sugary drinks are the main source of added sugar.

Sugar has been shown to increase blood pressure and levels of unhealthy cholesterol and triglycerides; and also may increase signs of inflammation linked with heart

disease. A study published in the Journal of the American Medical Association (JAMA), Internal Medicine in 2014 used national health surveys between 1988 and 2010 that included questions about people's diets were used to calculate risks of dying during 15 years of follow-up. More than 30,000 American adults aged 44 on average were involved. Previous studies have linked diets high in sugar with increased risks for non-fatal heart problems, and with obesity, which can also lead to heart trouble. But in the new study, obesity did not explain the link between sugary diets and death. That link was found even in normal-weight people who ate lots of added sugar.

The researchers focused on sugar added to processed foods or drinks, or sprinkled in coffee or cereal. Even foods that do not taste sweet have added sugar, including many brands of packaged bread, tomato sauce and salad dressing. Naturally occurring sugar, in fruit and some other foods, was not counted. USA government dietary guidelines issued in 2010 say "empty" calories including those from added sugars should account for no more than 15 percent of total daily calories. The average number of daily calories from added sugar among USA adults is about 15 percent toward the end of the study, slightly lower than in previous years. The authors divided participants into five categories based on sugar intake, from less than the safest amount of 10 percent of daily calories to more than 25 percent. Most adults exceed the safest level; and for 1 in 10 adults, added sugar accounts for at least 25 percent of daily calories.

The researchers had death data on almost 12,000 adults, including 831 who died from heart disease during the 15-year follow-up. They took into account other factors known to contribute to heart problems, including smoking, inactivity and excess weight, and still found risks for added sugar. Adults who got at least 25 percent of their calories from added sugar were almost three times more likely to die of heart problems than those who consumed the least at less than 10 percent. For those who got more than 15 percent; or the equivalent of about two cans of sugary soda out of 2,000 calories daily, the risk was almost 20 percent higher than the safest level.

Sugar calories quickly add up: One teaspoon has about 16 calories; one 12-ounce can of non-diet soda contains has about 9 teaspoons of sugar or about 140 calories; many cinnamon rolls have about 13 teaspoons of sugar; one scoop of chocolate ice cream has about 5 teaspoons of sugar.

CAFFEINE ENERGY DRINKS RISK



Figure 4. Caffeine energy drinks.

Researchers at the University of Bonn, Germany imaged the hearts of 17 people an hour after they had an energy drink. They showed that heart contractions were more forceful after the drink. The team reported at the annual meeting of the Radiological Society of North America that children and people with some health conditions should avoid the drinks.

The amount of caffeine in energy drinks is up to three times higher than in other caffeinated beverages like coffee or cola. There are many known side effects associated with a high intake of caffeine, including rapid heart rate, palpitations, rise in blood pressure and, in the most severe cases, seizures or sudden death.

The research gave the participants a drink containing 32 mg / 100 ml of caffeine and 400 mg / 100 ml of another chemical, taurine. They observed the chamber of the heart that pumps blood around the body. They report that the left ventricle, was contracting harder an hour after the energy drink was taken than at the start of the study. They concluded that energy drink consumption has a short-term impact on cardiac contractility. It is not clear how this greater contractility of the heart impacts daily activities, athletic performance and people with heart disease. The researchers advise children and people with an irregular heartbeat to avoid the drinks [14].

SODIUM INTAKE RISK

A small, steady reduction of sodium in the American diet could save up to half a million lives over the next decade. And a more rapid reduction could save even more lives; as many as 850,000. The New England Journal of Medicine describes how, since the early 1970s, when Finland launched a national campaign to reduce salt intake, daily consumption has dropped by 3,000 mgs / day in men and women, with a corresponding decline in death rates from stroke and coronary heart disease of 75 to 80 percent. Americans still consume a third more than the amount recommended for an otherwise healthy person and more than twice the amount recommended for people with high blood pressure, cardiovascular disease or kidney disease.

Sodium is an essential dietary element, but a mere 200 mgs a day is all one needs for good health. The average American, however, takes in 3,300 mgs daily, primarily from salt added to foods prepared commercially and in restaurants. The USA federal Dietary Guidelines for Americans recommend a maximum of 2,300 mgs / day, about one teaspoon for an otherwise healthy person. The guidelines, and the American Heart Association, recommend an even lower limit, 1,500 mgs /day, for about 60 percent of American adults: those already afflicted with ailments adversely affected by sodium such as hypertension, and adults 51 years of age and older.

Sodium in the diet causes the body to retain water, placing an added burden on the heart and blood vessels. The journal Hypertension, projects that 280,000 to 500,000 lives would be saved by a 40 percent reduction in sodium intake, to about 2,200 mgs / day over 10 years. An instantaneous reduction, to 1,500 mgs, could avert between 700,000 and 1.2 million deaths in 10 years.

Sodium chloride (NaCl) or table salt is just one common dietary source of sodium. Others include Mono Sodium Glutamate (MSG), baking soda, baking powder, disodium phosphate and other Na compounds. About 80 percent of the salt in the American diet, however, is introduced in food factories and restaurant kitchens. Ten types of foods contribute more than 40 percent of the sodium consumed by Americans, according to the Centers for Disease Control (CDC) and Prevention. Other than anchovies, French fries and pretzels, the leading nine main sources of sodium are cold cuts and cured meats, pizza, poultry that is often infused with salt water, soups, sandwiches, cheese, pasta dishes, meat dishes and snacks.

HOSPITAL ERRORS RISK

About 180,000 patients die in hospitals each year from mistakes and substandard care. In a study, Consumer Reports rates hospitals with a safety score, and most are not making the grade. It looked at more than 2,000 hospitals with an eye on hospital-acquired infections, re-admission rates, lack of communication around medications and discharges, the overuse of CT scans and rate of complications. The Mayo Clinics in Florida, Arizona and Minnesota were all near the top in safety.

MEAT AND EGGS HEART DISEASE AND STROKE RISK

Dr. Stanley Hazen, of the Cleveland Clinic, USA, reports in the New England Journal of Medicine that red meat and eggs are linked to heart disease. It appears that it is not just what we eat, but how our bodies process it that leads to heart disease [4].

Eggs and meat have high amounts of the fatty substance “lecithin.” The bacterial population in the human gut digests lecithin, producing the chemical TMAO. The TMAO then enters the blood-stream where it makes likely for the arteries to clog.

About 4,000 patients with suspected heart disease were followed for three years. Those that had the highest levels of TMAO were 2 1/2 times more likely to undergo a major cardiovascular event than those with the lowest levels, and the risk is higher with processed meats.

People with normal or low cholesterol levels can suffer a heart attack. When the amount of gut bacteria is lowered, the TMAO levels also decreased, raising the possibility that heart disease could be prevented or treated by developing drugs that lower the TMAO level.

FIZZY SWEETENED DRINKS RISK

According to a study by Dr. Dora Romaguera of the Imperial College London, drinking at least one 330 ml can of sugary soft beverage every day leads to a 22 percent higher risk of developing Type-2 diabetes. This is attributed partially to the associated higher average body weight, as well as an associated higher level of insulin resistance in the body cells. Drinking artificially sweetened diet drinks similarly leads to a higher risk of diabetes, but this could be explained by the larger body size; a key contributor to the disease [5].

The research covered data on the consumption of sugar-sweetened and artificially-sweetened soft drinks in 28,000 Europeans. The results were published in the Diabetologia journal. When accounting for higher body weight, drinking at least one sugar-sweetened drink per day leads to an 18 percent higher likelihood to suffer from diabetes. Regularly drinking diet soft drinks, leads to an increased risk of diabetes caused primarily by the higher body weight. This implies that diet soft drinks may not trigger the same mechanisms as sugary soft drinks in the human body, but the use of diet soft drinks is not a refuge if body weight is not managed [5].

CAFFEINATED PRODUCTS RISKS

Food manufacturers are marketing for adults caffeine in candy, nuts and other snack foods. Jelly Belly have 50 mg of caffeine in a 100 calorie pack. Decaffeinated coffee still has caffeine. A number of food products boast added caffeine for an energy boost. A caffeinated chewing gum was introduced, and later withdrawn, by Wrigley, a subsidiary of the Mars Company, and is called Alert Energy Gum. It contains 40 mg of caffeine, the equivalent of half a cup of coffee, and more than a 12 ounce can of Coke. The Food and Drug Administration (FDA) investigated the safety of energy drinks and energy shots, prompted by consumer reports of arrhythmias, heart palpitations, illness and death. The only time FDA explicitly approved the added use of caffeine in a food or drink was in the 1950's for cola drinks.

Some people are sensitive to caffeine and may display more symptoms when using caffeine products such as tea, coffee, soft drinks, and some over-the-counter medications. Medical associations have warned that too much caffeine can be dangerous for children, who have less ability to process the stimulant than adults. The American Academy of Pediatrics suggests that caffeine has been linked to harmful effects on young people's developing neurologic and cardiovascular systems [6].

ACRYLAMIDE, ROASTED COFFEE

Acrylamide is created when starchy foods are roasted, grilled or fried for long periods at high temperatures. Studies in animals found that the chemical causes tumors. This suggests that it also has the potential to cause cancer in humans.

Scientists believe that there should be a margin of exposure of 10,000 or higher between an average adult's intake of acrylamide and the lowest dose which could cause adverse effects. But at the moment the numbers are 425 for the average adult and 50 for the highest consuming toddlers, making it a slight public health concern, UK and European food safety experts say.

Coffee sold in California must carry a cancer warning, a court has ruled. The judge in Los Angeles said Starbucks and about 90 other coffee sellers had failed to warn customers about a potentially toxic compound that is produced during the roasting process. The firms were sued by a California-based non-profit-group over the chemical acrylamide. The group argued that as acrylamide is regarded as carcinogenic under state law, it should be sold with a warning.

Ruling in favour of the Council for Education and Research on Toxics, Superior Court Judge Elihu Berle said the companies should not be exempt from the law, as they

had failed to prove that the "consumption of coffee confers a benefit to human health". The lawsuit was filed in 2010 and says coffee sellers should pay fines of up to \$2,500 (£1,800) for every person exposed to acrylamide in California since 2002.

The ruling came despite a recent easing of concern about the potential health impact of coffee, which was removed from a list of possible carcinogens by the UN's World Health Organization (WHO) in 2016. A 2017 study of almost half a million people from 10 European countries found that drinking three cups of coffee a day may have health benefits. But skeptical experts said it was impossible to say for sure that the coffee was having a protective effect.

“CAMEL COLORING” IN SOFT DRINKS

The golden-brown color of many soft drinks comes from the chemical 4-methylimidazole, or 4-MeI. On USA product labels it appears simply as "caramel coloring." Those who say the chemical may possibly cause cancer include The World Health Organization's International Agency for Research on Cancer and the state of California suggest that it is a possible carcinogen and California limits manufacturers to 29 micrograms of exposure for the average consumer per day. Foods exceeding that limit have to carry a warning label that reads: "WARNING: This product contains a chemical known to the State of California to cause cancer."

When Consumer Reports purchased sodas in California and had them analyzed by a lab, it found that one 12-ounce serving of Pepsi One or Malta Goya exceeded the levels permitted without a warning label. Ten other brands tested by the group did meet the California standard, which is estimated to limit the risk of cancer from 4-MeI to one case in every 100,000 lifetimes of daily exposure.

The Food and Drug Administration does not set federal limits on 4-MeI in food, and the data gathered by Consumer Reports show that in some cases consumers outside California are drinking a slightly different ingredient. For example, Pepsi One purchased by the group in December in New York contains four times as much 4-MeI as the same product bought that same month in California. In a statement to Consumer Reports, PepsiCo Inc. said data indicate that the average person consumes less than one-third a can of diet soda per day; therefore, its product meets the California standard, even if a complete serving exceeds that limit [14].

MENTAL DEPRESSION AND SUICIDE RISKS

Suicide moved from being the eighth leading cause of death among middle-aged USA citizens to the fourth position, behind cancer, heart disease and accidents in 2010. The overall national suicide rate in the USA climbed from 12 suicides per 100,000 people in 1999 to 14 per 100,000 in 2010.

The Center for Disease Control and Prevention (CDC) reports that there were 33,687 deaths from motor vehicle crashes in 2010, while more people at a 38,364 number, committed suicide. The rate among middle-aged Americans reached 28 percent in a decade within a period that includes the recession and the mortgage crisis. People aged 35- 64 account for about 57 percent of suicides in the USA. The trend was most pronounced

among white males and females in that age group. Their suicide rate jumped 40 percent between 1999 and 2010.

Luckily, the rates among younger and older people held steady. There was little change among middle-aged African-Americans, Hispanics and most other racial and ethnic groups. The increase among baby boomers in their 50s may be a characteristic of their generation, as they also showed high rates of suicide in their teenage years. Suicides among middle-aged Native Americans and Alaska Natives climbed 65 percent to 18.5 per 100,000. The overall numbers remain very small at 171 such deaths in 2010. Guns are instrumental in nearly half of all suicides in that age group in 2010. Hangings overtook drug overdoses, becoming the second most frequent manner of suicide. Other methods do not result in death. The individual survives, often with even more mental torment, physical scars and other side-effects.

DISTRACTED DRIVING RISKS

According to the Illinois Governor's Highway Safety Association, drivers are 4 times more likely to cause an accident while talking on a cellular phone or driving while intoxicated. The likelihood doubles to 8 times if texting is involved. About ½ million people were injured in distracted driving accidents [7].

The youngest and most inexperienced drivers are most at risk with 16 percent of all distracted driving crashes involving drivers under the age of 20 years. Statistics reveal that during daylight hours 800,000 vehicles are driven by somebody using a hand-held cellular phone.

Texting is of most concern since it involves multitasking in manual, visual and cognitive skills. Reading or sending a text takes the eyes off the road for 4.6 seconds, during which a car driving at 55 miles/hours travels the length of an entire football field [7].

As of January 1st, 2013, the State of Illinois has instigated the following laws to reduce the risks of distracted driving [7]:

- i) Ban on texting for all drivers.
- ii) Ban on the use of cell-phones for novice drivers (hand-held and hand-free). A novice driver is a person under the age of 19 who is driving on an instruction permit or graduated driver's license. Emergency use of a cell-phone is allowed for these drivers.
- iii) Ban on use of cell-phones while driving in a school zone or construction zone. (hand-held and hands-free)
- iv) Ban on use of hand-held cell-phones within 500 feet of an emergency scene. (Certain exclusions apply)
- v) Ban on use of cell-phones by bus-drivers. (hand-held and hands-free)

RISK FROM ANESTHESIA IN THE ELDERLY

Older people who undergo general anesthesia for major surgery have a 35 percent higher risk of developing dementia later in life. The "Three-City Study" included thousands of people age 65 and older in Bordeaux, Dijon and Montpellier in France starting in 1999. In a subpopulation of 7,008 citizens, 632 participants developed dementia over the course

of the study, and those patients were more likely to have had general anesthesia than those who did not develop mental deterioration.

A theory exists that post-operative cognitive dysfunction, a common complication in elderly patients in which their thinking and memory is temporarily impaired, is associated with a higher risk of developing dementia. Previous research has suggested that some anesthetics may prompt inflammation of neural tissues, leading to early signs of Alzheimer's disease including amyloid plaques and protein tangles in the brain [8].

DEHYDRATION RISKS

The human body consists of 60-70 percent water. Symptoms of dehydration include a dry and a sticky mouth, sunken eyes, low tears production, little to no urine output and lethargy, according to the National Institutes of Health (NIH). Insufficient water intake could lead to low blood pressure and a rapid heart rate.

Water consumption moistens the lungs, whose function uses about a pint of water per day, releasing water through the exhalation process. People who do not drink enough fluids can accumulate excess body fat, show poor muscle tone and a decreased ability to digest food. The general recommendation is to use 8-10 glasses of water per day.

Whereas caffeinated and alcoholic beverages are liquid; soda beverages, coffee and tea are diuretic and cause the body to become dehydrated by hastening the body's elimination of fluids. Mild symptoms of dehydration include heart burns, stomach aches, lower back pain, headaches and depression.

HYPONATREMIA, WATER INTOXICATION RISKS

Too much water intake over a short period of time can be dangerous and even fatal. If a person drinks more water than his/her kidneys can excrete, the overall electrolyte level in the blood will drop significantly and the excess water can enter and swell the brain cells, resulting in a potential seizure and/or a coma.

A result of too much water consumption is hyponatremia, a decrease in the blood's Na level. If more water enters the body than the kidneys can process, the mineral content of the blood decreases and the blood's overall Na levels drop. When Na and other electrolyte levels such as K drop in the blood, water can escape the blood and enter the cells as the blood and the cells struggle for electrolyte levels equilibrium.

Water intoxication occurs when hyponatremia leads to cerebral edema. The swelling of cells because of water retention becomes risky if it occurs in the brain, which is known as cerebral edema. Brain cell swelling within the confines of the skull could lead to irreversible brain damage.

The symptoms of cerebral edema mirror other brain conditions such as tumors and concussions. They start with a headache that increases in intensity followed by mental confusion and seizures. Vomiting and exhaustion are possible. As the brain cells continue to swell, the risk of death from water intoxication increases.

An increase in water will add to the body's overall blood volume and place a strain on the heart and the circulatory system. Water drinking contests, are risky from this perspective. Marathon runners are at risk if they try to rehydrate too quickly. The best strategy is to ration the rehydration process over a period of time.

GRAIN BIN ENTRAPMENT

Farmers get into grain bins to unplug jammed grain. The grain acts like quicksand and can literally drown those caught in it. A total of 180 fatalities over 28 years occurred over the period 1984-2012, or about 6.4 fatalities per year. A total of 92 fatalities have been listed over the 2006-2011 period at an average of 15.3 fatalities/year. Associated accidents are grain bin collapses and suffocation due to the formation of toxic gases from fires.

In 2012, the primary medium of entrapment was soybeans (7 cases) followed by corn (4 cases). Since 1965, there were 1,500 fatal and non-fatal grain entrapments cases. Of 19 entrapments reported in 2012, eight resulted in death, compared with 11 in 2011, 31 in 2010, 19 in 2009, 17 in 2008 and 16 in 2007.

GRAIN ELEVATORS DUST EXPLOSIONS

The storage and conveyance of grain leads to the generation of dust with a large surface area in which a spark from a starting motor or a cigarette light can initiate a deflagration in the grain dust. In December 1977, a series of five grain elevator explosions killed 59 people and injured 48.

Table 10. Dust explosions statistics. Source: OSHA, USA Department of Labor.

Year	Number	Injuries	Deaths
1976-1989	281	480	155
1990-1999	130	119	15
2000-2010	89	77	7
2011	3	1	7
2012	7	6	0





Figure 5. Suspected dust explosion and fire aftermath, Broadlands Grain Elevator, Illinois, summer 2013. Photos: Barbara Ragheb.

INTERNET COUNTERFEIT DRUGS RISKS

The National Association of Boards of Pharmacy reviewed 10,000 internet drug websites and suggests that 97 percent of them were peddling counterfeit or substandard medications. The National Crime Prevention Council and the USA Food and Drug Administration, after studying the drugs, found the following characteristics to be most prevalent:

1. Some of the counterfeit drugs were found to contain toxic materials as fillers such as drywall, antifreeze and yellow highway paint.
2. Some tested drugs contained three times the active ingredient of their non-counterfeit counterparts. In one case, the counterfeiters emptied bottles of the anti-psychotic drug Zyprexa, replacing them with aspirin.
3. Some fake drugs contain some active ingredient, but are sub-potent, which is hazardous in the treatment of diseases such as malaria and HIV.
4. Some of these drugs are nothing but chalk or water. A version of the growth hormone drug for AIDS patients Serostim, was found to have no active ingredient at all.

Patients cannot tell the difference in the imitations without going through detailed laboratory testing. According to the Smithsonian magazine, the anti-malarial drug Artesunate was counterfeited with flour. In 2009, the World Health Organization (WHO) estimated that counterfeit drugs were associated with 20 percent of the 1 million deaths from malaria worldwide, for a total of $10^6 \times 0.2 = .200,000$ cases.

As forged labeling continues to get sophisticated, wholesalers are buying from multiple sources while shopping for the best price, jumbling up the product line. A growing number of high-demand, but expensive new pharmaceutical treatments allows forgers to rake in substantial profits. In addition, criminals are attracted to the fake drugs business, because they can get away with short prison terms or just fines when they are caught. Loopholes in regulation from country to country make it easy for unscrupulous individuals or organized crime to exploit the situation, making huge profits before disappearing from the market.

RISK FROM ARSENIC IN APPLE JUICE

The USA Food and Drug Administration (USFDA), after decades of consideration, proposed limiting the amount of inorganic arsenic in apple juice to the same level of the potential cancer-causing chemical allowed in USA drinking water. The USFDA proposed a limit of 10 parts per billion (ppb) for inorganic arsenic in apple juice, the level set by the USA Environmental Protection Agency (EPA) for arsenic in drinking water.

Inorganic arsenic may be found in foods because it is present in the environment, both as a naturally occurring mineral and due to the use of arsenic-containing pesticides. Inorganic arsenic has been associated with skin lesions, developmental effects, cardiovascular disease, neurotoxicity and diabetes. Organic forms of arsenic, also found in soil and ground water, are considered essentially harmless.

OBESITY RISK

About 18.2 percent of premature deaths in the USA between 1986 and 2006 were associated with excess body mass, according to a team of sociologists led by a Columbia University demographer. That estimate, published in the American Journal of Public Health, is far higher than the 5 percent toll widely cited by researchers. The new figures do not reflect newly discovered facts about obesity's effects on health. Rather, they emerged after the researchers applied a finer-grained approach to examining obesity across the USA population [9].

Using historical survey data, the study authors toted up differences in excess weight status across different gender, ethnic and age groups. They combined that data with existing "mortality risk" statistics to estimate how many Americans over age 40 who died during that 20-year period did so because of weight-related causes. The study makes clear that as obesity has become more widespread across successive waves of American generations, it has the momentum to reduce the average life expectancy of an entire population for many years to come. Some premature deaths could still be prevented by public campaigns or medical therapies that drive down obesity or its effect on health.

The study found that weight-related early mortality had struck American women harder than men, and that African American women had suffered the most. The premature deaths of 21.7 percent of white women between 1986 and 2006 could be attributed in part to excess weight, as could 26.8 percent of early deaths among African American women.

Among white men, 15.6 percent of premature deaths in that period were linked to excess weight. Among black men, the figure was only 5 percent. Though African American men have high rates of obesity, they are also more likely than all other groups to die

prematurely of other causes, such as injury or violence. The latest calculation calls into question the emerging belief that obesity in old age confers some protection against premature death or the so-called obesity paradox that has given comfort to many older adults struggling to shed weight. The study concluded, the probability of death among those carrying excess weight continued to rise after age 60, and did so steeply [9].

SURGICAL PROCEDURES INFECTION RISK

A report shows that 198 patients acquired new infections while being treated at New Hampshire hospitals in 2012. New Hampshire's 31 hospitals have been required since 2009 to provide data on patients who develop infections after heart, colon and knee surgeries or through central lines or catheters inserted in blood vessels near the heart or another major vessel. This includes 116 surgical site infections, 21 bloodstream infections associated with central lines and 61 urinary tract infections.

RISKS OF SPICES USE IN FOOD

According to the USA Food and Drug Administration (USFDA), 7 percent of imported spices over a three-year period were contaminated with the salmonella pathogen. In a report released on October 30, 2013, the USFDA says testing of imported spices between 2007 and 2010 showed that spices were twice as likely as other inspected foods to be contaminated with the pathogen. More than 80 different types of salmonella were detected. The study looked at spices imported from several countries, with many of the shipments coming from India, Mexico, Thailand and Vietnam.

In 2009 and 2010, black pepper and red pepper from India, Vietnam and China used in salami caused hundreds of illnesses. The FDA says there have been 14 known outbreaks around the world since 1973, causing almost 2,000 illnesses, many of which were in children. During the three-year period, 749 shipments of spice were refused entry into the USA because of salmonella contamination, while 238 other shipments were denied because of the presence of what the FDA calls "filth" as insects, excrement, hair or other materials.

The USFDA said some of the spices that were found contaminated at the border were later cooked or treated to eliminate possible pathogens, so much of the salmonella was likely gone by the time the spices were eaten. The agency also noted that the amount of spice generally eaten at a meal is small, meaning people have less of a chance of getting sick from a contaminated spice than a contaminated fruit or vegetable.

Most all of the spices eaten in the USA are imported, and most come from small farms in a variety of countries that have different levels of food safety oversight. The report says spices are produced by a wide variety of agricultural practices, including "on very small farms where farm animals are used to plow, crops are harvested by hand, and spices are dried in open air." All of these practices have potential for animal, bird or human contamination. Off the farm, spices from the small farms are often combined, sold to exchanges or packing companies, or stored for years, increasing the chances that they are temporarily in unclean circumstances.

The chances of someone getting sick can be reduced by adding spices to food before it is cooked. Problems arose because of generally unhygienic conditions, including the

failure to limit animal and insect access to food and not taking steps like irradiation to kill any potential pathogens.

RISK IN ANTIBACTERIAL SOAPS

The USA Food and Drug Administration (FDA) warned that antibacterial chemicals in soaps and body washes may pose health risks. It proposed a rule requiring manufacturers to prove such soaps are safe and more effective against infection than plain soap and water.

Studies indicate an ingredient in such products could scramble hormone levels and boost drug-proof bacteria. The proposal rule does not apply to alcohol-based hand sanitizers and products used in healthcare settings.

Data suggest that the risks associated with long-term, daily use of antibacterial soaps may outweigh the benefits. Certain added ingredients in such products such as “triclosan” in liquid soaps and “triclocarban” in bar soaps, may contribute to bacterial resistance to antibiotics. Such products may also have “unanticipated hormonal effects that are of concern.” Recent studies of such chemicals on animals have shown they may alter hormones, the FDA said, but such results have not yet been proven in humans. In March 2013, a federal appeals court approved a lawsuit by the non-profit Natural Resources Defense Council, aimed at forcing the FDA to review the health impacts of triclosan.

MEDICAL DEVICES AND ROBOTIC SURGERY RISK

In robotic surgery, a physician sits at a console several feet from the patient and peers into a high-definition display. Foot pedals and hand controls maneuver mechanical arms equipped with tools, guided by a 3-D camera that shows the work as it is done inside a patient.

Officials in Australia and the UK tracked hip implants in their countries using registries and first demonstrated high failure rates with metal-on-metal hip implants. Australia’s registry noticed high failure rates in one metal hip model as early as 2007, according to the website of Australia’s Therapeutic Goods Administration. Johnson & Johnson cited failure rate data from the British registry as it recalled two of its metal-on-metal devices in August 2010. In 2012, the British data showed metal-on-metal hips from various manufacturers failed at high rates, according to results published in *The Lancet*.

The USA’s Food and Drug Administration (FDA) made an “initial communication” about potential long-term risks of removable filters to prevent lung blood clots in August 2010, after it received more than 920 reports of serious problems from the filters over five years. The agency’s warning was issued the same day as the *Journal of the American Medical Association (JAMA) Internal Medicine* released a study showing some models of the devices could fracture in as much as 16 percent of patients, sometimes leaving shards impaled in internal organs.

The Intuitive robotic surgery system was cleared by the FDA in 2000, after a trial, done in a Mexico City hospital, of 233 patients in two kinds of surgery, gall bladder removal and heartburn operations. In 2013, it was used in the USA for everything from hysterectomies to heart-valve procedures to operations for head-and-neck and prostate

cancer. Few robotic operations have been studied in large randomized trials to identify the advantages and disadvantages, compared with standard less-invasive operations.

The FDA received 3,697 adverse reports involving deaths, injuries, or malfunctions linked to robotic surgery procedures in 2013 through November 3, compared with 1,595 in all of 2012. Some of the increase may have come as the result of media attention, announcement of recalls of robotic instruments, or more device use,

The number of robotic operations rose 18 percent worldwide in the first nine months of 2013 compared with the first nine months of 2012, according to a regulatory filing from the Intuitive medical robotics company. In 2013, the FDA surveyed 11 doctors who have performed from 70 to 600 robot surgeries each using Intuitive's robotic instrument, the only such product cleared in the USA for a wide variety of soft tissue procedures such as gynecologic and prostate operations [13].

FRAGMENTED SLEEP RISK

A study published in the journal "Cancer Research" suggests that "Fragmented sleep" changes how the immune system deals with cancer in ways that make the disease more aggressive. Toll-like receptor 4, a biological messenger, helps control activation of the innate immune system. It appears to be a lynchpin for the cancer-promoting effects of sleep loss. The researchers used mice, housed in small groups. During the day—when mice normally sleep—a quiet, motorized brush moved through half of the cages every two minutes, forcing those mice to wake up and then go back to sleep. The rest of the mice were not disturbed. After seven days in this setting, both groups of mice were injected with cells from one of two tumor types (TC-1 or 3LLC). All mice developed palpable tumors within 9 to 12 days. Four weeks after inoculation the researchers evaluated the tumors. They found that tumors from mice with fragmented sleep were twice as large, for both tumor types, as those from mice that had slept normally. A follow-up experiment found that when tumor cells were implanted in the thigh muscle, which should help contain growth, the tumors were much more aggressive and invaded surrounding the tissues in mice with the fragmented sleep.

PESTICIDES EXPOSURE RISK

A study that was published in the Journal of the American Medical Association (JAMA) Neurology reveals that patients with Alzheimer's disease have significantly higher levels of DDE, the long-lasting metabolite of the pesticide DDT, in their blood than healthy people. In a case-control study involving 86 Alzheimer's patients and 79 healthy elderly controls, researchers found that DDE levels were almost four times higher in serum samples from Alzheimer's patients than in controls. Having DDE levels in the highest third of the range in the study increased someone's risk of Alzheimer's by a factor of four.

The study identifies a strong environmental risk factor for Alzheimer's disease. The magnitude of the effect is large and is comparable in size to the most common genetic risk factor for late-onset Alzheimer disease.

BISPHENOL A, BPA AND PHTHALATES AND OTHER INCORPORATED CHEMICALS RISK

Bisphenol A, or BPA, and phthalates are referred to as "everywhere chemicals" because they are found in so many products such as water bottles and kitchen vinyl flooring. BPA epoxy resins can leach into food from the lining of metallic food cans. In one CDC study, researchers found traces of BPA in the urine of nearly all 2,517 participants. BPA is frequently found in plastic wrap, although many companies have started to remove BPA from their products.

Scientists have voiced concerns about these chemicals disrupting our bodies' hormones. Recent studies link them to a variety of fertility problems in men and women. The FDA says it is investigating the safety of BPA and monitoring the exposure to phthalates.

Most people's exposure to BPA comes from food and water stored in plastic containers, according to the Centers for Disease Control and Prevention. BPA can leach from these containers into meals, especially when they are heated in microwave ovens.

The number of chemicals known to be toxic to children's developing brains has doubled over the last seven years. These chemicals can enter the brain through the blood brain barrier and cause neurological symptoms. When this happens in children or during pregnancy, those chemicals are extremely toxic, and the effects are permanent.

Five chemicals are identified as neuro-toxicants which are substances that impact brain development and can cause a number of neurodevelopmental disabilities including Attention Deficit Hyperactivity Disorder (ADHD), autism, dyslexia and other cognitive damage: lead, methyl-mercury, arsenic, Poly-Chlorinated Biphenyls, or PCBs, and toluene. Six more chemicals have been added to the list: manganese; fluoride; tetra-chloro-ethylene, a solvent; a class of chemicals called poly-brominated-diphenyl ethers, or flame retardants; and two pesticides, chlorpyrifos, which is widely used in agriculture, and dichloro-diphenyl-trichloroethane, or DDT.

Banned in the United States in 1979, PCBs were used in hundreds of products including paint, plastic, rubber products and dyes. Toluene exists in household products like paint thinners, detergents, nail polish, spot removers and antifreeze.

Fluoride, in tap water in many areas, leads to a decline on average of about seven IQ points in Chinese children.

At least 1,000 chemicals using lab animals have shown that they somehow interfere with brain function in rodents as rats and mice, and those are prime candidates for regulatory control to protect human developing brains. But this testing has not been done systematically. At greatest risk are pregnant women and small children as the biggest window of vulnerability occurs in utero, during infancy and early childhood.

Beyond reduced IQ, shortening of attention span, increased risk of Attention Deficit Hyperactivity Disorder (ADHD) are observed. These include emotional problems, less impulse control, being more likely to make bad decisions, get into trouble, dyslexia and dropping out of school. These are problems that are established early, but travel through childhood, adolescence, even into adult life.

In 2007, the European Union adopted regulations known as Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) to protect human health from risks posed by chemicals. REACH covers all chemicals, placing the burden of proof on companies to prove that any chemicals they make are safe.

Example of products banned in Europe but marketed in the USA are cosmetics and phthalates. Phthalates are a group of chemicals used in hundreds of products from cosmetics, perfume, hair spray, soap, shampoos, plastic and vinyl toys, shower curtains, mini-blinds, food containers and plastic wrap, shampoos and lotions. Phthalates are used in hair spray to help avoid stiffness; they allow the spray to form a flexible film on the hair, according to the FDA. They are found in plastic plumbing pipes, medical tubing and fluid bags, vinyl flooring and other building materials. They are used to soften and increase the flexibility of plastic and vinyl. The floors and walls of homes may also contain phthalates. A 2010 test of four representative vinyl flooring samples found four of the six phthalates severely restricted in children's products, with levels as high as 84,000 parts per million or 84 times what is allowed in toys.

Phthalates previously were used in pacifiers, soft rattles and teething rings. In 1999, after a push from the USA Consumer Product Safety Commission, American companies stopped using them in those products. The Food and Drug Administration asserts that two of the most common phthalates; di-butyl-phthalate, or DBP, used as a plasticizer in products such as nail polishes to reduce cracking by making them less brittle, and di-methyl-phthalate, or DMP used in hairsprays, are now rarely used in the USA. Di-ethyl-phthalate, or DEP, used in fragrances, is the only phthalate still used in cosmetics, according to the FDA. An expert panel that convened from 1998 to 2000 by the National Toxicology Program (NTP), part of the National Institute for Environmental Safety and Health, concluded that reproductive risks from exposure to phthalates were minimal to negligible in most cases.

Toothbrushes can contain phthalates and dental materials used to treat and prevent cavities can contribute to very low-level BPA exposure for a few hours after placement, according to the American Dental Association.

Phthalates can be found in kids' toys, rattles and teething rings. If a plastic product is flexible, it probably contains phthalates unless the label specifically says it does not, according to the National Institute of Environmental Health Sciences. The biggest risk comes from items children place in their mouths. Congress has permanently banned three types of phthalates: DEHP, DBP and BBP1, in any amount over 0.1 percent in many children's products.

The Environmental Working Group; an environmental health research organization that specializes in toxic chemical analysis, has long called for reforms. In 2004, the group tested 10 samples of umbilical cord blood for hundreds of industrial pollutants and found an average of 200 in each sample. The 1976 Toxic Substances Control Act governs the exposure of toxic chemicals.

BPA is an endocrine disrupter that can mimic estrogen. In 2012, the Food and Drug Administration said BPA could no longer be used in baby bottles and children's drinking cups. Canadian regulators formally declared BPA a toxic substance in 2010 and banned it from all children's products. The American Chemistry Council, an industry trade group, has said BPA is safe and has opposed federal and state legislative proposals to ban it [19].

A study, published in *Hypertension*, a journal of the American Heart Association, used a randomized controlled trial. The authors, a team from Seoul National University's department of preventive medicine in Korea, recruited 60 older subjects, most of whom were women, and assigned them to drink soy milk from cans or glass bottles on three separate occasions, weeks apart. A majority had no history of high blood pressure, though some did. The researchers chose soy milk because it does not have any properties that are

known to increase blood pressure. And unlike soda, fruit juice and other acidic beverages, which are more likely to leach BPA from containers, soy milk is considered fairly neutral. When the subjects drank from glass bottles, the study found, their urinary BPA levels remained fairly low. But within two hours of drinking from a can, their levels of BPA were about 16 times higher. As BPA levels rose, so too did systolic blood pressure readings – on average by about five millimeters of mercury. In general, every 20 millimeter increase in systolic blood pressure doubles the risk of cardiovascular disease [19].

BPA is known to block certain estrogen receptors that are thought to be responsible for repairing blood vessels and controlling blood pressure. The chemical may also affect blood pressure indirectly by disrupting thyroid hormone. A study in the journal *Environmental Health Perspectives* found that plastic products advertised as BPA-free still leached chemicals with estrogenic activity, and some of these chemicals were even more potent than BPA [19].

VITAMIN C DEFICIENCY STROKE RISK

According to the American Academy of Neurology, consuming foods that contain Vitamin C may lower the risk of the most common kind of hemorrhagic stroke. Fruit and vegetables, such as oranges, papayas, peppers, broccoli and strawberries, contain Vitamin C. According to the American Stroke Association, hemorrhagic stroke accounts for approximately 13 percent of stroke cases. It results from a weakened vessel that ruptures and bleeds into the surrounding brain. The blood collects and compresses the surrounding brain tissue.

The reported research involved 65 people who had dealt with an intra-cerebral hemorrhagic stroke. They were examined in contrast to 65 healthy people who had not experienced an intra-cerebral hemorrhagic stroke. The levels of vitamin C in their blood were obtained. Forty-one percent of cases had normal levels of vitamin C, while 45 percent had sapped levels of vitamin C and 14 percent were considered lacking the vitamin. The researchers discovered that, on average, the people who had a stroke had deficient levels of vitamin C, while those who had not experienced a stroke had normal levels of vitamin C.

The results suggest that vitamin C deficiency should be considered as a risk factor for this severe type of stroke, as were high blood pressure, drinking alcohol and being overweight. Research is needed to explore specifically how vitamin C may help to reduce stroke risk. For instance, it may regulate blood pressure.

RISK OF BRASS GAS CONNECTIONS

Manufacturers have stopped making flexible gas connectors made of uncoated brass 4 decades ago, yet many homes still use these corrugated metal tubes for the connection of gas appliances such as stoves and water heaters. Some of these connectors have a serious flaw that places homes at risk for a leak and a fire or a gas explosion.

Uncoated brass connection must be replaced by an AGA- certified plastic-coated brass or stainless steel connectors to connect gas appliances.

PORTABLE AND STANDBY GENERATORS RISKS

Portable generators are used by homeowners and contractors as a temporary power source in the case of power outages or in the field if electrical connections are not available. Permanent or standby generators are run for an extended period of time using an independent fuel source such as propane gas or natural gas. Permanent generators are connected directly into the home power supply to operate sump pumps, and appliances like furnaces, well pumps and lights.

Generators generate CO₂ and CO and must not be used in an enclosed area like a garage. They must be used only in well-ventilated outdoor locations away from windows, doors and intake vents.

A transfer switch needs to be professionally installed on permanent standby generators to disconnect the home from the power grid while the generator is in use, to prevent the electrocution risk from the hazardous “back-feed” to the neighbors, the homeowner and to utility crews working on reconnecting the interrupted power supply that would trigger the operation of the standby generator.

Portable and standby generators pose a risk of electrocution if operated in a wet environment. Under rainy or wet conditions outdoors they must be placed under a protective canopy and on a dry surface. Hands must be dry before touching the generator.

The generator must be allowed to cool down before adding new fuel to avoid fire hazards.

HEPATITIS C VIRUS (HCV) RISK

Hepatitis C Virus (HCV) infection is a hazardous liver infection that has become the main cause of cirrhosis, liver cancer and liver transplants in the USA, according to the CDC. Some patients who contract HCV recover in a matter of weeks, but at least 75 percent of them eventually develop chronic infections that can last for the rest of their lives. The virus can be spread through contact with infected blood, such as infected blood transfusions or the use of infected hypodermic needles. Health experts estimate that hepatitis C now kills more Americans each year than HIV [15].

Analyzing data from thousands of people who participated in the National Health and Nutrition Examination Survey, researchers from the Centers for Disease Control and Prevention estimated that about 1 percent of the USA population over age 5 have hepatitis C. If so, that would translate to 2.68 million people with HCV.

The researchers estimated that 900,000 additional people once had the liver disease but no longer have an active infection. Altogether, 1.3 percent of the USA population has a past or current HCV infection, according to a 2014 study published in the *Annals of Internal Medicine* [15].

Compared with Americans who never had the virus, those with chronic infections were more likely to have received a blood transfusion before 1992 and to have injected illicit drugs. However, 49 percent of people with chronic infections had neither of these risk factors in their history, therefore, “risk-based screening alone is an incomplete approach to identifying chronically infected persons. [15].”

People with hepatitis C are more likely to be men; to be between the ages of 40 and 59; to have less education; and to have lower family income. Overall, 81 percent of all people with chronic hepatitis C were born between 1945 and 1965. This is why the CDC

recommends that all people born during that window to get tested at least once. Such screening would flag about 800,000 people who otherwise would not know they were infected; if all of them got treatment, an estimated 120,000 deaths due to HCV could be avoided [15].

RISK OF TESTOSTERONE INJECTIONS

A National Cancer Institute study published on January 29, 2014 reiterates results from an earlier study that taking testosterone tempts a heart attack. About 3 percent of men in the USA 40 and older receive testosterone therapy. More than 55,000 men were studied for 90 days before receiving a prescription for testosterone therapy and for 90 days afterward. Their increased risk of heart attack or myocardial infarction went up by 36 percent overall. For men over 65 years of age, that risk doubled. A man over 65 taking testosterone is more than 70 percent more likely to have a heart attack within 90 days of starting treatment than a similar person who does not get the therapy.

A study of men in the Veterans Affairs health care system published in November 2013 showed a 30 percent increase for risk of stroke, heart attack and death among those taking testosterone therapy.

RISK OF BROAD-SPECTRUM ANTIBIOTICS USE

The broad-spectrum “azithromycin” antibiotic is easy to take: one pill a day for five days. However, in many cases, azithromycin can make patients sicker, not better. Its widespread use as the most popularly prescribed antibiotic in the USA has helped superbugs, as well as many other threatening bacteria, become resistant to it.

In just 2013, the FDA has warned that azithromycin can cause a fatal arrhythmia of the heart known as torsades de pointe. The Canadian Pediatric Society insisted that azithromycin not be used at all in cases of pneumonia, ear infections and sore throats in children. The Infectious Diseases Society of America has recommended that azithromycin not be used at all for sinusitis. A Centers for Disease Control study published on February 14 2014 in Morbidity and Mortality Weekly Report indicates that azithromycin is often ineffective in cases of shigella, a common but potentially fatal diarrhea.

Often, there are better antibiotics to prescribe for common illnesses. In October 2013, a review study of 94 million patient visits to doctors published in JAMA Internal Medicine reported that in 73 percent of visits for acute bronchitis and 60 percent of visits for sore throats, patients left with prescriptions for antibiotics. New guidelines suggest only 10 percent of sore throat patients and no acute bronchitis patients should get prescriptions. About 15 percent of all the sore throat prescriptions in the study were made for azithromycin, which is often ineffective. Penicillin, which was prescribed in only 9 percent of cases, remains highly effective in treating sore throats.

Researchers suggest that a cough from acute bronchitis, which typically follows a cold or flu, should go untreated for at least three weeks, the amount of time the body takes to overwhelm it. However, studies show that most sufferers in the USA go to their doctors for bronchitis within a week after symptoms begin, and they typically get a prescription.

Overuse of antibiotics is not just causing rapidly increased resistance by bacteria. It causes allergies, yeast infections, nausea and an increasing association with irritable

bowel syndrome. Countries that have recommended the use of narrow-spectrum antibiotics have seen a fall in their resistance rates.

RISKS OF FARM-FED TILAPIA FISH

According to the National Fisheries Institute, the Tilapia fish is the fourth most eaten seafood in the USA, behind shrimp, salmon and canned tuna. Its popularity comes from the fact that it is easy to farm, so it is inexpensive as it is adaptable to different types of feed.

In 2008, researchers at the Wake Forest University School of Medicine released a study comparing fatty acid levels among popular fish. It found that tilapia contained far less omega-3 fatty acid than other American favorites, such as salmon and mackerel. According to the paper, salmon also has a “more favorable” omega-3 to omega-6 ratio. While both fatty acids are important, omega-3 has anti-inflammatory properties that play a critical role in brain development and cognitive function and may prevent diseases like diabetes and Alzheimer’s. The report suggested that the “inflammatory potential of hamburger (80 percent lean) and pork bacon is lower than the average serving of farmed tilapia (100 g).” The report caused concern when it stated that farmed tilapia contains high levels of arachidonic acid, an omega-6 fatty acid that, while necessary to help repair damaged body tissues, has been linked to brain disorders like Alzheimer’s disease and may exacerbate inflammation. The observation is that tilapia has as much omega-3 as other popular seafood, including lobster, mahi-mahi and yellow-fin tuna. Tilapia is also very low in fat. A 4-ounce serving of tilapia has about 1 gram of saturated fat, 29 grams of protein and around 200 mg of omega-3. By comparison, a 1-ounce serving of bacon of about 4 strips contains 4 grams of saturated fat, 10 grams of protein and 52 mg of omega-3.

A rumor going around the Internet: that farm-raised tilapia from China are fed animal feces. A study conducted by the Economic Research Service of the USA Department of Agriculture noted that “many of China’s farms and food processors are situated in heavily industrialized regions where water, air and soil are contaminated by industrial effluents and vehicle exhaust.” The report also stated that it “is common practice to let livestock and poultry roam freely in fields and to spread livestock and poultry waste on fields or use it as fish feed.” The USDA report was based on documents obtained from the Food and Drug Administration, which oversees seafood inspections.

According to Monterey Bay Aquarium Seafood Watch, over 95 percent of tilapia consumed in the USA in 2013 came from overseas, and 73 percent of those imports came from China. One reason is that the fish thrives in a subtropical climate, making it a difficult fish to farm in most of the USA. In 2006, Seafood Watch listed farmed Chinese tilapia as “Avoid” due to poor food quality enforcement and high levels of chemicals, antibacterial drugs (nitrofurans) and malachite green, which is used to dye silk, leather and paper, in fish samples. Seafood Watch cautions that the fish currently tests in the “red zone” for the presence of banned or illegal chemicals such as antibiotics, malachite green and methyl testosterone hormones used in Chinese tilapia production. The group says tilapia raised in Ecuador, the USA or Canada are alternative choices.

A 2004 paper, “Domestic Wastewater Treatment in Developing Countries,” that cites the practice of using properly treated wastewater as a sustainable, and ultimately profitable, farming technique. Since 2005, Country of Origin Labeling (COOL), which is

overseen by the USDA, requires seafood and shellfish retailers to label product origins. But labeling exceptions and a lack of enforcement make it hard to know exactly what is on a dinner plate. Processed seafood such as fish sticks or other prepared food sold at supermarkets and seafood retailers is exempt from labeling. Whole fish sold at grocery stores is required to have a country-of-origin label and to indicate whether the fish has been farm-raised or caught wild, but not everyone does it. The USDA conducts supplier inspections, and stores in violation have a mandated timeframe to correct the problem.

RISK FROM MIDDLE EAST RESPIRATORY SYNDROME, MERS

The Middle East Respiratory Syndrome (MERS) is a type of corona virus of the same family as the common cold causing respiratory infections that can evolve into pneumonia and kidney failure. Its first death was recorded in Saudi Arabia in June 2012. Camels are under suspicion of being the primary source as well as human to human transmission under unsanitary crowded conditions and in hospitals.

Cases occurred in Jordan, Qatar, the United Arab Emirates, France, Germany, Italy, Tunisia, Egypt, the UK and the USA. A report in the New England Journal of Medicine found "identical" MERS viruses in camels and their owners. Other possible carriers could be sheep and goats which are usually bred along with camels in the Middle East.

About half of the cases were spread between people. It seems to have spread after close contact with family members or medical staff. The World Health Organization (WHO) does not recommend restrictions on trade or travel. It warns people to avoid raw camel milk, camel urine and to ensure that camel meat is properly cooked.

RISK FROM SLUDGE, "BIOSOLIDS"

About one half of sewage waste solids are land-filled or incinerated. The other one half of the 15 trillion gallons of sewage Americans flush annually is biologically scrubbed, "dewatered," processed and sold as products with the names BioEdge, Nitrohumus, and Vital Cycle to spread on farmland, lawns, and home vegetable gardens. In 2007 the Carlyle Group paid \$772 million for the sludge-residuals company Synagro, whose products are the most popular on the market.

Theoretically, recycling municipal sludge into an inexpensive fertilizer means cleaner rivers and oceans. But as sludge has spread across the country, so have concerns that it may cause as many environmental problems as it solves. In communities where sludge has been used, residents have reported ailments ranging from migraines to pneumonia to mysterious deaths. In a 1994 episode often cited by sludge disposal critics, an 11-year-old Pennsylvania boy died of a staph infection after biking through sludge at an abandoned mine.

Sludge may contain discarded medications such as Prozac flushed down toilets or motor oil hosed from factory floors. Sludge sold to consumers is pathogen free, but sludge used on farms and industrial sites is permitted to contain low levels of human pathogens. Sludge might be contaminated with radioactive waste. Food companies such as Del Monte and H. J. Heinz would not accept produce grown on sludge-treated land. The Netherlands and Switzerland effectively ban the use of sludge on farmland, and 37 states regulate it more strictly than the EPA.

The EPA acknowledges that "biosolids" have their own distinctive odor, but it doesn't regulate their smell. Studies have shown that severe odors can cause health problems, including depression and stress that can lead to chronic hypertension and heart disease. An EPA survey of sludge samples from across the USA found contamination by 10 flame retardants and 12 pharmaceuticals and exceptionally high levels of endocrine disruptors such as triclosan, an ingredient in antibacterial soap that scientists believe is killing amphibians.

Some scientists are concerned that dangerous levels of contaminants from sludge are passing into crops and groundwater as well as blowing off fields and becoming airborne. Some chemicals in sludge can interact with one another to become more persistent or toxic. Research has suggested that the toxins such as thallium used in rat poison in sludge can pass into milk and meat.

In May 2007, the USA Environmental Protection Agency (EPA) determined that sludge had contaminated as many as 5,000 acres of grazing land about 25 miles from Kimbrough's Alabama ranch with perfluorooctanoic acid (PFOA), a probable carcinogen used in Teflon manufacturing. The chemical was traced back to a local manufacturer that had dumped contaminated wastewater straight into the sewer system.

A single American's daily sludge output can generate enough power to light a 60-Watt bulb for more than nine hours a day. Sludge is rich in methane, the main component of natural gas. The wastewater sector, which uses about 1 percent of the nation's electricity, could power itself with sludge and possibly have wattage to spare. Fewer than 10 percent of the nation's 6,000 public wastewater plants have anaerobic digesters that can extract methane from sludge. Just 20 percent burn the gas for energy. Flint, Michigan, is one of several cities worldwide to fuel buses with gas from sludge. Los Angeles injects sludge into a mile-deep well, where pressure and heat are expected to release enough methane to power 1,000 homes. Methane removal cuts sludge's volume in half.

Leftover sludge is often incinerated, releasing heavy metals into the air and packing landfills with enough ash each year to fill more than 3,100 dump trucks. Using high-temperature or low-oxygen reactions, they convert sludge into a synthetic gas or oil, or a char similar to barbecue briquettes. The process can produce twice as much energy as it consumes. In Southern California, a plant converts sludge from about a third of Los Angeles and Orange counties into a char that replaces coal at a local cement kiln; its ash is mixed into the cement.

EBOLA RISKS

The number of Ebola cases in Liberia and Sierra Leone could rise to between 550,000 and 1.4 million by January 2015 if there are no "additional interventions or changes in community behavior," the Center for Disease Control and Prevention said in a report on September 23, 2014. The range of estimated cases; from 550,000 to 1.4 million, is wide because experts suspect the current count is highly under-reported. The official death toll from Ebola in West Africa has climbed to more than 2,800 in six months, with 5,800 cases confirmed as of September 22, 2014, according to the World Health Organization (WHO).

The CDC estimates that if 71 percent of people with Ebola are properly cared for in medical facilities, the epidemic could decrease and eventually end. WHO experts

suggest that the "current epidemiologic outlook is bleak." They also warn that without "drastic improvements" in measures to control its spread, the number of cases and deaths from Ebola is expected to continue climbing from hundreds to thousands per week. The cumulative number of cases could exceed 20,000 by November 2, 2014.

The spread is blamed not on a particularly virulent strain of the virus, but the outbreak was so deadly because of a "combination of dysfunctional health systems, international indifference, high population mobility, local customs, densely populated capitals, and lack of trust in authorities after years of armed conflict. "Ebola has reached the point where it could establish itself as an endemic infection because of a highly inadequate and late global response."

SNOW SHOVELING RISK

Every winter season, about 100 people in the USA die while shoveling snow. A study looking at data from 1990 to 2006 by researchers at the USA Nationwide Children's Hospital recorded 1,647 fatalities from cardiac-related injuries associated with shoveling snow. The actual numbers could be double this figure. In Canada, these deaths make the news every winter [18].

When healthy young men shoveled snow, their heart rate and blood pressure increase more than when they exercise on a treadmill. Combining this activity with cold air, which causes arteries to constrict and decrease blood supply, one gets a perfect storm for a heart attack.

Snow shoveling is particularly strenuous because it uses arm work, which is more taxing than leg work. Many people hold their breath during the hard work, which also puts a strain on the body. In addition, the prime time for snow clearance is between 6 am and 10 am which is when circadian fluctuations make us more vulnerable to heart attacks.

Snow shoveling is so dangerous that anyone over the age of 55 should not to do it. People at greatest risk are those who are habitually sedentary with known or suspected coronary disease, who go out once a year to clear snow. Smoking and being overweight drastically increase the risk.

If one must do it, pushing rather than lifting the snow, dressing in layers, taking regular breaks indoors and not eating nor smoking before shoveling is advised. Using a snow-blower may be a better option, but there have also been heart attacks recorded in men using blowers.

ARSENIC IN WINE RISK

Popular wines are reported to contain enough arsenic to eventually cause cancer. CBS News reported on March 26, 2015 that "very high levels of arsenic" showed up in almost a quarter of 1,300 wines tested by independent Denver-based lab Beverage-Grades. "Very high," according to Beverage-Grades founder and former wine distributor Kevin Hicks, meant four to five times more arsenic than the EPA standard for drinking water, which is 10 parts per billion (ppb), or 10 micrograms per liter (mcg/L) [20].

Among the top-selling wines with three, four and five times the 10 ppb standard were, respectively, Trader Joe's Two-Buck Chuck White Zinfandel, M nage   Trois

Moscato and Franzia White Grenache. A trend of higher amounts of arsenic exists as the cheaper the wine was on a per-liter basis [20].

The EPA maximum contaminant level of 10 ppb of arsenic in drinking water is based on calculations that assume a person will drink approximately 2 liters of water a day, a reasonable standard. If a person drinks 2 liters of wine a day, he has bigger problems than just the arsenic levels in the wine. For one, his liver would be affected by cirrhosis and he likely won't last long enough for him to develop cancer. A daily drinker of that much would qualify as an alcoholic [20].

For two standard glasses of wine a day, a 5 oz. glass is approximately 150 ml, so two glasses is 300 ml. If that wine contains arsenic at five times the EPA standard for drinking water, then 300×5 means he is getting as much arsenic as the equivalent of drinking 1.5 liters of drinking water at the maximum amount allowed by the EPA. That calculation, ignores the net effect of arsenic from different sources.

The biggest health concerns related to arsenic intake are different types of cancer, especially bladder, lung and skin cancer. A 1999 National Academy of Sciences report estimated the risk of dying from cancer due to arsenic in drinking water at 10 ppb at approximately 1 in 500 to 1 in 1,000, which many people would find too high.

Drinking water typically has far lower levels than this maximum. A recent study on rural wells water, which is more likely to have contaminants than municipal water supplies, found median levels at one tenth the standard, and most cities have arsenic levels below 5 ppb. Los Angeles water averages 1.4 ppb and had a recorded maximum of 3.4 ppb. Chicago's drinking water supply averages 0.17 ppb with a maximum recorded 1 ppb. So even if one is drinking 2 L of water per day, that makes the "extra" arsenic one might be getting from wine that much less of an issue [20].

The EPA levels appear to be good enough for the FDA, the agency actually tasked with regulating food and drink, including wine, but that is solely for drinking water. The only standard the FDA has for arsenic in food or drinks is 10 ppb in bottled water. They have a proposal for the same standard in apple juice, but beyond that, the FDA offers no guidance in arsenic levels in food. The FDA has proposed a 10 ppb standard for apple juice. The FDA suggests that levels as high as two to five times the EPA drinking water standard have been detected in some fruit juices but do not pose a concern because individuals do not typically drink 2 liters of juice a day. They do not drink that much wine daily, either [20].

Arsenic poisoning is a serious concern with chronic exposure. More than cancer risk, arsenic poisoning can damage the central and peripheral nervous systems, the liver and the kidneys. Arsenic is a systemic poison that affects virtually every organ system in the body. These concerns have led arsenic to make headlines for its presence in rice products, baby formula and apple juice.

A study in late 2013 found those who drank more than two beers or a glass of white wine daily had 20 to 30 percent higher arsenic levels. But even in that study, the health significance of those findings was unclear, as was the source of the arsenic in the alcoholic drinks.

Even arsenic poisoning at levels below what will kill a person have unmistakable symptoms: brownish green spots on the hands, feet and sometimes trunk as well as white lines in the fingernails. These can appear at low levels of arsenic intake, and the risk increases as arsenic intake increases. For those consuming dangerously high levels of

arsenic, it would be hard to miss those spots, as well as symptoms such as headaches, confusion, drowsiness and diarrhea [20].

Steps are needed to identify the source of the arsenic and reducing it. One can surmise that it originates from the grape seeds or from the soils where the grape vines are planted or from the water supplies used to irrigate the grape vines.

POTASSIUM IN BANANAS AND TOMATOES

Bananas are one of the world's most popular fruits, rich vitamins and minerals. Potassium levels are dangerously high if one eats more than six bananas. Potassium is crucial for survival and can be found within every single cell of the body. It is an electrolyte that helps generate electrical charges which helps the cell function properly. It helps keep the heart rate steady and triggers insulin release from the pancreas to help control blood sugars, and more importantly keeps blood pressure in check [21].

However, if the level of potassium in the body is too low or too high it can result in an irregular heartbeat, stomach pain, nausea and diarrhea. Potassium chloride is one of the chemicals used in lethal injections in the USA. At extremely high doses can cause cardiac arrest.

For a healthy person, it would be impossible to overdose on bananas. One would need to eat around 400 bananas a day to build up the kind of potassium levels that would cause the heart to stop beating. Adults should consume about 3,500 mg of K per day, according to the UK's National Health Service. The average banana, weighing 125 g, contains 450 mg of potassium, meaning a healthy person can consume at least seven and half bananas before reaching the recommended level.

People with kidney disease should steer clear of foods that are high in K. These patients have a very low kidney function which can potentially see a build-up of harmful potassium levels in their blood-stream because they cannot get rid of the mineral when they pass urine. A patient on dialysis had a heart attack after eating too many tomatoes, which are rich in potassium. His kidneys had already stopped working so he was unable to get rid of the excess.

Like many foods, bananas naturally contain some radioactive isotopes, particularly the K^{40} in the potassium. The USA think tank, Nuclear Threat Initiative, warns that they can trigger sensors used at USA ports of entry to detect smuggled nuclear material.

A typical banana contains a small amount of 0.1 microsieverts in radiation. A typical CT scan in a hospital exposes humans to between 10 and 15 millisieverts, or about 100,000 times more. Bananas are not as radioactive as Brazil nuts which concentrate the thorium mineral from the ground, and both are safe when eating them in moderation."

CLOSTRIDIUM DIFFICILE, OVERUSE OF ANTIBIOTICS, SUPERBUGS RISK



Figure 6. Clostridium difficile bacterium. Gram-positive *C. difficile* bacteria from a stool sample obtained using a $.1\mu\text{m}$ filter (right). Source: CDC.

This hard-to-treat bacteria, known as Clostridium difficile (*C. diff.*), can cause infectious diarrhea. It is considered as a growing problem in hospitals, killing an estimated 14,000 people annually in the USA. The superbug Clostridium difficile has been linked to the deaths of 29,000 Americans a year. There were nearly twice as many deaths associated with the bacteria than had previously been recorded. Infections by the deadly bug was due to the overuse of antibiotics. People can become infected if they touch items or surfaces that are contaminated with feces and then touch their mouth or mucous membranes. Healthcare workers can spread the bacteria to other patients or contaminate surfaces through hand contact.

The germ - Clostridium difficile, or *C. diff.* - flourishes in the gut after antibiotics kill off other bacteria and causes diarrhea. It can be severe and is blamed for about 15,000 deaths annually - mostly in people over the age of 65. Patients who have been in the hospital and have taken antibiotics are greatest at risk for developing *C. diff.* infections.

For years, it has been seen as a growing problem, and health officials have made it a focus in a campaign to reduce infections picked up in the hospital. A study led by the Centers for Disease Control and Prevention and published in the New England Journal of Medicine, found that in 2011, at least 453,000 Americans got sick from *C. difficile*. The number probably would be more like 600,000 if the most sophisticated tests had been used in every case. Researchers previously had put the number of annual cases at around 250,000. The new study cast a wider net than earlier research, and used information from labs in selected counties in 10 states.

The infections can be prevented by improving antibiotic prescribing and by improving infection control in the health care system. *C. difficile* is found in the colon and can cause diarrhea and a more serious intestinal condition known as colitis. It is spread by spores in feces. The spores are difficult to kill with most conventional household cleaners or alcohol-based hand sanitizers. About two-thirds of *C. difficile* cases occur in hospitals or nursing homes or in recently discharged patients. Of the other third, researchers say a majority had visited a medical facility like a doctor's office or dentist in the 12 weeks before their diagnosis.

C. difficile is treated with antibiotics, but health officials are especially concerned about the growing prevalence of antibiotic resistance. Experimental treatment alternatives

involving fecal transplants from a healthy person, perhaps in the form of a ‘poop pill,’ have shown promise and may work more effectively than current drugs by reintroducing healthy bacteria that fight the infection. Hospitals and other health care facilities have been stepping up efforts to more thoroughly clean rooms to prevent *C. difficile* from spreading to other patients. There also have been programs to use antibiotics more sparingly.

These infections can be prevented by improving antibiotic prescribing and by improving infection control in the health care system. Between 30 and 50 per cent of antibiotics prescribed in hospital are unnecessary and incorrect. This can increase the spread of the bacteria, which can be picked up from contaminated surfaces or spread from person to person. Two-thirds of *C. difficile* cases occur in hospitals or nursing homes or in recently discharged patients. The other third were mostly people out in the community who got sick and saw a doctor.

The CDC has documented a 10 percent decrease in hospital-onset *C. difficile* infections between 2011 and 2013. Fighting the infections costs hospitals \$4.8 billion each year, according to the CDC.

RISK FROM PLAGUE, BLACK DEATH, YERSINIA PESTIS

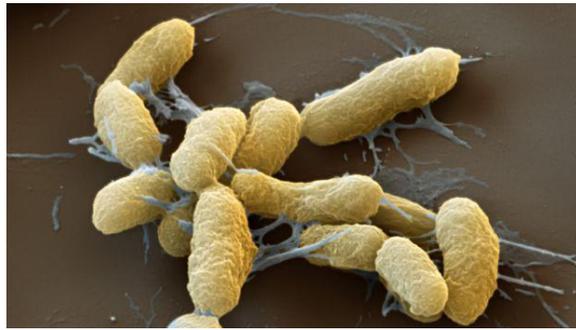


Figure 7. *Yersinia Pestis*, plague bacteria.



Figure 8. Hand affected by gangrene from bubonic plague infection.

Plague is spread to humans through a bite from an infected flea. People can decrease their risk by treating their pets for fleas and avoiding contact with wildlife. They should use insect repellent, and wear long pants and socks when visiting plague affected areas.

The symptoms of plague typically appear within two to six days of exposure, and include sudden fever, chills, headache and weakness. There is typically a painful swelling of the lymph nodes in the armpit, groin or neck.

Plague symptoms in animals include fever, loss of appetite and lethargy along with swollen lymph nodes under the jaw. Prompt diagnosis and immediate antibiotic treatment can greatly reduce the risk of death in both people and pets.

Plague was first introduced into the USA in 1900, by rat-infested steamships that had sailed from affected areas, mostly from Asia. Epidemics occurred in port cities. The last urban plague epidemic in the USA occurred in Los Angeles from 1924 through 1925.

Plague then spread from urban rats to rural rodent species, and became entrenched in many areas of the western USA. Since that time, plague has occurred as scattered cases in rural areas. Most human cases in the USA occur in two regions:

1. Northern New Mexico, northern Arizona, and southern Colorado,
2. California, southern Oregon, and far western Nevada

Over 80 percent of the USA's plague cases have been the bubonic form. In recent decades, an average of seven human plague cases have been reported each year (range: 1–17 cases per year). Plague has occurred in people of all ages from infants up to age 96, though 50 percent of cases occur in people ages 12–45. It occurs in both men and women, though historically is slightly more common among men, probably because of increased outdoor activities that put them at higher risk.

Americans are still dying from the plague disease that ravaged globe in the Middle-Ages. The Black Death caused about 50 million deaths across Africa, Asia and Europe in the 14th Century and wiped out up to half of Europe's population. In London, the Great Plague of 1665, killed about a fifth of the city's inhabitants. A 19th Century pandemic in China and India, killed more than 12 million. The disease is endemic in Madagascar, the Democratic Republic of Congo and Peru as well as the USA [22].

The bacterium *Yersinia Pestis* was introduced to the USA by rats infested with fleas from steamships in 1900 causing infestations in the Western port cities. The last urban plague was in Los Angeles in 1925. It spread to rural rats and mice, and became entrenched in parts of the USA.

The disease vector to humans is typically fleas. But it can be caused by handling dead carcasses of animals like squirrels or rabbits as well as by bites whilst hand feeding chipmunks, ferrets or squirrels. It has a 30-60 percent fatality rate if left untreated. Antibiotics are effective if patients are diagnosed early.

More than 80 percent of USA cases have been bubonic plague, the most common form, which affects the lymph nodes and causes gangrene. There are two other plague types: septicaemic, an infection of the blood, and pneumonic, which infects the lungs.

Symptoms develop after three to seven days and are flu-like with a laboratory test confirming the diagnosis. Most cases occur during the summer, when people are active outdoors.

The plague-endemic areas are New Mexico, Arizona, California and Colorado, according to the CDC. Prairie dogs are the main reservoir for plague, and they tend to be west of the 100th meridian. Black-footed ferrets and the Canada lynx are other susceptible species. The animal reservoir is what makes the plague hard, if not impossible, to eradicate [22].

The only human disease eradicated, smallpox, does not exist in animals. It is the same with polio, which the WHO is keen to eradicate, but which remains endemic in three countries: Nigeria, Afghanistan and Pakistan and has returned to Syria, caused by its civil war.

Scientists are trying to improve ways of diagnosing the infection and to develop an effective human vaccine, as the plague has been classified as a "category A bioweapon

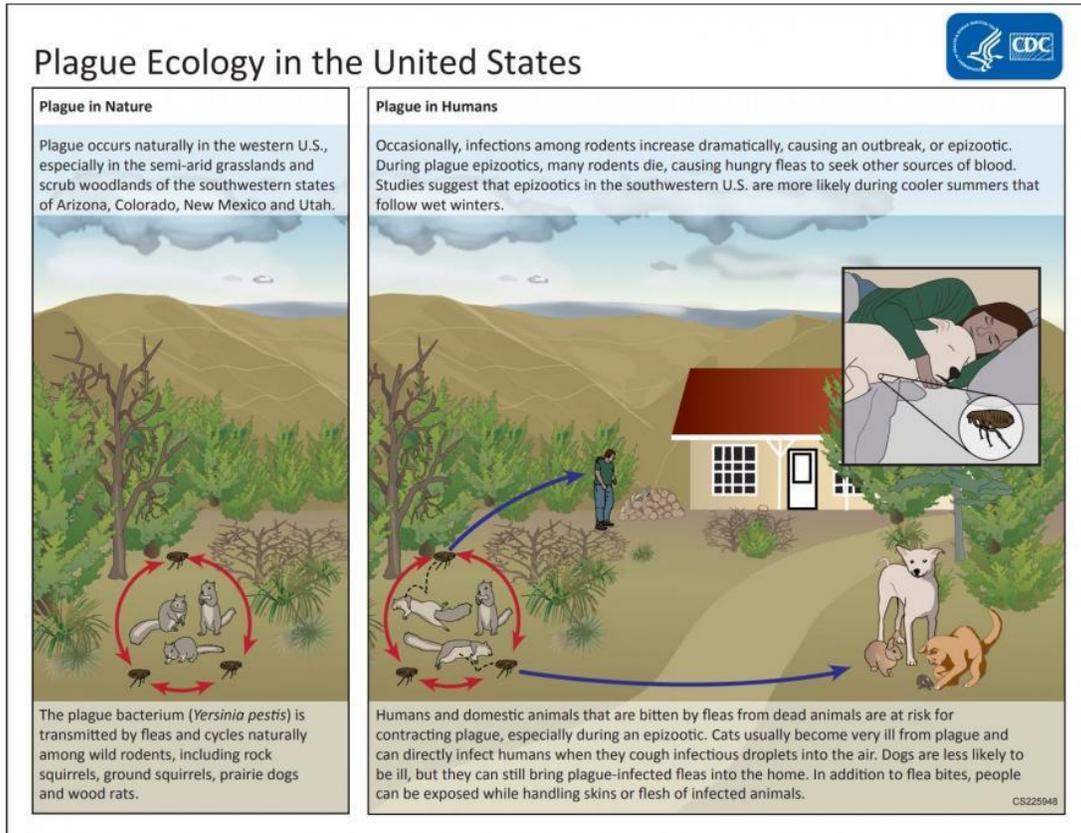


Figure 9. Plague ecology. Source: CDC.

Author Holle Abee [28] offers this interesting description of the black plague:

“The black plague, also known as the black death, is a disease caused by the bacterium *Yersinia pestis*. It enters the body through the skin and travels via the lymph system. The bacteria live in the digestive tracts of fleas. The fleas, of course, live off blood from a host, and when the fleas swallow the blood, it becomes infected with the bacteria. As the bacteria multiply inside the flea, an intestinal blockage forms, starving the parasite because nutrients cannot be absorbed. The flea vomits in an effort to clear the blockage, and since the flea is starving, it feeds voraciously. When the infected flea vomits the diseased blood into a bite site on a host animal or human, the host becomes infected with black plague.

The disease was once devastating, and the resulting death was horrible. There were actually three forms of the black plague – the bubonic form, the pneumonic form, and the septicemic form. Victims of the bubonic

plague suffered painful swollen lymph nodes in the neck and the underarms, called buboes. They were also wracked with high fever, vomiting, pounding headaches, and gangrene. Some were so weak that they barely had the energy to swallow.

The pneumonic form was even more punishing. As the body tried to fight off the disease, large amounts of phlegm were produced. The victims had to constantly cough up sputum in an effort to breathe, and more than ninety-five percent of the time, the patient drowned in his own body fluids. The pneumonic form of the plague didn't need rats or fleas to spread – it was an airborne bacterium spread by the coughs of infected individuals. Septicemic black plague was a form of blood poisoning and had a mortality rate of one hundred percent. With this type of plague, the individual suffered from high fever and purple blotches on the skin. Fortunately, this deadliest form was also the rarest.

From the middle of the 1300s until the 1700s, the black plague terrorized much of Europe and parts of Asia. Most historians believe the plague was first brought to Europe on ships from Asia. The most likely culprit was the black rats that often foraged among the ships' holds for food scraps. These were smaller relatives of the brown rats.

The initial outbreak of the plague in fourteenth-century Europe was the most virulent. In fact, much of the populations of England and France were decimated. In some parts of England the death toll was 50%. Some parts of France suffered an astounding loss of ninety percent of their populations.

Many modern readers assume that there was only one outbreak of the black plague, but there were actually several. In fact, it raged through Europe about once every generation until the beginning of the eighteenth century. One of the last major outbreaks occurred in England with the Great Plague of London, which took place in 1665-1666.

Interestingly, the fate of mankind was curiously linked to that of the common house cat. When the cat populations rose, the pandemic ebbed, and when the cat population plummeted, the black plague made a resurgence. Why?

Remember that the plague was spread by fleas that lived on rats. A vicious cycle kept the disease going. Infected fleas would bite a rat, and the rodent would become infected. Then other fleas biting the infected rat would become infected themselves. Once the host rat died of the plague, any fleas living on it would find themselves homeless and would go in search of a new host. Unfortunately, this often took the form of a human. When the sick infected fleas bit the human in order to feed, the human would become infected. So why didn't the Europeans just keep plenty of cats around to kill the rats and thereby reduce the incidence of the plague? They had cats at the time. They were originally brought to Europe by the Romans, who had discovered the felines in Egypt. Keeping pet cats as mousers had become popular in Europe by the time of the first plague.

To fully answer that question, you need to understand the belief system of medieval Europe. Based on historical accounts and medieval art,

people during this period were prone to many superstitions. The Catholic Church was the most powerful entity in Europe at the time, and the masses were consumed with the presence of evil and eradicating it in any form it might be believed to take. Because of their secretive nature and their ability to survive extraordinary circumstances, the general population came to fear cats as consorts of Satan. The innocent cats began to be killed by the thousands.

The cats ultimately got their revenge, of course. Since there were few felines left, the rat populations increased unchecked, and the plague grew even more widespread. You'd think that the humans would make the connection by this point, but instead, they made things even worse. They began to associate the plague's new vigor with the cats and even with dogs. They believed that since both of these animals typically harbored fleas, they must be the cause of the plague. Subsequently, cats were outlawed in many parts of Europe, and huge numbers of cats and dogs were killed. In fact, at one point in the middle ages, there were barely any cats left in England at all.

Even though cat ownership was illegal in some regions, a few people kept their felines. Other people finally noticed that these cat owners often seemed to be immune to the black plague. Word spread quickly, and more observations of this phenomenon were noticed. This resulted in research, crude as it was during the time.

Eventually, it was decided that the *rats*, not the *cats*, were responsible for spreading the black plague. Then, of course, everyone wanted to own a cat or two. And since cats are prolific breeders, it didn't take long for the demand to be satisfied. The laws which had been the cats' death sentence were repealed. In many regions, a new law took its place – one that protected felines instead of banning them and almost causing their extinction in Europe.”

CHAGAS DISEASE

It is spread by the “kissing bug.” This parasitic illness is rarely fatal, but it can cause debilitating heart problems and other complications. It has been dubbed the “new AIDS of the Americas” because its spread through the northern hemisphere mimics the early spread of HIV. More than 300,000 infected people live in the USA.

MEASLES

Parents refusing to vaccinate their children contributed to a series of outbreaks that sickened hundreds of people in 2014 and 2015. The year 2014 saw more measles cases in the USA than any year since 1994. It is extremely contagious and can be fatal.

STAPH INFECTION

These infections are caused by a germ commonly found on the skin or nose; staph infections can be deadly and some strains no longer respond to common antibiotics.

E. COLI

This type of deadly food poisoning caused a big scare in the early 1990s when four children died after visiting a fast food restaurant. Since then, the bacterium has been linked to some packaged salads and other fresh foods.

HAND, FOOD AND MOUTH DISEASE

This highly contagious bug mostly affects children. It is spread through saliva, feces, and the fluid from blisters. There is no cure, but the body often fights off the virus on its own.

TUBERCULOSIS, TB

It is not highly contagious, but it does cause frequent scares. In 2013, there were more than 9,500 cases in the USA. At a hospital in El Paso, Texas, in 2014, more than 700 patients and 40 employees were exposed to a disease-carrier who worked at the hospital nursery. Worldwide, TB kills at least 1 million people every year.

SALMONELLA

Raw chicken is most often associated with this type of food poisoning. In 2014, a California chicken producer issued a recall connected with a strain of salmonella that had been making hundreds of people sick for more than a year.

MALARIA

Malaria, spread by infected mosquitoes, sickens more than 200 million people each year with high fevers, shaking chills, nausea and other severe flu-like symptoms. The World Health Organization (WHO) says it killed 627,000 in 2012. Health officials are alarmed by the spread of a drug-resistant strain in Asia that could make the disease even harder to control.

BRUCELLOSIS

Symptoms are similar to that of the flu. Rarely fatal, but when the disease causes complications, such as abscesses or infection of organs, surgery to remove the infected areas might be necessary. People can get the disease through contact with infected livestock or from eating unpasteurized dairy products.

LEGIONELLA, LEGIONNAIRE DISEASE

Legionnaire's Disease, caused by the Legionella bacteria, festers in moist environments in hotels and cruise ships. It can be fatal in up to one-third of the cases.

HIV/AIDS

Globally, an estimated 36 million people have died of AIDS since the epidemic emerged in the 1980s. The virus attacks the immune system, and while drugs have helped increase survival rates, there is no known cure.

EBOLA VIRUS

This sickness causes victims to essentially bleed to death internally. The latest major outbreak of the virus, ravaging West Africa in 2014-2015, has killed at least 8,235 people.

NECROTIZING FASCIITIS

Known as the flesh-eating bacteria, this condition is rare but still kills in the USA. A Michigan woman died of the infection in July 2012.

CARBAPENEM-RESISTANT ENTEROBACTERIACEAE, CRE

At least seven people were infected and two of them died after being exposed to an antibiotic-resistant superbug during specialized endoscopy procedures at Ronald Reagan UCLA Medical Center in 2015. This bug is known as the "nightmare" bacteria because of its resistance to antibiotics. UCLA is just the latest to have an outbreak of infection and the cases further highlight the challenges hospitals face with the growing risk of drug-resistant superbugs.

TOXOPLASMA GONDII PARASITE

The human body is a mishmash of many different organisms. Microbes in the gut can produce neurotransmitters that alter the mood. Some scientists have proposed that the microbes may sway the appetite, so that one craves their favorite food.

The infection of the parasite Toxoplasma Gondii might lead a person to their death. The microbe warps rats' brains so that they are attracted to cats, which offer them a cozy home for it to reproduce. Humans can be infected and subjected to the same kind of mind control. The microbe makes someone adopt risky behavior, and increases the chance they will suffer from schizophrenia or suicidal depression. A third of the meat in the UK carries this parasite, despite the fact an infection could contribute to these mental illnesses is known.

SEASONAL FLU

According to the USA Department of Health and Human Services, the fall season's start sparks the onset of flu season, beginning in the autumn months and stretching into as late as May. The flu typically peaks in January and February during the brunt of winter.

As a respiratory illness, the flu spreads from person to person, mostly through coughs, sneezes and even general talking. It is possible to contract the flu by touching a surface infected with the flu virus then transmitting it to the mouth, nose or eyes. Up to 20 percent of the USA population will be impacted by the flu each year.

COMMON COLD

The Common colds can affect anyone at any time of the year, but peak cold activity hits during the winter and rainy months, according to the University of Maryland Medical Center (UMMC). There are over 1 billion cold cases reported in the USA throughout each year. An upper respiratory infection, colds are spread similarly to the flu. Colds ordinarily bring nasal congestion, scratchy throats and sneezing along with other symptoms depending on the strain.

NOROVIRUS

This is the most common stomach inflammation illness in the USA, commonly referred to as the stomach flu, norovirus reaches its highest strength during the winter months. As an extremely contagious virus, norovirus is the cause of up to 21 million illnesses each year, according to USA Centers for Disease Control and Prevention. Outbreaks spread from person to person, most commonly in long-term care facilities.

ACUTE EAR INFECTIONS

Ear infections, especially in children, are more likely to occur in winter than any other season. Changes in climate, especially as colder air takes hold, will enhance the threat of an acute ear infection. Ear infections are the number one reason parents take their children to the doctor. Symptoms of general ear pain and even nausea can be the most disruptive symptoms.

BRONCHIOLITIS

Caused by a virus that impacts children, mostly under the age of two, bronchiolitis is a swelling and mucus buildup within the smallest lung air passages. The virus peaks in the fall and winter months. It most commonly is caused by a viral infection and is spread from person to person when coming in direct contact with nose and throat fluids of someone carrying the virus. The CDC recommends to wash hands frequently as the easiest way to prevent the spread of the illness. Disinfect counter tops, door knobs and other frequently touched surfaces often.

GUN DEATHS RISKS

The risks of gun deaths in the USA is suicide, not homicide. There were 33,000 gun-related deaths during 2013 in the USA, but 21,175 of them were suicides, and another 1,000 were due to accidental discharges or other undetermined reasons.

Statistics show that each year 7,000 people take their lives by poisoning and another 11,000 by “suffocation” or, hanging. In a typical year there are more suicides by hanging than there are homicides by guns.

The comparison is more telling when one considers that some considerable share of the 10,000 or so annual homicides stem from activities such as drug distribution, gambling and prostitution that would not involve any murders at all had they not been driven into the criminal underground by the proscriptions and prohibitions of the state.

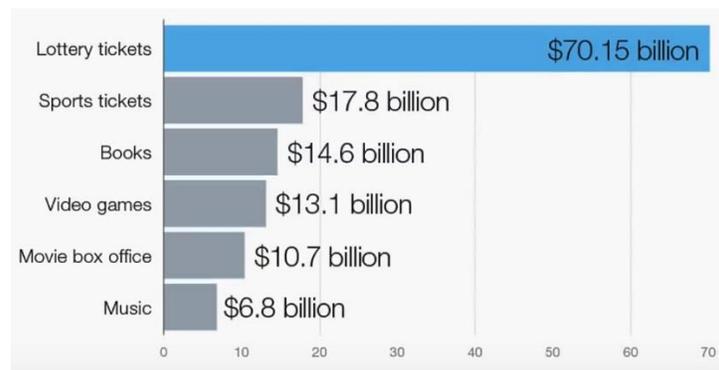
LOTTERY RISKS

Lottery organizers base their work on a well-understood facet of human nature: people do not understand odds. They pay less attention to the probability of a given event than the consequences if it takes place. The odds of a terrorist incident on a plane come to 1 per 16.6 million departures, statistician Nate Silver calculated in 2009, but people tend to focus on the outcome; hundreds of passengers perishing at once, than on the probabilities [23]. The same phenomenon can be observed with the Powerball lottery: Customers focus their attention less on that incomprehensibly small 1 in 292 million probability, and more on what they would do with the billion-dollar prize if they win it.

The Powerball gambling fever gripped the USA, with a jackpot of nearly \$1.5 billion at the January 13, 2016 drawing. Powerball officials in the 44 states that participate in the game are quoted expressing astonishment at the size of the jackpot and the nationwide frenzy it has induced.

The rules were changed to increase the odds of winning any prize, while making it more difficult to win the jackpot prize. For each \$2 entry, players select five "white" numbers and 1 single "red" number. At each drawing, five numbered white balls and a red ball are picked. Matching all the whites and the red, one wins the jackpot. Matching only the whites, one wins the second prize of \$1 million; only the red, and one wins \$4, which they are likely to convert into another pair of tickets [23].

The rules were changed to increase the white numbers to 69 from 59 and to decrease the red number to 26 from 35. The effect was to decrease the odds of winning the jackpot from 1 in 175.2 million to 1 in 292.2 million. The odd of winning the \$4 in change was reduced to 1 in 92 from 1 in 111 [23].



Match	Prize	Odds
	Grand Prize	1 in 292,201,338.00
	\$1,000,000	1 in 11,688,053.52
	\$50,000	1 in 913,129.18
	\$100	1 in 36,525.17
	\$100	1 in 14,494.11
	\$7	1 in 579.76
	\$7	1 in 701.33
	\$4	1 in 91.98
	\$4	1 in 38.32

The overall odds of winning a prize are 1 in 24.87.
The odds presented here are based on a \$2 play (rounded to two decimal places).

Figure 10. Lotteries spending in the USA. Odds of winning in Powerball game. Source: New York State Gaming Commission [23].

The odds of obtaining a winning number is:

$$odds = \frac{{}^n C_r}{m {}^m C_r} \frac{1}{s} \quad (10)$$

where: ${}^n C_r = \frac{n!}{r!(n-r)!}$ is the number of combinations or arrangements of r objects out of

n objects; for the white balls,

s is the number of choices for the red balls,

$n! = n(n-1)(n-2)\dots 1$, is the factorial of n,

$0! = 1$, by definition, there is only 1 way to arrange 0 objects.

EXAMPLE 2

For $n = 5$, $r = 5$, $m = 69$, $s = 26$,

$$\begin{aligned}
\text{odds} &= \frac{{}^n C_r}{m {}^m C_s} \frac{1}{s} = \frac{{}^5 C_5}{69 {}^69 C_5} \frac{1}{26} = \frac{5!}{69!} \frac{1}{26} = \frac{(0)!}{69!} \frac{1}{26} = \frac{1}{69!} \frac{1}{26} = \frac{5!(64)!}{69!} \frac{1}{26} \\
&= \frac{120}{69 \times 68 \times 67 \times 66 \times 65} \frac{1}{26} = \frac{120}{1,348,621,560} \frac{1}{26} = \frac{1}{292,201,338}
\end{aligned}$$

EXAMPLE 3

For $n = 5$, $r = 5$, $m = 59$, $s = 35$,

$$\begin{aligned}
\text{odds} &= \frac{{}^n C_r}{m {}^m C_s} \frac{1}{s} = \frac{{}^5 C_5}{59 {}^59 C_5} \frac{1}{35} = \frac{5!}{59!} \frac{1}{35} = \frac{(0)!}{59!} \frac{1}{35} = \frac{1}{59!} \frac{1}{35} = \frac{5!(54)!}{59!} \frac{1}{35} \\
&= \frac{120}{59 \times 58 \times 57 \times 56 \times 55} \frac{1}{35} = \frac{120}{600,766,320} \frac{1}{35} = \frac{1}{175,223,510}
\end{aligned}$$

It is understood that in economic terms, the people who are exploited by the mismatch of expectations tend to be disproportionately low-income and less educated. Lotteries are effectively a tax on the poor. In 1999, researchers at Duke University reported that American households spent an average of \$162 per year on lottery tickets, but low-income households spent \$289 and those with less than \$10,000 in income spent \$597.

Higher lottery purchases are associated with lower educational attainment and ethnic minorities. Experts are not entirely sure why "those who can least afford it play the most," as German sociologists asked in a 2013 paper. The pessimistic, and perhaps condescending, view is that the poor and less-educated do not have the intellectual gifts to appraise the odds; but middle-class and rich people play the lottery too. The sociological answer is that lower-income people have a greater need to relieve tension in their daily lives, gambling is a socially acceptable way to do so, and only the lottery offers the lure of a potentially life-changing payoff. Another attraction, the German researchers conjectured, is that lotteries are egalitarian; every buyer of a ticket has the same chance of success. That may be more appealing to those in the lower socioeconomic strata; for whom equal opportunity may seem like a rare break, than to the more affluent, who may look at an equal-opportunity situation as one working to their disadvantage [23].

The assertion that lottery revenues are used to fund education is little more than window-dressing. In California, \$1.39 billion in lottery funds went to education in 2015. That is less than 2 percent of the state's education budget of more than \$76 billion. If the schools and higher education systems were properly funded by taxes, there would be no need to provide the dribble of funding out of the paychecks of the working-class Californians [23].

RISK OF QUICKSAND

Wet quicksand

Quicksand usually consists of sand or clay and salt that became waterlogged, often in river deltas. The ground looks solid, but when you step on it the sand begins to liquefy. But then the water and sand separate, leaving a layer of densely packed wet sand which can trap it. The friction between the sand particles is reduced, meaning it cannot support your weight anymore and at first you do sink.

Daniel Bonn from the University of Amsterdam used aluminum beads which have the same density as a human. He put them on top of the sand and then, to simulate the flailing of a panicking human, he shook the whole model and waited to see what happened. At first they sunk a little, but as the sand gradually began to mix with water again, the buoyancy of the mixture increases and they floated back up to the top. Bonn and his team tried placing all sorts of objects on his lab-made quicksand. If they were of density equivalent to a human they did sink, but never completely, only half way.

Although quicksand does not continue to pull you right under, if you cannot get free in time, a high tide can sweep across you. This is really when quicksand can be dangerous. We do still need to be wary. If one want to free oneself without waiting for rescue or for the sand to liquefy again, then Bonn's research showed that just to release one foot, you would need to provide a force of 100,000 newtons, the equivalent of the strength to lift a medium-sized car.

The quicksand effect means that falling into a silo full of grain can often be fatal. In the lab Bonn's team found that salt was an essential ingredient because it increased the instability of quicksand, leading to the formation of these dangerous areas of thick sediment.

Another team from Switzerland and Brazil, discovered a kind of quicksand that does not need salt. They tested samples from the shores of a lagoon in north eastern Brazil. They found that bacteria formed a crust on the top of the soil, giving the impression of a stable surface, but when stepped on the surface collapsed. The good news is that basins formed from this kind of soil are very rarely deeper than the height of a human, so even if someone did slip into the quicksand they would not drown [24].

Dry quicksand

The dry quicksand effect means that falling into a silo full of grain can often be fatal. To survive a fall into dry quicksand, you need outside help as quickly as possible. The classic idea of quicksand drags a person down. Each time a person exhales, the volume of his chest reduced, causing grain to rush to fill the gap and making it progressively harder for him to breathe.

The firefighters use a clever solution. They lower a cylinder over the trapped person's body. Then they suck the grain out with an industrial vacuum. The grain could not fall more tightly around the person and he can survive.

To survive a fall into dry quicksand, one needs outside help as quickly as possible. In some wet quicksand a person need to wiggle their leg a little in order to introduce water to the sand around the feet to liquefy the sand again.

The idea is to stay calm and lean back and spread out to spread the body weight more evenly and wait until they float back up to the surface [24].

RISK OF MERCURY IN FISH

A study published in the journal *Science Advances* suggests that rising global temperatures could boost mercury levels in fish by up to seven times the current levels. Extra rainfall drives up the amount of organic material flowing into the seas which alters the food chain, adding a layer of complex organisms which boosts the concentrations of mercury up the line.

Mercury is one of the world's most toxic metals, and according to the World Health Organization, is one of the top ten threats to public health. The substance at high levels has been linked to damage to the nervous system, paralysis and mental impairment in children. The most common form of exposure to mercury is by eating fish containing methyl-mercury, an organic form of the chemical which forms when bacteria react with mercury in water, soil or plants.

Levels of mercury in the world's ecosystems have increased by between 200 and 500 percent, since the industrial, driven up by the use of fossil fuels such as coal. In recent years there have been concentrated efforts to limit the amount of mercury entering the environment, with an international treaty, called the Minamata Convention, signed by 136 countries in place since 2013.

Swedish researchers from Umea University recreated the conditions found in the Bothnian sea estuary and discovered that as global temperatures increase, there is an increased run-off of organic matter into the world's oceans and lakes. This encourages the growth of bacteria at the expense of phytoplankton. The extra step in the food chain enriches methyl-mercury by a factor of ten in each such step in the food web."

Under the warmest climate scenario suggested by the Intergovernmental Panel on Climate Change, there would be an increase in organic matter run-off of 15-20 percent by the end of this century. This in turn would see levels of methyl-mercury in zooplankton, the bottom link in the food chain, grow by between two and seven fold.

Different parts of the world suffer different impacts, with lakes and coastal waters in the northern hemisphere being the most likely to have significant increases in methyl-mercury levels in fish, while the Mediterranean, the central USA and Southern Africa will likely see reductions.

ESCOLAR, BUTTERFISH, OILFISH, WALOO/WALU, "WHITE TUNA" MISLABELING

The importation of this buttery and succulent fish is banned in Italy and Japan. The governments of Canada, Sweden and Denmark require that all escolar fish come with warning labels. In the USA, the FDA lifted the escolar ban in 1992 because the fish is nontoxic. Sushi restaurants occasionally serve it as "super white tuna" or "king tuna."

The nonprofit ocean protection group Oceana took 1,215 samples of fish from across the USA and genetically tested them. It disclosed that 59 percent of the fish labeled "tuna" sold at restaurants and grocery stores in the USA is not tuna. Sushi restaurants were far more likely to mislabel their fish than grocery stores or other restaurants.

With some varieties of fish in danger of being overfished and other species becoming undesirable due to their high mercury content, seafood purveyors sell it as a fish that is delicious, cheap, sustainable, and low in mercury.

Escolar is a type of snake mackerel that cannot metabolize the wax esters naturally found in its diet. These esters are called gempylotoxin, and are very similar to castor oil or mineral oil. This is what gives the flesh of escolar its oily texture. When full portions of escolar are consumed, these wax esters cause serious gastrointestinal symptoms.

There are two different species of Escolar. They are known as Smooth-skin (*Lepidocybium Flavobrunneum*) and Rough-skin (*Ruvettus Pretiosus*) Escolar, the latter being the much cheaper yet problematic fish.

These two different fish species have been lumped together. A good seafood processor would ensure to deep-skin the Escolar to remove the high oil content muscle tissue between the skin and flesh, drastically reducing the purgative issues.

The fish is considered as environmentally sustainable due to its short population doubling time, so using this fish prevents the extinction of other species.

Consumption of escolar causes explosive, oily, orange “explosive diarrhea.” The discharges are difficult to control and accidents can happen while passing gas. Other side effects can occur including erratic heart rate, cold sweats, chest pressure and other symptoms similar to the beginnings of a heart attack or anxiety attack can happen within 1 hour of eating Escolar.

Serious medical toxicity problems often occur after eating the barracuda fish caught in Mexican waters.

ZIKA VIRUS, DENGUE FEVER, AEDES AEGYPTI MOSQUITO RISK

Zika is a virus discovered in a Rhesus monkey in the Zika forest of Uganda in 1947. It is native to tropical Africa, Southeast Asia, and the Pacific Islands. Infections have exploded in Latin America and the Caribbean. The virus is spread through bites from the same kind of mosquitoes that can spread other tropical diseases, like chikungunya and dengue fever [25].

The virus arrived in Brazil in 2013, likely by plane from French Polynesia. It only took a few months for it to spread to 60 countries. And everywhere Zika became established, it had been preceded by the *Aedes aegypti* mosquito. The *Aedes aegypti* mosquito has taken over the title as the world's most dangerous mosquito from the malaria-carrying *Anopheles*. The *Aedes aegypti* carries diseases such as dengue fever, yellow fever and Zika. In English, the word *Aedes* means a ne'er-do-well person; an idle, irresponsible, lazy person. In ancient Roman religion, *Aedes* is a shrine or a temple.

The *Aedes aegypti* mosquito was present when the chikungunya fever broke out on the island of La Réunion in 2005. It was there when chikungunya spread to India and it was there when the virus jumped from the Caribbean to the American mainland. Even yellow fever, which long seemed to have been eradicated, is making a comeback. By the time Angola, the Democratic Republic of Congo and Uganda in the spring of 2016 reported the worst outbreak of the disease in decades, the mosquito had already infected 2,000 people. Three hundred of them died. About 1 in 5 people who are infected with the Zika virus develop symptoms. Zika illness involves fever, rash, joint pain, and red eyes, which

usually last no more than a week. There is no medicine or vaccine for it. Hospitalizations are rare, and deaths from Zika have been rarely reported [25].

The *Aedes aegypti* mosquito is attracted both by the CO₂ that people exhale and by their perspiration, an alluring combination of butanoic acid and propanoic acid. Female mosquitoes pursue this scent until they come close enough to their victims to sense the warmth and dampness that everyone's body emits. Humans emit out about 500 odor molecules, and the mosquito can detect about 20 of these. The CO₂ in the breath, the carboxylic acid in the socks or the sweat on the skin tell the mosquito about the location of a human [25].

The lifecycle of a female *Aedes aegypti* is at least 10 days long. During this period, it lays several hundred tiny eggs on four or five occasions. In contrast to the *Anopheles* mosquito, which lays its eggs on the surface of standing water, the *Aedes aegypti* mosquito positions its spawn just above the water's surface. When the rain comes and the water level climbs, a new lifecycle begins in each egg.

DEET is still the most reliable mosquito repellent substance. It is a synthetic molecule that was developed in the 1940s by the USA military after it became clear that, in some wars, almost as many men were being lost to mosquitoes as to enemy fire. DEET activates certain receptors on the mosquito antennae, thus confusing them. But DEET has two disadvantages. First, it has side-effects. And second, it does not work as well on *Aedes aegypti* mosquitoes as it does on the *Anopheles* mosquito. Interestingly, a natural anti-mosquito substance is present in 10 percent of the human population.

Blood is vital for female mosquitoes as it provides the protein necessary to complete the egg formation process. To prevent blood from quickly clotting, mosquitoes secrete an anticoagulant into their host's bodies. It is this exchange of bodily fluids that makes mosquitoes into a "vector", or an animal that transmits pathogens.

Evidence links Zika infection in pregnant women to a rare condition called microcephaly, in which the newly-born's head is smaller than normal and the brain has not developed properly. Brazil had a recent spike in the birth defect.

Infections are occurring in Mexico, and the kind of mosquitoes that can carry the virus are found along the southern USA. Travelers are advised to wear long sleeves and long pants and use insect repellent.



Figure 11. The black-and-white striped *Aedes aegypti* mosquito is one of the world's most dangerous vectors, a term used to describe insects that transmit diseases. The mosquito carries chikungunya, dengue fever, yellow fever and Zika. India is afflicted by diseases carried by the *Aedes aegypti*, including regular dengue fever outbreaks. This mosquito is the most dangerous animal in the world presenting a threat to some 4 billion people globally [25].

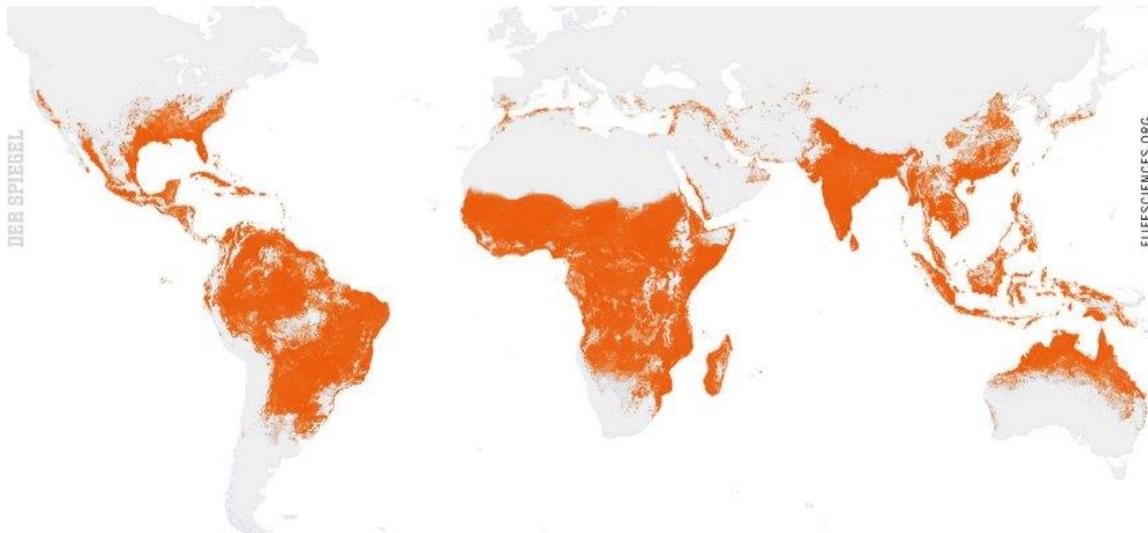


Figure 12. Areas of the world at risk of diseases carried by the *Aedes aegypti* mosquito. Mosquitoes were on this planet before humans and they may still be here if humans were gone.

The CDC reported more than 500 cases it is monitoring, including nearly 300 pregnant women thought to have the disease, determined by actual lab tests. The increasing number of cases is not because the disease is spreading by mosquitoes in the USA. All

cases are thought to have been acquired by travel or by having intercourse with a person carrying the disease.

Table 11. Mosquito deaths worldwide.

Disease	Deaths
Malaria	450,000
Yellow fever	45,000
Dengue fever	20,000
Japanese encephalitis	17,000
Total	> 500,000

There are numerous good reasons to think the disease can cause microcephaly in infants as well as Guillain-Barré syndrome in anyone. Guillain-Barré is potentially as consequential, if not more so, as an outcome of the Zika virus, although neither microcephaly nor Guillain-Barré has been proven as yet to be caused by the virus. The CDC has declared a causal relationship between the virus and brain diseases like microcephaly, and justifies its conclusion partly because of “the absence of an alternative explanation.”

Guillain-Barré causes sudden onset of paralysis and can be life-threatening because victims may lose the ability to breathe. It typically comes on following an infection, but is rare, affecting about one in 100,000 people annually. People with the Zika virus seem to have an increased chance of succumbing to the syndrome.

No one has a good test for the Zika virus, because dengue fever and yellow fever can trigger an antibody test for it. A real-time reverse-transcription polymerase chain reaction (PCR) test is available, but only certain high-precision testing labs can perform it. The blood serum must be collected within three days of onset of the symptoms (urine for PCR testing can be used up to 14 days after the onset of symptoms), and the CDC is not promising anyone will get test results back in less than three weeks.

The Utah Department of Health is reported a "unique" case of Zika in July 2016 in Utah whereby a person reportedly became infected with the virus without a clear means of transmission. The case was discovered in a care giver of an elderly individual with the virus who died in late June 2016. The caregiver is not believed to have traveled to an area with Zika or to have had sex with someone who had the virus. Evidence is needed that the Zika can be passed from one person to another person by sneezing or coughing or touching or hugging or sharing utensils. As there is currently no evidence that the Aedes mosquito is capable of spreading Zika in Utah, the investigation is seeking to discover how the caregiver became infected.

The majority of people who get the virus do not even know they have it because they will have no symptoms. Those that do will experience mild fever, rash, joint pain, conjunctivitis (red eyes), muscle pain or headache. No one is sure what the incubation period of the virus is, but the CDC is guessing it is a few days to a week.

Whereas the Anopheles was the mosquito of the 20th century, the Aedes aegypti seems intent on taking that title for the 21st. The number of people dying of malaria has long been in decline, but Aedes-spread dengue fever, by contrast, is considered the fastest spreading mosquito-borne illness in the world. Fully 128 countries are now considered at risk of dengue and around 4 million people become infected each year, according to WHO.

Most of them suffer from rashes, joint pain and high fever. But an estimated 20,000 per year have a different reaction: They experience severe internal bleeding which often ends in death.

An artificial genetic modification that is passed on during mating is under consideration to control the mosquito. That gene produces a protein called tTAV, which ensures that the mosquitoes' larvae will die before reaching adulthood. The British company Oxitec conducted trials on the Cayman Islands and in Panama. The method succeeded in reducing the wild *Aedes aegypti* population by 90 percent in just a few months. The USA biotech firm Intrexon purchased Oxitec, which was originally formed out of an Oxford University research project, for \$160 million.

In a country like India inpatient treatment of dengue fever patients can easily cost as much as half of a family's annual income. In Thailand, the tourism industry estimates that dengue-induced revenue losses could amount to as much as \$363 million. In Malaysia, researchers have calculated that 10,000 dengue cases resulted in the loss of 940,000 work days.

Mosquitoes originally lived exclusively in sub-Saharan Africa. They preferred targeting wild animals to satiate their thirst for blood. Females mostly laid their eggs in branch hollows that filled with water during the rainy season. Evolution researchers have differing answers to the question as to when mosquitoes began changing their behavior. According to one theory, when the Sahara began expanding around 1,000 years ago, much of the mosquitoes' habitat dried out, which in turn meant that water could only reliably be found in places where humans had settled, and these humans soon became their most stable source of blood. A second theory holds that the domestication of the mosquito only happened later, as a spontaneous event that took place on a slave ship traveling from Africa to the New World. The theory was developed by the Brazilian historian Rodrigo Magalhaes, who wrote his Ph.D. about the 20th century South American fight against an insect that has repeatedly caused yellow fever outbreaks since its arrival.

An American doctor named Fred Soper, in 1947 became the coordinator of a program to eliminate the *Aedes aegypti* mosquito under the auspices of the Pan American Health Organization. He possessed the miracle weapon that would make it possible: "Dichloro-diphenyl-trichloro ethane" or DDT. DDT is a chemical whose potency as an insecticide was discovered in 1939 by an employee of the Swiss pharmaceutical company Geigy. He was awarded the Nobel Prize for medicine.

Fred Soper managed to get South American countries to change their laws such that local mosquito hunters were provided access to private homes. In 1958, 11 years after launching his campaign, Fred Soper announced that all countries in South and Central America had successfully eliminated the *Aedes aegypti* mosquito.

Because the USA had not experienced a yellow fever epidemic since 1905 and because dengue and Zika had not yet become a danger, American politicians were reluctant to allocate millions of dollars to do battle against an apparently harmless insect. By 1965, the *Aedes aegypti* was back, first in Mexico and then, one year later in Nicaragua and two years after that in the northern Brazilian city of Belém, where researchers determined that the mosquitoes had the exact same genetic code as *Aedes aegypti* mosquitoes in Florida. During the time when Fred Soper's army of sprayers was making its way through Central and South America a mutation in the mosquito's genetic code took place during one of the

species' myriad breeding cycles, one which made the insect immune to DDT. It was a mutation that guaranteed the survival of the species.

In addition to adapting to humans and the development of resistance to DDT, *Aedes aegypti*, in contrast to the malaria-carrying mosquito *Anopheles*, was able to quickly adapt to conditions in rapidly growing megacities. Whereas they once bred in branch hollows found in the pre-historic African forest, today they are just as comfortable with car tires, plastic bottles or computer casings.

A vaccine for yellow fever was developed in the 1940s, but in the decades since then, there has been no additional vaccine created to protect humans from the diseases carried by *Aedes aegypti*.

Aedes aegypti, the mosquito of the 21st century, has become established in the slums of cities like Rio de Janeiro, Brazil, where the sewage system is just as dysfunctional as garbage disposal. In Piracicaba, the neighborhood mosquito hunters have found that the stomachs of many *Aedes* females can now hold twice as much blood as they could just 20 years ago. In a city like Singapore, which is lit up all night long, researchers have found that the mosquitoes now suck blood around the clock.

The forecasts of climate researchers also play into the hands of *Aedes aegypti*. Steady warming is one element, but more important is the possibility of an increasing number of droughts, which will lead more people to store water in tanks over their rooftops [25].

NAEGLERIA FOWLERI AMOEBIA RISK FROM SWIMMING IN FRESH WATER SOURCES

Naegleria fowleri is a heat-loving amoeba commonly found around the world in warm fresh water bodies such as lakes, rivers, ponds and hot springs, as well as soil, but not in salt water, according to the Centers for Disease Control and Prevention [17]. If ingested, the amoeba can cause an infection known as Primary Amebic Meningoencephalitis (PAM). Infection-causing PAM is extremely rare, but from 1962 to 2013, there have been 132 cases reported in the USA, with 34 cases coming between 2004 and 2013 [17].

The initial symptoms are the same as bacterial meningitis and typically start five days after the infection: headache, fever, nausea, vomiting and a stiff neck. During the later stages of the infection, people develop seizures, become lethargic and can develop an altered mental state and eventually go into a coma.

A precaution to take to lower the risk of infection is using nose plugs since infection typically occurs after the amoeba enters the body through the nose and travels to the brain when a person is swimming underwater.

Cases of *Naegleria fowleri* are more common in the months of July, August and September when there is prolonged heat and thus higher water temperatures and lower water levels. Most of the cases occur in the USA's southern-tier states, and about 50 percent of the cases occurred in Texas and Florida.

The following tips for Summer Swimmers are suggested by the CDC [17]:

1. Hold your nose shut, use nose clips or keep your head above water in warm bodies of freshwater.

2. Avoid digging in or stirring up the sediment while taking part in water-related activities in shallow, warm bodies of freshwater.
3. Avoid water-related activities in warm freshwater during periods of high water temperature and low water levels.
4. Do not put your head under water in hot springs.

Humans are infected by the deadly organisms when water containing the amoeba travels through the nose and migrates to the brain, destroying its tissue. High temperatures in the summer months elevate the risk of coming into contact with the brain-eating amoeba.

Most infections in the USA occur during periods of prolonged heat, high water temperatures and lower water levels. The amoeba grows best at high temperatures up to 115 °F but can survive for brief periods of time in warmer conditions, according to the Centers for Disease Control and Prevention. The amoeba can also be found in river or lake sediment where temperatures are below the preferred threshold.

Cases of *Naegleria fowleri* are rare but deadly with a fatality rate of 97 percent. After initial symptoms such as headaches, vomiting and fever, the disease progresses rapidly and in most cases does result in death within 3-18 days. Over the period 2006-2015, 37 cases of *Naegleria fowleri* were reported in the USA.

MEAT GRILLING, BARBECUE RISKS

Cooking meat on the grill presents a higher risk for colorectal, breast, stomach and pancreatic cancers. According to Karen Collins, nutrition advisor for the American Institute for Cancer Research (AICR), two cancer-causing compounds can form when meat is cooked on the grill: HCAs and PAHs:

1. HCAs, or heterocyclic amines, are formed when animal protein is exposed to intense heat.
2. PAHs, or polycyclic aromatic hydrocarbons, form in smoke and are deposited on meat. Most often, this occurs when fat from meat drips onto charcoal or another heat source, causing smoke to develop.

The risk may not be equal for all people. Genetic differences may cause some people to face a greater risk than others despite the same exposure.

Since the HCAs are generated by exposure to intense heat, two different steps can reduce that. One is by reducing the temperature. When meat is cooked to the same degree of doneness at a high temperature, finishing the cooking faster causes the amount of HCAs that form to be substantially increased. This can be cut by cooking slower on medium instead of high temperature.

Well-done, blackened meat also has higher levels of these compounds, thus one must consider limiting the exposure to this intense heat by not cooking animal proteins to super well-done levels.

Acidic marinades, such as lemon juice, vinegar, and herbs and spices can reduce the formation of HCAs by over 90 percent, according to the AICR. The AICR recommends that one reduces the risk by making overall lifestyle changes and eating healthier foods. It

advises to focus most meals around whole grains, fruits and vegetables, some of which contain phytochemicals that naturally deactivate harmful carcinogens.

RISK OF LEAD AND COPPER WATER CONTAMINATION

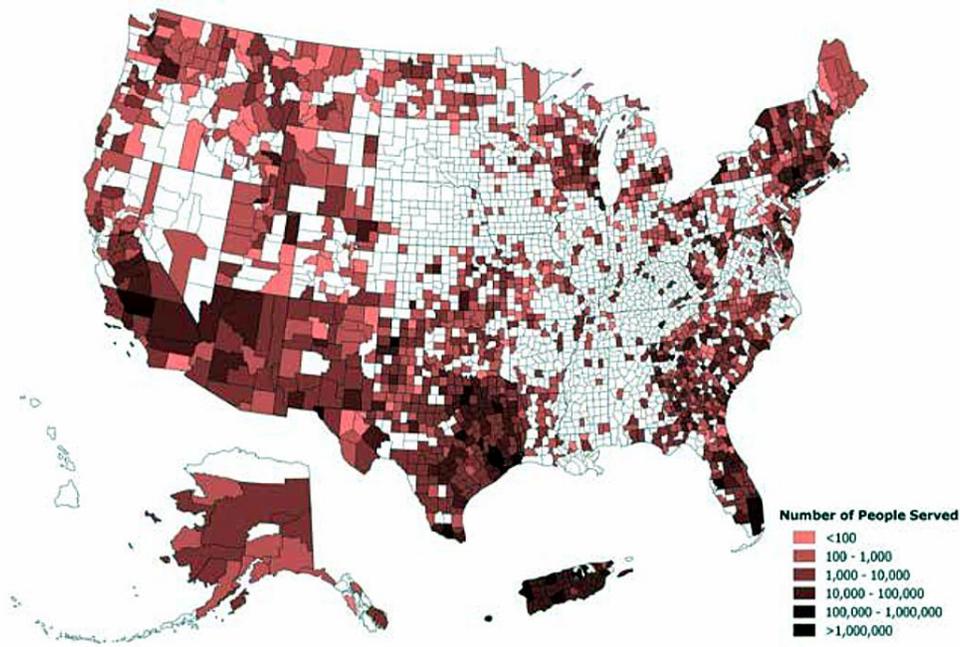


Figure 13. Number of people served by community water systems with reported violations of the Pb and Cu rules in 2015: 18 million. Source: EPA.

According to the Natural Resources Defense Council (NRDC), more than 18 million Americans were served by 5,363 community water systems with lead violations in 2015. A total of 1,110 of those water systems, which collectively serve 3.9 million people, showed lead levels in excess of 15 parts per billion (ppb) in at least 10 percent of the homes tested. Though public health officials say that no levels of lead should be considered safe, the 15 ppb-mark is the action level set by the EPA. All 50 USA states had at least one water system in violation of the lead and copper rule in 2015. The states and the EPA took formal enforcement action against just 11.2 percent of the over 8,000 violations in 2015 leaving 88.8 percent free from any formal enforcement action.

Lead exposure can have damaging and life-altering consequences, even at low levels. Children and babies are most at risk, with side effects including developmental delay, learning difficulties and slowed growth, according to the Mayo Clinic.

In April 2014, the city of Flint, Michigan, lead-contaminated water resulted when the city's water supply was switched from Lake Huron to the Flint River, which contains highly corrosive and polluted water, without first treating the lead pipes. As these pipes corroded, Pb levels soared as high as 10,000 ppb in some locations.

The lack of enforcement can be attributed in part to severe understaffing of the EPA at the federal level. Underreporting may be due to a variety of issues, including bad or unreliable testing methods and testing in houses not served by lead service lines.

SWIMMING IN FRESH WATER AND SALT WATER RISKS

During the summer months, millions of people across the USA are attracted to swim in fresh or salt water, chlorinated pools. Unknown to them they are at risk of contracting the following risks.

1. Cyanobacteria toxic algae

Toxic algae, known as blue-green algae, cyanobacteria are microscopic organisms found naturally in all types of water; fresh, combined salt and fresh water and marine water, according to the Centers for Disease Control and Prevention (CDC). Sometimes the algae start to multiply quickly, forming toxic blooms in warm waters that are not moving fast and are filled with nutrients, such as fertilizer or septic overflows. One may be able to see the blooms that spread across the water's surface and the CDC recommends that you and your pets stay away from water that is discolored or has a foamy or scummy surface.

Cyanobacteria tend to outcompete other algae when water temperatures get above about 20 degrees Celsius or 68 degrees Fahrenheit, and they outcompete most other organisms and persist for long periods of time.

2. Naegleria fowleri brain-eating amoeba

Naegleria is an amoeba commonly found in the environment, in water and soil. Only one species of Naegleria has been found to infect humans, Naegleria fowleri. It is important to note that these deadly infections are rare, but they did happen in the USA. Between 1962 and 2016, the CDC reported 143 known Naegleria fowleri infections, with only four survivors, a fatality rate of more than 97 percent.

The amoeba, a single-celled organism, lives in warm freshwater, such as lakes, rivers and hot springs. These organisms can travel up the nose to the brain and spinal cord as people swim or dive. This can cause a brain infection called Primary Amoebic Meningoencephalitis (PAM). CDC researchers said people do not become infected from drinking contaminated water.

Naegleria fowleri is thermophilic, or heat-loving. Most infections occur during July, August and September when there is prolonged heat, higher water temperatures and lower water levels.

3. Vibriosis, Vibrio vulnificus flesh-eating bacteria

Several cases of Vibrio vulnificus bacteria have been confirmed in the summer of 2017 in Mobile County, Alabama. Those affected are recovering, but health officials continue to warn the public about how to avoid soft-tissue infections. Vibriosis infections can occur when people eat raw or undercooked seafood, particularly oysters, or when an open wound is exposed to warm seawater, according to the Alabama Department of Public Health.

Vibrio bacteria naturally live in certain coastal waters, according to the CDC, and are measured in higher concentrations between May and October. Those individuals with open wounds, cuts, abrasions and sores, must stay out of brackish and warm salt water. Persons

with low immune systems, cancer, diabetes, liver disease and other chronic conditions should avoid eating raw or undercooked seafood, especially oysters.

4. Cercarial Dermatitis swimmer's itch parasites

This itchy rash occurs when people come into contact with water that is infested with parasites. According to the American Academy of Dermatology, the parasites burrow into the skin when the water starts to evaporate, not when the person is in the water. They cause tingling or burning spots, welts or blisters in the affected areas. Oral and topical medications eventually calm the rash and itch but the skin remains sensitive for about a week.

5. Cryptosporidiosis parasites

This parasitic infection is often found in swimming pools and water playgrounds. Outbreaks occur when swimmers swallow water contaminated with fecal matter discharged by other swimmers. Cryptosporidium is the leading cause of outbreaks from recreational water venues and can survive for up to 10 days even in properly chlorinated water, making it extremely hard to kill.

Cryptosporidiosis causes a gastrointestinal illness that lasts for a few weeks. The CDC's data for 2016 shows at least 32 outbreaks occurred in 13 states, compared to 13 outbreaks reported for 2013 and 16 outbreaks reported for 2014. The higher numbers could be due to an actual increase in the number of outbreaks, or it could be related to better surveillance systems and laboratory methods for diagnosis.



Figure 14. Cyanobacteria toxic algae. Source: CDC.

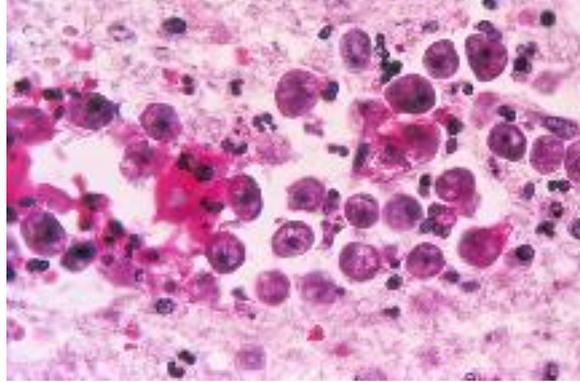


Figure 15. *Naegleria fowleri*, Brain-eating amoeba. Source: CDC.

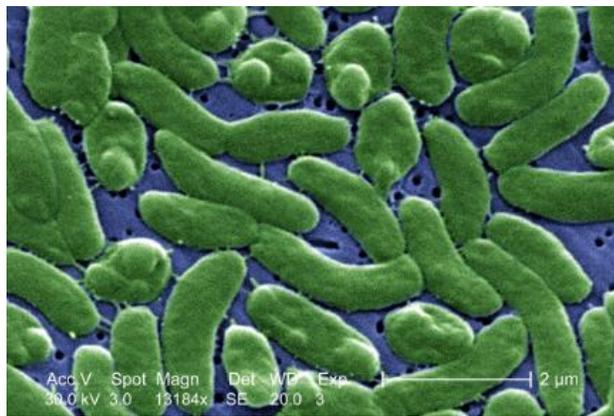


Figure 16. Vibriosis, flesh-eating bacteria. Source: CDC.



Figure 17. Cercarial Dermatitis, swimmer itch parasites. Source: CDC.



Figure 18. Cryptosporidiosis parasites. Source: CDC.

HYOSCINE, SCOPOLAMINE, DEVIL'S BREATH DRUG

Hyoscine, from the nightshade family of plants, is also known colloquially as "Devil's Breath". It is medically used to treat nausea, motion sickness, and gastro-intestinal pain, among others, with common side-effects including sleepiness and dry mouth. In higher doses it can cause hallucinations, agitation, seizures and unconsciousness. The drug is most widely known in Colombia, where it is derived from the "borrachero" tree which grows wild in the northern Andean region.

In the criminal world, the drug is used for its ability to diminish resistance, creating "zombies", and reduce memory of past events. As such it is used in robberies, sexual assaults, date rapes and kidnappings. Hyoscine, a prescription drug, has gained notoriety as a date rape drug.

About 50,000 incidents are associated with the drug every year in Colombia. Horror stories are attributed to the drug; for instance, that its powder can be blown into the victims' faces to incapacitate them.

SUPERVOLCANO ERUPTION RISK



Figure 19. Sunset Lake hot spring, Yellowstone. If a lake disappears and drains into the Magma Chamber then it is time for concern as it would cause a steam explosion. Small earthquakes may open up a fissure in the faults zones and cause a lake to drain into the magma. The lakes do not have to be above ground and visible. The underground water shed could drain through a fissure like the ocean water in the Krakatoa eruption, or snow from a mountain cap like in Mount Saint Helens.

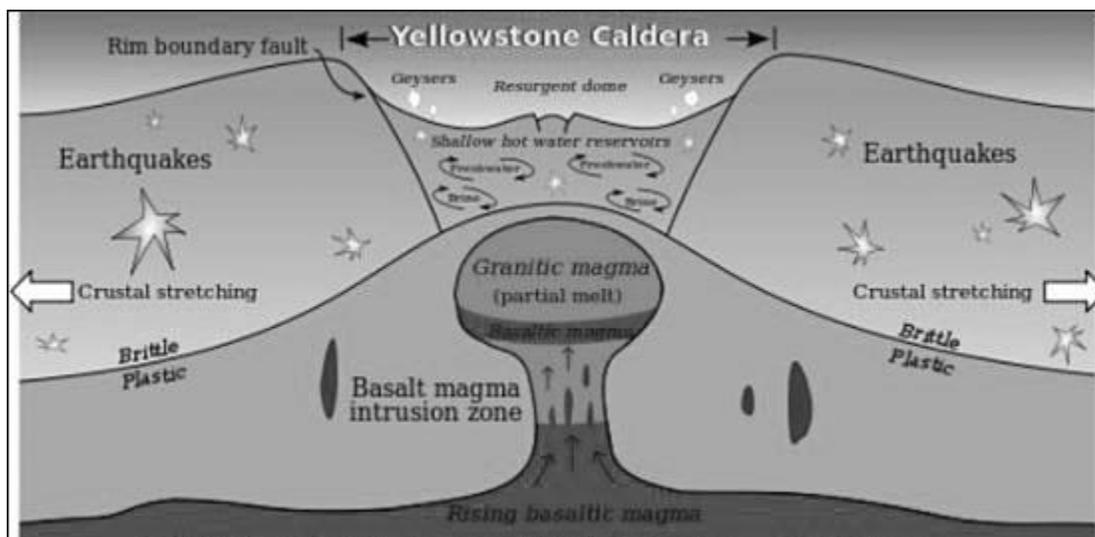


Figure 20. Magma intrusion, Yellowstone caldera.

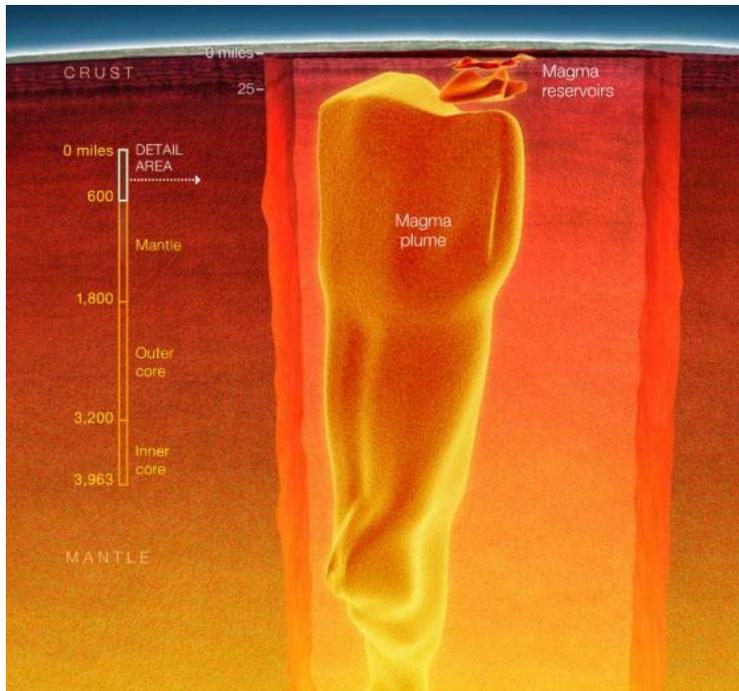


Figure 21. Magma reservoir, Yellowstone. Source: National Geographic.



Figure 22. Yellowstone caldera.



Figure 23. Extent of damage from a Yellowstone eruption.

A swarm of more than 800 earthquakes have been recorded at the Yellowstone Caldera, a long-dormant super-volcano located in Yellowstone National Park, in June 2017. Small earthquakes are desirable to the extent that they indicate cumulative pressure release.

The USA Geological Survey says the risk level remains in the “green,” unchanged from its normal levels. The biggest earthquake in this “swarm” - which registered a magnitude of 4.4 – took place on June 15, 2017; three days after the rumblings started. That quake was the biggest in the region since a magnitude 4.8 earthquake struck close to Norris Geyser Basin in March 2014. This magnitude 4.4 earthquake was so powerful that people felt it in Bozeman Montana, about eighty miles away. The swarm consists of one earthquake in the magnitude 4 range, five earthquakes in the magnitude 3 range, 68 earthquakes in the magnitude 2 range, 277 earthquakes in the magnitude 1 range, 508 earthquakes in the magnitude 0 range, and 19 earthquakes with magnitudes of less than zero. An earthquake with a magnitude less than zero is a very small event that can only be detected with the extremely sensitive instruments used in earthquake monitoring.

There is normally a rise in seismic activity before a volcano erupts. Scientists believe there’s a 10 percent chance that a “super-volcanic Category 7 eruption” could take place this century, as pointed out by theoretical physicist Michio Kaku. An eruption, Kaku said, is long overdue: The last one occurred 640,000 years ago.

A super-volcanic eruption at Yellowstone would impact the regional ecosystem, and the USA more broadly. Hundreds of cubic miles of ash, rock and lava would be blasted into the atmosphere, and this would likely plunge much of the northern hemisphere into several days of complete darkness. Virtually everything within 100 miles of Yellowstone would be immediately killed, but a much more cruel fate would befall those living in major cities outside of the immediate blast zone such as Salt Lake City, Utah and Denver, Colorado.

Hot volcanic ash, rock and dust would rain down on those cities literally for weeks. In the end, it would be extremely difficult for anyone living in those communities to survive. It has been estimated that 90 percent of all people living within 600 miles of Yellowstone would be killed.

Experts project that such an eruption would dump a layer of volcanic ash that is at least 10 feet deep up to 1,000 miles away, and approximately two-thirds of the USA would suddenly become uninhabitable. The volcanic ash would severely contaminate most of the water supplies, and growing food in the middle of the country would become next to impossible.

The rest of the planet, and this would especially be true for the northern hemisphere, would experience what is known as a “nuclear winter”. An extreme period of “global cooling” would take place, and temperatures around the world would fall by up to 20 degrees. Crops would fail all over the planet, and severe famine would sweep the globe.

HEAT STROKE RISK



Figure 24. Symptoms and effects of heat stroke. Source: Mayo Clinic.

The human body absorbs heat from the environment, and as the temperature starts to rise, the human body will naturally do a number of things to get rid of that excessive heat. At higher levels of body temperature, or prolonged exposure, the human body may lose that ability.

The most serious level of temperature dysregulation is called “heat stroke,” and it occurs when the body’s temperature reaches an excess of 104 °F. During heat stroke, body

functions grind to a halt, as the hypothalamus region of the brain shuts down the body's natural coolant system, perspiration. Without sweat, the body can no longer keep its temperature in check, which causes a devastating chain reaction that can be fatal without timely medical intervention.

From a neurological standpoint, heat stroke causes the brain to swell, leading to headaches and even seizures in more extreme cases. Victims also experience an altered level of consciousness, including confusion, delirium, hallucinations, agitation and even unconsciousness. The cardiovascular system is affected as well. Heat stroke causes blood pressure to drop and the heart to beat faster and more irregularly, heightening the risk for high-output cardiac failure. Small blood clots can also form in blood vessels, preventing healthy circulation and cutting off blood flow to other parts of the body.

As for the renal system, heat stroke decreases urine output and causes a condition known as acute tubular necrosis, in which the kidneys fail to receive enough oxygenated blood to support proper function. If untreated, heat stroke can eventually cause the kidneys to fail. This is the reason why people die during heat waves.

High humidity has an associated risk. When there is an increase in humidity, the human body's ability to lose heat to the environment through sweating is diminished. Age also plays a big role in the body's ability to regulate heat. Young children and the elderly are not only more susceptible to high temperatures due to their lower-functioning nervous systems, but they may also have more difficulty removing themselves from a hot situation. For the elderly, if the air conditioner is not working, their ability to go get it fixed could not be possible diminished.

Physical exertion is an important factor. Strenuous exercise heightens the risk of heat stroke, especially if an individual is not used to training in hot weather. People with conditions such as heart or lung disease, obesity or a history of prior heat stroke are more at risk than their healthier counterparts. Other diseases that affect circulation, such as diabetes, can also be problematic. Anyone who suffers from these ailments should be watched closely in hot weather, and if they begin to show signs of heat stroke, medical attention should be rendered immediately.

Certain drugs and medications can also be a contributing factor in a heat stroke situation. Alcohol, stimulants, vasoconstrictors, beta blockers, diuretics, anti-depressants and anti-psychotics detract the body's ability to cool itself. Individuals going out in the sun should wear loose-fitting, light-weight clothes, drink plenty of fluids, apply sunscreen regularly and listen to their body's warning signs. If nausea, headaches, fatigue or any other indicators of heat illness present themselves, it's time to get indoor.

Treatment of heat stroke involves lowering a victim's body temperature as quickly as possible. First would be to remove individuals from a hot situation, whether that be pulling them inside to a cooler place or getting them out of the sunlight into the shade. Then one tries to regulate better and increase any air convection going past them in a natural wind stream or artificially using a fan.

Heat stroke is a medical emergency. Timely intervention can be the only thing separating life and death in many cases.

POLES SHIFT RISK

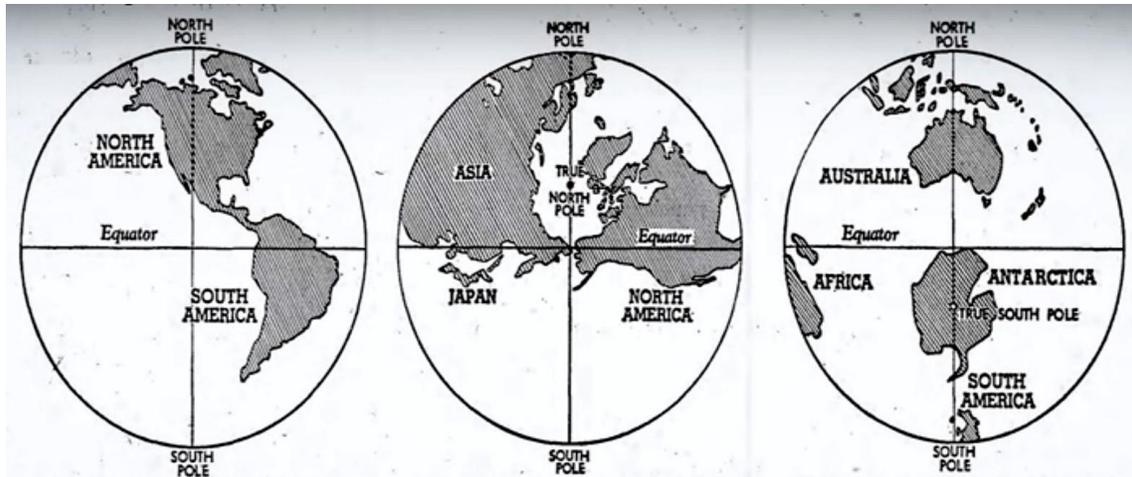


Figure 25. Western hemisphere at present, in a previous epoch of time, and a possible future.

The position of the land masses relative to the north and south poles have remained stable in the last 7,000 years. However in a previous epoch of time, prior to the last rollover, the equator ran along the rocky mountains of the America's continent. A rollover where the Antarctic continent would careen close to the equator would lead to a melting of its vast ice cap, raising the level of the oceans and leading to a cataclysmic flooding of the land masses.

EXTENSIVELY DRUG RESISTANT TUBERCULOSIS XDR RISK

The term "totally drug resistant" tuberculosis is not yet recognized by the World Health Organization (WHO). For now these cases are defined as extensively drug resistant tuberculosis (XDR-TB), according to WHO definitions. In 2006, the first reports of extensively drug-resistant tuberculosis (XDR-TB), an even more severe form of drug resistant TB than multidrug-resistant TB (MDR-TB), began to appear.

MDR-TB is defined as resistance to isoniazid and rifampicin, with or without resistance to other first-line drugs (FLD). XDR-TB is defined as resistance to at least isoniazid and rifampicin, and to any fluoroquinolone, and to any of the three second-line injectables (amikacin, capreomycin, and kanamycin). Within a year of the first reports of XDR-TB, isolated cases were reported in Europe that had resistance to all first-line anti-TB drugs (FLD) and second-line anti-TB drugs (SLD) that were tested. In 2009, a cohort of 15 patients in Iran was reported which were resistant to all anti-TB drugs tested.

The terms "extremely drug resistant" ("XXDR-TB") and "totally drug-resistant TB" ("TDR-TB") were given by the respective authors reporting on this group of patients. Recently, a further 4 patients from India with "totally drug resistant" tuberculosis ("TDR-TB") were described, with subsequent media reports of a further 8 cases.

Why are these terms not yet recognized by WHO?

Lastly, new drugs are under development, and their effectiveness against these "totally drug resistant" strains has not yet been reported.

For these reasons, the term “totally drug resistant” tuberculosis is not yet recognised by the WHO. For now these cases are defined as extensively drug resistant tuberculosis (XDR-TB), according to WHO definitions.

TB bacilli with different levels of resistance spread in the same way and with the same risk of infection as fully drug susceptible strains. The discovery of patients with MDR or XDR-TB emphasizes the importance of ensuring that all care for tuberculosis, whether in the public or private sector, must conform to international standards in order to prevent the emergence of drug resistance. Almost all countries must, in addition, ensure appropriate diagnosis and treatment of cases of MDR-TB.

Options are available, although they have not been studied in large cohorts. For such cases additional drugs will need to be procured from among the group of agents that are known to have some action against tuberculosis but are not routinely recommended for treatment of MDR-TB. These include clofazimine, linezolid, amoxicillin/clavulanate, thioacetazone, imipenem/cilastatin, clarithromycin and high-dose isoniazid. Efficacy is not assured, however, and both toxicity and cost for some of these compounds are high. Potential purchasers should be aware that international availability of some of these agents is limited at present.

NERVE AGENTS EXPOSURE RISK

Nerve agents work fast and their effects are almost instantaneous: drooling, blurry vision, smell of cut hay or grass, convulsions or seizures. Eventually, death occurs either through asphyxiation or cardiac arrest. Atropine intra-muscular (IM) injection is the only useful treatment.

Liquid nerve agents would affect an area of 100 - 200 meters in radius for weeks or months. Any person who touches an exposed person would also be affected. One needs a level 5 ppe (personal protective equipment) and full decon (decontamination) of the affected area.

The only partially useful antidote is a mark 1 kit- atropine, diazepam, prodoxalane chloride. These are not effective on VX, tabun, soman and novachuk multiple 7 nerve agents.

The first nerve agents were discovered by accident in the 1930s when researchers were trying to synthesize cheaper and better neo-nicotinoids alternatives to nicotine as an insecticide. German scientists made two organic compounds containing phosphorus that were very effective at killing insect pests. They discovered that, even in minuscule amounts, the substances caused distressing symptoms in humans exposed to them.

The two substances, too toxic to be used as commercial insecticides in agriculture, became known as tabun and sarin. The research was transferred to the Wehrmacht Nazi armed forces, which evaluated them as weapons and began manufacturing them. The sarin plant was not operational by the time the Third Reich collapsed, but fell into the hands of Soviet forces that overran Poland and Germany.

Pesticide research continued after the war and the molecule known as was first made in an Imperial Chemical Industries (ICI) laboratory in the UK in 1952. It again proved too toxic to be used in agriculture and it was passed to the UK's Porton Down Chemical Weapons Research Centre, and subsequently to the USA government, when the UK renounced chemical weapons. Its destructive power became clear on March 13, 1968 when

the substance escaped from the army's chemical weapons proving ground and killed over 3,000 sheep grazing 27 miles away in the Skull Valley area of Utah.

Other nerve agents have been developed, but much less is known about them, although they are thought to work in the same way. Unlike street drugs, nerve agents cannot be made in a kitchen or garden shed, on account of their toxicity, even in tiny amounts. Synthesis of nerve agents requires a specialist laboratory, with fume cupboards.

In the 1980s Iraqi forces are suspected to have used sarin during the Iran-Iraq war, notably against Kurdish citizens in Halabja in March 1988 causing an estimated 5,000 deaths.

On March 20, 1995, members of the Japanese Aum Shinrikyo cult used umbrellas with sharpened tips to puncture plastic bags and boxes containing sarin while travelling on the Tokyo subway system. The sarin used was impure causing 13 deaths and several thousand felt sick.

Until recently, the only known human fatality caused by VX occurred when two members of the Aum Shinrikyo cult used VX to assassinate a former member of their sect in Osaka in 1994.

Two women, an Indonesian and a Malaysian, were charged in Malaysia with killing Kim Jong-nam, the half-brother of Kim Jong-un, North Korea's leader, allegedly by smearing VX nerve gas agent in liquid form across his face and into his eyes, thinking it was a prank, in an airport in Kuala Lumpur, Malaysia. He perished within 20 minutes of his exposure.

The former Russian spy Sergei Skripal and his daughter were admitted into a hospital in Salisbury, UK, following suspected exposure to an unknown nerve agent. The pair were found unconscious on a park bench on March 5, 2018.

Nerve agents can be absorbed through inhalation or skin contact. When the Nazis were building their first nerve agent plant, workers wearing protective suits died in agony when nerve agent got through gaps in their suits.

Unlike traditional poisons, nerve agents do not need to be added to food and drink to be effective. They are quite volatile, colorless liquids, except VX, that is said to resemble engine oil. The concentration in the vapor phase at room temperature is lethal.

The symptoms of poisoning come on quickly, and include chest tightening, difficulty in breathing, and very likely asphyxiation. Associated symptoms include vomiting and massive incontinence and diarrhea. Victims of the Tokyo subway attack were reported to be bringing up blood. Kim Jong-nam died in less than 20 minutes.

The nerve agent chemicals work by disrupting the central nervous system. The body uses a molecule called acetylcholine to transmit messages between cells. When an acetylcholine molecule "arrives", it causes an electrical impulse to be sent. The body constantly has to remove those acetylcholine molecules from the receptors, otherwise there would be a dangerous build-up. It uses an enzyme called acetylcholinesterase (AChE) for the task. A nerve agent stops acetylcholinesterase from doing its job.

Exposure to foods such as mushrooms, mussels, clams and fugu fish inadequately prepared or contaminated with algae can generate similar symptoms, even though not necessarily fatal.

Antidotes do exist, one being atropine, but have to be administered quickly, otherwise the effect of the nerve agent cannot be reversed. Some antidotes can be

administered as prophylactics to troops at risk about to engage battle. In a civilian situation there is no expectation of encountering these chemicals.

To decontaminate streets and other hard surfaces, water is used to flush it out – making sure to use enough to properly dilute the chemical. This works well for the more volatile sarin, which tends to evaporate easily or slowly get broken down by moisture. Other substances, such as VX, are less volatile and reactive. In this case, bleach and alkali can be used to break the molecules down. In a situation where we do not know which has been used, a mix of water and bleach may be the best approach. Nerve agents are horrendously lethal and chemical warfare is an obscene use of chemicals.

CAVE ORGANISMS AND SPELUNKING RISKS

Not all caves are microbial death traps. It depends on where they're located and what lives inside. Most of the caves are some of the cleanest environments on Earth, and have lower cell numbers than ancient ice found in Antarctica.

However, tropical caves are hotspots for potentially deadly infections. They are home to a surprising abundance of wildlife, from birds and bats to rats, which can carry microbes, including rabies, Marburg virus and obscure fungal pathogens. Caves become lost worlds of venomous spiders, millipedes and scorpions. The ticks that feed on them carry "cave fever", a rare disease that is also sometimes caught in abandoned buildings. Some caves have Africanized bees, bats, and scorpions.

The walls of limestone caves constantly seep water from above. This is how they form in the first place, as water drips in through cracks, it dissolves the rock underneath to leave a gap. This constant saturation, combined with the limited air and oxygen supply, means the humidity of some caves is close to 100 percent. In caves inhabited by bats, the air is thick with pathogenic fungi, while at the bottom, a sludge of water, mud and animal guano provide a luxurious home for bacteria and parasites.

Histoplasmosis is caused by a fungus found in the droppings of birds and bats, mostly in humid areas. It can usually be treated with a course of antifungal medication, which has to be taken for several months, and possibly up to a year. It kills around one in 20 children and roughly 8 percent of adults who are infected. It is particularly problematic for those who are already weak or immune-compromised.

A microbe that often hides in caves is the corkscrew-shaped bacteria **Leptospira**. It is spread in bodily fluids like urine from rodents and is usually caught after contact with contaminated water, where it may sneak in to the body through cuts on the skin, or through the mouth, nose, eyes, or lungs. It causes Weil's disease, which starts as a mild, flu-like illness. In 5-15 percent of cases it develops into something more serious, with symptoms that include internal hemorrhaging and organ failure. Ultimately it can be fatal. This bacterium has a history of infecting cavers.

Melioidosis is an emerging infection found across the tropics, from Southeast Asia to Northern Australia. It is thought to affect around 165,000 people every year, of which roughly half die. The disease presents a number of problems. It is caused by a bacterium that lives in soil, and can be caught from everyday activities such as rice farming. Diagnosis is notoriously tricky, since the disease can manifest itself as a wide range of symptoms; from coughs to fevers, which are also hallmarks of infection by many other microbes. It is also naturally resistant to a wide range of antibiotics.

Wearing rubber boots can prevent bacteria from getting on the skin as a person walks through water that may contain guano. After a dive, a shower at a rinse station is needed [27].

4.9 NATURAL VERSUS TECHNOLOGICAL RISKS, DISCUSSION

Technology introduces risks to our modern society. However there are also risks introduced by natural phenomena. Natural risks are sometimes unavoidable, even though modern science is providing us with instruments, techniques and strategies to predict and anticipate them, hence mitigating or sometimes avoiding their consequences.

The introduction of technological risk adds to the natural risks that humans face, but our best insight suggests that these can be introduced only as an individual choice. Placing risks in perspective and as a matter of ethics and morals, larger groups of people should not be subjected to risks by smaller groups that are above the natural risks, involuntarily or unknown to them. As an example, as a result of global warming, island and atoll dwellers on some pacific islands find their land being submerged and are being evacuated. There are also indication that it is at the origin of a massive drought in the Sahel region of Africa and a drying of Lake Chad.

All human endeavors involve certain levels of risk that is sometimes wrongly perceived. For instance it is accepted that the construction and mining professions involve a higher level of risk than the office staff profession.

Risk quantification is governed by the need to distinguish between objective and perceived or subjective risk.

APPENDIX I

POPULAR DEFINITIONS OF “UNCERTAINTY”

According to Ibn Yami, a 13th-century Persian-Tajik poet:

“There are four types of men:

One who knows and knows that he knows. His horse of wisdom will reach the skies.

One who knows, but does not know that he knows. He is fast asleep, so you should wake him up.

One who does not know, but knows that he does not know. His limping mule will eventually get him home.

One who does not know and does not know that he does not know. He will be eternally lost in his hopeless oblivion”

According to Donald Rumsfeld, USA Defense Secretary, 2002:

“There are known knowns; there are things we know that we know.

There are known unknowns; that is to say there are things that, we now know we do not know.

But there are also unknown unknowns – there are things we do not know we do not know.”

According to Albert Einstein:

“As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality.”

“The most incomprehensible thing about the world is that it is at all comprehensible.”

According to economist John Maynard Keynes in the “The General Theory of Employment,” 1937:

“By ‘uncertain’ knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty; nor is the prospect of a Victory bond being drawn. Or, again, the expectation of life is only slightly uncertain. Even the weather is only moderately uncertain. The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention, or the position of private wealth owners in the social system in 1970. About these matters there is no scientific basis on which to form any calculable probability whatever.”

APPENDIX II

CAUSES OF DEATHS IN THE USA

Table I. Leading causes of death, 2010. Data: CDC.

Cause	Number of deaths
Heart disease	596,577
Cancer	576,691
Chronic lower respiratory diseases	142,943
Stroke, cerebro-vascular diseases	128,932
Accidents, unintentional injuries	126,438
Alzheimer’s diseases	84,974
Diabetes	73,831
Influenza and pneumonia	53,826
Nephritis, nephrotic syndrome, and nephrosis	45,591
Intentional self-harm, suicide	39,518

EXERCISES

1. An insurance company requires a 30 percent overhead on the premiums it collects from its customers. If the payment to a beneficiary is \$100,000 and it collects \$1,000 per year

in premiums, what is the probability of death in the year that the insurance company used to calculate the collected premium? Compare the result to the case of breakeven for the actuarial risk.

2. Estimate the individual risks for each human from the different natural events in units of [death / (capita. year)].

3. Estimate the distance travelled by a car at 70 miles / hour during the 4.6 seconds taken by a texting event.

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