THE BIG IDEA

GEORGE GRAY AND DAVID ROPEIK

What, me worry?

You have a better chance of getting killed by lightning than by anthrax

To most of us, risk is simply the likelihood that something will happen, a matter of probability. But to a risk analyst, a risk to your health is the probability that exposure to a hazard will result in a negative outcome of varying consequence.

Exposure matters because even the most hazardous substance isn't a risk unless we're exposed to it. Hazard matters because we need to know whether the substance in question does any harm, and how much.

The consequence — the severity of the outcome — matters because even if the probability of an outcome is extraordinarily low, it's still a serious risk if the consequence is high. (There are also high-probability, low-consequence risks. Seventy-six million Americans will get food poisoning this year, but most will only suffer an upset stomach.)

The science of risk analysis is an inherently risky business. It relies on scientific disciplines like toxicology and epidemiology, powerful tools that can provide only imprecise results. Of course, how we repsond to risk — with a shiver or a shrug — is based as much on emotional factors as on statistics.

Terrorism threats present a special challenge. Risk analysis considers all the variables, quantifies each, and multiplies them together to come up with a final risk number. But when the variables are as uncertain as they are with terrorism, risk analysts can't come up with a reliable number. Any risk calculations shown on this page reflect only our experience so far and will shift to reflect shifting realities.

Sometimes, when there are victims to count, good old simple math is enough. Add up all the deaths from a particular cause, divide them into the total population, and get the risk of an average American dying from that cause. Of course, there is no such thing as that imaginary average American. Your risk is almost certainly higher or lower than that number.

When there aren't actual victims to count and we want to know what our risks might be, we use toxicology. Scientists expose cells in a dish or animals in a lab to a potentially hazardous substance, see what happens, and extrapolate those results to humans. That's imprecision number one, because no matter what you might think of some people, humans are not identical to rats.

Imprecision number two comes from the doses the animals are given. Each day for their whole lives test animals get more of the suspicious substance than you or I would get in our entire lifetimes. These megadoses allow researchers to detect the most subtle impacts without having to use millions of test animals.

But it is a basic tenet of toxicology that the dose makes the poison. Too much of almost anything can kill you. The size of the dose, rather than the hazard itself, might be causing the outcome. That's imprecision number two.

Imprecision three arises because toxicology is done in a controlled lab, testing one agent at a time. That's very different from the soup of hazards to which we are exposed in the real world.

Since we can't do toxicological tests on humans, risk analysts also use epidemiology, the science of observing health outcomes among populations of people, measuring the hazards to which they were exposed, and trying to figure out which of those hazards most likely caused the outcome. But epidemiologists can never be sure they've included all the possible hazards the test population might have been exposed to. And they can never be sure precisely what the actual levels of exposure were. Epidemiology is shrewd detective work, but it almost never finds the smoking gun of firm proof. Like toxicology, it's imprecise.

You may be reassured to know that in the face of these knowledge gaps, risk analysts make conservative assumptions and assume the worst. That's protective, but it's also imprecise. So read risk analyses with a bit of caution. The numbers are instructive, but it's risky to put your faith in them as absolutely accurate.

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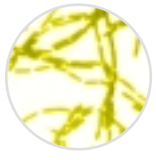
ONE-YEAR PROBABILITIES FOR ALL AMERICANS

Actual probabilities vary with individual circumstances

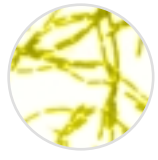
LESS LIKELY | MORE LIKELY

Killed by shark
1 in **350 million**
Florida Natural History Museum



Die from anthrax
1 in **70 million**
Boston Globe

Die from a spider, lizard, or snake bite
1 in **54 million**
NSC



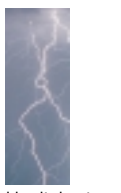
Contract anthrax
1 in **20 million**
Boston Globe

Die from a dog bite
1 in **18 million**
NSC

Die in an earthquake
1 in **11.2 million**
NSC

Die from a bee sting
1 in **6 million**
NSC

Win Megabucks (1 play)
1 in **5.2 million**
Mass. Lottery Comm.



Killed by lightning
1 in **4.2 million**
NSC

Die during earthmoving or excavation
1 in **3 million**
NSC

Die from a fall into a hole
1 in **2.8 million**
NSC

Die after clothing catches fire
1 in **1.6 million**
NSC

Die in a flood caused by a storm
1 in **1.3 million**
NSC

Die of hunger, thirst, exposure, or neglect
1 in **1 million**
NSC

DYING AT WORK

Odds of dying in selected occupations

Calculated from 2000 Bureau of Labor Statistics data on deaths and numbers employed

School teachers
1 in **200,000**

Accountants and auditors
1 in **145,000**

Registered nurses
1 in **125,000**

Lawyers
1 in **96,100**

College teachers
1 in **96,000**

Bartenders
1 in **91,000**

Social workers
1 in **52,000**

Executives and managers
1 in **50,000**

Retail cashiers
1 in **43,000**

Postal workers
1 in **34,000**

Construction workers
1 in **10,000**

Electricians
1 in **9,700**

Police
1 in **8,200**

Fire fighters
1 in **6,500**

Taxi drivers
1 in **4,000**

Farmers
1 in **3,800**

Roofers
1 in **3,300**

Military personnel
1 in **3,200**

Garbage collectors
1 in **2,350**

Pilots and navigators
1 in **1,000**
(includes crop dusters, hunting and fishing guides)

Forestry workers and loggers
1 in **965**

Fishermen
1 in **925**

Sailors and deckhands
1 in **825**

DYING IN TRANSIT

Passenger deaths per 100 million passenger miles of travel

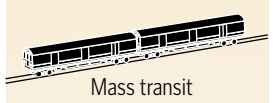
Motorcycle
20.158

Any aircraft
5.436

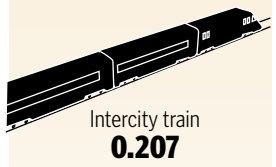
Truck
5.056

All highway traffic
0.978

Passenger cars
0.901



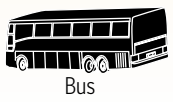
Mass transit
0.649



Intercity train
0.207

Commercial airliner
0.022

NOTE: Adding 268 deaths on Sept. 11 to the 9-year average used for these comparisons increases airline deaths to **0.079** deaths per 100 million passenger-miles.



Bus
0.00018

Drown in bathtub
1 in **800,000**
NSC

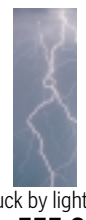
Die after falling off a ladder or scaffolding
1 in **768,000**
NSC

Die from a fall from a building
1 in **491,000**
NSC

Die from excessive heat
1 in **721,000**
NSC

Attacked by shark
1 in **700,000**
NSC

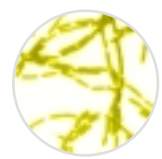
Die from excessive cold
1 in **643,000**
NSC



Struck by lightning
1 in **555,000**
NOAA

Electrocuted
1 in **250,000**
NSC

Die from a fall on stairs or steps
1 in **195,000**
NSC

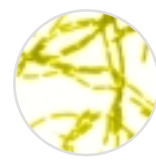


Postal workers dying from anthrax
1 in **170,000**
Boston Globe

Win Megabucks
(play once a week)
1 in **100,000**
Mass. Lottery Comm.

Die from medical or surgical complications
1 in **84,000**
NSC

Drown
1 in **68,000**
NSC



Postal workers contracting anthrax
1 in **38,000**
Boston Globe

Die in a motor vehicle accident
1 in **6,700**
NCHS

Die in an accident other than motor vehicle
1 in **5,400**
NCHS

ODDS OF GETTING INTO COLLEGE

Accepted by Harvard
1 in **1,350**
(of all US high school graduates)

1 in **9**
(of all applicants)
Harvard University

Accepted by UMass-Amherst
1 in **208**
(of all US high school graduates)

1 in **1.4**
(of all applicants)
UMass

10 LEADING CAUSES OF DEATH

Calculated from National Center For Health Statistics data

Liver disease
1 in **11,040**

Kidney disease
1 in **10,625**

Suicide
1 in **9,100**

Any accident
1 in **2,850**

Flu/pneumonia
1 in **3,025**

Diabetes
1 in **4,300**

Emphysema/ chronic lung disease
1 in **2,470**

Stroke
1 in **1,750**

Heart disease
1 in **384**

Cancer
1 in **514**

Die of any cause this year
1 in **117**

Die
1 in **1**

CRIME VICTIM ODDS

Calculated from 2000 FBI Uniform Crime report

Become a victim of a crime
1 in **24**

Victim of property crime
1 in **28**

BY CRIME

Arson
1 in **2,700**

Auto theft
1 in **242**

Burglary
1 in **137**

Larceny
1 in **40**

Victim of violent crime
1 in **200**

BY CRIME

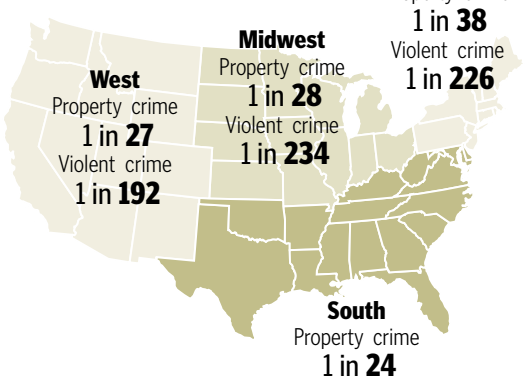
Murder
1 in **18,000**

Rape
1 in **3,125**

Robbery
1 in **690**

Aggravated assault
1 in **310**

Regional odds



NOTES ON CALCULATING THE ODDS

■ Probabilities from the National Safety Council and from the National Center for Health Statistics represent the US population in 1998 divided by the number of deaths attributed to each cause for that year, the most recent for which statistics are available.

■ Deaths by occupation are calculated by dividing the number of people working in an occupation in 2000 by the number who died of a job-related injury that year.

■ Lottery statistics are provided by the Massachusetts Lottery Commission.

■ Anthrax-related odds are calculated by dividing the US population or the number of postal workers by numbers of deaths/infections in the past year.

■ Transportation deaths and passenger-miles are averages based on data from the Bureau of Transportation Statistics for 1990 through 1998. The bureau uses 100 million passenger-miles in its tables.

GLOBE STAFF GRAPHIC/KATHLEEN HENNRIKUS, DAVID BUTLER