# Lecture 15-1

Statistics for Civil & Environmental Engineers

### Some Definitions (www.wikipedia.com)

- Disaster: a disaster (from Middle French désastre, from Old Italian disastro, from the Greek pejorative prefix dis- bad + aster star) is the impact of a natural or man-made harzard that negatively affects society or environment.
- Hazard: a situation which poses a level of threat to life, health, property or environment.
- **Risk:** a concept that denotes a potential negative impact to an asset or some characteristic of value that may arise from some present process or future event. In everyday usage, *risk* is often used synonymously with the probability of a known loss.

# Wit@Wisdom



"You have only a couple of weeks to live."

# Some residents returning home after chlorine leak

Thursday, January 13, 2005 Posted: 8:28 AM EST (1328 GMT)

COLUMBIA, South Carolina (AP) -- A week after chlorine gas leaked from a train wreck and killed nine people in this mill town, officials will let about half the 5.400 residents displaced by the accident return home Thursday morning.

Air quality tests show chlorine has returned to normal levels on the edges of the evacuation area, which extended a mile from the crash site, according to the Aiken County Sheriff's Office.

Conditions remain too dangerous to allow people back into homes and businesses closer to the crash site. near the Georgia line and about 60 miles southwest of Columbia.



Chemicals leak from train cars after Thursday's crash.

# WORLD

Tsunami deaths soar past 212,000

Wednesday, January 19, 2005 Posted: 10:58 PM EST (0358 GMT)

AFTER THE TSUNAMI

JAKARTA. Indonesia --Indonesia is reporting a staggering new death toll from the tsunami disaster as recovery efforts slowly resolve the fates of tens of thousands of missing people.

The Indonesian Health Ministry says the December 26 earthquake and tsunamis killed 166,320 people in Indonesia, double the previous official figure.

The latest figures out of Indonesia now put the regional death toll for the Indian Ocean disaster at 212,611.

The new death numbers reflected the latest reports from the provinces of Aceh and North Sumatra, both in the path of the killer tsunamis spawned by a magnitude 9 earthquake the day after Christmas, Dodi Indrasanto, a director at the Health Ministry, told Reuters.



Volunteers from an Islamic group collect bodies from the debris of homes in Banda Aceh.



http://www.globalsecurity.org/military/world/thailand/khaolak.htm



# **The Ithaca** JURNAL

Monday January 17, 1994 **Major** quake rocks L.A.

At least 3 dead in pre-dawn temblor in San Fernando Valley; freeways damaged; broken gas mains touch off numerous fires

LOS ANGELES (AP) — A severe carthquake centered in the San Fernando Valley johted South-ern California before dawn today, buckling free-tern Aparking fires and blacking out yeat swaths of way angeles. There were reports of at least three

raths. Buildings shook from San Diego to Las Vegas, ss Angeles Mayor Richard Riordan declared a te of emergency. The quake struck at 4.31 a.m., and measured a climinary 6.60 nt he Richter scale, suid Kate Hur-n, a seismologist at the California Institute of chnology in Paedena.

The construction of the california institute of the construction of the california institute of the construction of the california in the california recovery in Lies Angeles and collapsed an intersec-tion of the california of the california of the california california interstates of the california of the california california of the californi



ng to the Califo The San Fernando Valley, s north of dow The quake was felt for hundreds of miles, at

See EARTHQUAKE 64

**CITY & TOWNS** 

# Kid accidents decline, but still biggest killer

#### By GLEN JOHNSON The Associated Press

WASHINGTON--The number of children dving in car wrecks, bike crashes and other accidents has fallen 26 percent in the past decade, with the increased use of seat belts and bike helmets getting a lot of the credit.

At the same time, injury rates for sports-related activities such as basketball, football and in-line skating are up, the National Safe Kids Campaign reported as it marked its 10th anniversary.

"We know that prevention works," said Dr. C. Everett Koop, the former surgeon general and current chairman of the cam-paign. "We can make our world a safer place for future generations to grow up unharmed by the dangers that surround us."

In 1987, the overall death rate from accidental injuries was 15.56 per 100,000 children 14 and under. By 1995, that figure had fallen to 11.45 per 100,000, a

Ithaca Journal 5 May, 1998

decrease of 26.4 percent, the cam-paign reported. It based its study on data from the National Center e Nationa. Statistics, the Safety Health Statistic Product for Consumer Council, the Transportation Department and other government and private groups.

Despite the overall decline, accidents remain the No. 1 threat to children, killing at four times the rate of either cancer, birth defects or homicide. In 1995, accidents claimed 6,600 children ages 14 and under. Motor vehicle deaths account for the greatest accidental loss of life, killing about 1,800 children a year and injuring 290.000

In 1987, the death rate for motor vehicle occupants 14 and under was 3.37 per 100,000. By 1995, it had fallen to 3.06 per 100,000, a drop of 9.06 percent. Deaths from bicycle accidents showed the greatest decline in the study, falling from 0.75 per 100,000 to 0.44 per 100,000 -a drop of 41 percent.

# Deaths up since Florida helmet law repealed

Tuesday, August 9, 2005; Posted: 6:35 a.m. EDT (10:35 GMT) 4



Bikers, most without helmets, cruise through Daytona Beach, FL in 2001 photo.

#### WASHINGTON (AP) -- Motorcycle fatalities have risen sharply in Florida since the state repealed its mandatory helmet law.

States that repeal such laws run the risk of increased deaths and mounting health care costs for injured bikers, according to two studies released Monday, one by the government, the other by the insurance industry.

3A The Ithaca Journal Friday, December 1, 1995

# Higher speeds may cost drivers

higher speed limit.

there's ... a tremendous

amount of collision

But New Yorkers

to the 55-mph state

won't see any changes Luster

man Martin A. Luster (D-125th Dist.) said

Thursday that legislators won't look to

losses."

# More accidents would increase premiums But Wilcox predicted that rates have a possibility of decreasing as a result of a

#### By LEA SETEGN Journal Staff

The end of the national 55-mph speed limit is expected to have a positive economc effect but could eventually hit drivers in their pockets. While it's not likely any time soon,

there's a chance drivers would face higher car-insurance premiums if speed limits increase and cause more car accidents.

The bill President Clinton signed Tuesday doing away with Washington-mandated limits allows states to set their own restrictions on highway speeds - or none at all. Some states plan to raise their limits 20 miles per hour, and daytime drivers in Montana will be able to drive whatever

ore accidents. And more accidents mean higher insur-

ance premiums "Obviously, just raising the limit has no effect whatsoever," said Floyd Wilcox, a certified insurance counselor and general manager at L.A. Lama Insurance, 501 S. Meadow St. "If there are more accidents due to the higher speed - guaranteed, it's

going to have an adverse effect on insurance Insurance rates are calculated using a number of factors, including the rate of accidents. The more accidents there are across the board, the higher the premiums.

And according to Jay True, president of True Insurance, 124 Seneca Way, higher speed limits usually do lead to more accispeed mey decide is reasonable. "Statistics show that the faster people go, Although drivers might welcome the "Statistics show that the faster people go, added quickness, many safety groups ty of accidents increases," True said, believe higher speeds will inevitably lead to "Insurance companies, as a rule, are not in favor ... of allowing speed limits to be increased.

But Wilcox predicted that rates have a raise the speed limit again, because a increase to 65 mph on some state roads was approved last session.

"For many people, the rates may go down," he said. "If the limit is that high, We did that for a trial period, to see what effect, if any, that change would have people who get caught speeding now might on driver safety," Luster said of the increase. "We're likely to await the results of that" before changing any more limits,

> When Gov. George Pataki and the Leg islature agreed to raise the speed limit on certain state roads - including Interstate 81 and parts of the Thruway - it was done as an exception to the existing law that se the state speed limit at 55 mph, said Michael Fleischer, director of public affair for the state Department of Transporta

DOT supported the move to 65 mph for the selected roads, but Fleischer said he could not comment on whether DOT would support raising the overall state speed limit

"That is something we'd look at if the governor and the Legislature wanted us to," he said.

not be" with the higher limit. Still, any effect on premiums will be a while in coming. he said "It may not have any real impact, and it will not be immediate, said Suzanne Aigen, a local Prudential agent on The Commons, of the lifting of the federal cap. "There won't be a big impact unless

speed limit in the near future. Assembly-

# **The Ithaca**

Tuesdav January 16, 1996

# **Infectious diseases now** third-leading killer in United States

#### By ELIZABETH NEUS

Gannett News Service WASHINGTOON — Death from infectious diseases has risen to the point that such illnesses now are the third leading killer in the United States, after heart disease and cancer, researchers reported today. under 5

The overall death rate rose 58 per-cent between 1980 and 1992, and sky-rocketed by 533 percent for people between 25 and 44. The death rate among the elderly also rose, by 39 per-cent, but it dropped for children

 are rising.
 "In 1996, we view infectious diseases with a humbler eye," the JAMA editors wrote in an editorial. "The victories of a quarter-century ago ring the studies published in

mities should do more to Communities should do more to smote use of a vaccine against pneu-scoccal pneumonia, a disease that nicillin now does not always cure, and nich can kill the elderly, say earchers from Ohio State University.

"The thesis that infectious discases would continue to decrease in the United States and other developed countries and be replaced in time by noninfectious causes of death ... requires reconsideration," the researchers wrote. Decline in HIV in New York, 5A AIDS — which primarily strikes those between 25 and 44 — is one rea-son for the local Constructions of the local Construction of the Concol But it is not the only one. Once AIDS-related deaths were removed from the statistics, the death removed from the death removed from the death removed from the death removed from the statistics, the death removed from the death remo

The researchers do not offer expla The researchers do not offer expla-nations, outside of the appearance of AIDS, and say that further study is needed to find out why deaths from the top two infectious killers — respi-ratory illness and septicemia, a life-threatening form of blood poisoning

Climate change and global warm-ing can affect human health — for example, dino areas once too cold for them and spread malaria, dengue fever and encephalitis, according to a scien-tist from the Johns Hopkins School of Public Health. Medicine report on emerging infections, in an accompanying editorial in JAMA-More monitoring of potential dis-ease outbreaks is needed, as well as more research into causes of disease, vaccines, antibiotics and other treat-ments, he wrote.

ments, he wrote. "Private entrepreneurs are unlike-ly to invest in purely anticipatory development. So there is an unavoid-able responsibility for the public sec-tor — hard news at a time when disin-vestment is the political name of the game in Washington." Public Health. "Emergence is in fact regression, a return to the standard that prevailed universally in the previous century," wrote Dr. Joshua Lederberg, a Nobel Prize winning researcher and co-author of the influential 1992 Institute of

#### NYTimes.com > Business

#### F.D.A. Failing in Drug Safety, Official Asserts



Dr. David Graham (back to camera), a drug reviewer, told the Senate Finance Committee the F.D.A. could not assure drug safety. The chairman, Charles Grassley of Iowa, left, conferred with Orrin Hatch of Utah.

By GARDINER HARRIS

Published: November 19, 2004

ASHINGTON, Nov. 18 - Federal drug regulators are virtually incapable of protecting America" from unsafe drugs, a federal drug safety reviewer told a Congressional panel on Thursday, and he named five drugs now on the market whose safety needs "to be seriously looked at."

#### ARTICLE TOOLS

E-Mail This Article B Printer-Friendly Format B Most E-Mailed Articles C Reprints & Permissions

Cineda Davia Carriet



#### MEDICINE

# **When Drugs Do Harm**

A new study says that some medicines, even if properly prescribed, may kill as many as 100,000 Americans a year

#### BY CLAUDIA KALB

T WAS TO HAVE BEEN JERRY and Mary Sagen's first New Year's Eve together as a married couple. But on that morning in 1996, says Jerry Sagen, "I awoke to hear her dy-

#### **Too-Strong Medicine**

If the University of Toronto study is right. bad reactions to prescription drugs were the U.S.'s fourth leading killer in 1994.

Construction of the Charles of the Society of the	1994 DEATH
1 Heart disease	734,09
2 Cancer	536,86
3 Stroke	154,35
4 Adverse drug reactions	106,00
5 Chronic obstructive lung disease	101,87
6 Accidents	90,14
7 Pneumonia/influenza	82,09
8 Diabetes	55,89
9 HIV/AIDS	41,93
10 Suicide	\$2,41
SOURCESED, LAZABOU PT AL., NORS	UNW 100



#### FIELINES

# The threat of environmental estrogens Are synthetic hormones changing our future?

Since 1940, sperm counts in men worldwide have fallen about 50 percent: the incidence of testicular cancer has tripled in some countries; and the incidence of prostate cancer has doubled.

During this same time period, the incidence of breast cancer has risen in Western Europe and the United States. It increased 30 percent between 1979 and 1991, in part due to increased use of mammography as a screening tool; but most likely, environmental estrogens accounted for a large part.

Endometriosis - a disease in which tissue from the uterus grows in inappropriate places outside the uterus is increasing, and more than 5 million women in the United States are affected. Endometriosis causes severe menstrual pain, internal bleeding, and often, infertility.

#### **Endocrine-Disrupting Chemicals** INSECTICIDES NEMATOCIDES HERBICIDES B-HCH 2.4-D Aldicarb Carbaryl 2.4.5-T DBCP Alachlor Chlordane INDUSTRIAL Dieldrin Amitrole CHEMICALS Synthetlo pyrethroids Atrazine Cadmium Methoxychlor Metribuzin Mercurv Endosulfan Nitrofen Lead Oxychlordane Trifluralin Dioxin Parathion FUNGICIDES PBBs Toxaphene Benornyl Mirex PCBs Maneb Dicofol Styrenes Mancozeb Methomyl Phthalates Ziram DDT & metabolites Pentachlorophe-Zineb Transnonachlor nol (PCP) Tribuvtltin Heptachlor & H-Penta-to nonvi-Metiram-complex epoxide phenols Lindane (gamma-Hexachloroben-HCH) zene

That do these changes mean

Table 8. Some federal laws under which chemicals are regulated in the United States

Law	Regulatory agency	Regulated products	Regulatory model*
Food, Drug and Cosmetics Act	FDA	Foods, drugs, and cosmetics, medical devices, veterinary drugs	Risk (food, cosmetics) Balancing (drugs, medical devices)
Federal Insecticide, Fungicide,	EPA	Pesticides	Balancing
Federal Hazardous Substances Act	CPSC**	Household products	Risk
Occupational Safety and Health Act	OSHA	Workplace chemicals	Technical feasibility
Clean Air Act	EPA	Air pollutants	Risk (stationary sources). Technical feasibility (moving vehicles)
Clean Water Act	FPA	Water pollutants	Technical feasibility
Safe Drinking Water Act	EPA	Drinking water contaminants	Technical feasibility
Superfund Amendments and	EPA	Contaminants at waste	Risk/technical feasibility
Toxic Substances Control Act	EPA	Industrial chemicals not covered elsewhere	Balancing

\*'Risk' means the agency considers only risk information when reaching decisions. 'Balancing' means that both risks and benefits are considered. 'Technical feasibility' means that the law requires the agency not only to consider risks, but also the availability of technology to control risk. Some laws invoke more than one model.

\*\* CPSC: Consumer Product Safety Commission.

Note: at the time of writing the Clean Air Act was reauthorized. The 1990 version is substantially different from the earlier law listed here.

# Study: Tobacco No. 1 cause of death in U.S.

Government report finds half of all deaths in 1990 were preventable

LOS ANGELES TIMES

In a first-of-its-kind examina-tion of death in the United States government researchers report today that while heart disease and cancer may be listed as the nation's leading killers, the biggest underlying cause of death is tobacco use.

The authors came to the startling conclusion that nearly half of the 2.148 million deaths in 1990 could have been prevented through behavioral changes, among them stopping smoking, eating healthier food, exercising more, shunning alcohol and practicing safe sex.

But the research, published in today's Journal of the American Medical Association, singled out tobacco as the No. I culprit in causing death. It found that smoking contributed to the deaths of 400,000 people in 1990 - more than the deaths caused by drug use, guns, irresponsible sexual behavior and automobile accidents combined

"People may not realize the evtent of which deaths among Americans are preventable," said Dr. J. Michael McGiumis, who beads the Office of Disease Prevention at the U.S. Department of Health and Human Services and is the study's lead author

The JAMA article, which is the first study to rank the "root causes" of death, comes at a time when the Clinton administration is pushing health care reform as a way to cut medical costs. The study suggests, however, that simply giving all people access to care will not be enough to reduce the nation's medical bill. True savings will come only when people stop their unhealthful habits

"When you come up with half the total number of deaths in this country are preventable, that people can do something about, the implications are enormous

To the individual, the message is, You can do a great deal to control your own health destiny."" **Dr. J. Michael McGinnis** 110 0 of Health and Human Sa

> from an economic point of view," said Dorothy Rice, a medical economist at the University of California, San Francisco, still have a host of public health problems that simply will not be solved by comprehensive universal health care.

> > The government estimates that the nation will spend \$900 billion on health care this year - an average of about \$14,000 per year for a family of four

"There are two messages here, one is to the individual and one is to society," said McGinnis, "To the individual, the message is, You can do a great deal to control your own health destiny.' To society, the message is, 'If we want to get serious about controlling premature and unnecessary and costly death and illness, we meed to ... invest heavily in health promotion and disease prevention.

## Which are most risky activities in our society?

Commercial aviation Contraceptives **General** aviation Home appliances Motor vehicles **Nuclear Power** Pesticides Smoking

"Consider risk of dying (across all US Society as a whole) as a consequence of this activity or technology." "According to the present risk of death from each." "thinking of all the possible ways someone might die from each."

Example from: Slovic, et al., Rating the Risks, in Readings in Risk

LEAGUE OF WOMEN VOTERS	ACTIVITY OR TECHNOLOGY Nuclear power Motor vehicles	EXPERTS 20
× 1 2 3	Nuclear power Motor vehicles	20
2 3	Motor vehicles	and the second
3	a first of the second second of the second	1
	Handguns	4
4	Smoking	2
5	Motorceles	6
6	Alcoholic beverages	3
7	General (private) aviation	12
8	Police work	17
9	Pesticides	8
10	Surgery	5
11	Fire fighting	18
12	Large construction	13
	Hunting	23
s 14	Spray cans	26
15	Mountain climbing	29
16	Bicycles	15
17	Commercial aviation	16
18	Electric power (non- nuclear)	9
19	Swimming	10
20	Contraceptives	11
21	Skling	30
22	X-rays	7
23	High school and college football	27
24	Railroads	19
25	Food preservatives	14
26	Food coloring	21
27	Power mowers	28
28	Prescription antibiotics	24
29	Home appliances	22

# **Ranking Comparison**

Activity	Experts	Lowv
Motor Vehicles	1	2
Smoking	2	3
Pesticides	3	5
Contraceptives	4	7
General Aviation	5	4
Commercial Aviation	6	6
Nuclear Power	7	1
Home Appliances	8	8

# **Ranking Comparison with Death Statistics**

Activity	Experts	Lowv	Deaths/year
Motor Vehicles	1	2	150,000
Smoking	2	3	50,000
Pesticides	3	5	1,300
Contraceptives	4	7	200
General Aviation	5	4	150
Commercial Aviation	6	6	150
Nuclear Power	7	1	130
Home Appliances	8	8	100



VATURAL DISASTERS

**Our biggest fears?** Percentage saying they are "afraid" or "very afraid" of the following: Being in a car crash Having cancer Inadequate Social Security Not enough money for retirement Food poisoning from meat **Getting Alzheimer's** Pesticides on food Being a victim of individual violence Inability to pay current debts Exposure to foreign viruses **Getting AIDS** Natural disasters Unsafe or sick building Losing job Being in a plane crash Suffering a work-related injury Stock market crash Being a victim of mass violence Being audited by the IRS **Electromagnetic fields** Being accused of sexual harassment 1 Asking for a raise 1 Being sexually harassed

		54%
		53%
		50%
		49%
1999 - See	36%	
3	35% 34% 33% 32% 0%	Health and food fears generally hit women more than men.
28	vo ra	rvone's worry
23% 24% 23% 22% 21% 20% 18%	<ul> <li>list - male</li> <li>North</li> <li>Baby I</li> <li>more a</li> <li>those y</li> <li>In ev</li> <li>blacks a</li> <li>than wh</li> </ul>	<ul> <li>rich and poor, and female, and South.</li> <li>boomers worry bout money than younger or older.</li> <li>ery category, are more fearful ites.</li> </ul>
16% 5% 4%	This scient adults was by Opinion Internation plus or mir points. Job the respon	fic poil of 1.009 conducted in June Research Corp. al. Margin of error: us 3 percentage -related items reflect ses of 665 adults butts/de the home

## Some More Definitions (www.wikipedia.com)

- Risk Analysis = Risk Assessment + Risk Management + Risk Communication
- **Risk Assessment:** involves identifying sources of potential harm, assessing the likelihood that harm will occur and the consequences if harm does occur.
- **Risk Management:** evaluates which risks identified in the risk assessment process require management and selects and implements the plans or actions that are required to ensure that those risks are controlled.
- **Risk Communication:** involves an interactive dialogue between stakeholders and risk assessors and risk managers which actively informs the other processes.

## The Probability of Risk

Jack W. Hoffuhr JAWWA, 91(10),6, 1999

Risk assessment is the tool we have to bring rational thinking to emotionally charged issues

Risk assessment is an improving science based upon approximations and expert judgement

Decisions require tradeoffs: consider disinfection by products.

There is no such thing as "zero risk."

#### Statistics for Civil & Environmental Engine



Committee on Risk Assessment of Hazardous Air Pollutants

Board on Environmental Studies and Toxicology

Commission on Life Sciences National Research Council

NATIONAL ACADEMY PRESS, Washington, D.C. 1994

When EPA reports estimates of risk to decision-makers and the public, it should present not only point estimates of risk, but also the sources and magnitudes of uncertainty associated with these estimates.

Risk assessment is a set of tools, not an end it itself. The limited resources available should be spent to generate information that helps risk managers to choose the best possible course of action among the available options.