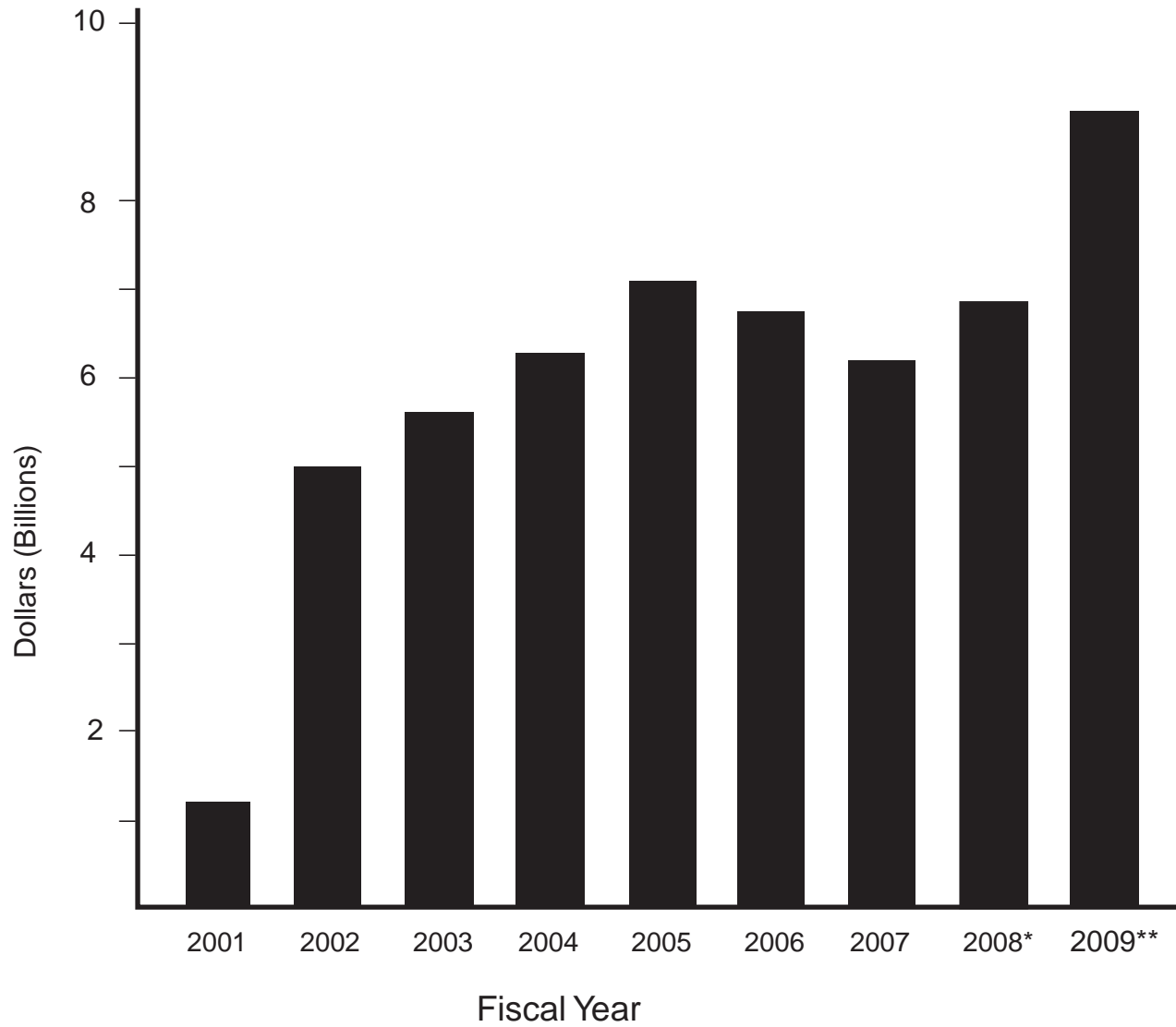


Bracing For Armageddon?

The Science and Politics of Bioterrorism in America
Oxford University Press, 2008

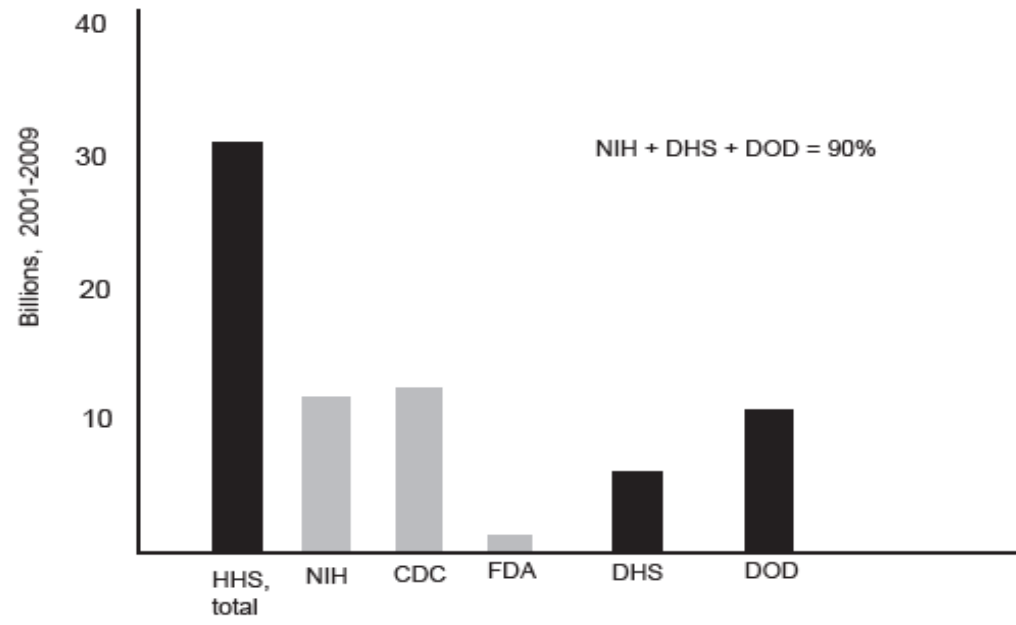
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Biodefense Spending by Fiscal Year. *estimated **requested.

Bioterrorism Spending in Context

Agency or Function	Billions Spent
Social Security Administration	7.9
Environmental Protection Agency	7.3
Bioterrorism	6.4
Commerce Department	6.1
National Science Foundation	6.0
Judicial Branch	5.9
Legislative Branch	4.3
Iraq War	120



Terrorism Defined

Terrorism is the premeditated use, or threatened use, of force or violence against governments or societies by sub- or transnational groups to achieve political, religious or ideological objectives.

The goals of terrorism are panic and its attendant social and economic disruption, media attention to a political or ideological cause, and recruiting more individuals to a cause. It may or may not be killing large numbers of people.

Bioterrorism is the use of biological pathogens or their derivatives to carry out a terrorist act. Biocrime is the use of bioweapons for personal gain or enrichment, with no political, religious or ideological overtones. Once immediate gain is achieved, activity ceases.

CDC Classification of Potential Bioterror Agents

Category	Agent	Type	Disease
A	<i>B. anthracis</i>	bacterium	Anthrax
	<i>V. major</i>	virus	Smallpox
	<i>Y. pestis</i>	bacterium	Plague
	<i>F. tularensis</i>	bacterium	Tularemia
	<i>C. botulinum</i> (neurotoxin)	protein	Botulism
	Ebola, Marburg ¹	viruses	Hemorrhagic fever
B	<i>Brucella sp.</i>	bacterium	Brucellosis
	<i>E. coli</i> O157:H7	bacterium	Food poisoning
	<i>B. mallei</i>	bacterium	Glanders
	<i>B. pseudomallei</i>	bacterium	Melioidosis
	<i>C. perfringens</i> ϵ -toxin	protein	
	<i>C. psittaci</i>	bacterium	Psittacosis
	<i>C. burnetii</i>	bacterium	Q fever
	<i>R. communis</i> toxin	protein	Ricin poisoning
	<i>Staphylococcus sp.</i> enterotoxin B	protein	Food poisoning
	<i>R. prowazekii</i>	bacterium	Typhus
	Alphaviruses (various)	virus	Viral encephalitis
	<i>V. cholera</i>	bacterium	Cholera
C	Nipah virus	virus	
	Hantavirus	virus	
	MDR ² <i>M. tuberculosis</i>	bacterium	Drug-resistant TB
	Yellow fever virus	virus	Yellow fever
	Avian influenza virus H5N1	virus	Pandemic influenza

¹Other hemorrhagic fever viruses in Category A include Lassa fever virus; four New World arenaviruses; Rift Valley Fever virus; Onk hemorrhagic virus; Kayasanur Disease virus.

²MDR = multi-drug resistant

Some Putative Examples of Bioterrorism

Rajneeshee cult
Oregon, 1985

Spread Salmonella bacteria in salad bars of restaurants.
700 people made ill; no deaths.

Aum Shinrikyo
Japan, 1990-95

Tried extensively to develop bioweapons, deploy them against civilian targets. No one made ill; no deaths. (Finally turned to sarin gas: 19 killed, ~200 injured. But this is chemical, not biological, terrorism.)

Postal anthrax attacks
DC, NY, FLA, 2001

Highly potent anthrax spores spread through mail. Five deaths, 16 serious injuries.

Minnesota Patriots
Council, MN, 1990s

Made crude preparations of ricin toxin. Never used.

Larry Wayne Harris
OH, NV, 1995-96

Tried to fashion bioweapons based on anthrax, plague. Failed.

Aum Shinrikyo

Spent tens of millions of dollars to build state-of-the-art science laboratories to develop biological weapons. Recruited PhD/MD level scientists.

Stated purpose: political destabilization of Japan, prepare the way for a new order headed by their guru, Shoku Azahara

Carried out numerous attempted bioterror attacks using weapons based on botulinum toxin and anthrax spores. Targets: civilians; Japanese parliament; royal family; US 7th fleet at Yokahama.

All bioterror attacks failed, were never even noticed at the time. The cult finally turned to sarin gas. Twelve killed, hundreds injured.

Amerithrax 2001

- Extremely pure anthrax spores delivered by mail to several east-coast news outlets, two US senators
- Five killed, sixteen injured – some seriously. No targeted individuals were harmed.
- Senate office building closed for several months for decontamination; two postal facilities closed for several years. Major social, economic disruption.
- Perpetrator still unknown. Almost certainly a US scientist working in a high-level government research laboratory. Government could not build a prosecutable case against Steven Hatfill. Bruce Ivins is dead, can't be 100% certain he did it.

Some minor incidents....

Minnesota Patriots Council. MN, 1990s.

Made crude preparations of ricin toxin from castor beans. Purpose unclear; never used. By this time, mere possession of CDC list agents a federal crime: all went to prison. (As probably will Roger von Bergendorff...)

Larry Wayne Harris. Ohio, Nevada, 1995-96. (note congruence with Aum)

Tried to fashion bioweapons based on plague, anthrax. Failed.

Some Key Events In Evolution Of U.S. Thinking About Bioterrorism

- **1985** Report from US National Academy of Science, chaired by Joshua Lederberg: Terrorist use of even low-level bioweapons is a significant threat to U.S. security.
- **1992** Defection of Ken Alibek from Soviet Union. Paints picture of massive Soviet build-up of bioweapons, possible leakage to other countries. Information disseminates among top echelons of government.
- **1993** OTA releases statement that an airplane disseminating 100 kg anthrax spores over major city could kill 1-3 million people. Immediately challenged by bioweapons experts, but this receives little attention.
- **1995** Aum Shinrikyo; Larry Wayne Harris. (Timothy McVeigh)
- **1995** Nunn-Lugar Senate hearings on WMD and terrorism. Stimulated in part by Shinrikyo/Harris. Bioterrorist attacks on U.S. “foregone conclusion.” Woefully underprepared.
- **1997** August issue of JAMA devoted to various aspects of a bioterrorist attack in U.S. Lends credence to likelihood of attack. Bioterrorism in US “near certainty.”
- **1998** Secretary of Defense Cohen’s sugar bag.
- **1999** Creation of Center for Civilian Biodefense Studies at JHU and elsewhere. Produce series of “acting-out” exercises for top government officials.
- **2001** Amerithrax

Exercises in Bioterrorism

Name	When	What
TOPOFF I ¹	May, 2000	Plague
Dark Winter	June, 2001	Smallpox
Sooner Spring	April 2002	Smallpox
TOPOFF II	May, 2003	Plague
Atlantic Storm ²	January, 2005	Smallpox
TOPOFF III	April, 2005	Plague

Partial list of such exercises. Several of these also tested responses to chemical and radiological attacks.

¹TOPOFF is an acronym for "Top Officials"

²Atlantic Storm was an extension of Dark Winter to an international stage. See Smith, B., et al, *Biosecurity and Bioterrorism* 3:256, 2005.

Countervailing Viewpoints

Jeanne Guillemin, international security and bioweapons expert at MIT

“...influential politicians and consulting experts broadcast apocalyptic visions of thousands, even hundreds of thousands of Americans dying from unnatural, intentional epidemics of anthrax, smallpox, or some newly devised disease, invisibly inflicted by barbarous foreigners.”

Milton Leitenberg, arms control expert, analyzing the Aum Shinrikyo episode,

“...Aum utterly and totally failed [to produce biological weapons], after no small expenditure of time and money....The experience of Aum is...in marked contrast to the legions of statements by senior US government officials and other spokesmen claiming that the preparation of biological agents and weapons could be carried out in ‘kitchens’, ‘bathrooms’, ‘home breweries’, and is a matter of relative ease and simplicity.”

Amy Smithson, Director of the Stimson Center’s Chemical and Biological Weapon Nonproliferation Project:

“The subject of unconventional [biological] terrorism was tailor-made for hyperbole, and unfortunately much of what has been said has made it difficult to ascertain the gravity of the unconventional terrorist threat. Taken together, the technical realities, actual case histories, and statistical records of terrorist behavior with chemical and biological substances undercut the rhetoric considerably and point not to catastrophic terrorism but to small attacks where a few, not thousands, would be harmed.”

Countervailing Viewpoints 2

Ayman al-Zawahiri, left behind on a computer in Kabul, Afghanistan after Al Qaeda members had fled in 2001:

“The enemy starting thinking about [biological and chemical] weapons before WWI. Despite their extreme danger, we only became aware of them when the enemy drew our attention to them by repeatedly expressing concerns that they can be produced simply with easily available materials.”

Terrorism expert **Bruce Hoffman**, looking back, summed up the years of frantic governmental spending on bioterrorism after it took off in the late 1990s:

“[Bioterrorism] was where the funding was, and people were sticking their hands in the pot. It was the sexiest of all the terrorism threats and it was becoming a cash cow. So the threat of bioterrorism became a kind of self-fulfilling prophecy. It was archetypical Washington politics in the sense that you generate an issue and it takes on a life of its own.”

And yes, even the **bean counters** were getting worried:

Beginning in 1997, the Government Accountability Office (GAO) issued a series of cautionary statements about the growing funding for anti-terror programs. They expressed concern that sound risk-assessment studies had not been carried out, goals had not been defined, and there was no coordination of spending on the programs that had been approved. The GAO also questioned the likelihood of chemical and biological weapons use by terrorists, given the complexity of their production and utilization. Two years later the GAO warned that risk assessment studies still had not been carried out, particularly for expenditures to combat bioterrorism, the dangers of which it continued to question.

Following up on Milton Leitenberg's point....

What would it take to make a bioweapon?

Money To assemble a properly equipped laboratory for growing pathogens under biohazard conditions, and converting them into a bioweapon, would cost tens of millions of dollars

People Creating a deployable bioweapon would require a large number of highly trained scientists with years of experience and finely honed, interdisciplinary problem-solving skills that comes only with years of laboratory experience

Aum Shinrikyo had the money... Absolutely!

Aum Shinrikyo had the people.....

- **Masumai Uchiya** Trained in organic chemistry at Tsukuba University
- **Toro Toyoda** Graduate studies in particle physics at Tokyo University
- **Ikuo Hayashi** Cardiovascular surgeon trained at Keio University in Japan and at Mt. Sinai in New York
- **Seiichi Endo** Doctorate in molecular biology; did research in genetic engineering at Kyoto University before joining Aum.
- **Hideo Murai** Advanced degree in astrophysics from Osaka University, did research for Japanese steel company

But did they...?

Expertise Needed To Make A Bioweapon

Microbiologists

Can identify pathogenic strains of microorganisms, transfer them to the laboratory, grow them without killing them. For spore formers, knows how to convert them to spores without losing pathogenicity. For conversion of pathogens to a bioweapon, get them into superconcentrated form while stabilizing them.

Biochemists

Know how to isolate protein toxins from microorganisms from bacteria, purify them and convert them to a stable form without losing toxicity over time.

“The most virulent culture in a test tube is useless as a weapon until it has been put through a process that gives it stability and predictability. The manufacturing technique is, in a sense, the real weapon, and it is harder to develop than individual agents.”

Ken Alibek, former Biopreparat executive

Equally Important...

Bioengineers

Developing an effective means of dispersal over large areas is a major challenge. Aerosols are extremely difficult to generate due to tendency to clump. Electrostatic agents. Spraying through nozzles kills most living cells unless extreme care is taken. Major problem for Aum Shinrikyo.

Meteorologists

For successful dissemination of microorganisms over a large geographical area, knowledge of prevailing winds and temperatures at different times of day will be important, as will degree of exposure to sun's UV rays. (Was a major problem for military)

“The capability to disperse microbes and toxins over a wide area as an inhalable aerosol...requires a delivery system whose development would outstrip the technical capabilities of all but the most sophisticated terrorists. Not only is the dissemination process for biological agents inherently complex, requiring specialized equipment and expertise, but effective dispersal is easily disrupted by environmental and meteorological conditions.”

J. Tucker, Rand Corporation

But Perhaps Most Important Of All....

“True, almost any scientist can produce a toxic chemical or grow a biological agent in a laboratory beaker, but the scientists most likely to overcome the demands of causing mass casualties are the particularly innovative and dedicated ones, the types who excel in the creative, interactive environments of industry and academia. That modern-day Thomas Edisons and Madame Curies would flock to the next Shoko Asahara or Timothy McVeigh begs skepticism.”

Amy Smithson, biological weapons expert, Center for Non-Proliferation Studies

Some in the U.S. government saw the evidence of Aum's dabbling in production of bioweapons as trumpeting a dangerous new escalation in the global threat of bioterrorism. Others saw it as evidence that producing effective bioweapons was not trivial, and almost certainly beyond the capabilities of even the most technically sophisticated terrorists. The latter view did not prevail.

Who Would Do It??

Individuals

Can wreak havoc: Theodore Kaczynski; Timothy McVeigh; Amerithrax perpetrator. Technology beyond most.

Groups

Militias: overweight, middle-aged white males running around the woods on weekends?

Domestic extremist groups: anti-abortion; animal rights; ecoterrorists. Generally don't want deaths.

Foreign groups: Al-Qaeda. Desire for great harm. Did at least consider bioweapons: cave materials from Afghanistan. But media attention, bang for the buck: explosives, airplanes, nuclear weapons much more attractive.

Rogue states

6-8 have the requisite technology. But occasional emergence of a Bush/Cheney team must convince them massive US retaliation is a virtual certainty.

Some Potential State Suppliers of Bioweapons

Country	Comments
China	Despite denials, suspected of having transferred bioweapons technology to Iran and other countries
Cuba	Has sophisticated biotechnology industry, is suspected by some of having well-developed bioweapons program
Egypt	Strong university microbiology programs. Allegations by Israel of bioweapons program
Iran	Strong biotechnology base. Believed to be pursuing bioweapons program
Kazakhstan	Home to many former Soviet bioweapons facilities. Status of these uncertain. Has never formally renounced bioweapons reserach
Libya	Formerly had bioweapons program. Current status uncertain
N. Korea	Presumed to have strong bioweapons program, but no reliable intelligence
Pakistan	Strong biotechnology base. Status of bioweapons programs uncertain.
Russia	Strong background in bioweapons. Current status uncertain, particularly with respect to plague.
Syria	Good pharmaceutical infrastructure. Status of bioweapons programs uncertain
Uzbekhistan	Houses several former Soviet bioweapons facilities. Presumed to still hold stockpiles of many Select List pathogens.

The Ultimate Bioterrorist – Mother Nature!

Infectious disease pandemics* over the past 90 years

Pandemic	US Deaths*	Worldwide deaths	Mortality rate
• (Seasonal flu)	40,000	>1,000,000	.01%
• 1918 flu	650,000	50-100 million	2-3%
• 1957 flu	70,000	2-4 million	0.3%
• SARS	none	8,000	8-10%
• Avian flu (H5N1)	none	175	60%

*only contagious pathogens are involved in pandemics, e.g. smallpox, influenza, SARS

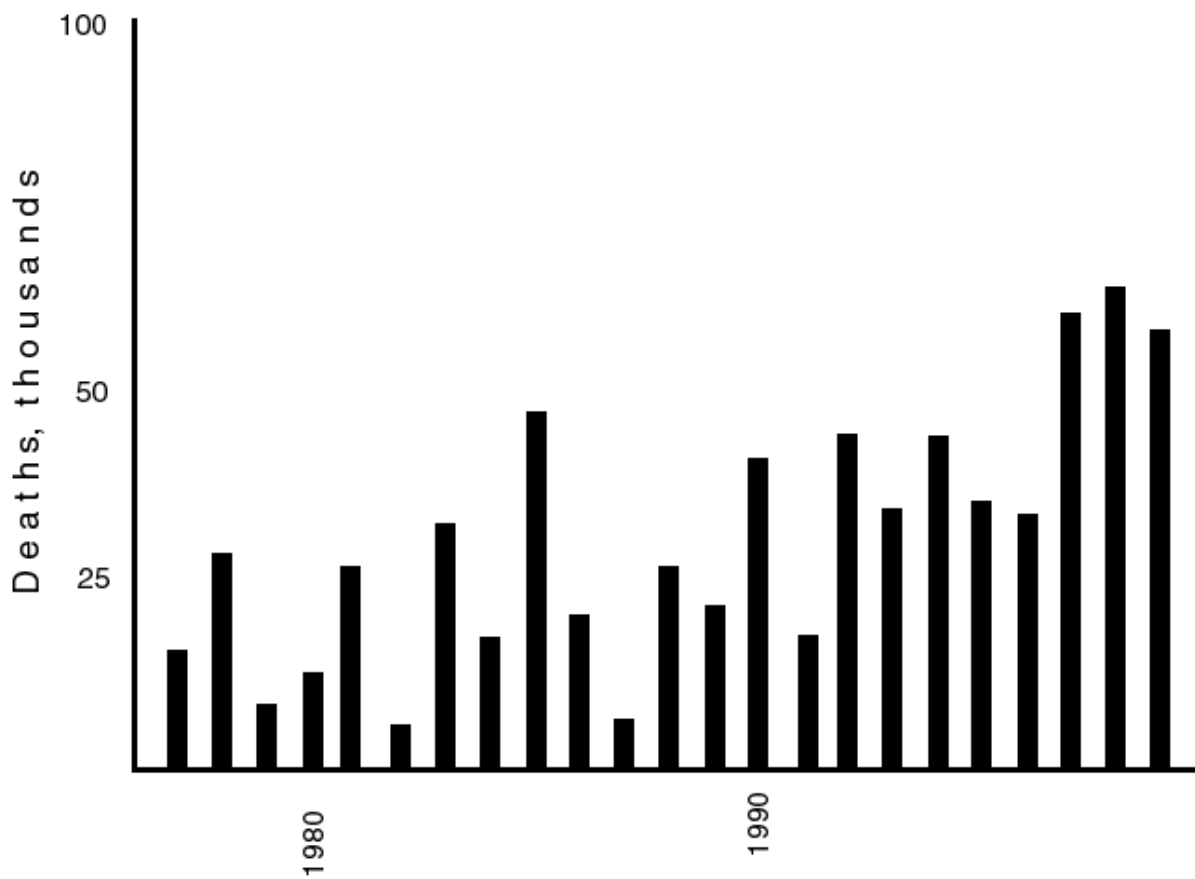


Figure 5.1 Deaths from seasonal flu in the U. S. by year

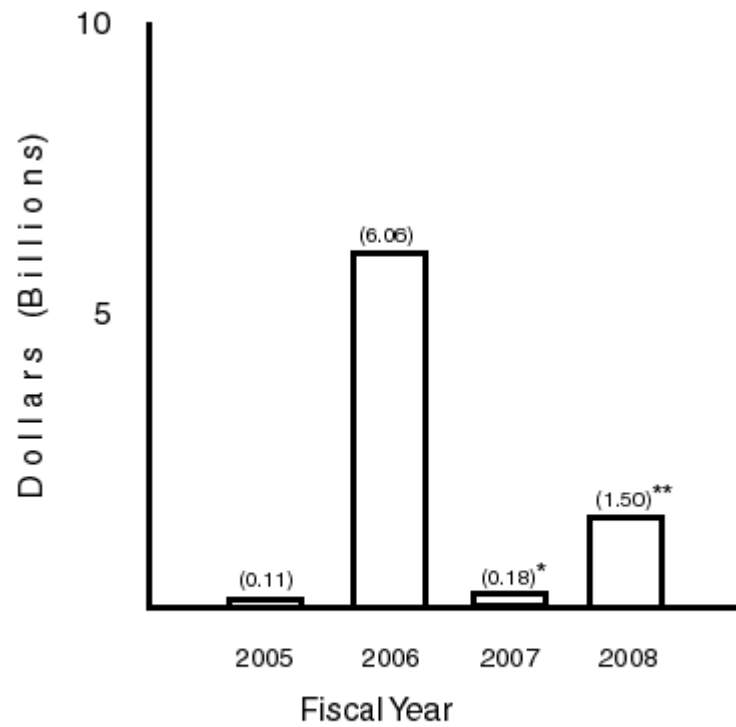


Figure 7.2 Funding for the National Strategic Pandemic Influenza plan. *estimated **requested

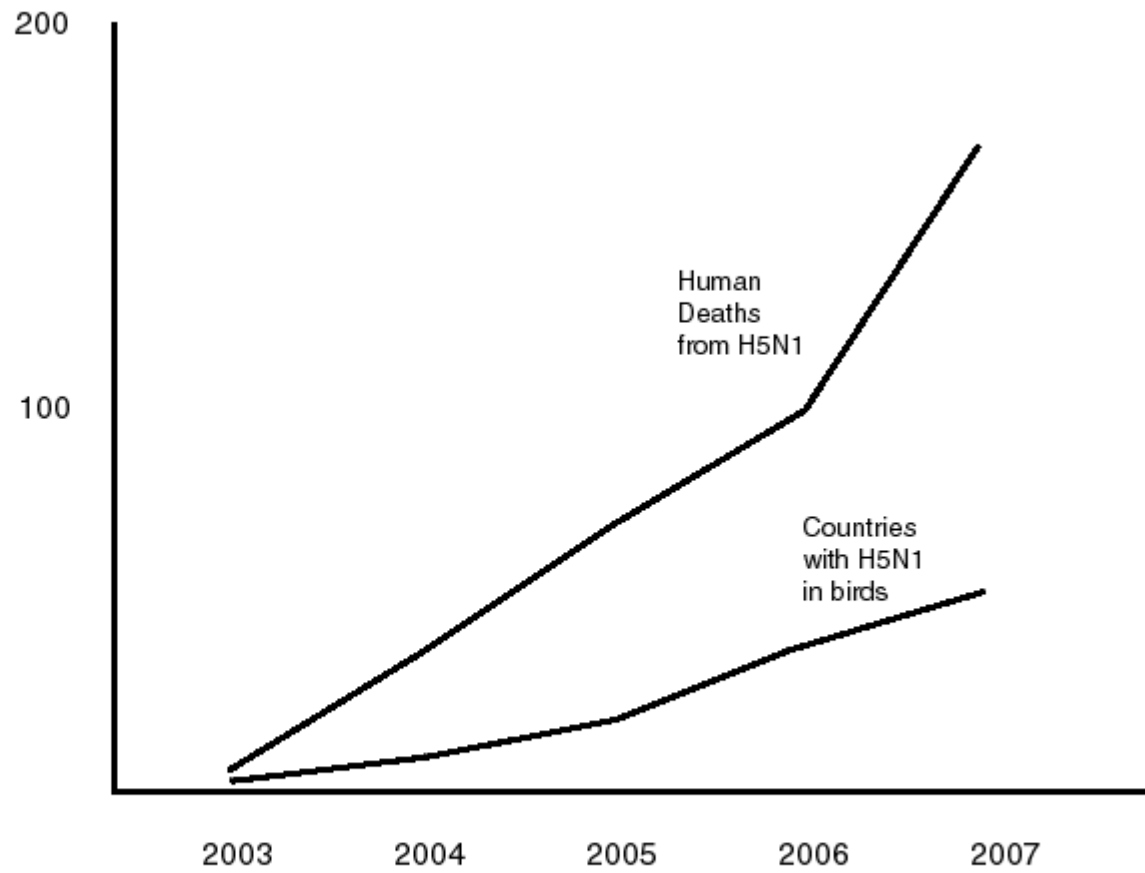


Figure 5.3 Cumulative spread and human deaths from H5N1 avian flu.

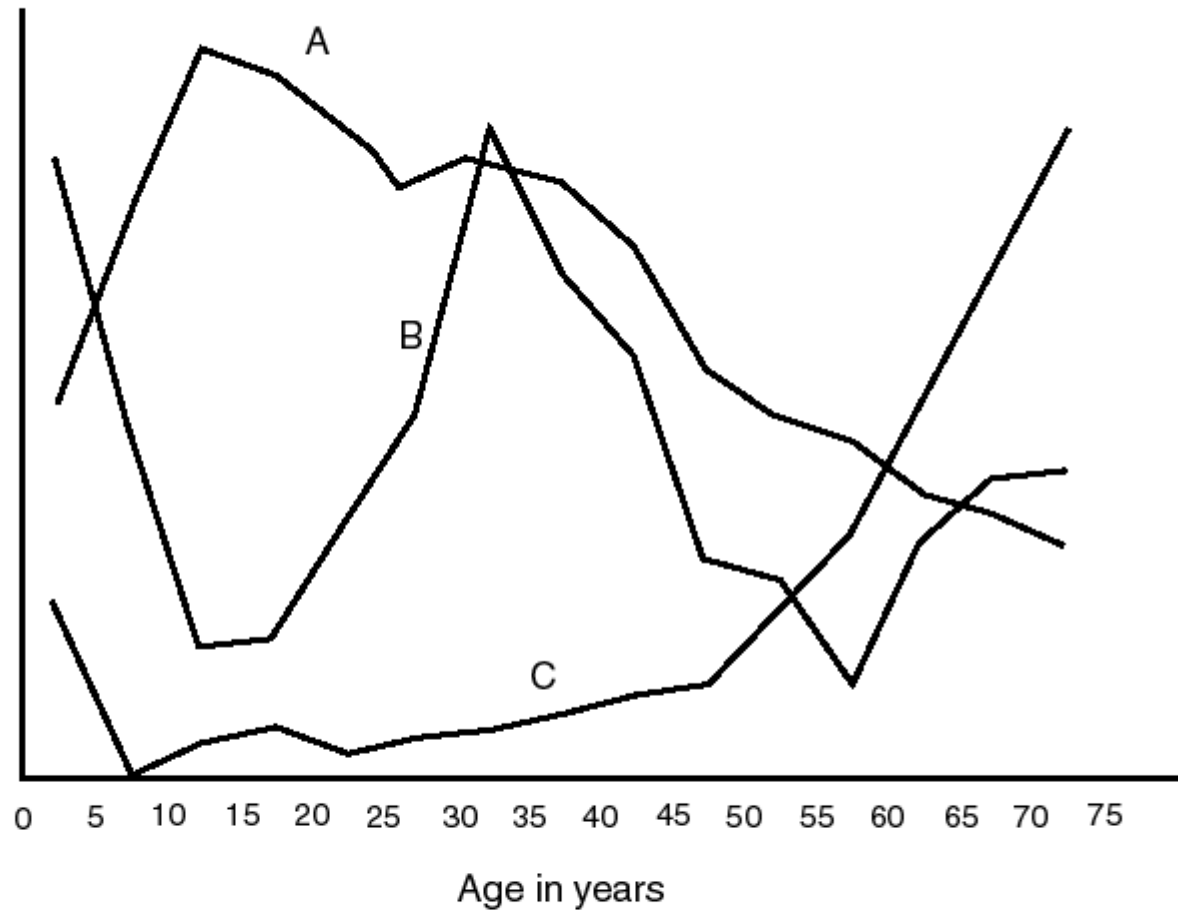


Figure 5.2 Proportional distributions by age of (A) Rate of infections in the 1918 pandemic; the disease struck across all age groups, although the young were particularly susceptible. B) Rate of deaths in the 1918 pandemic; surprisingly, the death rate in individuals 1-40 years of age were extremely high, by comparison with (C), the rate of deaths seen in a standard outbreak of influenza. Based on data presented in Taubenberger, J. and D. Morens, 2006. *Emerging Infectious Diseases* 12:1

Box 5.2 FDA-approved anti-influenza drugs

Generic name	Trade name	Approved
Amantadine*	Symmetrel	1966
Rimantadine*#	Flumadine	1993
Zanamivir	Relenza	1999
Osetelamivir	Tamiflu	1999

*available as generic

** available only as an inhalant