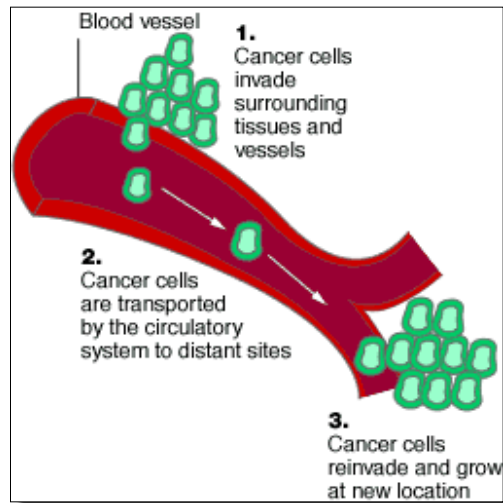


Biochemistry of Cancer



1

TABLE 6. Ten Leading Causes of Death in the United States, 2017 and 2018

	2017			2018			RELATIVE CHANGE IN RATE
	NO.	PERCENT	RATE	NO.	PERCENT	RATE	
All causes	2,813,503		732.6	2,839,205		723.9	-1.2%
1 Heart diseases	647,457	23%	165.2	655,381	23%	163.7	-0.9%
2 Cancer	599,108	21%	152.6	599,274	21%	149.0	-2.4%
3 Accidents (unintentional injuries)	169,936	6%	49.4	167,127	6%	47.9	-3.0%
4 Chronic lower respiratory diseases	160,201	6%	41.1	159,486	6%	39.8	-3.2%
5 Cerebrovascular disease	146,383	5%	37.6	147,810	5%	37.1	-1.3%
6 Alzheimer disease	121,404	4%	31.1	122,019	4%	30.6	-1.6%
7 Diabetes mellitus	83,564	3%	21.5	84,946	3%	21.4	-0.5%
8 Influenza and pneumonia	55,672	2%	14.3	59,120	2%	14.9	4.2%
9 Nephritis, nephrotic syndrome, & nephrosis	50,633	2%	13.0	51,386	2%	12.9	-0.8%
10 Intentional self-harm (suicide)	47,173	2%	14.0	48,344	2%	14.2	1.4%

Rates are per 100,000 and age adjusted to the 2000 US standard population.
Source: National Center for Health Statistics, Centers for Disease Control and Prevention.

2

Cancer

- Knowledge of tumors date from antiquity.
 - Egyptians and Greeks
- Streaks of hard gray tissue that extended from tumors reminded the Greeks of a crab.
 - Named the condition cancer from the Latin word for crab.
- Today, Cancer is a generic term for a malignant tumor.
- Essentially, cancer is a good cell gone bad

3

Cancer in the United States

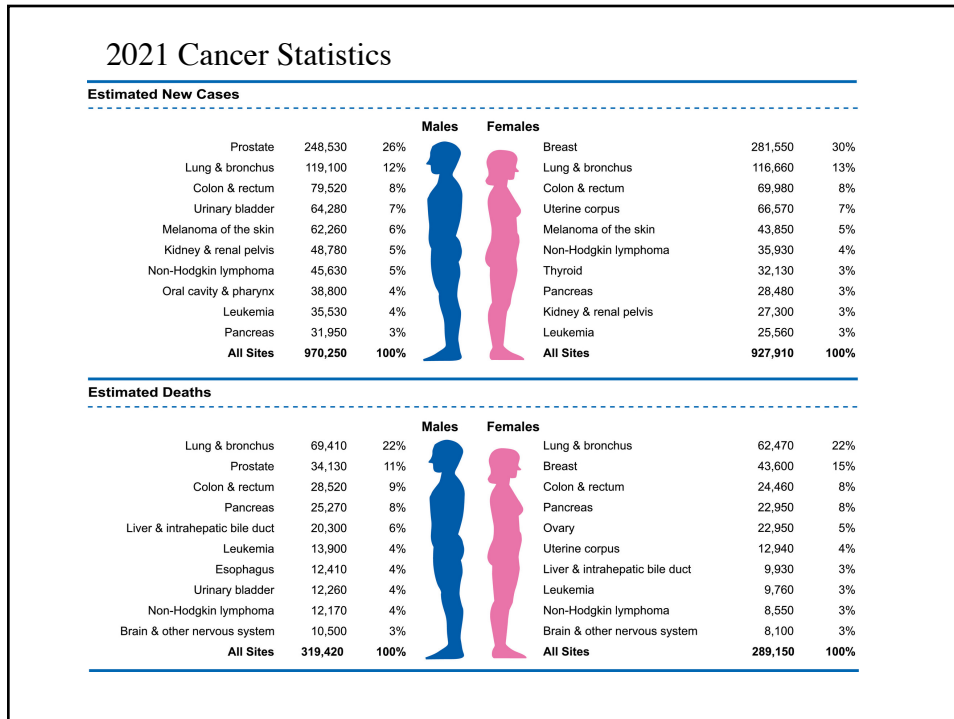
In 2021 ~ 608,570 people will die from cancer.

1.9 million new cases will be diagnosed in 2021

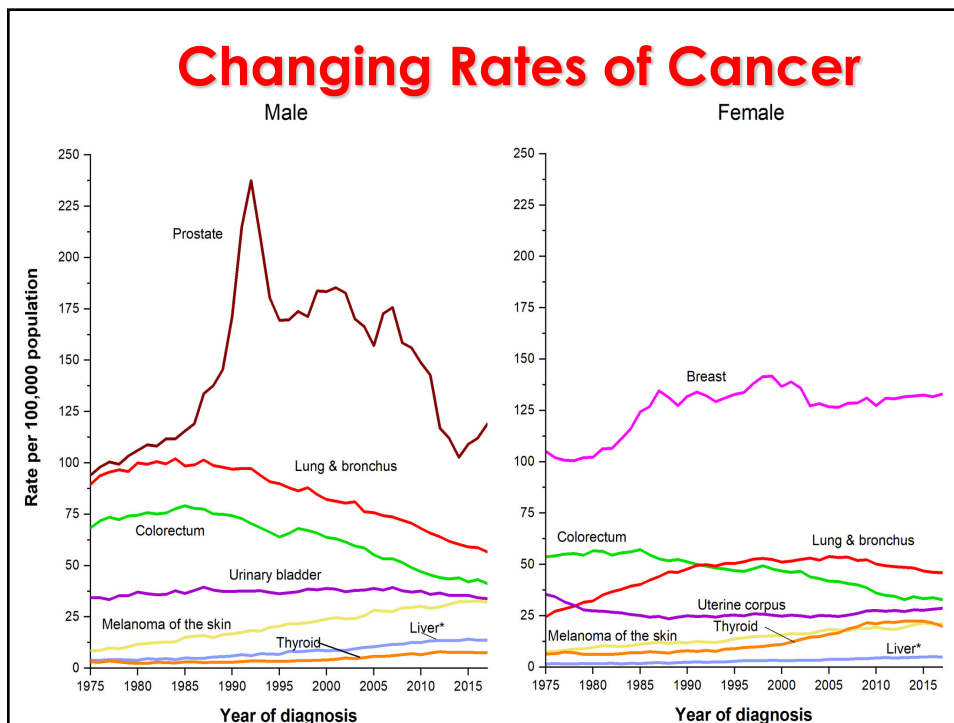
At least one in three people will develop cancer in their lifetime.

- 1 in 4 men will die of cancer.
- 1 in 5 women will die cancer.

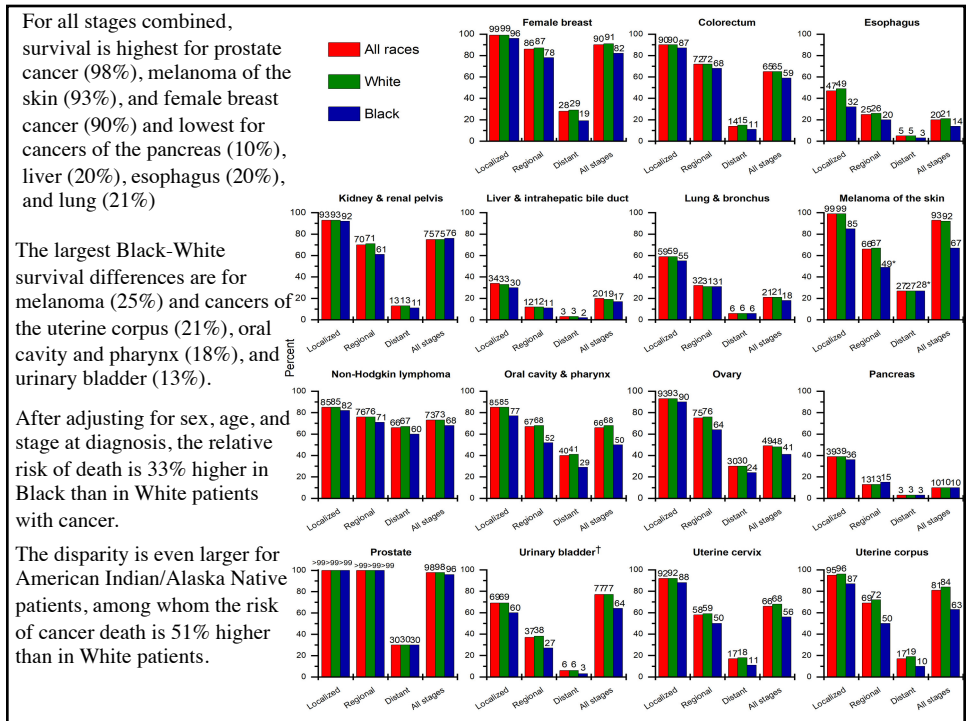
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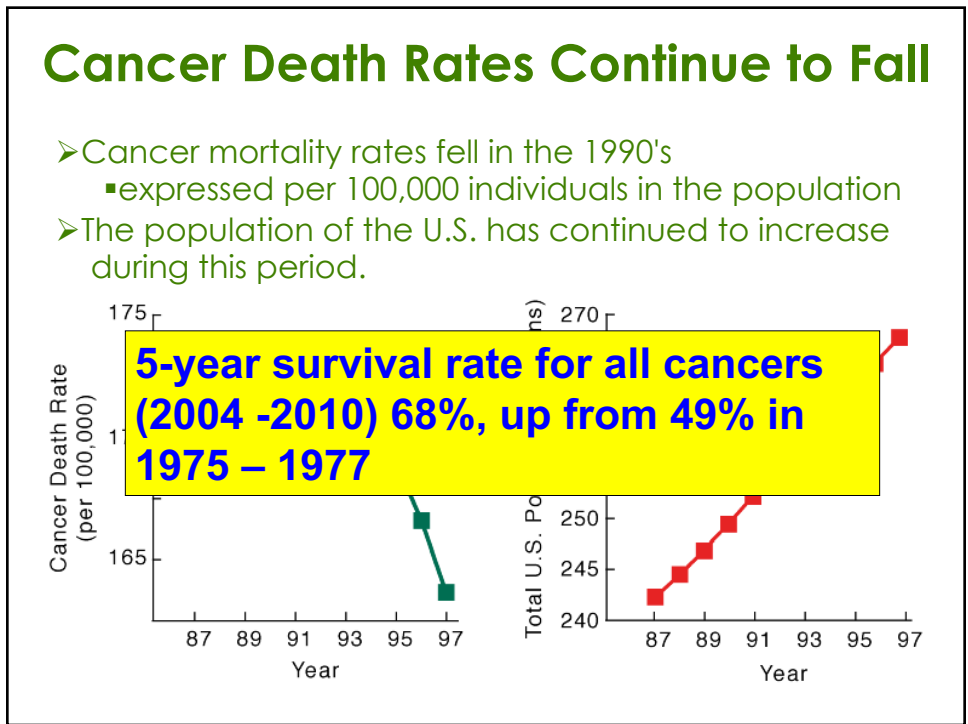
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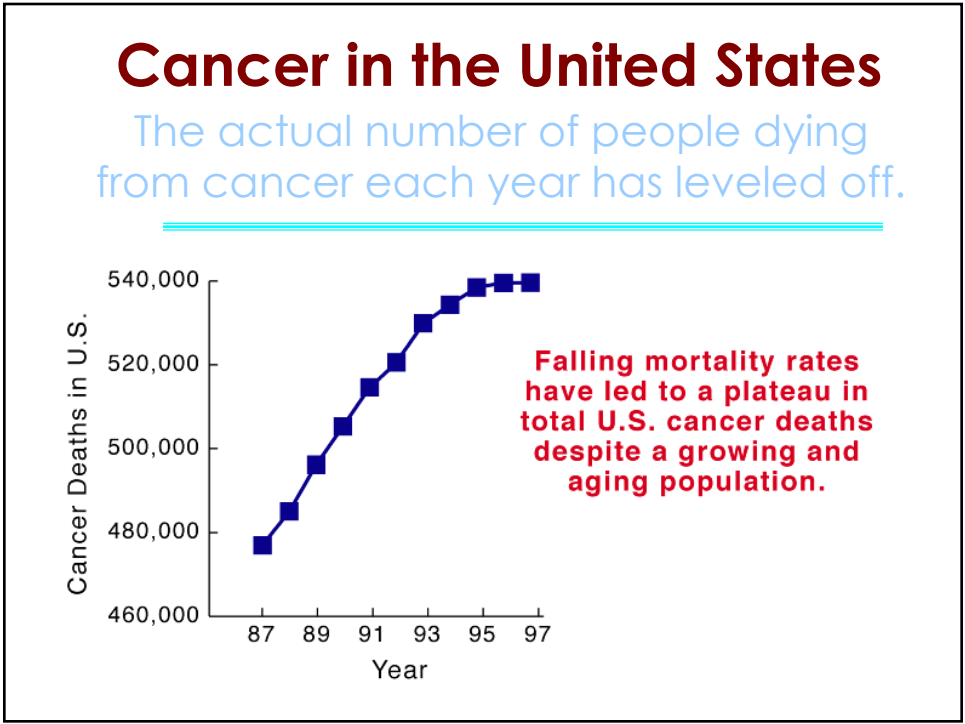
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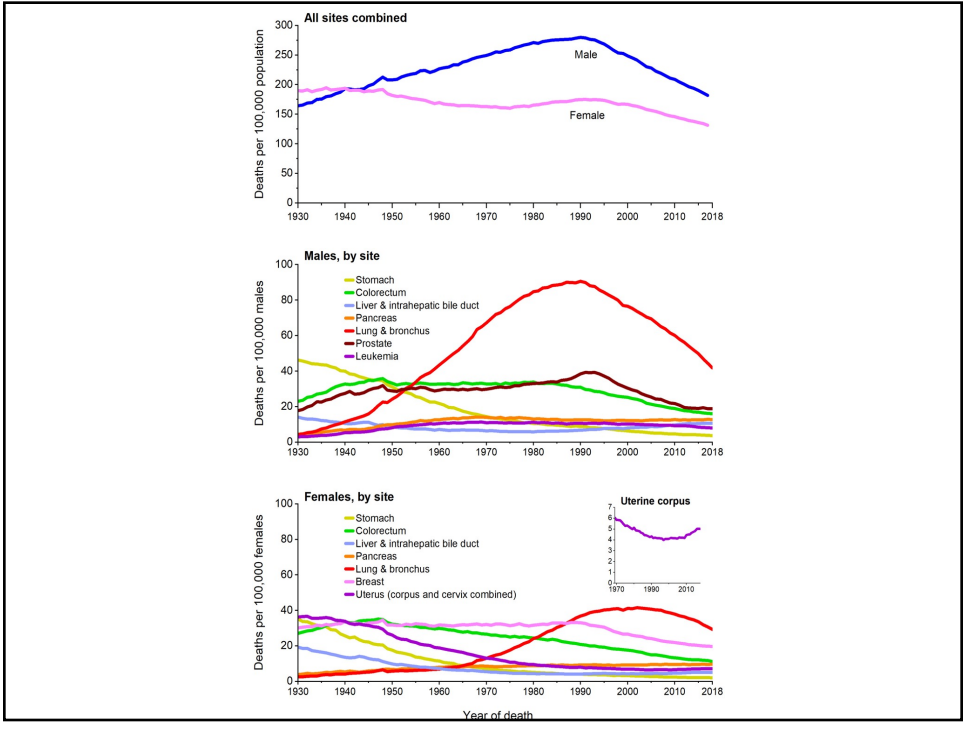
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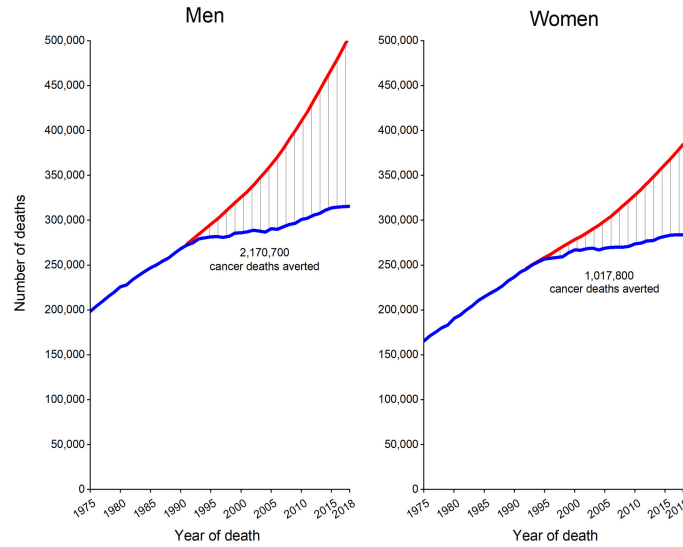


9



10

Total Number of Cancer Deaths Averted



The blue line represents the actual number of cancer deaths recorded in each year; the red line represents the number of cancer deaths that would have been expected if cancer death rates had remained at their peak.

11

TABLE 10. Incidence and Mortality Rates for Selected Cancers by Race and Ethnicity, United States, 2013 to 2018

	ALL RACES COMBINED	NON-HISPANIC WHITE	NON-HISPANIC BLACK	ASIAN/PACIFIC ISLANDER	AMERICAN INDIAN/ALASKA NATIVE*	HISPANIC
Incidence, 2013 to 2017						
All sites	449.0	465.6	457.6	291.0	379.8	346.9
Male	489.1	501.4	524.0	294.3	399.8	371.3
Female	422.4	442.2	406.6	292.6	368.8	335.5
Breast (female)	126.0	131.6	127.3	95.6	94.9	94.8
Colon & rectum [†]	36.9	36.6	43.6	29.2	42.3	32.9
Male	42.6	42.0	51.6	34.6	47.2	39.6
Female	32.1	31.8	37.9	24.8	38.3	27.6
Kidney & renal pelvis	16.9	17.1	18.9	8.0	23.9	16.7
Male	22.9	23.1	26.1	11.3	31.3	21.9
Female	11.7	11.7	13.3	5.3	17.7	12.4
Liver & intrahepatic bile duct	8.5	7.1	11.0	12.6	15.7	13.5
Male	12.9	10.7	18.0	19.3	22.9	20.1
Female	4.6	3.8	5.5	7.1	9.4	7.9
Lung & bronchus	58.4	62.6	60.9	34.4	52.7	29.7
Male	67.6	70.8	79.8	43.2	59.2	37.1
Female	51.3	56.4	47.9	27.9	47.9	24.3
Prostate	104.6	97.7	171.6	53.8	67.7	85.6
Stomach	6.5	5.3	10.0	10.0	8.8	9.6
Male	8.9	7.5	13.7	13.1	11.4	12.0
Female	4.6	3.5	7.4	7.7	6.8	7.7
Uterine cervix	7.6	7.2	9.0	6.1	8.8	9.5
Mortality rates, 2014 to 2018						
All sites	155.5	160.2	182.5	97.2	141.1	110.8
Male	185.5	190.2	227.2	114.6	169.3	134.0
Female	133.5	137.8	154.9	84.6	120.1	94.6
Breast (female)	20.1	20.1	28.2	11.7	14.8	13.8
Colon & rectum	13.7	13.6	18.5	9.4	15.1	10.9
Male	16.3	16.1	23.2	11.2	18.5	14.0
Female	11.5	11.5	15.3	7.9	12.4	8.6
Kidney & renal pelvis	3.6	3.8	3.6	1.7	5.5	3.4
Male	5.3	5.5	5.5	2.5	8.3	4.9
Female	2.3	2.3	2.3	1.1	3.2	2.2
Liver & intrahepatic bile duct	6.6	5.8	8.6	8.6	10.6	9.3
Male	9.7	8.4	13.4	13.1	14.8	13.3
Female	4.0	3.6	4.9	5.4	7.0	6.0
Lung & bronchus	38.5	41.7	41.3	21.2	32.1	16.8
Male	46.9	49.4	57.0	28.0	38.4	23.0
Female	32.0	35.6	30.6	16.3	27.4	12.3
Prostate	19.0	17.9	38.3	8.8	18.5	15.6
Stomach	3.0	2.2	5.3	5.0	4.7	4.9
Male	4.0	3.1	7.8	6.3	6.3	6.3
Female	2.2	1.6	3.6	4.0	3.5	3.9
Uterine cervix	2.2	2.0	3.4	1.7	2.4	2.6

Rates are per 100,000 population and age adjusted to the 2000 US standard population and exclude data from Puerto Rico.
[†]Data based on Purchased/Referred Care Delivery Area (PRCDA) counties.
^{*}Colorrectal cancer incidence rates exclude appendix.

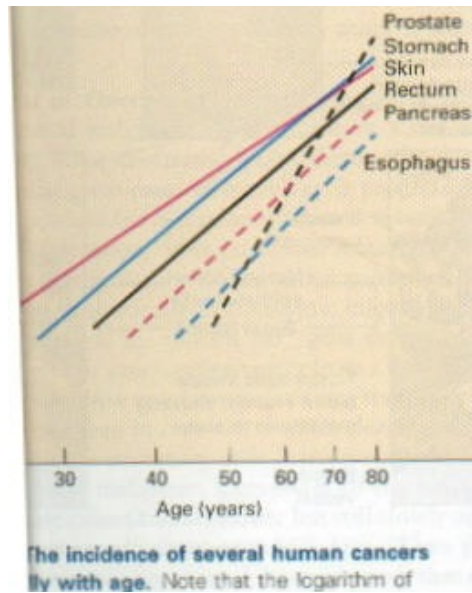
12

Growing old-

563,100 people died from cancer in 1999 an [increase from 331,000 in 1970](#)

40% of Americans will be stricken with the disease and 1 in 5 will die from it - 1,221,800 person incidence rate in 1999

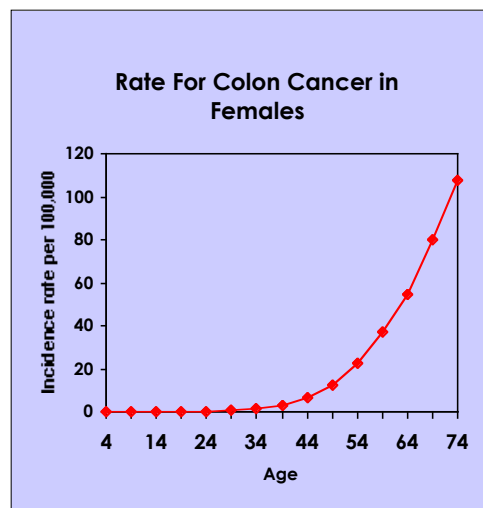
For the most part cancer is obviously a disease of age - of individual and DNA



13

A Disease of Age

- Most cancers develop late in life.
- Cancer did not become a major societal challenge until the middle 19th century.



14

TABLE 9. Five Leading Causes of Cancer Death in the United States by Age and Sex, 2018

ALL AGES	<20	20 TO 39	40 TO 59	60 TO 79	≥80
MALE					
All sites	All sites	All sites	All sites	All sites	All sites
315,553	1,046	3,983	45,321	175,882	89,315
Lung & bronchus	Brain & ONS	Brain & ONS	Lung & bronchus	Lung & bronchus	Lung & bronchus
76,234	290	583	9,674	47,948	18,432
Prostate	Leukemia	Colorectum	Colorectum	Prostate	Prostate
31,489	258	522	5,971	14,396	15,723
Colorectum	Bones & joints	Leukemia	Pancreas	Pancreas	Colorectum
27,964	117	458	3,641	14,160	7,345
Pancreas	Soft tissue (including heart)	Non-Hodgkin lymphoma	Liver ^a	Colorectum	Urinary bladder
23,178	103	225	3,442	14,118	5,577
Liver ^a	Non-Hodgkin lymphoma	Soft tissue (including heart)	Brain & ONS	Liver ^a	Pancreas
18,594	40	220	2,397	12,083	5,246
FEMALE					
All sites	All sites	All sites	All sites	All sites	All sites
283,721	795	4,604	45,070	144,858	88,391
Lung & bronchus	Brain & ONS	Breast	Breast	Lung & bronchus	Lung & bronchus
65,847	242	1,102	9,847	38,866	18,412
Breast	Leukemia	Uterine cervix	Lung & bronchus	Breast	Breast
42,466	201	467	8,394	19,935	11,581
Colorectum	Soft tissue (including heart)	Colorectum	Colorectum	Pancreas	Colorectum
24,199	89	395	4,223	11,903	9,189
Pancreas	Bones & joints	Brain & ONS	Ovary	Colorectum	Pancreas
21,737	78	340	2,708	10,386	7,176
Ovary	Kidney & renal pelvis	Leukemia	Pancreas	Ovary	Leukemia
13,748	26	325	2,575	7,540	3,999

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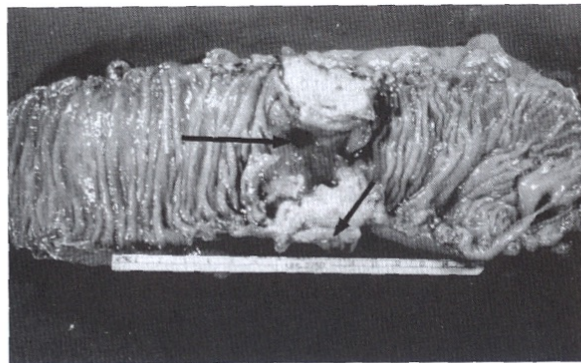


Figure 1–7. Photograph of an adenocarcinoma of the colon. The bowel has been opened along its long axis. Note the napkin ring appearance imparted by the adenocarcinoma that has invaded the mucosa forming a malignant ulcer at the long arrow and through the bowel wall and into the fat (short arrow). This stage of malignancy carries a poor prognosis.

16