MASSACHUSETTS INSTITUTE OF TECHNOLOGY

CAMBRIDGE. MASS. 02139

DEPARTMENT OF MATHEMATICS

January 18, 1977

Dr. J. Kastner, Chief
Environmental Standards Branch
Office of Standards Development
United States Nuclear Regulatory
Commission
Washington, D. C. 20555

Dear Jake:

I enclose comments on South Dakota. I am writing more detailed comments on Manuso and will send them shortly. However, I will be away for this week and they will arrive only next week.

I enclose also a list of times spent on the project up to last week.

Sincerely yours,

Daniel J. Kleitman
Professor of Applied Mathematics

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Enclosures

In this paper cancer deaths and respiratory cancer deaths are compared between Fall River county and the rest of South Dakota. Data is presented over a sixteen year period. The following table summarizes the results:

	Fall River county	All South Dakota
Resp. cancer deaths	64	2,335
All cancer deaths	297	17,186
Mean population	8,995	683,740
Resp. cancer rate, SD (deaths/thousand)	----------	0.231
All cancer rate, SD	----------	1.571

	Exp. # of cases Fall River county	One Standard Deviation	Observed Deviation
Resp. cancer	30.7	5.5	33.3
All cancer	225	15	72
Other cancer	194.3	14	38.7

The respiratory cancer deviations here are significant by all statistical standards. The statistical analysis used in the paper involves computing death rates for each year (death/pop.) for the county and the state and using an F-test. This is a somewhat obscure procedure but does arrive at the conclusion, which is inescapable, that without correction of any kind there are significantly more cancer deaths in Fall River county over the past fifteen years than expected from the overall South Dakota data.

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However, the results do not justify any causal conclusions for a number of reasons. The most glaring error is the failure to consider the effects of age and sex distribution. All cancer statistics are adjusted for age and sex because of the large variations in cancer death rates within these groups. It is a mistake to assume that the population of Fall River has the same distribution as the State. In fact a check of the 1970 census shows that Fall River county's age and sex distributions are markedly atypical. The relevant data is enclosed. As examples, we note that the median age in 1970 was 43.5 as compared to the state's median of 27.4. Fall River in fact has the highest median age in the state, its closest competitor being Turner County . (38.4 in 1970) The sex distribution is also anamolous: The male to female ratio over 50 years is 1.3 as compared with the state's 0.91. The enclosed age and sex specific cancer rates from publicly available studies show Fall River's population characteristics will lead to a considerably higher average cancer rate than the state.

We proceed with a rough recalculation of the expected cancer deaths. We assume a distribution of cancer deaths by age and sex according to the statistics of the Patterns in Cancer Mortality... book. Included are overall cancer deaths and those from respiratory cancers. It is reasonable to assume that the relative distribution of deaths as a function of age and sex did not change appreciably over the time of the study.

Statistics of age and sex distribution of the state and county as presented in the 1970 census are applied to populations of

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683,740 and 8,955 to get an average population breakdown by age and sex in the state and county respectively.

The figures of 2,335 for respiratory and 17,186 for all cancers are then applied in the obvious way to arrive at a distribution of death rates in the state by age and sex. Applying these rates to the county and a total population of (8955)*(16) broken down via the county distribution we can obtain the distribution of expected deaths in the county, which we then sum to get the total expected cancer deaths. The variance of these expectations is estimated as the sum of $n_i p_i (1-p_i)$ where n_i is the population of one of the (age) X (sex) classifications and p_i the corresponding death rate. The sum is to be taken over all the classifications in age and sex. This estimate of the variance will be too conservative, as the p_i are themselves estimates.

The results are rather surprising. For all cancers, the expected mortality is 414 with standard deviation 20. The observed mortality of 297 represents a significantly lower death rate. For respiratory cancers, the expected mortality is 61 with standard deviation of 8. Thus the observed mortality of 64, being well within one standard deviation, is not significant.

While the above calculation is a bit crude, it does provide a strong argument that a more careful analysis adjusted for age and sex distributions will lead to conclusions different from the study in question.

Other factors which can be more carefully considered in interpreting the data are:

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1. smoking habits -- Respiratory cancer incidence is highly dependent on smoking habits; no relative statistics for the county are given.

2. pollution patterns -- Certain pollutants are suspected as leading to cancer; While Fall River is apparently of rural character the absence of significant sources should be verified.

3. occupational hazards -- The existence of mining operations in the nearby Black Hills is noted. Respiratory cancer is associated with such employment. The existence of other industrial hazards should be explored.

The anamolous population distribution in the 1970 census should be explained. Is the county noted for hospitals or nursing homes or as a retirement area? What is the source of the preponderance of older men? From where has the recent population increase been coming? What is its population spectrum?

It would help in distinguishing the effects of tailings from those of other factors by determining whether the deaths correlate primarily with occupational, migrational or smoking habits or with distance of dwelling place from the tailings among county residents.

Since the data used in the study was from a larger set of statistics drawn from the entire state it should not be much trouble to perform such an unadjusted test on other counties with similar characteristics in population (e.g. Turner) or region. Large significant positive deviations in cancer death rates in these counties would make the results of the study in question much less extraordinary.

Finally, since there are only 50 or so respiratory cases it might be possible to ascertain the case histories at modest

cost. It would not be unreasonable in my opinion to ask the licensee, as a condition of licensing to investigate if the living patterns of these cases point to tailings as a source of danger or to alternatives.

To sum up, it appears that a more careful age and sex adjusted analysis will yield results different than those arrived at in the study. If this is not satisfactory, further areas of investigation have been mapped out for determining any effect of the tailings. In truth, it is hard to see how Fall River county deaths would reflect the effects of low-level radiation very sensitively and one suspects that other factors, most notably demography, will have effects that dwarf those of the source in question.

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NATIONAL CANCER INSTITUTE MONOGRAPH 33

May 1971

Patterns in Cancer Mortality in the United States: 1950-1967

By

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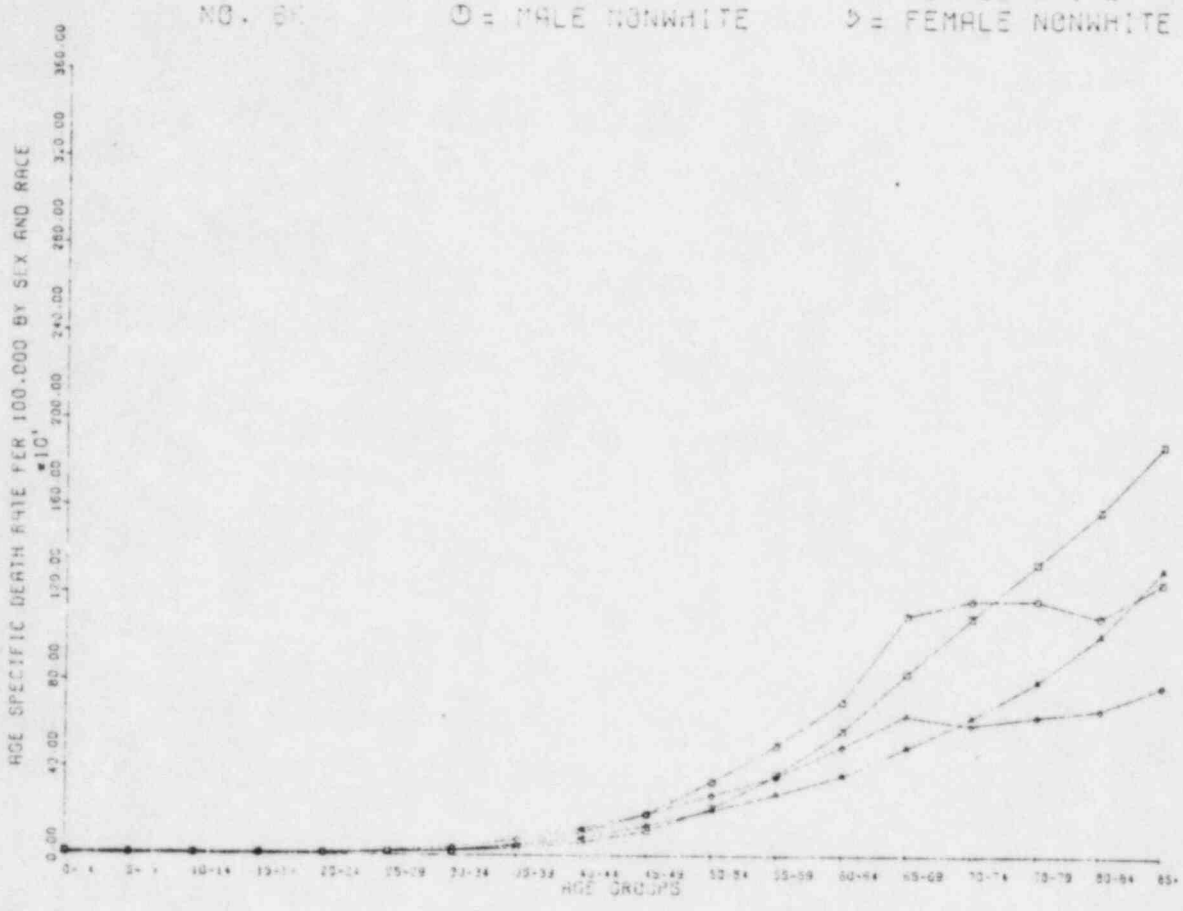
National Cancer Institute
National Institutes of Health

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
NATIONAL INSTITUTES OF HEALTH
NATIONAL CANCER INSTITUTE, BETHESDA, MARYLAND

TUMOR TYPE
NO. 60

□ = MALE WHITE
◸ = MALE NONWHITE
△ = FEMALE WHITE
▷ = FEMALE NONWHITE



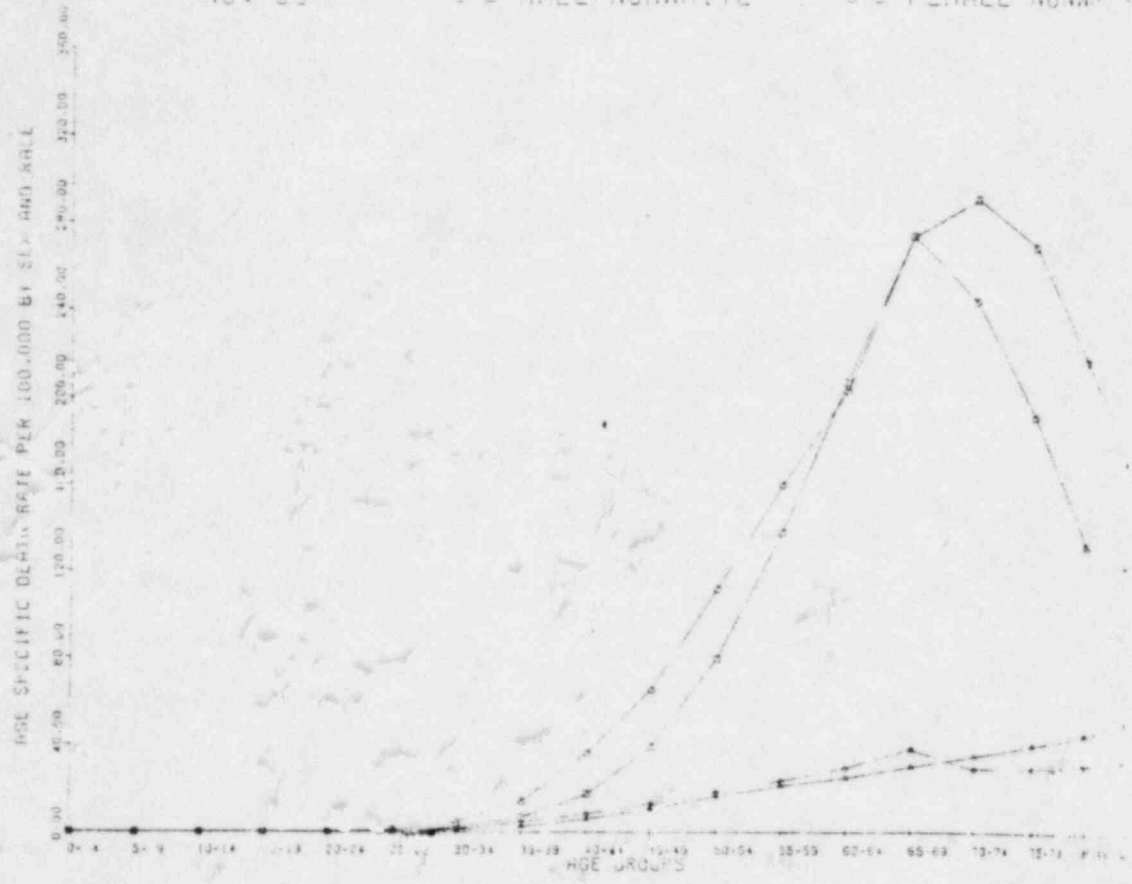
AGE ADJUSTED DEATH RATE PER 100,000 BY SEX AND RACE

TUMOR TYPE NO. 60	MALE		FEMALE	
	WHITE	NONWHITE	WHITE	NONWHITE
0- 4	9.6040*	6.2332	8.1501	5.6374
5- 9	6.4988	5.5116	6.0776	5.0100
10-14	6.7722	5.9459	5.3984	4.7554
15-19	9.1366	7.4252	6.1251	5.7769
20-24	10.8695	8.5162	7.4166	7.7183
25-29	14.0200	14.0441	12.1253	17.3217
30-34	20.6797	23.0968	24.[illegible]580	37.4339
35-39	34.0419	44.8740	45.8477	71.6593
40-44	61.9826	103.8886	93.4645	120.6747
45-49	117.3158	190.4054	139.7051	189.8374
50-54	214.8005	340.4376	211.3783	276.6818
55-59	373.8972	506.3905	286.[illegible]212	362.7818
60-64	575.4164	700.6731	370.8956	500.8424
65-69	838.6260	1101.1610	500.3098	645.2023
70-74	1093.6204	1172.0279	637.2122	603.4810
75-79	1341.7219	1173.1374	802.0772	640.3937
80-84	1584.0516	1095.7940	1014.5177	672.7028
85+	1869.4367	1251.1655	1318.8080	782.9805

* AGE SPECIFIC DEATH RATE PER 100,000

TUMOR TYPE
NO. 20

□ = MALE WHITE
○ = MALE NONWHITE
△ = FEMALE WHITE
◇ = FEMALE NONWHITE



TUMOR TYPE NO. 20	MALE		FEMALE	
	WHITE	NONWHITE	WHITE	NONWHITE
0- 4	0.0696*	0.0625	0.0486	0.0632
5- 9	0.0254	0.0454	0.0355	0.0367
10-14	0.0389	0.1036	0.0362	0.1031
15-19	0.4025	0.1599	0.0943	0.0838
20-24	0.3182	0.4035	0.1175	0.2258
25-29	0.9829	0.9659	0.2330	0.5426
30-34	2.3563	4.3630	0.9545	1.2641
35-39	6.3944	14.0910	2.6501	4.6033
40-44	16.6952	36.0740	6.0796	8.1247
45-49	36.4410	65.3695	11.3075	13.1383
50-54	79.4864	111.4548	16.7392	18.1044
55-59	157.4047	159.2660	21.4670	23.9373
60-64	200.8007	202.5923	25.2720	29.4087
65-69	273.4854	273.9134	30.3530	30.1503
70-74	290.5801	243.8065	35.2196	29.3057
75-79	268.7783	190.8391	40.3275	29.5133
80-84	216.7363	131.7201	45.1593	31.4270
85+	169.8383	122.7199	51.5439	33.1130

* AGE SPECIFIC DEATH RATE PER 100,000

Table 20. Age by Race and Sex: 1970

[For minimum base for derived figures (percent, median, etc.) and meaning of symbols, see text]

The State Size of Place	Urban						Rural		
		Urbanized areas			Other urban places of—				
	Total	Total	Total	Central cities	Urban fringe	10,000 or more	2,500 to 10,000	Total	Places of 1,000 to 2,500	Other
TOTAL POPULATION										
Both Sexes										
All ages	**665 507**	**296 628**	**76 006**	**72 488**	**3 518**	**137 060**	**83 562**	**368 879**	**53 156**	**315**
Under 1 year	11 004	5 189	1 322	1 232	90	2 105	1 462	5 815	764	5
1 year	10 603	4 853	1 045	1 158	87	2 237	1 371	5 950	750	5
2 years	10 314	4 644	1 226	1 148	78	2 086	1 334	5 670	745	4
3 years	10 680	4 731	1 256	1 161	95	2 120	1 335	5 949	779	5
4 years	11 457	5 016	1 357	1 274	83	2 204	1 455	6 441	830	5
5 years	12 546	5 496	1 452	1 363	89	2 516	1 528	7 050	920	4
6 years	13 410	5 869	1 639	1 541	98	2 596	1 634	7 541	984	5
7 years	13 966	6 096	1 656	1 574	82	2 725	1 715	7 870	1 001	5
8 years	14 214	6 099	1 709	1 598	102	2 694	1 709	8 115	1 033	7
9 years	14 499	6 170	1 687	1 602	85	2 746	1 737	8 329	1 084	7
10 years	15 361	6 414	1 774	1 643	81	2 880	1 810	8 947	1 165	7
11 years	14 358	5 871	1 591	1 524	67	2 592	1 687	8 487	1 048	7
12 years	14 879	6 074	1 594	1 524	70	2 808	1 642	8 805	1 055	7
13 years	14 764	5 931	1 637	1 552	85	2 596	1 698	8 833	1 035	7
14 years	15 163	6 064	1 599	1 520	79	2 786	1 679	9 099	1 120	7
15 years	14 781	5 870	1 618	1 536	82	2 622	1 630	8 911	1 118	7
16 years	14 495	5 633	1 493	1 435	58	2 556	1 584	8 862	1 115	7
17 years	14 246	5 620	1 521	1 440	81	2 574	1 525	8 626	1 081	7
18 years	14 019	7 935	1 724	1 675	49	4 186	2 025	6 104	915	5
19 years	12 428	8 628	1 672	1 621	51	4 628	2 328	3 800	672	5
20 years	11 749	8 130	1 564	1 498	66	4 237	2 329	3 619	617	5
21 years and over	386 371	170 315	43 729	41 869	1 860	79 248	48 338	216 056	33 366	190
Under 5 years	54 258	24 413	6 404	5 973	433	11 050	6 957	29 845	3 868	31
5 to 9 years	68 635	29 730	8 134	7 678	456	11 271	8 323	28 905	5 027	33
10 to 14 years	74 505	30 354	8 143	7 783	360	12 693	8 516	44 151	5 377	23
15 to 19 years	69 989	33 688	8 028	7 707	321	16 586	9 092	36 293	4 901	27
20 to 24 years	48 646	30 725	6 561	6 244	317	15 108	9 056	17 921	2 768	12
25 to 29 years	35 367	17 959	4 954	4 650	304	8 076	4 929	17 408	2 380	8
30 to 34 years	31 705	12 825	4 034	3 803	231	4 668	4 120	16 880	2 371	9
35 to 39 years	32 959	14 732	3 981	3 783	181	5 513	4 255	18 227	2 341	15
40 to 44 years	35 862	15 260	4 196	3 998	198	7 022	4 042	20 602	2 655	7
45 to 49 years	36 295	14 870	4 209	4 047	161	6 833	3 829	21 425	2 718	7
50 to 54 years	35 141	14 624	3 872	3 704	168	6 413	3 729	21 117	2 829	11
55 to 59 years	32 405	12 317	3 147	3 012	135	5 708	3 462	20 088	2 740	11
60 to 64 years	29 756	11 142	2 766	2 689	77	4 199	3 160	18 131	2 838	12
65 to 69 years	25 208	9 681	2 344	2 294	50	3 635	2 702	15 527	2 415	12
70 to 74 years	21 629	8 501	2 073	2 034	39	3 650	2 778	13 128	2 739	12
75 to 79 years	16 440	6 773	1 552	1 526	26	3 057	2 164	9 667	2 227	7
80 to 84 years	10 498	4 543	985	966	20	2 031	1 526	5 955	1 601	4
85 years and over	6 709	3 110	636	617	19	1 402	1 072	3 599	979	2
Under 18 years	240 920	101 620	27 317	25 825	1 492	41 768	28 535	139 300	17 086	171
62 years and over	97 359	38 977	9 198	8 996	202	11 891	11 888	58 382	12 086	60
65 years and over	80 484	32 608	7 591	7 437	154	14 945	10 072	47 876	10 361	27
Median age	27.4	24.9	25.7	25.9	22.6	24.6	24.9	30.0	34.8	
Male										
All ages	**330 033**	**142 815**	**35 810**	**34 059**	**1 751**	**65 609**	**41 396**	**187 218**	**25 764**	**161**
Under 1 year	5 666	2 661	667	622	45	1 234	760	3 005	380	1
1 year	5 460	2 434	620	578	42	1 130	684	3 029	396	1
2 years	5 253	2 312	622	580	42	1 025	665	2 941	406	1
3 years	5 397	2 364	620	572	48	1 077	667	3 033	389	1
4 years	5 808	2 538	676	633	43	1 112	750	3 270	414	1
5 years	6 350	2 798	721	673	48	1 329	748	3 552	463	1
6 years	6 824	2 928	796	752	44	1 319	813	3 896	523	1
7 years	7 204	3 128	849	815	34	1 421	856	4 076	513	1
8 years	7 200	3 047	842	787	55	1 338	867	4 153	518	1
9 years	7 374	3 015	854	812	42	1 370	851	4 359	557	1
10 years	7 802	3 273	871	834	37	1 477	925	4 529	550	1
11 years	7 340	2 942	795	762	32	1 301	845	4 398	549	1
12 years	7 586	3 109	847	807	40	1 434	828	4 477	521	1
13 years	7 488	2 946	801	759	42	1 303	842	4 542	520	1
14 years	7 738	3 055	811	771	40	1 412	832	4 683	566	1
15 years	7 592	2 929	794	754	40	1 323	812	4 663	592	1
16 years	7 406	2 881	757	728	29	1 287	762	4 525	574	1
17 years	7 373	2 862	781	735	46	1 276	781	4 513	536	1
18 years	6 950	3 673	709	683	26	1 955	1 009	3 277	464	1
19 years	6 046	4 018	609	591	18	2 209	1 200	2 028	345	1
20 years	5 663	3 787	572	547	25	1 972	1 243	1 876	319	1
21 years and over	188 578	80 135	20 201	19 285	936	36 280	23 654	108 443	15 167	91
Under 5 years	27 587	12 309	3 205	2 985	220	5 578	3 526	15 278	1 981	19
5 to 9 years	34 952	14 976	4 062	3 839	223	6 777	4 137	19 976	2 574	23
10 to 14 years	37 974	15 325	4 125	3 932	193	6 927	4 273	22 649	2 747	13
15 to 19 years	35 279	16 263	3 645	3 491	153	8 074	4 564	18 996	2 501	15
20 to 24 years	24 390	15 317	2 782	2 650	132	7 249	5 066	9 073	1 331	7
25 to 29 years	17 650	8 943	2 436	2 292	144	4 055	2 502	8 707	1 175	5
30 to 34 years	15 421	7 108	1 946	1 819	127	3 190	1 972	8 313	1 191	9
35 to 39 years	15 947	7 120	1 924	1 839	85	3 087	2 109	8 827	1 171	7
40 to 44 years	18 015	7 524	2 052	1 951	101	3 414	2 058	10 491	1 301	7
45 to 49 years	18 282	7 370	2 087	2 006	81	3 339	1 944	11 012	1 322	7
50 to 54 years	17 594	6 750	1 893	1 799	94	3 030	1 827	10 844	1 320	11
55 to 59 years	16 063	5 652	1 433	1 260	73	2 583	1 636	10 411	1 219	11
60 to 64 years	14 261	4 936	1 241	1 195	46	2 262	1 433	9 325	1 252	12
65 to 69 years	12 012	4 147	992	964	28	1 942	1 213	7 865	1 213	7
70 to 74 years	10 068	3 512	801	801	20	1 561	1 150	6 556	1 150	7
75 to 79 years	7 359	2 733	611	596	14	1 173	949	4 626	916	4
80 to 84 years	4 416	1 681	344	335	9	714	623	2 735	684	2
85 years and over	2 643	1 129	211	205	6	504	414	1 514	354	1
Under 18 years	122 768	51 202	13 719	12 973	746	23 192	14 291	71 574	8 969	97
62 years and over	44 712	16 034	3 708	3 603	105	5 158	5 168	28 678	5 051	51
65 years and over	36 518	13 202	2 979	2 901	78	5 871	4 349	23 316	4 297	27
Median age	26.4	24.1	25.2	25.3	23.2	23.6	24.1	29.4	31.6	

[For minimum base for derived figures (percent, median, etc.) and meaning of symbols, see text]

Counties	1970 population: All races Total	All races Male	All races Female	White Male	White Female	Negro Male	Negro Female	1960 population	1970 population: All races Total	All races Male	All races Female	White Male	White Female	Negro Male	Negro Female	1960 population
	DOUGLAS								**EDMUNDS**							
All ages	4 569	2 271	2 298	2 270	2 293	-	-	5 113	5 548	2 802	2 746	2 801	2 746	-	-	6 079
Under 1 year	78	46	32	46	32	-	-	113	83	40	43	40	43	-	-	144
1 year	71	36	35	36	35	-	-	104	97	46	51	46	51	-	-	148
2 years	78	40	38	40	38	-	-	118	102	49	53	49	53	-	-	128
3 years	77	44	33	44	33	-	-	129	98	50	48	50	48	-	-	129
4 years	79	42	37	42	37	-	-	124	101	50	51	50	51	-	-	144
5 years	84	44	40	44	40	-	-	133	121	59	62	59	62	-	-	136
6 years	109	53	56	53	56	-	-	115	108	57	51	57	51	-	-	150
7 years	92	44	48	44	48	-	-	130	118	54	64	54	64	-	-	140
8 years	107	59	48	59	48	-	-	117	130	65	65	65	65	-	-	125
9 years	90	51	39	51	39	-	-	113	121	69	52	69	52	-	-	131
10 years	105	46	59	46	59	-	-	113	134	67	67	67	67	-	-	141
11 years	108	67	41	67	41	-	-	122	133	67	66	67	66	-	-	134
12 years	101	57	44	57	44	-	-	134	137	70	67	70	67	-	-	129
13 years	114	57	57	57	57	-	-	105	118	57	61	57	61	-	-	134
14 years	100	57	43	57	43	-	-	102	136	75	61	75	61	-	-	122
15 years	102	55	47	55	46	-	-	95	127	67	60	67	60	-	-	110
16 years	104	59	45	59	45	-	-	109	134	65	69	65	69	-	-	131
17 years	111	58	53	58	53	-	-	113	122	69	53	69	53	-	-	102
18 years	68	34	34	34	34	-	-	63	80	43	37	43	37	-	-	74
19 years	38	16	22	16	22	-	-	49	42	28	14	28	14	-	-	58
20 years	36	13	23	13	22	-	-	43	36	19	17	19	17	-	-	47
21 years and over	2 717	1 293	1 424	1 292	1 421	-	-	2 699	3 270	1 636	1 634	1 635	1 634	-	-	3 522
Under 5 years	383	208	175	208	175	-	-	588	481	235	246	235	246	-	-	693
5 to 9 years	482	251	231	251	231	-	-	604	598	304	294	304	294	-	-	682
10 to 14 years	528	284	244	284	244	-	-	546	658	336	322	336	322	-	-	660
15 to 19 years	423	222	201	222	200	-	-	429	505	272	233	272	233	-	-	475
20 to 24 years	198	88	110	88	109	-	-	222	203	96	107	96	107	-	-	235
25 to 29 years	207	100	107	100	107	-	-	243	256	127	129	127	129	-	-	292
30 to 34 years	206	105	101	105	101	-	-	301	239	125	114	125	114	-	-	344
35 to 39 years	213	89	124	89	123	-	-	271	286	138	148	138	148	-	-	387
40 to 44 years	264	143	121	143	121	-	-	304	307	153	151	153	151	-	-	364
45 to 49 years	253	128	125	128	125	-	-	307	314	167	147	167	147	-	-	352
50 to 54 years	255	121	134	120	134	-	-	270	320	162	158	162	158	-	-	332
55 to 59 years	268	130	138	130	138	-	-	246	331	165	166	165	166	-	-	332
60 to 64 years	222	118	104	118	103	-	-	236	271	141	130	141	130	-	-	309
65 to 69 years	208	94	114	94	114	-	-	201	259	117	142	116	142	-	-	258
70 to 74 years	178	82	96	82	95	-	-	155	214	112	102	112	102	-	-	184
75 to 79 years	134	51	83	51	83	-	-	109	155	81	75	81	75	-	-	108
80 to 84 years	81	37	44	37	44	-	-	52	91	41	50	41	50	-	-	53
85 years and over	66	20	46	20	45	-	-	25	57	25	32	25	32	-	-	19
Under 18 years	1 710	915	795	915	794	-	-	2 059	2 120	1 076	1 044	1 076	1 044	-	-	2 378
62 years and over	786	347	439	347	438	-	-	683	931	459	472	457	472	-	-	807
65 years and over	567	284	283	284	282	-	-	542	777	376	401	375	401	-	-	622
Median age	31.5	29.1	34.0	29.1	34.0	-	-	28.4	31.5	31.2	31.8	31.2	31.8	-	-	30.0
	FALL RIVER								**FAULK**							
All ages	7 505	4 053	3 452	3 868	3 289	8	2	10 688	3 893	1 938	1 955	1 933	1 948	-	-	4 397
Under 1 year	77	42	35	40	33	-	-	203	64	35	29	35	29	-	-	90
1 year	81	38	43	34	37	-	-	198	72	36	36	36	35	-	-	98
2 years	85	48	37	44	33	-	-	196	47	28	19	28	19	-	-	111
3 years	104	55	49	50	47	-	-	227	59	26	33	26	33	-	-	115
4 years	98	48	50	41	44	-	-	232	69	32	37	32	37	-	-	114
5 years	101	52	49	47	46	-	-	215	69	31	38	31	38	-	-	115
6 years	124	73	51	63	46	-	-	239	79	43	36	43	36	-	-	115
7 years	115	58	57	53	53	-	-	214	86	41	45	41	45	-	-	98
8 years	108	57	51	54	47	-	-	211	96	47	49	47	49	-	-	111
9 years	118	58	60	52	54	-	-	219	98	47	51	47	51	-	-	104
10 years	124	65	59	62	52	-	-	246	83	41	42	41	42	-	-	102
11 years	132	75	57	65	54	-	-	219	91	52	39	52	38	-	-	97
12 years	119	60	59	55	54	-	-	233	95	47	48	47	47	-	-	95
13 years	155	78	77	74	75	-	-	222	107	60	47	59	47	-	-	88
14 years	144	73	71	67	65	-	-	162	115	59	56	57	55	-	-	67
15 years	148	69	79	64	76	-	-	181	94	39	55	39	55	-	-	66
16 years	147	77	70	70	65	-	-	185	90	53	37	53	37	-	-	75
17 years	153	78	75	73	73	-	-	159	90	46	44	46	44	-	-	88
18 years	70	36	34	35	34	-	-	65	62	32	30	30	30	-	-	38
19 years	61	37	24	37	23	-	-	72	32	20	12	20	12	-	-	27
20 years	61	27	34	25	34	-	-	52	23	11	12	11	12	-	-	31
21 years and over	5 180	2 849	2 331	2 751	2 243	8	2	6 717	2 272	1 112	1 160	1 110	1 157	-	-	2 552
Under 5 years	445	231	214	209	194	-	-	1 057	311	157	154	157	153	-	-	528
5 to 9 years	566	298	268	274	246	-	-	1 098	428	209	219	209	219	-	-	543
10 to 14 years	674	351	323	323	301	-	-	1 082	491	259	232	258	229	-	-	449
15 to 19 years	579	297	282	279	271	-	-	687	368	190	178	188	178	-	-	294
20 to 24 years	320	146	174	142	164	-	-	374	129	60	69	60	66	-	-	189
25 to 29 years	275	135	140	127	128	-	-	487	173	89	84	89	84	-	-	220
30 to 34 years	294	137	157	130	149	-	-	598	167	80	87	79	87	-	-	261
35 to 39 years	303	158	145	151	141	-	-	673	213	94	119	93	117	-	-	262
40 to 44 years	426	225	201	215	189	4	-	622	231	124	107	124	107	-	-	225
45 to 49 years	517	294	223	281	213	2	-	605	233	125	108	125	108	-	-	245
50 to 54 years	551	319	232	311	222	-	-	557	195	106	89	106	89	-	-	198
55 to 59 years	480	278	202	269	196	-	-	567	221	104	117	104	117	-	-	215
60 to 64 years	484	273	211	266	208	-	2	655	163	72	91	72	91	-	-	243
65 to 69 years	414	213	201	208	196	1	-	657	160	74	86	74	86	-	-	194
70 to 74 years	446	254	192	247	187	1	-	515	158	74	84	74	84	-	-	169
75 to 79 years	407	264	143	255	141	-	-	227	124	59	65	59	65	-	-	89
80 to 84 years	224	133	91	132	90	-	-	137	86	44	42	44	42	-	-	50
85 years and over	100	47	53	47	53	-	-	98	42	18	24	18	24	-	-	23
Under 18 years	2 133	1 104	[illegible]	[illegible]	955	-	-	3 762	1 504	763	741	762	737	-	-	1 749
62 years and over	[illegible]	1 059	[illegible]	[illegible]	758	[illegible]	-	2 027	673	310	363	[illegible]	[illegible]	-	-	670
65 years and over	[illegible]	[illegible]	[illegible]	589	[illegible]	[illegible]	-	1 634	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	525
Median age	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	29.4

ATLAS OF CANCER MORTALITY FOR U.S. COUNTIES: 1950-1969

by
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National Institutes of Health

Cancer Mortality Among Whites, 1950-69, by County

All Malignant Neoplasms

Percentile ranking of counties according to magnitude of the age-adjusted rates or the number of deaths

Percentile	Rates		No. of Deaths	
	Males	Females	Males	Females
10th	120.68	95.71	68	51
20th	130.64	103.11	109	84
30th	137.17	108.06	149	122
40th	142.78	112.28	196	161
50th	147.92	116.33	254	210
60th	153.07	120.15	325	282
70th	158.48	124.95	436	379
80th	166.56	129.69	637	564
90th	178.06	136.32	1357	1228
Range	44.58-248.62	37.68-373.44	2-157396	1-139313
Total U.S.	174.04	130.10	2572035	2253282

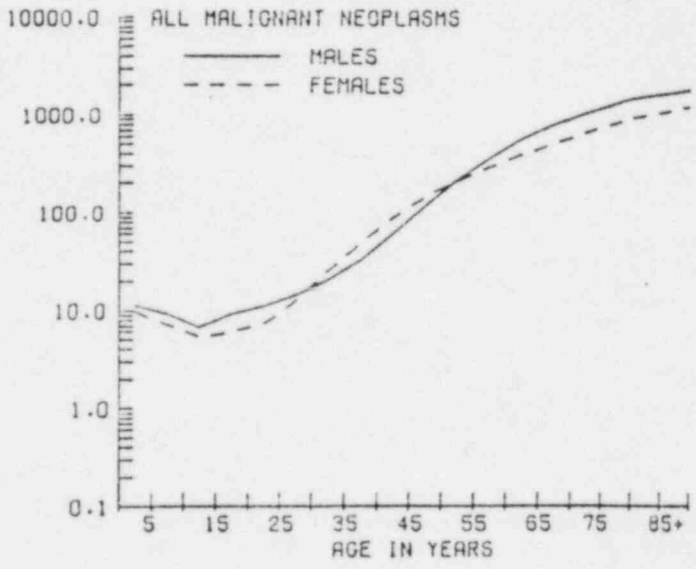
Number of counties with no deaths: Males 0 Females 0

Number of counties by mapping category

Category	No. of Counties	
	Males	Females
Signif. high, in highest decile	158	145
Signif. high, not in highest decile	0	14
In highest decile, not signif.	148	161
Not signif. different from U.S.	822	1444
Signif. lower than U.S.	1928	1292

Age-specific rates (per 100,000), U.S. whites

Age	Males	Females
0- 4	11.27	9.66
5- 9	9.07	7.04
10-14	6.75	5.35
15-19	9.34	6.12
20-24	11.25	7.39
25-29	14.52	12.75
30-34	20.72	25.39
35-39	33.60	48.72
40-44	62.09	89.30
45-49	116.16	144.60
50-54	214.16	214.00
55-59	358.95	292.52
60-64	559.46	387.33
65-69	787.99	505.30
70-74	1052.62	663.23
75-84	1454.51	935.09
85+	1798.98	1231.15



Cancer Mortality Among Whites, 1950-69, by County

Trachea, Bronchus & Lung

Percentile ranking of counties according to magnitude of the age-adjusted rates or the number of deaths

Percentile	Rates		No. of Deaths	
	Males	Females	Males	Females
10th	17.46	2.34	12	2
20th	21.37	3.32	20	3
30th	24.30	4.01	27	5
40th	27.05	4.54	36	7
50th	29.59	5.07	48	9
60th	32.30	5.61	62	12
70th	35.05	6.16	89	17
80th	38.52	6.88	138	26
90th	43.34	8.02	297	55
Range	0.00-85.81	0.00-35.88	0-35596	0-7385
Total U.S.	37.98	6.29	571226	108326

Number of counties with no deaths: Males 7 Females 123

Number of counties by mapping category

Category	No. of Counties	
	Males	Females
Signif. high, in highest decile	174	42
Signif. high, not in highest decile	44	47
In highest decile, not signif.	132	264
Not signif. different from U.S.	1167	2052
Signif. lower than U.S.	1539	651

Age-specific rates (per 100,000), U.S. whites

Age	Males	Females
0- 4	0.08	0.06
5- 9	0.03	0.02
10-14	0.04	0.03
15-19	0.08	0.06
20-24	0.22	0.11
25-29	0.51	0.23
30-34	1.95	0.74
35-39	5.67	2.06
40-44	15.04	4.72
45-49	33.43	8.39
50-54	66.66	12.50
55-59	113.21	16.84
60-64	167.49	21.08
65-69	206.52	25.71
70-74	219.25	31.87
75-84	191.28	38.62
85+	120.82	38.74