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National Cancer Institute

Skin Cancer Epidemiological Studies

I will begin this presentation by explaining that both projects listed in the program refer to the same basic mission - that is, to provide epidemiologic information relative to the potential human health effects of stratospheric ozone depletion. The NCI/EPA program provided support in two waves. The first was for a small amount of funds ($60,000) to supplement our initial, short term project entitled, Special Skin Cancer Epidemiologic Studies. The second, also a small amount ($200,000) was to initialize the long-term effort, the National Nonmelanoma Skin Cancer Study.

At the opening session, Dr. Kraybill reviewed the brief history of the NCI/EPA program. I believe it was around 1978 when funding was actually provided under this cooperative effort. But just before this program materialized the EPA and NCI were already engaged in an interagency collaborative agreement on skin cancer epidemiology. The NCI was asked to utilize its ongoing Surveillance, Epidemiology and End Results Program, usually referred to as the SEER Program, to obtain information, as soon as possible, which would reduce the degree of uncertainty in the dose-response estimates of UV related skin cancer in our country. It was recognized that the SEER locations were not necessarily the best or only places where these studies should be done, and that to monitor the trends in skin cancer incidence as well as ozone depletion, a longer term project was needed. In addition NCI was asked to prepare for field studies which would provide new measurements of solar ratiation exposure utilizing personal dosimeters, which were currently being developed by the EPA. The project presently labeled the "National Nonmelanoma Skin Cancer Study", is essentially an extension of the Special SEER study. To start us off on this

long-term effort, funding was provided to initiate studies in two new locations, San Diego, California and the combined states of New Hampshire-Vermont. The data collection phase in San Diego is just being completed, and the New Hampshire-Vermont study has just gotten underway this winter. This presentation will now deal with the progress, early findings and first analysis of the current surveys just being completed.

Slide 1 The first slide shows the locations where incidence data and UV-B measurements were obtained. Before looking at the preliminary report, a brief review of the recent history of events leading to the urgent need for skin cancer data may put this project into proper perspective. As an adjunct to NCI's Third National Cancer Survey, 1969-1971, which provided incidence data on all cancers, except nonmelanoma skin cancer, a special survey of skin cancer was conducted during the later part of 1971 and the early part of 1972. Four locations were able to participate in this study: Dallas-Ft. Worth, San Francisco-Oakland, Iowa, and Minneapolis-St. Paul. In 1973 while we were editing and reviewing the results from this study, the Department of Transportation was becoming quite concerned about the potential danger to the protective stratospheric ozone layer which may result from the excessive use of supersonic aircraft (the SST's). The DOT developed a multifaceted research program called the Climatic Impact Assessment Program (CIAP) to study the effects of the nitrogen oxides which were being emitted as exhaust gases from the SST's. Ozone depletion results in increases of solar ultraviolet radiation reaching the earth's surface, and consequently potentially greater risk for skin cancer among humans. In addition to the incidence data for these four locations, NCI collected and reported to the CIAP Program measurements of solar ultraviolet radiation reaching the earth's surface at these and other locations in the United States. By 1975, other man-made pollutants,

chlorofluoromethane gases (CFM's) which we know as "freons" used in aerosol spray cans and as refrigerants in air conditioners were discovered to be potentially much more devastating to the ozone layer than the nitrogen oxides. Soon afterward federal regulatory agencies were in great need of information on both the biological effects to plants and animals as well as the human health effects of ozone depletion. The CIAP Program had only begun to scratch the surface.

The epidemiologic information which the NCI provided from its early surveys supported the hypothesis that UV may cause skin cancer and that greater amounts of UV exposure which result from ozone depletion may lead to increased risk to skin cancer. However, most researchers agreed that much more information was needed. Not only more geographic locations but also more epidemiologic information on host factors (such as skin color and ethnicity) and environmental factors (such as lifestyle and outdoor exposure habits) would be needed to estimate the potential hazards of increased doses of solar ultraviolet radiation with greater precision. In the mid 1970's it was estimated that an eventual ozone depletion of 7 percent may be expected to occur sometime in the 21st century. Today, National Academy of Science sources indicate that a 16.5 percent ozone depletion may be expected from the continued release of chlorofluoromethanes at 1977 levels. It was also noted that a one percent decrease in ozone translates to a two percent, or a twofold increase, in solar ultraviolet radiation reaching the earth's surface. This is usually denoted as the physical amplification factor. And this factor may be greater than 2 for relative decreases in ozone greater than 10 percent.

Turning back to the map which displays the locations where UV and incidence data are available, in addition to the locations depicted on this map, we will include New Hampshire/Vermont, representing the Northeast, and San Diego, California, representing the Southwest Pacific Coast.

Slide 2 The next slide shows a schematic diagram of the electromagnetic spectrum. We are most concerned with the invisible solar ultraviolet, called UV-B. Stratospheric ozone shields the earth from high intensity wavelengths shorter than 290 nm. However, UV-B between 290 nm and 320 nm, which does reach the earth's surface in small amounts, is known to cause skin cancer in experimental animals and erythema, or sunburn, in man and is suspected of causing skin cancer in man.

Slide 3 Measurements of the amount of UV-B reaching the earth's surface are provided by Robertson-Berger meters. A count of 400 to 440 units of UV-B will produce a reddening of the skin in a typical, untanned Caucasian. The next slide shows that, in general, as latitude decreases, UV-B increases.

Slide 4 The next slide shows the added SEER locations where new estimates of annual amounts of UV-B were obtained. The open circles represent the original 10 locations obtained in 1974. The new 1977-78 UV locations are depicted by the asterisk (*) in the graph. It can be seen that the relationship between UV and latitude remains, as we have seen before. In addition to latitude dependence, we should consider altitude and sky cover as well. That is why some of the locations may not fall in line.

We will now turn to the epidemiological information on our recently collected studies dealing with basal cell and squamous cell skin cancers from these eight locations. The eight locations are in the order of increasing latitudes: New Orleans; Atlanta; Albuquerque, New Mexico; San Francisco/Oakland; Salt Lake City, Utah; Detroit; Minneapolis-St. Paul; and Seattle.

Slide 5 This slide shows the dramatic difference in the latitude dependence of skin cancer morbidity compared to all other cancers. Incidence rates for the White race only are given, since this disease is rare in other race groups. The broken line indicates a limited amount of variability in cancer risk by geographic location for "all other cancers" combined. The solid line shows that as latitude decreases, skin cancer incidence increases.

Slide 6 The next slide ranks the age-adjusted skin cancer incidence rates by sex and geographic area according to recent estimates of the annual amounts of UV-B reaching the specified locations. In Utah the Robertson-Berger meter was placed at Salt Lake City, and in New Mexico it was placed at Albuquerque. The Salt Lake City rates appear to be comparable to those for Utah State as a whole. In Albuquerque an additional adjustment was made for ethnic group. The "Anglo" rates for Albuquerque refer to Caucasians other than Latin. It should be noted that Albuquerque, while not the southernmost point in the survey, had the highest UV-B index. It is clear that the risk for males is approximately twice that for females. Utilizing these new rates we now estimate that as many as 400,000 Caucasians will develop new skin cancers each year in the United States. Compared with data from the earlier NCI survey, incidence rates appear to have increased by 15 to 20 percent over a six year period.

Slides 7-8 The next two slides show the age-specific incidence rates by geographic area for males and females. In the southern locales, the male rates appear to diverge from the female rates and show increased risk as early as age 30 (see Albuquerque, Anglo). In the Northern and Central regions (next slide) the male rates begin to depart from the female rates by age 45. This difference in age-specific risk by geographic area should be remembered when applying mathematical models to these data.

Slide 9 The next slide shows age-specific incidence by grouped anatomical site, for all geographic areas combined. Basal cell and squamous cell cancers occur most frequently on the face, head and neck. Exposed areas of the body account for about 80 percent of the malignant lesions for both men and women. The incidence for lower extremities among females is equal to or greater than that observed for males.

Slides 10-11 The next two slides summarize the most important findings to date. All available information on the annual UV-B levels, and the age-adjusted skin

cancer incidence rates are graphically displayed. The solid squares represent the results from the most recent 8-area survey and the empty squares represent results from the earlier 4-area survey. Two locations, Minneapolis-St. Paul and San Francisco-Oakland, were involved in both surveys. The UV-B indices for the 10 locations vary from a low of 101 for Seattle to a high of 197 for Albuquerque. The incidence rates for males vary from a low of 172 for Detroit to a high of 752 for Albuquerque Anglos.

An exponential, or log-linear model, was applied to the data to estimate the change in skin cancer risk due to small relative increases in ultraviolet radiation. In locales of relatively low insolation a 1 percent increase in UV-B (290nm-320nm) may result in about 1½ percent increase in skin cancer incidence (e.g., Seattle, White males); while in locales of relatively high insolation levels, skin cancer incidence may be expected to increase by more than 2 percent if UV-B levels are increased by 1 percent (e.g., Albuquerque, Anglo males). Estimates for females were somewhat (next slide) lower than those for males. At this juncture the results appear to be consistent with earlier NCI estimates of the biological amplification factor (roughly 2 to 1). The degree of uncertainty in the estimates, however, has substantially been reduced. Should these relationships hold, a one percent decrease in ozone may result in an eventual four percent increase in skin cancer incidence. A preliminary report on the nonmelanoma studies will be available for distribution, perhaps by next week. Please leave your name and address if you would like a copy

Interview Studies

In addition to the incidence studies, we conducted telephone interview surveys designed to obtain information on host factors and environmental factors which may be associated with skin cancer incidence. The information obtained from these studies will soon be incorporated into the incidence and UV exposure analyses. This should further decrease the degree of uncertainty in the dose/response estimates.

Slide 12 The next slide shows the instrument which was used. Individuals received a copy of the questionnaire in the mail, prior to responding to the telephone interview. In the patient sample, 500 patients were computer-selected for interview. Before any contact was made, the dermatologist or attending physician granted permission to make contact with the patient. The patient's free and informed consent was obtained prior to conducting the interview. In the general population sample, at least 500 Caucasian households in each location were selected through the telephone random-digit-dialing technique. Adults 20 years of age and over were selected for interviews in these households. The instrument was mailed to cooperating households and again, free and informed consent was obtained prior to conducting the telephone interview.

Slide 13 The next slide shows the number of individuals responding to the telephone interview. The overall general population response rate was between 75 and 80 percent. The patient response rates vary widely among geographic areas. In fact, the success of the patient surveys in San Francisco and New Orleans remain questionable. In New Orleans, physician cooperation was the big problem, only a 50 percent response rate was obtained. It should be mentioned, however, that once contact was made with the patient, the response rate was well over 90 percent. As you can see, there are over 10,000 interviews to evaluate.

Slides 14-22 The next series of slides will highlight preliminary findings for several host and environmental factors which have historically been associated with skin cancer morbidity. This slide (14) shows the proportions of respondents who claimed to have "fair" complexions. As expected, the patient group had a greater proportion of "fair complexioned" individuals than the general population group. Also, women apparently admitted to be more "fair" than men. We were concerned that this type of question may produce only a subjective response, and we therefore attempted to provide a more objective measure of determining

skin color by developing a skin complexion chart, which you noticed on the bottom of the instrument.

Slide 15 The next slide shows the proportions of respondents who matched the inside of their upper arms to the lighter colored skin swatches, color numbers 7 through 10. It is the inside of the upper arm which is usually untanned. Here again, it appears that the women may indeed be the fairer sex. At each location, the female proportion with light skin matches was greater than the male proportion.

Slides 16-17 The next two slides show the response to questions on eye color and hair color. Blue eyes and blond or red hair predominate among the patient groups for both sexes.

Slides 18-20 The next three slides deal with ancestry or ethnic categories. More Scottish (18) and Irish (19) people are found among the patient groups, as expected. Responses to Scandinavian ancestry were somewhat surprising. In Minneapolis-St. Paul, where the concentration of Scandinavian decents is high, the proportions of Scandinavians were lower in the patient group for both sexes.

Slide 21 The next slide shows the proportions of individuals who held outdoor jobs. The differences in proportions are clearly in the expected direction, except for New Orleans females.

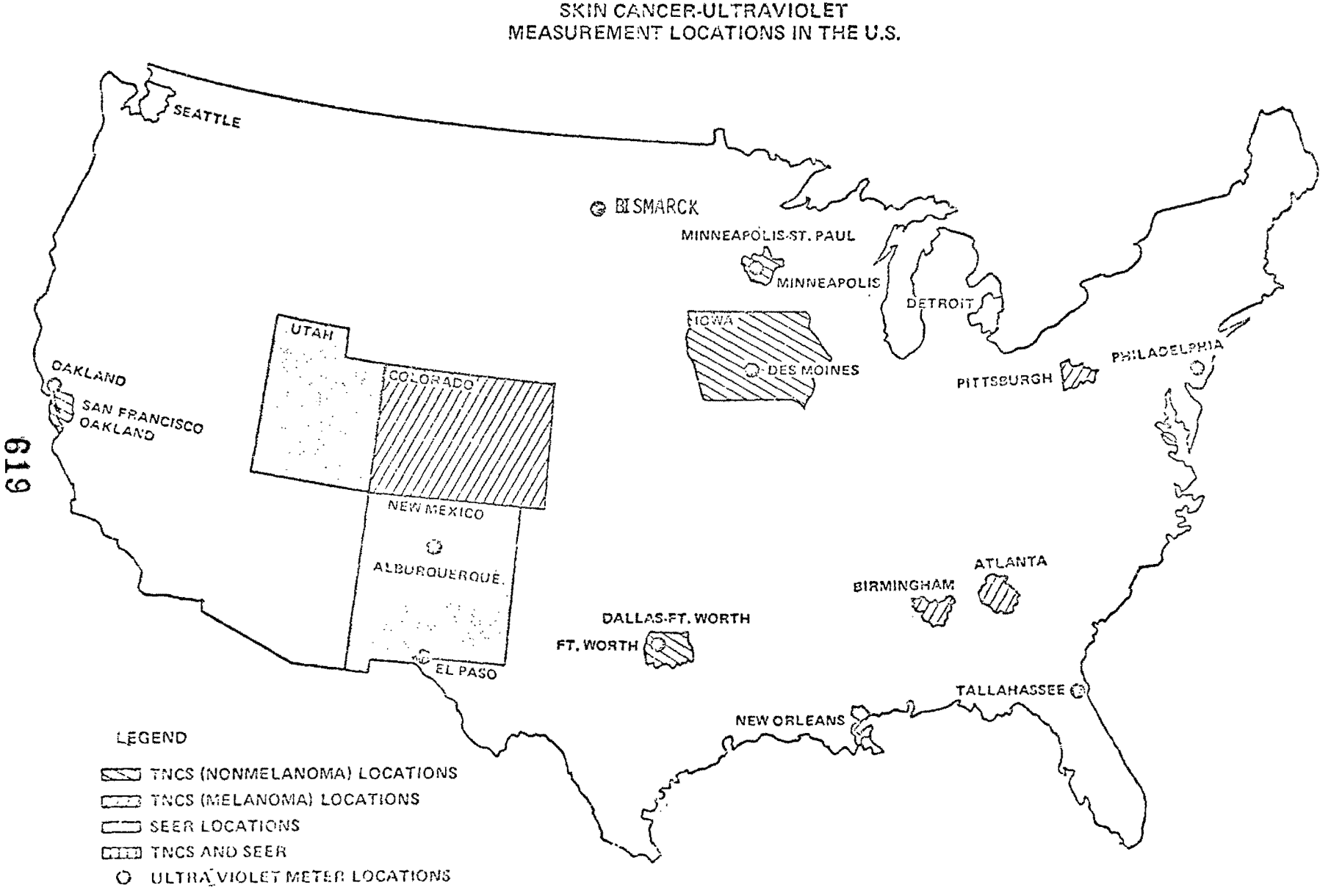
Slide 22 Finally, the last slide shows the proportions of individuals who are able to develop a deep tan. There is no question that the patient group cannot tan as easily as the general population group.

To summarize our progress to date, we are winding down on the data collection phases of this project and we are beginning to get into the thick of the analyses. We plan to provide two monographs displaying complete details and descriptions of the data probably by the end of this fiscal year. It has taken us a great deal of time to edit the information which we have received. Unlike some of the other studies that go on in the National Cancer Institute, we had the

responsibility for all of the editing procedures and developing the programs for the analysis, doing the resolution checks and actually working with the physical documents and making all kinds of comparisons by hand as well as by computer. It is very time consuming and we are glad to be getting out of this phase and getting into the thick of the analysis.

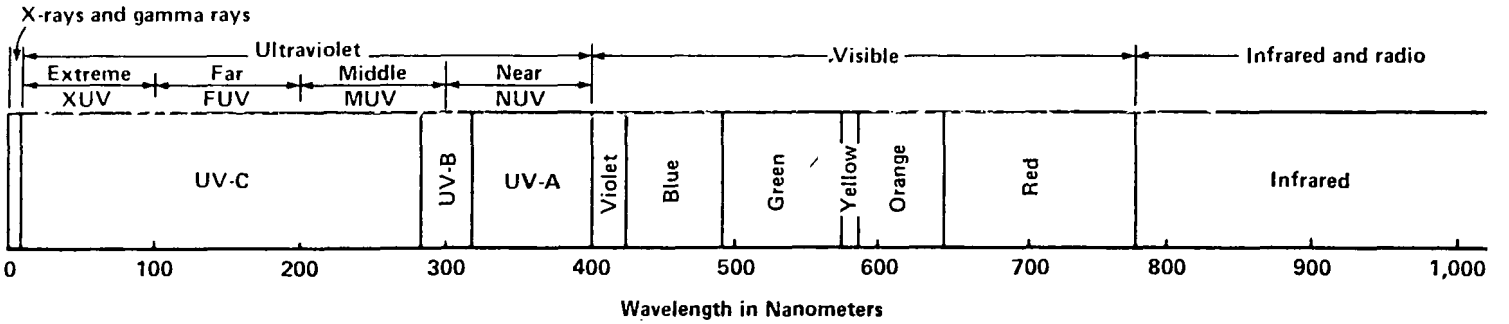
With respect to future research, more information is needed on personal dosimetry measurements, as Dr. Orme has already mentioned. But perhaps even more importantly, we should look to epidemiologic studies of skin melanoma. Most of the general relationships relative to UV-B exposure and skin cancer are also found for skin melanoma. But skin melanoma is a much more serious skin malignancy than the nonmelanomas. The nonmelanomas are 95 to 99 percent curable, whereas the malignant melanomas have a survival rate equal to that which is found for breast cancer (about 70%). The process by which UV may be involved in either the induction or promotion of skin melanoma is complex. Some of the reasons, which Dr. Orme also mentioned, are the distribution of the anatomical sites on skin melanoma patients, the trunk in the males, for example. We strongly suggest that if this long term effort is to continue, that we get the skin melanoma studies under way very soon.

Slide 1


SKIN CANCER-ULTRAVIOLET
MEASUREMENT LOCATIONS IN THE U.S.
SEATTLE
BISMARCK
MINNEAPOLIS-ST. PAUL
MINNEAPOLIS
DETROIT
PHILADELPHIA
PITTSBURGH
IOWA
DES MOINES
UTAH
COLORADO
OAKLAND
SAN FRANCISCO
OAKLAND
NEW MEXICO
ALBUQUERQUE
ATLANTA
BIRMINGHAM
DALLAS-FT. WORTH
FT. WORTH
EL PASO
TALLAHASSEE
NEW ORLEANS
LEGEND
TNCS (NONMELANOMA) LOCATIONS
TNCS (MELANOMA) LOCATIONS
SEER LOCATIONS
TNCS AND SEER
ULTRAVIOLET METER LOCATIONS

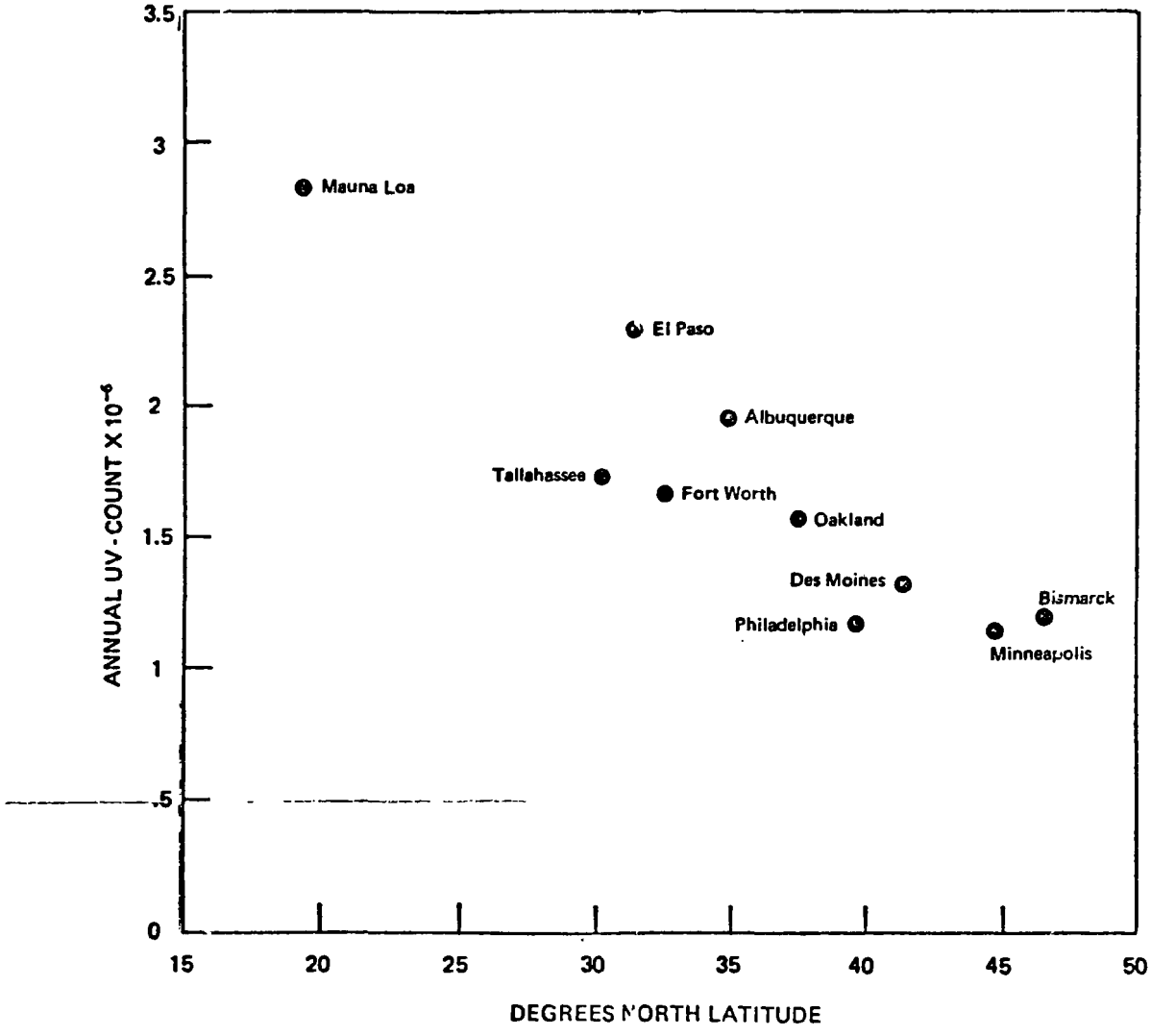
619

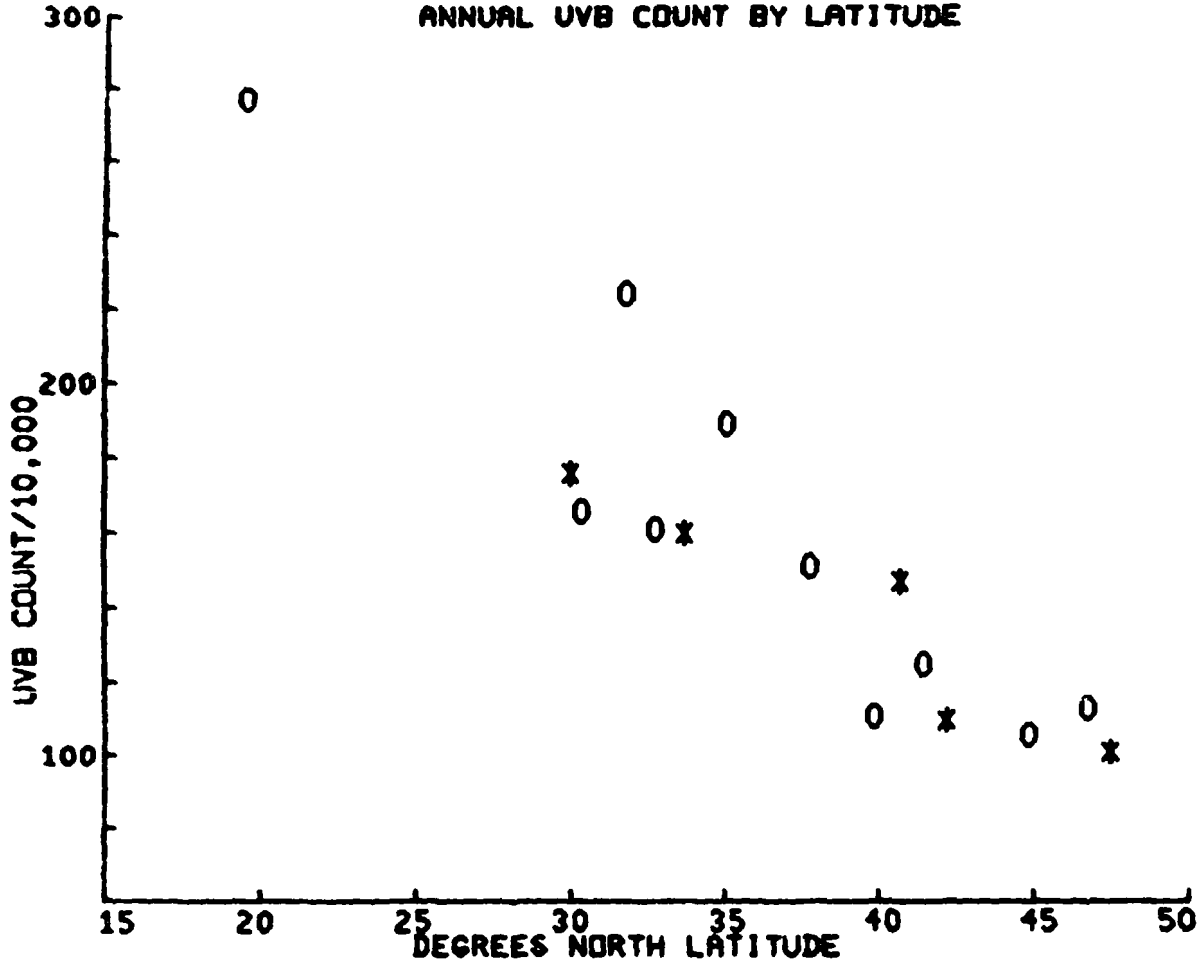
THE ELECTROMAGNETIC SPECTRUM



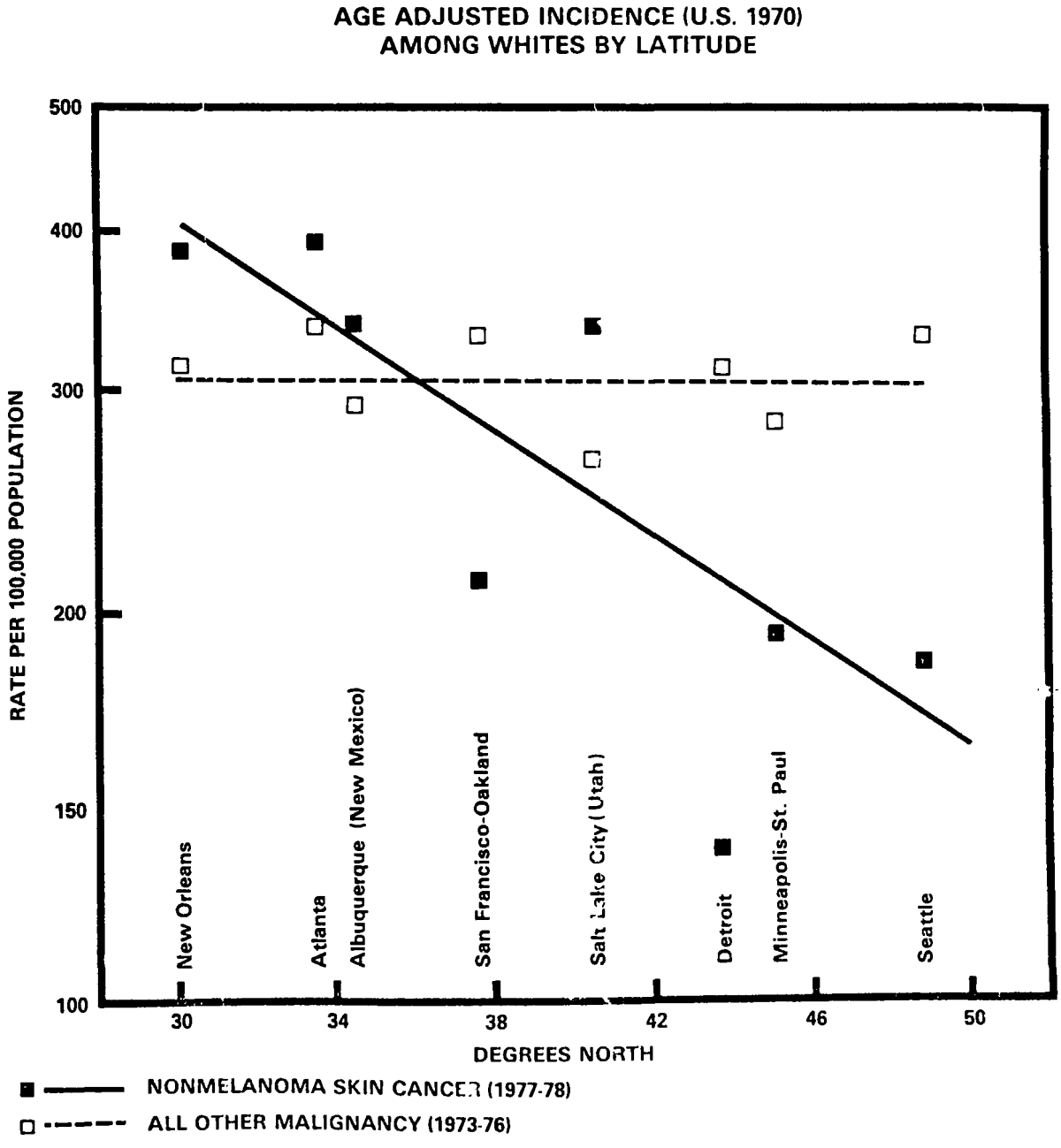
Slide 3

FIGURE 2.1. ANNUAL UV COUNT BY LATITUDE

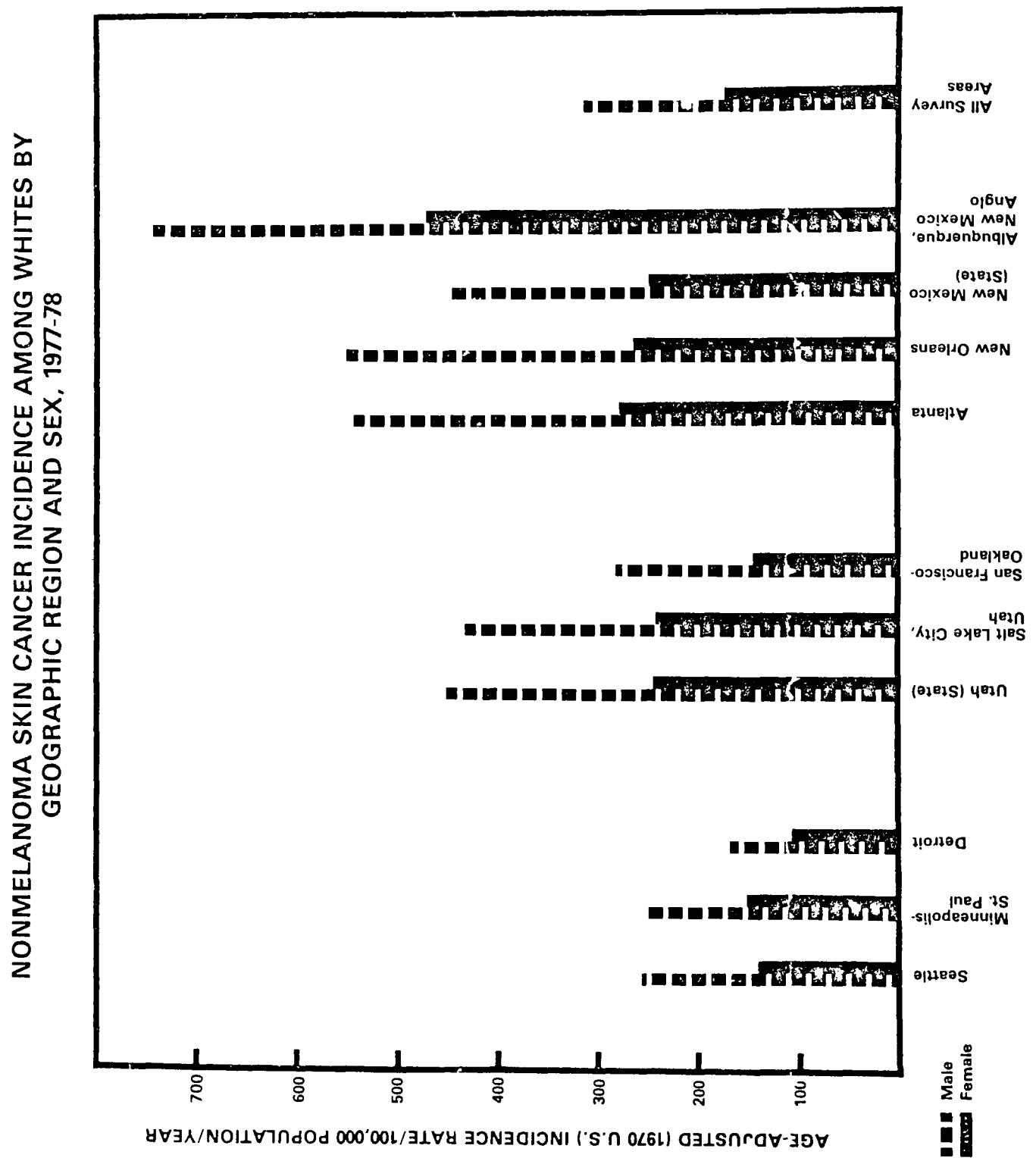



ANNUAL UVB COUNT BY LATITUDE
UVB COUNT/10,000
300
200
100
15
20
25
30
35
40
45
50
DEGREES NORTH LATITUDE

Slide 5

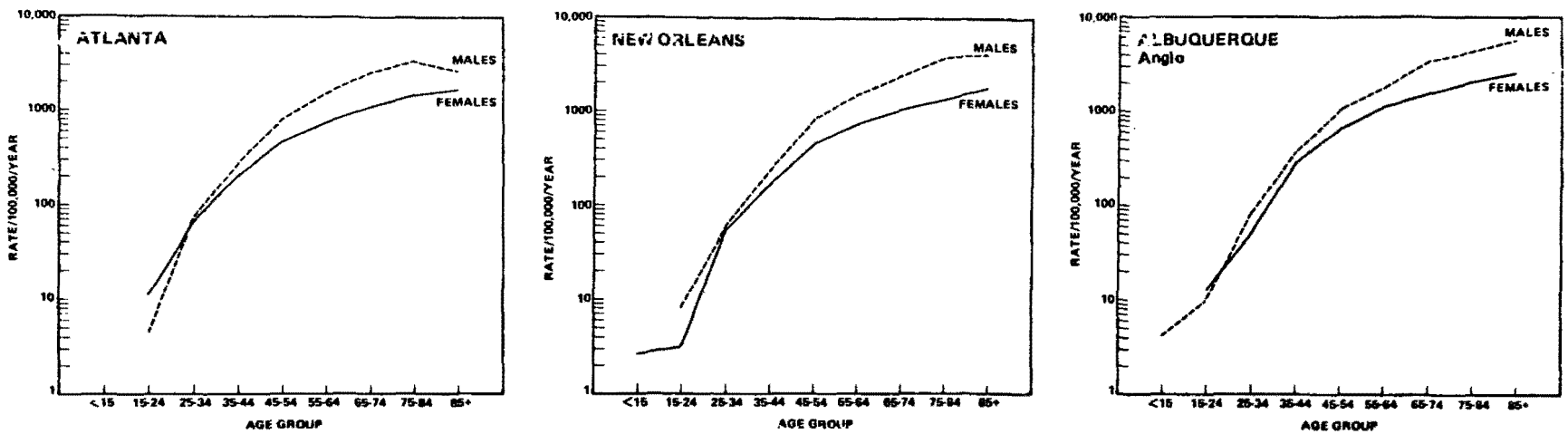

AGE ADJUSTED INCIDENCE (U.S. 1970)
AMONG WHITES BY LATITUDE
RATE PER 100,000 POPULATION
500
400
300
200
150
100
30
34
38
42
46
50
DEGREES NORTH
New Orleans
Atlanta
Albuquerque (New Mexico)
San Francisco-Oakland
Salt Lake City (Utah)
Detroit
Minneapolis-St. Paul
Seattle
NONMELANOMA SKIN CANCER (1977-78)
ALL OTHER MALIGNANCY (1973-76)

Slide 6


NONMELANOMA SKIN CANCER INCIDENCE AMONG WHITES BY GEOGRAPHIC REGION AND SEX, 1977-78
AGE-ADJUSTED (1970 U.S.) INCIDENCE RATE/100,000 POPULATION/YEAR
100
200
300
400
500
600
700
Male
Female
Seattle
Minneapolis-St. Paul
Detroit
Utah (State)
Salt Lake City, Utah
San Francisco-Oakland
Atlanta
New Orleans
New Mexico (State)
Albuquerque, New Mexico Anglo
All Survey Areas

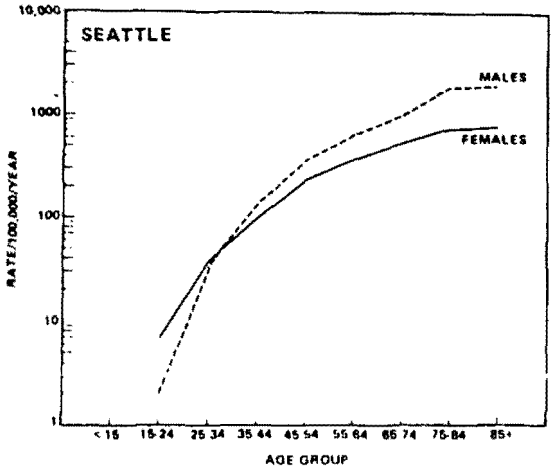
AGE-SPECIFIC NONMELANOMA SKIN CANCER INCIDENCE AMONG WHITES BY REGIONS OF THE UNITED STATES

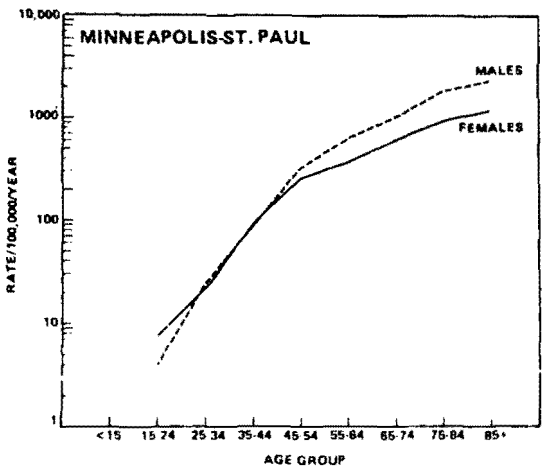
SOUTHERN REGION (LATITUDES 30-35 DEGREES NORTH)

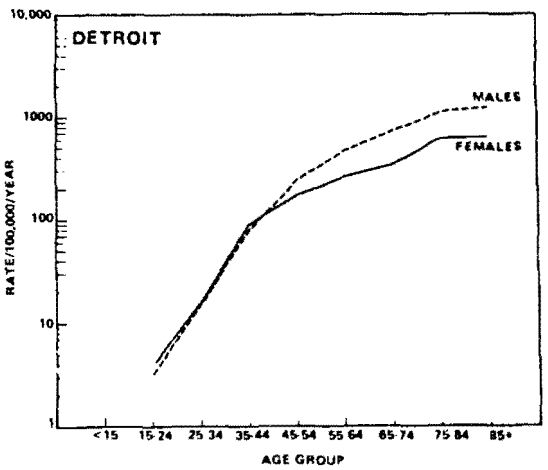


AGE-SPECIFIC NONMELANOMA SKIN CANCER INCIDENCE AMONG WHITES BY REGIONS OF THE UNITED STATES

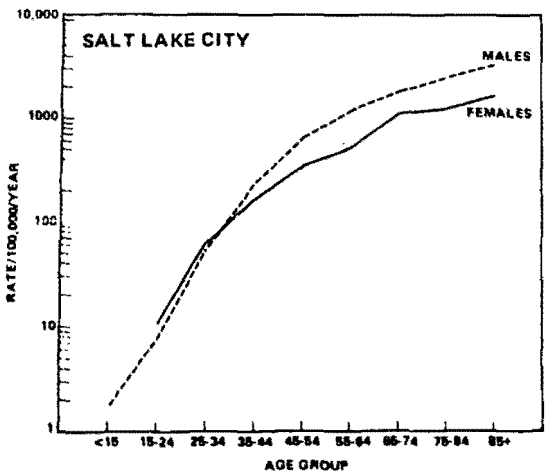
NORTHERN REGION (LATITUDES 40-50 DEGREES NORTH)

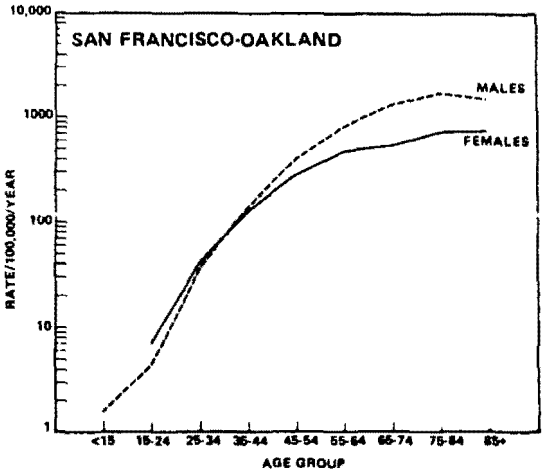






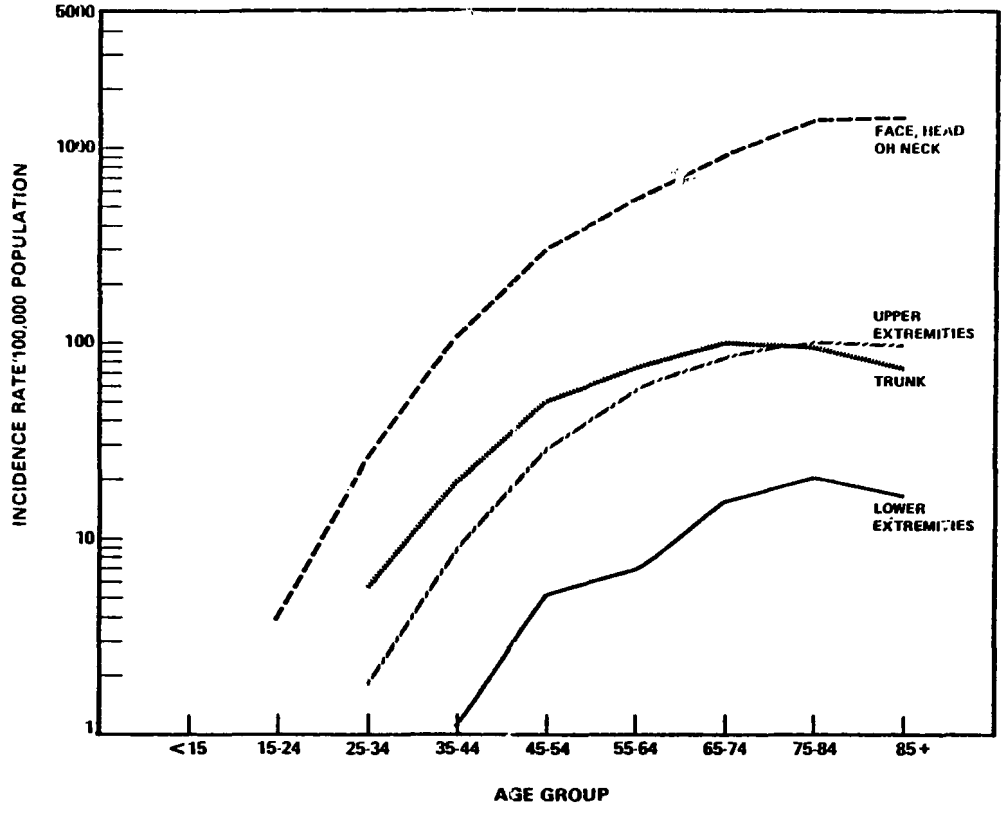
MID REGION (LATITUDES 35-40 DEGREES NORTH)



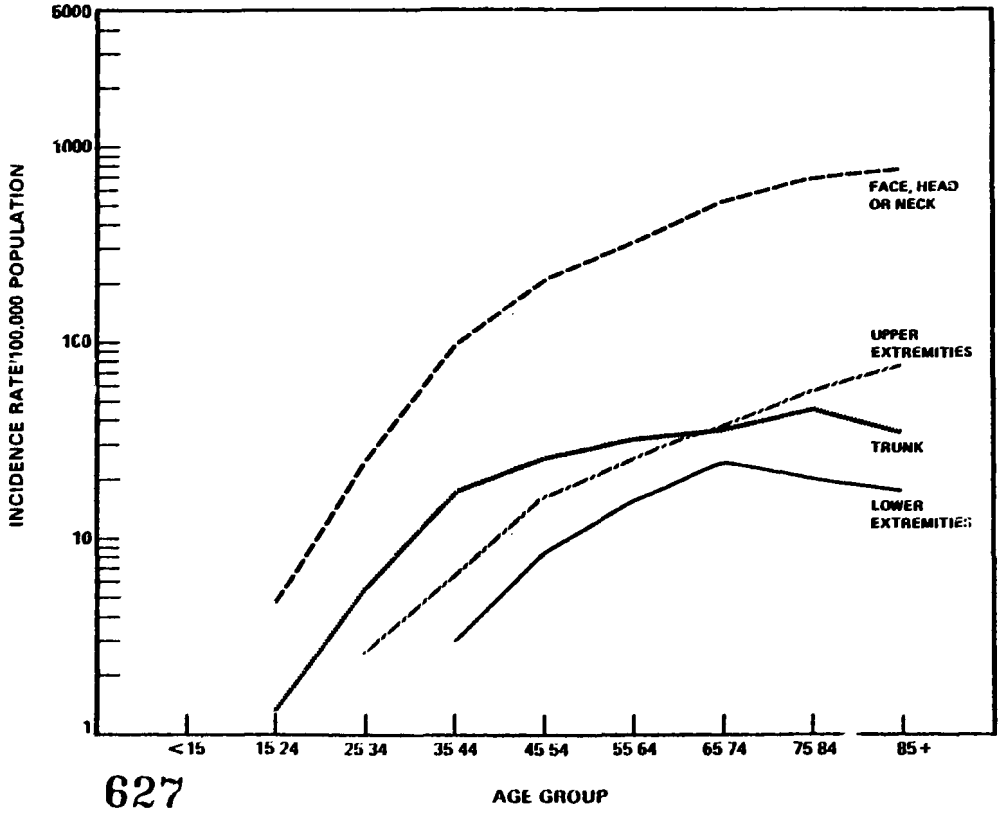


Slide 9

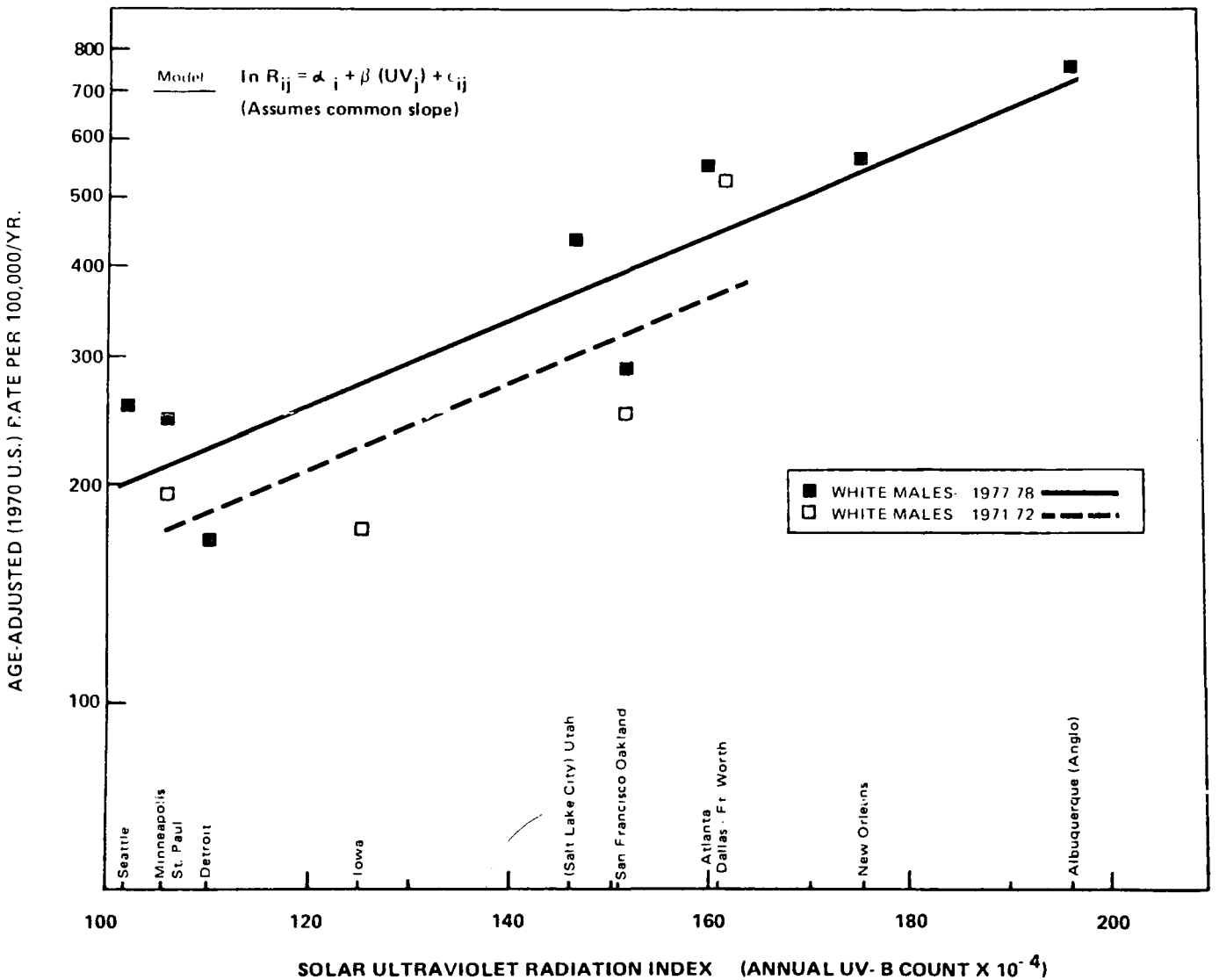
TRENDS IN ANNUAL AGE-SPECIFIC, NONMELANOMA
SKIN CANCER RATES AMONG WHITE MALES



TRENDS IN ANNUAL AGE-SPECIFIC, NONMELANOMA
SKIN CANCER RATES AMONG WHITE FEMALES

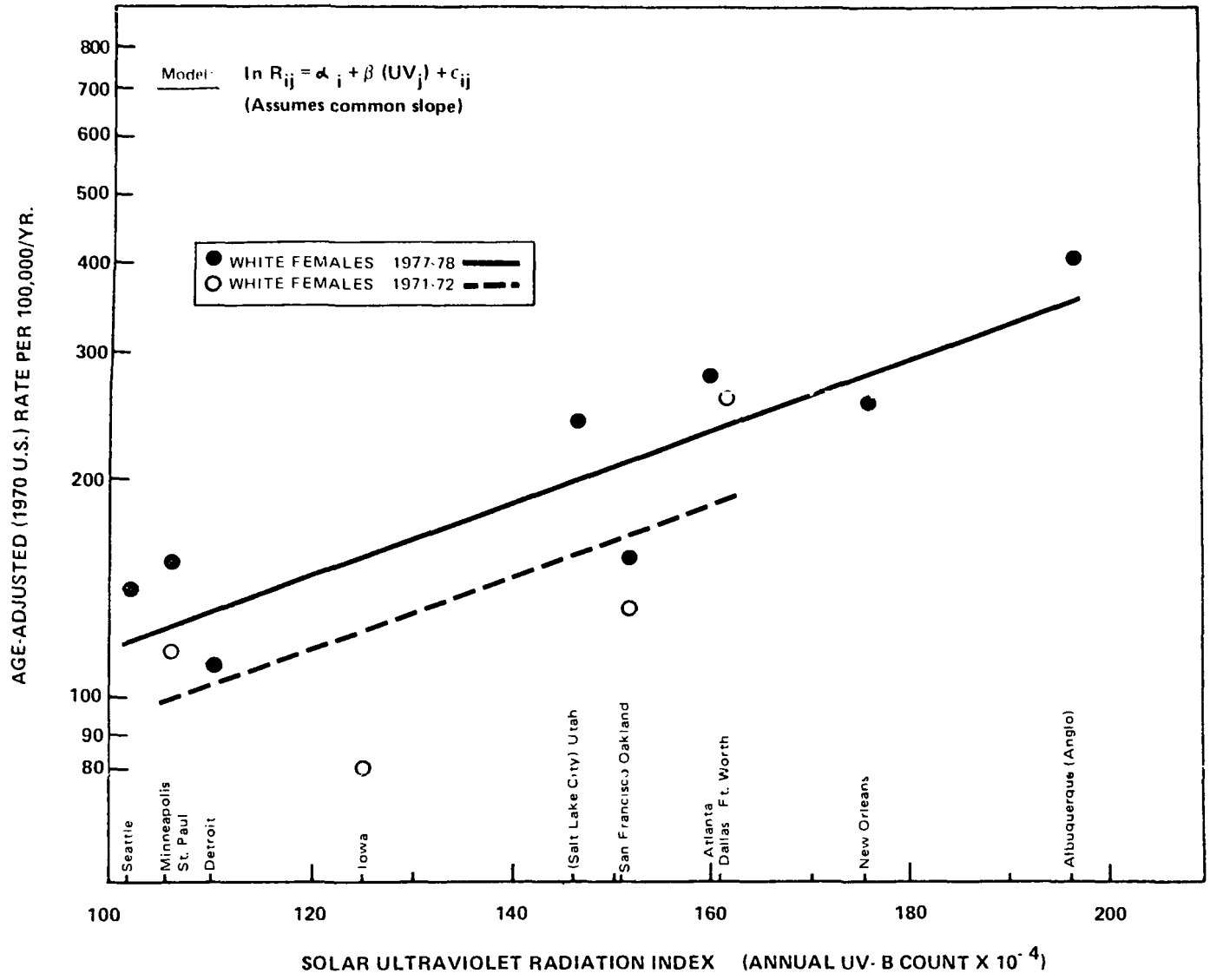


NONMELANOMA SKIN CANCER INCIDENCE AMONG WHITE MALES IN THE UNITED STATES BY GEOGRAPHIC AREA AND UV-B EXPOSURE



Slide 10

NONMELANOMA SKIN CANCER INCIDENCE AMONG WHITE FEMALES IN THE UNITED STATES BY GEOGRAPHIC AREA AND UV-B EXPOSURE



Slide 11

Slide 12 COMMUNITY HEALTH SURVEY — TELEPHONE QUESTIONNAIRE

When the Survey's interviewer telephones, the following questions will be asked:

I'm going to ask some questions about the amount of time you have spent outdoors during the summer.

1 In your early adult life (20's and 30's) during a typical summer week, how many hours per week did you spend outdoors during daylight hours on weekdays? What about during your 40's and 50's? What about since you have been 60?

2. In your early adult life (20's and 30's) during a typical summer week, how many hours per week did you spend outdoors during daylight hours on weekends? What about during your 40's and 50's? What about since you have been 60?

3. How many weeks per year do you usually vacation?

4. How many hours per week do you usually spend in the sun when you are on vacation?

5. Since age 20, during a typical summer, did you sunbathe frequently, occasionally, rarely or never?

6. When you are out in the sun do you use suntan lotions frequently, occasionally, rarely or never? What about sun screens? What about protective clothing such as long sleeve shirts or hats?

Now the next two questions will deal with your reaction to the sun without the use of suntan lotions.

7. In the summer, once you have already been in the sun several times, what reaction will your skin have the next time you go out in the sun for two or more hours on a bright day? Would you say you get no reaction, some redness only, a burn, or a painful burn?

8. After repeated sun exposures, for example, a two-week vacation outdoors, what kind of a tan will you have: Will you have practically none, a light tan, an average tan or a deep tan?

9. Do you use a sun lamp frequently, occasionally, rarely or never?

10. Have you ever worked with or been routinely exposed to oils, coal tar, pitch, radiation or radiation therapy, industrial chemicals, dusts, fumes, or arsenic? If yes, to which one(s) of these were you exposed?

11. Have you ever been treated by a doctor for any of the following skin conditions?

Dry skin	Eczema
Oily skin	Psoriasis
Acne or pimples	Warts
Moles/birthmarks	Hives
	Unusual loss of hair

12. What is the color of your eyes?

13. Do you have freckles?

14. What was your natural hair color when you were 15 years old?

Thinking back over your working lifetime:

15. What is the occupation in which you were employed the longest?

In what kind of business or industry was that? For how long?

Were you outdoors on this job frequently, occasionally, rarely, or never? How many hours was that per week?

Now I would like to ask you about any jobs you have held for more than one year at a time, since age 20, that required you to be outdoors for two or more hours per day.

16. Would you start by telling me about those jobs you had during your 20's? How many years did you hold that job? How many hours per day were you outdoors on that job?

17. Have you lived in this State most of your lifetime? If no, where did you live most of your lifetime?

18. In what countries were your four grandparents born?

19. To which of the following ancestral groups do you consider yourself to belong? You may answer more than one:

English/Welsh	Russian	Greek
Scot	Other Slavic	American Indian
German	French	Asian
Irish	Italian	African
Scandinavian	Spanish	Middle Eastern
Polish	Mexican	Other

20. Please look at the color chart on the bottom of the questionnaire and tell me which color matches your skin complexion best. Match the chart against the inside of your upper arm, (the portion that is not exposed to the sun). Please give me the number above the color. How closely does your choice match your skin color? (exactly, fairly closely, not very closely) Is the color chart lighter or darker? What do you consider your complexion to be? (fair, medium, dark)

SKIN COMPLEXION CHART

1	2	3	4	5	6	7	8	9	10

EXPIRES 6/30/78

68-S 77038

NIH-2368-3

Slide 13

NCI/EPA Skin Cancer Sample Survey

No. of Individuals Responding to Telephone Questionnaire

	PATIENTS	GENERAL POPULATION
Seattle	343	743
Minneapolis-St. Paul	443	1143
Detroit	374	829
Utah	347	899
San Francisco-Oakland	274	1075
Atlanta	399	793
New Orleans	251	778
New Mexico	421	1219
TOTAL	2852	7479

Slide 14

SKIN CANCER EPIDEMIOLOGY - White Males * All Ages

UV-B Count $\times 10^{-4}$		Complexion Proportion "Fair" PATIENT Prop.	S.D.	GENERAL POPULATION Prop.	S.D.
101	Seattle	.662	(.035)	.415	(.028)
106	Minneapolis-St. Paul	.611	(.032)	.423	(.022)
110	Detroit	.656	(.033)	.355	(.026)
147	Utah	.604	(.035)	.357	(.023)
151	San Francisco-Oakland	.688	(.036)	.416	(.024)
160	Atlanta	.613	(.031)	.332	(.023)
176	New Orleans	.690	(.041)	.376	(.028)
197	New Mexico	.631	(.032)	.341	(.024)

SKIN CANCER EPIDEMIOLOGY - White Females * All Ages

UV-B Count $\times 10^{-4}$		Complexion Proportion "Fair" PATIENT Prop.	S.D.	GENERAL POPULATION Prop.	S.D.
101	Seattle	.666	(.040)	.562	(.028)
106	Minneapolis-St. Paul	.574	(.035)	.514	(.019)
110	Detroit	.568	(.040)	.525	(.023)
147	Utah	.628	(.041)	.482	(.023)
151	San Francisco-Oakland	.659	(.049)	.518	(.020)
160	Atlanta	.610	(.040)	.474	(.026)
176	New Orleans	.633	(.049)	.501	(.029)
197	New Mexico	.650	(.037)	.418	(.021)

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WHITE MALES

		Skin Color No. & Meter-Reading Color Number 7-10			
		PATIENT		GENERAL POPULATION	
		Prop.	S.D.	Prop.	S.D.
101	Seattle	.848	(.027)	.691	(.031)
106	Minneapolis-St. Paul	.831	(.025)	.669	(.022)
110	Detroit	.843	(.025)	.650	(.022)
147	Utah	.803	(.029)	.642	(.025)
151	San Francisco-Oakland	.773	(.033)	.664	(.021)
160	Atlanta	.841	(.023)	.594	(.033)
176	New Orleans	.774	(.036)	.535	(.030)
197	New Mexico	.845	(.024)	.549	(.027)

WHITE FEMALES

		Skin Color No. & Meter Reading Color Number 7-10			
		PATIENT		GENERAL POPULATION	
		Prop.	S.D.	Prop.	S.D.
101	Seattle	.893	(.026)	.835	(.020)
106	Minneapolis-St. Paul	.851	(.026)	.792	(.019)
110	Detroit	.871	(.028)	.835	(.020)
147	Utah	.918	(.022)	.747	(.022)
151	San Francisco-Oakland	.891	(.031)	.771	(.021)
160	Atlanta	.839	(.030)	.727	(.022)
176	New Orleans	.820	(.039)	.681	(.025)
197	New Mexico	.864	(.027)	.642	(.022)

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SKIN CANCER EPIDEMIOLOGY - White Males * All Ages

UV-B Count $\times 10^{-4}$		Eye Color Proportion BLUE EYES PATIENT Prop.	S.D.	GENERAL POPULATION Prop.	S.D.
101	Seattle	.562	(.036)	.462	(.029)
106	Minneapolis-St. Paul	.523	(.033)	.441	(.023)
110	Detroit	.510	(.034)	.365	(.023)
147	Utah	.491	(.036)	.464	(.026)
151	San Francisco-Oakland	.530	(.039)	.352	(.022)
160	Atlanta	.463	(.032)	.423	(.028)
176	New Orleans	.353	(.041)	.293	(.024)
197	New Mexico	.417	(.032)	.304	(.020)

SKIN CANCER EPIDEMIOLOGY - White Females * All Ages

UV-B Count $\times 10^{-4}$		Eye Color Proportion BLUE EYES PATIENT Prop.	S.D.	GENERAL POPULATION Prop.	S.D.
101	Seattle	.519	(.042)	.395	(.027)
106	Minneapolis-St. Paul	.413	(.035)	.429	(.021)
110	Detroit	.394	(.040)	.331	(.024)
147	Utah	.388	(.041)	.336	(.022)
151	San Francisco-Oakland	.435	(.051)	.297	(.023)
160	Atlanta	.448	(.041)	.365	(.026)
176	New Orleans	.371	(.047)	.271	(.022)
197	New Mexico	.434	(.038)	.250	(.020)

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SKIN CANCER EPIDEMIOLOGY - White Males * All Ages

UV-B Count $\times 10^{-4}$		Hair Color Proportion Red or Blond			
		PATIENT		GENERAL POPULATION	
		Prop.	S.D.	Prop.	S.D.
101	Seattle	.313	(.034)	.235	(.027)
106	Minneapolis-St. Paul	.299	(.030)	.272	(.020)
110	Detroit	.346	(.033)	.174	(.020)
147	Utah	.329	(.034)	.276	(.022)
151	San Francisco-Oakland	.326	(.036)	.238	(.021)
160	Atlanta	.296	(.030)	.218	(.024)
176	New Orleans	.382	(.041)	.226	(.022)
197	New Mexico	.303	(.030)	.188	(.019)

SKIN CANCER EPIDEMIOLOGY - White Females * All Ages

UV-B Count $\times 10^{-4}$		Hair Color Proportion Red or Blond			
		PATIENT		GENERAL POPULATION	
		Prop.	S.D.	Prop.	S.D.
101	Seattle	.378	(.040)	.350	(.026)
106	Minneapolis-St. Paul	.392	(.035)	.312	(.023)
110	Detroit	.368	(.040)	.316	(.024)
147	Utah	.416	(.041)	.310	(.021)
151	San Francisco-Oakland	.309	(.048)	.299	(.021)
160	Atlanta	.436	(.041)	.294	(.022)
176	New Orleans	.399	(.048)	.313	(.021)
197	New Mexico	.413	(.038)	.260	(.020)

Slide 18 WHITE MALES

Scotch

		PATIENT		GENERAL POPULATION	
		Prop.	S.D.	Prop.	S.D.
101	Seattle	.328	(.035)	.202	(.024)
106	Minneapolis-St. Paul	.130	(.022)	.112	(.014)
110	Detroit	.202	(.028)	.139	(.022)
147	Utah	.309	(.033)	.220	(.021)
151	San Francisco-Oakland	.296	(.035)	.187	(.016)
160	Atlanta	.370	(.032)	.223	(.025)
176	New Orleans	.183	(.033)	.105	(.017)
197	New Mexico	.329	(.031)	.176	(.018)

WHITE FEMALES

Scotch

		PATIENT		GENERAL POPULATION	
		Prop.	S.D.	Prop.	S.D.
101	Seattle	.280	(.037)	.233	(.024)
106	Minneapolis-St. Paul	.191	(.028)	.087	(.011)
110	Detroit	.223	(.034)	.142	(.018)
147	Utah	.316	(.039)	.198	(.021)
151	San Francisco-Oakland	.372	(.050)	.199	(.020)
160	Atlanta	.355	(.040)	.244	(.022)
176	New Orleans	.196	(.039)	.133	(.018)
197	New Mexico	.379	(.038)	.157	(.015)

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WHITE MALES

Irish

		PATIENT		GENERAL POPULATION	
		Prop.	S.D.	Prop.	S.D.
101	Seattle	.419	(.036)	.334	(.025)
106	Minneapolis-St. Paul	.298	(.030)	.245	(.020)
110	Detroit	.338	(.032)	.258	(.021)
147	Utah	.198	(.029)	.202	(.021)
151	San Francisco-Oakland	.509	(.039)	.316	(.021)
160	Atlanta	.462	(.032)	.393	(.030)
176	New Orleans	.449	(.043)	.321	(.024)
197	New Mexico	.538	(.033)	.325	(.027)

WHITE FEMALES

Irish

		PATIENT		GENERAL POPULATION	
		Prop.	S.D.	Prop.	S.D.
101	Seattle	.478	(.04')	.363	(.027)
106	Minneapolis-St. Paul	.307	(.033)	.270	(.019)
110	Detroit	.422	(.040)	.326	(.026)
147	Utah	.291	(.033)	.229	(.021)
151	San Francisco-Oakland	.433	(.051)	.350	(.023)
160	Atlanta	.578	(.041)	.478	(.026)
176	New Orleans	.486	(.049)	.390	(.025)
197	New Mexico	.594	(.038)	.370	(.023)

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SKIN CANCER EPIDEMIOLOGY - White Males * All Ages

UV-B Count $\times 10^{-4}$		Scandinavian PATIENT Prop.	S.D.	GENERAL POPULATION Prop.	S.D.
101	Seattle	.179	(.028)	.281	(.025)
106	Minneapolis-St. Paul	.348	(.031)	.424	(.024)
110	Detroit	.072	(.018)	.050	(.013)
147	Utah	.322	(.034)	.273	(.024)
151	San Francisco-Oakland	.165	(.029)	.125	(.015)
160	Atlanta	.035	(.012)	.043	(.011)
176	New Orleans	.035	(.016)	.029	(.009)
197	New Mexico	.080	(.018)	.050	(.010)

SKIN CANCER EPIDEMIOLOGY - White Females * All Ages

UV-B Count $\times 10^{-4}$		Scandinavian PATIENT Prop.	S.D.	GENERAL POPULATION Prop.	S.D.
101	Seattle	.215	(.034)	.279	(.025)
106	Minneapolis-St. Paul	.372	(.035)	.401	(.018)
110	Detroit	.056	(.018)	.052	(.011)
147	Utah	.339	(.040)	.341	(.021)
151	San Francisco-Oakland	.095	(.030)	.149	(.017)
160	Atlanta	.026	(.013)	.040	(.010)
176	New Orleans	.020	(.014)	.045	(.010)
197	New Mexico	.074	(.020)	.069	(.011)

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SKIN CANCER EPIDEMIOLOGY - White Males * All Ages

UV-B Count $\times 10^{-4}$		Held an Outdoor Job Proportion "Yes" PATIENT Prop.	S.D.	GENERAL POPULATION Prop.	S.D.
101	Seattle	.702	(.033)	.495	(.027)
106	Minneapolis-St. Paul	.666	(.031)	.459	(.025)
110	Detroit	.597	(.034)	.478	(.026)
147	Utah	.833	(.026)	.578	(.024)
151	San Francisco-Oakland	.745	(.034)	.519	(.025)
160	Atlanta	.664	(.030)	.478	(.027)
176	New Orleans	.567	(.043)	.554	(.027)
197	New Mexico	.773	(.027)	.593	(.029)

SKIN CANCER EPIDEMIOLOGY - White Females * All Ages

UV-B Count $\times 10^{-4}$		Held an Outdoor Job Proportion "Yes" PATIENT Prop.	S.D.	GENERAL POPULATION Prop.	S.D.
101	Seattle	.241	(.036)	.165	(.018)
106	Minneapolis-St. Paul	.167	(.027)	.087	(.013)
110	Detroit	.297	(.037)	.133	(.018)
147	Utah	.285	(.038)	.188	(.020)
151	San Francisco-Oakland	.182	(.040)	.141	(.017)
160	Atlanta	.164	(.031)	.085	(.014)
176	New Orleans	.076	(.026)	.124	(.017)
197	New Mexico	.298	(.035)	.166	(.020)

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SKIN CANCER EPIDEMIOLOGY - White Males * All Ages

UV-B Count $\times 10^{-4}$		Type of Tan Proportion Deep Tan			
		PATIENT		GENERAL POPULATION	
		Prop.	S.D.	Prop.	S.D.
101	Seattle	.196	(.029)	.352	(.028)
106	Minneapolis-St. Paul	.223	(.027)	.359	(.022)
110	Detroit	.173	(.026)	.404	(.026)
147	Utah	.211	(.030)	.362	(.027)
151	San Francisco-Oakland	.179	(.030)	.391	(.019)
160	Atlanta	.197	(.026)	.391	(.030)
176	New Orleans	.155	(.031)	.387	(.026)
197	New Mexico	.214	(.027)	.410	(.027)

SKIN CANCER EPIDEMIOLOGY - White Females * All Ages

UV-B Count $\times 10^{-4}$		Type of Tan Proportion Deep Tan			
		PATIENT		GENERAL POPULATION	
		Prop.	S.D.	Prop.	S.D.
101	Seattle	.135	(.028)	.235	(.023)
106	Minneapolis-St. Paul	.190	(.028)	.219	(.017)
110	Detroit	.178	(.031)	.260	(.024)
147	Utah	.170	(.028)	.231	(.021)
151	San Francisco-Oakland	.183	(.040)	.275	(.019)
160	Atlanta	.138	(.028)	.271	(.021)
176	New Orleans	.129	(.035)	.213	(.022)
197	New Mexico	.156	(.028)	.278	(.019)

Dr. Kelsey, NCI: Have you included any data on people who use sunscreens, for example?

Mr. Scotto, NCI: Yes. We ask the question whether they use a sunscreen, as you may have seen in the slide. We have gotten very little information on that. I do not think that the general population understood what a sunscreen was, but the patient group, as expected, had a higher proportion. They did admit to using or even knowing about sunscreens.

Dr. Cameron, NCI: I had two questions, but I think you have already answered the first one just in the last few moments. The reason for rationale for breaking out the melanoma from the other skin cancers is the fact that it does not necessarily appear in the exposed portions of the skin, is that correct?

Mr. Scotto, NCI: The reason for breaking out?

Dr. Cameron, NCI: Yes, for separating the melanomas from other skin cancer.

Mr. Scotto, NCI: One reason for separating these studies is that melanoma is a malignancy which is routinely reported to the SEER program, which the NCI also conducts and monitors. But SEER does not uniformly collect incidence information on non-melanoma. The reason for this is that the basal cell and squamous cell carcinomas of the skin are usually treated in the physicians's office or as an out-patient. We have to canvass doctor's office to access their records, a more tedious kind of study. The information on the other malignancies is pretty much complete and available in the hospital chart records. Another reason is, as I indicated earlier, that the process by which UV relates to either the induction or the promotion of skin melanoma appears to be different from the skin cancer. I think Dr. Orme mentioned that the reasons why we want to get at personal dosimetry information is because we want to measure something about a short-period, and to see if we could measure the effects of various modes of exposure. Mathematical models applied to the various skin malignancy data indicate that the process involving UV may be different for skin melanoma and skin cancer.

Dr. Kelsey, NCI: My second question is has anybody approached the reason for the difference or variance in physician cooperation?

Mr. Scotto, NCI: There is usually a variance of physician cooperation in most studies. Epidemiological studies are usually difficult in the South, where the tendency has been to not get involved with federal projects. Our contractors in each of the locations were local universities, health groups and cancer registries. That was the beauty of attaching to an existing program. The SEER program had already established the cooperation from the medical community. Physicians are not reluctant to provide medical records. However, obtaining permission to contact the patient for additional epidemiological information was difficult in some locations.

Dr. Orme, NCI: I was not aware that the personal dosimeter was tied into your program. I think that is a major incentive to prod the Boston group.

Mr. Scotto, NCI: We have been waiting. The information on the personal dosimeter was supposed to come to us eventually. Drs. Forziatti and DeFabo, who had earlier

represented the EPA on this NCI/EPA project, had hoped that we could set up some field tests for personal dosimeters. I have talked to Dr. Davidson and the people who are developing the personal dosimeters and one of the reasons we were getting into the new locations was not only to obtain more needed epidemiologic information from northern and southern locations and to explore some of the leads on these epidemiological factors, but also to be able and ready to conduct the field studies. From what you said, it sounds like when Boston is finished developing and evaluating the physical measuring device, we will probably be out of funds and out of the new locations where studies have recently been implemented.

Dr. Orme, NCI: Right. That is what I am asking.

Mr. Scotto, NCI: We are going to run out of funds by the end of this year.

Dr. Orme, NCI: Would the film badge type of thing, even in the developmental stage, be useful to you now?

Mr. Scotto, NCI: Yes. I would recommend that whatever you do on it, first of all you should, before we do anything as you indicated, make sure we make all the laboratory tests to see what kind of variability we are stuck with and to see how useful such a thing would be, before we conduct field studies. I suggest and recommend that you do these in locations where we already have epidemiological information on skin cancer and where we already have UV measurements such as from the Robertson-Berger meter, especially if you are going to use the personal dosimeter device which was calibrated to the R-B meter.

Dr. Orme, NCI: Well, I am more optimistic about a continuation of this than perhaps you are at this stage.

Mr. Scotto, NCI: Right now, by the way, is a good time. The study is going on in New Hampshire/Vermont, which is real close to Boston.

Dr. Orme, NCI: Well, I will definitely get back to Herb Wiser about this to see if we can coordinate it a little more closely. The other question I had was, you mentioned that the incidence rate has gone up from 300,000 in an earlier estimate to 400,000. Now, I was not sure that you were suggesting that that was real change in incidence or is that an improvement in your methodology? Are you saying that that is actually correlated with real decreases in ozone?

Mr. Scotto, NCI: No, I cannot say that that is correlated with real decreases in ozone. With respect to the measurements of the ultraviolet radiation reaching the earth's surface over time, we hardly see any trends during the short period we have been obtaining measurements. So, I cannot say that there has been a substantial, or any notable, increase in UV, or decrease in ozone. The estimate of the biological amplification factor is better because of the added locations. After making adjustments for the time of the year in which the studies were conducted in San Francisco and Minneapolis-St. Paul the indications are that there has been a 15 to 20% increase in skin cancer over the six year period from 1972 to 1978. These increases are mainly observed for basal cell carcinomas of the skin. Hardly any increase was noted for squamous cell carcinomas.

Dr. Orme, NCI: If in fact the Robertson-Berger meters over this same period are giving us generally a steady reading, I am just wondering whether we should take into consideration the possibility of a chemical UV interaction in some of these areas.

Mr. Scotto, NCI: I thought some of you were doing that.

Dr. Orme, NCI: We are doing it experimentally.

Mr. Scotto, NCI: I have not gotten that far into the human studies.

Dr. Orme, NCI: The third question I had was the relationship between susceptibility to skin cancer and fair skin, which we have toyed with in a lot of ways. This is obviously an over-simplification of things. I was just going to point out some of these things. We have looked at a number of different strains of albino mice, for instance, and measured the susceptibility. These were hairless albino mice and they still showed a wide spectrum of ranges of susceptibility. So there are obviously many factors contributing to that variation.

NIOSH

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PROGRESS ON JOINT ENVIRONMENTAL AND
OCCUPATIONAL CANCER STUDIES

MAY 6-8, 1980

SHERATON/POTOMAC, ROCKVILLE, MARYLAND

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