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HUMAN  
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Dioxin  
2,4,5-T

Evaluation of Soft and Connective Tissue Cancer Mortality Rates  
for  
Midland and Other Selected Michigan Counties  
Compared Nationally and Statewide

MICHIGAN DEPARTMENT OF PUBLIC HEALTH

May 4, 1983

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## EXECUTIVE SUMMARY

Investigation of an apparent elevation in mortality from soft and connective tissue cancers in Midland County was conducted by the Michigan Department of Public Health and Midland County Health Department. National and Michigan mortality rates were reviewed. County specific standard mortality ratios were constructed for Michigan counties. Age and sex distribution were explored. The impact of ICDA coding changes was examined. The death certificates and hospital records for cases from Midland County were reviewed and interviews with next of kin were conducted to obtain details of location and length of residence in Midland County and occupational histories of the deceased and their spouses. The hypothesis that TCDD and/or other chemicals contaminating the environment were the cause of the elevation in mortality was also explored.

### Conclusions

1. The overall crude cancer mortality rate for Midland County for the period 1970-1979 was 120.2 as compared to a State of Michigan rate of 159.4.

The age adjusted cancer mortality rate for Midland County for the period 1970-1979 was 148.2 with a standard mortality ratio of 0.929. For white males the adjusted rate was 170.1 and the standard mortality ratio 0.944. For white females the figures were 139.2 and 0.975.

Age adjusted cancer mortality rates for all cancers combined for Midland County for all persons, white males and white females, were below the State of Michigan rates for this time period.

2. Mortality rates from soft and connective tissue cancers among white females from Midland County were confirmed to be 3.8 and 4.0 times the national average for the periods of 1960-1969 and 1970-1978, respectively. The rates were 2.3 per hundred thousand population in the period 1960-1969 (5 deaths), and 2.8 for the 1970-1978 period (7 deaths).
3. While the statistically significant excess in soft and connective tissue cancers in white females from Midland County may have resulted from chance alone, the unlikelihood of this occurring by chance in two consecutive 10-year periods suggests that some other factor may have been involved and supports the need for more detailed evaluation.
4. Two other Michigan counties showed statistically significant higher rates for this relatively rare form of cancer during the period of 1970-1981. These were Kent County, which showed higher than expected rate in white males, and Grand Traverse County, which was higher for both sexes combined. No definite explanation can be given as to the cause of the higher rates in these counties, but for the eleven year period, four out of 83 Michigan counties (5%) would be expected to have a statistically significant excess of these cancers solely on the basis of chance. The Grand Traverse County rate was not statistically higher for 1970-1978. The elevated rate for the 11-year period was the result of 7 deaths in the 3-year period of 1979-1981, the period immediately following the 9th revision of the ICDA coding structure.

5. A detailed review of death certificates, hospital records, location and duration of residency in the county, and occupational histories of the decedents and spouses for the 20 cases of soft and connective tissue cancer deaths in Midland County from 1960-1981 failed to reveal any commonalities which would suggest a single causative agent.
6. Methodological problems identified in the ICDA coding of soft and connective tissue cancers over the 31 year reporting period may have been a partial factor in the increasing rate in Midland County but does not completely account for the increase between the 1950's and the 1970's.
7. Analysis was made of mortality data from 28 other counties within the United States, but outside of Michigan, with manufacturing facilities that hypothetically could result in dioxin generation. This analysis indicated that statistically significant excesses of soft and connective tissue cancer rates occurred at the same frequency in these counties as for counties not known to have industrial manufacturing sources which may be suspected of releasing dioxins because of the manufacture of chlorophenolic compounds.
8. Although the overall cancer rate for Midland County is not higher than Michigan or the United States, the rate of soft tissue cancers in women has been higher from 1960 to 1978. Investigation has not revealed any common characteristic of the persons that would account for this increase or any relationship with likely exposures to chemicals. More detailed studies will be necessary if an attempt to find a common cause for these tumors is undertaken. The small number of tumors and the long interval since many of their occurrences will make such a detailed study difficult.

#### Recommendations

1. A case-control study would be necessary to further explore the possible "cause" or "association" of soft and connective tissue cancers with life style, occupation, and other variables. Additional funds are needed to conduct such a study which the Department would conduct in cooperation with outside expertise.
2. A cancer reporting system should be developed statewide to enable collection of cancer incidence for all counties. Without complete coverage it is difficult to accurately determine the county of residence of cancer cases since they commonly cross county lines for treatment. Cancer cases living in the Midland area could then be compared to other parts of the State from now on. Such a system now exists for about 35 counties in cooperation with the Michigan Department of Public Health and for the populous southeastern Michigan counties through the federally funded SEER operated by the Michigan Cancer Foundation. Funding support should be given to expand the program Statewide, and legislation supporting it should be passed if necessary.
3. A registry should be developed of persons most likely exposed to dioxins as evidenced by their occupations, fish consumption patterns, or location of residence. Such a cohort of people would serve as a framework for possible future epidemiological studies.

## BACKGROUND

In a November 22, 1982, letter to the Director of the Michigan Department of Public Health, Mr. Larry Fink of the Foresight Society, cited statistics on soft and connective tissue cancer deaths which he felt warranted further investigation.

Statistics cited for the 1950-1969 period were obtained from the document U.S. Cancer Mortality by County 1950-1969 DHEW Publication No. (NIH) 74615.

The 1970-1978 data were extracted from an unpublished document titled U.S. Cancer Mortality Rates and Trends 1950-1978 to be published by the U.S. Environmental Protection Agency. The data are displayed in Table 1 and are summarized below as from Mr. Fink's letter:

1. Soft and connective tissue cancer age adjusted mortality rates were 1.6 and 1.3 per 100,000 population for white male and white female Midland County residents based on six deaths for each sex during the period of 1950-1969. These are contrasted with rates of 0.65 and 0.48 for white male and white female United States residents and rates of 0.60 and 0.48 for white male and white female residents of Michigan.
2. Only one other county, Osceola, showed significantly higher than expected mortality rates between 1950 and 1969. These rates are based on only two deaths for each sex.
3. Soft and connective tissue cancer age adjusted mortality rates were 1.6 and 2.8 for white male and white female Midland County residents based on 3 male deaths and 7 female deaths during the period of 1970-1978.
4. The 1970-1978 soft tissue cancer mortality rate for white females residing in Midland County is in the 95th percentile for all counties in the United States.
5. The 1970-1978 rate represents an increase of 771% over the 1950-1959 rate for Midland County white female residents.

The Michigan Department of Public Health recognizes that such geographic and temporal differences noted from compilations of U.S. mortality data are useful in developing and examining hypotheses concerning the influence of various possible environmental factors. Hypotheses concerning cause and effect relationships deserve careful and cautious consideration.

## MPDH EVALUATIONS

Upon review of the data presented by the Foresight Society, the Michigan Department of Public Health, in cooperation with the Midland County Health Department, immediately initiated a more in-depth review of the cancer death records for the Midland County area (see MDPH news release, December 9, 1982).

This report summarizes the results of several evaluations to determine if the cited mortality patterns were artifacts relative to the reporting and coding system or could be indicative of a common type of toxic substance exposure or other etiologic agent.



## Mortality Rates

A check of Michigan Death Statistics 1960-1981 verified that there were 9 Midland County residents deaths between 1960-1969 and 10 deaths between 1970 and 1978 that were coded to soft and connective tissue cancers. There was one additional death attributed to soft and connective tissue cancer in the three year period 1979-1981.

An examination of crude mortality rates for soft and connective tissue cancers reveals that for the period 1950-1970 both the national and Michigan rates increased steadily (Fig. I). The Michigan rate fluctuates from year-to-year as would be expected for a relatively rare event. Both the national and Michigan rates increased dramatically in 1979. This is the result of the introduction of the 9th revision of the ICDA coding structure. The changes in coding will be discussed later in this analysis.

While the Midland County 1970-1978 rate for females is in the 95th percentile of the rates for all United States counties, there are 152 other counties in the United States also in the 95th percentile for soft and connective tissue cancer for females. If the soft and connective tissue cancer mortality rates by county in Michigan for white females are distributed as is the nations', then four of Michigan's counties should be in the 95th percentile for a single period of observation. The U.S. mortality rate data showed that 6 Michigan counties in fact had rates in the 95th percentile for white females. These included Chippewa, Keweenaw, Lake, Leelanau, Midland, and Schoolcraft Counties. None except Midland County, however, were found to be statistically significant.

The fact that Midland County had a statistically higher rate for two consecutive 10-year periods, decreases the likelihood that the occurrence in Midland County was due solely on the basis of chance.

## Standard Mortality Ratios

The number of deaths, age adjusted death rates, expected deaths and standard mortality ratios (SMR's) for each county based on Michigan Death Certificates for the period 1970-1981 were examined. Data for twelve counties with the highest rates of soft tissue cancer mortality (both sexes combined) plus Kent County are displayed in Table 2.

Of all counties in Michigan, there was only one county for which the overall standard mortality ratio (SMR) for the 1970-1981 period was statistically significant at the .05 level or higher. This was Grand Traverse County. This County with 12 soft tissue cancer deaths (6 males and 6 females) in the 12 year period had the fourth highest age adjusted mortality rate for both sexes combined for this cause of death (2.0215). However, 7 of these 12 deaths occurred from 1979-1981, and thus, are probably a result of the ICDA coding changes. Two other counties had statistically significant sex-specific SMR's for soft and connective tissue cancer deaths. They were Midland County with a SMR of 2.8489 based on 8 deaths for females and Kent County with a SMR of 1.5099 based on 33 deaths for males. Statistical tests were done using the ratio of a Poisson variable to its expectation.

### Time Distribution of Deaths

Examination of the distribution of deaths for both males and females during the 1960-1981 period (Tables 3 and 4) indicates that the deaths occur as one might expect for a relatively rare event.

### Age, Sex, and Race Distribution

The distribution of soft and connective tissue cancer deaths by age and sex for Midland County and Michigan are displayed in Tables 5 and 6. For the State, the distribution breaks roughly into three groups (age 0-14, 15-49, 50 and over) with an essentially uniform distribution within age group 15-49 and an increasing and then declining pattern after age 50. The numbers and percentages of deaths in these three groups are displayed in Table 6. While the distribution of deaths for Midland County as a whole appears to be very similar to the State, the distribution of female deaths by age group in Midland County appears to be different. Upon analysis, however, this age distribution is not statistically different than that for females for the State as a whole ( $\chi^2 = 2.86$ ).

### International Classification of Disease (ICDA) Coding of Specific Causes

The specific causes of death as recorded on the death records for Midland County during the period 1960-1981 are recorded in Tables 7 and 7a. Of the 1960-1969 deaths, four of the nine deaths (44.4%) were assigned codes 171.9 or 197.9 which indicates a specific anatomical site was not specified. For the period 1970-1981, ten of the eleven deaths (90.9%) were assigned site unspecified codes thus indicating a change in the recording of this information on the death records ( $\chi^2 = 5.1$  significant at  $p < .025$ ). For the 1970-1981 period there is considerable variation among Michigan counties in the percentage of records assigned to nonsite specific codes for soft tissue cancer deaths (Table 8). The percentage assigned to a nonspecific code for the State is 71.9% and for those counties with 8 or more deaths, 72.0%. For those counties with 8 or more soft and connective tissue cancer deaths their percentages range from 46.6 to 92.8. The Midland County percentage (90.9%) is among the highest but is not significantly different from the State or from the counties listed in Table 8 ( $\chi^2 = 1.978$ ).

Because of the obvious changes in recording, specifically between the 1960-1969 period and 1970-1981 period for Midland County and the fact that, for the State and nation as a whole, an increased number of deaths in 1979 and 1980 were attributed to soft and connective tissue cancer due to the implementation of the 9th ICDA revision, a closer examination of the recording and coding of medical information on certificates is warranted. The 7th and 8th revision of ICDA coding instruction for soft and connective tissue cancer deaths were identical (1958-1978). The 9th revision instructions changed how metastatic soft and connective tissue cancers were to be recorded. In the 7th and 8th revision metastatic soft tissue cancer of a particular organ site was classified as cancer of that particular organ, whereas in the 9th revision the cancers were to be coded to the nonspecific soft and connective tissue cancer code 171.9. Following are examples of the coding changes:

Examples of Soft and Connective Tissue Cancer Codes  
8th and 9th Revision ICDA

	<u>8th Revision</u>	<u>9th Revision</u>
1. Fibrosarcoma of Lung	162.9 (Lung)	162.9
2. Metastatic Fibrosarcoma of Lung	162.1 (Lung)	171.9 (Soft Tissue)
3. Leiomyosarcoma of Stomach	151.9 (Stomach)	151.9
4. Metastatic Leiomyosarcoma of Stomach	151.9 (Stomach)	171.9 (Soft Tissue)
5. Metastatic Leiomyosarcoma	171.9 (Soft Tissue)	171.9
6. Myosarcoma	171.9 (Soft Tissue)	171.9

Under the 8th revision a metastatic soft and connective tissue cancer with an organ site specified may be coded as cancer of the particular organ if the phrase includes the word "of" (entry 4 above), whereas if a site is not specified it would be coded to soft and connective tissue cancer (entry 5 above).

Of the 10 soft and connective tissue cancer deaths recorded for Midland County in the period 1970-1978, 3 were metastatic with a site not specified (Table 7a). In addition, all of the other cancers except one do not specify a site. It is possible that some of these cancers were actually specific to an organ site rather than to connective tissue of, for example, the shoulder, neck, leg or arm. With such small numbers, the recording of the organ or tissue sites on these death certificates would alter significantly the soft and connective tissue cancer mortality rate for the County.

Histological Types of Cancer Reported

Death certificate analysis for Midland County indicates that for females the soft and connective tissue cancer deaths are of various histological types. A review of the death certificates for the years 1960 through 1981 showed 13 females dying of soft and connective tissue cancer (Tables 7 and 7a). These were diagnosed as 3 liposarcomas, 3 leiomyosarcomas, 2 fibrosarcoma/leiomyosarcoma, 2 rhabdomyosarcomas, 1 hemangiosarcoma, 1 Kaposi sarcoma and 1 histiocytoma. The persons involved in these deaths ranged in ages from one year old to 88 years old, with a median age of 54 and a mean age of 52.

The males did not show a higher than expected rate. There were 7 male deaths from soft and connective tissue cancer from 1960-1981 (Tables 7 and 7a). These were diagnosed as 2 rhabdomyosarcomas, 2 leiomyosarcomas, 1 liposarcoma, 1 fibrosarcoma and 1 mesothelioma. The age range was from 20 years of age to 89 years of age with a median age of 63 and a mean age of 58.5.

Residence of Cases

The geographic location of the residence of record was investigated. While death records are coded to city, village, and township based on the information

provided by the funeral director, it is not uncommon to find this information in error. An informant usually provides the funeral director with a mailing address rather than a specific residence. Persons living near the border of counties may have a post office address in one county whereas their actual residence is in a neighboring county. Persons that live in a township with the same name as a city are many times recorded as living in the city rather than the township. Therefore, a history of residence was determined for each case.

Upon investigation, no clustering of cases in Midland County by geographic location was found (Table 7 and 7a). One case was a female Bay County resident who had spent three years of her life in the City of Midland in the early 1950's approximately 25 years before her death. The other cases were Midland County residents with their residences of record quite widely scattered throughout the County.

### Length of Residence

Since most cancers develop many years after exposure to a possible causative agent, it was important to obtain the residence history for the 20 persons who died between 1960-1981 of soft and connective tissue cancer. Midland County has had a significant change in population over the last 30 years. Between 1950 and 1960 the population increased 44.3%, between 1960 and 1970, 23.9%, and between 1970 and 1980, 15.4%. In the period of interest (1960-1980), the Midland County population increased from 51,450 persons to 73,578 persons. This is an increase of 22,128 (43%) in this period. A review of the length of time the female cases (Table 9-10) lived in Midland County revealed that one case lived in the County for only one year prior to diagnosis of cancer. One case lived in Midland County for 3 years earlier in her life and was residing in Bay County at the time of her death. One case was diagnosed in Ohio prior to moving to the county; one case was diagnosed while she was a Genesee County resident prior to moving to Midland County; the 88 year old woman lived in Midland County for two years prior to the diagnosis and her subsequent death; one case had no information available on her length of residence in the County; and four cases, including the one year old infant, lived in Midland County all their lives. The remaining 3 cases had lived in the county continuously prior to their deaths for 17, 33, and 39 years respectively.

Five of the seven male cases (Tables 9 and 10) lived all their lives in Midland County. Of the other two cases, one lived in Midland for 4 years prior to diagnosis of soft tissue cancer and 5 more years prior to his death. Before that, he had lived for approximately 23 years in New York and New Jersey. The 89 year old male lived in Midland for 18 years in retirement. Prior to that he had lived most of his adult life in a suburb of Chicago.

In considering length of residency in Midland County as a possible cause of soft and connective tissue cancers, we might exclude 5 of the female cases and 2 of the male cases on the basis of genetic causation in the infant and insufficient latency in the others. However, conversely, we also recognize that persons may have resided in Midland County for a time, then moved elsewhere and have been diagnosed with soft and connective tissue cancer at a different geographic location.

## Occupation

Information regarding the occupational history of each case (Table 9) was obtained by interviewing next of kin and from newspaper obituary notices. Review of this information revealed that of the 13 females, 5 had not worked for Dow Chemical nor Dow Corning the two primary chemical manufacturers in Midland County, and neither had their spouses. Two cases had not worked for either of the above companies, but their spouses had worked for Dow Chemical Company. One case had not worked for either Dow Chemical or Dow Corning but her spouse had worked at Dow Corning. Two cases worked at Dow Chemical as did their spouses. One case worked at Dow Corning and her spouse's employment was not available. There was one case about which no employment information was available on either the deceased or her spouse. The one year old infant's parents employment information indicated that her father did not work for either company, but no information was available for her mother.

Of the 7 male deaths, 4 had worked at Dow Chemical sometime in their lifetime. Two of these were employed by Dow Chemical for at least 25 years, one had worked there approximately 9 years in the 1920's and the other worked at Dow Chemical for the 9 years prior to his death. Three of the cases were not employed at Dow Chemical at any time in their lifetime. Only one of the spouses from these last 3 cases was known to have worked at Dow Chemical for a short period of time (4 years) during World War II.

## TCDD as Possible Cause of Excess Mortality

The hypothesis that soft and connective tissue cancers are caused by 2,3,7,8-tetrachlorodibenzo-para-dioxin (TCDD) has been proposed. To examine this possibility the soft and connective tissue cancer mortality data was reviewed for 29 U.S. counties which have industrial manufacturing facilities which manufacture chemicals believed to generate dioxins as a contaminant (Based upon a list of industries that manufacture chlorophenolic compounds as identified by Esposito, et.al., 1980<sup>1</sup>). Also examined were mortality data for soft and connective tissue cancer in the counties in the U.S. which have:

1. A soft and connective tissue cancer death rate in the 95th percentile of the rates for the 3,050 U.S. counties.
2. A change in the 1970-78 rate compared to the 1950-59 rate which is in the 95th percentile of changes for the 790 and 704 U.S. counties for which a change can be computed for males and females respectively.
3. An excess of deaths in 1970-78 based on the national death rate.

Tables 11 through 18 show these comparisons. There are no statistically significant higher numbers (Chi Square analysis) of the 29 counties with these characteristics than in the remaining 3,021 U.S. counties where such facilities are not known to exist. However, it should be noted that environmental data are not available to confirm the presence or absence of dioxin in either group of counties, but there are data which show the presence of TCDD in locations other than Midland County.

Examination was also made of mortality data for other selected types of cancer and geographic areas in close proximity to Midland County. In addition to soft and connective tissue cancers, statistics were examined for liver cancer, Hodgkins disease, and lymphomas, and all cancers combined. This was done in an attempt to expand on the hypothesis that if Dow Chemical Company at Midland was the source of chemical contamination in Midland County, such contamination would be expected to have an effect in areas downwind and/or downstream. Since Kent and Grand Traverse Counties were found to have an excess of soft and connective tissue cancer mortality, they were also included in the tables for comparison purposes.

Table 19 shows observed and expected deaths from 1970-1978. Examination of data for Midland, Saginaw, Bay and Arenac Counties collectively shows:

1. Deaths from all cancer combined are less than expected.
2. Deaths from soft tissue cancer are slightly greater than expected.
3. Deaths from liver and lung cancer and Hodgkins disease and lymphomas are all less than expected.

Table 20 evaluates the data shown in Table 19 for significance using proportional mortality analysis with Mantel-Haenszel estimates of relative risk. The estimated relative risk with respect to death from all other causes of mortality from soft and connective tissue cancer is significantly greater in Midland and Kent Counties and for Hodgkins Disease and lymphomas in Kent County than for white residents in other Michigan counties. Also of interest is the finding that risk of mortality from lung cancer is significantly less for Kent County.

## CONCLUSIONS

1. The overall crude cancer mortality rate for Midland County for the period 1970-1979 was 120.2 as compared to a State of Michigan rate of 159.4.

The age adjusted cancer mortality rate for Midland County for the period 1970-1979 was 148.2 with a standard mortality ratio of 0.929. For white males the adjusted rate was 170.1 and the standard mortality ratio 0.944. For white females the figures were 139.2 and 0.975.

Age adjusted cancer mortality rates for all cancers combined for Midland County for all persons, white males and white females, were below the State of Michigan rates for this time period.

2. Mortality rates from soft and connective tissue cancers among white females from Midland County were confirmed to be 3.8 and 4.0 times the national average for the periods of 1960-1969 and 1970-1978, respectively. The rates were 2.3 per hundred thousand population in the period 1960-1969 (5 deaths), and 2.8 for the 1970-1978 period (7 deaths).
3. While the statistically significant excess in soft and connective tissue cancers in white females from Midland County may have resulted from chance alone, the unlikelihood of this occurring by chance in two consecutive 10-year periods suggests that some other factor may have been involved and supports the need for more detailed evaluation.

4. Two other Michigan counties showed statistically significant higher rates for this relatively rare form of cancer during the period of 1970-1981. These were Kent County, which showed higher than expected rate in white males, and Grand Traverse County, which was higher for both sexes combined. No definite explanation can be given as to the cause of the higher rates in these counties, but for the eleven year period, four out of 83 Michigan counties (5%) would be expected to have a statistically significant excess of these cancers solely on the basis of chance. The Grand Traverse County rate was not statistically higher for 1970-1978. The elevated rate for the 11-year period was the result of 7 deaths in the 3-year period of 1979-1981, the period immediately following the 9th revision of the ICDA coding structure.
5. A detailed review of death certificates, hospital records, location and duration of residency in the county, and occupational histories of the decedents and spouses for the 20 cases of soft and connective tissue cancer deaths in Midland County from 1960-1981 failed to reveal any commonalities which would suggest a single causative agent.
6. Methodological problems identified in the ICDA coding of soft and connective tissue cancers over the 31 year reporting period may have been a partial factor in the increasing rate in Midland County but does not completely account for the increase between the 1950's and the 1970's.
7. Analysis was made of mortality data from 28 other counties within the United States, but outside of Michigan, with manufacturing facilities that hypothetically could result in dioxin generation. This analysis indicated that statistically significant excesses of soft and connective tissue cancer rates occurred at the same frequency in these counties as for counties not known to have industrial manufacturing sources which may be suspected of releasing dioxins because of the manufacture of chlorophenolic compounds.
8. Although the overall cancer rate for Midland County is not higher than Michigan or the United States, the rate of soft tissue cancers in women has been higher from 1960 to 1978. Investigation has not revealed any common characteristic of the persons that would account for this increase or any relationship with likely exposures to chemicals. More detailed studies will be necessary if an attempt to find a common cause for these tumors is undertaken. The small number of tumors and the long interval since many of their occurrences will make such a detailed study difficult.

#### RECOMMENDATIONS

1. A case-control study would be necessary to further explore the possible "cause" or "association" of soft and connective tissue cancers with life style, occupation, and other variables. Additional funds are needed to conduct such a study which the Department would conduct in cooperation with outside expertise.
2. A cancer reporting system should be developed statewide to enable collection of cancer incidence for all counties. Without complete coverage it is difficult to accurately determine the county of residence of cancer cases

since they commonly cross county lines for treatment. Cancer cases living in the Midland area could then be compared to other parts of the State from now on. Such a system now exists for about 35 counties in cooperation with the Michigan Department of Public Health and for the populous southeastern Michigan counties through the federally funded SEER operated by the Michigan Cancer Foundation. Funding support should be given to expand the program Statewide, and legislation supporting it should be passed if necessary.

3. A registry should be developed of persons most likely exposed to dioxins as evidenced by their occupations, fish consumption patterns, or location of residence. Such a cohort of people would serve as a framework for possible future epidemiological studies.



### Acknowledgements

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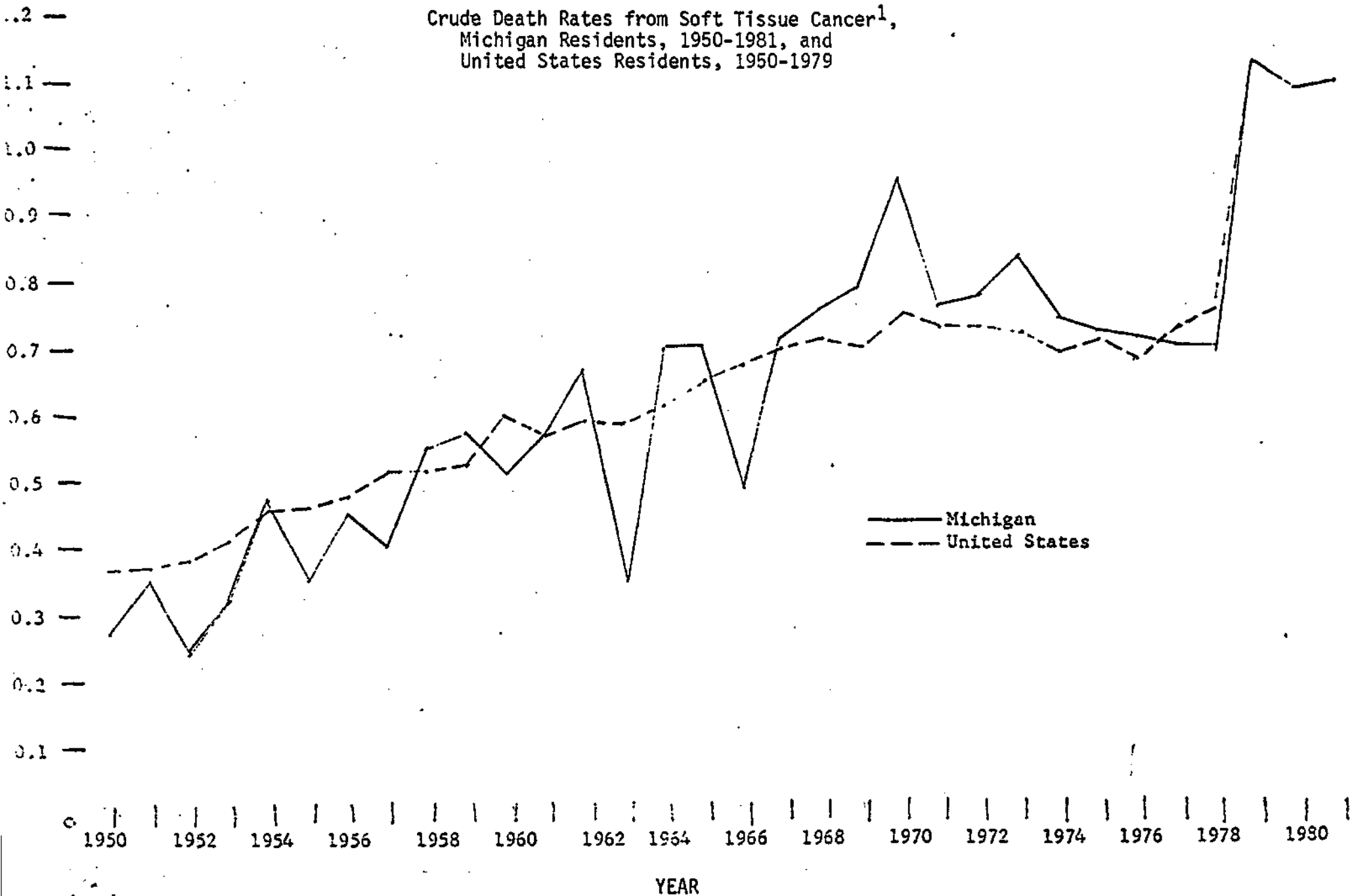
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Figure 1

Crude Death Rates from Soft Tissue Cancer<sup>1</sup>,  
Michigan Residents, 1950-1981, and  
United States Residents, 1950-1979



<sup>1</sup>Classified according to 6th Revision ICD 197 (1950-1957), 7th Revision ICD 197 (1958-1967), 8th Revision ICDA 171 (1968-1978), 9th Revision ICD 164.1, 171 (1979-1981)

Table 1

Soft & Connective Tissue<sup>1</sup> Cancer Deaths and Age Adjusted Rates  
(Per 100,000 Population)Midland County Residents 1950-1978<sup>2</sup>

Race-Sex	1950-1959		1960-1969		1970-1978		Total		Percent Change		
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	1950-59 1960-69	1960-69 1970-78	1950-59 1970-78
White Male	2	1.3	4	2.0	3	1.6	9	N.A.	55 (53.8) <sup>3</sup>	-20 (-20)	25 (23.1)
White Female	1	0.3	5	2.3	7	2.8	13	N.A.	618 (666.6)	21 (21.7)	771 (833.3)
TOTAL	3	N.A.	9	N.A.	10	N.A.	22	N.A.	N.A.	N.A.	N.A.

<sup>1</sup>Classified according to 6th Revision ICD 197(1950-1957), 7th Revision ICD 197(1958-1967), 8th Revision ICDA 171(1968-1978), 9th Revision ICD 164.1, 171(1979-1981)

<sup>2</sup>P1034 & 104 U.S. Cancer Mortality Rates & Trends 1950-1978 U.S. E.P.A. Unpublished

<sup>3</sup>Figures in parentheses calculated from rates (not included in report)

Table 2

Number of Soft Tissue Cancer Deaths,<sup>1</sup> Age Adjusted Mortality Rates  
(Per 100,000 Population)  
Expected Deaths, and Standard Mortality Ratios, By County<sup>2</sup>

Michigan Residents 1970-1981

County	TOTAL				MALES				FEMALES			
	No.	Rate	No. Exp.	SMR	No.	Rate	No. Exp.	SMR	No.	Rate	No. Exp.	SMR
State	928	0.8481	-	-	481	0.8997	-	-	447	0.7989	-	-
Keweenaw	2	5.2166	0.3252	6.1508	1	4.6614	0.1930	5.1811	1	5.6091	0.1424	7.0215
Schoolcraft	3	2.3314	1.0913	2.7489	1	1.5234	0.5906	1.6933	2	3.1114	0.5135	3.8948
Mackinac	3	2.0046	1.2693	2.3636	2	2.5936	0.6938	2.8828	1	1.3554	0.5894	1.6967
Gd.Traverse	12	2.0215	5.0347	2.3834*	6	2.1082	2.5605	2.3433	6	1.9471	2.4616	2.4374
Benzie	3	1.9760	1.2876	2.3299	2	2.6043	0.6909	2.8946	1	1.3115	0.6091	1.6418
Leelanau	3	1.6864	1.5087	1.9884	1	1.0800	0.8331	1.2004	2	2.2990	0.6950	2.8779
Huron	9	1.6863	4.5265	1.9883	5	1.8416	2.4427	2.0469	4	1.5034	2.1255	1.8819
Missaukee	2	1.6695	1.0160	1.9685	2	3.1684	0.5679	3.5216	0	0.0	0.4679	0.0
Alger	2	1.6224	1.0455	1.9129	0	0.0	0.5969	0.0	2	3.4141	0.4680	4.2738
Arenac	3	1.5897	1.6005	1.8744	3	3.0031	0.8988	3.3379	0	0.0	0.7261	0.0
Gogebic	6	1.5892	3.2020	1.8738	5	2.6376	1.7055	2.9317	1	0.5248	1.5222	0.6510
Midland	11	1.5670	5.9534	1.8477	3	0.8574	3.1478	0.9530	8	2.2758	2.8081	2.8489*
Kent	62	1.2080	43.528	1.4244	33	1.3584	21.856	1.5099*	29	1.0806	21.439	1.3527

<sup>1</sup>8th Revision ICDA 171 (1968-1978); 9th Revision ICD 164.1, 171 (1979-1981)

<sup>2</sup>Twelve counties with the highest age-adjusted rates plus Kent county, both sexes combined

\* Statistically significant at the 0.05 level

Table 3  
 Number of soft tissue cancer deaths<sup>1</sup>  
 by year Midland County and Michigan residents  
 1960-1981

Residence	YEAR																					
	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
Midland Co.	-	1	1	1	1	-	-	2	1	2	2	1	1	-	1	1	1	-	3	1	-	-
State	40	45	53	28	57	57	41	61	66	69	84	68	70	75	67	66	65	64	64	104	100	101

<sup>1</sup>Classified according to 8th Revision ICDA 171(1968-1978), 9th Revision ICD 164.1, 171(1979-1981)

Table 4  
 Number of observed deaths & related probabilities  
 soft tissue cancer deaths<sup>1</sup> Midland County  
 residents 1960-1981

Number of observed deaths	0	1	2	3
Probabilities of observing this number of deaths <sup>2</sup>	0.4029	0.3663	0.16665	0.0504
Expected number of years with indicated number of deaths	8.86	8.06	3.66	1.10
Actual number of years with indicated number of deaths	7	11	3	1

<sup>1</sup>Classified according to 8th Revision ICDA 171(1968-1978), 9th Revision ICD 164.1, 171(1979-1981)

<sup>2</sup>Calculated using the poisson distribution with the parameter set to the mean number of deaths per year.

Table 5

Number of soft tissue cancer deaths<sup>1</sup> by age, sex  
and race. Michigan and Midland County Residents 1970-1981

Age	Michigan					Midland County		
	Total	White Male	White Female	Other Male	Other Female	Total	White Male	White Female
All Ages Under	928	428	389	53	58	20	7	13
1 Yr	7	2	3	1	1	-	-	-
1-4	14	8	6	-	-	1	-	1
5-9	11	5	5	1	-	-	-	-
10-14	17	11	5	-	1	-	-	-
15-19	36	17	17	1	1	-	-	-
20-24	32	20	7	3	2	2	1	1
25-29	40	16	16	4	4	2	-	2
30-34	20	10	7	1	2	1	1	-
35-39	35	21	11	-	3	1	-	1
40-44	36	11	15	6	4	1	-	-
45-49	45	17	18	7	3	1	-	1
50-54	68	34	25	6	3	2	1	1
55-59	92	34	47	5	6	2	-	2
60-64	98	40	40	2	16	2	1	1
65-69	110	51	51	5	3	-	-	-
70-74	87	44	36	5	2	-	-	-
75-79	75	37	31	4	3	4	2	2
80-84	59	27	30	-	2	-	-	-
85-89	30	16	12	1	1	2	1	1
90/Over	16	7	7	1	1	-	-	-
Mean Age	55.4	55.1	56.8	51.0	52.9	52.0	58.57	48.46
Median Age	60	60	61	51	59	54.5	63	51

<sup>1</sup>Classified according to 8th Revision ICDA 171(1968-1978), 9th Revision ICD 164.1, 171(1979-1981)

Table 6  
 Numbers and percentages<sup>1</sup> of soft tissue  
 cancer deaths<sup>2</sup> by age groups, Michigan and Midland  
 county residents 1960-1981

Age	Michigan			Midland County		
	Total	White Male	White Female	Total	White Male	White Female
All Ages	928 (100.0)	428 (100.0)	389 (100.0)	20 (100.0)	7 (100.0)	13 (100.0)
0-14	49 (5.3)	26 (6.1)	19 (4.9)	1 (5.0)	- 0.0	1 (7.7)
15-49	312 (33.6)	112 (26.2)	91 (23.4)	7 (35.0)	2 (28.6)	5 (38.5)
50 & Over	567 (61.1)	290 (67.8)	279 (71.7)	12 (60.0)	5 (71.4)	7 (53.8)

<sup>1</sup>Percentages in parenthesis

<sup>2</sup>Classified according to 7th Revision ICD 197 (1958-1967), 8th Revision ICDA 171 (1968-1978), 9th Revision ICD 164.1 171 (1979-1981)



TABLE 7  
MIDLAND COUNTY  
SOFT TISSUE CANCER DEATHS<sup>1</sup> ABSTRACTS  
1960-1969

Year	Sex	Age	Residence	Occupation	Type of Cancer	Duration
61	F	24	Midland (City?)	Housewife	Hemangiosarcoma of Left Face	3 1/2 Yrs.
62	M	63	Jerome Twp.	Crane Operator Construction	Rhabdomyosarcoma Left Lower Leg	
63	F	75	Coleman Village	Housekeeper	Liposarcoma Rt. Gluteal	16 Mos.
64	F	51	Midland City	Sales Clerk Retail Sales	Leiomyosarcoma with widespread Metastasis	
67	M	77	Midland City	Metal Casting Inspector/Chemical Industry	Mesothelioma Malignant with Metastasis	Months
67	M	20	Midland City	Student	Rhabdomyosarcoma Metastatic	
68	F	37	Midland City	Housewife	Liposarcoma	18 Mos.
69	F	45	Midland City	School Teacher	Fibrosarcoma Metastasis to Lung/Liver/Skin	1 Year
69	M	32	Midland City	Chemical Engineer	Liposarcoma Left Arm Metastasis	5 Years

<sup>1</sup>Classified according to 7th Revision ICD 197(1958-1967), 8th Revision ICDA 171(1968-1978), 9th Revision ICD 164.1, 171(1979-1981)

MIDLAND COUNTY  
SOFT TISSUE CANCER DEATHS<sup>1</sup> ABSTRACTS  
1970-1981

Year	Sex	Age	Residence	Occupation	Type of Cancer	Duration
70	F	59	Larkin Twp.	Housewife	Kaposi Sarcoma	1 Year
70	F	56	Midland R#4	Retired teacher	Leiomyosarcoma metastatic	8 Mos.
71	M	76	Midland Twp.	Carpenter	Leiomyosarcoma metastatic	2 1/2 Yr.
72	M	89	Midland City	Salesman Sears-Roebuck	Myosarcoma	6 Mos.
74	F	1	Homer Twp.		Rhabdomyosarcoma	4-5 Mos.
75	M	53	Jerome Twp.	Construction Dow Chemical	Fibrosarcoma	--
76	F	77	Midland City	Housewife	Liposarcoma	
78	F	64	Homer Twp.	Clerk/Dow Corning	Metastatic Synovial Cell Sarcoma	2 Years
78	F	26	Ingersoll Twp.	Housewife	Rhabdomyosarcoma	24 Hrs.
78	F	88	Midland City	Housewife	Fibrosarcoma R Orbit	6 Mos.
79	F	27	Lee Twp.	Housewife	Leiomyosarcoma Metastatic to Lungs	1 Year

<sup>1</sup>Classified according to 7th Revision ICD 197(1958-1967), 8th Revision ICDA 171(1968-1978), 9th Revision ICD 164.1, 171(1979-1981)

**Table 8**  
**Soft Tissue Cancer Deaths by Specificity of Code**  
**and Percentage Non-specific Code by County**  
**Michigan Residents 1970-1981**

County	Number of Deaths	Number Coded ICD 171.9	Percentage Coded 171.9
Wayne	262	181	69.0
Oakland	99	80	80.8
Macomb	67	48	71.6
Kent	62	41	66.1
Genesee	42	35	83.3
Washtenaw	26	18	69.0
Ingham	22	19	86.3
Saginaw	22	14	63.6
Kalamazoo	16	10	62.5
Calhoun	15	7	46.6
Berrien	14	13	92.8
Jackson	12	9	75.0
Monroe	12	9	75.0
Muskegon	12	9	75.0
Grand Traverse	12	7	58.3
Midland	11	10	90.9
Bay	11	8	72.7
Ottawa	11	7	63.6
Huron	9	7	87.5
Lenawee	8	7	87.5
Van Buren	8	5	62.5
Gratiot	8	4	50.5
<b>Total</b>	<b>761</b>	<b>548</b>	<b>72.0</b>

Table 9  
Midland County  
Soft and Connective Tissue Cancer Deaths  
1960-1981

IDENTIFICATION			TIME IN COUNTY (YEARS)			OCCUPATIONAL HISTORY (YEARS)					
YEAR OF DEATH	SEX	AGE	CONTINUOUS PRIOR TO DEATH	WITHIN LAST 25 YEARS OF LIFE	TOTAL IN LIFE	DOW CHEM	SPOUSE	DOW CORN	SPOUSE	OTHER OUTSIDE OCCUPATION	YRS
1961	F	24	4	4	4(?)	4	4(?)	0	0	UNKNOWN	UNK
1963	F	75	*								
1964	F	51	51	25	51	0	YES	0	0	RETAIL SALES CLERK	7
1968	F	37	17	17	17	0	0	0	YES	NONE	NA
1969	F	45	3	3	3	0	0	0	0	SCHOOL TEACHER	3
1970	F	59	33	25	33	0	0	0	0	NONE	0
1970	F	56	0	0	3	19	25	0	0	ENGLISH TEACHER	14
1974	F	1	1	1	1	NA	NA	NA	NA	NA	NA
1976	F	77	39	25	39	0	23	0	0	NONE	0
1978	F	64	64	25	64	0	UNK	25	UNK	SECRETARIAL	25
1978	F	26	1	1	1	0	0	0	0	NONE	0
1978	F	88	2	2	2	0	0	0	0	NONE	0
1979	F	27	27	25	27	0	0	0	0	WAITRESS	UNK
1962	M	63	63	25	63	0	0	0	0	CRANE OPERATOR	UNK
1967	M	77	77(?)	25	77	30	UNK	0	0	UNKNOWN	UNK
1967	M	20	20	20	20	0	NA	0	NA	GAS STATION ATTENDANT	1 MO
1969	M	32	9	9	9	9	UNK	0	UNK	CHEMICAL ENGINEER	0
1971	M	76	76	25	76	9	0	0	0	CARPENTER FARMER(PARTIME)	40 20
1972	M	89	18	18	18	0	0	0	0	RETIRED	21
1975	M	53	53	25	53	25	4	0	0	CARPENTER AIRFORCE VETERAN	26 UNK

\* NO MEDICAL RECORDS AVAILABLE. DESTROYED AT GRATIOT COMMUNITY HOSPITAL PRIOR TO ESTABLISHMENT OF RECORD LIBRARY.

Midland County  
Soft and Connective Tissue Cancer Deaths  
1960-1981

IDENTIFICATION			TYPE MALIGNANCY			
YEAR OF DEATH	SEX	AGE	TYPE	PRIMARY SITE	METASTASES	YEAR DIAG NUSED
1961	F	24	HEMANGIOSARCOMA	FACE	SKULL AND UPPER LOBE OF LUNG	5-58
1963	F	75	LIPOSARCOMA	RIGHT GLUTEAL	UNK	UNK
1964	F	51	LEIOMYOSARCOMA	UTERUS	WIDESPREAD	11-63
1968	F	37	LIPOSARCOMA	SPINE	LUNGS&PELVIS	1-66
1969	F	45	FIBROSARCOMA LEIOMYOSARCOMA	RIGHT THIGH UTERUS	LUNG, LIVER ADRENAL GLAND AND SKIN	10-68
1970	F	59	KAPOSI SARCOMA	RIGHT LEG	LYMPH NODES	8-68
1970	F	56	FIBROSARCOMA LEIOMYOSARCOMA	RIGHT THIGH ABDOMINAL WALL	SPINE LUNG	1960 1967
1974	F	1	RHABDOMYOSARCOMA	INGUINAL AREA	UNK	8-73
1976	F	77	LIPOSARCOMA	RIGHT THIGH	BUTTOCK, LUNG, RIB, LYMPH NODES	12-74
1978	F	64	LEIOMYOSARCOMA	LEFT KNEE	LIVER, LYMPH NODES, LUNG, BONE	7-70
1978	F	26	RHABDOMYOSARCOMA	RECTUM	LUNG, NECK INGUINAL REGION	6-76
1978	F	88	FIBROSARCOMA	RIGHT CHEEK	FACIAL AREA	6-78
1979	F	27	LEIOMYOSARCOMA	LEFT THIGH	LUNG	3-70
1962	M	63	RHABDOMYOSARCOMA	LEFT LOWER LEG	LUNG AND RIGHT OUTER CHEST WALL	8-61
1967	M	77	MESOTHELIOMA	LUNG	LUNG, PERITONEUM AND DIAPHRAGM	6-67
1967	M	20	RHABDOMYOSARCOMA	PHARYNX	PERIORBITAL AREA AND LIVER	1-67
1969	M	32	LIPOSARCOMA	LEFT ARM	PERINEUM AND BUTTOCK	6-64
1971	M	76	LEIOMYOSARCOMA	SMALL INTESTINE	LIVER	10-69
1972	M	89	LEIOMYOSARCOMA	RETROPERITONEAL REGION	HEPATIC SYSTEM	7-72
1975	M	53	FIBROSARCOMA	PERITONEUM	LUNG, LIVER	3-75

Table 11  
Soft and Connective Tissue Cancer Statistics  
for Selected U.S. Counties with Manufacturing Facilities  
That Generate Chlorophenolic Compounds

White Males

1950-1959		1960-1969		1970-1978		County and State	Percent Change			Percentile	
Deaths	Rate	Deaths	Rate	Deaths	Rate		60s/50s	70s/60s	70s/50s	%Change 70s/50s	Rate 1970s
3748	.3	6030	.7	6391	.8	United States	40	6	49		
1	.2			6	2.0	Harford MD			778	99	90
2	1.3	4*	2.0	3	1.6	Midland MI	55	-20	25	47	67
7	.6	9	.8	14*	1.4	Niagara NY	29	69	119	78	83
38	.6	51	.8	71*	1.2	Cuyahoga OH	33	59	112	77	80
8	.4	18	.8	26*	1.2	Union NJ	104	42	190	87	78
4	.9	4	.8	4	1.1	Buchanan MD	-12	46	28	49	77
1	.8			1	1.1	Lawrence MD			46	58	77
27*	.8	38	1.0	40	1.1	Alameda CA	21	13	36	53	76
18	.8	28	.9	37	1.0	St Louis MO	12	15	30	50	74
12*	1.2	19*	1.4	12	1.0	Sedgwick KS	18	-30	-17	27	72
11	.4	31*	1.2	24	1.0	Multnomah OR	159	-18	112	76	72
5	.6	6	.6	9	.9	Pulaski AR	5	48	56	61	70
8	.6	18	.8	19	.9	San Mateo CA	53	4	59	62	69
2	.3	3	.5	6	.9	Greene MO	42	80	156	83	69
2	.5	5	1.2	3	.8	Tuscarawas OH	119	-32	48	58	66
5	.3	22	1.1	15	.8	Ramsey MN	297	-27	191	87	65
9	.5	14	.7	15	.8	Passaic NJ	31	16	52	60	65
92	.5	149	.7	141	.8	Cook IL	54	7	65	64	64
55	.7	67	.9	42	.7	Philadelphia PA	29	-19	4	37	62
13	.6	25	1.0	16	.6	Montgomery PA	60	-39	-3	33	58
9	1.0	3	.3	5	.5	St Clair IL	-70	87	-44	14	57
7	.5	11	.7	8	.5	Pierce WA	44	-24	10	41	56
7	.8	8	.5	12	.5	Du Page IL	-34	-2	-35	17	55
3	.4	8	.7	6	.4	Orange FL	57	-38	-3	34	53
2	1.4	3	1.3	1	.4	Orange TX	-7	-67	-70	03	53
5*	1.6	5	1.3	1	.4	Tuscaloosa AL	-16	-73	-77	01	52
3	.4	4	.7	1	.2	Wardotte KS	51	-76	-64	04	50
		1	.9			Putnam WV					
						Pase IA					

Significantly more deaths than expected.

Table 12  
Soft and Connective Tissue Cancer Statistics  
for Selected U.S. Counties with Manufacturing Facilities  
That Generate Chlorophenolic Compounds

White Females

1950-1959		1960-1969		1970-1978		County and State	Percent Change			Percentile	
Deaths	Rate	Deaths	Rate	Deaths	Rate		60s/50s	70s/60s	70s/50s	%Change 70s/50s	Rate 1970s
2991	.4	5024	.6	5967	.7	United States	38	13	57		
1	.3	5*	2.3	7*	2.8	Midland MI	618	21	771	99	95
8	.4	13	.6	23*	1.1	Ramsey MN	35	99	169	88	80
8	.7	9	.6	16*	1.1	Sedwick KS	-20	82	45	61	79
3	.3	10	1.0	12	1.1	Niagara NY	227	11	264	94	79
1	.4	1	.6	5	1.0	Harford MD	41	69	139	85	70
		3	.7	4	1.0	Tuscaloosa AL		33			76
1	.7	2	1.4	1	1.0	Lawrence MO	96	-31	35	56	76
7	.5	18	.9	22	.9	San Mateo CA	73	6	85	73	75
34	.5	45	.6	53	.8	Cuyahoga OH	16	32	53	64	70
18	.5	26	.6	31	.8	Alameda CA	31	21	58	66	68
		2	.5	3	.8	Tuscarawas OH		43			60
85	.4	137	.6	137	.7	Cook IL	42	10	56	65	65
49	.6	54	.7	48	.7	Philadelphia PA	14	2	16	46	65
6	.3	16	.6	16	.7	Union NJ	118	10	139	85	65
3	.5	6	.5	7	.6	Pulaski AR	18	15	36	56	63
10	.4	16	.4	25	.6	St Louis MO	9	45	58	65	63
3	.3	8	.5	13	.6	Du Page IL	62	23	99	77	62
5	.2	16	.8	12	.6	Passaic NJ	219	-25	138	84	61
10	.4	12	.4	17	.6	Montgomery PA	-7	34	24	50	60
5	.6	3	.3	9	.5	Orange FL	-52	95	-6	35	60
4	.3	7	.5	9	.5	Pierce WA	45	14	65	68	60
5	.9	5	.7	4	.5	Greene MO	-22	-23	-40	14	59
4	.4	7	.7	5	.5	St Clair IL	58	-25	19	47	58
12	.4	22	.7	13	.5	Multnomah OR	71	-35	11	44	57
		1	.3	1	.4	Orange TX		16			54
2	.3	3	.4	2	.3	Wyandotte KS	35	-31	-7	34	52
2	.4	6	1.1	2	.3	Buchanan MO	198	-75	-24	23	52
						Pase IA					
						Putnam WV					

Significantly more deaths than expected.

Table 13  
 Number of U.S. Counties With a Percentile Rank of 95 or  
 Higher For Those Deaths Between 1970 and 1978 With  
 Reported Soft and Connective Tissue Cancer, According  
 to Their Potential Exposure to Dioxins<sup>1</sup>

White Males

Percentile of 1970's Rate	Total	Exposed	Not Exposed
95+	153	0	153
0-94	2,897	29	2,868
Total	3,050	29	3,021

<sup>1</sup>As defined by the presence of facilities which are known to have  
 manufactured chlorophenolic compounds, Esposito, et.al., 1980.



Table 14  
 Number of U.S. Counties With a Percentile Rank of 95 or  
 Higher For Those Deaths Between 1970 and 1978 With  
 Reported Soft and Connective Tissue Cancer, According  
 to Their Potential Exposure to Dioxins<sup>1</sup>

White Females

Percentile of 1970's Rate	Total	Exposed	Not Exposed
95+	152	1*	151
0-94	2,898	28	2,870
Total	3,050	29	3,021

\* Midland, MI

<sup>1</sup>As defined by the presence of facilities which are known to have  
 manufactured chlorophenolic compounds, Esposito, et.al., 1980.

Table 15  
 Number of U.S. Counties With a Percentile Rank of 95 or  
 Higher for Percent Change for Those Deaths from 1950-1959  
 to 1970-1978 with Reported Soft and Connective Tissue  
 Cancer, According to Their Potential Exposure to Dioxin<sup>1</sup>

White Males

Percentile of 70s/50s Change	Total	Exposed	Not Exposed
95+	40	1*	39
0-94	777	26	751
Total	817	27	790

\* Harford, Md.

<sup>1</sup>As defined by the presence of facilities which are known to have  
 manufactured chlorophenolic compounds, Esposito, et.al., 1980.

Table 16  
 Number of U.S. Counties With a Percentile Rank of 95 or  
 Higher for Percent Change for Those Deaths from 1950-1959  
 to 1970-1978 with Reported Soft and Connective Tissue  
 Cancer, According to Their Potential Exposure to Dioxin<sup>1</sup>

White Females

Percentile of 70s/50s Change	Total	Exposed	Not Exposed
95+	35	1*	34
0-94	669	23	646
Total	704	24	680

\* Midland, MI.

<sup>1</sup>As defined by the presence of facilities which are known to have  
 manufactured chlorophenolic compounds, Esposito, et.al., 1980.

Table 17  
 Number of U.S. Counties With a Statistically  
 Significant Excess Number of Deaths Between 1970 and  
 1978 with Reported Soft and Connective Tissue Cancer,  
 According to Their Potential Exposure to Dioxin<sup>1</sup>

White Males

Significance of 1970's Rate	Total	Exposed	Not Exposed
95+	177	3*	174
0-94	2,873	26	2,847
Total	3,050	29	3,021

\* Union, NJ, Niagara, NY and Cuyahoga, OH.

<sup>1</sup>As defined by the presence of facilities which are known to have manufactured chlorophenolic compounds, Esposito, et.al., 1980.

Table 18  
 Number of U.S. Counties With a Statistically  
 Significant Excess Number of Deaths Between 1970 and  
 1978 with Reported Soft and Connective Tissue Cancer,  
 According to Their Potential Exposure to Dioxin<sup>1</sup>

White Females

Significance of 1970's Rate	Total	Exposed	Not Exposed
95+	220	3*	217
0-94	2,830	26	2,804
Total	3,050	29	3,021

\* Sedgewick, KS., Midland, MI. and Ramsey, MN.

<sup>1</sup>As defined by the presence of facilities which are known to have  
 manufactured chlorophenolic compounds, Esposito, et.al., 1980.

Table 19  
 Observed and Expected Deaths for Selected  
 Types of Cancer and Geographic Area  
 White Michigan Residents 1970-1978

AREA	ALL CANCER ICDA 140-209		SOFT TISSUE CANCER ICDA 171		LIVER CANCER ICDA 155		LUNG CANCER ICDA 162		HODGKINS & LYMPHOMAS ICDA 200-202	
	OBS	EXP	OBS	EXP	OBS	EXP	OBS	EXP	OBS	EXP
	MIDLAND CO.	714	666.01	10	3.57	2	3.65	156	141.61	32
SAGINAW CO.	2571	2635.85	15	13.08	17	14.24	530	562.86	108	111.35
BAY CO.	1621	1638.40	3	8.01	5	8.85	351	354.52	59	68.73
ARENAC CO.	227	238.72	2	1.09	0	1.32	68	54.80	9	9.42
ABOVE 4 COUNTIES COMBINED	5133	5178.98	30	25.75	24	28.06	1105	1113.80	208	218.70
KENT CO.	5534	5589.62	45	26.39	35	29.49	1038	1170.23	271	228.96
GRD. TRAVERSE CO.	604	658.12	5.0	3.12	7	3.54	126	142.28	31	27.00

Table 20  
Mantel-Haenszel Estimates of Relative Risk of Mortality  
for Selected Types of Cancer and Geographic Areas  
White Michigan Residents 1970-1978

AREA	ALL CANCER ICDA 140-209		SOFT TISSUE CANCER ICDA 171		LIVER CANCER ICDA 155		LUNG CANCER ICDA 162		HODGKINS & LYMPHOMAS ICDA 200-202	
	R+	P+	R+	P+	R+	P+	R+	P+	R+	P+
	MIDLAND CO.	1.09	0.04	2.84*	<0.01	0.55	0.55	1.11	0.23	1.10
SAGINAW CO.	0.97	0.15	1.15	0.69	1.20	0.54	0.94	0.16	0.97	0.78
BAY CO.	0.99	0.64	0.37	0.11	0.56	0.26	0.99	0.87	0.86	0.26
ARENAC CO.	0.94	0.41	1.84	0.69	0.00	0.48	1.26	0.08	0.96	1.00
ABOVE 4 COUNTIES COMBINED	0.99	0.47	1.18	0.45	0.85	0.49	0.99	0.79	0.95	0.48
KENT CO.	0.99	0.40	1.77*	<0.01	1.20	0.34	0.88*	<0.01	1.20*	<0.01
GRD. TRAVERSE CO.	0.90*	0.02	1.61	0.43	1.99	0.11	0.88	0.17	1.15	0.50

R+= MANTEL-HAENSZEL ESTIMATE OF RELATIVE RISK

P+= P VALUE

\*= STATISTICALLY SIGNIFICANT

December 9, 1982

Contact: John Hesse 517 373-8050

FOR IMMEDIATE RELEASE

ATTACHMENT 1

LANSING--Dr. Bailus Walker, director of the Michigan Department of Public Health, has initiated a review of cancer death records for the Midland County area. The study will determine if any human epidemiological studies are warranted to look at identifiable health problems that could be related to environmental or occupational exposures to toxic substances. The department is looking for mortality patterns that could be indicative of a common type of toxic substance exposure.

Dr. Walker's action is in response to a November 20 letter from a citizen claiming a higher than normal rate of soft connective tissue cancers in white females in Midland County as well as other concerns voiced by Midland area residents.

Cancer rate data from Midland County is being carefully compared to that of all other counties in the state. Death certificates for Midland County residents who died of soft connective tissue cancers since 1970 have been reviewed. They have so far failed to show any clues as to possible cause. The initial review, based on 11 deaths between 1970 and 1981, does reveal a higher than expected rate of this particular form of cancer in white females (8 deaths). The white male mortality rate, at 3 deaths, is not higher than expected. These data are now undergoing further study.

Concerning the overall cancer mortality rate in Midland County, the age adjusted rate for Midland County for 1979 through 1981 is 143.8 deaths for 100,000 population compared to a statewide rate of 170.5 for the same period.

As a part of the health department's current study, cancer mortality records for an area in Bay County are also being examined. This area of concern is the site of the Dow Chemical Company Rockwell Road dumpsite which was used by the company in the 1950's. Citizen concern voiced in recent years regard seepage of benzene related chemicals from the dumpsite. There also have been complaints of what was believed to be an unusually high incidence of cancer and other health problems among people living in the area.

A hydrogeologic study done in 1979 showed that contaminated water had moved from the site a short distance westward in a shallow groundwater aquifer. Dow took action under direction of the Department of Natural Resources to contain the movement of wastes from the site. The State Health Department tested private wells in the direction of the groundwater movement and found no contamination.

With regard to another locality in the Midland area, extensive investigations in 1977-1980 by several state and federal agencies in the Hemlock area of Saginaw County failed to show an environmental contamination relationship to any of the reported human and animal health problems of that area. Much of the citizen concerns were related to the fear of contaminated groundwater from past injections of wastes by Dow Chemical Company into deep brine wells.

MORE



After negative findings by the Michigan Departments of Public Health, Natural Resources, and Agriculture, the U.S. Environmental Protection Agency and the Centers for Disease Control independently conducted investigations, at a cost of nearly \$1 million, and confirmed the absence of any identifiable toxic disease clusters or evidence of chemical contamination.

Walker stressed that now, as in the past, the health department is always concerned that problems which may be related to unhealthful environmental conditions be identified and corrected. If and when scientific studies show evidence of significant public exposure to toxic substances in Midland County, or elsewhere, the department will work with all appropriate agencies toward safeguarding the public health, Walker assured.

"Citizens should continue to bring their concerns to our attention, so they may be scientifically evaluated," he said.

Through the creation of the Center for Environmental Health Sciences within the Michigan Department of Public Health in early 1982, Dr. Walker has attempted to establish a system for early identification, correction, and prevention of environmental health problems. This new focal point pulls together the departmental expertise on toxic substances and draws upon outside expertise as necessary to evaluate and correct potential or existing problems. If a potential or existing exposure to an environmental hazard is found which constitutes an unacceptable risk to humans, plants, or animals, actions can then be taken to eliminate or reduce that exposure to the target populations identified. A system for evaluating the degree of risk is under development through a grant from the U.S. Environmental Protection Agency awarded to the Michigan Departments of Public Health, Natural Resources, and Agriculture.

FOR RELEASE AT 10:00 a.m. EDT, WEDNESDAY, MAY 4, 1983

(MIDLAND)--As a result of citizen concerns, an extensive review of mortality data of soft and connective tissue cancer in Midland County, begun last November by the Michigan Department of Public Health and the Midland County Health Department, has failed to provide a definitive answer to the cause of an apparent excess of the cancer. A similar result came from a review of birth defects in the county.

Responding to results of the study, State Health Director, Gloria R. Smith, said, "This study clearly points to the need for statewide cancer and birth defect registries, among other things."

While age adjusted cancer mortality rates for all cancers combined for Midland County for all persons were below the State of Michigan rates, mortality rates from soft and connective tissue cancers among white females from Midland County were found to be higher than the national average for the periods of 1960-1969 and 1970-1978, respectively. The rates were 2.3 per hundred thousand population in the period 1960-1969 (5 deaths), and 2.8 for the 1970-1978 period (7 deaths). One additional female died from this cause in 1979, none in 1980-81.

A detailed review of death certificates, hospital records, location and duration of residency in the county, and occupational histories of the decedents and spouses for 20 cases (male and female) of soft and connective tissue cancer deaths in Midland County from 1960-1981 failed to reveal any commonalities which would suggest a single causative agent.

Of the 13 female deaths, ages ranged from 1 to 88 years. Cancer usually does not develop until many years after exposure to a possible causative agent. The study showed that one female had lived in the county only 1 year before diagnosis of cancer. One had been diagnosed in Ohio before moving to Midland. One was diagnosed while she lived in Genesee County prior to moving to Midland. Another female lived in Midland County for three years earlier in her life and was residing in Bay County at the time of her death. The 88 year old woman lived in Midland County for 2 years before her diagnosis and subsequent death. No residential information was found for 1 person, and 4 cases (including the 1 year old infant) lived in the county throughout their lifetimes. The remaining 3 cases had lived in the county continuously prior to their death for 17, 33, and 39 years.

Reviewers probed for occupational history of each cancer case. Of the 13 females, only 2 had worked for Dow Chemical at some point in their lives. Only 1 of the females' spouses is known to have worked for Dow. Because of the hypothesis that TCDD, a form of dioxin, cause soft and connective tissue cancer, the mortality data for 28 other U.S. counties in which dioxin was likely produced as a contaminant of certain products were also reviewed. This analysis indicated that no more statistically significant excesses of soft and connective tissue cancer rates occurred in these counties than counties that did not have industrial manufacturing sources suspected of releasing dioxins because of the manufacture of chlorophenol

• compounds.

Cancer data for counties directly "downwind" or "downstream" from Midland were also examined. Data for Saginaw, Bay, and Arenac counties collectively show deaths from all cancers combined are slightly less than expected. Also, death rates from soft and connective tissue cancer, liver cancer, lung cancer, Hodgkins disease, and lymphomas were analyzed and found comparable to the State of Michigan rate.

It is the view of the Department that the following is required:

\*To allow more complete tumor records for statewide comparisons in the future, the Department recommends a mandatory statewide cancer incidence registry be developed and funded.

\*A case-control study would be necessary to further explore the possible "cause" or "association" of soft and connective tissue cancers with life style, occupation, and other variables. Additional funds are needed to conduct such a study which the Department would conduct in cooperation with outside expertise.

\*A registry should be developed of persons most likely exposed to dioxins as evidenced by their occupations, fish consumption patterns, or location of residence. Such a cohort of people would serve as a framework for possible future epidemiological studies.

The birth defects study dealt with data for the years 1970-1981 in Midland, Arenac, Bay, and Saginaw Counties. Information evaluated included data from the Birth Defects Monitoring Program (BDMP) available from the Centers for Disease Control in Atlanta, Georgia, and from data contained on birth and fetal death records at the Michigan Department of Public Health.

Of the 37 congenital malformations followed by the BDMP, only one rate was found to be significantly higher in Midland County than the United States rate for the period of 1970-1981 - Hip Dislocation without central nervous system (CNS) defects. This anomaly would not be expected to be related to an environmental or occupational etiological agent and was identified as significantly high in five other Michigan counties for the same time period.

Midland County was not unique in reporting an excess of births with a particular anomaly. Hospitals in 42 of the other 62 Michigan counties in the BDMP system reported at least one significant anomaly in excess of the expected number during the period 1970-1981.

Data from birth and fetal death records showed four anomalies to have statistically significant higher rates in Midland County than the State of Michigan rates for the grouped years 1970-1975. These anomalies included cleft lip with or without cleft palate, cleft palate without cleft lip, hypospadias, and hip dislocation without CNS defects. Only hip dislocation without CNS defects was found to be significant for the period of 1976-1981.

The combined Arenac, Bay, and Saginaw County rates for oral clefts were lower than the State of Michigan rate for the period of 1970-1975. This indicates that the counties "downstream" or "downwind" of Midland did not experience higher rates during this period.

Although from January, 1981, through August, 1982, the latest available data, no oral cleft anomalies have been reported on the birth or fetal death records for Midland County resident pregnancies, the Department feels that birth defects in the county need to be continuously monitored for unusual occurrence rates.

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