

High-Risk Notification of Chromate and Bichromate Production Workers

K.D. Rosenman, MD, M. Stanbury, MSPH, A. Lemon, BA,
G. Solice-Sample, BA, and A. Kalush, MS

A high-risk notification program is in progress for 4,862 former chromate and bichromate production workers. A previous mortality study of this cohort found a 29-fold increase in mortality for respiratory cancer. The increase was greater in black than white workers (80-fold vs. 15-fold). The cohort was compiled from Social Security Administration records. Notification was performed mainly using addresses on file with the Internal Revenue Service.

At this time, 68% of the cohort has either been determined to have died or has been contacted. A description of the various steps of notification is included. This project has demonstrated that it is possible to perform high-risk notification in an economical manner even in the absence of employer personnel records or current addresses. The methodology used in this project is generalizable to other cohorts. © 1993 Wiley-Liss, Inc.

Key words: bichromate, chromate, worker notification, lung cancer, perforated nasal septum, hazard communication

INTRODUCTION

The potential carcinogenicity of chromates was first reported in the German literature in the 1930s [Langard, 1990]. The first health study of workers in the United States was reported in 1948 [Machle et. al., 1948]. This study of workers in all U.S. plants where chromates and bichromates were made from chromite ore (four in New Jersey, one in New York, one in Ohio, and one in Maryland) found that 22% of all deaths were due to cancer of the respiratory system. The death rate for lung cancer was 25 times normal with a range of 18-50-fold for the different plants [Machle et. al., 1948]. The Public Health Service studied these same plants in the early 1950s [Public Health Service, 1953], including environmental assessments, medical testing, and mortality analysis. A majority of the workers had perforated nasal septums (57%), and there was a 29-fold increase in deaths from respiratory cancer. Black workers had higher morbidity and mortality than white workers; 77% of the black workers had perforated nasal septums vs. 50% among white workers. There was an

Department of Medicine, Michigan State University, East Lansing (K.D.R., A.L., A.K.).
Division of Occupational and Environmental Health, New Jersey Department of Health, Trenton (M.S., G.S.-S.).

Address reprint requests to K.D. Rosenman, Michigan State University Department of Medicine, East Lansing, MI 48824-1317.

Accepted for publication August 24, 1992.

80-fold increase in deaths from lung cancer among black workers vs. a 15-fold increase among white workers. The prevalence of smoking among black and white workers was similar, 84% and 81%, respectively. There were more heavy smokers among white than black workers (32% vs. 12%) [Public Health Service, 1953].

More recent studies of the workers at the plant in Maryland have shown reduced risks of lung cancer with later year of hiring [Hayes et al., 1979]. One cannot distinguish from the data whether improvement in working conditions with a decrease in exposure to chromium or the biological phenomenon of a long latency period between first exposure and the manifestation of a work-related cancer is responsible for the reduced risks in the more recent studies. We assume that both factors are involved.

Subsequent to these studies, all seven plants have closed, with the Maryland plant, which closed in the mid-1980s, being the last to do so. Two new facilities have opened in North Carolina and Texas.

The Public Health Service concluded its report in 1953 by recommending: "It is recommended that all employees who have worked 5 years or more in the chromate industry should be X-rayed every 3 months and their films should be read by a competent roentgenologist. The study of the morbidity and mortality experience of workers in chromate plants should be continued. The local health department should follow up all chromate workers who have worked in the industry 5 years or more [Public Health Service, 1953].

No such follow-up was instituted until our project was initiated. Included in our study are the four original New Jersey plants and the new plant in Texas. There are three components to our project: (1) mortality study, (2) determination of the feasibility of locating former workers and enrolling living workers in a research program for early detection of lung cancer, and (3) high-risk worker notification. This article discusses the high-risk worker notification component of this project.

METHODS

Personnel records were requested from the three corporations that formerly owned the plants in New Jersey and Texas. Either no or incomplete personnel records on workers from the five plants were available. Limited seniority lists with birthdates were available for selected years for two plants. The corporations agreed to request the Social Security Administration to release the "941" forms that a corporation submits on a quarterly basis to the SSA. These forms contain a worker's name, social security number, and the amount of money the employer is paying on that worker to Social Security for that quarter. Quarterly Social Security records for the following dates were obtained: Plant A, 1948 until its closure in 1954; Plant B, 1948 until its closure in 1971; Plant C, 1937 until its closure in 1964; Plant D, 1937 until its closure in 1954; and Plant E (new plant in Texas), 1957 until 1964.

We were unable to obtain the information from Social Security in a computerized format. All names and social security numbers had to be entered into a computer file for each quarter of each year. All data were doubly verified during computer entry. A total of 68,900 names and social security numbers were entered. Initial matches by name and social security numbers, then social security numbers alone, were made by computer. Finally, visual matches were made. For example, an individual could be entered with the same social security number for multiple quarters,

but in a single quarter might have a single digit in his or her social security number that differed. Such discrepancies would be resolved in favor of the predominant social security number found in the quarterly records. In a few cases where it was not clear-cut which social security number needed to be traced, both social security records were included in the cohort. These discrepancies were resolved during subsequent contact with the worker or next of kin or from the death certificate. At the end of this process, a total of 4,862 workers with unique social security numbers were identified. The quarterly records were used to determine duration of employment. Deductions for social security have to be made only up to a certain salary. Workers earning more than that amount would not be included in the final quarter(s) of a given year. In calculating duration, we assumed that an individual worked during the final quarter of a year if there were quarterly reports filed for the preceeding quarter(s) of a year and the first quarter of the next year. For Plant B, we received only one quarterly report per year. For this plant, we assumed an individual worked throughout the period between the quarterly reports.

Members of the cohort were traced using a variety of methods. Individuals did not receive a second contact if they responded to a previous contact, nor were the next of kin of individuals who were determined to be deceased contacted. More than one data source was used to assist in determining whether a person had died. The following steps were taken to trace and contact cohort members: (1) identification of deceased individuals from Social Security and other governmental records provided to outside commercial firms, (2) a mailing by the Internal Revenue Service (IRS), (3) identification of additional dead individuals from New Jersey Death Tapes, (4) a mailing to individuals who filed New Jersey income tax forms, (5) placement of three newspaper advertisements in Texas, (6) a second mailing by the IRS, (7) identification of addresses by the Social Security Administration of individuals or dependents receiving benefits, (8) identification of phone numbers in the local phone book from the city where the Texas facility is located, (9) New Jersey motor vehicles records when we had an available birthdate, (10) the National Death Index, and (11) identification of phone numbers and addresses of fellow workers by cohort members.

A description of each of the tracing/notification steps follows.

1. Identification of deceased individuals from Social Security records and other governmental agencies provided to outside commercial firms. Our list was matched by social security number against a computerized list of ~42 million death records that date back to the early 1960s. This death record file is maintained by a commercial firm that sells access to it. The major source of the deaths is the Social Security Administration. Other sources are Railroad Retirement, Department of Defense, State of California, and Civil Service. When a social security number is matched, then the first and last name, date of death, date of birth, state where death occurred, last known zip code of residence, and source of data are supplied on the match.

2. Mailing by the Internal Revenue Service. The IRS provides a service designated Project 753. For a fee, they will forward a letter on behalf of another institution. The letters are forwarded to the addresses of all individuals who filed an income tax form in the previous year and that match with the supplied list of social security numbers. The letter forwarded by the IRS must include in bold type the following statement: "In accordance with current policy, the Internal Revenue Service (IRS) has agreed to forward this letter because we at Michigan State University do not have your current address. The IRS has not disclosed your address nor any

other tax information to us, and has no involvement in the matter aside from forwarding this letter.”

They will send no more than three pages and the material can be no larger than 8 ½" × by 11". Our mailing consisted of a letter and fact sheet on the front and back of one page, a questionnaire on the front and back of the second page, and a return postage paid envelope. The material is mailed in an IRS envelope with the IRS return address on the envelope. The time between requesting the IRS to provide this service and the actual mailing was 5 months.

The content of our notification package was designed to comply with the IRS page limitations and with our additional objectives of performing a mortality study and determining the feasibility of enrolling living workers in a future research program for early detection of lung cancer.

The cover letter and fact sheet were brief, included expressions of personal concern, were written at a sixth-grade reading level, and highlighted action to be taken by the individuals. Prior to mailing, the letter and fact sheet were reviewed by staff from the National Institute for Occupational Safety and Health who regularly do notification, an experienced researcher in high-risk worker notification, and a panel of four blue-collar workers. Emphasis in the letter was placed on asking the workers to complete the questionnaire, show the letter to their doctor, and consult an attorney if they developed lung cancer. Facts on how their name was obtained, concerns about confidentiality, concerns about cancer, and the best estimates of their risk for disease in the future were included. The questionnaire asked about demographics, health status, smoking history, job history at the plant(s), and ways to reach the respondent in the future if they moved.

The IRS will not supply information about who, on the list supplied to them, matched their records or even how many matched. Estimates of the number of matches can be based on the amount of material returned by the IRS as not mailed and/or the amount of the bill from the IRS to pay for the service.

3. Identification of additional dead individuals from the New Jersey Department of Health Death tapes. For the years 1970–1989, we matched our data file with a computerized listing of deaths in New Jersey. This step overlapped in time with the performance of step 1. A name was considered matched if the first eight letters of the last name and the social security number of our list matched the New Jersey death tape list.

4. Mailing to individuals who filed New Jersey income tax forms. For the year 1990, we matched our data file with a computerized listing of individuals who filed New Jersey income tax. The New Jersey Department of Taxation considered a name matched if the first four letters of the last name and the social security number of our list matched the income tax list. They released the addresses of these individuals to us.

These individuals were sent a cover letter, the original letter and a fact sheet, the questionnaire, and a postage paid envelope. Nonresponders received a reminder postcard. For individuals who did not respond to the postcard, directory assistance was used to obtain a telephone number. The individual was called and the questionnaire was then completed over the phone.

5. Placement of a newspaper advertisement in a Texas newspaper. A newspaper advertisement was run on three separate days (Sunday, Monday, Tuesday) in a 1-week period in the local paper of the city where the Texas facility was located.

6. Second mailing by the IRS. A repeat mailing was done by the IRS with the same requirements as the initial mailing. The second mailing included a new cover letter with the standard IRS disclaimer, the original letter/fact sheet, and an abbreviated questionnaire, which could be folded into a postage paid mailer. The time period between requesting the second mailing and the actual mailing was 4 months.

7. Identification of addresses by the Social Security Administration of individuals or dependents receiving benefits. A list of names and social security numbers was sent to the SSA. They verified these social security numbers through their Enumeration Verification System and then matched these verified social security numbers against their list of recipients receiving benefits. They provided date of birth and address information on all beneficiaries. This included either the original worker in our cohort or if deceased, his or her beneficiary.

8. Identification in the local phone book from city where the Texas facility is located. The local phone book of the city where the Texas facility is located was used to call individuals where first and last names matched.

9. Identification from New Jersey motor vehicle records of individuals for whom we had available birth dates. New Jersey computerized motor vehicle records do not include social security numbers. Manually, a match was made on last and first name. Given the large number of matches on name alone, we limited the use of these records to look for individuals for whom we had a birth date available. Information on birth dates was available in the motor vehicle records and was used to match the correct individual.

10. National Death Index. A list of names and social security numbers will be sent to the National Center for Health Statistics. Matching criteria to be used will be social security number and first or last name or father's surname if a female. Deaths occurring in 1979 and after are available for matching.

11. Identification of phone numbers and addresses of fellow workers by cohort members. All individuals who are located are asked if they know about the whereabouts of fellow workers and if it would be all right to call them to help us find fellow workers. Additionally, anyone who responds to the questionnaire is questioned about all people with the same last name who worked at the same plant.

A toll-free telephone line has been staffed to answer questions. A physician, board certified in internal and occupational medicine, was available to respond by phone or in writing to all medical questions. All individuals who indicated on the questionnaire that they wished to receive information on lung cancer were sent a brochure on its early detection. These individuals also were sent a second letter, which contained a second toll-free number to a law firm, which had agreed to answer the workers' legal questions. This law firm invited all former New Jersey workers who called this number to attend a meeting to discuss their legal rights.

A random sample of 275 former New Jersey workers who sent in their questionnaire received a third mailing asking if they would agree to a telephone interview. The results of these interviews are being used to evaluate the notification program [Needleman, 1993].

RESULTS

The tracing of individuals and notification of members of the cohort is still ongoing. The results of each of the tracing/notification steps follows.

1. Identification of dead individuals from Social Security records and other governmental agencies provided to outside commercial firms. A total of 1,647 matches were made with our data base at a cost of \$673.

2. Mailing by the Internal Revenue Service. A total of 752 questionnaires was received in response to the first mailing. The charge by the IRS for this mailing was \$2,280.

The response rate to the questionnaire was estimated to be between 24.9% and 63.5%. The low response rate is based on assuming that the number of questionnaires sent out by the IRS equaled the amount sent to the IRS less the number of questionnaires that the IRS returned to us. This assumes IRS lost no questionnaires secondary to machine or human error. The high response rate is based on the amount IRS charged for the service. The charge had both a flat fee and a price per envelope charge.

Twenty-eight letters were sent to the individuals who stated that they had never worked at any of the companies. Four individuals or their spouses were determined to have worked at one of the companies. Eight individuals matched with social security numbers listed for other individuals (i.e., an incorrect social security number was listed on the 941 forms). Two individuals and their spouses did not work at any of the companies. Four persons declined to give out their social security numbers, and we were unable to determine if they were on the list or if they were matched with other individuals. We are still attempting to determine why the other 10 individuals received the letter. Another possible problem occurred. Included in our unused mailings, which were returned by the IRS, we found 35 stuffed envelopes containing another mailing by the IRS about a specific company's pension plan. We could not obtain any information on how the presence of these envelopes might have affected our mailing.

In response to this IRS mailing, we received 173 phone calls and 13 letters in addition to the questionnaires. Most letters and calls requested more information about how we had gotten their name, offered us information or advice, thanked us, or asked specific medical and legal questions. A few individuals seemed particularly anxious but calmed down during the call. A half dozen calls and/or letters were from individuals who were angry and felt we had overstated the risk or were wasting taxpayer dollars. These latter responses were from active workers at either the North Carolina or Texas facilities.

3. Identification of additional dead individuals from New Jersey Death tapes. There was a total of 798 matches. However, only 45 of these deaths were not also identified in step 1.

4. Mailing to individuals who filed New Jersey income tax forms. The names of 492 individuals matched, and we received 237 responses to our mailing and/or phone contact. Because of overlap in timing with the second IRS mailing, an additional 60 from this group responded to that mailing but not our direct mailing; 184 have not responded to the mailing and had nonpublished, nonlisted, or discontinued telephone numbers. We are still attempting to contact another 11 with listed phone numbers.

5. Placement of a newspaper advertisement in a Texas newspaper. Thirty new individuals responded to this advertisement. A number of people or widows, who had previously contacted us, also responded. Finally, we received a couple of phone calls from noncohort members. One of these callers informed us that, as a consultant

TABLE I. Results of Tracing by the Method Used to Identify Deceased Chromate and Bichromate Production Cohort Members

Step ^a	Number identified
1 Social Security death tapes (only)	894
3 New Jersey Health Department death tapes (only)	45
1 and 3 (both)	753
2, 4, 6, and 11	19
TOTAL	1,711

^aSee the Methods section for a complete description of the process involved in each step.

to the plant, this person was concerned about the inadequacy of current industrial hygiene controls in the plant.

6. Second mailing by the IRS. A total of 191 individuals responded to the second IRS mailing, and 41% stated they never received the first IRS mailing. We have not received any returned mailings or the bill from IRS to estimate the percent response.

7. Identification of addresses by the Social Security Administration of individuals or dependents receiving benefits. A total of 1,936 names has been sent to the SSA. The estimated cost for this service is \$4,262.

8. Identification in the local phone book from city where the Texas facility is located. Seventy individuals have been located and contacted by going through the phone book.

9. Identification from New Jersey motor vehicle records of individuals for whom we had available birth dates. Fifty-two letters and/or calls have been initiated using information obtained from this source. To date, eight questionnaires have been received and seven additional individuals stated that they were not the persons for whom we were looking.

10. National Death Index. An actual match has not yet been attempted. The cost estimate is \$5,800 for matching 2,500 names.

11. Identification of phone numbers and addresses of fellow workers by cohort members. Finally, 114 individuals were contacted after their location was identified by other respondents.

Tables I and II summarize the results of the tracing by the different steps.

Most of the calls to the hot line occurred after the first IRS mailing and to a lesser extent from the second IRS mailing.

The results of the 1,414 questionnaires received to date are shown in Table III. The respondents to date are predominantly white men who live in either New Jersey or Texas. Half are interested in attending a medical screening clinic, 16% still smoke cigarettes, and 15% have perforated nasal septums.

DISCUSSION

This notification program took place in the absence of company personnel records to either create or locate a cohort of workers. We have previously proposed the methodology we used in this project as a method for identifying and notifying cohorts of former asbestos exposed workers [Stanbury et al., 1987]. Despite the lack

TABLE II. Results of Tracing by the Method Used to Contact Chromate and Bichromate Production Cohort Members

Step ^a	Number identified
2 First Federal IRS mailing	752
4 New Jersey IRS mailing	237
5 Newspaper ad	30
6 Second Federal IRS mailing	191
8 Texas phone book	57
9 New Jersey motor vehicle records	52
11 Cohort members	114
TOTAL	1,433 ^b

^aSee the Methods section for a complete description of the process involved in each step.

^b19 responses were received from next of kin of deceased cohort members.

TABLE III. Summary of Results From 1,414 Questionnaires Received From Chromate and Bichromate Cohort Members

	Number	Percentage ^a
Current geographic distribution		
New Jersey	502	36.2
Texas	496	35.8
Interested in attending screening clinic	612	47.5
Race		
White	1,122	81.1
Black	150	10.8
Hispanic	100	7.2
Gender		
Male	1,203	85.1
Cigarette smoking status		
Current	189	15.6
Ex	538	44.8
Never	475	39.5
Perforated nasal septum	206	14.6
Scars from chrome ulcers	209	16.8

^aPercentages were calculated based on the number of persons who answered question.

of current addresses, we have been able to determine the vital status and location of 64% of the cohort. Another 4% filed New Jersey income tax in 1990 but have not responded. Because of the nature of records we had available, we do not yet know what percentage of the remaining 32% of the cohort not located has been notified but has not responded, or if alive has not been notified, or has died.

We have reached a 68% follow-up, before we have had the opportunity to use two large national data bases, the Social Security Administration benefit file and the National Death Index. After using these data bases, we expect our percentage of follow-up to be comparable to other high-risk worker notification programs [Schulte et al., 1985].

The total cost (indirect and direct) for our project is \$130,000. This includes the

mortality study and the feasibility study to set up an early detection program for lung cancer. This is ~\$26 per worker in the cohort. This compares to a cost of \$33 per person estimated by NIOSH for notification programs sponsored by a governmental agency [BNA Special Report Occupational Safety and Health, 1989].

Our ability to obtain social security numbers through the Social Security form 941 program of quarterly payments by employers was essential to locating former workers. The availability of these records to independent investigators is dependent on the cooperation of the employer, or former officers of the employer, if the company no longer exists. The Minnesota Department of Health has, however, been able to obtain a court order to obtain such records [Finendale, 1993].

Most of our subsequent tracing steps depended on social security numbers. Most importantly, this included the IRS project 753 mailing service. Because of confidentiality restrictions, we were not able to determine the actual response rate to the IRS mailing. However, we know that these mailings accounted for 88% of our completed questionnaires.

The OSHA act gives NIOSH access to IRS information for tracing individuals. Even though this was a NIOSH funded activity, we did not have access through NIOSH to IRS records. Expansion of NIOSH's access to the IRS for these types of investigations would be useful, even if the only information released was the number of letters sent out by the IRS.

Another important aspect of our program was the close working relationship we had with the State Health Department in the state where the majority of the workers had worked. This cooperation allowed us access to state records such as addresses on file at the New Jersey State Department of Taxation.

Our impression from contact with individuals in the cohort and the more formal evaluation reported elsewhere in this volume [Needleman, 1993] is that notification was well accepted and, in fact, appreciated by a large percentage of the cohort. At this time, 45% of the cohort, who may still be alive, has responded to our questionnaires. Of the respondents, 48% indicated they wish to participate in a future medical screening program.

In the future, we are planning to notify the workers we have located of the results of the mortality study and to work with members of this cohort to offer them an opportunity to participate in a program to test early detection techniques for lung cancer.

ACKNOWLEDGMENTS

This work was funded by 5 R01 OH02298 from the National Institute for Occupational Safety and Health. Winnie Boal and in particular, Carolyn Needleman, provided important oversight of the notification material. Rukmani Ramprasad and Dave Martin provided essential assistance in assessing the vital status of cohort members. Special thanks to Ruth VanderWaals for manuscript preparation.

REFERENCES

- BNA Special Report Occupational Safety and Health: (1989):7 Critical Issues for the 1990's. Washington, DC: Bureau of National Affairs.
- Finendale MJ (1993): Beyond notification: A Case Study from Cloquet, Minnesota. *Am J Ind Med* 23:153-159.

- Hayes RB, Lilienfeld AM, Snell LM (1979): Mortality in chromium chemical production workers: A prospective study. *Int J Epidemiol* 8:365–374.
- Langard S (1990): One hundred years of chromium and cancer: A review of epidemiological evidence and selected case reports. *Am J Ind Med* 17:189–215.
- Machle W, Gregorius F (1948): Cancer of the respiratory system in the U.S. chromate-producing industry. *Public Health Rep* 63:1114–1127.
- Needleman C (1993): Social aspects of high-risk notification among chromium-exposed workers. *Am J Ind Med* 23:113–123.
- Public Health Service (1953): "Health of Workers in Chromate Producing Industry." Washington, DC: Public Health Service 192:1–131.
- Schulte PA, Ringen K, Altekruze EB, Gullen W, Davidson K, Anderson SS, Patton MG (1985): Notification of a cohort of workers at risk of bladder cancer. *J Occup Med* 27:19–28.
- Stanbury M, Rosenman KD (1987): Industrial sources of asbestos exposure in New Jersey with estimates of numbers exposed 1940–1979. *Am J Public Health* 77:854–855.