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MR. CHAIRMAN AND MEMBERS OF THE SYMPOSIUM.

I was asked to present a paper on the topic Pulmonary Cancer in the Asbestos Industry, not on account of any special qualifications but because I happen to be in charge of a Clinic which has as its primary function the supervision of the pulmonary condition of some 4,000 asbestos miners; such a group of employees working in a small radius of 5 miles offers an exceptional opportunity to study the problem of cancer of the lung in relation to the inhalation of asbestos fibers.

PRELIMINARY REMARKS.

This question of pulmonary cancer among the asbestos workers is as confusing and obscure as the etiology and the pathogenicity of cancer in general. From 1920 - 1950 the medical literature reports a series of 58 cases of pulmonary cancer and asbestosis. Obviously this list must be incomplete but, nevertheless, one could ask is it sound to think that the mere fact of detecting a total of 58 cases of pulmonary cancer during a period of 30 years is sufficient to establish a causal relationship when one realizes that in 1950 an estimated number of 45,000 men were employed in the asbestos industry, and that during that period a minimum of 100,000 employees have inhaled a significant amount of asbestos dust?

It is recognized that the English statistics published in the Annual Report of the Chief Inspector of Factories for the

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DATE: JUL 31 1978
M.E.M

year 1947 seem to indicate a causal relationship between the factor asbestos and pulmonary cancer but, on the other hand, in South Africa with about the same number of asbestos workers as in Great Britain, and when there is also a large number of autopsies and good medical control of all employees in dusty trades, the statistics do not indicate any abnormal incidence of pulmonary cancer.

If the frequency of pulmonary cancer in South Africa and in the Province of Quebec is really not higher amongst the asbestos workers than in any comparable groups as it seems to be, is it possible to suspect that the asbestos mining industry might be different from the Asbestos Textile Industry as far as carcinogenic activity of the asbestos is concerned? The fact that the frequency among the 30,000 asbestos workers of the United States who are also working in the Asbestos Textile Industry is not known to be higher, adds still more to the confusion.

Why is the standardized death rate from cancer of the lungs in Great Britain 3 times higher than that in the United States - 231 in comparison to 723 (rates per million)?

It would indeed be very informative to have some answers to this list of unanswered questions before being able to form an opinion; and it might be that a few answers could influence or modify any conclusion concerning a causal relationship.

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DATE: JUL 3 1979
M.E.M

PURPOSE OF THIS STUDY.

The purpose of this investigation is to try to learn as precisely as possible the incidence of pulmonary cancer in the group of asbestos mining workers; to know the incidence in groups of employees with severe or insignificant exposure and to know the incidence in groups with or without asbestotic fibrosis.

The Saranac Laboratory and many other investigators were interested in a complete study which would include an epidemiological and an experimental investigation and which would permit to ascertain whether or not a relationship exists between the inhalation of asbestos dust and primary pulmonary cancer. This paper is a preliminary and incomplete report of the epidemiological investigation and the Saranac Laboratory, once the investigation has been achieved, will publish a final report.

METHODS AND MATERIALS.

This study was rendered possible mainly because there exists in Thetford Mines a co-operative industrial clinic where all the employees working in the different asbestos companies are required to have a pre-employment examination, plus an annual periodic examination completed each time by a standard stereogram. At this clinic it was easy to analyse all the medical records, the death certificates, the protocols and the pathological findings of the necropsies and to review the series of chest roentgenograms of each employee. Thetford Mines being a small city of 18,000 it was also easy to contact and to discuss

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DATE: JUL 31 1979
M.E.M

with the treating physician the nature of any respiratory episode, to have follow-up reports on any suspicious cases and to collect additional details on the cause of the deaths.

In summary, this study is based on the results and findings obtained from the analysis of the medical files of 3,957 employees having worked in the asbestos industry from 2 - 60 years, on the findings from 53 necropsies, on the details collected from the death certificates, on the follow-up reports of cases sent to specialized centers for more complete investigation and diagnosis.

It is possible, and more than likely, that cases of pulmonary cancer have been missed; nevertheless, we think that we have employed a standard procedure in this investigation and that the results therefore are of sufficient interest to make this publication worthwhile.

RESULTS.

Before submitting the results of this investigation, it would seem proper to give a few routine tables in order to reach a better understanding of this communication.

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DATE: JUL 31 1979
M.E.M

TABLE 1.

POPULATION SAMPLED.

Age group distribution of 3,957 asbestos workers.

AGE GROUPS	15 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69	70 & Over	TOTAL
Number of Employees	76	1113	1091	766	505	307	99	3957

This table gives the age group distribution of the sampled population and needs no comment except to mention that the average age of the asbestos workers is somewhat higher than that of the average industrial worker; i.e., 35 in comparison to 33 for most other industrial groups. This remark is logical when we know that the labor turnover in the Quebec Asbestos Mining Industry is about the lowest of all the industries in the whole of Canada. This first table also shows that some 2,000 asbestos workers are 35 years of age and over - a representative group for the study of a cancer problem.

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DATE: JUL 3 1 1979
M.E.M
5063

TABLE 2.

Years employed in the asbestos industry
by 3,957 asbestos workers.

Years in the Industry	2 - 4.9	5 - 9.9	10 - 14.9	15 - 19.9	20- 24.9	25- 34.9	35 & Over	T
Number of Employees	640	1060	645	476	251	546	309	3
Man - Years	1920	7420	7740	8092	6182	14742	12360	56

REMARKS: 2,257 men have spent 10 years and over in the asbestos industry.

The second table indicates the number of years spent in the asbestos mining industry by the 3,957 employees studied. Of course this table is not as significant as one indicating the specific exposure for each employee by categories; but after many attempts it has seemed impossible to find a common denominator which would permit to add together the years spent in different degrees of exposure by the same employee.

The man-years exposure has in the mind of many investigators no great meaning in general, but in this case the fact that 56,456 man-years asbestos exposure having given rise to only 10 confirmed cases of pulmonary cancer might indicate that we are not facing an acute problem.

The following table 3 shows classification of various exposures in the asbestos mining industry. I realize that such a classification could be discussed at length and possibly

modified because in the asbestos industry, as in most of the other dusty industries, it is impossible to translate with a strict mathematical precision the different concentrations of dust particular to each job. This classification is given notwithstanding its limitations because it is based on dust counts performed by different competent agencies and, moreover, because we feel that a satisfactory classification is very useful in understanding more clearly scientific and medico-legal problems.

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DATE: JUL 3 1 1975
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TABLE 3.

Classification of various exposure in the asbestos mining industry.

Estimated degree of hazard.	Industrial Operations	ATMOSPHERIC CONDITIONS: Total dust count M.P.P.C.F. of air sampled.	ATMOSPHERIC CONDITIONS: Percent fiber count.
0	Open Pit, Shops	Less than 1	Less than 2
1	Open Pit: Box Loader, Cobber	1 - 3	Less than 2
	Dump	1 - 3	Less than 2
	Primary Crusher	2 - 3	5
	Dryer	2 - 6	6
	Concentrating	2 - 5	5
	Underground: all jobs under wet condition.		
	Short exposure of skilled employees	3 - 6	1 - 2
2	Open Pit: dry drilling	2 - 5	1 - 2
	Secondary Crushing	10 - 12	4 - 6
	Storage Bin	10 - 14	4 - 6
3	Underground: dry drilling	10 - 15	1 - 3
	Grizzlies	5 - 15	2
	Shed Cobbing	3 - 5	14 - 16
	Shipping Shed: Cleaners, Pilers	4 - 15	10 - 14
4	Mill: Millwrights, Oilers, Sweepers.	10 - 25	25 - 9
	Testers.	8	20
5	Bagging Department	20 - 30	28

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DATE: JUL 3 1 1979
M.E.M

This table indicates that the total dust count and the percent fiber count are both constituents of the degree of hazard, meaning that a rather low total dust count may become a risk when the percentages of fibers is high and inversely, that a high total dust count may also become harmless in producing pulmonary fibrosis if the fiber percent count is low.

The percentage of fibers in relation to the total count is calculated for fibers 5 microns and over, and on the principle that only particules having a length at least twice its width are fibers.

As you may see in the table, the industrial operations are grouped in 6 different categories and these categories are again sub-divided by a double line in two main groups. The upper group includes the jobs which in our experience do not produce fibrosis of some clinical importance and the lower group the jobs which can produce asbestosis.

There is an obvious explanation why the men working in the open pit do not develop asbestosis and also why the men working as baggers might develop asbestosis, but it is more difficult to explain why some industrial operations with about the same dust concentration as secondary crushing, storage bin on one part, the grizzlies and shed cobbing on the other part have been classified in different categories. We admit that in adopting such a classification we have been influenced by our clinical findings to some extent, but also by the fact that in the operations of category 3, the fiber concentration is more constant and work much heavier than in the operations of category 2. There is a marked difference

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DATE: JUL 3 1 1979
M.E.M

in the degree of hazard of categories 1,2 and 4 and 5, but the difference is not so marked for the categories 2 and 3. This table is important in order to fully understand those to follow.

It is true that the main purpose of this presentation is to report the incidence of pulmonary cancer in a group of 3,957 asbestos workers, but the nude statement that 10 cases of pulmonary cancer have been detected would not be significant unless we can compare this prevalence with that in comparable groups.

This task of finding a good comparable group or a control group in this study as in any similar studies is very difficult. We wish it had been possible to find a control group in other industries or in other industrial centers in the Province of Quebec or elsewhere in Canada. We soon realized that no other industries were interested in that problem of cancer of the lungs nor did they have the necessary data for comparison. No other industrial city has ever had two-thirds of its male adult population of the same age group so closely medically supervised with a clinical and routine roentgenographic examination as has been done in Thetford Mines for the last 7 years. The mass surveys in different cities did not help the situation; the findings were too dificient doubtless because a too small proportion in the 40-year and over age group is taking advantage of the mass survey. As a matter of fact, a mass survey in Thetford Mines in 1950 by the Provincial Department of Health did not detect a single case of pulmonary cancer as in most of the other centers, and the analys of the results is not very helpful.

RECEIVED F.H.H&S
DATE: JUL 3 1 1979
M.E.M

5067

It seems probable that the general increase in the frequency of lung cancer is not purely apparent, but when we observe in many cities a sudden and important increase in the lung cancer mortality rates such as the increase in the City of Montreal from 7.7 in 1946 to 12.9 in 1949, we must admit that the medical diagnosis facilities are responsible to an appreciable extent for such an increase. Therefore the exclusive analysis of death certificates in various centers which do not have the same medical facilities, has to be used with caution nor should it be used unless the facilities are comparable. In this study the comparative statistical analysis of the death certificates was not used because in the opinion of the official statistician of the City of Montreal and of the Statistician of the National Cancer Institute of Canada, the death certificates of the asbestos group condisted of a highly selective group and a similar selective group was not available elsewhere.

For all the reasons mentioned above and the fact of being unable to make a better selection, we decided to compare the incidence of pulmonary cancer in different groups of asbestos workers who have been submitted to the same medical investigation, and who at the same time were presenting enough characteristics to permit certain conclusions or impressions.

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DATE: JUL 3 1979
M.E.M

5065

TABLE 4.

Incidence of pulmonary cancer according to degree and length of exposure by age groups.

	GROUP 1. Unsignificant exposure		GROUP 2. Significant exposure	
	AGE GROUPS		AGE GROUPS	
	16 - 39	40 - 86	16 - 39	40 - 86
Number of Employees	2229	1367	56	305
Prevalence of Pulmonary Cancer	0	6 (0.44%)	0	4 (1.31%)

REMARKS: Unsignificant exposure includes men with exposure 0-1-2 and less than 15 years 3-4-5.

Significant exposure includes only men with more than 15 years 3-4-5. (See Table 3)

The usual calculations of the standard error show that the observed difference in percentages of incidence in the 2 groups (.87) is inferior to twice the Standard Error (1.346).

This table shows that there is no statistical evidence that the incidence of pulmonary cancer in the group 2 including the employees who have sustained severe exposure and all those who have also developed asbestosis, is higher than in group 1 of employees those without significant exposure and without any clinical asbestosis.

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DATE: JUL 3 1 1979
M.E.M

It is recognized that this table might lose a large part of its meaning if it is shown that any intensity of asbestos inhalation or any amount of asbestotic fibrosis could be considered as cancerigenic because then a large number of employees in group 1 will be transferred to group 2 and it is probable that an unknown number of pulmonary cancers in the group 1 would also have to be transported to group 2, changing rapidly the observed difference in incidence as well the conclusion.

As a logical complement to this table, we wish we could give a long series of other tables showing the incidence of pulmonary cancer in groups with recent or remote exposure; in groups with gradual exposure of 1-2 to 15 years or a similar exposure of long duration, 15 years and over; also in groups with extensive exposure and asbestosis or without asbestosis.

The data obtained from such tables might tell us in the hypothesis of a causal relationship whether the inhalation of asbestos dust is more important than the presence of asbestosis itself also what approximative degree of asbestos inhalation can be considered as predisposing to cancer.

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DATE: JUL 3 1 1979
M.E.M

TABLE 5.

Comparative Incidence of Pulmonary Cancer in 2 groups of 53 Autopsied asbestos workers.

	GROUP 1.	GROUP 2.	TOTAL
	Employees with Asbestosis	Employees without Asbestosis	
Number Autopsied	34	19	53
Number of Pulmonary Cancer	4	6	10
Percent in Each Group	11.7%	31.5%	

This table shows the prevalence of pulmonary cancer in a series of 53 autopsied asbestos workers having worked in the asbestos mining industry from 17 to 40 years in different degrees of exposure.

This series of autopsies is not as important as the series published in the Annual Report of Great Britain for the year 1947, but can be considered as less selective and more representative in not being composed from cases of asbestosis exclusively but composed of all the employees who happen to be autopsied; although it should be mentioned that there was an

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DATE: JUL 31 1979
M.E.M

involuntary selection in the sense that most of these employees have been autopsied because they were presenting some respiratory symptoms.

This coincidental selection might explain to some extent the high percentage of cases of asbestosis, but in many instances the amount of asbestotic fibrosis detected was described as minimal and of no clinical importance because not sufficient to produce symptoms.

Because the observed difference in percentages of incidence is inferior to twice the Standard Error, this table does not reveal a statistical evidence of a causal relationship between asbestosis and pulmonary cancer.

Unless we have the opportunity to perform an autopsy on all employees who die, it remains difficult to explain why in our series there are less cases of pulmonary cancer in the asbestotic group and I think we have here a good illustration as to why many statisticians counsel not to draw any conclusions from statistics based on a selective group even if such a group be in the 'autopsy' category because the role played by the factor co-incidence might be too great.

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TABLE 6.

Deaths from Pulmonary Cancer as a proportion of deaths from Cancer of all sites. 1940 - 1950

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DATE: JUL 3 1 1979
M.E.M

	Number of Cancer All forms	Number of Pulmonary Cancer	Percentages
Province of Quebec	43643	1393	3.2
City of Montreal	15247	918	6.0
City of Quebec	2543	94	3.7
City of Thetford Mines	172	9	5.2

Table 6 was prepared for the purpose of determining if the ratio between the number of cancer deaths all sites and the pulmonary cancer deaths was somewhat different in Thetford Mines from the ratio observed in few other control groups. First it should be mentioned that about 90% of the cases of pulmonary cancer in Montreal and 100% of the cases of the Thetford Group are autopsy cases and both cities have thoracic clinics, so these two groups are reasonably comparable. In Quebec City for the specific period 1945 - 1950 inclusive, 5% of all cancer deaths were also pulmonary cancer. It was thought that had a special factor existed in Thetford Mines the ratio between the number of total cancer and the number of pulmonary cancer would have been different. The difference observed here is not sufficient to draw any conclusion either positively or negatively.

5073

TABLE 7.

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DATE: JUL 3 1 1979
M.E.M

Comparative 10 Years Expectancy and 10 years Prevalence of Pulmonary Cancer in 2 cities.

PLACE	YEARS	10 YEARS EXPECTANCY	10 YEARS PREVALENCE
Thetford Mines	1941 - 1950	10.5	9
Montreal	1941 - 1950	693	856

Based on U.S. Public Health Service Report 2537. A random population of 48,833 giving a year pulmonary cancer expectancy of 7 cases per 100,000 population.

Table 7 was prepared at the suggestion of Dr. Philipps, Statistician for the National Cancer Institute of Canada who thinks that the comparative study of the 10 years expectancy and 10 years actual prevalence of pulmonary cancer in Thetford Mines and in Montreal will be more informative and more conclusive than analysis of the mortality rates. According to the surfey of Dr. Dorn, taking random population of 48,833, an annual incidence of pulmonary cancer of 7 cases per 100,000 can be expected, giving a year expectancy of 7. It is true that Dr. Dorn's survey was made in 1943-45 and that the year expectancy might have increased recently. As a matter of fact, Watson of Saskatoon, Canada, found in 1948 a year expectancy of 8.5; therefore, a year expectancy of 7 is a rather conservative standard.

On that basis Thetford Mines with an average population of 15,000 for 1940 - 1950 period is supposed to have 10.5 cases

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DATE: JUL 3 1979
M.E.M

of pulmonary cancer, and the actual prevalence is 9 cases. Again it seems logical to think that the 10 year prevalence for pulmonary cancer in Thetford Mines where two-thirds of its adult population is working in the asbestos industry would be higher than the normal 10 year expectancy, should the factor asbestosis be considered carcinogenic.

SUMMARY.

The etiology and the pathogenicity of the pulmonary cancer in relation to asbestos factor is as obscure and confusing as those of cancer in general, and in presence of contradictory data, the many different aspects of the problem should be considered before arriving at a conclusion.

The purpose of this study is to learn the incidence of pulmonary cancer amongst the 3,957 asbestos mining workers and to compare this incidence with other comparable groups. This incomplete epidemiological report is a contribution to a more complete investigation under progress at the Saranac Laboratory.

According to the standard procedure the medical files, the results of medical supervision, the annual stereograms of all the asbestos workers having worked from 2 to 60 years and the findings of 53 autopsies have been used as material.

The results have been tabulated and compared to control groups and we think that the data collected in the Asbestos Mining Industry are not exactly superposable to the results found in the

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DATE: JUL 31 1979
M.E.M

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English Asbestos Textile Industry of Great Britain and if they do not permit to deny a causal relationship between the inhalation of asbestos dust and the occurence of pulmonary cancer, they do not seem either to bring any positive evidence.

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DATE: JUL 3 1 1970
M.E.M

BY DOCTOR REOADS:

The next paper on the Symposium concerns the paper already discussed by Doctor Hueper. If we could have a little quiet, it would be very helpful for those who are presenting papers. Doctor Hueper has asked to comment on Doctor Drinker's remarks. I think we must defer this until we can get the papers under way.

I will, therefore, introduce the paper on asbestos mining by Doctor Cartier. Doctor Cartier.

BY DOCTOR CARTIER:

Members of this Tymposium: Not being a statistician, neither an epidemiologist, I don't think I should have accepted to present this paper, but I think, to excuse myself, I should say that this statistics and most of the papers I am presenting have been reviewed by your statistician in Montreal and Doctor Phillips, official statistician for National Cancer Institute of Canada in Toronto, so I would like that these two experts take the responsibility of the statements I might advance.

So I was invited to present this paper on the pulmonary cancer in the asbestos mining industry, not on account of any special qualification, only because I happen to be in charge of a clinic which has, as a primary function, to supervise the primary condition of four thousand asbestos miners, such a group of entrants offering an

TAKEN FROM PAGE 381.

RECEIVED F.H.H&S
DATE: JUL 3 1 1979
M.E.M

BY DOCTOR CARTIER:

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DATE: JUL 3 1978
M.E.M

outstanding metallurgical study of cancer of the lung in relation to asbestos fibers or any other related fibers.

In the origin of mines, six different companies are doing asbestos mining operations, so for more than eighty years, and since 1945, these companies have organized the Thetford Industrial Clinic which has, as a primary aim, to fulfill a program of industrial hygiene, mainly medical and with dust control provisions.

In 1950, the concept of an inhalation of asbestos fibers and pulmonary cancer was mentioned by many investigators and it was at that moment that the Medical Advisor or the Quebec Asbestos Mining Association, saw advantages for the employees and the employers, to recommend a company investigation composed of an epidemiological and experimental study.

This report is part of this study.

The Thetford Industrial Clinic has been in operation only since 1946, and we have medical records on five thousand fifty-two employees, but this survey is based only on three thousand nine hundred fifty-seven workers having worked in the industry from two to sixty years. About one thousand employees have been rejected from this survey because they have not worked long enough, or because they have worked in different industrial trades before.

Before presenting the first table, I think it is

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DATE: JUL 3 1 1973
M.E.M

worthwhile to say that the labor turn-over in the asbestos industry is one of the lowest in all the industry in Canada, meaning that the stable population is working in our mine and meaning, also, that in many aspects, it is easier to study and more representative.

The first slide please. So as I mentioned, this Table Number 1 shows the age group distribution of the group study and I don't think it needs any comments except to say that the average age of our employees is thirty-five, about two years older than the average for the general industrial population, and this table will show also that 1,577 men are included in the age group from forty to - and over, in the group where the incidence of cancer is more general.

Second -- next table, please. This table indicates the number of years spent in the asbestos mining industry by the total number of employees surveyed. Of course, this table is not as significant as would be a table indicating the specific exposure of these employees, but after many attempts it has seemed impossible to - to add together the different years spent in different concentration of fibers, to which most of the employees have been exposed, and I think as a remark too, it is worthwhile to mention that two thousand, two hundred have spent more than ten years in the asbestos industry.

RECEIVED F.H.H&S
DATE: JUL 3 1 1979
M.E.M

Next table, please. The following table shows a classification of various exposures in the asbestos mining industry. Realize that this classification could be discussed for many hours, and present many quarrels, but I think nevertheless that we need, for many purposes, we need a job classification, even for the exposure aspect or for research, so after we were stationed with our engineer, we took the average of all the dust survey made in the mining industry and we decided just to draw this table, and this table has also, I don't know if it is objective advantage, but has the advantage of correlating with our case of asbestosis.

I want to state that all the cases of asbestosis have belonged - have worked in shops, under that rule, I'm sorry, in the lower group, and our men having worked even from two to forty-five years in that kind of exposure, has never developed an asbestosis which was found by pathologists or epidemiologists or by experiments, to be of any sequence, any medical sequence.

This table, as you may see, presents million particles per cubic foot and the percentage of fiber count. This is very important, because from experience to experience, it seems that the fiber is the only pathological agent, rock dust not being - not being reproduced in any concensus, pulmonary fibrosis. I think, only this might

RECEIVED F.H.H&S 365.
DATE: JUL 31 1978
M.E.M

need some further explanation, because you see that is not clear. Even this might seem a little less concentrated, but just the same we put in this whole group, because on the ground, dry work and the grizzly men are working longer, they are working in more constant concentration of fibers, and in the third place, because we have found a few exceptional cases of asbestosis in that group. So, please remember the categories, 0, 1, 2, 3, 4 and 5, because in the coming tables, they might help you to understand them.

The following tables intend to indicate indicence or prevalence of pulmonary cancer in different groups of asbestos workers in comparison to different control groups. The task of selecting significant control group has been, in this case, as everywhere, very difficult. We would have wished to be able to find a group in the province of Quebec, a group in any other comparative - comparable industrial group, but it was impossible for the following reason, that in no other industrial cities in Province Quebec, so large a proportion of the adult population is followed medically so closely, because I think I should mention to you that about thirty-three - about thirty percent of the adult population in Thetford are working in the mines, being the only industry, so we can't have a very close supervisoon of the function of the - of the condition of the lungs.

We tried, with the mass survey, to detect a com-

RECEIVED F.H.H&S
DATE: JUL 31 1979
M.E.M

parable survey group, but I don't think it was or is possible, because in the Province of Quebec, very few adults over fifty years of age are taking advantage of the mass survey. As a matter of fact, the mass survey made in Thetford mines in 1950 by the Provincial Department of Health, did not detect a single case of pulmonary cancer, either in the generic operation or in fourteen miners who have been X-rayed, so having not succeeded in selecting a good control group for the reason just mentioned, we have decided to make comparative study of incidence of the pulmonary cancer in different groups of asbestos workers, which can be studied with the same methods and which, at the same time, would present sufficient characteristics to be significant.

The next table, please. This table indicates the prevalence of pulmonary cancer according to degree of length, to degree and length of exposure and by age. This table shows the prevalence of pulmonary cancer in the group with severe exposure, that's this group, and this is more or less a control group.

This, we have six cases of pulmonary - of primary pulmonary cancer and four cases, in fact, in the group exposed and this, of course, the number being smaller, it gave us a higher incidence, but if we also take that, we have to admit that this difference in incidence is not, has

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DATE: JUL 3 1968
M.E.M

no statistical value, because it is not more or equal to twice the secondary condition.

Next, please. This table was made at the suggestion of Doctor Pratt, who was interested to know the comparative incidence in group of employee, of employees who have been exposed to a significant degree of exposure, Category 3, 4 and 5, given as less - as one year, and as a control group, we take the group of employees with any kind of exposure, but of the Categories 1, - 0, 1 and 2.

Doctor Pratt had in mind, in suggesting that table, that the factor exposure to severe concentration of asbestos for any length of time might be as significant as the factor asbestosis itself, meaning that if there is a possible causal relationship, the inhalation of sufficient dosage of asbestos fibers might be as important as the factor asbestosis itself and at the same time, I think we have the two extremes.

In the previous slide, we have men with severe exposure, the incidence of cancer, pulmonary cancer in men with severe exposure, and in this - in this table, we have men in the group 2 with very light or very little exposure but with sufficient dosage of - of dust.

Next table, please. This table indicates the prevalence of pulmonary cancer in a series of fifty-three autopsied asbestos workers. This analysis, although not as

RECEIVED P.H.H&S
DATE JUL 3 1 1978
N.E.M

important as that of Doctor Merewether of Great Britain, is based on quite a similar basis and I would think that this group is less selective, because that is no section at all. That's all the cases we meant to autopsy after - from fifteen years and over in the industry. Again here, the difference is not as big as it looks, because after using - using the standard there, we came to a difference of about only .5 between the two groups, the group with asbestosis and group with - without asbestosis.

I can not answer why there is less cases of cancer in the asbestotic group, but I think that if we could have autopsy on every employee who happens to die, we might get either a different picture of maybe an indirect explanation.

Next table, please. This table was made for the purpose of knowing if the ratio between the number of cancer deaths outside and the pulmonary cancer deaths was somewhat different from the ratio observed in a few other control groups. First, I think it should be mentioned that ninety percent of the cases for the City of Montreal and a hundred percent of the cases for the City of Thetford Mines, are autopsied, are post mortem cases, so that is why I say it is difficult to compare. I don't know in which proportion for the Province or City of Quebeck, but for the Province of Quebec, the statistician and the

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DATE: JUL 31 1959
M.E.M.

epidemiologist at the same time told me that less than ten percent are post-mortem cases, so this might be not comparable to a large extent, but I think if there was any significance, we should expect to have a bigger variation in the percentages.

Next, table, please. Instead of comparing the annual prevalence on incidence of pulmonary cancer in the population of Thetford Mines with the incidence in other control groups, Doctor Phillips from the National Cancer Institute of Canada has suggested to work this number, this table, which is based on the fact that Doctor Dorning has found in a random population of 48,833, an annual incidence of seven cases for each hundred thousand of population, given a year expectancy of seventy.

On that basis, Thetford Mines, which is average population of 15,000 for the last ten years, should have ten cases between - twenty-five cases of pulmonary cancer, and the actual prevalence for ten years, this ten years, the actual prevalence is nine cases.

In Montreal, with the ten years expectancy of six, six ninety or six ninety-three cases, it has, as you see, eight hundred fifty-six and I think it is worthwhile to mention that in Montreal, the rate since '45, in '45 the rate per hundred thousand of population was only .5, 5.9, and in 1950, it has reached 12.9.

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DATE: JUL 31 1979
M.E.M

In conclusion, this paper hasn't been, by any means, the intention to bring the final answer to the problem of the final relation between the inhalation of asbestos fibers and the development of pulmonary cancer, but I think that this incomplete study, I must admit, may have found one of the most representative groups of asbestos workers, believing that the data collected in Thetford Mines do not seem to indicate a causal relationship, and that if it be so, that the data do not correlate the data of Doctor Merewether in Great Britain. Thank you.

(Applause).

BY DOCTOR RHOADS:

I'm curious to observe the remark of Doctor Cartier of the mass survey employed in his group, did not reveal any patients with early pulmonary cancer. I must presume that the mass survey was not sufficiently large, so if this means, after all, for picking up a disease which is treatable and in many instances curable, may not have been sufficient.

I'm also very curious about the fifty-three autopsied individuals of whom ten had pulmonary cancer. I thought they were autopsied because it was thought they may have had pulmonary cancer. It was not a routine autopsy?

BY DOCTOR CARTIER:

No.

RECEIVED F.H.H&S
DATE: JUL 3 1 1975
M.E.M

BY DOCTOR RHOADS:

are there any questions on this paper? (No re-sponce). Of course, the implication is clear that there is no danger of pulmonary cancer from the workers in this particular group, and perhaps you are right. It appears to me that asbestosis is a very healthy ailment as far as cancer is concerned. There seems to be no discussion.

BY DOCTOR PLATTE:

My name is Platte from Kirkman Lake. It's essentially a gold mining district. We now have an asbestos mine in the Town of Banville near Madison. I'd like to ask the doctor what his first signs - I mean it has nothing to do with cancer - but what he looks for for indications of trouble from asbestos?

BY DOCTOR RHOADS:

The question is, what are the first indications of trouble from asbestos exposure. Can you answer that, Doctor?

BY DOCTOR CARTIER:

I don't think there is any specific symptoms except as actually changes in the - if the fibrosis is extensive enough, that is dyspnea and cyanosis, on the extreme degree, but that is, for asbestosis, in my experience, we have had about - I can mention, we have ninety-eight cases of asbestosis in our group and only the group with marked

RECEIVED F.H.H&S Dept.
DATE: JUL 3 1 1975
M.E.M

exposure and many - for many years, and many times when they start to reach fifty-five and over, they are more dyspneac, and I think the main thing, the resistance to it, they seem to die more rapidly once they reach fifty, seventy years without much of any disease. Within a few months, they go down the hill very rapidly.

BY DOCTOR RHOADS:

What do they die of?

BY DOCTOR CARTIER:

They die, some from cardiac and from generalized miscellaneous diseases, and some from bronchiectasis, but I don't think, in my experience, there is any special picture except that in a few, in two or three months, they go down very rapidly.

BY DOCTOR RHOADS:

Doctor Vorwald would like to comment.

BY DOCTOR VORWALD:

I'd like to comment just a bit. We have been encouraging Doctor Cartier to continue or pursue this study in the rather isolated population in Thetford. We are presently conducting a similar epidemiological survey in a neighboring city, also engaged in the mining of asbestos. Of course, I think you realize Doctor Cartier's difficulties in a community such as Thetford, where he must rely upon the material available to him, and we debated how the

RECEIVED F.H.H&S 393.
DATE JUL 3 1 1975
M.E.M

incidence of cancer in his exposed population in Thetford might be identified, and we have suggested, as he did, reviewal of the chest Roentgenograms, of all these cases, the Roentgenograms having been taken during the last period of fifteen years. Admittedly though, there will be a number of cases of pulmonary cancer missed by that method. We have considered sputum examination of a large population such as that, but at the moment, the best we can do was survey and study the chest Roentgenograms of this large series of individuals exposed to a special industry.

BY DOCTOR RHOADS:

And you did not pick up any cancer, I take it, in so doing?

BY DOCTOR CARTIER:

Oh, yes, from the X-ray.

BY DOCTOR RHOADS:

From your survey?

BY DOCTOR CARTIER:

Yes - no, not from mass survey; all the cases have been detected in the clinic.

BY DOCTOR RHOADS:

I'm a little puzzled about this. This can be a very interesting topic. You say mass survey didn't do it but the review of Roentgenograms taken when individuals applied for medical care?

RECEIVED F.H.H&S
DATE: JUL 31 1979
M.E.M

BY DOCTOR CARTIER:

No, that's a routine examination at the clinic.

BY DOCTOR RHOADS:

How does that differ from the mass survey?

BY DOCTOR CARTIER:

I think it differs in that the people over fifty years of age do not take advantage of the mass survey, but at the clinic, all the cases have been detected at the clinic and after that they have been followed up, and we have the cases of post mortem.

BY DOCTOR RHOADS:

This indicates what we have referred to before in a number of discussions at this point, that somehow the mass survey doesn't come through to the actual detection and use of the detection facility in bringing the patient into medical hands always.

Any further discussion? (No response). If not, we'll proceed to the next paper. Doctor Kenneth Lynch, as you know, is Professor of Pathology and Dean at the Medical College of South Carolina. Doctor Lynch.

BY DOCTOR LYNCH:

(Doctor Lynch read a prepared paper which is on file at the Saranac Laboratory.)

BY DOCTOR RHOADS:

Thank you, Doctor Lynch, for a very orderly and

RECEIVED F.H.H&S
DATE: JUL 31 1979
M.E.M

BY DOCTOR RHOADES:

Thank you, Doctor Lynch, for a very orderly and

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DATE: JUL 3 1 1979
M.E.M

DR. REGALS: You say that the mass survey did not reveal these cases but that the roentgenograms taken when the individuals applied for medical care did?

DR. CARTIER: No, the roentgenogram was taken during a routine examination at the clinic.

DR. REGALS: How does that differ from the mass survey?

DR. CARTIER: It differs in that people over 50 years of age do not take advantage of the mass survey. All the cases have been detected at the clinic and, later, have been followed up and have come to autopsy.

DR. REGALS: It appears that somehow the mass survey doesn't always result in the actual detection of cancer and in the bringing of the patient into medical hands.