

The qualifications needed by the part-time industrial physician are not difficult to attain, provided he has a genuine interest in the field.

The part-time physician is greatly assisted in industry by one or more qualified nurses, with whom he must have clear-cut professional relationships, understood and respected by management.

There are obvious but often intangible values in an industrial health service. They should stand on their own merits. If they result in demonstrable cash saving, this should be considered as a fortunate by-product.

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AN IMMUNOLOGICAL STUDY OF THE CANADIAN INDIAN

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IT HAS BEEN ESTIMATED that at the time of the first settlement in North America about four centuries ago the Indian population of what is now Canada was approximately 200,000. Shortly after the arrival of the European their numbers began to decline. Much of this decline was due to the toll taken by epidemic disease. There are instances on record of entire bands being wiped out by smallpox, cholera and the other plagues brought from the Old World on disease-infested "coffin ships". It became a belief that the Indians were a dying race; the population in 1870

9. *Idem*: Recommended Qualifications . . . for a Professional Nurse Working with Nursing Supervision in an Industrial Medical Service, 1955.

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RÉSUMÉ

L'acceptation de la médecine du travail dans les rangs de la médecine organisée aux États-Unis est à l'avantage et de l'industrie et de la profession médicale. Elle permet au médecin non spécialisé de consacrer une partie de son temps aux petites industries où ses soins sont des plus nécessaires. L'expansion phénoménale de l'industrie au Canada et aux États-Unis a profondément influencé le milieu social dans lequel la médecine est pratiquée. Nous devons accepter ces changements et nous y adapter. L'un d'entre eux consiste en une demande croissante de directives médicales que nous devons être en mesure d'offrir. Il existe un certain nombre de principes fondamentaux en médecine préventive, s'appliquant à toute industrie quelqu'en soit l'étendue. Ainsi, par exemple, doit-on veiller à la sécurité de l'atelier, conserver la santé des employés et participer dans le choix de l'emploi qui leur convient. Ces services ne font pas partie des soins médicaux élargis dont il n'est d'ailleurs pas question dans la présente communication. L'entraînement requis d'un médecin employé à temps partiel par l'industrie s'acquiert facilement à condition de s'intéresser à ce genre de clientèle. Sa tâche est beaucoup allégée s'il a à sa disposition les services de quelque infirmière diplômée dont les responsabilités professionnelles seront clairement établies et reconnues tant par le médecin que par l'administration. Les avantages d'un service de santé industrielle tout évidents qu'ils puissent être sont souvent impondérables. On doit les reconnaître comme tels. S'il en peut découler quelque économie, peut-on se considérer comme chanceux.

had fallen to about 80,000 and much was written of the "vanishing American".

In the last half century, however, there has been a steady improvement and there are signs that the rate of increase is accelerating. In 1949, the Indian population was 136,500 and in 1954 it was 151,500. This is an increase of 11% over the five-year period—a rate appreciably in excess of the natural increase in the non-Indian group. This is due both to a higher birth rate and a lower death rate, the former being the more significant. In 1954, the birth rate in Indians was 40.8 as compared with 28.4 in the non-Indian population. The death rate, however, is still somewhat higher than average; in the same year the crude rate for all Canada was 8.2 per thousand while that of the Indian was 9.8.

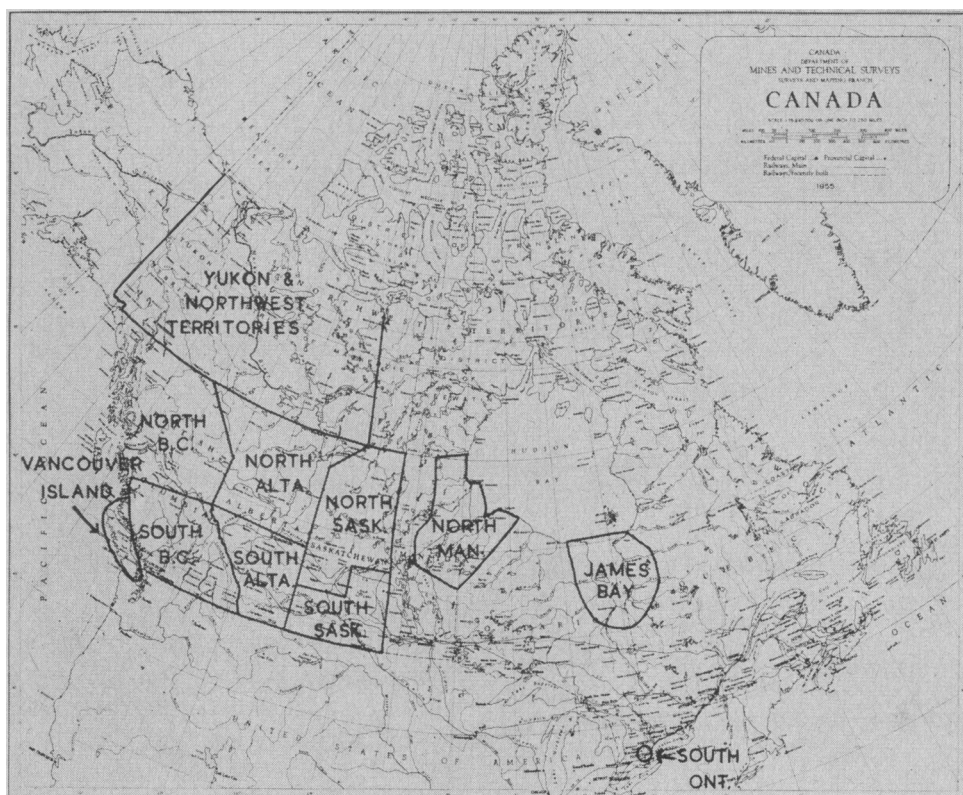
Some of this relatively high death rate and an appreciable amount of over-all Indian morbidity is still due to communicable and theoretically preventable disease. Striking advances have been made in the control of these conditions. This is particularly true in tuberculosis where

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the death rate has fallen from 579 per 100,000 in 1946 to about 48 in 1955. Nevertheless, the prevalence of those communicable diseases which follow in the train of poor sanitation and inadequate housing remains a problem, particularly amongst the more primitive bands in the more inaccessible parts of the country. Of particular importance in this respect is gastroenteritis of infants. Salmonellosis, pertussis, and pneumonia following on upper respiratory tract infections are other conditions that still cause concern.

this reason it was considered desirable to ascertain the over-all immunological status of the Indian bands in different parts of the country with a view to evaluating past procedures and determining which infectious diseases were of particular importance in different areas. It was believed, too, that an immunological survey of the type undertaken here would allow for the more intelligent planning of immunization programs. To carry this out, the co-operation of the Laboratory of Hygiene was sought in 1954.



(Produced by the Surveys and Mapping Branch, Ottawa, 1955.)
Fig. 1.—Boundaries (approximate) of Indian groups in study.

An intensive immunization program has been carried out over the past several years by Indian and Northern Health Services of the Department of National Health and Welfare. The triple diphtheria, pertussis and tetanus antigen has been brought to every band; BCG immunization has been encouraged, and in those districts where the risk was thought to be high TAB courses have been given. The complicating factor in such campaigns is that many native groups can be assembled only at irregular intervals and it is sometimes impossible to complete a course that has been started. For

PROCEDURE

Blood samples of approximately 10 ml. were collected from cross-sections of Canadian Indians in Ontario, all of the provinces west of Ontario, the Yukon and Northwest Territories. The whole blood was shipped to the Laboratory of Hygiene (usually via air), where the sera were separated and stored in the frozen state (-20° C.) until used. Prior to each use the sera were thawed in a 37° C. water bath and were returned to the freezer immediately after use. Our experience has shown that such repeated

freezing and thawing does not affect their antibody content.

The present study was restricted to antibodies related to bacterial infections. Specifically, we tested the sera for the antitoxins of diphtheria and tetanus, and for agglutinins to *Br. abortus*, *H. pertussis*, *P. tularensis*, *S. typhi* and *S. paratyphi* A, B and C. The antitoxins were titred by means of low level antitoxin techniques de-

The ages of 782 were available; these ranged from 3 to 93 years. Less than 1% were children under 5, approximately 10% were children under 10, 27% were over 30, and the remaining 60% were fairly evenly distributed between 10 and 30 years of age.

The results of diphtheria and tetanus antitoxin titrations and *H. pertussis* agglutinins are shown in Table II. Of 770 sera titrated, 722 (94%)

TABLE I.—AGE GROUPING OF INDIANS IN IMMUNOLOGICAL STUDY

District	Number Indians	Age in years						
		Under 5	5-10	11-15	16-20	21-25	26-30	Over 30
British Columbia								
North.....	38	0	3	9	9	7	4	6
South.....	96	0	8	16	26	10	10	26
Vancouver Island.....	74	0	0	8	30	8	7	21
Northwest Territories and Yukon.....								
	82	1	9	12	13	7	20	20
Alberta								
North.....	106	2	5	13	28	18	16	24
South.....	89	0	8	14	17	22	12	16
Saskatchewan								
North.....	46	0	2	4	6	6	7	21
South.....	108	1	12	30	21	11	9	24
Manitoba								
North.....	42	2	5	6	3	4	5	17
Ontario								
James Bay.....	67	1	19	12	11	7	3	14
South.....	34	0	0	2	2	3	1	26
Totals.....	782	7 (0.9%)	71 (9%)	126 (16%)	166 (21.2%)	103 (13%)	94 (12%)	215 (27%)

signed to measure unitages as low as 0.002 units. A neutralization skin test¹ on rabbits was used for diphtheria antitoxin measurement and a neutralization test in guinea pigs for tetanus antitoxin. The agglutination tests* were carried out by a concavity slide technique described elsewhere,² the tests being adjusted so that they yielded the same results as the tube test. The results of the titrations are shown in Tables II and III.

RESULTS

Blood samples were collected from 797 Indians. The geographical distribution of the groups surveyed is shown in Fig. 1, and their origin, numbers and ages are shown in Table I.

had greater than the Schick immune level of 0.004 unit of antitoxin per ml. Three hundred and thirty-seven (43%) had measurable tetanus antitoxin, and 408 (51%) had agglutinin titres of 1:8 or greater, against *H. pertussis*.

The agglutination titres found for the various salmonella are presented in Table III, where the numbers with titres of 1:16 or higher are shown. "O" agglutinins of this level were found in 328 (41%) for *S. typhi*, 13 (2%) for *S. paratyphi* A, 142 (18%) for *S. paratyphi* B, and 7 (1%) for *S. paratyphi* C. "H" agglutinins of 1:16 or higher were found in 107 (13%), 16 (2%), 43 (5%) and 5 (0.6%) for *S. typhi* and *S. paratyphi* A, B and C respectively.

The agglutinin titres for *Br. abortus* and *P. tularensis* are also shown in Table III. Thirty-five (4%) of the 797 sera tested had titres of 1:8 or more for *Br. abortus*, the greatest incidence being in the Northern Alberta area, where 11 (9%) of the 112 tested had this level of antibody. Fifty-eight (7%) had agglutinins of 1:8

*The antigens used were provided by the following: *Br. abortus* and *P. tularensis*—Zoonoses Section, Laboratory of Hygiene (Dr. F. A. Humphries), *H. pertussis*—Eli Lilly & Co. (Dr. G. C. Culbertson), H antigens for *S. typhi* and *S. paratyphi* A, B and C—Lederle Laboratories (Mr. W. S. Hammond), O antigens for *S. typhi*, *S. paratyphi* A, B and C—National Salmonella Centre, Laboratory of Hygiene (Dr. E. T. Bynoe).

TABLE II.—IMMUNITY STATUS—CANADIAN INDIANS—DIPHTHERIA, TETANUS, AND PERTUSSIS

District	On test	Diphtheria Number			On test	Tetanus Number	Pertussis Number			
		Antitoxin units					On test	With .002 unit or more	On test	With agglutinin titres of 1:8 or higher
		<.004	.004 - 1.0	>1.0						
British Columbia										
North.....	37	1	16	20	37	22	37	19		
South.....	95	1	36	58	96	34	96	44		
Vancouver Island.....	76	12	27	37	77	11	77	30		
Northwest Territories and Yukon.....	76	7	26	43	76	52	83	39		
Alberta										
North.....	100	4	35	61	100	56	105	65		
South.....	83	2	24	57	90	55	90	53		
Saskatchewan										
North.....	48	2	15	31	48	10	48	15		
South.....	111	1	37	73	112	79	112	72		
Manitoba										
North.....	42	1	15	26	42	1	42	20		
Ontario										
James Bay.....	66	3	32	31	66	11	68	27		
South.....	36	14	16	6	35	6	36	24		
Totals.....	770	48 (6%)	279 (36%)	443 (58%)	779	337 (43%)	794	408 (51%)		

or higher against *P. tularensis*, the incidence rates being 10 (9%) of 108 in Northern Alberta, 10 (9%) of 112 in Southern Saskatchewan, 7 (17%) of 42 in Northern Manitoba, and 19 (28%) of 68 in the James Bay area.

DISCUSSION

In considering the results of the present immunological study, it is not possible to assess

the relative efficacy of different immunization routines. The procedures followed in individual areas have varied markedly at times, both as regards the prophylactic employed and the age at immunization. In recent years, most Indian Health Medical Officers have been attempting to start immunization between the third month and first year of life. This is not always possible, however, because of the no-

TABLE III.—IMMUNITY STATUS—CANADIAN INDIANS

District	No. of sera titrated	ANTIBODIES FOR <i>S. typhi</i> , <i>S. paratyphi</i> A, B AND C, <i>Br. abortus</i> AND <i>P. tularensis</i>								Number with agglutinin titres of 1:16 and higher		Agglutinin titres 1:8+	
		<i>S. typhi</i>		<i>S. paratyphi</i> A		<i>S. paratyphi</i> B		<i>S. paratyphi</i> C		<i>Br. abortus</i>	<i>P. tularensis</i>		
		O	H	O	H	O	H	O	H				
British Columbia													
North.....	37	12	5	1	0	13	3	0	0	1	1		
South.....	96	32	0	0	0	23	8	0	0	3	3		
Vancouver Island.....	77	45	17	2	3	24	15	0	0	3	0		
Northwest Territories and Yukon.....													
83	33	18	1	4	15	0	0	0	0	1	2		
Alberta													
North.....	108	42	17	1	2	13	1	4	2	6	10		
South.....	90	44	25	3	2	9	2	0	0	3	0		
Saskatchewan													
North.....	48	26	4	0	0	9	1	0	0	3	3		
South.....	112	69	18	1	4	18	4	0	0	11	10		
Manitoba													
North.....	42	6	1	0	0	4	1	0	0	1	7		
Ontario													
James Bay.....	68	7	1	0	0	8	0	0	0	0	19		
South.....	36	12	1	4	1	6	8	3	3	3	3		
Totals.....	797	328 41%	107 13%	13 2%	16 2%	142 18%	43 5%	7 1%	5 0.6%	35 4%	58 7%		

madic way of life of many Indians. The readily available Indian is, as a rule, immunized early in life and receives frequent booster doses, the latter in many instances being administered during annual survey trips. The prophylactic for primary immunization has varied from diphtheria toxoid given alone to diphtheria toxoid combined with either pertussis vaccine or tetanus toxoid or both. In some instances, T.A.B. vaccine was given as well. The booster doses have always consisted of diphtheria toxoid given alone or in combination with one or more of these immunizing agents. Today, most Indian Health Medical Officers use diphtheria and tetanus toxoids combined with pertussis vaccine as the minimum number of antigens for both the primary immunization and booster doses. In addition BCG vaccine is administered very early in life, usually before the other primary injections, and smallpox vaccination, when done, is generally carried out between the first and second years of life. From this rather incomplete picture it will be appreciated that the Canadian Indian, when available, is a well-immunized individual. The question arises whether he is not too well immunized or whether booster doses given with such frequency are really necessary. The present study has done much to answer this problem.

The best method for assessing the over-all value of these immunization procedures is to study the response to diphtheria toxoid, since it was the one antigen that was given in all courses for both the primary immunization and the booster dose. Of the 770 blood sera tested (Table II), 722 (94%) had titres greater than the Schick-negative level, 0.004 unit of diphtheria antitoxin per ml., and 443 (58%) had titres greater than 1.0 unit. In the latter group, a considerable number had titres of 16 units and more, which was the highest titre tested. These figures give a rather encouraging picture. The frequent booster doses may not have been entirely necessary but certainly the immune status of the recipients was excellent as judged by antitoxin titres. This does not mean that we should relax our efforts for, notwithstanding these figures, the odd case still occurs amongst the Indian population, and even in the past year there were three deaths due to diphtheria in incompletely immunized children.

The response to tetanus toxoid is also shown in Table II. Of the 779 sera tested, 337 (43%)

had measurable tetanus antitoxin. The immunity level for this disease is not known, but levels of 0.001 and 0.01 unit have been suggested by different authors. The presence of tetanus antitoxin is of course the result of active immunization, since this is not a disease where subclinical infections occur. It is expected that the proportion showing measurable tetanus antitoxin will increase with the greater use of tetanus toxoid but here too the status of immunity is encouraging.

Of the 794 sera (Table II) tested for *H. pertussis* agglutinins, 408 (51%) had titres of 1:8 or higher. The significance of agglutinins for this disease has not yet been established, but the majority of workers in this field believe that they have some meaning. Miller *et al.*³ found that titres of 1:320 or greater indicated immunity. Powell and Jamieson⁴ have claimed that the rapid slide test was an indication of successful immunization—the latter in our experience is positive at titres of 1:8 or higher. Here too it is expected that the proportion of immunized will increase with the increased use of *H. pertussis* vaccine. However, it should be pointed out that pertussis is not a problem for the age groups in this study—99% of the participants being over five. Pertussis is a problem of infants in the first year of life, particularly in the first six months. Theoretically, a high level of immunity in the older age groups might lower the incidence of pertussis in the community, but the most certain way of protecting the infant is to immunize it very early in life, possibly even prenatally.

The results of titrations for "O" and "H" agglutinins for *S. typhi* and *S. paratyphi* A, B and C are shown in Table III. A titre of 1:16 or greater was arbitrarily selected as having significance. It was considered that titres lower than this level would have little meaning since many of the normal enteric (non-pathogenic) organisms have common or closely related antigens. "O" and "H" titres of 1:16 or higher for *S. paratyphi* A and C were found in only 2% or less, an indication that these two diseases are not of major concern in the population under study. However, a considerably greater proportion had titres of this level for *S. typhi* and *S. paratyphi* B. In general, it is considered that "O" antibody is an indication of clinical or subclinical encounter with the disease and that "H" antibody is more indicative of active immunization.

In our experience, contrary to reports in the literature, the response of both "O" and "H" agglutinins has been of a low order following active immunization—usually less than 1:16. For this reason we believe that the high titres found were due to a greater extent to their endemic nature in the groups under study and to a considerably lesser extent to active immunization. This is borne out by the relationship of "O" to "H" agglutinins. Three hundred and twenty-eight (41%) of the 797 had *S. typhi* "O" agglutinin titres greater than 1:16, whereas only 107 (13%) had titres of this level for "H". Similarly for *S. paratyphi* B, 18% had titres of 1:16 for "O", and only 5% had titres of this level for "H".

For *Br. abortus* and *P. tularensis*, titres of 1:8 were considered to show evidence of either clinical or subclinical experience. Active immunization has not been practised against either disease and they do not have antigens common to the bacteria found in the normal intestinal flora. By these findings, *Br. abortus* does not appear to be of very great concern, even though 4% of the study group had titres of 1:8 or greater. *P. tularensis* appears to present a greater problem, for although in the over-all picture only 58 (7%) had agglutinin titres of 1:8 or higher, the rate in four areas was at least 9%, and the rates in Northern Manitoba and around James Bay were 17 and 29%, respectively.

SUMMARY AND CONCLUSIONS

1. Active immunization programs followed by Indian Health Medical Officers have been extremely effective, particularly so far as immunization against diphtheria is concerned.

2. It is expected that immunization against tetanus will be equally effective in the future, now that tetanus toxoid is used more frequently.

3. The effectiveness of protection against *H. pertussis* is dependent on very early immunization and cannot be judged by the criteria used in this report.

4. The low incidence of both "O" and "H" agglutinins of *S. paratyphi* A and C indicates that these two organisms are of little concern to the populations studied.

5. The high incidence of "O" and "H" agglutinins of *S. typhi* and *S. paratyphi* B and their relative distribution indicates that these diseases are highly endemic amongst the groups studied.

In the absence of better sanitation, vaccination against both diseases should be more widely practised amongst all groups of Indians.

6. The incidence of agglutinins of *Br. abortus* suggests that this disease is of relatively minor concern to Indian populations.

7. The incidence of agglutinins of *P. tularensis* shows this to be endemic in certain areas, particularly in Northern Manitoba and around James Bay. Immunization against tularæmia might be considered for these districts.

The authors would like to express their appreciation to the many Medical Officers in the Indian and Northern Health Services for the collection and documentation of the blood samples on which this study is based.

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RÉSUMÉ

D'après ce que les médecins préposés au service de santé des Indiens ont été à même de constater, les programmes d'immunisation active ont été extrêmement efficaces au sein de cette population tout particulièrement en ce qui concerne la diphtérie. L'on s'attend à ce que l'immunisation contre le tétanos soit aussi efficace à l'avenir, comme l'usage de la toxoïde est maintenant plus répandu. Ce rapport n'est pas en mesure d'évaluer les résultats obtenus dans la coqueluche puisque l'immunité à l'égard du bacille de Bordet et Gengou dépend d'une vaccination très précoce. La rareté des agglutinines "O" et "H" de *S. paratyphi* A et C signifie que ces micro-organismes n'ont que peu d'importance dans la population dont il est question. Par contre la fréquence des agglutinines "O" et "H" de *S. typhi* et *S. paratyphi* B indique que ces maladies sont répandues à l'état endémique parmi les groupes examinés. Vu l'état actuel de l'hygiène dans ces régions, la vaccination contre ces maladies devrait être pratiquée à une plus grande échelle dans toutes les populations indiennes. Si, toujours d'après la présence d'agglutinines, *B. abortus* ne semble pas jouer un rôle bien important dans ces milieux, il semblerait par contre que *B. tularensis* se trouve à l'état endémique dans les régions de la baie James et du nord du Manitoba. L'immunisation pourrait être utile dans ces circonstances.

METABOLIC EFFECTS OF CORTISONE IN SARCOIDOSIS WITH HYPERCALCÆMIA AND RENAL INSUFFICIENCY

In a study by Scholz and his colleagues (*Proc. Staff Meet. Mayo Clin.*, 32: 182, 1957) cortisone produced a prompt reduction in the level of serum calcium with concomitant improvement in renal function when given to a patient with sarcoidosis, hypercalcaemia and renal insufficiency. In addition to disappearance of the hypercalcaemia, balance studies revealed a decrease in urinary excretion of calcium and a delayed increase in faecal content of calcium. The observed changes probably can be attributed to the effects of cortisone despite the observation that the significant increase in faecal excretion of calcium appeared after administration of cortisone was discontinued.