

An epidemiologic study of hypertension in Newfoundland

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Summary: The distribution of arterial blood pressure (BP) values of 1499 adult inhabitants of four Newfoundland communities was surveyed. Mean age- and sex-adjusted BP scores were found to be higher in each of three fishing villages than in the logging and mining community, Badger, in the central part of the province. It is postulated that the observed differences may be caused by environmental factors. The prevalence of individuals with probable essential hypertension (diastolic BP > 100 mm. Hg) in individuals over 50 years of age was found to be three times higher in the island community, Fogo, than in Badger. In both communities less than one third of those with probable hypertensive disease had received treatment.

Résumé: *Etude épidémiologique de l'hypertension à Terre-Neuve.*

L'enquête a porté sur la distribution de la tension artérielle (TA) parmi 1499 habitants de quatre villages de Terre-Neuve. On a ainsi découvert que les chiffres moyens de la TA, répartis suivant l'âge et le sexe, étaient plus élevés dans trois villages de pêche que dans Badger (village minier et forestier) situé dans le centre de la province. On suppose que les valeurs constatées peuvent relever de facteurs du milieu. Le nombre de sujets de plus de 50 ans souffrant d'hypertension essentielle probable (pression diastolique > 100 mm Hg) était trois fois plus élevé dans le village insulaire de Fogo que dans Badger. Il faut noter que moins d'un-tiers des hypertendus probables avaient été traités.

In the past decade, in Newfoundland, physicians in general practice have made observations which suggest an unusually high prevalence of elevated arterial blood pressure among the inhabitants.¹ These impressions appear to be supported by mortality figures showing a high death rate attributable to cerebrovascular accidents in the Atlantic Provinces in general and specifically in Newfoundland.² Attention focused on coastal communities which for centuries lived in relative isolation and where the diet traditionally contained a large quantity of salt. Heavily salted fish, beef and pork were until recently typical components of the everyday rural Newfoundland diet. Motivated by this evidence and earlier impressions one of the initial research projects of the newly established Faculty of Medicine of Memorial University was an epidemiologic study of arterial pressure in Newfoundland.

Methods

In 1967 four widely separated communities were selected for study. Three of them, Fogo, Ramea and Bay de Verde are fishing villages; the fourth, Badger, is an inland mining and logging community (Fig. 1) and was therefore selected as a control community. All residents of these areas are Caucasians and the majority are of English, Scottish or Irish ancestry. The research plan was to examine the population over 19 years of age in these four communities which, according to the official Canada census in 1966, was 2147 persons; 1499 respondents were examined, 773 of them in the two communities (Badger and Fogo) that are the main subject of this paper. The response rate was 85% for females and 65% for males in Badger, 75% for females and 62% for males in Fogo (Table I).

In the autumn of 1967 blood pressure clinics were held in each of the four communities within a period of one month. A data card on each individual was completed prior to examination and recorded details such as age, weight, height, presence or absence of

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a family history of hypertension, the number of pregnancies, drug usage and occupation. Height was recorded without shoes and weight was recorded in pounds in the least amount of clothing considered convenient. Before the recording of blood pressure each individual was seated for about three to five minutes while further details pertaining to the medical and family history were recorded by the examiner. Virtually all blood pressure recordings were made on one of two sphygmomanometers developed at the London School of Hygiene and Tropical Medicine. These instruments have been shown to be well suited to such epidemiological studies because observer bias is avoided by having the examiner record the blood pressure semi-automatically by using purely auditory rather than auditory-visual perception. Since the scale is not visible to the observer, preferential selection of any particular reading is avoided. Phase 5 of the Korotkoff sounds was used in our analysis as an indicator of diastolic pressures. Clip-on cuffs 14 cm. wide were used on all patients.

A dietary survey based on "phantom diet" collection for seven consecutive days in two different seasons (summer and late autumn) was conducted on 209 respondents.³ This was supplemented by a dietary history obtained by professional dietitians.

To compare the blood pressure values of the communities, age- and sex-adjusted scores were calculated for each respondent as described by Hamilton *et al.*⁴ Student's t-test was used for testing statistical significance.

Results

The first report of this undertaking was published in 1971 by E.C. Abbott *et al.*³ From their results it was apparent that the blood pressure level of inhabitants in the three fishing villages was generally higher than in Badger in central Newfoundland.

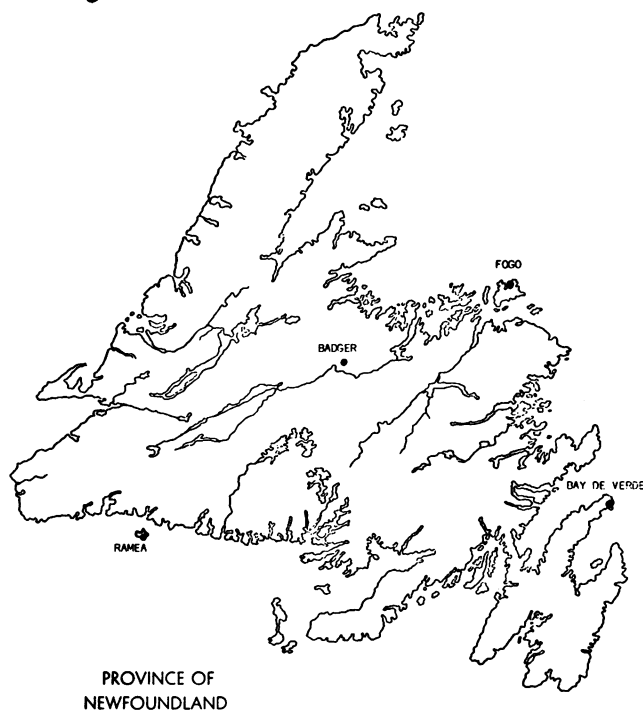


FIG. 1—Map showing the location of the four surveyed communities.

Table I shows the mean value of systolic and diastolic age- and sex-adjusted scores for the four communities. The greatest contrast exists between the island community of Fogo and the inland village of Badger, with highest and lowest blood pressure values respectively. We will restrict our analysis to these two communities. The difference between diastolic blood pressure values in the two communities is statistically significant at the 1% level for both males and females. While not statistically significant, the systolic blood pressure values show a similar pattern. These differences in arterial pressure cannot be accounted for by different somatotypes in the two communities. The difference in the standardized body weight ratios, BWR =

Observed body weight
Expected body weight* for given age, sex and body height

between Fogo and Badger is negligible (Table II). In addition, the correlation coefficient between the standardized body weight ratio and blood pressure (both systolic and diastolic) has essentially the same pattern in Fogo and in Badger (Table III). In the two communities the impact of age on blood pressure is practically identical in females, a group where the high participation rate makes a bias caused by selection unlikely (Table IV).

These data indicate that the higher blood pressure

*From tables supplied by Society of Actuaries⁵

Table I
Age- and sex-adjusted blood pressure scores of adults in four Newfoundland communities

Community	Systolic BP**	Diastolic BP**	Total adults over age 19	Examined no.	%
Females					
Badger	+ 2.1 ± 29	-4.5 ± 17*	259	219	85
Bay de Verde	+ 5.7 ± 30	-1.9 ± 13	202	154	76
Ramea	+ 5.9 ± 30	-0.6 ± 15	262	236	90
Fogo	+ 7.4 ± 28	+3.7 ± 14*	267	201	75
Males					
Badger	+ 9.5 ± 31	-2.1 ± 16*	280	183	65
Bay de Verde	+ 8.4 ± 30	-0.7 ± 17	300	150	50
Ramea	+ 9.8 ± 31	+1.5 ± 17	301	186	62
Fogo	+15.3 ± 27	+4.7 ± 14*	276	170	62
Totals:			2147	1499	70%

*P < 0.01

**Mean ± standard deviation

Table II
Comparison of body weight ratios of residents of Badger and Fogo

	Badger	Fogo
Males	1.02 ± 0.14 n = 162	0.99 ± 0.15 n = 154
Females	1.10 ± 0.20 n = 199	1.12 ± 0.24 n = 187

values in Fogo are caused by factors unrelated to body weight or age. The possible genetic and environmental influences which may affect blood pressure in the communities studied will be discussed in a separate communication. In the present paper we propose to consider some of the public health implications of our survey.

We were interested in assessing the proportion of the population suffering from suspected hypertensive disease in both communities. A comparison of the number of respondents whose diastolic blood pressure level was higher than 100 mm. Hg is shown in Table V.

In Fogo the number of probable "hypertensives" is three times higher in the age group 45 to 54 years and nearly two times higher in the age range 55 to 74

Table III
Correlations between age- and sex-adjusted (observed/expected) body weight ratio and blood pressure

Age group	Coefficient of correlation		
	Fogo	Badger	
Females			
≤ 40 yrs. :	SBP	0.303***	0.480***
	DBP	0.413***	0.328***
> 40 yrs. :	SBP	0.324***	0.290***
	DBP	0.293***	0.268***
Males			
≤ 40 yrs. :	SBP	0.229*	0.198
	DBP	0.098	0.123
> 40 yrs. :	SBP	0.336***	0.207
	DBP	0.414***	0.396***

Level of statistical significance: * 5%
** 2.5%
*** <1%

Fogo females	≤ 40 years	n = 86;	> 40 years	n = 105
Fogo males	≤ 40 years	n = 75;	> 40 years	n = 78
Badger females	≤ 40 years	n = 99;	> 40 years	n = 99
Badger males	≤ 40 years	n = 86;	> 40 years	n = 73

Table IV
Correlation between blood pressure and age in females

	Systolic BP vs. age	Diastolic BP vs. age
Badger n = 219	r = 0.59	r = 0.42
Fogo n = 201	r = 0.57	r = 0.41

Table V
Percent of population under treatment with casual diastolic blood pressure > 100 mm. Hg

Age	Fogo				Badger			
	No.	No. BP > 100 mm.Hg	%	% Treated	No.	No. BP > 100 mm.Hg	%	% Treated
25-34	72	2	2.7	0	94	2	2.1	0
35-44	94	2	2.1	0	74	3	4.0	67
45-54	69	8	11.6	38	80	3	3.7	33
55-64	50	11	22.0	37	46	6	13.0	17
65-74	42	14	33.3	22	23	4	17.3	25
Total	327	27	11.3	27	317	18	5.6	28

years than in Badger. Moreover, less than one third of these persons had been receiving some sort of anti-hypertensive treatment. Approximately one third of these newly discovered suspect cases had a systolic blood pressure over 170 mm. Hg and a diastolic pressure over 110 mm. Hg. Therefore the high mean blood pressure values of the Fogo population seem to have a direct relation to an increased number of probable cases of hypertensive disease, most of which might remain undetected or untreated without a community survey.

Discussion

It appears from our data that the original observations made by the practising physicians were correct: there is an increased prevalence of hypertensive disease in some of the coastal areas of Newfoundland as compared with the central community of Badger. The mean blood pressure levels in Badger are similar to those reported in the United States white population examined during the Health Examination Survey of 1960-1962.⁶ Prevalence rates in Fogo (and the other fishing communities) are higher than those reported in the U.S. survey. Many factors may contribute to these differences and their analysis is beyond the scope of the present paper. Possibly the isolated island community of Fogo might have a different genetic pool; it definitely has an entirely different environment including its psychosocial climate. Additional data which are now under analysis show a marked familial aggregation of various blood pressure classes in Fogo. This aggregation in families is apparent even in spouses — presumably genetically unrelated individuals. This finding substantiates our belief that environmental factors are operating within families to produce the observed aggregation. This phenomenon is considerably weaker or in some respects (the aggregation of the blood pressure of spouses) is entirely absent in Badger. It is noteworthy that in the dietary survey³ of the four communities, participants in Fogo had the highest mean sodium intake (146-153 mEq. per day) and the Badger participants the lowest (117-127 mEq. per day).

Regardless of factors causing an elevated blood pressure level in Fogo, one important aspect seems to emerge clearly: a considerable portion, indeed the majority, of hypertensives are untreated. This may be because they have no apparent symptoms or because medical help has not been sought or for other reasons. Although it is accepted⁷ that early detection and treatment of essential hypertension can improve the prog-

nosis and decrease the risk of expected complications, there are only occasional studies dealing with the present status of antihypertensive therapy in communities. A recent survey in New Orleans⁸ found that one third of the hypertensive individuals were previously unrecognized cases and that less than one half of all hypertensives were treated. Our data show that less than one third of detected cases were receiving some form of specific therapy. The magnitude of the problem, at least in certain areas of Newfoundland, seems to justify a special screening and intervention program.

The Newfoundland Hypertension Survey may provide a good foundation on which further community control programs can be built and various — including economic — aspects of the secondary prevention of hypertensive disease can be studied.

We gratefully acknowledge the help and support of the following: Mrs. Christine Cole, Head Nurse, Fogo Cottage Hospital; Mrs. Yvonne Foster, Public Health Nurse, Badger; Dr. Thomas Cooper, Chief Medical Officer, Fogo Cottage Hospital; and Dr. R. C. Roberts who was one of the two observers who performed the initial blood pressure determinations and was co-author of a paper on this work presented to the Canadian Public Health Association in 1971.

We should also like to thank the Department of Health of the Government of Newfoundland and Labrador for their excellent cooperation in every way possible.

This research was supported in part by National Health Grant #601-7-21.

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