EXPANSION OF VETERINARY MANPOWER IN CANADA

This issue of the Journal contains five articles on the subject of expansion of veterinary manpower in Canada. Readers of the Journal will remember that the January 1976 issue contained an editorial and a letter to the editor on this subject which was followed in later issues by further correspondence from veterinarians in Canada who expressed their opinions on veterinary manpower.

The articles in this issue were presented at the Plenary Session of the Annual Convention of the Canadian Veterinary Medical Association held in Vancouver in July 1976.

Readers are reminded that the papers reflect an attempt on the part of the authors to address themselves to the pros and cons of expansion of veterinary manpower in Canada and do not necessarily reflect their personal opinions. The papers by J. Archibald and T. J. Hulland were delivered in the form of a debate.

Dean D. G. Howell presented his view as dean of the Ontario Veterinary College. A. Carmichael presented some views from the British Veterinary Association and Dean N. O. Nielsen presented an analysis of veterinary manpower in Canada.

THE EDITOR

L'AUGMENTATION DU NOMBRE DES VÉTÉRINAIRES AU CANADA

Le présent numéro de la Revue contient cinq articles sur l'augmentation du nombre des vétérinaires au Canada. Les lecteurs se souviendront que le numéro de janvier 1976 contenait un éditorial et une lettre à l'éditeur, traitant du même sujet; les numéros ultérieurs présentèrent l'opinion de certains vétérinaires du Canada, concernant l'effectif des vétérinaires au pays.

Les articles du présent numéro correspondent aux communications présentées à la session plénière du dernier congrès de l'association canadienne des vétérinaires, tenu à Vancouver, en juillet 1976.

Nous tenons à rappeler aux lecteurs que ces articles traduisent, de la part de leurs auteurs, un effort de s'adresser aux tenants et aux opposants de l'augmentation de l'effectif des vétérinaires, au Canada; par conséquent, ils ne reflètent pas nécessairement leur opinion personnelle sur ce sujet. Les docteurs J. Archibald et T. J. Hulland présentèrent leurs communications sous la forme d'un débat.

Dans son article, le Dr D. G. Howell livre ses impressions, à titre de doyen du collège vétérinaire de l'Ontario. M. A. Carmichael présente quelques opinions de l'association britannique des vétérinaires. Le Dr N. O. Nielsen, doyen du collège de médecine vétérinaire de l'ouest, présente une analyse de l'effectif actuel des vétérinaires, au Canada.

LE RÉDACTEUR

A STUDY OF VETERINARY MANPOWER IN CANADA

N. O. Nielsen, W. M. Riddell and G. R. Kelly*

INTRODUCTION

To overcome a chronic severe shortage of veterinarians in all areas of employment, the Canadian Agricultural Services Coordinating Committee (CASCC), an advisory group to the Federal Government, recommended an increase in the enrollment at each of the three veterinary colleges in Canada and to consider the establishment of a fourth. The aims of this expansion were to graduate the following number of students per year from the existing colleges: University of Montreal, 70; University of Guelph, 120; University of Saskatchewan, 90. A feasibility study sponsored by the Maritime Commission on Higher Education[1] has

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[1]"Report of a Study of the Establishment of a School of Veterinary Medicine in the Atlantic Region," prepared for the Maritime Provinces Higher Education Commission by Dr. D. G. Howell, Dean, Ontario Veterinary College, University of Guelph, August 31, 1975.

recommended Charlottetown as the site for the fourth college, with a class size of 50. This proposal is presently under study by the Maritime provincial governments.

In view of the significant increase in the population of veterinarians that will occur as a result of the expanded output, it was considered worthwhile to develop methods for evaluating manpower in Canada and to attempt a study of veterinary manpower with a view to examining projections of supply and requirement over the next 15 years (i.e. until 1991).

It is relatively simple to estimate the number of veterinarians. In contrast, an estimate of future needs is extremely difficult because of a rapidly changing society, and the fact that the severe shortage of veterinarians for the past 50 years has kept veterinarians in traditional fields. Their full potential to serve in many biological and medical fields remains to be determined.

Before analysing the requirements for and the supply of veterinarians in Canada, we would like to describe the size of the human and animal populations served by the existing colleges together with that proposed for the Maritimes and to review some of the major general factors that generate a need for veterinarians.

Demographic and Educational Factors Related to the Location and Size of Veterinary Colleges

The distribution of the Canadian population in relation to the region served by the colleges of veterinary medicine is shown in Table I.

It will be noted that the distribution of the existing colleges and their enrollment (Table II) are reasonably well balanced in relation to the present human population of the region they serve and its projected growth during the next several decades, except that the proposed college in the Maritimes would be serving a relatively small population in proportion to enrollment and the University of Montreal a larger proportion than the other two colleges.

With respect to livestock population in the area served by the veterinary colleges, Table III indicates that there is some imbalance in the Maritimes where livestock population is low and in western Canada where it is high.

The areas served by the existing colleges seem to have sufficiently large human and animal populations to justify the size and resources required for an adequate veterinary medical program. Many educators estimate this to be commensurate with a class size of 80 to 100 students at current student–teacher ratios. Presently the W.C.V.M. is the third smallest college of the 22 fully operational North American colleges of veterinary medicine, and following expansion will be close to the average size. The proposed Maritime school would be the smallest.

TABLE I

Canadian Population Projected Growth[a] and Distribution in Relation to Areas Served by a Veterinary College

	Year			
	1976	1986	1991	2001
Canadian Population in Millions	22.9	26.3	27.7	30.7
	Regional Percentage of Total Population			
Western Canada	27.1	27.6	27.9	28.4
Ontario	36.7	38.4	39.3	40.8
Quebec	26.9	25.2	24.2	22.6
Maritimes[b]	9.3	8.8	8.6	8.2

[a]Statistics Canada, Projection B (Appendix B).
[b]Maritime Veterinary College is only a proposal at this time.

The existing colleges have at least five times more applicants for admission than can be accommodated, and the number could be greater if more students were encouraged to apply. Therefore, there is no problem obtaining students of high quality. On the contrary, the colleges cannot accommodate the legitimate aspirations of a large number of qualified applicants.

Contemporary veterinary medicine has featured the evolution of many academic and practice specialties. As a consequence there has been strong pressure to expand faculty numbers sufficient to give adequate coverage to the various specialties that make up the totality of veterinary medical education. Since faculty numbers are ultimately based on student numbers, small institutions will not be able to afford the size of faculty that permit a full range of specialties. This will likely handicap the teaching program and could conceivably create accreditation difficulties if the standard required of faculty continues to rise.

Factors Creating a Need for Veterinarians

The factors which determine the need for veterinarians are: 1) human population, 2) the animal population and its composition, 3) economic conditions, 4) human dietary habits,

TABLE II

SOURCE AND ANNUAL OUTPUT OF CANADA'S VETERINARIANS IN RELATION TO PERCENT OF POPULATION SERVED FOLLOWING EXPANSION AT ALL COLLEGES

Veterinary College	Yearly Output	% Total Output	% Population Served 1976
Proposed Maritime College	50	16	9
University of Montreal	70	21	27
University of Guelph	120	36	37
University of Saskatchewan	90	27	27
Total	330	100	100

TABLE III

DISTRIBUTION OF CANADA'S LIVESTOCK BY REGION

Area	Percent of Livestock Population
Maritimes	3
Quebec	23
Ontario	24
Western Canada	50

5) the magnitude of animal and/or zoonotic disease problems, 6) the comparative advantage of veterinarians and 7) societal values and customs. A brief discussion of each of these major factors follows.

Human Population

The size of the human population is naturally one of the major factors governing the magnitude of veterinary manpower requirements. It is man's use of animals that is the ultimate determinant. Therefore, projections of manpower require careful consideration of future human population estimates.

Statistics Canada published, in 1972, several projections of population growth to the turn of the century based on differing assumptions with respect to basic factors influencing population growth. In calculations used subsequently in this paper, projections have been used; and Projection B, the medium growth projection, seems to be reasonably acceptable with respect to total population. Forecasts of provincial populations are perhaps less reliable, since, for example, Saskatchewan has grown in population rather than experiencing a decline as predicted. It would seem reasonable to plan that Canada's population will exceed 30 million by the turn of the century. As noted earlier, the expanded enrollments of the existing colleges are in rough proportion to the human population in the areas served, and the projected population increase will not significantly alter this situation.

Animal Population

The numbers, class and value of farm livestock are the ultimate determinants of the demand for *rural* veterinary practitioners. Since the economics of livestock production is cyclical, it seems unwise to use livestock value in predicting long-term needs for veterinarians. Livestock numbers are a more stable figure and in the long-term should be the most satisfactory parameter for predicting demand for veterinary service, providing there is some stability in the market place. One can expect that governments will work to assure such a situation.

The large number of wild animals in Canada also creates concern about diseases in this population and a demand for veterinary skills. Modern society poses an increasing threat to the survival of many species, and veterinarians are essential members of the corps of biologists necessary to cope with this situation.

Economic Conditions

Economic conditions have a major influence on veterinary manpower. The most important of these are per capita income, the value of animals, and government programs.

Per capita income is thought to be a major determinant of demand for *urban* veterinary service. That is, with increasing per capita income there is increasing demand for veterinary care for pets and companion animals. In 1975 it was estimated that every $44 million of personal income in an urban community would generate the need for one veterinarian.[2] Given per capita incomes of at least $4,400 in many Canadian communities, a human popu-

[2]Dr. John Judy, 6th Symposium, Veterinary Medical Education, University of Guelph, June 11–31, 1975.

lation of 10,000 could conceivably require the services of one veterinarian.

The demand for *rural* practitioners has also been related to an economic factor. In this case, it has been estimated that one veterinarian is required for every $4.4 million of sales of livestock or livestock products.[2] While the value of livestock and per capita income are probably the major determinants of demand for veterinary services at any one time, their cyclical nature makes them less useful for predicting long-term needs.

Major government-sponsored veterinary service programs are in effect in New Brunswick and in Quebec. A federal ministerial committee is presently looking into the introduction of similar programs on a national scale. The introduction of such a program can be expected to produce a sudden increase in demand for rural practitioners, judging from the experience of Quebec.

Human Dietary Habits

There has been a downward trend in the consumption of cereals and dairy products, but an upward trend for vegetables, fruit and meat. Currently, meat consumption is at 210 to 220 pounds per capita per year and could increase slightly in the future. With increasing per capita income, meat consumption rises. This seems to occur in all nations. In the absence of economic disaster, the demand for meat should continue to remain at least as strong as it is at present in Canada. In developing countries, meat consumption can be expected to rise with increasing per capita purchasing power.

Even with increasing world population, people will not willingly replace meat and animal products with cereals. The production of meat and animal products will always be the most efficient method of food production on the massive amount of land that is not suited to cereals. It also appears that forecasts of a world shortage of cereals may have been unduly pessimistic.[3]

Magnitude of Animal and/or Zoonotic Disease Problems

In the presence of serious and widespread epizootics of livestock diseases or of animal diseases transmissible to man, the need for veterinarians is great. At the present time, Canada is spared the most devastating livestock diseases such as foot and mouth disease. However, they are a constant threat because of greatly increased communication and transportation links with countries harboring such problems. Serious indigenous diseases do occur. For example, brucellosis remains despite rigorous efforts directed at its eradication.

Since disease is the single greatest threat to the livestock industry in terms of its ability to cause a calamity, both farmers and governments are anxious to have the assurance of adequate veterinary care. It is assumed that the expansion of the veterinary colleges was, in part, planned to provide adequate manpower for comprehensive preventive medicine.

There are about 200 diseases transmissible from animals to man. As more is learned about epidemiology and epizootiology, it is clear that animals are important reservoirs of infections for humans. Recent concern for diseases such as influenza and Lassa fever are topical examples which demonstrate the importance of increased veterinary input in public health.

An emerging problem is the increasing presence of chemical residues in food. Food animals may be located at the end of a food chain and accumulate chemical residues that are present at low levels in the environment. This public health problem will require increased vigilance on the part of veterinarians responsible for the wholesomeness of the meat and milk which we consume.

Practicing *urban* veterinarians will play an increasingly important role in public health. Not only will they help prevent the spread of those diseases of pet animals that are communicable to man, they will help control diseases of man arising from contamination of the environment with harmful toxicants, because animals can serve as useful monitors of such problems. A classic example is the Minamata Bay disaster of Japan, where significant numbers of humans were affected by organomercurial poisoning. Retrospective studies indicated that cats began dying from this disease one year before human cases occurred. Had adequate veterinary surveillance been available, the disaster could have been largely averted. In Canada, a similar mercury pollution problem was identified in fish before there were human cases.[4]

Comparative Advantage of Veterinarians

Veterinarians are uniquely qualified to deal with problems requiring a knowledge of basic medical science. Since the veterinarian is concerned with disease in many species, he has especially good insight into the principles of disease. As a consequence, he has unique skill

[3]Science, Vol. 188, No. 4188, 9 May, 1975.

[4]J. Fish Res. Board Can. 27: 830–834, 1970.

to contribute to basic medicine, public health and environmental health.

Increasingly, all chemicals used by our society will be tested for biological activity before widespread use. This requires, for example, toxicological testing in animals and monitoring of mortality and levels of chemicals in wild and domestic animals.

Medical colleges and departments of biology are finding that veterinary academics are highly suited for teaching general courses related to disease. Medical research institutes can also be expected to employ significant numbers of veterinarians.

Societal Values and Customs

Canadians appear to consider pets or companion animals as important contributors to the quality of life. Such animals have become an increasingly important part of the urban life style. While there is increasing pressure for responsible pet ownership, it seems there will be continued growth in the population of this class of animals. The tremendous increase in all types of horses is worth noting here. Considering that animals are much more in harmony with the environment than power boats and toboggans, the use of animals in recreation is to be encouraged.

Presently about 76% of Canada's population is urban. By the turn of the century, this is expected to be 94%. Modern communications and transportation coupled with increased rural per capita income are rapidly erasing cultural differences between rural and urban populations. It seems reasonable to predict that the demand for veterinary services for pets in urban communities will extend to the population as a whole. Indeed, rural practitioners indicate that this is so. Rural people are increasingly demanding health services for their companion animals in a pattern similar to that of the urban pet owner.

An Assessment of the Requirement for Veterinarians in Major Employment Categories

For purposes of simplicity, the major categories of veterinary employment will be considered as follows: rural veterinary practice, urban veterinary practice, government and other. The following attempts to estimate the needs in these categories in the next 15 years.

Rural Veterinary Practice

The number and class of livestock and their value determines the need for rural veterinary practitioners.

TABLE IV

Livestock Equivalents The Relative Amount of Veterinary Service Required by Each of the Various Classes of Livestock

Dairy	5.0
Horse	3.0
Beef	1.0
Pig	0.25
Sheep	0.25
Poultry	0.001[a]

[a]Recent analysis indicates this value should be somewhere in the range of 0.005–0.01. The effect of such a change would be relatively slight on subsequent projections.

The object of the following analysis is to identify census districts or regions which have the most favorable rural veterinary service under present conditions. If one assumes that rural veterinarians in such areas are earning satisfactory incomes and providing adequate service, the number of livestock per rural practitioner in these areas can then serve as a guide to estimate the total national requirements and the extent and location of deficits in rural veterinary service which presently exist.

In order to compare livestock numbers with demand for veterinary service, it is first necessary to estimate the relative amounts of veterinary service required by each of the various classes of livestock. The F.A.O. suggested this be in the following proportion: dairy cattle, 1; beef cattle, 0.5; pigs, 0.2; sheep, 0.2 and poultry, 0.01. Our initial analysis indicates this relative weighting is not applicable to Canada. Table IV gives the livestock equivalent system used in this study. In this scheme, beef cattle have been assigned a unit value of 1, to which all other livestock can be compared. Thus, when the population of each of the various classes of livestock is multiplied by the appropriate equivalent, the resultant "livestock units" or "beef cattle equivalents" can be used as a uniform base to estimate the livestock population served by rural veterinary practitioners.

The livestock population was enumerated nationally in each census district in 1971.[5] Since the livestock population in 1975 is only available on a provincial basis, it is necessary to arbitrarily adjust the 1971 livestock population in each census district by a specific factor

[5]Statistics Canada, Vol. IV (Parts 1, 2 & 3). Census of Agriculture 96-701 to 96-711.

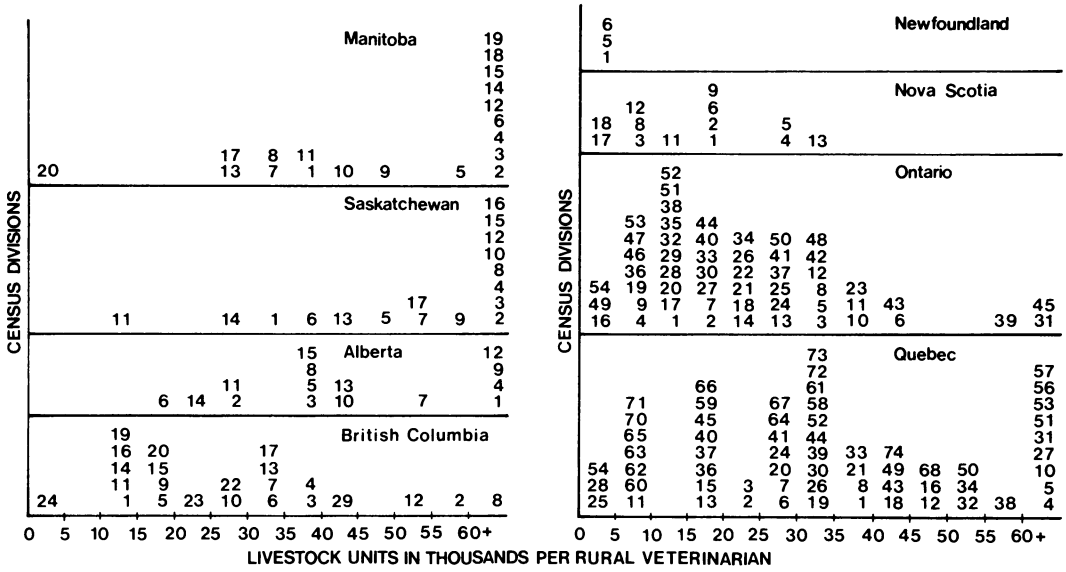

FIGURE 1. The census districts in each province have been identified by number and assigned to the column reflecting the number of livestock units per rural veterinarian in that district.

that reflects the change that has occurred.[6] While this may introduce some error, it should not be of sufficient magnitude to significantly distort the object of analysis, which is to identify the range of livestock units per rural practitioner which presently exist in the census districts.

The population and definition of "rural practitioner" is based on the classification as such in the directory of each provincial veterinary association (in some cases supplemented by consultation with those knowledgeable with activities of the membership listed). Where a practitioner has been designated as operating a "mixed" practice, only 50% of his time is allocated as a rural veterinarian (and 50% as an urban veterinarian). Furthermore, where a rural practitioner is judged to be conducting a significant amount of small animal practice, he has been assigned an increment of urban practice on the base of 0.25 veterinary equivalents for each 2,500 of urban population he serves. This has been deducted accordingly from the unit value of one assigned for full-time rural practice.

The data for most provinces are summarized in Figure 1 where the frequency distribution of census districts is given for each range of livestock units per veterinarian. Figure 2 presents the pooled data from Figure 1. It will be

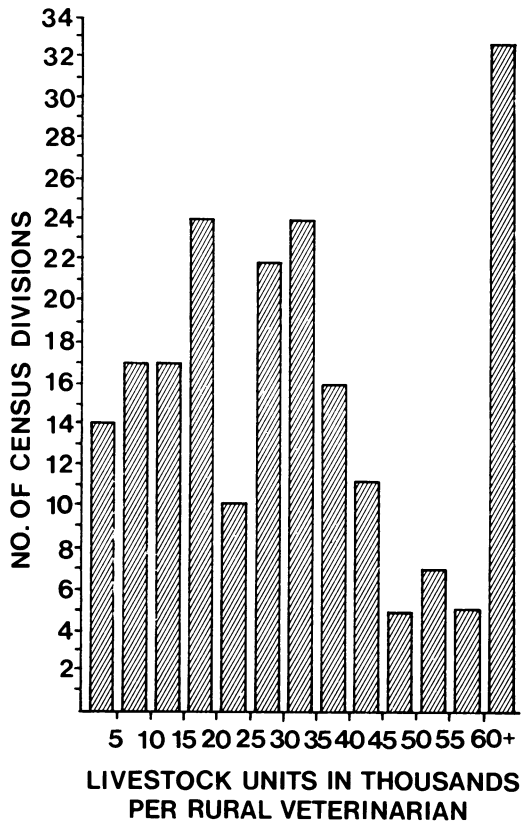

FIGURE 2. The frequency distribution of census districts in Canada (except P.E.I. and N.B.) ranked according to the numbers of livestock units per rural veterinarian.

[6]The 1975 livestock population was determined from information available in Selected Agricultural Statistics for Canada, Economics Branch, Publications 75/10, June, 1975.

TABLE V

RURAL VETERINARY PRACTICE IN CANADA, SPRING 1975

Province	Livestock Units (000's)	Rural Veterinary Practitioners	Mean Livestock Units/ Rural Veterinarians
British Columbia	1,200	50	24.3
Alberta	5,800	167.3	34.6
Saskatchewan	3,850	76.8	50.3
Manitoba	2,100	44.3	47.2
Ontario	6,500	365.5	17.8
Quebec	6,250	201	31.0
New Brunswick	250	25	10.0
Nova Scotia	300	20.8	14.5
Prince Edward Island	230	13.0	17.6
Newfoundland	25	5.0	5.2
ca.	26,500	969	27.3

noted that there is large variation in the number of livestock units per rural practitioner. This is partially due to geographic and cultural differences in various regions and most likely to a shortage of veterinarians in some areas. In the more highly urbanized areas, rural veterinarians probably have an unmeasured component of small animal practice derived from rural non-farm population which contributes significantly to their income. This analysis suggests that in the more highly urbanized communities, like Ontario and British Columbia, 15,000 livestock units can support one veterinarian under present conditions, and in the more rural situation on the prairies, this rises to about 30,000.

Table V shows the mean number of livestock units per rural practitioner in each province and indicates a rather wide disparity.

With the exception of Newfoundland, New Brunswick has the largest number of veterinarians relative to its livestock population: one per 10,000 livestock units. This province employs all its rural practitioners in a government-sponsored veterinary care program. Saskatchewan has the smallest number of rural veterinarians relative to its livestock population, one per 50,000 livestock units. Quebec introduced a "veticare" program in 1973 which resulted in a doubling of the number of veterinarians in rural practice in that province. Here there were 31,000 livestock units per veterinarian.

The fact that the number of livestock units per rural practitioner in the prairie provinces is considerably above the national average seems a consequence of the low population density of this area and probably genuine shortage of rural practitioners. The analysis of individual census districts suggests that an average of one veterinarian per 25–30,000 livestock units in the prairie provinces might be commensurate with an adequate, largely salvage, type of service, given present standards of veterinary practice in this region. One must, however, ask the question, is the situation optimal in provinces, such as New Brunswick, with more intensive veterinary care? Geographic factors and farming practices undoubtedly exert special influences in each area under study.

Present rural veterinary service in Canada is largely emergency care or salvage. Probably only 10–20% of rural veterinary service could be classed as preventive medicine. Therefore, the information in Table V and Figures 1 and 2 about existing veterinary service permits estimation of needs for largely salvage veterinary medicine only.

Estimates of demand for veterinarians at differing levels of livestock units per rural practitioner are set out in Table VI. This table also estimates the projected growth in livestock population on the basis of population growth (that is, present figures have been increased in relation to Statistics Canada Projection B growth curve for the human population). Recognizing that Canada is presently a net red meat importer and that export demands for meat (example, pork to Japan) could conceivably increase, then the projection may, in fact, be on the low side. It is also noteworthy that meat consumption in Canada has shown a steady increase but remains less than several other nations. Consequently, there may be greater potential for growth in livestock population than shown in this table.

On the basis of the foregoing, it is estimated that Canada could use one rural veterinarian per 20–25,000 livestock units at the present time, and by 1981 this should increase to one per 15–20,000 given the orderly development of preventive medicine programs.

TABLE VI

PROJECTED[a] REQUIREMENTS FOR RURAL VETERINARIANS AT VARIOUS LEVELS OF LIVESTOCK UNITS PER VETERINARIAN

Year	1976	1981	1986	1991	1996	2001
Total Livestock Units in Canada In Millions	26.5	28.5	30.6	32.2	33.8	35.7
Livestock Units/Vet in Thousands						
50	530	570	612	644	676	714
45	589	633	680	716	751	793
40	662	713	765	805	845	893
35	757	814	874	920	966	1020
30	883	950	1020	1073	1127	1190
25	1060	1140	1224	1288	1352	1428
20	1325	1425	1530	1610	1690	1785
15	1767	1900	2040	2147	2253	2380
10	2650	2850	3060	3220	3380	3570
5	5300	5700	6120	6440	6760	7140

[a]Projected to grow at the same rate as human population (Statistics Canada, Projection B).

TABLE VII

COMPARISON OF VETERINARY AND HUMAN POPULATION IN URBAN CENTRES ABOVE 100,000

City	Human Population (000's) 1974	Urban Veterinarians 1975	Human Population (000's)/ Veterinarian
Metro. Victoria	208	14	14.9
Metro. Vancouver	1,137	68	16.7
Metro. Edmonton	529	29.5	17.9
Metro. Calgary	444	30	14.8
Regina	151	6	23.2
Saskatoon	140	7	20.0
Winnipeg	570	25	22.8
Thunder Bay	112	5.5	20.4
Metro. Toronto	2,741	101	27.1
Kitchener	238	10	23.8
Ottawa	311	26	11.6
London	296	15	19.7
Metro. Montreal	2,798	47	59.5
Halifax	224	7	28.9
Saint John, N.B.	112	4	28.0
St. John's, Nfld.	132	7	18.2
	10,143	402	25.2

Urban Veterinary Practice

In order to determine the need for urban veterinary service, the human population per veterinary practitioner has been determined in major cities. These data should give some indication of the minimal urban population supporting or using one veterinarian at the present time. This value may then be used judiciously to predict the need for the entire urban population now and in the future.

Urban population data were obtained from Statistics Canada and by correspondence with individual cities. The numbers of urban practitioners were determined from directories of provincial veterinary associations. Incremental adjustments were made to recognize situations where practitioners were in "mixed" practice, as noted earlier.

Table VII has a comparison of human population per urban veterinarian in cities with populations of over 100,000. If one assumes that cities like Calgary and Edmonton are comparable and predict minimal requirements in present circumstances for cities with similar demography in Western Canada, then the data suggest that in Regina and Winnipeg there is a net shortage of urban veterinarians.

It also appears that large densely populated centres such as Toronto and Montreal may require significantly fewer urban veterinary

TABLE VIII

COMPARISON OF VETERINARY AND HUMAN POPULATION IN URBAN CENTRES LESS THAN 100,000

City	Human Population (000's) 1974	Urban Veterinarians 1975	Human Population (000's)/ Veterinarian
Prince George	35	3	11.7
Kelowna	47	4.5	10.4
Lethbridge	44	4	11.0
Red Deer	28.8	2	14.4
Prince Albert	30	1	30.0
Brandon	34.3	3	11.4
Kingston	60.4	5.8	10.5
Oshawa	94	3	31.0
Peterborough	60	5.5	10.9
Moncton	48	3	16.0
	481.5	34.8	13.9

Source—Population estimates as received from cities except Oshawa, Peterborough, and Moncton (which were not contacted). The estimates for these have been projected from 1971 census data (Statistics Canada).

TABLE IX

PROJECTED REQUIREMENTS FOR URBAN VETERINARY PRACTITIONERS AT VARIOUS LEVELS OF HUMAN POPULATION PER VETERINARIAN

Year	1976	1981	1986	1991	1996	2001
Human Population In Canada In Millions[a]	23.0	24.5	26.3	27.7	29.0	30.7
Human Population Per Veterinarian						
25,000	920	980	1052	923	1160	1228
20,000	1150	1225	1315	1108	1450	1535
15,000	1533	1633	1753	1847	1933	2047
12,500	1840	1960	2104	2216	2320	2456
10,000	2300	2450	2630	2770	2900	3070
7,500	3067	3267	3507	3693	3867	4093
5,000	4600	4900	5260	5540	5800	6140

[a]Statistics Canada—Projection B.

practitioners, possibly because of significant economic or cultural differences in comparison to smaller communities.

Table VIII contains similar data for cities below 100,000 population. It is interesting to note that such communities have significantly lower values for population per veterinarian and may predict possible future demand for urban veterinary service, since the life style in such communities seems to be highly desirable to most Canadians at present. It may also indicate that most cities require more practitioners under present circumstances.

It seems not unreasonable to predict that, by the turn of the century, every 10,000 population will generate the need for one urban veterinary practitioner. Some communities may require even more intensive veterinary services. This, of course, assumes a reasonable economic growth, social stability and present cultural values.

Table IX gives the numbers of veterinarians needed at varying ratios of urban population per veterinarian for the next 25 years. Presently, the ratio is about 23,000 per veterinarian, since Canada has about 950 urban practitioners. This appears to be a net shortage, in view of more favorable ratios which exist in some communities. It does not seem unreasonable that by 1981 the number of urban veterinarians required would increase to one per 15-20,000 of population and by 1986 and 1991 to one per 10-15,000.

Governmental Employment

Federal – The major federal employer of veterinarians at present is the Health of

Animals Branch, Canada Department of Agriculture. This agency has primary control of regulatory veterinary medicine as it relates to interprovincial and international transport of animals and the more serious contagious animal diseases. They also have primary responsibility for meat inspection. Laboratory research on animal diseases is another major function of the Branch. Historically, the Health of Animals Branch has been a major employer of veterinarians, utilizing 20-25% of the veterinary manpower. The fact that this agency has been chronically understaffed provided some of the incentive for the current expansion of veterinary education.

The recent "dead meat scandal" and public insistence on greater control of meat in commerce has increased demand for veterinary inspection of meat. Canada lags in the use of veterinary medical public health officers in the control of meat quality in comparison to European countries where a larger percentage of veterinary graduates are employed in this branch of veterinary medicine. Trade agreements with the European Economic Community and domestic consumer demand could force improvement in meat quality control and, consequently, significantly increase numbers of veterinarians required in the veterinary public health or the food hygiene sector.

Increased community concern for the humane treatment of animals may bring about legislation which would require increased government participation in regulation of animals in commerce and research. This would undoubtedly create increased demand for federal veterinarians.

It is worth noting that during the next ten to 12 years, nearly 50% of the veterinarians employed by the Health of Animals Branch will reach retirement age. The estimated total requirements for replacement and growth in this organization during this period is over 700 veterinarians.

In 1964 the Health Protection Branch established a veterinary drug division. They presently employ about 30 veterinarians in this and other divisions. Increasing demand for more comprehensive evaluation of drugs and chemicals used in commerce will probably require considerable growth in this branch of government and by the turn of the century, they will require large numbers of medically trained scientists and regulatory officers. Veterinarians are ideally suited to meet this need, since animals will be central to control programs either in toxicological research or in the use of animals as monitors of environmental pollution. Current concepts about cancer suggest that environmental pollutants are one of the principal causes of many forms of this disease.

The Department of Environment can also be expected to employ more veterinarians in jobs relating to wildlife management and aquaculture. It might be of interest that there are presently about 2,000 Saskatchewan farmers raising fish in ponds, compared to none in 1968. Disease is one of the principal limiting factors in the development of an aquaculture industry.

Provincial – Presently provincial governments employ nearly 8% of veterinarians to provide diagnostic laboratory service to the practicing veterinary profession and livestock industry and for regulatory programs such as inspection of auction markets and small local abattoirs. If preventive medicine on the farm becomes the responsibility of the public sector, there will be a tremendous growth in veterinary manpower in provincial departments of agriculture.

Provincial wildlife and natural resource units can also be expected to employ modest numbers of veterinarians with specific training in wildlife diseases and management as they become available.

Municipal – While not a major employer at present, municipal government could employ substantial numbers of veterinarians in regulatory public health work.

Other Major Employers of Veterinarians

Academic and Research Institutes – Canadian veterinary colleges presently employ about 225 veterinarians. At these institutions there are approximately another 80-100 veterinarians enrolled in graduate study programs. Together, this represents about 10% of the total veterinary population. This percentage will likely remain constant in the period under study and could increase if postgraduate specialty training programs are expanded.

The establishment of animal health technology programs at technical institutes across Canada has led to the employment of veterinarians as educators in this setting.

Other segments of the academic community employ veterinarians; namely, colleges of agriculture, medicine and biology. Also, it seems likely that in the next few years, departments of veterinary science may be established at several Canadian universities. For example, the Alberta Agricultural Coordinating Committee has recommended to the Board of Governors of the University of Alberta that such a department be established in Edmonton. Depart-

ments of veterinary science are relatively common at universities in the U.S.A.

The field of laboratory animal medicine has become a major employer of veterinarians over the last decade. Opportunities will continue to grow in this field because of expanding animal experimentation associated with research in medicine, toxicology and nutrition.

Industry – Pharmaceutical and agribusiness sectors employ modest numbers of veterinarians. Increased industrialization of Canada can be expected to lead to growth in veterinary input in these industries.

Entrepreneur – A small number of veterinarians become engaged in some form of business, usually related to the animal industry. This could increase if private practice becomes less attractive to those who wish to secure very high incomes.

Projected Requirements

Table X gives the projected requirements for veterinarians until 1991. These are based on estimates of the total requirements for each of the major employment categories of rural practice, urban practice, government and other. Low, medium and high projections have been developed by varying assumptions on which the projections are based over a range judged to be reasonable and to include that requirement which will actually occur. The major variables are human population, the number of livestock units per rural veterinarian, the human population per urban veterinarian and the growth rate in government and "other" employment. The estimates of low, medium and high requirements are based on Statistics Canada Projections A, B and C for population growth, respectively. The values of the number of livestock units per rural veterinarian used in the projections range from the average which presently exists in Canada down to that in areas having the least livestock units per veterinarian. The size of human population required to support one urban veterinarian which have been chosen to estimate low, medium and high demand for urban veterinarians range from slightly below the national average (20,000) down to values in selected communities which presently have the smallest population (10,000) required to support one veterinarian. The projected growth in government is arbitrary and based on judgement and was chosen to span growth ranging from 20-40% in the next 15 years. The category "other" is very difficult to project. The view has been taken that heretofore veterinarians have not sought employment in a number of biological or health related fields, for which they are well trained, because of the shortage of veterinarians and the attractiveness of private practice. With the prospect of more nearly filling the demand in areas of traditional employment, it can be expected that opportunities will be sought in these fields. The projection therefore ranges from 66-300% growth for this category.

Supply of Veterinarians

The supply of veterinarians is more easily predicted than is the requirement for veterinarians. The following analysis takes into account the present numbers, immigration and those that will be added by the Canadian colleges. An attempt is made to consider the major factors that will influence the size of the active veterinary work force.

Present Veterinary Population

The present number of veterinary man-years in major employment categories are given in Table XI. Roughly equal numbers of veterinary man-years are devoted to rural practice, urban practice and government service plus remaining areas of employment. These data have been derived from provincial veterinary association directories and personal communication.

Immigration

Immigration has supplied a significant number of veterinarians to Canada. Over the past ten years this has amounted to an average of about 50 per year. While there continues to be a shortage of veterinarians with specialized skills, increasing numbers of native graduates will make immigration less essential than it has been in the past and immigration policies can be expected to become more restrictive. Consequently, the projections of veterinary supply assume that, in future, immigration will equal emigration and therefore no adjustment has been made for these factors.

Future Veterinary Population

The future supply of veterinarians, including the effect of the proposed Maritime College, has been estimated in Table XII. This projection is based on the existing veterinary population plus the output from Canadian universities agreed to at the time the decision was made to expand veterinary student enrollment in Canada.

The following assumptions were used in making these projections:

a) There are approximately 3,000 veterinarians

TABLE X

PROJECTED REQUIREMENT FOR VETERINARIANS AT LOW, MEDIUM AND HIGH DEMAND, 1976–1991

Year	Parameters Used in Projecting Requirements: Human[a] Population (000's)	Human[b] Population (000's)/ Veterinarian	Livestock[c] Units (000's)	Livestock[d] Units (000's)/ Veterinarian	Requirements for Veterinarians: Rural	Urban	Government[e]	Other[e]	Total Requirement
Low Demand[f]									
1976	22,772	20.00	26.5	25.0	1,060	1,139	950	300	3,449
1981	24,041	18.33	28.0	23.5	1,191	1,311	1,020	350	3,872
1986	25,383	16.67	29.5	22.0	1,341	1,523	1,080	425	4,369
1991	26,591	15.00	30.9	20.5	1,507	1,773	1,150	500	4,930
Medium Demand[g]									
1976	22,846	20.00	26.5	25.0	1,060	1,143	950	300	3,453
1981	24,473	17.50	28.4	22.0	1,291	1,398	1,050	400	4,139
1986	26,258	15.00	30.5	19.0	1,650	1,751	1,150	550	5,056
1991	27,902	12.50	32.4	16.0	2,025	2,232	1,250	700	6,207
High Demand[h]									
1976	23,086	20.00	26.5	25.0	1,060	1,154	950	300	3,464
1981	25,312	16.67	29.1	20.5	1,420	1,519	1,080	450	4,469
1986	27,811	13.33	31.9	16.0	1,994	2,086	1,220	675	5,975
1991	30,178	10.00	34.6	11.5	3,009	3,018	1,350	900	8,277

[a]Statistics Canada projections.
[b]Described linearly.
[c]Projected to grow at the same rate as the human population.
[d]Declined linearly.
[e]Estimates beyond 1976 made on the basis of judgement of subjective factors.
[f]Statistics Canada Projection C.
[g]Statistics Canada Projection B.
[h]Statistics Canada Projection A.

TABLE XI

NUMBER OF VETERINARY MAN-YEARS IN MAJOR EMPLOYMENT CATEGORIES,[a] 1975

Province	Rural Practice	Urban Practice	Government Service			Other[c]	Total
			Fed.[b]	Prov.	Municipal		
British Columbia	50	162	20	19		2	253
Alberta	167	84	56	24	1	16	348
Saskatchewan	77	27	25	5		64	198
Manitoba	44	34	27	10	1		116
Ontario	366	497	171	65	8	170	1,277
Quebec	209	98	174	94	19	36	630
New Brunswick	25	8	16	6	1	2	58
Nova Scotia	22	30	9	4		1	66
Prince Edward Island	12	4	2	3	1		22
Newfoundland	6	8	2			1	17
Unclassified			50				50
Total	978	952	552	230	31	292	3,035

[a]As determined from provincial directories. An attempt has been made to assess fractional man-years wherever a practitioner works in more than one category. Excludes retired veterinarians and graduate students.
[b]Data from Health of Animals Branch.
[c]Majority are employed at veterinary colleges (*ca.* 200).

TABLE XII

ESTIMATE OF CANADIAN VETERINARY MANPOWER, 1976–1991

Year	Number of Veterinarians				Active Veterinarians/ 100,000 Population[c]
	Existing	New[a]		Total	
		Available	Active[b]		
Without a Maritime College					
1976	3000	251	213	3213	14.0
1981	2714	1444	1227	3941	15.6
1986	2394	2762	2348	4742	17.1
1991	2057	4069	3459	5516	18.3
With a Maritime College					
1986	2394	2999	2549	4943	18.8
1991	2057	4541	3860	5917	21.2

[a]Assuming attrition has reduced class sizes by 5% at graduation and assuming the first class of 90 from the Western College of Veterinary Medicine graduates in 1982.
[b]Available × 0.85: Assuming that only 85% of veterinary population active at any one time.
[c]Assuming Statistics Canada Projection B for human population.

practicing their profession in Canada in 1976 (without 1976 graduates). This is an estimate based on Canadian and provincial veterinary association memberships.

b) Migration of veterinarians to and from Canada is assumed to be equivalent and, therefore, not an influence on total manpower.

c) Death rates in Canada in 1971 are assumed to be applicable to veterinarians and, therefore, are used to decline the Canadian veterinary population at each of the time intervals noted.

d) All veterinarians are assumed to enter the work force at age 26 and retire at age 65.

e) One-third of new veterinary graduates are assumed to be women and their professional working years are assumed to be 75% that of male veterinarians. This has the effect of reducing the veterinary population available for practice by 8% in any one year. Also, a percentage of male veterinarians can also be expected to be unavailable for practice in any one year. Additionally, it is anticipated that about 3% of the veterinarians graduating henceforth will be enrolled in graduate programs. Consequently, 15% of those graduating after 1976 will not be available to meet the needs for veterinarians. Furthermore, it is assumed

that the existing practicing veterinary population of 3,000 is active and the attrition noted above has already been lost from this segment of the profession.

f) The potential number of students graduating from each college was assumed to have the following distribution. After 1981 the class sizes were assumed to be constant. The total students in any given year was reduced by 5% to recognize attrition that will occur within the classes that are accepted for veterinary studies.

	Univ. of Saskatchewan	Univ. of Guelph	Univ. of Montreal	Maritime College
1976	61	120	70	0
1977	61	120	70	0
1978	64	120	70	0
1979	66	120	70	0
1980	66	120	70	0
1981	66	120	70	0
1982	90	120	70	50

Concluding Remarks

Figure 3 graphically depicts the relationship between the low, medium and high levels of projected requirements for veterinarians and the supply derived from the aggregate of present numbers plus those that will be provided by the existing colleges until 1991. Figure 4 shows the effect of the additional output from the proposed Maritime veterinary college. If the assumptions used in this study are not grossly in error, there would appear to be a reasonable balance between supply and requirement. The establishment of the proposed Maritime college would not increase the supply of veterinarians beyond the medium requirement projection in the time period under study.

It might be useful to identify those assumptions used in this analysis which in our view are the most vulnerable. A prime assumption is that the use of veterinarians will increase significantly over that which presently exists during the next 15 years, even at the low requirement projection. We are unaware of any compelling evidence to the contrary. The big challenge is to project the magnitude of the increase. Another fairly critical assumption is that Canada will have some form of nationally subsidized preventive medicine program for livestock within a few years. One of

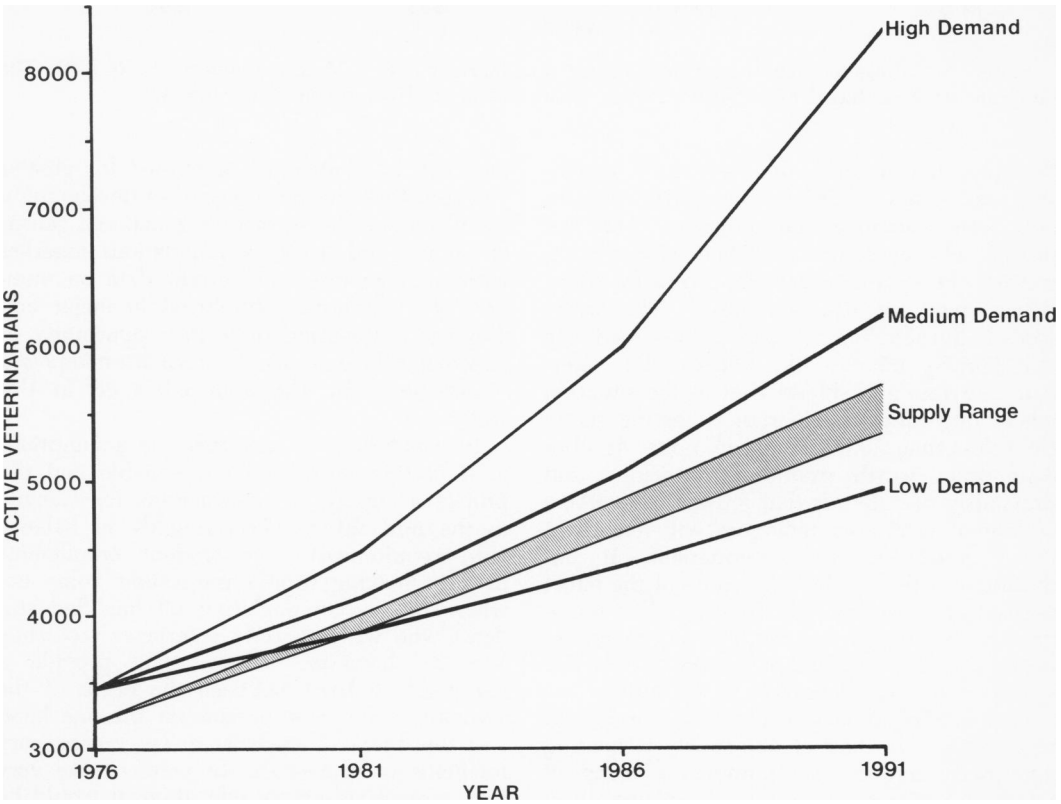

Figure 3. Projected supply and demand for veterinarians without a Maritime college, 1976–1991. The range in supply is based on a 0-10% attrition of veterinary students during their studies.

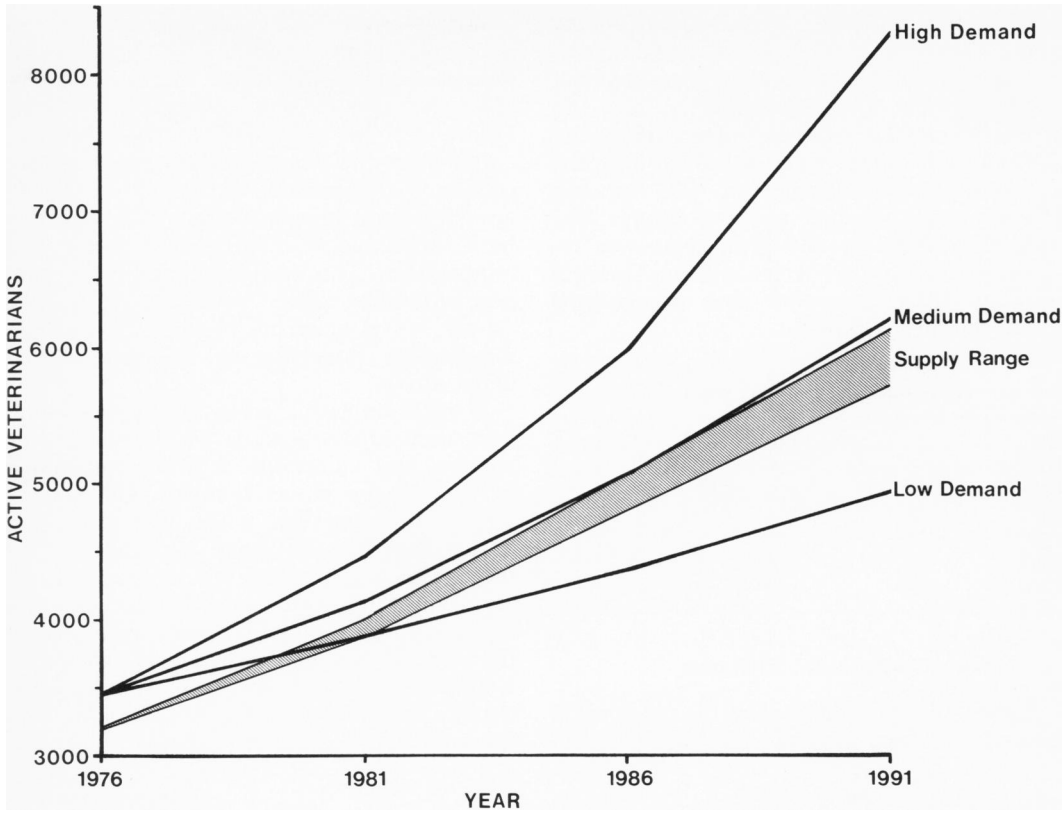

FIGURE 4. Projected supply and demand for veterinarians with a Maritime college, 1976–1991. The range in supply is based on a 0-10% attrition of veterinary students during their studies.

the important motives for veterinary expansion was to have sufficient manpower to carry out preventive medicine programs. This approach to veterinary medicine promises to provide the greatest economic return for every dollar spent on disease control. The widespread introduction of preventive medicine will initially increase the demand for veterinary services and should lead to the situation where one rural veterinarian is serving something less than 20,000 livestock units. Another assumption worth examining critically, and previously unstated, is that growth in numbers of animal health technologists will not affect the requirements for veterinarians. It undoubtedly will and the magnitude of the effect needs to be determined. Finally, while immigration historically has contributed to an increase in veterinary manpower, we expect this will be much less important in the future.

One of the primary goals of this study was to develop a method of objectively estimating veterinary manpower requirements using as much factual data as possible. Furthermore, it has been our intent to clearly state all the assumptions necessary for the analysis so that they can be challenged or refined for greater veracity. If we have succeeded in developing a useful model, the forthcoming national census of human and livestock populations together with more precise and current data on numbers of veterinarians employed in major employment categories, offer the opportunity of improving the analysis of veterinary manpower requirements by the approach used in this study.

In conclusion, we consider the assumptions used in this study to be reasonable and the projected supply of veterinarians for Canada in the next fifteen years roughly in balance with requirement. The student enrollments used in making supply projections come nowhere near accommodating all qualified students who wish to study veterinary medicine. We do, however, believe they provide a reasonable balance between the needs of the community for veterinarians on the one hand and the desire of students to enter veterinary medicine on the other. In view of the very high cost of veterinary education, it would be difficult to justify significant over-production of veterinarians.