

# Predicted trends in the supply and demand of veterinarians in Japan

S. Kimura<sup>(1)</sup>, S. Shinkawa<sup>(2)</sup>, J. Mago<sup>(2)</sup>, M. Yamamoto<sup>(2)</sup>, M. Sakai<sup>(2)</sup>,  
T. Sugisaki<sup>(3)</sup>, H. Karaki<sup>(4)</sup>, K. Sugiura<sup>(5)\*</sup>

(1) Agriculture and Trade Directorate, Organisation for Economic Cooperation and Development (OECD), 2 rue André Pascal, F-75775 Paris Cedex 16, France

(2) Animal Products Safety Division, Ministry of Agriculture, Forestry and Fisheries, 1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8950, Japan

(3) Planning and Evaluation Division, Ministry of Agriculture, Forestry and Fisheries, 1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8950, Japan

(4) Science Council of Japan, 7-55-34 Roppongi, Minato-ku, Tokyo 106-8555, Japan

(5) Food and Agricultural Materials Inspection Center, 2-1 Shintoshin, Chuo-ku, Saitama-shi, Saitama 330-9731, Japan

\* Corresponding author: E-mail: katsuki\_sugiura@nm.famic.go.jp

Submitted for publication: 5 July 2007

Accepted for publication: 18 March 2008

## Summary

Currently in Japan, there are 32,000 active veterinarians, mainly engaged in small and large animal practice and public animal health and public health services. In the face of the notable increase in recent years in the proportion of female students enrolled in veterinary schools and in the number of households with companion animals, a model was developed to predict the supply and demand of veterinarians toward 2040 in Japan. Surveys were conducted on sampled households and veterinarians to estimate input variables used in the supply and demand model. From this data it is predicted that there might be somewhere between a shortage of 1,000 to an over-supply of 3,700 veterinarians engaged in small animal practice in 2040. This, however, will depend on possible changes in the number of visits made to veterinarians by small animal owners and the efficiency of practices in the future. The model also predicts that there will be a shortage of around 1,100 veterinarians in large animal practice in 2040. Considering the many assumptions made to estimate the input variables used in the model, the results of this study do not provide definitive conclusions, but provide a base for discussions on what will be needed in the veterinary profession in the future.

## Keywords

Japan – Large animal practice – Prediction – Small animal practice – Supply and demand analysis – Veterinarian.

## Introduction

In recent years, the role of veterinarians has expanded from the healthcare of small and large animals, to animal and public health, animal welfare, wildlife protection and medical research. For the past four decades, there has been no increase in the number of veterinary schools in Japan or in their enrolment capacity, resulting in the supply of a

constant number of veterinarians every year. Because there are a substantial number of veterinarians (12% to 13% of total) who are not engaged in any area of the veterinary profession (7), the Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) had been of the view that there was no shortage of veterinarians. However, in recent years there have been some notable changes that might affect the future supply and demand of veterinarians – a higher proportion of female students enrolled in veterinary

schools; more households with companion animals; and increased demand for veterinarians in public health service.

The MAFF established a study group in November 2006, composed of seven members representing different occupational categories, and assigned it to predict the future supply and demand trend of veterinarians in Japan in the face of these changes. This paper summarises the results of this analysis, conducted by this study group in cooperation with the MAFF's Animal Products Safety Division.

## Current supply and demand situation

### Qualification pathway for veterinarians in Japan

Licensing of veterinarians and the qualifications required are stipulated in the Veterinary Licensing Law (Law No. 186, 1949). Based on this law, the Minister of Agriculture, Forestry and Fisheries issues a veterinary licence to those who have passed the national veterinary licensing examination. In Japan, those who want to become a veterinarian must:

- complete a six year course in a veterinary school in Japan (or an equivalent course in a foreign veterinary school)
- pass the national veterinary licensing examination, and
- apply to the Minister of Agriculture, Forestry and Fisheries for a veterinary licence.

Currently, there are 16 veterinary schools in Japan. Table I is a list of these schools with their respective official enrolment capacities and actual number of graduates in 2007. In total, the official enrolment capacity of these schools has been 930 since 1966, but most veterinary schools have admitted students in excess of their official capacities. Most students enter veterinary school at 18 years of age, complete a six-year course, and graduate at 24 years of age or older.

The national veterinary licensing examination is held every March by the Veterinary Affairs Council in cooperation with the MAFF. Those who have completed a six-year course in veterinary schools are qualified to take this licensing examination. Between 90% and 94% of the examinees pass the examination at their first attempt and obtain their licence. Including those who pass the examination in subsequent attempts, most (96.9%) of the veterinary graduates eventually pass the examination and receive a licence. The name, age and sex of all those who pass the national licensing examination are registered in the MAFF database.

**Table I**  
**Enrolment capacities, number of graduates, and number of graduates successful in the national licensing examination in March 2007 from 16 veterinary schools in Japan**

Veterinary School	Enrolment capacity	Number of graduates	Number of graduates successful in the national licensing examination
Hokkaido University	40	38	37
Obihiro University of Agriculture and Veterinary Medicine	40	45	42
Iwate University	30	37	35
Tokyo University	30	32	32
Tokyo University of Agriculture	35	42	36
Gifu University	30	32	31
Tottori University	35	39	36
Yamaguchi University	30	36	32
Miyazaki University	30	32	30
Kagoshima University	30	30	27
Osaka Prefecture University	40	43	40
Rakuno-gakuen University	120	146	140
Kitazato University	120	132	127
Nippon Veterinary and Life Science University	80	103	99
Nihon University	120	132	122
Azabu University	120	154	143
<b>Total</b>	<b>930</b>	<b>1,073</b>	<b>1,009 (94.0%)</b>

### Number of veterinarians as of 31 December 2006

In accordance with the Veterinary Licensing Law, veterinarians are obliged to report to the Minister of Agriculture, Forestry and Fisheries every two years in January, stating their name, registration number, prefecture of residence, age, sex and the occupational categories they were engaged in at the end of the previous year.

Based on the reports submitted in January 2007, the number of veterinarians as of 31 December 2006 was 35,855; of which 13,202 were engaged in small animal practice, 9,112 were civil servants mainly engaged in animal and public health services, 4,180 were engaged in large animal practice, 5,023 were engaged in other types of veterinary work, and 4,338 reported that they were not engaged in any area of the veterinary profession (7).

Figures 1a, 1b and 1c indicate the age distribution of male and female active veterinarians, veterinarians engaged in small animal practice and veterinarians engaged in large animal practice, respectively. The proportion of female veterinarians is 23%, but varies depending on age and occupational categories. The proportion of female veterinarians is high in young generations, exceeding 50% under 33 years of age (Fig. 1a), 30% in small animal practice (Fig. 1b), and 7% in large animal practice (Fig. 1c). The average ages of veterinarians engaged in large animal and small animal practice are 51.1 and 44.3, respectively.

## Supply and demand models and input variables

### Supply and demand models

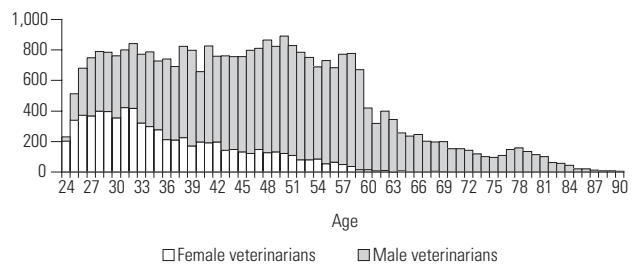
To predict the supply and demand of veterinarians in the future, supply and demand models were constructed separately. Table II provides a list of the variables used in the models.

#### Supply model

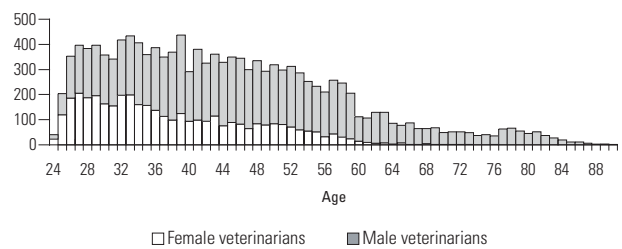
An age cohort model was constructed to calculate the number of veterinarians of a particular age in a particular year. An age cohort  $y$  means the group of veterinary students or veterinarians who were 24 years old (expected age of graduation) in year  $y$ .

For an age cohort  $y$  ( $1930 \leq y \leq 2006$ ), the number of active veterinarians, of sex  $s$ , engaged in occupational category  $c$ , in year 2007 ( $RVA_{2007,24+k,c,s}$ ) (where  $k=2007-y$ ) can be calculated as the sum of the number of  $(24+k)$ -year-old veterinarians of sex  $s$  licensed in year 2007; and the

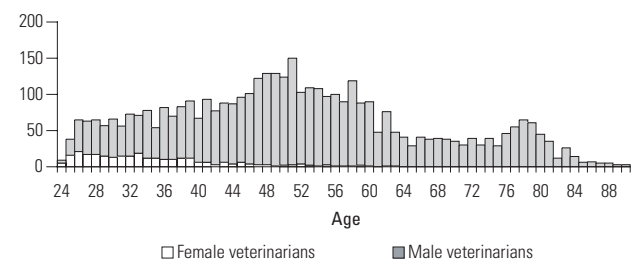
a) Active veterinarians



b) Veterinarians engaged in small animal practice



c) Veterinarians engaged in large animal practice



**Fig. 1**  
Distribution of veterinarians by age, sex and sector

number of active veterinarians of sex  $s$ , licensed at age  $24+k-1$  or younger, engaged in occupational category  $c$  and survived up to year 2006 ( $RVA_{2006,24+k-1,c,s}$ ), who survived from 2006 to 2007 (from age  $24+k-1$  to  $24+k$ ), adjusted by the change of the working rate from age  $24+k-1$  to  $24+k$ :

$$RVA_{2007,24+k,c,s} = GR_{y,s} \times SU_{24+k,s} \times WR_{24+k,s} \times PR_{c,s} + RVA_{2006,24+k-1,c,s} \times SR_{24+k,s} \times WR_{24+k,s} / WR_{24+k-1}$$

where:

$GR_{y,s}$  is the number of veterinary graduates of sex  $s$  in an age cohort  $y$ ;

$SU_{24+k,s}$  is the proportion of veterinary graduates of sex  $s$  who get licensed at age  $24+k$ ;

$WR_{24+k,s}$  is the working rate of  $(24+k)$ -year-old veterinarians of sex  $s$ ;

$WR_{24+k-1,s}$  is the working rate of  $(24+k-1)$ -year-old veterinarians of sex  $s$ ;

**Table II**  
**Output and input variables used in the supply and demand models**

Variables	Definitions
$GR_{y,s}$	Number of veterinary students of sex $s$ in age cohort $y$
$PR_{c,s}$	Proportion of veterinarians of sex $s$ engaged in occupational category $c$
$RVA_{y,a,c,s}$	Number of active veterinarians of sex $s$ of age $a$ in year $y$ engaged in occupational category $c$
$SR_{a,s}$	Survival rate of veterinarians of sex $s$ from age $a-1$ to age $a$
$SU_{a,s}$	Proportion of veterinary graduates of sex $s$ who obtain their licence at age $a$
$WR_{a,s}$	Working rate of veterinarians of sex $s$ at age $a$
$C_{y,i}$	Number of animals of category $i$ that one veterinarian is capable of attending in year $y$
$DV_{y,i}$	Number of animal practice veterinarians needed in year $y$ for animal category $i$
$D_{y,i}$	Number of animals of category $i$ that one veterinarian is capable of attending in one day in year $y$
$E_{y,i}$	Number of days that one veterinarian engaged in animal practice of category $i$ works per year in year $y$
$H_{y,i}$	Number of veterinary visits that an animal of category $i$ receives in year $y$
$L_{y,i}$	Number of animals of category $i$ in year $y$
$a$	Ages (24, 25, ..., 100)
$c$	Occupational categories (small animal practice, large animal practice, public sectors and other types of veterinary work)
$i$	Animal categories (beef cattle, dairy cattle, pigs, chickens, horses, dogs and cats)
$s$	Sexes (male and female)
$y$	Years (1930, 1931, ..., 2040)

$PR_{c,s}$  is the proportion of newly licensed veterinarians of sex  $s$  that are engaged in an occupation category  $c$ , where  $c = 1$  (small animal practice),  $c = 2$  (large animal practice),  $c = 3$  (public sectors) and  $c = 4$  (other types of veterinary work); and

$SR_{24+k,s}$  is the survival rate of  $(24+k-1)$ -year-old veterinarians of sex  $s$  up to  $(24+k)$  years old.

Likewise, the number of active veterinarians of sex  $s$  in this age cohort engaged in occupational category  $c$ , in year  $y+n$  ( $n > k$ ) ( $RVA_{y+n,24+n,c,s}$ ) can be calculated as the sum of the number of  $(24+n)$ -year-old active veterinarians licensed in year  $y+n$ ; and the number of active veterinarians of sex  $s$ , licensed at age  $24+n-1$  or younger and survived up to year  $y+n-1$  and engaged in occupational category  $c$  ( $RVA_{y+n-1,24+n-1,c,s}$ ), who survived from year  $y+n-1$  to year  $y+n$ , adjusted by the change of the working rate from age  $24+n-1$  to  $24+n$ :

$$RVA_{y+n,24+n,c,s} = GR_{y,s} \times SU_{24+n,s} \times WR_{24+n,s} \times PR_{c,s} + RVA_{y+n-1,24+n-1,c,s} \times SR_{24+n,s} \times WR_{24+n,s} / WR_{24+n-1,s}$$

where:

$SU_{24+n,s}$  is the proportion of veterinary graduates of sex  $s$  who get licensed at age  $24+n$ ;

$WR_{24+n,s}$  is the working rate of  $(24+n)$ -year-old veterinarians of sex  $s$ ;

$WR_{24+n-1,s}$  is the working rate of  $(24+n-1)$ -year-old veterinarians of sex  $s$ ; and

$SR_{24+n,s}$  is the survival rate of  $(24+n-1)$ -year-old veterinarians of sex  $s$  up to  $(24+n)$  years old.

For an age cohort  $y$  ( $2007 \leq y \leq 2040$ ), the number of active veterinarians (veterinarians engaged in a veterinary profession), of sex  $s$ , engaged in occupational category  $c$ , in year  $y$  ( $RVA_{y,24,c,s}$ ) can be calculated by:

$$RVA_{y,24,c,s} = GR_{y,s} \times SU_{24,s} \times WR_{24,s} \times PR_{c,s} \text{ where:}$$

$SU_{24,s}$  is the proportion of veterinary graduates of sex  $s$  who get licensed at age 24; and

$WR_{24,s}$  is the working rate of 24-year-old veterinarians of sex  $s$ .

The number of active veterinarians of sex  $s$  in this age cohort, engaged in occupational category  $c$ , in the following year (25-year-old veterinarians in year  $y+1$ ) ( $RVA_{y+1,25}$ ) can be calculated as the sum of the number of 25-year-old veterinarians of sex  $s$ , licensed in year  $y+1$ , and engaged in occupational category  $c$ ; and the number of active veterinarians of sex  $s$ , licensed in year  $y$  at age 24, engaged in occupational category  $c$  ( $RVA_{y,24,c,s}$ ), who survived from year  $y$  to year  $y+1$  (from age 24 to 25), adjusted by the change of the working rate from age 24 to 25:

$$RVA_{y+1,25,c,s} = GR_{y,s} \times SU_{25,s} \times WR_{25,s} \times PR_{c,s} + RVA_{y,24,c,s} \times SR_{25,s} \times WR_{25,s} / WR_{24,s}$$

where:

$SU_{25,s}$  is the proportion of veterinary graduates of sex  $s$  who get licensed at age 25;

$WR_{25,s}$  is the working rate of 25-year-old veterinarians of sex  $s$ ; and

$SR_{25,s}$  is the survival rate of 24-year-old veterinarians of sex  $s$  up to 25 years old.

Likewise, the number of active veterinarians of sex  $s$  in this age cohort, engaged in occupational category  $c$  in year  $y+n$  ( $RVA_{y+n,24+n,c,s}$ ) can be calculated as the sum of the number of  $(24+n)$ -year-old veterinarians of sex  $s$ , licensed in year  $y+n$ , and engaged in occupational category  $c$ ; and the number of active veterinarians of sex  $s$ , licensed at age  $24+n-1$  or younger, survived up to year  $y+n-1$  engaged in occupational category  $c$  ( $RVA_{y+n-1,24+n-1,c,s}$ ), who survived

from year  $y+n-1$  to year  $y+n$  (from age  $24+n-1$  to  $24+n$ ), adjusted by the working rate from age  $24+n-1$  to  $24+n$ :

$$RVA_{y+n,24+n,c,s} = GR_{y,s} \times SU_{24+n,s} \times WR_{24+n,s} \times PR_{c,s} + RVA_{y+n-1,24+n-1,s,c} \times SR_{24+n,s} \times WR_{24+n,s} / WR_{24+n-1,s}$$

As the number of active veterinarians of sex  $s$ , of occupational category  $c$  and of age  $24+n$  at the end of 2006 ( $RVA_{2006,24+n,c,s}$  ( $n \geq 0$ )) is known as a result of the obligatory reporting system described in the previous section, and other input variables ( $GR_{y,s}$ ,  $SU_{24+n,s}$ ,  $WR_{24+n,s}$ ,  $PR_{c,s}$ ,  $SR_{24+n,s}$ ) are also known (as will be discussed in the input variables section),  $RVA_{y+n,24+n,c,s}$  can be calculated for any age cohort  $y$  ( $1930 \leq y \leq 2040$ ), by starting with  $RVA_{y+k,24+k,c,s}$  (where  $k=2007-y$ ) for age cohorts 1930-2006 and by starting with  $RVA_{y,24,c,s}$  for age cohorts 2007-2040.

The number of veterinarians supplied (supply function) in a particular year, and for a particular occupational category was computed by summing over the different ages and sexes. The total number of veterinarians to be supplied in a particular year was computed by summing over the different ages, occupational categories and sexes.

### Demand model

The number of animal practice veterinarians needed in year  $y$  for animal category  $i$  ( $DV_{y,i}$ ) was calculated by:

$$DV_{y,i} = L_{y,i} / C_{y,i} \text{ where } C_{y,i} = D_{y,i} \times E_{y,i} / H_{y,i}$$

Where  $L_{y,i}$  is the number of animals of category  $i$  in year  $y$ ;  $C_{y,i}$  is the number of animals of category  $i$  that one veterinarian is capable of attending in year  $y$ ;  $D_{y,i}$  is the number of animals of category  $i$  that one veterinarian is capable of attending in one day in year  $y$ ;  $E_{y,i}$  is the number of days that one veterinarian engaged in animal practice of category  $i$  work per year in year  $y$ ;  $H_{y,i}$  is the number of veterinary visits that an animal of category  $i$  receives in year  $y$ , where  $i = 1$  (beef cattle),  $i = 2$  (dairy cattle),  $i = 3$  (pigs),  $i = 4$  (chickens),  $i = 5$  (horses),  $i = 6$  (dogs) and  $i = 7$  (cats).

The number of veterinarians required (demand function) in a particular year, and for a particular occupational category was computed by summing over the different ages and sexes. The total number of veterinarians required in a particular year was computed by summing over the different ages, occupational categories and sexes.

### Input variables

The values for input variables used in the supply and demand models were based on published data, results of the obligatory reporting system under the Veterinary Licensing Law, and results of the surveys conducted by the MAFF's Animal Products Safety Division in December 2006 and January 2007 on sampled households and veterinarians. The result of a survey conducted by the Japan Veterinary Medical Association (JVMA) on veterinarians engaged in small animal practice was also used as a basis for some input variables. The values for some input variables were replaced by other possible values for sensitivity analysis.

#### Number of veterinary graduates expected in year $y$ by sex $s$ ( $GR_{y,s}$ )

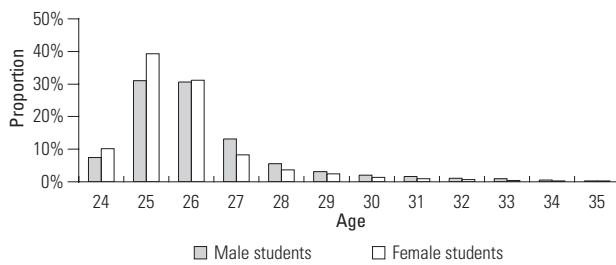
The total official enrolment capacity of students for the 16 veterinary schools is 930, but most of the veterinary schools admit students in excess of their official capacity. Table III shows the number of students that are actually admitted and their breakdown by sex. The number of male and female veterinary graduates in the years 2007 to 2012 was assumed to be equal to the number of male and female veterinary students actually enrolled. The number of male and female veterinary graduates in and after 2013 was assumed to be equal to the average number of male and female students actually enrolled in these six years.

#### Proportion of veterinary graduates of sex $s$ who get licensed at age $a$ ( $SU_{a,s}$ )

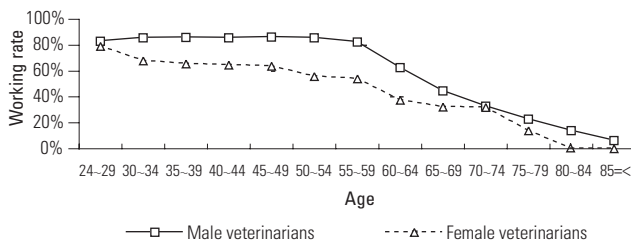
Figure 2 shows the assumed proportions of male or female students who have obtained licences at different ages, based on the MAFF's database of registered veterinarians

**Table III**  
**Assumed number of male and female veterinary school students expected to graduate between 2006 and 2011 based on the number of students enrolled in the previous six years (2000-2005)**

Year of graduation	Number of male students	Number of female students	Total
2006	498 (48.6%)	526 (51.4%)	1,024
2007	547 (53.5%)	476 (46.5%)	1,023
2008	571 (55.4%)	460 (44.6%)	1,031
2009	588 (57.2%)	440 (42.8%)	1,028
2010	557 (54.0%)	474 (46.0%)	1,031
2011	591 (57.5%)	436 (42.5%)	1,027
<b>Average</b>	<b>565 (54.6%)</b>	<b>470 (45.4%)</b>	<b>1,035</b>



**Fig. 2**  
**Proportions of veterinary school students who obtain licenses, by age and sex**

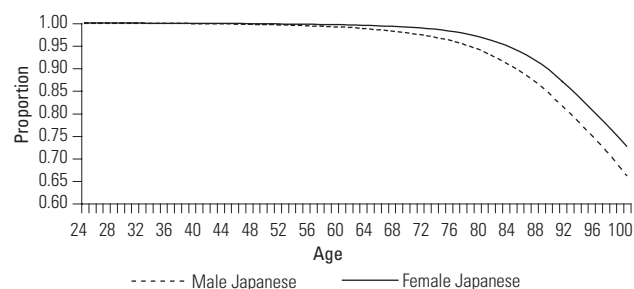


**Fig. 3**  
**Working rates of veterinarians, by age group and sex**

from 2001 to 2005. Most of the veterinary graduates are licensed by the age of 35, immediately after they pass the national licensing examination.

#### *Working rate of an $a$ -year-old veterinarian of sex $s$ ( $WR_{a,s}$ )*

Figure 3 shows the working rates (proportions of active veterinarians over the total licensed veterinarians) of male and female veterinarians at the end of 2006 by different ages, based on data from the obligatory reporting system under the Veterinary Licensing Law. Eighty-five percent of male veterinarians are active (engaged in some area of the veterinary profession) up to 60 years of age, while the proportion of active female veterinarians is smaller than that of male veterinarians by some 20% between 30 and 60 years of age. These working rates by different ages and sexes were assumed not to change in the future.



**Fig. 4**  
**Survival rate of Japanese males and females at ages 24 to 100**

#### *Proportion of newly licensed veterinarians of sex $s$ that are engaged in occupational category $c$ ( $PR_{c,s}$ )*

Based on the reports submitted in January 2007 by 1,622 male veterinarians and 1,722 female veterinarians under 30 years of age, 51.5%, 12.4% and 21.1% of the male veterinarians and 53.3%, 5.3% and 30.0% of female veterinarians that are newly licensed are assumed to take up jobs in small animal practice, large animal practice and the public sector, respectively (7). These proportions were assumed not to change in the future.

#### *Survival rates of veterinarians of sex $s$ from age $a-1$ to age $a$ ( $SR_{a,s}$ )*

Figure 4 indicates the survival rates of Japanese males and females at ages 24 to 100, from the Human Life-Table prepared by the Ministry of Health, Labour and Welfare (11). These survival rates were assumed to apply to male and female veterinarians in the future.

#### *Number of animals of category $i$ in year $y$ ( $L_{y,i}$ )*

The MAFF set livestock production targets for the years to 2015 in March 2005 (5); 1.62 million dairy cattle and 3.48 million beef cattle will be required to achieve those targets. The number of cattle was assumed to increase until 2015 according to these targets and then stabilise until 2040. The number of pigs and chickens per farm and the number of horses were assumed to stay at current levels.

To estimate the current and future numbers of dogs and cats, an Internet survey was conducted from 16 to 19 January 2007, on 11,691 Internet users (9). The survey revealed the proportions of households that have dogs and/or cats in different geographical areas and age groups. By multiplying the current geographical and age distribution of households (14) by these proportions, the number of dogs and cats as of the end of 2006 was estimated to be 12.45 million and 10.55 million, respectively. The number of dogs and cats up to 2025 was extrapolated by the future age and geographical distribution of households predicted by the National Institute of Population and Social Security Research (14). As no information was available on the distribution of households after 2026, the number of dogs and cats was assumed to stabilise after that year (Table IV).

#### *Number of veterinary visits that an animal of category $i$ receives in year $y$ ( $H_{i,y}$ )*

The number of veterinary visits that a beef and dairy cattle beast receives per year was assumed to be 1.22 and 2.58, respectively, with no change in the future, based on the results of the Livestock Mutual Assistance Provision Improvement Study (6).

Based on the results of a survey of veterinarians engaged in pig or chicken practices (2), a veterinarian was assumed to

**Table IV**  
**Assumed number of companion and food animals in Japan from 2006 to 2040**

	2006	2010	2015	2020	2025	2030	2035	2040
Dogs	12,453,497	12,765,166	12,955,251	13,073,512	13,029,640	13,029,640	13,029,640	13,029,640
Cats	10,548,930	10,883,042	11,105,263	11,182,760	11,171,677	11,171,677	11,171,677	11,171,677
Beef cattle	2,755,000	3,117,500	3,480,000	3,480,000	3,480,000	3,480,000	3,480,000	3,480,000
Dairy cattle	1,635,000	1,629,500	1,624,000	1,624,000	1,624,000	1,624,000	1,624,000	1,624,000
Pig farms	7,800	7,800	7,800	7,800	7,800	7,800	7,800	7,800
Chicken farms	6,203	6,203	6,203	6,203	6,203	6,203	6,203	6,203
Horses	92,886	92,886	92,886	92,886	92,886	92,886	92,886	92,886

attend 30 pig farms or 40 chicken farms annually, with no change in the future. Based on the results of a survey of veterinarians engaged in horse practices (2), a veterinarian was assumed to attend 300 horses per year, with no change in the future.

Table V indicates the number of visits per year made to veterinarians by dog and cat owners, based on the results of a survey conducted on households with companion animals (9). Dog and cat owners in Kanto, Kinki and Tokai regions make more visits to veterinarians than those in other regions. For the basis of this report, as a baseline scenario the numbers of visits by dog and cat owners were assumed not to change in the future. The numbers of visits were also assumed to increase by 10% or 20% by the year 2015 for sensitivity analysis.

*Number of animals of category **i** that one veterinarian is capable of attending in one day in year **y** ( $D_{i,y}$ )*

A survey using questionnaires was conducted on small and large animal practices to estimate the values for this and other variables (2). A questionnaire was sent to 730 and 2,949 veterinarians engaged in large and small animal practices, respectively, of which 138 and 606 veterinarians responded, respectively (8).

**Table V**  
**Average number of visits per year made to veterinarians by dog and cat owners in different regions of Japan**

Regions	Average number of visits per year	
	Dog owners	Cat owners
Hokkaido	3.12	1.67
Tohoku	2.65	1.57
Kanto	3.73	2.12
Hokuriku	2.75	1.99
Tokai	3.15	1.97
Kinki	3.42	1.99
Chugoku	2.72	1.83
Shikoku	2.72	1.61
Kyushu	2.59	1.83
<b>Grand average</b>	<b>3.23</b>	<b>1.95</b>

According to the results of this survey, a typical veterinarian is capable of attending 7 beef cattle, or 15 dairy cattle, or 14 dogs or 15 cats per day.

If the number of beef and dairy cattle increases according to the MAFF's production target (5) and the number of beef and dairy farms stay at the current level, the number of animals per beef and dairy farms will increase 1.3 and 1.4 times, respectively. Therefore, the efficiency of large animal practices was assumed to increase by 1.3 and 1.4 times for beef and dairy cattle, respectively, by 2015.

As a baseline scenario, the number of dogs and cats that a veterinarian is capable of attending was assumed to remain at the current level in the future. Based on the prediction by the JVMA that the efficiency of veterinarians in small animal practice will increase by 10% with assistance of veterinary auxiliaries in the future (2), the number of dogs and cats that a veterinarian in small animal practice is capable of attending was also assumed to increase by 10% in the next 10 years.

*Number of days that one veterinarian engaged in animal practice of category **i** works in year **y** ( $E_{y,i}$ )*

Based on the results of a survey mentioned above (8), a veterinarian in small or large animal practice was assumed to work 277 or 267 days per year, respectively.

*Number of veterinarians in other occupational categories*

The number of veterinarians who are civil servants engaged in animal health and public health was 3,582 and 4,863, respectively, at the end of 2006 (7). Although an increased demand is expected for veterinarians in a variety of public sectors, the total number of civil servants has been declining under the ongoing administrative reforms. Therefore, the number of veterinarians in these sectors was assumed to stay at 3,500 and 4,800, respectively, until 2040. Likewise, given that 688 veterinarians were working for prefecture animal welfare centres and zoological parks at the end of 2006 (7), the number of veterinarians in these sectors was assumed to stay at 700 in the future.

As of 31 December 2006, 4,856 veterinarians were working for incorporated administrative agencies and pharmaceutical companies as researchers in veterinary medicine (7). The number of veterinarians in these sectors was assumed to stay at 5,000 until 2040.

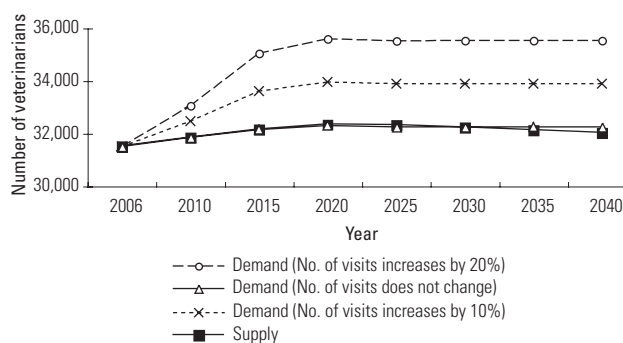
## Prediction results

### Adjustment of demand in 2006

The number of veterinarians required for small and large animal practice in 2006 was calculated to be 15,432 and 3,576, while the actual number of veterinarians engaged in small and large animal practice at the end of 2006 was 13,202 and 4,180, respectively. Given that the values used for input variables for the demand model are based on the results of sample surveys and are therefore accompanied by error margins, the results produced by the demand model were adjusted so that the supply and demand met in 2006.

### Supply and demand trend of total active veterinarians

The baseline scenario based on the assumption that either the number of visits made by a small animal owner or the efficiency of small animal practices does not change predicts that the supply and demand of veterinarians will be more or less balanced until 2040, with a shortage of 200 veterinarians in that year (Fig. 5, solid line). However, if the input variables are changed slightly the model predicts something rather different: if the number of visits to veterinarians made by a dog or cat owner increases by 10% during the next 10 years (for sensitivity analysis), the model predicts that there will be a shortage of 1,600 veterinarians in 2020, and 1,900 veterinarians in 2040 (Fig. 5, dotted line); if the number of visits to veterinarians made by a dog or cat owner increases by 20% during the next 10 years, there will be a shortage of



**Fig. 5**  
Predicted supply and demand of active veterinarians assuming that the efficiency of small animal practices does not change

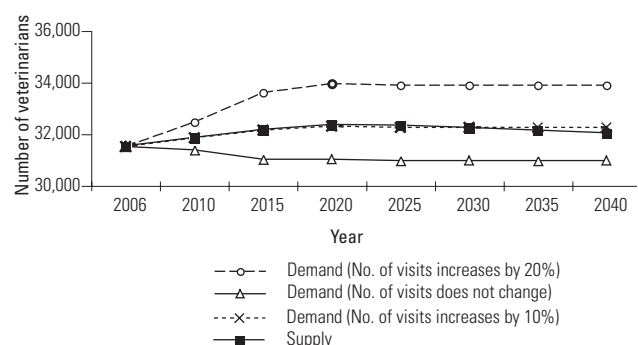
3,300 veterinarians in 2020, and 3,500 veterinarians in 2040 (Fig. 5, dashed line).

The scenario based on the assumption that the efficiency in small animal practices will increase by 10% in the next 10 years predicts an over-supply of 1,300 veterinarians in 2020 and 1,000 veterinarians in 2040 (Fig. 6, solid line). However, by increasing the number of visits to veterinarians made by a dog or cat owner by 10% during the next 10 years, supply and demand of veterinarians will be more or less balanced in the future (Fig. 6, dotted line). By increasing the number of visits to veterinarians made by a dog or cat owner by 20%, there will be a shortage of 1,600 veterinarians in 2020 and 1,900 veterinarians in 2040 (Fig. 6, dashed line).

### Supply and demand trend of veterinarians engaged in small animal practice

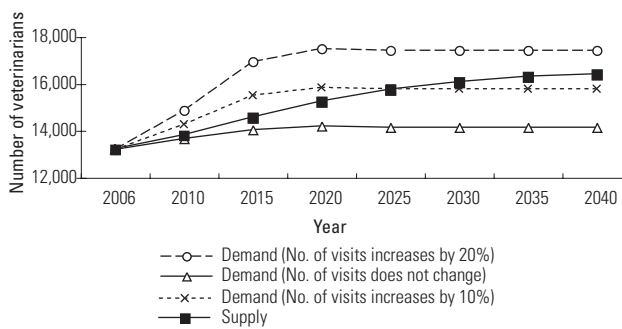
The baseline scenario based on the assumption that either the number of visits made by a small animal owner or the efficiency of small animal practices does not change predicts an over-supply of around 1,000 veterinarians in 2020 and 2,300 veterinarians in 2040 (Fig. 7, solid line). However, the scenario based on the assumption that the number of visits made by a small animal owner increases by 10% predicts a shortage of veterinarians until 2025 and an over-supply of veterinarians after that year (Fig. 7, dotted line). By increasing the number of visits made by a small animal owner by 20%, there will be a shortage of 2,300 veterinarians in 2020 and 1,000 veterinarians in 2040 (Fig. 7, dashed line).

The scenario based on the assumption that the number of visits made by a small animal owner does not change but the efficiency of small animal practices increases by 10% predicts an over-supply of 2,500 veterinarians in 2020 and 3,700 veterinarians in 2040 (Fig. 8, solid lines). However, by increasing the number of visits made by a small animal owner by 20%, there will be an over-supply of 1,000 veterinarians in 2020 and 2,300 veterinarians in

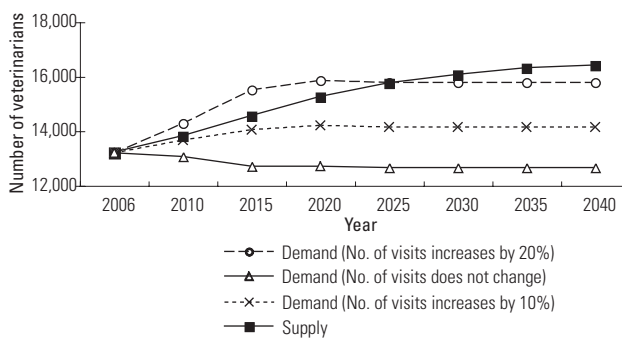


**Fig. 6**  
Predicted supply and demand of active veterinarians assuming that the efficiency of small animal practices increases by 10%





**Fig. 7**  
**Predicted supply and demand of veterinarians in small animal practice assuming that the efficiency of practices does not change**

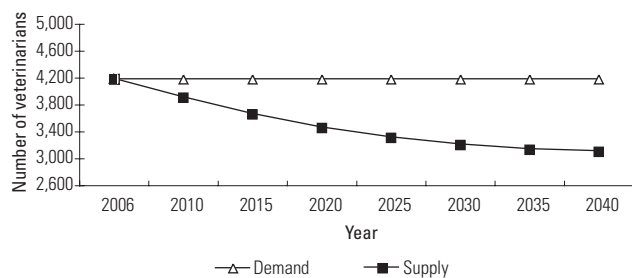


**Fig. 8**  
**Predicted supply and demand of veterinarians in small animal practice assuming that the efficiency of practices increases by 10%**

2040 (Fig. 8, dotted line). The scenario based on the assumption that the number of visits made by a small animal owner increases by 20% predicts a shortage of veterinarians until 2025 and an over-supply of veterinarians after that year (Fig. 8, dashed line).

**Supply and demand trend of veterinarians engaged in large animal practice**

Regardless of the assumptions used, there will be a shortage of 700 veterinarians in 2020 and 1,100 veterinarians in 2040 (Fig. 9). This is due to the expected decrease in the supply of newly licensed



**Fig. 9**  
**Predicted supply and demand of veterinarians in large animal practice**

veterinarians in this area and the large number of veterinarians aged 40 to 60 that are currently engaged in large animal practice (Fig. 1c) and expected to retire in the next 20 to 40 years.

**Discussion and conclusion**

The results of this study show that if the current annual supply of veterinarians into small animal practice continues, there might be somewhere between a shortage of a maximum of 3,700 and an over-supply of a maximum of 1,000 small animal practitioners in 2040, depending on the number of visits made by a small animal owner and the efficiency of practices in the future.

The results of this study also show that, even if the supply and demand of the total number of active veterinarians balance in the future, there will be a shortage of around 900 veterinarians in large animal practice, due to the expected decrease in the supply of newly licensed veterinarians entering this area and the large number of veterinarians expected to retire from this area in the next 20 to 40 years.

In this study, it was assumed that not only does the proportion of newly licensed veterinarians entering into the respective occupational categories not change, but also that there is no inter-category movement of veterinarians in the future. However, there would be inter-category movement of veterinarians depending on how work and other economic conditions change in these areas. There might be a need for a government intervention to promote recruitment of newly licensed veterinarians into large animal practice and inter-category movement to correct the predicted shortages of large animal practitioners.

In this study, the role of veterinarians in large animal practice in the future was assumed to remain identical to the current one, which focuses on treatment of individual animals. However, as the number of animals per farm increases, as predicted in the MAFF's production targets, there will probably be more demand for veterinary services that focus on herd health management. If the role of veterinarians in large animal practice changes from treatment of individual animals to herd management, there will be less demand for veterinarians, alleviating the potential future shortage of veterinarians in this area.

In this study, many assumptions were made to estimate the input variables in the model. Most of the values used for the input variables were estimated based on the data currently available or based on the results of surveys conducted in December 2006 and January 2007 and assumed to stay the same in the future unless there are

reasonable reasons to do otherwise. The values for some input variables were replaced by other possible values for sensitivity analysis. The result of the sensitivity analysis indicated that even a slight variation in the values in some of the input variables would have a considerable effect on the future supply and demand situation.

This is the first attempt that has been made to predict the future supply and demand trend of veterinarians in Japan. In the past, attempts were made to predict the supply and demand trend of veterinarians in the United States of America (1, 3, 4, 15), and to predict the supply and demand trend of medical surgeons, dentists and pharmacists in Japan (10, 12, 13). In these attempts,

predictions were made using supply and demand models more or less similar to the ones used in this study. As shown above and in these previous attempts, estimating the values of input variables for demand supply models is not always easy. In particular, a precise estimation of the values for the future is difficult and one has to make assumptions for sensitivity analysis. Nevertheless, making such an attempt is useful because it provides an indication of which input variables affect the future supply and demand trend, and identifies the areas where government interventions may be required. ■

## Prévisions sur l'évolution de l'offre et de la demande de vétérinaires praticiens au Japon

S. Kimura, S. Shinkawa, J. Mago, M. Yamamoto, M. Sakai, T. Sugisaki, H. Karaki & K. Sugiura

### Résumé

Actuellement, le Japon compte 32 000 vétérinaires en activité, qui exercent dans des cliniques vétérinaires pour petits ou grands animaux ou bien dans les services de santé publique vétérinaire ou de santé publique. Face à l'augmentation très nette du nombre de jeunes filles s'inscrivant dans les écoles vétérinaires et du nombre de foyers possédant un animal de compagnie, il a paru utile de réaliser une étude prospective de l'offre et de la demande de vétérinaires praticiens à l'horizon 2040 au Japon. Des enquêtes ont été réalisées sur un échantillon de foyers et de vétérinaires, afin d'estimer les variables à prendre en compte pour modéliser l'évolution de l'offre et de la demande. A partir de ces données, les prévisions indiquent que la profession de vétérinaire praticien spécialisé dans les petits animaux connaîtra en 2040 une situation allant d'une pénurie d'effectifs de l'ordre de 1 000 vétérinaires à un excédent d'effectifs de l'ordre de 3 700 vétérinaires. Cela dépendra, en effet, du nombre de visites chez le vétérinaire que les propriétaires d'animaux de compagnie seront disposés à faire à l'avenir, ainsi que de la rentabilité de cette activité. Le modèle prédit également en 2040 une pénurie d'effectifs de près de 1 100 vétérinaires spécialisés dans les grands animaux. Compte tenu des nombreuses suppositions ayant servi à évaluer les variables utilisées dans ce modèle, les résultats ne permettent pas de tirer de conclusions définitives, mais offrent néanmoins des éléments de réflexion qui seront utiles à la profession vétérinaire à l'avenir.

### Mots-clés

Analyse de l'offre et de la demande – Clinique vétérinaire pour grands animaux – Clinique vétérinaire pour petits animaux – Japon – Prédiction – Vétérinaire praticien. ■

## Predicción de las tendencias de oferta y demanda de veterinarios en Japón

S. Kimura, S. Shinkawa, J. Mago, M. Yamamoto, M. Sakai, T. Sugisaki, H. Karaki, K. Sugiura

### Resumen

Hay actualmente en Japón 32.000 veterinarios en activo que trabajan con grandes y pequeños animales y participan en labores de sanidad animal y servicios de salud pública. Ante el notable aumento en los últimos años de la proporción de alumnas matriculadas en las facultades de veterinaria y del número de hogares con animales de compañía, se elaboró un modelo de proyección de la oferta y demanda de veterinarios en el país hacia 2040. Se realizaron encuestas sobre una muestra de domicilios y veterinarios a fin de estimar las variables utilizadas en el modelo de oferta y demanda. A partir de estos datos se calcula que en 2040 la situación podría variar entre dos extremos: desde que faltaran 1.000 hasta que sobrarán 3.700 veterinarios de pequeños animales. Ello, sin embargo, dependerá de la evolución del número de consultas que realizan los propietarios de los animales y de la eficiencia de la praxis veterinaria en el futuro. El modelo predice asimismo que en 2040 faltarán alrededor de 1.100 veterinarios de grandes animales. Considerando las numerosas hipótesis formuladas para estimar las variables utilizadas en el modelo, los resultados del estudio no permiten llegar a conclusiones definitivas, aunque constituyen un punto de partida para reflexionar sobre las necesidades de la profesión veterinaria en el futuro.

### Palabras clave

Análisis de la oferta y la demanda – Japón – Predicción – Veterinarios – Veterinarios de grandes animales – Veterinarios de pequeños animales.



## References

1. Brown J.P. & Silverman J.D. (1999). – The current and future market for veterinarians and veterinary medical services in the United States. *JAVMA*, **215** (3), 161-183.
2. Japan Veterinary Medical Association (2007). – Survey on the division of work between veterinarians and non-veterinarians in small animal practice. *In* Discussion Paper presented to the 3rd Meeting of the Study Group on the Future Supply and Demand Trend of Veterinarians, 25 April, Tokyo [in Japanese]. Available at: [http://www.maff.go.jp/www/council/council\\_cont/syohi\\_anzen/jui\\_jukyuu/03/data02.pdf](http://www.maff.go.jp/www/council/council_cont/syohi_anzen/jui_jukyuu/03/data02.pdf) (accessed on 25 August 2007).
3. Lloyd J.W. (2006). – Current economic trends affecting the veterinary medical profession. *Vet. Clin. N. Am. (small Anim. Pract.)*, **36**, 267-279.
4. McLaughlin G.W., Bard H.E. & Talbot R.B. (1976). – Veterinary medical manpower: supply–demand projections to 2020. *JAVMA*, **168** (4), 319-321.
5. Ministry of Agriculture, Forestry and Fisheries (MAFF) (2005). – Basic plan for food, agriculture and rural areas (Cabinet decision March 2005) [in Japanese]. Available at: <http://www.maff.go.jp/keikaku/20050325/20050325honbun.pdf> (accessed on 25 May 2007).

6. Ministry of Agriculture, Forestry and Fisheries (MAFF) (2006). – Livestock mutual assistance provision improvement study [in Japanese]. MAFF, Tokyo.
  7. Ministry of Agriculture, Forestry and Fisheries (MAFF) (2007). – Summary distribution of veterinarians as of 31 December 2006 based on notification under Article 22 of the Veterinary Licensing Law [in Japanese]. Available at: <http://www.maff.go.jp/toukei/sokuhou/data/jyuui-todoke2006/jyuui-todoke2006.xls> (accessed on 25 May 2007).
  8. Ministry of Agriculture, Forestry and Fisheries (MAFF) (2007). – Result of the survey conducted on veterinary practitioners. *In* Discussion Paper presented at the 2nd Meeting of the Study Group on the Future Supply and Demand Trend of Veterinarians, 12 March, Tokyo [in Japanese]. Available at: [http://www.maff.go.jp/www/council/council\\_cont/syohi\\_anzen/jui\\_jukyuu/02/data02.pdf](http://www.maff.go.jp/www/council/council_cont/syohi_anzen/jui_jukyuu/02/data02.pdf) (accessed on 25 August 2007).
  9. Ministry of Agriculture, Forestry and Fisheries (MAFF) (2007). – Result of the survey conducted on dog and cat owners. *In* Discussion Paper presented at the 2nd Meeting of the Study Group on the Future Supply and Demand Trend of Veterinarians, 12 March, Tokyo [in Japanese]. Available at: [http://www.maff.go.jp/www/council/council\\_cont/syohi\\_anzen/jui\\_jukyuu/02/data02.pdf](http://www.maff.go.jp/www/council/council_cont/syohi_anzen/jui_jukyuu/02/data02.pdf) (accessed on 25 August 2007).
  10. Ministry of Health, Labour and Welfare (MHLW) (2002). – Prediction of future supply and demand of pharmacists. Study Group on Pharmacist Issues [in Japanese]. Available at: <http://www.jpec.or.jp/contents/c13/jyukyuyosoku.pdf> (accessed on 25 August 2007).
  11. Ministry of Health, Labour and Welfare (MHLW) (2005). – 19th Human Life-Table [in Japanese]. Available at: <http://www.mhlw.go.jp/toukei/saikin/hw/life/19th/> (accessed on 25 May 2005).
  12. Ministry of Health, Labour and Welfare (MHLW) (2006). – Report of a study group on the supply and demand of medical surgeons in Japan [in Japanese]. Available at: <http://www.mhlw.go.jp/shingi/2006/07/dl/s0728-9c.pdf> (accessed on 25 August 2007).
  13. Miyatake M. (2006). – A study on the prediction of demand for new dental service [in Japanese]. Oral Health Association, Tokyo, 102 pp.
  14. National Institute of Population and Social Security Research (IPSS) (2006). – The Fifth National Survey on Household Changes Report [in Japanese]. Available at: <http://www.ipss.go.jp/> (accessed on 25 May 2007).
  15. Prince J.B., Andrus D.M. & Gwinner K.P. (2006). – Future demand, probable shortages, and strategies for creating a better future in food supply veterinary medicine. *JAVMA*, **229** (1), 57-69.
-