

Current Situation and Actuarial Issues of Long-Term Care Insurance in Japan

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Abstract

Over recent years, the Japanese population has continued to enjoy an increase in average longevity, thanks to advances in medical technology, etc., and Japan now boasts the longest lifespan of any country in the world. However, while the number of elderly people is increasing, the birthrate is on a declining trend due to changes in lifestyle, which makes Japan the country with the oldest and fastest aging population in the world. The changes in lifestyle have also brought about a proliferation of the nuclear family (a family that typically consists of father, mother and their children, with grandparents living apart). As a result, long-term care for seniors has become an extremely serious issue.

Due to these factors, the public long-term care insurance system was introduced in Japan in 2000. This is a system whereby service users who need long-term nursing care can receive services financed by long-term care insurance premiums collected from all people aged over 40 years and by taxes. However, even when users receive care services under public long-term care insurance, they have to bear part of the cost of the insured services, and the upper limit for benefits to be paid is predetermined. If they use services in excess of the limit, they have to pay the total cost of the extra services. So, users still have to bear a financial burden in the event that long-term nursing care becomes necessary.

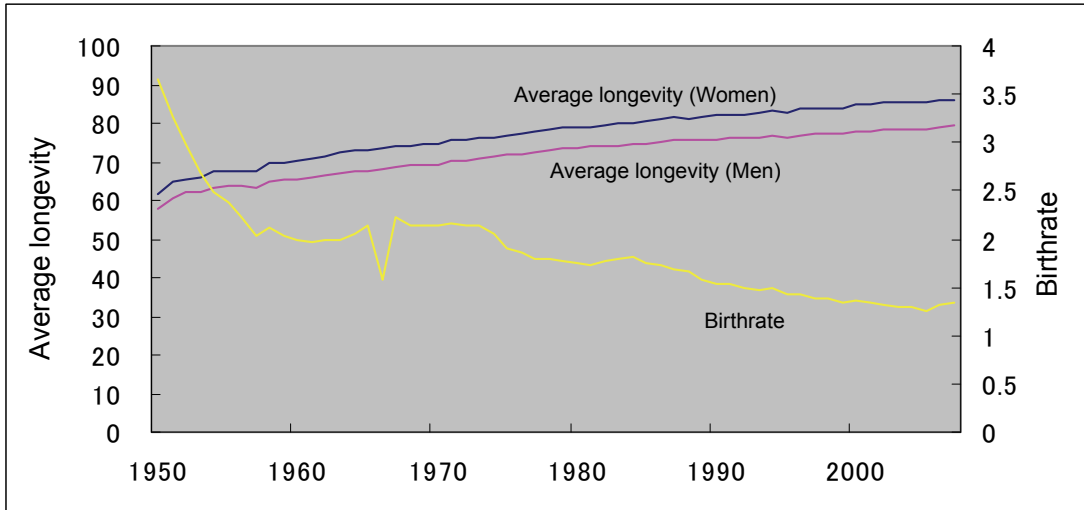
Against this background, private long-term care insurances, which pay insurance money when care is needed, have become popular. This paper introduces the contents of Japanese long-term care insurance and issues from the actuarial perspective.

1. Introduction

In Japan, average longevity is continuing to rise year-on-year, thanks to advances in medical technology. The average longevity of Japanese people as of 2007 is 79 years for men, which is third longest in the world, and 86 years for women, the world's longest. Average longevity for both sexes is 83 years, which also leads the world. On the other hand, the birthrate is continuing to decline due to the growing tendency to defer marriage and the rising cost of education per child. The birthrate in Japan as of 2007 is 1.34 ^(note), lower than the rate for other advanced countries.

(Note) The value here is the single totaled age-specific fertility rate for women.

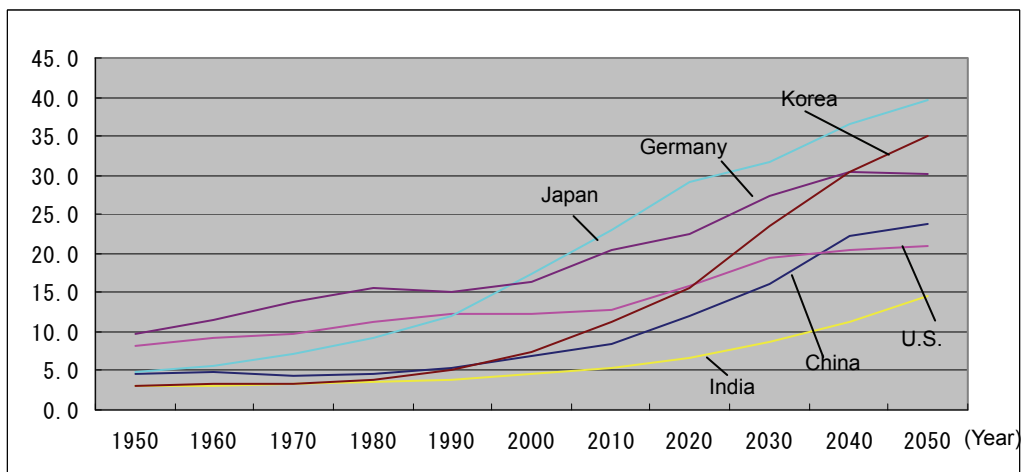
Fig. 1. Average longevity and birthrate in Japan



Source: Ministry of Health, Labour and Welfare: Population Survey Report, Life Table

As a result of this combination of increasing life expectancy and declining birthrate, Japan's population has been aging at a pace not seen elsewhere in the world. The percentage of persons aged 65 and over in the total population of Japan currently is about one in five, and it is expected to rise to one in four by 2015 and one in three by 2040.

Fig. 2. Cross-country comparison of the proportion of population aged 65 years or over to total population

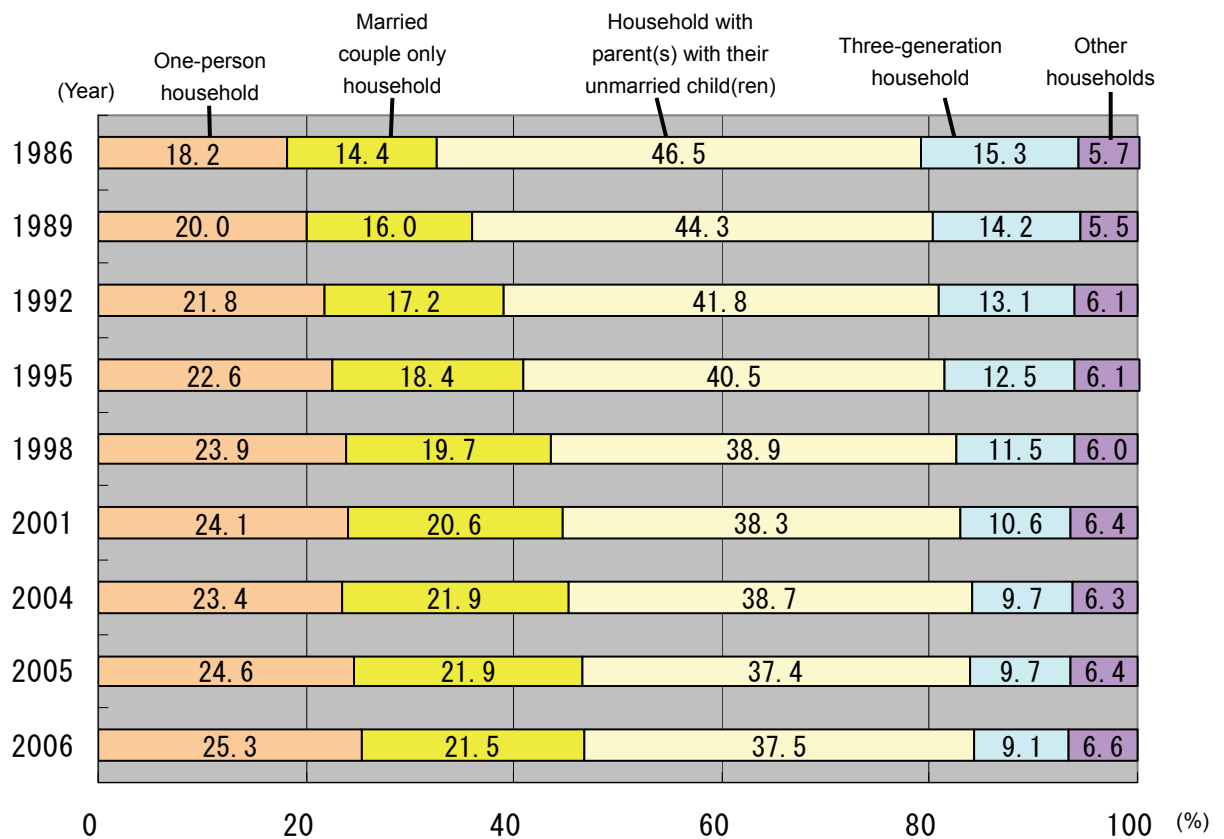


Source: World Population Prospects; 2006 Revision

Moreover, the numbers of married couple only households and one-person households are

increasing while the number of households where grandparents, parents, and children live together is decreasing, and family members are much more likely to live separately. In Japan, these households are called “nuclear families” and caring for the aged has become an extremely serious issue for the people because other family members who are expected to support elderly relatives tend to live apart, i.e., not in the same household.

Fig. 3. Proportion of households by type of household in Japan



Source: Ministry of Health, Labour and Welfare: A Survey of National Living Standards

These statistics motivated introduction of Japan’s public long-term care insurance system, in April 2000.

2. Outline of the public long-term care insurance system in Japan

Started in April 2000, this system was modeled on that of Germany, where a similar pattern of population aging led to growing concern about long-term nursing care issues. Germany launched its public long-term care insurance system in 1995.

The Japanese system is structured as follows:

(1) Eligible persons

Financed by a combination of premiums collected from all people aged 40 years or over and public funds, care services are provided to those who develop a need for long-term nursing care. People are divided into two age groups. Those aged 65 years or over are classified as Category 1 insured persons while those aged 40 - 64 years are designated as Category 2 insured persons. Benefit payment conditions, etc. differ between the two groups. When people become in need of care, they can receive a benefit payment under the public long-term care insurance. However, payments for people aged 40 - 64 are limited to situations in which such people need care due to certain diseases such as dementia presenilis or cerebral vascular disease.

	Category 1 insured persons	Category 2 insured persons
Age category	65 years or over	40 - 64 years
Benefit payment conditions	When care becomes necessary	When care becomes necessary due to any of 16 types of mainly age-related diseases such as dementia presenilis or cerebral vascular disease
Method of premium collection	Premiums shall be deducted from pension benefits. (Note 1)	Collected with premiums for health care insurance program they join and paid in lump sums. (Note 2)

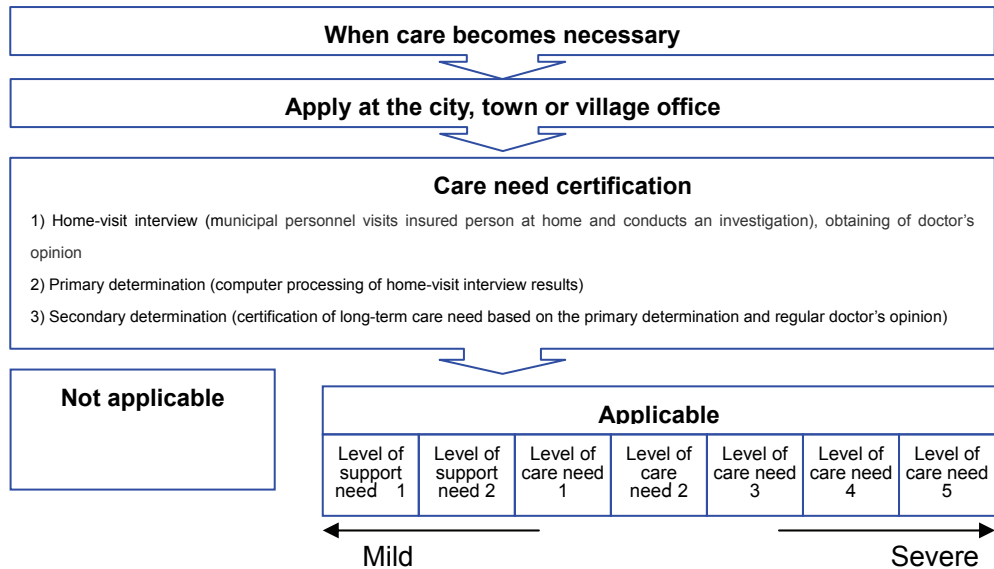
(Note 1) People aged 65 and over can receive public pension benefits in Japan.

(Note 2) In Japan, all persons are required to enroll in the public medical insurance system. If you are a salaried worker, your premiums for public medical insurance and public long-term care insurance are deducted from your salary and paid by your employer.

(2) Steps for receiving care services

When care becomes necessary, an insured person applies for a “care need certification” at the municipal office. Based on an investigation by municipal personnel and a doctor’s opinion, determination of “care need certification” is conducted through primary determination by computer and secondary determination by the care need certification committee. “Care need certification” is divided into seven levels depending on the degree of care required. Following care need certification, depending on the

insured person's condition, the care service plan (called "care plan") is decided and the long-term care service is initiated.



(3) Type of services available

There are two types of services: "home care services" by which a user can mainly receive home-visit nursing care by home helpers at home and "facility services" where a user moves into a welfare facility, etc, to receive nursing care at the facility.

Home care services	<ul style="list-style-type: none"> ● Home help service Home helpers visit at home and provide care. ● Day service A user goes to a day service care facility and receives care. ● Rental of assistive devices
Facility services	A user moves into accommodation at a facility such as a special nursing home for the elderly, and receives care.

(4) Self-pay burden when receiving services

There is a limit on benefits paid for home care services depending on the level of care required, and the co-payment is 10%. As for services at facilities, co-payment is determined by each facility. When users receive services outside of or in excess of those included in public long-term care insurance cover, they have to bear the full expense.

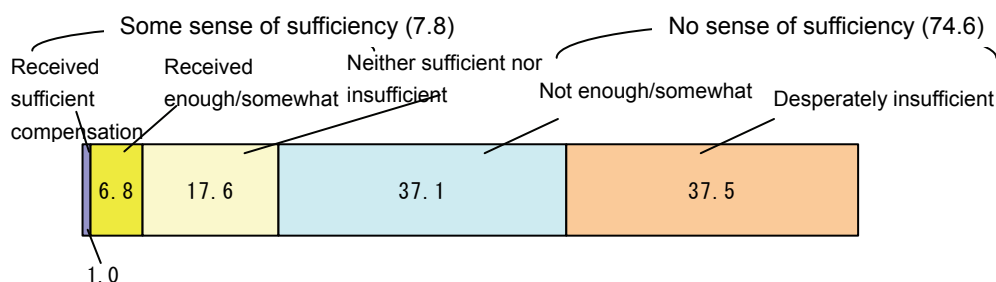
3. Marketability of private long-term care insurance and contents of product

(1) Marketability

Despite the existence of the public long-term care insurance system, people still have to bear some financial burden when they become in need of care. For example, if they use home care services, they have to pay 10% of the cost as an out-of-pocket payment, and to pay all expenses for any extra services in excess of the specified amounts of services. Moreover, they may have to pay for some higher costs of care such as purchase of a wheelchair or a nursing bed, or home remodeling to cater for the special physical needs of persons requiring nursing care.

According to a questionnaire survey conducted by a private company, the sense of sufficiency of long-term care compensation combined with public long-term care insurance and private savings for long-term care averages 7.8% for “With sense of sufficiency” and 74.6% for “No sense of sufficiency.”

Fig. 4. Sense of sufficiency for long-term care compensation (Unit: %)



Source: Japan Institute of Life Insurance: Survey of life security 2007

In a similar survey on medical security, 30.2% of respondents indicated “Some sense of sufficiency” and 59.7% indicated “No sense of sufficiency.” From these comparison results, it would appear that many people are more concerned about long-term care compensation than about medical security.

(2) Contents of products

The typical contents of products are introduced below. Note that individual companies' products may differ in some respects.

[1] Reason for payment – Linked to the public long-term care insurance system or certified based on insurance conditions stipulated in individual policies

Definitions of states requiring care that qualify for payment of insurance money can be broadly divided into two types.

In one type, the state needing care is spelled out in the insurance conditions; for example, a state in which a person cannot maintain his/her physical posture for about ten seconds on the floor, even when walking with the assistance of a stick.

The other type is “linked to the public long-term care insurance system.” For example, insurance is paid if he/she is certified as Care Level 3 or higher under the public long-term care insurance system.

The latter type is becoming increasingly popular as it makes it easier for insurance purchasers to understand when they qualify to be paid insurance money, and it also facilitates payment assessment by insurance companies. However, this type raises other issues, such as, if the contents of public long-term care insurance are changed (e.g., if the care level classification by severity is reviewed and changed from seven levels to ten levels), the contents of the insurance contract will also have to be modified in accordance with such changes.

In addition, it is common to set an exclusion period, e.g., insurance will be paid only if the state requiring care continues for at least 90 days.

[2] Insurance money

It is common practice to set a lump-sum amount to be paid when persons first enter a state requiring long-term care and subsequent amounts (hereinafter referred to as “care annuity”) to be paid as long as the state requiring care persists. The contents of the care annuity may be, for example, payment of one million yen per year as long as the state requiring care persists. Some types of insurance policies set only a lump-sum payment, while others offer only an annuity.

[3] Exemption from payment of premium

It is common practice to waive payment of premium when an insured person enters a state requiring long-term care.

[4] Insurance term

The insurance term is often a long term, similar to that for whole of life insurance.

[5] Main contract or special contract

There are such types of insurance as stand-alone long-term care insurance and long-term care insurance as a special contract under death insurance or medical care insurance. In Japan, both life insurance companies and non-life insurance companies are permitted to handle “insurances that pay insurance money for insured persons’

damages due to illness”*, such as health insurances or long-term care insurances.

(Note) In Japan, insurance products (able to be handled by life insurance companies) that promise to pay a certain amount of money in respect of a person’s life and/or death are called “first sector insurances”; insurance products such as car insurances or fire insurances (able to be handled by non-life insurance companies) that cover insured persons’ damages are called “second sector insurances”; and insurance products (able to be handled by both life insurance companies and non-life insurance companies) that pay insurance money for insured persons’ damages due to illness are called “third sector insurances”.

[6] Underwriting method

Underwriting methods are divided into two types: a non-medical application case whereby an insurance company receives from an applicant a declaration form regarding his/her health condition and evaluates whether or not the insurance is underwritten and its underwriting conditions according to the contents; and a medical examination report case where the insurance company makes its determination based on the results of a medical examination by a doctor. In health insurances and long-term care insurances which provide no death benefit, non-medical application is more common. There are some simplified non-medical application cases wherein underwriting is accepted if none of the health conditions listed in the declaration form is applicable to the applicant conditions, and is not accepted if any of the conditions is declared to be applicable.

4. Issues from an actuarial point of view

There are various issues relating to the relatively short history of long-term care insurances and the absence of sufficiently supportive insurance statistics. Examples of issues in respect of premium rates calculation and valuation of liabilities are explained below:

(1) Calculation of premium rates

[1] Calculation method for the rate of incidence of persons requiring long-term care

- As mentioned above, the rise in availability and purchase of long-term care insurance contracts has come about only recently, so there are many contracts in force where the insured persons have not yet reached an age at which they may require care (usually an extremely old age). Consequently, most insurance companies do not have insurance payment records on which to confidently base specific calculation formulas and it is normal practice to calculate using official data.
- One of the most important basic rates in calculating premiums for long-term care

- However, especially in respect of products linked to public long-term care insurance, “the number of persons who are certified as requiring long-term care at some point” can be obtained from general statistics and “the percentage of persons who are in a state requiring long-term care” can be calculated using demographic statistics. With some other basic rates, the rate of incidence of persons requiring long-term care can be calculated using the following formula:

<Definitions>

r_x : Rate of incidence of persons requiring long-term care at the age of x
(probability of newly entering a state requiring long-term care within a year)

j_x : Percentage of persons requiring long-term care at the age of x (number of persons who are certified as requiring long-term care at the age of x /total population at the age of x)

q_x : Mortality rate at the age of x

q_x^{ii} : Mortality rate of persons requiring long-term care at the age of x

$$r_x = \frac{j_{x+1} \times (1 - q_x) - j_x \times (1 - q_x^{ii})}{(1 - j_x) \times (1 - \frac{1}{2} \cdot q_x^{ii})}$$

(Note) In this paper, cases in which users recovered and reverted to a state in which long-term care is not needed are ignored. See Appendix 1 for the derivation of the above expression.

- Here, you should be careful to note that the above expression uses “mortality rate (q_x)” and “mortality rate of persons requiring long-term care (q_x^{ii})” in addition to “percentage of persons requiring long-term care (j_x).” “Mortality rate (q_x)” can be obtained from general statistics or insurance records, but there are no statistics that clearly show “the mortality rate of persons requiring long-term care (q_x^{ii}).” One of the methods for estimating q_x^{ii} is to estimate the difference between “the mortality rate of persons not requiring long-term care (healthy people) (q_x^{aa})” and “the mortality rate of persons requiring long-term care (q_x^{ii})” and to calculate on that basis. An example of this calculation method is shown in Appendix 2.

Thus, it is an important challenge to estimate r_x very precisely, especially q_x^{ii} according to the above expression.

[2] Insurance payment period

With regard to care annuities, it is also important to take into account how long a qualifying state requiring long-term care will last. In health insurances, it is common to set an upper limit for the number of days for which insurance will be paid per hospitalization instance, such as 120 days. However, in respect of care annuities under long-term care insurances, many products do not set such upper limits; instead, they undertake to pay insurance as long as the insured person remains in a state requiring long-term care. Unfortunately, there are few statistics on periods of such states. It is safer to assume that, once entered, the state requiring long-term care will persist until the death of the insured person, and, in this case, similarly to [1], setting of “the mortality rate of persons in a state requiring long-term care (q_x^{ii})” also has important implications.

[3] Reflection of uncertainty against probability oscillation and future environmental changes

- Even if the rate of incidence of persons requiring long-term care can be estimated very precisely, there still exists a risk that the rate of incidence of persons requiring long-term care will increase due to a probability oscillation. There is also a possibility that the rate of incidence of persons requiring long-term care could increase due to future environmental changes. In fact, in Japan, since the public long-term care insurance system started in 2000, the number of persons certified as requiring long-term care has continued to rise. To absorb these uncertainties, it is common practice to set the premium rate slightly higher with extra premium included when the premium is first calculated.
- One frequently used method is to add a certain percentage of standard deviation (σ) to an expected value; for example, 2σ in assumed probability distribution. However, in this method, the extra premium standard can vary greatly depending on how large the expected number of insured persons will be, i.e., how many contracts are expected, and, depending on the setting of the number of insured persons, premiums could become excessively high. Here, as explained in Appendix 3, we conducted a simulation of the rate of incidence of persons requiring long-term care (r_x). In some cases, the rate of incidence after adding extra premiums became nearly twice as high

Thus, it is important to consider how to incorporate elements of uncertainty, especially in the case of longer-term insurance contracts.

(2) Loss reserves

When insured persons actually enter a state requiring long-term care and they make insurance claims to insurance companies, payment reserves are accumulated for future insurance payments. As mentioned previously, because care annuities are paid for as long as insured persons are in the state requiring long-term care, the amount of payment reserves can often be very high. As a simple estimation method of payment amount for an actual event, it can be “payment amount per year multiplied by life expectancy of the insured person at the time of an event.” When this estimation method is employed, similarly to (1) above, the mortality rate of persons who require long-term care becomes important.

(3) Policy reserves

Especially in respect of contracts with long insurance terms, it is vital to set an appropriate premium rate, but equally important is the need to accumulate proper policy reserves in preparation for future insurance payments after concluding a contract. The types of policy reserves to be accumulated for Japan’s health insurances and long-term care insurances are determined by laws and regulations, and the outline of main policy reserves is as follows:

[1] Premium reserves

This refers to policy reserves for usually predictable risks. The accumulation system for premium reserves, assumed interest rate that is the basis for calculation, and mortality rates are determined by laws and regulations so as not to affect the soundness of insurance companies, regardless of how premiums are set. However, in respect of the rate of incidence of insured events, a standard rate has not been determined because the contents of products vary between insurance companies, and this has become a matter of concern.

[2] Contingency reserves

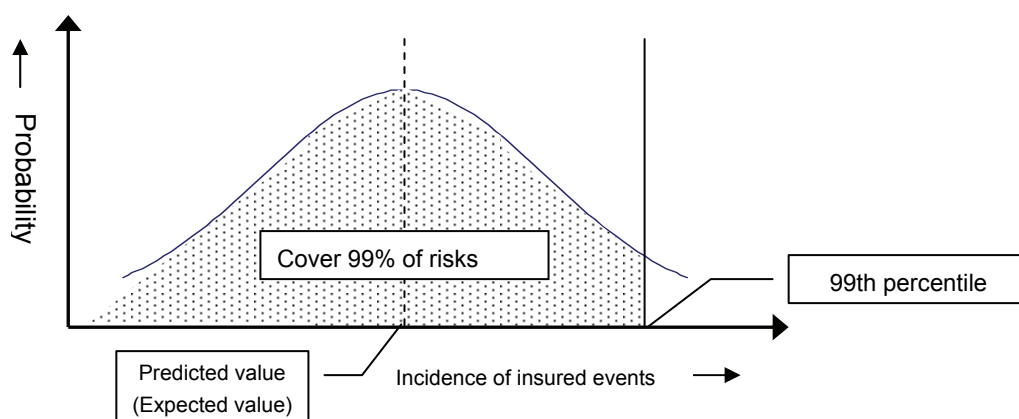
Health insurances and long-term care insurances are susceptible to external factors such as political measures. (For example, they are affected when political measures

are implemented such as shortening the duration of hospital stays or reviewing standards for care need certification in order to curb rising costs of medical care and long-term care services.) It is also considered that Japan's health insurances and long-term care insurances contain uncertainty factors because the insurance terms of many products last for the whole of life. On the other hand, as mentioned in the section on calculation of premium rates, many products have only short histories and there has been insufficient data accumulation, with the result that there is no standard index for rates of event incidence.

Therefore, it is important to accumulate sufficient reserves for future insurance payments after conducting follow-up inspections against uncertainties on the rates of event incidence. Based on this background, rules were established in 2007 on accumulation of policy reserves for health insurances and long-term care insurances, and follow-up inspections.

Specific contents are as follows:

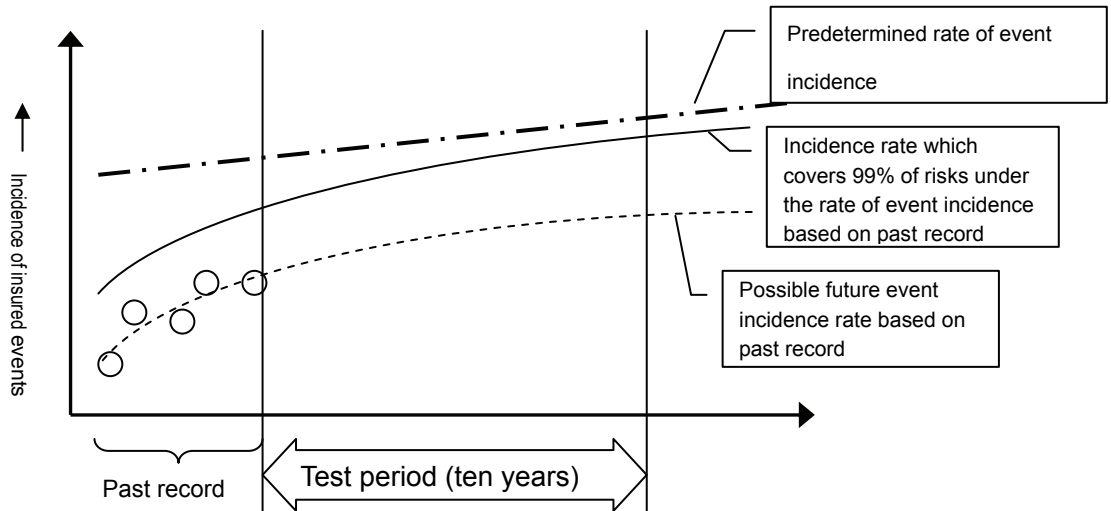
- Predict the rates of insured event incidence over the next ten years based on the actual rates of insured event incidence.
- Taking the probability oscillation into consideration, calculate a standard to cover 99% of risks over the next ten years.



- When the predetermined rate of event incidence set in advance to calculate premiums, etc. does not meet the standard to cover this 99%, contingency reserves are accumulated in order to maintain an adequate premium reserve.

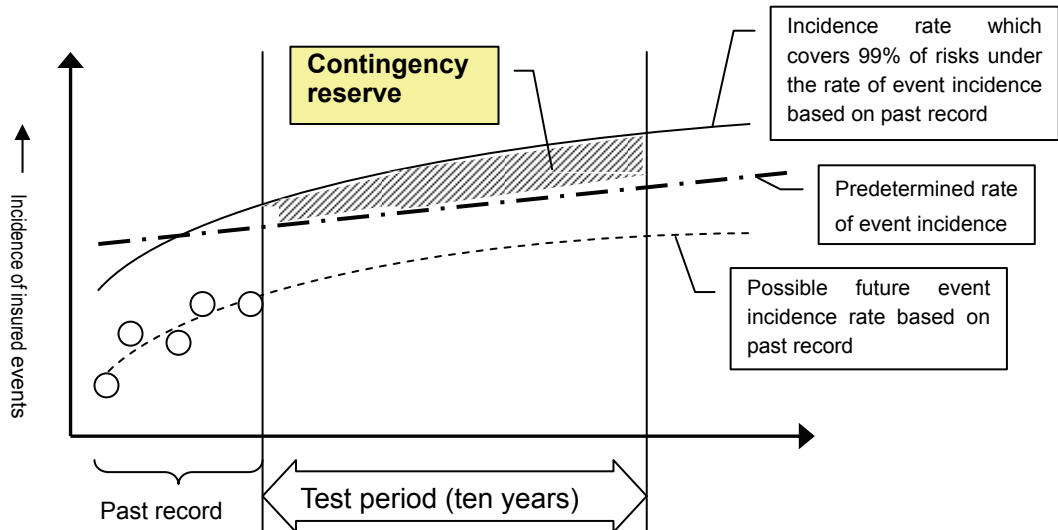
This is illustrated below:

a. Cases where the predetermined rate of event incidence covers 99% of risks



⇒ There is no need to accumulate contingency reserves.

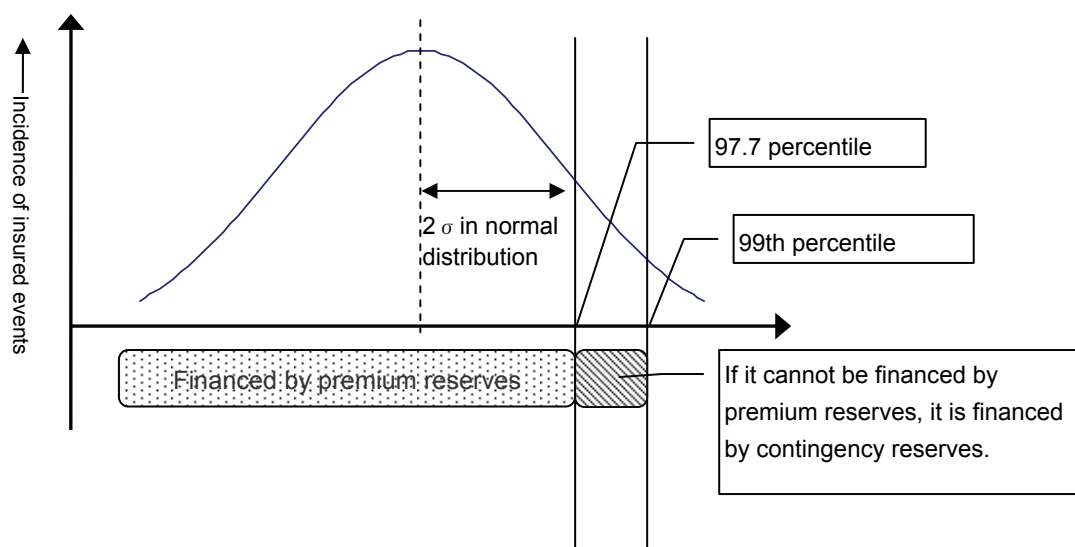
b. Cases where the predetermined rate of event incidence cannot cover 99% of risks



⇒ Contingency reserves need to be accumulated.

This contingency reserve requirements system for health insurances and long-term care insurances has been in place since 2007, as mentioned above. However, the new challenge is deciding what model to use to estimate the event incidence rate in the future, and how to build a database for this analysis.

In addition, it is considered that 97.7% risks (risks equivalent to an expected value + 2σ in normal distribution) should be covered by the premium reserves in the above-mentioned [1]. Consequently, if the estimated event incidence rate cannot meet the level to cover 97.7% risks, an amount equivalent to the difference between the 99% level and the 97.7% level shall be accumulated as contingency reserves and a test (liability adequacy test) shall be conducted to determine whether or not the premium reserves cover all liabilities, including not only future insurance payments but also various company costs.



(4) Supervision and regulation by administration

As seen in our examination of the contingency reserves system in (3) above, recently, regulations regarding health insurances and long-term care insurances and the nature of the policy reserves have come to be reviewed in various ways. In particular, the nature of policy reserves appears to be under ongoing discussion in relation to international accounting standards and solvency margin standards.

In Japan, each insurance company appoints chief actuaries in order to assure sound management of the company. (The roles of a chief actuary are to become involved in the calculation methods for premiums and policy reserves, and to check that policy reserves are properly accumulated.) Recently, the roles of these chief actuaries have been expanded and they are now required to directly carry out the above-mentioned duty of conducting liability adequacy tests. In addition, in Japan, insurance companies basically

need to obtain pre-certification from supervisory authorities in order to be able to sell insurance products. Written opinions by chief actuaries are required to support applications for approval of calculation methods for premiums and policy reserves for health insurances and long-term care insurances. It appears to be expected that the nature of supervision of and regulations on health insurances and long-term care insurances should be continuously reviewed.

5. Summary

As mentioned above, there is a growing need for long-term care insurance in Japan and the sector is expected to grow further in coming years. On the other hand, there are many issues regarding premium calculation, such as the fact that there are no hard data on the rates of incidence of states requiring long-term care. In addition, in light of future uncertainty, valuation of policy reserves is also important, given that many insurance contracts have very long terms. We actuaries must continue to calculate appropriate premiums, evaluate policy reserves, and manage risks with due consideration to both profitability and the soundness of insurance companies. Going forward, we hope to contribute to the development of long-term care insurances, using examples from other countries.

Appendix 1 Calculation of the incidence rate of requirement for long-term care r_x

<Definitions>

$l_x \rightarrow$ Number of insured persons at the age of x

Other symbols are the same as in the text.

Number of persons requiring long-term care at the age of $x+1$ is expressed as follows:

Number of persons requiring long-term care at the age of $x+1$

= [Number of persons who survive to the age of $x+1$ among the persons requiring long-term care at the age of x] ...[1]

+ [Number of persons who enter a state requiring long-term care before the age of $x+1$ and survive to the age of $x+1$ among the persons who are not in a state requiring long-term care (healthy people)] ...[2]

Expressed in equations as follows:

Left-hand side = [number of survivors at the age of $x+1$] x [percentage of persons in need of long-term care at the age of $x+1$] = $l_{x+1} \times j_{x+1}$

[1] of right-hand side = [number of survivors at the age of x] x [percentage of persons requiring long-term care at the age of x] x [1 - (mortality rate of persons requiring long-term care at the age of x)]

$$= l_x \times j_x \times (1 - q_x^i)$$

[2] of right-hand side = [number of healthy people at the age of x] x [rate of incidence of persons requiring long-term care at the age of x] x $[1 - \frac{1}{2} \times$ (mortality rate of persons requiring long-term care at the age of x)]

= [number of survivors at the age of x] x [1 - (percentage of persons requiring long-term care at the age of x)] x [rate of incidence of persons requiring long-term care at the age of x] x $[1 - \frac{1}{2} \times$ (mortality rate of persons requiring long-term care at the age of x)]

$$= l_x \times (1 - j_x) \times r_x \times (1 - \frac{1}{2} q_x^i)$$

(Note) The state requiring long-term care shall occur in the middle of a year on average.

Therefore,

$$l_{x+1} \times j_{x+1} = l_x \times j_x \times (1 - q_x^i) + l_x \times (1 - j_x) \times r_x \times (1 - \frac{1}{2} q_x^i)$$

Substitute $\frac{l_{x+1}}{l_x} = 1 - q_x$ and rearrange r_x ,

$$r_x = \frac{j_{x+1} \times (1 - q_x) - j_x \times (1 - q_x^i)}{(1 - j_x) \times (1 - \frac{1}{2} \cdot q_x^i)}$$

Appendix 2 Example of calculation method for q_x^{aa} , q_x^{ii}

<Definitions>

p_x^{aa} → Percentage of persons who are healthy one year later among the persons who are not in a state requiring long-term care at the age of x (healthy people)

q_x^{aa} → Percentage of persons who die while being healthy within a year among the healthy people at the age of x

l_x → Number of insured persons

α_x → The ratio of “mortality rate of persons in a state requiring long-term care (q_x^{ii})” to “mortality rate of healthy people (q_x^{aa})” (= q_x^{ii} / q_x^{aa})

Other symbols are the same as in the text.

The following expression is obtained.

$$p_x^{aa} + r_x + q_x^{aa} = 1 \quad \dots[1]$$

$$l_x(1 - j_x)p_x^{aa} = l_{x+1}(1 - j_{x+1}) \quad \dots[2]$$

$$l_x(1 - j_x)q_x^{aa} + l_x j_x q_x^{ii} + l_x(1 - j_x)r_x \frac{q_x^{ii}}{2} = l_x - l_{x+1} \quad \dots[3]$$

$$q_x^{ii} = \alpha_x q_x^{aa} \quad \dots[4]$$

By using $\frac{l_{x+1}}{l_x} = 1 - q_x$, [2] and [3] are given by the following expression:

$$p_x^{aa} = \frac{1 - j_{x+1}}{1 - j_x}(1 - q_x) \quad \dots[5]$$

$$(1 - j_x)q_x^{aa} + j_x q_x^{ii} + (1 - j_x)r_x \frac{q_x^{ii}}{2} = q_x \quad \dots[6]$$

Substitute [1] into [5]

$$r_x = 1 - \frac{1 - j_{x+1}}{1 - j_x}(1 - q_x) - q_x^{aa} \quad \dots[7]$$

Substitute [4] and [7] into [6]

$$(1 - j_x)q_x^{aa} + j_x \alpha_x q_x^{aa} + (1 - j_x) \left\{ 1 - \frac{1 - j_{x+1}}{1 - j_x}(1 - q_x) - q_x^{aa} \right\} \frac{\alpha_x q_x^{aa}}{2} = q_x$$

Rearrange q_x^{aa}

$$\frac{\alpha_x(1 - j_x)}{2}(q_x^{aa})^2 - \left\{ \left(1 + \frac{\alpha_x}{2} \right)(1 - j_x) - \frac{\alpha_x}{2}(1 - j_{x+1})(1 - q_x) + \alpha_x j_x \right\} q_x^{aa} + q_x = 0$$

By solving this quadratic equation, q_x^{aa} can be obtained and q_x^{ii} is determined by [4].

Appendix 3 Simulation of rate of incidence of persons requiring long-term care (r_x)

<Explanation of terms>

j_x : Percentage of persons in a state requiring long-term care at the age of x

q_x : Mortality rate at the age of x

q_x^{ii} : Mortality rate of persons in a state requiring long-term care at the age of x

q_x^{aa} : Percentage of persons who die while being healthy within a year among the healthy people at the age of x

α_x : The ratio of "mortality rate of persons in a state requiring long-term care (q_x^{ii})" to "mortality rate of healthy people (q_x^{aa})"

r_x : Rate of incidence of persons requiring long-term care at the age of x (probability of newly entering a state requiring long-term care within a year)

σ_x : Standard deviation in the probabilistic distribution r_x is distributed. Where r_x shall be distributed according to a binomial distribution.

Where $\sigma_x = (r_x \cdot (1-r_x) / N_x)^{\frac{1}{2}}$ (N_x equals the number of insured persons)

r_x' : $2\sigma_x$ is added to r_x as an extra premium

<Result>

For example, at the age of 70, if $N_x = 1,000$, r_x' will be about twice the value of r_x . If $N_x = 10,000$, it will be about a 30% increase.

①Age	② j_x	③ q_x	④ α_x	⑤ q_x^{ii}	⑥ q_x^{aa}	Nx=1000		Nx=10000		
						⑦ r_x	⑧-1 σ_x	⑨-1 r_x'	⑩-2 σ_x	⑪-2 r_x'
70	0.01778	0.02123	6.43897	0.12305	0.01911	0.00449	0.00212	0.00872	0.00067	0.00583
71	0.02017	0.02361	6.18242	0.13029	0.02107	0.00522	0.00228	0.00978	0.00072	0.00666
72	0.02286	0.02615	5.93610	0.13732	0.02313	0.00605	0.00245	0.01095	0.00078	0.00760
73	0.02590	0.02895	5.69959	0.14459	0.02537	0.00701	0.00264	0.01228	0.00083	0.00868
74	0.02934	0.03208	5.47250	0.15229	0.02783	0.00812	0.00284	0.01379	0.00090	0.00991
75	0.03322	0.03555	5.25446	0.16031	0.03051	0.00940	0.00305	0.01550	0.00096	0.01133
76	0.03759	0.03939	5.04511	0.16863	0.03343	0.01088	0.00328	0.01744	0.00104	0.01295
77	0.04251	0.04368	4.84410	0.17742	0.03663	0.01258	0.00352	0.01963	0.00111	0.01481
78	0.04804	0.04856	4.65110	0.18703	0.04021	0.01456	0.00379	0.02213	0.00120	0.01695
79	0.05425	0.05402	4.46579	0.19716	0.04415	0.01683	0.00407	0.02497	0.00129	0.01941
(80)	0.06121									

(Note) • The rate of incidence shall be Care Level 3 and higher in public long-term care insurance.

- j_x → This is calculated using the number of certified persons requiring long-term care in Care Level 3 or above in "October 2007 Survey on Long-term Care Compensation" (Ministry of Health, Labour and Welfare) and population data of "Demographic Shift as of October 1, 2007" (Ministry of Internal Affairs and Communications), with a slight correction.
- q_x → Based on No. 20 Life Table (Ministry of Health, Labour and Welfare)
- α_x → Based on the rate for reference for long-term care expenses insurance (Non-Life Insurance Rating Organization of Japan)
- q_x^{ii} , q_x^{aa} → These are calculated using the method shown in Appendix 2.