

図1 転倒スコア 21 項目の陽性数の合計点 (21 点満点) と転倒率 (過去 1 年)  
(鳥羽研二他: 日老医誌 2005; 42: 346-352 より引用)

なお,  $p$  値が 0.05 未満を統計学的に有意とし, 有意な傾向として,  $p < 0.1$  の項目も記載した。

### III. 主要な結果

各項目の出現頻度: 過去 1 年の転倒例は 708 名 (男性 229 名, 女性 479 名, 平均年齢  $77.5 \pm 7.4$  歳), 転倒率は 29.6%, 観察期間中は 25% であった。骨折は 1.8% にみられた。質問項目と, 過去 1 年の転倒者と非転倒者における下位項目を危険と判断する「陽性頻度」を表 2 に示す。

転倒スコア 2)~22) 項目の陽性数の合計点と転倒率を図 1 に示す。スコアが大きくなるほど転倒率が高くなることが示された。

観察期間中の転倒を評価しえた 1,378 症例で, 観察期間中の転倒を従属変数としてロジスティック回帰分析を行い, 独立した危険因子として抽出された下位項目の転倒危険度 (オッズ比) を算出した<sup>4)</sup>。

独立した有意な危険因子として, 過去 1 年の転倒歴 ( $p < 0.0001$ ), 歩く速度が遅くなってき

表 3 簡易式の「転倒チェック」シート

該当項目に✓を付ける	
<input type="checkbox"/> 過去 1 年に転んだことがある	5 点
<input type="checkbox"/> 背中が丸くなってきた	2 点
<input type="checkbox"/> 歩く速度が遅くなってきたと思う	2 点
<input type="checkbox"/> 杖を使っている	2 点
<input type="checkbox"/> 毎日 5 種類以上の薬を飲んでいる	2 点
	合計 点

※ 7 点以上は「要注意」  
(鳥羽研二他: 日老医誌 2005; 42: 346-352 より引用)

た ( $p = 0.04$ ), 杖の使用 ( $p = 0.02$ ), 背中が丸くなってきた ( $p = 0.02$ ), 5 種類以上の服薬 ( $p = 0.03$ ) が抽出された。ロジスティック回帰分析におけるオッズ比は, 過去 1 年の転倒が 4.5 倍と最も高く, 次いで, 歩く速度が遅くなってきた (1.9 倍), 杖の使用 (1.8 倍), 背中が丸くなってきた (1.8 倍), 5 種類以上の服薬 (1.7 倍) であった。

これらのオッズ比を四捨五入して整数倍にし, 重み付けした簡易式の「転倒チェック」シート (表 3) の合計点を用い, 観察期間中の転倒予測の有用性を検討したところ, カットオフポイント 6/7 点において, 感度 68%, 特異度 71% の実用性に足る成績が得られた。

#### IV. 考察

転倒は、多数の内的要因、外的要因による多危険因子の重層的な症候群 (multiple risk factor syndrome) の1つである<sup>1)</sup>。

Rubenstein は、転倒に関する大規模研究のレビューを行ったところ、筋力低下、バランス欠如、歩行障害、移動障害、ADL 障害はほとんどすべての研究で一致した危険因子であるが、視力障害、認知機能障害は半数の研究では危険因子として有意でなく、起立性低血圧は7研究中2つのみ有意であった<sup>9)</sup>。このように、人種や地域の差異が比較的大きくないと予測される内的要因においても、危険因子としての重みは、対象によって異なる成績となる。

転倒の危険評価表の開発は、主として介護施設<sup>6)</sup>や病院<sup>7-9)</sup>で行われ、過去の転倒、認知機能、感覚機能、運動・歩行機能、薬剤、立ちくらみ、慢性疾患が危険因子として挙げられている。ところが、転倒の大部分は家庭内で、過半数は居間などの室内で起きるとされているが、外的要因に関して、危険因子を標準化する試みはほとんどない。地域における転倒危険因子の抽出は多く行われているが<sup>10-14)</sup>、機能評価は質問表のみで完了せず、測定に人手を要するものがほとんどである。また、内的要因と外的要因を公平に並べて、転倒の危険因子としての意味を調査した研究はなく、外的要因を加えた地域での簡易な危険因子評価表は見当たらない。

転倒スコアでは、過去の成績<sup>1,2,4)</sup>、および転倒評価表ワーキンググループの研究成績から、内的要因の選択を行った。外的要因に関しては、筋力低下、バランス欠如、歩行障害、移動障害、ADL 障害と関連する外的因子に焦点を絞り、バリアフリーの観点から、障害物、段差、階段、坂道など多様な因子を下位項目に挙げた。視力障害と関連して、「部屋が暗く感じるか」も加えた。

転倒者と非転倒者を比較すると、転倒スコア

のほとんどの項目に有意差があったが、段差、階段、坂道に有意差はなかった。「転倒といえればバリアフリー」という短絡的な反応が間違っていることが初めて判明した。

転倒スコアは陽性点が高くなるほど転倒率が増した。また、本スコアの実用性に関し、松林らは転倒スコアを用い、北海道浦臼町で他の検査方法との比較を施行した。転倒を従属変数として、転倒危険を察知するカットオフポイントは、転倒スコア10点以上で、感度、特異度とも70%以上の結果であった。また、従来のTimed up & go testや、歩行速度、Functional Reachよりも転倒予測の感度、特異度に優れているという結果を得ている [松林公蔵：平成18年度厚生労働科学研究費補助金長寿科学総合研究事業「効率的転倒予測技術の開発と転倒予防介入による生活機能の持続的改善効果に関する縦断研究」(主任研究者：鳥羽研二) 報告書]。菊地らは、もの忘れ外来において、将来の転倒予測に関し、片足立ち、タンデム歩行、Timed up & go test、Functional Reach、握力などと比較し、多変量解析で、転倒スコアのみが独立した危険予測因子となる成績を得ている (投稿中)。

今回多変量解析で抽出された「転倒スコア」の下位項目は、筋力低下(歩行速度遅延)、骨粗鬆症(円背)、筋力低下と骨粗鬆症および転倒不安(杖の使用)、多病(5種類以上の服薬)であった。これらに含まれない転倒危険因子は過去の転倒歴に含有されていると考える。

重要な点は、地域住民においては、環境要因よりも内的因子である虚弱、多病が転倒に重要であるという知見である。転倒リスクになる薬剤をいかに減らすかは、「安全な医療」の観点から、医師にとって今後重要な課題となろう。

#### おわりに

転倒予防事業で、今後の転倒危険者を抽出する検査を考える場合、従来のように、環境要因

の間診表と下肢筋力検査（歩行速度、片足立ち時間）などに時間を費やすより、過去の転倒回数を十分聴取し、身体的側面（骨粗鬆症、筋力低下）の情報を得るため、「転倒スコア」を活用することが簡易で、有用であることが示唆された。

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## A Cross-Sectional Study of Frailty Status Among the Elderly in a Japanese City

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### Abstract

In order to formulate the prevention program under the Long Term Care Insurance (LTCI) scheme, the authors conducted a cross-sectional study of frailty status among the elderly in a Japanese city. The population studied was inhabitants of one city, Fukuoka prefecture. The 3000 inhabitants more than 65 years old were randomly selected from citizen registration by the city council. From June to September 2002, the trained interviewers visited to chosen inhabitants and gathered information using a structured questionnaire composing of demographic data (sex, age, address, household's type), health status, ADL, and IADL. The present study has clarified that most of the aged live independently, even though they have some level of chronic health problems, such as knee-joint disorder and hypertension. Furthermore, even if they have got some problems for their transfer ability, most of them stay independent for other ADL and IADL, such as eating, toileting, bathing and house affairs. There was an interesting difference between male and female for house affairs autonomy. For female, 90% of persons categorized "mobility level 5" were independent for house affairs. On the contrary, only 40% of same mobility level of male were independent for house affairs. This finding indicates the necessity of another important preventive program especially for male.

Key words: frailty, prevention, long term care insurance, ADL, IADL, Japan

### ❖ Introduction

The very rapid graying of society is on going in Japan. It is estimated that the percentage of population over 65 years old will be over 30% in 2025. Besides this very rapid ageing, the number of births has been decreasing, and in 2003 the Total Fertility Rate (TFR) has become 1.29<sup>1)</sup>. Along with the economic development after the Second World War, the Japanese disease structure has dramatically changed from the acute diseases dominant pattern (i.e., infectious diseases) to the chronic diseases dominant one (i.e., can-

cer and cardio-vascular diseases).

This demographic change means the increase in dispende and the decrease in tax payers, which requires the Japanese government to re-organize the social security system.

With fewer children, more women working, and changing attitude toward family responsibilities, the traditional system of informal care-giving is widely perceived as inadequate to take care of the increasing number of the frail elderly. In fact, about 40% of the households with elderly people are now so called "aged households", that is, single old person's household or old couple's household. This situation naturally requires the socialization of care, and finally in 2000, the Japanese government implemented the Long Term Care Insurance (LTCI) as a new scheme for the frail elderly<sup>2)</sup>.

The health care reform debate often focuses largely on questions associated with the supply of ser-

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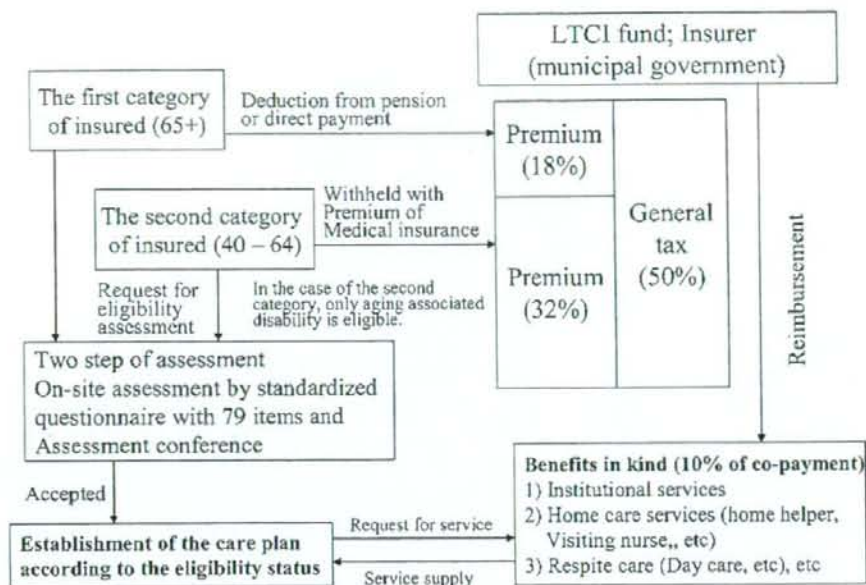


Figure 1. System of Long Term Care Insurance in Japan

services, such as measures to organize, finance and deliver health care in the cost-effective way. Less attention has been paid to key aspects of the demand side, in particular how the need for medical and social services might be reduced by improving the health of population. In most of the countries, public health services have been kept quite separate from the curative sector, although it is widely recognized that the two sectors must work together for better health of population.

In order to make the social insurance scheme sustainable in the coming aged society, it is pivotal how to integrate preventive and health promotive activities into the health care system. In this perspective, the authors have investigated the health and ADL level of the aged living in one local government of Fukuoka prefecture, Japan.

#### ❖ Long Term Care Insurance<sup>2)</sup>

Figure 1 describes the LTCI scheme (Modified in 2006). The budget of the insurance is based on fifty percent from the general tax and another fifty percent from the premium of the insured. There are two types of insured; the first category of insured who is 65+, and the second category of insured that is between the age of 40 and 64. The first category of insured is asked to pay a

premium deducted from pension or direct payment for insurer according to their pension status. In the case of the second category of insured, his or her premium is withheld from the medical insurance premium.

The benefit includes social welfare services such as home help and bathing service, stay in nursing home, as well as the use of medical services such as visiting nurses and institutional care in long term care hospitals.

The eligibility process begins with the individual or his/her family applying to the insurer (usually municipal government). A two-step assessment process follows and determines the limit of benefit. The first step is on-site assessment using the 79 items of a standardised questionnaire, each with a choice of three or four levels, plus space for comments on any particular aspects to be remarked on. The 79 items are analysed by an official computer program to classify the applicant into one of 6 levels of dependency or to reject eligibility<sup>1)</sup>. The lightest level is "assistance required" which is subject to preventive services; the other five levels are called "care required". The second step is the assessment conference by health care professionals. The conference reviews the classification made by a computer program by taking into account the descriptive statement plus a report from

the applicant's home doctor.

Each eligibility level entitles the applicant to an explicitly defined monetary amount of services. The recipient has to pay 10% of the cost as co-payment. Theoretically, users are free to choose services, but in reality, the care-manager who constitutes a care plan, a weekly time schedule of services, intervenes in this process and co-ordinates the services for the applicant.

## ❖ Studied Population and Method

### Studied population

The population studied was inhabitants of one city, Fukuoka prefecture. The 3000 inhabitants more than 65 years old were randomly selected from citizen registration by the city council.

### Method

The trained interviewers visited to chosen inhabitants and gathered information using a structured questionnaire from June to September 2002. There was no case of refusal. The questionnaire composes of items regarding demographic data (sex, age, address, household's type), health status, ADL, and IADL. The name of studied people was excluded from the data for analysis in order to assure the privacy.

For evaluation of ADL and IADL, the Typology of Aged with Illustration (TAI) was used<sup>3,4</sup>.

The statistical analyses were conducted by SPSS.

## ❖ Results

### Basic statistics

Age distribution: 1034 persons (34.5%) were under 70 years old, 1392 persons (46.4%) were between 70 and 79, 510 persons (17.0%) were between 80 and 89, and 64 peoples (2.1%) were more than 90 years old. The average age was 73.4 years old (72.8 for male, 73.9 for female).

Sex distribution: 1746 were female (58.2%), and 1254 were male (41.8%).

Type of household: 473 persons (15.8%) were categorized into "live alone", 1209 (40.3%) were "aged household", and 1318 (43.9%) were "extended family".

The distribution of eligibility status of LTCl was as follows: Non-applicant (2637 persons; 54.8%), in-

process of eligibility evaluation (8; 0.2%), non-eligible (28; 0.6%), assistance required (77; 1.6%). Care required 1 (58; 1.2%), care required 2 (18; 0.4%), care required 3 (6; 0.1%), care required 4 (8; 0.2%), care required 5 (10; 0.2%), unknown or no answer (151; 3.1%).

### Health status

206 persons (6.9%) had past and/or present history of cerebro-vascular diseases. 351 persons (11.7%) had past and/or present history of heart diseases. 561 persons (18.7%) had past and/or present history of osteo-articular diseases.

### ADL and IADL level

ADL and IADL were measured by TAI scale. Each item in the TAI has six hierarchical status (5 to 0), representing levels of disability in each domain. Five represents no disability and 0 represents extreme disability. Each status is defined by a threshold and illustrated as shown in the example of mobility level (Figure 2), mental status (Figure 3), eating (Figure 4), and Toileting (Figure 5).

Mobility level: 2325 (77.5%) persons were categorized into "5", 311 (10.4%) were "4", 128 (4.3%) were "3", 13 (0.4%) were "2", 11 (0.4%) were "1" and 212 (7.1%) were "0".

Mental status: 2690 (89.7%) persons were categorized into "5", 75 (2.5%) were "4", 9 (0.3%) were "3", 14 (0.5%) were "2", 3 (0.1%) were "1" and 209 (7.0%) were "0".












Eating independence: 2720 (90.7%) persons were categorized into "5", 53 (1.8%) were "4", 7 (0.2%) were "3", 4 (0.1%) were "2", 0 (0.0%) were "0" and 216 (7.2%) were "0".

Toileting independence: 2656 (88.5%) persons were categorized into "5", 94 (3.1%) were "4", 20 (0.7%) were "3", 15 (0.5%) were "2", 4 (0.1%) were "1" and 211 (7.0%) were "0".

Bathing independency: 2542 (84.7%) persons were categorized into "5", 160 (5.3%) were "4", 49 (1.6%) were "3", 26 (0.9%) were "2", 15 (0.5%) were "1" and 208 (6.9%) were "0".

Independency of house affairs: 1733 (57.8%) persons were categorized into "5", 201 (6.7%) were "4", 361 (12.0%) were "3", 57 (1.9%) were "2", 413 (13.8%) were "1" and 235 (7.8%) were "0".

Relationship between mobility level and other ADL items: Table 1 to Table 4 show the relationship

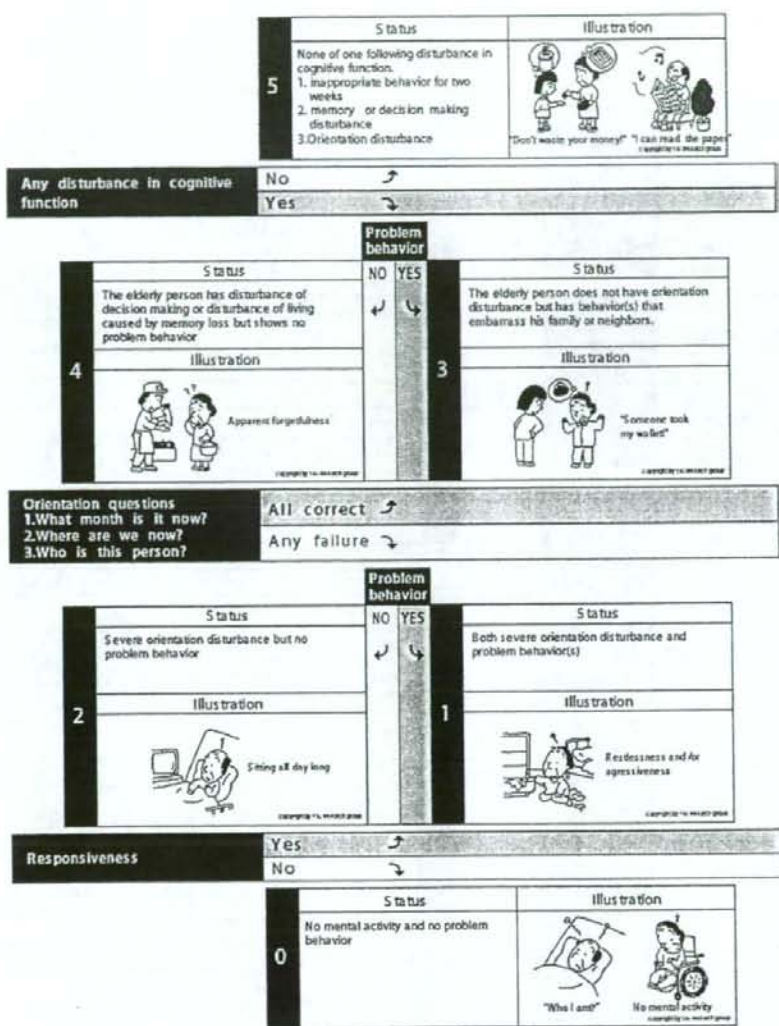
	Level	Status	Illustration
 <b>Climb stairs</b>	5	The elderly person can climb stairs without assistance and can walk out of a house.	
		Yes →	
 <b>Walk alone on a flat floor</b>	4	The elderly person can not climb stairs but can walk alone without assistance on a flat floor.	
		Yes →	
 <b>Both move around using equipment and transfer while sitting</b>	3	The elderly person cannot walk alone on a flat floor without help, but can move on a flat floor with instruments such as walking aid, wheelchair, cane, brace or walker.	
		Yes →	
 <b>Both sit up and maintain seated position</b>	2	The elderly person need help for transferring or moving, but can stand up from bed, and remain seated without help.	
		Yes →	
 <b>Roll over on the bed while lying</b>	1	The elderly person cannot transfer himself while sitting but can remain seated and change body position while lying.	
		Yes →	
	0	The elderly person cannot change body position while lying on a bed.	

Source: Okochi (2005)

Figure 2. TAI scale for mobility

between mobility level and other ADL items. In the case of eating and mental status, most of the elderly were relatively independent up to mobility level 3. However, the independent level has rapidly decreased from mobility level 4 for bathing and toileting. As the Japanese latrine requires squatting for toileting, and as the Japanese bath tub is usually very deep, the diffi-

culty in mobility will cause considerable difficulty in use of such activities. Another important point is that there is an interesting difference between male and female for house affairs autonomy (Table 5). For female, 90% of persons categorized "mobility level 5" were independent for house affairs. On the contrary, only 40% of same mobility level of male were inde-



Source: Okochi (2005)

Figure 3. TAI scale for mental status

pendent for house affairs.

#### ❖ Discussion













The present study has clarified that most of the aged live independently, even though they have some level of chronic health problems, such as knee-joint disorder and hypertension. Furthermore, even if they have got some problems with their transfer ability,

most of them stay independent for other ADL and IADL, such as eating, toileting, bathing and house affairs.

According to the official statistics, number of persons who received the LTCI services increased from 218.2 thousands in 2000 to 302.5 thousands in 2003, and the largest increase was observed in persons categorized into "care required 1"<sup>5)</sup>.

The most common disorders among this category














	Level	Status	Illustration
 <b>Stain around the table and/or require prepared food</b>	5	The elderly person can eat clearly by himself even in a presence of paralysis or dementia and does not require preparation or aid at table.	
		No ↗ Yes ↘	
 <b>Require assistance while eating</b>	4	The elderly person can eat by himself regardless of how he eats (without help in preparation). There is no assistance required while eating. However, the elderly person may stain the table.	
		No ↗ Yes ↘	
 <b>Swallowing disturbance</b>	3	The elderly person requires assistance while eating. However, there is no swallowing disturbance if the care giver brings foods to the mouth.	
		No ↗ Yes ↘	
 <b>Parenteral alimentation</b>	2	The elderly person has swallowing difficulty even if the care giver brings the food to their mouth. Therefore, softened foods such as paste and/or jelly are frequently used.	
		No ↗ Yes ↘	
 <b>Intravenous alimentation</b>	1	Parenteral alimentation (nasal, gastric or intestinal)	
		No ↗ Yes ↘	
 <b>Intravenous alimentation</b>	0	Intravenous alimentation (intravenous, IVH)	
		No ↗ Yes ↘	

Source: Okochi (2005)

Figure 4. TAI scale for eating independency level

are osteo-muscle disorders, especially knee-joint problems<sup>6</sup>). According to our previous study, the elderly with knee-joint problems had 2 times more possibility to have other ADL and health problems, such as toileting and mental autonomy<sup>6</sup>). Therefore, it is very important to organize some preventive services for

them. In fact, 60 to 80% of frail elderly evaluated as non-eligible for LTCI scheme have the bone-articular problems. Previous studies have indicated that the prevention of disabilities consequent on non-fatal conditions, such as chronic arthritis, is the most cost-effective preventive strategy<sup>7,8</sup>).

	Level	Status	Illustration
 <b>Use toilet cleanly</b>	5	The elderly person goes to toilet by himself and shows no failure of excretion for at least two weeks. There is no portable toilet or other aid at bedside.	
	No ↗ Yes ↘		
 <b>Require assistance to go to the toilet</b>	4	The elderly person goes to toilet by himself regardless of failure. The elderly person does not use a diaper or portable toilet except for special occasions such as during travel. This category includes the elderly persons with ostoma who controls excretion by himself.	
	No ↗ Yes ↘		
 <b>Use diaper always</b>	3	The care giver must give instruction or help to the elderly to go to the toilet. The elderly person does not always require diaper.	
	No ↗ Yes ↘		
 <b>Difficulty changing diaper</b>	2	The elderly person always requires diaper. However, the elderly person cooperates in changing diaper.	
	No ↗ Yes ↘		
 <b>Catheterization</b>	1	The care giver has difficulty changing the diaper of the elderly person. Therefore, it requires two persons to change the diaper. The elderly person may exhibit polluting of surroundings by urine, problem behaviour with urine, and toileting on the bed.	
	No ↗ Yes ↘		
	0	The elderly person require catheterization. This category includes the elderly person whose ostoma requires to be treated by care-givers.	

Source: Okochi (2005)

Figure 5. TAI scale for toileting independency level

After the introduction of the LTCI scheme, the two service categories have largely increased their users; home help services and day services. Home helpers assisted the frail elderly for house affairs, especially toileting and bathing, and day service centers offer them cafeteria and bathing services.

Based on the findings of this study, the city office has organized preventive services for the non-eligible elderly. The first-year result of this program was very encouraging. Among 199 persons receiving the preventive services, such as rehabilitation and aid services, only 5 persons had entered into LTCI scheme or

Table 1. Relationship between mobility level and mental status level

Mobility		Mental status						Total
		0	1	2	3	4	5	
0	N	201	1	1		1	5	209
	Mobility (%)	96.2	0.5	0.5		0.5	2.4	100.0
	Mental (%)	97.6	33.3	7.1		1.4	0.2	7.3
1	N	2			3	3	3	11
	Mobility (%)	18.2			27.3	27.3	27.3	100.0
	Mental (%)	1.0			33.3	4.1	0.1	0.4
2	N	1		2		3	6	12
	Mobility (%)	8.3		16.7		25.0	50.0	100.0
	Mental (%)	0.5		14.3		4.1	0.2	0.4
3	N		1	6	1	26	92	126
	Mobility (%)		0.8	4.8	0.8	20.6	73.0	100.0
	Mental (%)		33.3	42.9	11.1	35.1	3.6	4.4
4	N		1	4	3	31	269	308
	Mobility (%)		0.3	1.3	1.0	10.1	87.3	100.0
	Mental (%)		33.3	28.6	33.3	41.9	10.5	10.7
5	N	2		1	2	10	2188	2203
	Mobility (%)	0.1		0.0	0.1	0.5	99.3	100.0
	Mental (%)	1.0		7.1	22.2	13.5	85.4	76.8
Total	N	206	3	14	9	74	2563	2869
	Mobility (%)	7.2	0.1	0.5	0.3	2.6	89.3	100.0
	Mental (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 2. Relationship between mobility level and eating level

Mobility		Eating level						Total
		0	1	2	3	4	5	
0	N	200		3	1	3	2	209
	Mobility (%)	95.7		1.4	0.5	1.4	1.0	100.0
	Mental (%)	93.9		75.0	14.3	6.1	0.1	7.3
1	N			1	4	3	3	11
	Mobility (%)			9.1	36.4	27.3	27.3	100.0
	Mental (%)			25.0	57.1	6.1	0.1	0.4
2	N				2	4	6	12
	Mobility (%)				16.7	33.3	50.0	100.0
	Mental (%)				28.6	8.2	0.2	0.4
3	N					21	105	126
	Mobility (%)					16.7	83.3	100.0
	Mental (%)					42.9	4.0	4.4
4	N	1				17	290	308
	Mobility (%)	0.3				5.5	94.2	100.0
	Mental (%)	0.5				34.7	11.2	10.7
5	N	12				1	2190	2203
	Mobility (%)	0.5				0.0	99.4	100.0
	Mental (%)	5.6				2.0	84.4	76.8
Total	N	213		4	7	49	2596	2869
	Mobility (%)	7.4		0.1	0.2	1.7	90.5	100.0
	Mental (%)	100.0		100.0	100.0	100.0	100.0	100.0

Table 3. Relationship between mobility level and toileting independency level

Mobility	Toileting independency level							Total
	0	1	2	3	4	5		
0	N	201	2	4			2	209
	Mobility (%)	96.2	1.0	1.9			1.0	100.0
	Mental (%)	96.6	50.0	26.7			0.1	7.3
1	N		1	7		2	1	11
	Mobility (%)		9.1	63.6		18.2	9.1	100.0
	Mental (%)		25.0	46.7		2.2	0.0	0.4
2	N			3	5	3	1	12
	Mobility (%)			25.0	41.7	25.0	8.3	100.0
	Mental (%)			20.0	26.3	3.3	0.0	0.4
3	N			1	7	53	65	126
	Mobility (%)			0.8	5.6	42.1	51.6	100.0
	Mental (%)			6.7	36.8	57.6	2.6	4.4
4	N	1	1		5	27	274	308
	Mobility (%)	0.3	0.3		1.6	8.8	89.0	100.0
	Mental (%)	0.5	25.0		26.3	29.3	10.8	10.7
5	N	6			2	7	2188	2203
	Mobility (%)	0.3			0.1	0.3	99.3	100.0
	Mental (%)	2.9			10.5	7.6	86.4	76.8
Total	N	208	4	15	19	92	2531	2869
	Mobility (%)	7.2	0.1	0.5	0.7	3.2	88.2	100.0
	Mental (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4. Relationship between mobility level and bathing independency level

Mobility	Bathing independency level							Total
	0	1	2	3	4	5		
0	N	200	6	1			2	209
	Mobility (%)	95.7	2.9	0.5			1.0	100.0
	Mental (%)	97.6	42.9	4.0			0.1	7.3
1	N		6	5				11
	Mobility (%)		54.5	45.5				100.0
	Mental (%)		42.9	20.0				0.4
2	N			5	3	3	1	12
	Mobility (%)			41.7	25.0	25.0	8.3	100.0
	Mental (%)			20.0	6.1	1.9	0.0	0.4
3	N	1		14	36	59	16	126
	Mobility (%)	0.8		11.1	28.6	46.8	12.7	100.0
	Mental (%)	0.5		56.0	73.5	37.8	0.7	4.4
4	N	2			9	78	219	308
	Mobility (%)	0.6			2.9	25.3	71.1	100.0
	Mental (%)	1.0			18.4	50.0	9.0	10.7
5	N	2	2		1	16	2182	2203
	Mobility (%)	0.1	0.1		0.0	0.7	99.0	100.0
	Mental (%)	1.0	14.3		2.0	10.3	90.2	76.8
Total	N	205	14	25	49	156	2420	2869
	Mobility (%)	7.1	0.5	0.9	1.7	5.4	84.3	100.0
	Mental (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 5. Relationship between mobility level and house affaire independency level

Male		House affaire independency level						
Mobility		0	1	2	3	4	5	Total
0	N	69			1			70
	Mobility (%)	98.6			1.4			100.0
	Mental (%)	82.1			0.4			5.9
1	N	1	1				1	3
	Mobility (%)	33.3	33.3				33.3	100.0
	Mental (%)	1.2	0.3				0.3	0.3
2	N		3					3
	Mobility (%)		100.0					100.0
	Mental (%)		0.9					0.3
3	N	5	32	4	8	1		50
	Mobility (%)	10.0	64.0	8.0	16.0	2.0		100.0
	Mental (%)	6.0	9.6	14.3	3.1	1.2		4.2
4	N	3	36	6	23	14	8	90
	Mobility (%)	3.3	40.0	6.7	25.6	15.6	8.9	100.0
	Mental (%)	3.6	10.8	21.4	9.0	16.3	2.0	7.6
5	N	6	262	18	224	71	390	971
	Mobility (%)	0.6	27.0	1.9	23.1	7.3	40.2	100.0
	Mental (%)	7.1	78.4	64.3	87.5	82.6	97.7	81.8
Total	N	84	334	28	256	86	399	1187
	Mobility (%)	7.1	28.1	2.4	21.6	7.2	33.6	100.0
	Mental (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Female		House affaire independency level						
Mobility		0	1	2	3	4	5	Total
0	N	137	1				1	139
	Mobility (%)	98.6	0.7				0.7	100.0
	Mental (%)	93.2	1.6				0.1	8.3
1	N	4	4					8
	Mobility (%)	50.0	50.0					100.0
	Mental (%)	2.7	6.6					0.5
2	N	1	5	2	1			9
	Mobility (%)	11.1	55.6	22.2	11.1			100.0
	Mental (%)	0.7	8.2	7.4	1.1			0.5
3	N	2	20	15	18	13	8	76
	Mobility (%)	2.6	26.3	19.7	23.7	17.1	10.5	100.0
	Mental (%)	1.4	32.8	55.6	20.2	12.3	0.6	4.5
4	N		13	8	36	74	87	218
	Mobility (%)		6.0	3.7	16.5	33.9	39.9	100.0
	Mental (%)		21.3	29.6	40.4	69.8	6.9	13.0
5	N	3	18	2	34	19	1156	1232
	Mobility (%)	0.2	1.5	0.2	2.8	1.5	93.8	100.0
	Mental (%)	2.0	29.5	7.4	38.2	17.9	92.3	73.2
Total	N	147	61	27	89	106	1252	1682
	Mobility (%)	8.7	3.6	1.6	5.3	6.3	74.4	100.0
	Mental (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0

hospitalized<sup>6)</sup>. The city office estimated its financial effect as about 40 million yen (400 thousand US \$) of cost containment per year. Encouraged by these results, the city office enlarged this program from 2003 in order to rationalize the expenditure for the LTCI services. According to these encouraging results, the Ministry of Health, Labor and Welfare has decided to enforce preventive activities under the LTCI scheme. Some new preventive services are planned to be included into the LTCI scheme from 2006.

In order to ameliorate the autonomy level of the elderly people, the current study has revealed an interesting finding about house affairs autonomy level. As indicated in Table 5, there was an interesting difference between male and female for house affairs autonomy. For female, 90% of persons categorized "mobility level 5" were independent for house affairs. On the contrary, only 40% of same mobility level of male were independent for house affairs. This finding indicates the necessity of another important preventive program especially for male. The above fact suggests that the male elderly has a higher possibility to use home help services compared with the female elderly, if they become slightly frail. The city office is planning to organize community education classes for the male adults where they can learn how to manage house affairs, such as cooking and cleaning.

The present study is a cross-sectional study, thus it is not appropriate to derive a definitive conclusion from the current findings. We are following this population from 2002 consecutively. We would like to present further findings from the on-going cohort study in the future literatures.

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## ❖ Note

- <sup>1</sup> By the modification of LTCI law in 2006, "care required 1" was divided into "assistance required 2" and "care required 1", and "assistance required" was renamed "assistance required 1".

## Healthy Housing as an Infrastructure of Health Support System

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### Abstract

In order to evaluate the importance of housing program for the healthy aged society, we have conducted a situation analysis of housing condition of the aged living in a city of Fukuoka Prefecture. The data was collected from 2,611 elderly people living in a city of Fukuoka prefecture. At first, the necessity of reconstruction was cross-evaluated by sex, age, type of household, health status, ADL independency level, type of residence. Then factors associated with willingness to use the institutional care were analyzed by the logistic regression analysis. The present results clarified that the aged living in the houses with necessity of reconstruction have showed more willingness to use institutional services that are covered by the public medical insurance and LTCI. Historically, the housing policy has long been separated from the public health policy in Japan. It is strongly recommended to integrate the housing policy into the public health policy in order to realize a healthy aged society.

Key words: Healthy housing, home care, institutional care, the aged, Japan

### ❖ Introduction

The very rapid ageing is on going in Japan. Table 1 shows the chronological changes of demographic structure<sup>1)</sup>. It is estimated that there will be 1.7 million deaths in 2038<sup>2)</sup>. In 2003, 78.3% of deaths occurred at hospital and 13.0% were at home<sup>3)</sup>. Apparently, it will become impossible to deliver enough volume of terminal care only at hospital. Faced with the rapid ageing of society, it becomes an urgent task to prepare a well organized home care system in Japan.

In order to promote home care, the Japanese government introduced the Long Term Care Insurance (LTCI) in 2000. In 2000, 600,000 aged were institutionalized, and 1,240,000 aged received home-based ADL care services on monthly basis<sup>4)</sup>. On monetary base, these figures correspond to 194.0 billion yen

(1.94 billion USD; 100 yen = 1 USD) to institutional care and 99.6 billion yen (1.00 billion USD) to home-based care in each month. Six years later, in 2006, the monthly average number of aged persons who received institutional care and home-based care increased up to 810,000 and 2,570,000, respectively. On monetary base, these figures correspond to 206.3 billion yen (2.06 billion USD; 100 yen = 1 USD) for institutional care and 228.9 billion yen (2.29 billion USD) for home-based care. Even though the home care has been much advanced, the government considers there is still a room for promotion of home care.

In the 2006 Health Care Reform Plan, the government clarified its will to further promote the home care. The Ministry of Health, Labour and Welfare (MHLW) has largely decreased the tariff for long-term care beds intending to decrease a large number of this type of beds within the coming 5 years. Decreased beds are recommended to be transformed to a new type of residence for the aged; such as assisted living and nursing home. These types of facilities do not require higher staffing, thus do cost less both for delivery side and insurers. In order to facilitate this reorganization

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Table 1 Chronological changes in the age structures

	Total	Age category		
		0-14	15-64	65-
1950	84,114,574 100.0%	29,786,412 35.4%	50,168,312 59.6%	4,155,180 4.9%
1960	94,301,623 100.0%	28,434,159 30.2%	60,469,355 64.1%	5,397,980 5.7%
1970	104,665,171 100.0%	25,152,779 24.0%	72,119,100 68.9%	7,393,292 7.1%
1980	117,060,396 100.0%	27,507,078 23.5%	78,834,599 67.3%	10,647,356 9.1%
1990	123,611,167 100.0%	22,486,239 18.2%	85,903,976 69.5%	14,894,595 12.0%
2000	126,925,843 100.0%	18,472,499 14.6%	86,219,631 67.9%	22,005,152 17.3%
2005	127,767,994 100.0%	17,521,234 13.7%	84,092,414 65.8%	25,672,005 20.1%

of service delivery system, the government prepares a special loan with very low interest rate for them.

But it will be rather difficult to succeed unless they prepare supportive environment for the promotion of home care of the frail elderly. As our previous results indicated<sup>5)</sup>, a considerable number of frail elderly prefer to stay at hospitals because they regard the hospital as a safety and comfortable residence. This finding suggests that it must be required to prepare the safe and healthy housing for the aged in order to promote home care.

In order to evaluate the importance of housing program for the healthy aged society, we have conducted a situation analysis of housing condition of the aged living in a city of Fukuoka Prefecture.

#### ❖ Studied Population and Method

##### *Studied population*

The population studied was inhabitants of a city of Fukuoka prefecture. The 2,677 inhabitants more than 65 years old were randomly selected from citizen registration by the city council. Among them we have used data of 2611 peoples with sufficient information about residence for the analysis. There are no significant differences between the included and excluded persons for the distribution of age, sex, ADL dependency level.

##### *Method*

The trained interviewers visited to chosen inhabitants and gathered information using a structured questionnaire from June to September 2003. The questionnaire composes of items regarding demographic data (sex, age, address, household's type), health status, ADL and IADL, type of residence (apartment house or detached, private or public), necessity of reconstruction of residence, and willingness to use institutional services covered by medical insurance or LTCI (long-term care wards, medical nursing home, and nursing home). The name of studied people was excluded from the data by the city office in order to assure the privacy.

At first the necessity of reconstruction was cross-evaluated by sex, age, type of household, health status, ADL independency level, type of residence. Then factors associated with willingness to use the institutional care were analyzed by the logistic regression analysis.

For evaluation of ADL and IADL, the TAI (Typology of Aged with Illustration) was used<sup>6)</sup>.

The statistical analyses were conducted by SPSS 15.0J.

#### ❖ Results

Table 2 shows the general characteristics of stud-



Table 2 General characteristics of studied aged peoples

Age category			Necessity of reconstruction of residence		
	N	%		N	%
65-74 years old	1597	60.0	No	2180	81.9
75 years old and more	1064	40.0	Yes	481	18.1
Sex			Necessity of reconstruction for entrance		
	N	%		N	%
Female	1549	58.2	No	2570	96.6
Male	1112	41.8	Yes	91	3.4
TAI for mobility			Necessity of reconstruction for bathroom		
	N	%		N	%
0	7	0.3	No	2395	90.0
1	11	0.4	Yes	266	10.0
2	16	0.6	Necessity of reconstruction for toilet		
3	124	4.7		N	%
4	320	12.0	No	2448	92.0
5	2183	82.0	Yes	213	8.0
TAI for eating			Necessity of reconstruction for hallway		
	N	%		N	%
0	6	0.2	No	2510	94.3
2	4	0.2	Yes	151	5.7
3	12	0.5	Necessity of reconstruction for living room		
4	44	1.7		N	%
5	2595	97.5	No	2604	97.9
			Yes	57	2.1
TAI for toileting			Type of residence		
	N	%		N	%
0	6	0.2	Single house	2547	95.7
1	2	0.1	Group house	114	4.3
2	14	0.5	Type of household		
3	22	0.8		N	%
4	70	2.6	Extended family	1191	44.8
5	2547	95.7	Aged couple	1089	40.9
			Single	381	14.3
TAI for bathing			Ownership of residence		
	N	%		N	%
0	6	0.2	Own house	2492	93.6
1	10	0.4	Rent house	44	1.7
2	21	0.8	Public house	92	3.5
3	45	1.7	Others	33	1.2
4	141	5.3	Oldness of residence		
5	2438	91.6		N	%
TAI for house affairs			-5 years	153	5.7
	N	%	6-20 years	562	21.1
0	33	1.2	21-30 years	993	37.3
1	375	14.1	31 years -	928	34.9
2	60	2.3	Unknown	25	0.9
3	360	13.5	Past or present history of CVA		
4	217	8.2		N	%
5	1616	60.7	No	2482	93.3
			Yes	179	6.7
Present history of OMD			Present history of OMD		
	N	%		N	%
No	2135	80.2	No	2135	80.2
Yes	526	19.8	Yes	526	19.8

TAI: Typology of Aged with Illustration  
 CVA: Cerebro-vascular diseases  
 OMD: Osteo-muscular diseases

Table 3 Relationship between type of residence ownership and necessity of reconstruction

Type of ownership		Necessity of reconstruction		Total
		Yes	No	
One own house	N	2039	453	2492
	%	81.8	18.2	100.0
Rented Housing	N	44	0	44
	%	100.0	0.0	100.0
Public Housing	N	67	25	92
	%	72.8	27.2	100.0
Others	N	30	3	33
	%	90.9	9.1	100.0
Total	N	2180	481	2661
	%	81.9	18.1	100.0

Chi square test:  $p < 0.01$ .

Table 4 Relationship between type of household and necessity of reconstruction

Type of household		Necessity of reconstruction		Total
		Yes	No	
Extended family	N	973	218	1191
	%	81.7	18.3	100.0
Aged couple	N	881	208	1089
	%	80.9	19.1	100.0
Single	N	326	55	381
	%	85.6	14.4	100.0
Total	N	2180	481	2661
	%	81.9	18.1	100.0

Chi square test:  $p = 0.12$ .

ied peoples. The mean age was 73.8 (SD: 6.4) and 40% were over 75 years old. Female occupied 58.2%. So far as ADL independency is concerning, 80% were independent for mobility, 60% for house affairs, and more than 90% for eating, toileting and bathing. Past or present history of cerebro-vascular diseases were observed for 6.7% and present history of osteo-muscular diseases were for 19.8%. Eighteen percent of investigated persons indicated the necessity of reconstruction of their residence. The most frequent place that required reconstruction was bathroom (10.0%) followed by toilet (8.0%), hallway (5.7%), entrance (3.4%) and living room (2.1%).

Table 3 shows the relationship between type of residence ownership and necessity of reconstruction. Interestingly, persons in public housing indicated more the necessity of reconstruction with statistical significance ( $p < 0.01$ , chi square test).

Table 4 shows the relationship between type of household and necessity of reconstruction. Although the aged of single household showed a slightly higher response for necessity of reconstruction, there was no statistically significant relationship between the two variables.

Table 5 shows the relationship between type of residence ownership and type of household. The aged

Table 5 Relationship between type of household ownership and type of household

Type of household		Type of ownership				Total
		One's own house	Rented housing	Public housing	Others	
Extended family	N	1159	15	10	7	1191
	%	97.3	1.3	0.8	0.6	100.0
Aged couple	N	1040	12	35	2	1089
	%	95.5	1.1	3.2	0.2	100.0
Single	N	293	17	47	24	381
	%	76.9	4.5	12.3	6.3	100.0
Total	N	2492	44	92	33	2661
	%	93.6	1.7	3.5	1.2	100.0

Chi square test:  $p < 0.01$ .

Table 6 Analysis concerning factors associated with the willingness to use institutional services (Logistic regression analysis)

	Beta	SD	Wald	p-value	OR	95% CI of OR	
age_cat	0.059	0.086	0.463	0.496	1.061	0.895	1.256
SEX	-0.112	0.099	1.264	0.261	0.894	0.736	1.087
CVA	-0.138	0.168	0.675	0.411	0.871	0.626	1.211
OMD	0.132	0.105	1.593	0.207	1.141	0.930	1.401
Mobility	0.156	0.078	4.030	0.045	1.169	1.004	1.361
House affairs	0.005	0.035	0.018	0.893	1.005	0.939	1.075
Reconstruction	0.261	0.103	6.414	0.011	1.298	1.061	1.588
Dummy for single	0.442	0.123	12.939	0.000	1.555	1.223	1.978
Dummy for aged couple	0.216	0.088	5.958	0.015	1.241	1.043	1.476
Constant	-1.303	0.357	13.299	0.000	0.272	0.135	0.547

Dependent variable: Wish to use institutional services covered by medical insurance or LTCI  
Yes = 1, No = 0

Independent variables: age\_cat age category: 65 to 74 = 0, 75 and more = 1

Sex: male = 0, female = 1

CVA Past or present history of Cerebro-vascular disease: no=0, yes=1

OMD Present history of Osteo-muscular diseases: no=0, yes=1

Mobility Independency for mobility measured by TAI: lowest=0, highest=5

House affaires Independency for house affaires measured by TAI: lowest=0, highest=5

Reconstruction Necessity of reconstruction of residence: no=0, yes=1

Dummy for single: no single household=0, single household=1

Dummy for aged couple: no aged couple household=0, aged couple household=1

of single household lived in the public housing more than other types of household with statistical significance ( $p < 0.01$ ).

Table 6 shows the results of logistic regression analysis concerning factors associated with the willingness to use institutional services covered by the public medical insurance and LTCI. Statistically sig-

nificant higher odds ratios of willingness to use were observed for independency of mobility (OR = 1.169, 95% of CI = 1.004 – 1.361), necessity of reconstruction (OR = 1.298, 95% of CI = 1.061 – 1.588), single household (OR = 1.555, 95% of CI = 1.223 – 1.978), and aged couple household (OR = 1.241, 95% of CI = 1.043 – 1.476).

## ❖ Discussion

Our results clarified that the aged living in the houses with necessity of reconstruction have showed more willingness to use institutional services that are covered by the public medical insurance and LTCI. The Japanese generous health insurance scheme covers most of institutional fee (only 10% of co-payment for the aged). So that to live in hospital is a cheaper, safer and thus reasonable choice for the frail aged. In the case of single female aged, it is very often the case that they can receive only the lowest level of pension because most of them do not receive the additional pension by occupational settings<sup>7)</sup>. As our previous study has indicated<sup>9)</sup>, the frail aged prefers to stay in hospital as long as possible, because a hospital becomes a kind of comfortable and safe residence for them. This explanation fits well why the aged categorized as single or aged couple household showed more inclination to use the institutional services in the present study.

This type of hospitalization has long been criticized as the hospitalization with social reason. The MHLW estimates that at least one third of long hospitalized aged patients might be such cases. The hospitalization with social reasons cost expensive for the society even though it would be a rational and reasonable choice for the individual aged.

In order to solve this problem, the MHLW has launched the 2006 Health Care Reform Plan in which they put much importance on the development of home care. The MHLW has clarified their will to transform one third of long term care beds into nursing homes and assisted livings. However, under the actual situation, most of the users do not welcome such a program, because it will transfer the financial, psychological and physical burden to the aged and their family. In order to solve this problem, it is absolutely necessary to assure the comfort and safety at home. Hayakawa reported that many aged people in the lower socio-economic class were obliged to live in old and narrow-spaced houses<sup>8)</sup>. He also reported that the aged peoples were often denied to borrow a house because of their age and health problems. This is one of the reasons why the Japanese aged prefer to stay in hospital even though the medical problem does not require it.

It must be heard in mind that the current difficult situation has been partly caused by the poor housing

policy of our country. In most of the developed countries, such as UK and France, the development of residence has been organized as a part of social security policy.

On the contrary, the Japanese government has long depended on the private initiative for the construction of residence. During the highly economic development era, the preparation of residence for workers and their family was an important fringe benefit of welfare services organized by company. Furthermore, workers were recommended to do saving in order to construct their own house. The company prepared a variety of supportive services, such as a saving account with higher interest rate and a special loan with low interest rate. During this historical process, the public housing tended to be for the relatively lower economic classes. Furthermore, the public housing had characteristics of "temporary residence" and inhabitants were expected to quit the public housing after they become afford to obtain their own private residence. Thus most of the public housing have not paid enough attention to the vulnerable groups such as the aged and handicapped. The present result also showed that the aged living in the public housing responded the necessity of reconstruction the most frequently. It is very important to recognize that the single household aged live dominantly in the public housing.

The above explanation indicated that the Japanese poor housing policy for the vulnerable groups is one of the most important reasons for overuse of institutional services. In order to ameliorate the quality of life of such aged and at the same time to rationalize the expenditures for medical and ADL care services, the government is required to implement the appropriate housing program for the vulnerable groups. Initially, such a program cost to some extent, but it will save the money for the social security system in the long run.

As Hayakawa has indicated, the healthy housing is a fundamental of public health policy<sup>8)</sup>. After the great works by Snow and Chadwick, the healthy housing has long been a part of public health policy in UK<sup>9)</sup>. The WHO/Europe focuses the housing program at the WHO Centre for Environment and Health (Bonn office). Currently they address the following priority issues<sup>10)</sup>:

home safety and accidents  
indoor air quality