Table 2. Benefit Paid Limit and Average Benefit for At-Home Services (yen/month)

	ADL Condition	Benefit Paid Limit	Average Benefit*	At-Home Services	Institutional Services
Independent	With no problem to take care of himself			×	×
Support required	Have difficulties in house works	¥61,500	¥40,367	○	×
Care grade 1	Have difficulties in bathing	¥165,800	¥75,984	○	○
Care grade 2	Cannot walk without stick	¥194,800	¥111,832	○	○
Care grade 3	Cannot walk, need assisted bathing	¥267,500	¥155,725	○	○
Care grade 4	Have difficulties in daily self-caring	¥306,000	¥183,243	○	○
Care grade 5	Have difficulties in communications and self-caring	¥358,300	¥209,910	○	○

*Average benefits are calculated by authors using "Business Report on LTCI 2004" (MHLW).

home-rehabilitation service, daycare service, short-stay service, etc. It also includes such quasi-institutional services such as group homes (for the cognitively impaired), care-houses and private nursing homes. On the other hand, institutional-care services are available only in three kinds of institutions: in the increasing order of medical care components, they are special (public) nursing homes, rehabilitation institutions and long-term care hospitals.

Under LTCI, all services come with fixed prices per unit time, which is hour for most services, but day for some other services, and 10% of the costs are to be borne by the elderly as out-of-pocket costs, the rest being paid by the insurer. Given this modest out-of-pocket cost, one would expect a rational care manager to allocate all, or almost all, of the given budget of the elderly under these list prices to maximize the elderly welfare. This is the expectation of the majority of families providing long-term care before they apply for the benefits. Unfortunately, this is not what will happen to them.

In Table 2, we have shown the national average cost of benefits of each care grade using the official statistics. While the cost of benefits increases with the care grade, in every grade, it is only about 60% of the upper limit. In other words, on average, care managers draw up plans that utilize only 60% of allowable resources. Why is this happening? If they are simply acting as agents of service providers, who are their employers in most cases, they should provide as much service as possible under the given care grade to maximize the providers' profits. On the other hand, if they are acting as agents of the elderly or their family, we still expect them to utilize all the allowable budget, except perhaps for very poor families who cannot afford the 10% out-of-pocket costs.

Thus, the only rational explanation for their behavior is that they are acting as agents of the insurers (i.e., municipal governments), who are interested in minimizing the costs

of benefits for given long-term care needs. The self-restraint by the care managers probably reflects the authority of the municipalities to choose a limited number of service providers for their own municipalities. In the Japanese LTCI, the prices any provider can charge are nationally fixed, and the municipalities are given a free hand in choosing the providers from a list of qualified providers. Under the circumstances, the chosen providers and their care managers behave as if they were the agents of the insurers to maximize the chance of continued selection. From Table 2, it is clear that rationing is quite prevalent in the LTCI, but probably different municipalities may ration different services differently, as they face different fiscal constraints and different competition among providers.

In what follows, we will provide a conclusive microeconometric evidence that the restriction is imposed on the family care-givers on the utilization of important services, which is substantially adding to their subjective burden and deteriorating their self-evaluated health.

3. Data

3.1. *Nature of our data*

The data used in this paper was obtained through an internet survey of households with some long-term care needs. The survey questions were developed by the authors, but the internet survey was conducted by a national marketing survey company on their panel of "monitor" households, during the period of 9 March through 13 March 2006. Specifically, following our instructions, the company has selected 4,000 individuals randomly out of more than 35,000 individuals from its list of those who are living with someone needing long-term care. The sample selection has been conducted separately for nine large regions so as to reflect the size of the elderly population in each region. The marketing survey company, however, recruits its monitor households in the Yahoo Japan portal site, and hence its sample households must have someone with active internet usage. This may be a source of some bias with respect to age and sex, so we will try to control these characteristics closely.

The number of responding individuals altogether was 2,714, which translates to a response rate of 67.9%. For our present paper, we have excluded the families with more than two members needing long-term care, resulting in a sample of 2,530 households.

3.2. *ZBIC and J-ZBIC-8*

The Zarit Burden Index of Care-Givers, or ZBIC, is one of the standard measures of the subjective burden of care-givers (Zarit *et al.*, 1980, 1990). It provides a comprehensive measurement of physical, psychological and economic burdens of long-term care in a single index. The full ZBIC is computed from the care-giver's answers to 22 individual questions, and its Japanese version is provided by Yumiko Arai of National Institute of Longevity Sciences of Japan. In this paper, however, we have used an 8-question version of the ZBIC, which is called J-ZBIC-8 score, developed also by Dr. Arai and her associates (Arai *et al.*, 2003), primarily to secure better response rates in our internet survey. In each question,

the respondents are asked to choose one of the five alternatives (Never, Rarely, Sometimes, Quite frequently or Nearly always), which will be given a fixed weight of (0, 1, 2, 3 or 4) respectively. The ZBIC or J-ZBIC-8 scores are computed as the sum of these weights. The maximum score for J-ZBIC-8 is therefore 32.

The following are the full Zarit score questions, and those with * following the question number are those chosen in J-ZBIC-8:

Q1. Do you feel that your relative asks for more help than he/she needs?

Q2. Do you feel that because of the time you spend with your relative, you do not have enough time for yourself?

Q3. Do you feel stressed between caring for your relative and trying to meet other responsibilities for your family or work?

Q4* (J-ZBIC-8 Q1). Do you feel embarrassed over your relative's behavior?

Q5* (J-ZBIC-8 Q2). Do you feel angry when you are around your relative?

Q6* (J-ZBIC-8 Q3). Do you feel that your relative currently affects your relationships with other family members or friends in a negative way?

Q7. Are you afraid of what the future holds for your relative?

Q8. Do you feel that your relative is dependent on you?

Q9* (J-ZBIC-8 Q4). Do you feel strained when you are around your relative?

Q10. Do you feel that your health has suffered because of your involvement with your relative?

Q11. Do you feel that you do not have as much privacy as you would like because of your relative?

Q12* (J-ZBIC-8 Q5). Do you feel that your social life has suffered because you are caring for your relative?

Q13* (J-ZBIC-8 Q6). Do you feel uncomfortable about having friends over because of your relative?

Q14. Do you feel that your relative seems to expect you to take care of him/her as if you were the only one he/she could depend on?

Q15. Do you feel that you do not have enough money to take care of your relative in addition to the rest of your expenses?

Q16. Do you feel that you will be unable to take care of your relative much longer?

Q17. Do you feel you have lost control of your life since your relative's illness?

Q18* (J-ZBIC-8 Q7). Do you wish you could leave the care of your relative to someone else?

Q19* (J-ZBIC-8 Q8). Do you feel uncertain about what to do about your relative?

Q20. Do you feel you should be doing more for your relative?

Q21. Do you feel you could do a better job in caring for your relative?

Q22. Overall, how burdened do you feel in caring for your relative?

While Arai *et al.* (2003) have already confirmed the strong correlation between ZBIC and J-ZBIC-8, we can offer yet another proof to support their claim. Even though we have not collected the answers for the full Zarit ZBIC, a survey conducted by the Cabinet Office
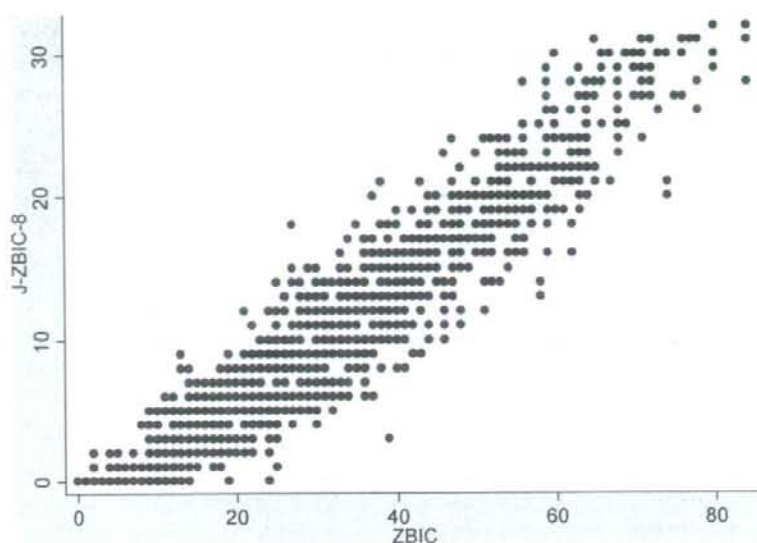
Figure 1. J-ZBIC-8 and ZBIC

in 2006 has used the full 22-question version ZBIC, and is based on the same population[8] as ours. The coefficient of correlation between the two Zarit indexes is computed to be 0.94,[9] which is slightly larger than 0.93 reported by Arai *et al.* (2003). The scatter diagram of the two indexes is presented in Figure 1.

3.3. *Descriptive statistics*

In Table 3, we have listed the descriptive statistics of our sample. To capture the biases in our dataset, we have compared the characteristics of our sample households with the national survey of households receiving Long-Term Care Insurance benefits.[10] In the first place, our care-givers are younger than the national survey (Table 4). Presumably this has happened because our survey methodology, namely an internet survey, discourages the participation of older care-givers. In the second place, compared with the national sample, our sample over-represents Support and Grade 5 elderly, while it underrepresents Grade 1 elderly (Table 5). In the third place, as is clear in Table 6, we note that our care-givers are generally healthier in terms of self-reported health, which may be part of the result we have obtained in this paper.

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[8]The samples of both surveys are chosen randomly and independently from the same list of households, but the Cabinet Office survey has 1,166 valid responses for its full ZBIC questions and their replies have been collected by mail. For details, please refer to Cabinet Office (2006).

[9]Suzuki, who had been a member of the Cabinet Office Study group, has obtained the permission to compute J-ZBIC-8 for this paper.

[10]The survey is conducted by the Ministry of Health, Labor and Welfare (or MHLW).

Table 3. Descriptive Statistics

Variable Names*	Sample Size	Means	SD	Min.	Max.
CE:J-ZBIC-8 Score	2530	11.9075	7.5692	0	32
CE:Male Elderly	2530	0.3249	0.4684	0	1
CE:Age	2530	78.3972	9.7427	65	100
CE:Independent	2530	0.0379	0.1911	0	1
CE:Support	2530	0.1190	0.3238	0	1
CE:Grade 1	2530	0.1794	0.3838	0	1
CE:Grade 2	2530	0.1601	0.3668	0	1
CE:Grade 3	2530	0.1447	0.3518	0	1
CE:Grade 4	2530	0.0972	0.2963	0	1
CE:Grade 5	2530	0.0960	0.2947	0	1
CE:No Certification	2530	0.1656	0.3718	0	1
CE:TD in Brushing Teeth	2530	0.1779	0.3825	0	1
CE:PH in Brushing Teeth	2530	0.2676	0.4428	0	1
CE:TD in Dressing	2530	0.2095	0.4070	0	1
CE:PH in Dressing	2530	0.4119	0.4923	0	1
CE:TD in Eating	2530	0.1364	0.3432	0	1
CE:PH in Eating	2530	0.3881	0.4874	0	1
CE:TD in Toilets	2530	0.2063	0.4047	0	1
CE:PH in Toilets	2530	0.3020	0.4592	0	1
CE:TD in Bathing	2530	0.3636	0.4811	0	1
CE:PH in Bathing	2530	0.3783	0.4850	0	1
CE:TD in Walking	2530	0.2387	0.4264	0	1
CE:PH in Walking	2530	0.5095	0.5000	0	1
CE:Unable to Communicate	2530	0.0767	0.2661	0	1
PB:N&D Reversal	2530	0.1909	0.3931	0	1
PB:Rude W&D	2530	0.1111	0.3143	0	1
PB:Screaming	2530	0.1320	0.3386	0	1
PB:Resisting	2530	0.1395	0.3466	0	1
PB:Roaming	2530	0.0711	0.2571	0	1
PB:Unable to Come Home	2530	0.0715	0.2578	0	1
PB:Mistreating Fire	2530	0.1051	0.3068	0	1
PB:Going Out Alone	2530	0.1150	0.3191	0	1
PB:Unsanitary Habits	2530	0.1431	0.3502	0	1
PB:Eating Disorders	2530	0.1075	0.3098	0	1
PB:Self-Inflicting Wounds	2530	0.0217	0.1459	0	1
PB:No Gratitude	2530	0.1866	0.3896	0	1
PB:Animosity	2530	0.1040	0.3053	0	1
T:Time by CG	2530	3.5375	3.5923	1	19
Gap:Home Helper	2530	1.5194	4.3899	−13	41
Gap:Home Bathing	2530	0.9498	3.0237	−29	31
Gap:Home Nursing	2530	0.8419	3.1399	−31	31
Gap:Rehabilitation	2530	1.3735	3.8796	−8	31
Gap:Day Service	2530	1.9459	4.5794	−16	31
Gap:Short-Term Stay	2530	3.0601	6.7127	−31	31
FC:Spouse	2530	0.3142	0.4643	0	1
FC:Children	2530	0.1107	0.3138	0	1
FC:Other Family	2530	0.4589	0.4984	0	1
FC:Relatives	2530	0.1142	0.3182	0	1
FC:No FC	2530	0.1822	0.3861	0	1

Table 3. (*Continued*)

Variable Names*	Sample Size	Means	SD	Min.	Max.
CG:Male	2530	0.4613	0.4986	0	1
CG:Age	2530	41.7184	11.3786	20	80
CG:College or More	2530	0.3542	0.4783	0	1
CG:Family Size	2530	3.0632	1.5052	1	10
CG:Owner-Occupied House	2530	0.8727	0.3333	0	1
CG:Income	2232	672.6	396.7	200	2000
CG:log(income)	2232	6.35	0.58	5.30	7.60
CG:Poor and Bad Health	2530	0.2241	0.4171	0	1

*CE:Cared Elderly Variables (TD:Total Dependence, PH:Partial Help), PB:Problem Behavior Variables, T:Time Variables, Gap:Gap Variables, FC:Family Cooperation Variables, CG:Care-Giver Variables.

Table 4. Age Distribution of Family Care-Giver

	Our Survey	MHLW Survey
Under 30s	5.7%	0.9%
30s	26.4%	2.9%
40s	30.9%	13.4%
50s	22.9%	31.1%
60s	11.9%	26.1%
70s	1.9%	19.3%
Over 80s	0.2%	6.4%

Source: Ministry of Health, Labor and Welfare (2000), "Household Survey of Family Care-Givers".

Table 5. Distribution of the Care Need Grades

	Our Survey	MHLW Survey
Support	21.3%	16.4%
Grade 1	19.0%	32.5%
Grade 2	17.2%	14.9%
Grade 3	11.5%	12.8%
Grade 4	11.4%	12.1%
Grade 5	19.6%	11.3%

Source: Ministry of Health, Labor and Welfare (2004), "Business Report on LTCI".

3.4. *Time and burden of care-givers*

As we have pointed earlier, most of the existing research on the burden of care-givers, including policy reviews of LTCI, the Ministry of Health, Labor and Welfare, has been relying on the total time spent for cares as the proxy measure of their subjective burden.

Table 6. Self-Reported Health

	Our Survey	MHLW Survey
Good	14.2%	18.2%
Fair	22.8%	14.5%
Neutral	40.5%	37.7%
Poor	19.6%	25.8%
Bad	2.8%	3.7%

Source: Ministry of Health, Labor and Welfare (2000), "Household Survey of Family Care-Givers".
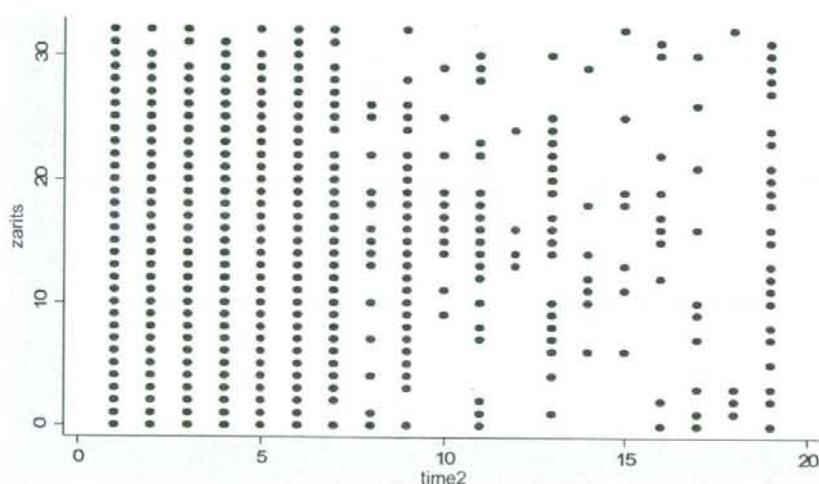

Figure 2. J-ZBIC-8 and Time for Care of the Care-Givers

The correlation between the time spent for the cares and the subjective burden (J-ZBIC-8) is shown in Figure 2. While we can observe a weak positive correlation ($\rho = 0.1837$) between these two variables, the relationship is subject to a fairly large error. Thus, by relying on the time for care as the only proxy for care-giver's burden, one loses a substantial amount of information and may even reach a wrong conclusion[11] as we have explained earlier.

3.5. *Gap variables in LTCI benefits*

In our questionnaire, for each of the LTCI benefits, we have asked the care-givers the number of days[12] per month each service was provided and the desired number of days for the service. We define the differences between the desired values and the actual values as the "gap" values, which stands for the result of rationing. In Table 7, we summarize the number

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[11] Suzuki, one of the present authors, has confirmed the same result using J-ZBIC, instead of J-ZBIC-8 (Cabinet Office, 2006).

[12] Standard number of hours per day depends on the service: for example, for home-helper service it is 90 minutes, and for day service it is between four to six hours.

Table 7. Gaps in LTCI Benefits: What Care-Givers Want vs. What They
Actually Get

		Means	SD	Min.	Max.
Home Helper	Days Provided	2.18	5.2096	0	41
	Days Wanted	3.70	7.4757	0	41
Home Bathing	Days Provided	0.92	2.8983	0	31
	Days Wanted	1.87	4.4079	0	31
Home Nursing	Days Provided	1.05	3.3786	0	31
	Days Wanted	1.89	4.7629	0	31
Rehabilitation	Days Provided	1.73	3.9792	0	31
	Days Wanted	3.10	5.7441	0	31
Day Service	Days Provided	4.05	6.0477	0	31
	Days Wanted	6.00	7.8470	0	31
Short-Term Stay	Days Provided*	2.96	7.6957	0	31
	Days Wanted*	6.02	10.0454	0	31

Note: All figures are for one month, except for short-term stay which is for six months.

of days each service was provided and the desired number of days. We can observe there
are positive gaps in all the services, but the largest gap can be found in short-term stays. In
fact, while the actual number of days the service was provided was only 2.96, the desired
number of days was 6.02, or more than twice the actual benefit.

4. Analysis of ZBIC Function

4.1. *Specification*

In order to see how these gaps in LTCI benefits are affecting the burden of family care-givers,
we specify the ZBIC as a function of the gaps and all other control variables that can affect
the care-giver's burden, and estimate the equation given by:

$$Y = X\alpha + Z\beta + \varepsilon. \tag{1}$$

In Equation (1), Y stands for the value of J-ZBIC-8, and X stands for the vector of "gaps"
in LTCI benefits obtained by subtracting the number of hours (or days) each service was
provided from the desired number of hours (or days) for the LTCI benefits.

The vector Z stands for all other factors that can affect the care-giver's burden: the first
group of factors consists of dummy variables of such characteristics of the cared individual
as the sex, age, LTCI need class grade (from 0 to 4), and various antisocial behaviors (rever-
sal of night and day, rude words and violent behaviors, screaming, resisting cares, roaming,
inability to find home, mismanagement of fire, going out alone, unsanitary behaviors, eating
disorders, syndrome of self-injury, ingratitude, open hostility to you).

The second group of factors in Z consists of the distributive nature of the family care:
the amount of time spent for care by the surveyed individual, cooperation of the family
members including spouse, children, other members living together or other relatives living
elsewhere, etc.

The third group of factors in Z consists of the care-giver's characteristics, the sex, age, education, number of individuals in the family, living in owner-occupied houses or not, log of household income, health status, etc.

We note several things in this specification: in the first place, if we have a perfect insurance coverage in our LTCI, care-giver's burden scores will be the same, regardless of the care need grades, characteristics of the cared elderly, or of their own. In such an insurance, none of these variables should have statistically significant coefficients. In other words, a significant coefficient in these variables suggests an incompleteness or insufficient benefits of the LTCI.

In the second place, however, we already know that the Japanese LTCI provides little formal benefits for caring for the elderly with antisocial behaviors, and that it does not take the health or other conditions of the care-givers into consideration in its provision of benefits except when it denies the benefits. Thus, we expect these factors to show up in the burden function as they stand for the incompleteness of present LTCI benefits.

In the third place, this specification does not include the provided individual LTCI benefits. This is mostly an econometric precaution to prevent the endogeneity problem in our regressors. If they are determined by the care managers as functions of Care Need Grade, their effects on care-giver's burden are collectively captured in the coefficients of each Care Need Grade dummy variable.

In the fourth place, however, if the care plans are suboptimal, the differences between the optimal quantities and the actual quantities are the sources of inefficiency, and they should be included in the regression. We shall call these distances or differences as "gaps" in LTCI benefits, including the absence of LTCI benefits. As they are the sources of potential inefficiency, they should be included in the regression.[13]

4.2. *Baseline estimation result*

Our Model 1 in Table 8 shows the baseline estimation under our present specification. The dummy variables for each grade of LTCI care need have significant coefficients. They increase until the care grade reaches 3, after which they fall. This result suggests that LTCI benefits are not sufficient to compensate for the increased burden of caring for those with Care Need Grade 3 or smaller.[14] Qualitatively, it is consistent with the finding of KT, although they had placed their peak at Grade 4. Implicit in this result, however, is the contribution of LTCI in reducing the family care-giver's burden. As we have explained in the Introduction, a number of studies comparing the total care time before and after the introduction of LTCI cast some doubt on whether or not LTCI is contributing to relieving for the care-giver's burden. Our result here (and KT's result) is a clear proof that LTCI benefits are helping to reduce the burden of those caring for the elderly with high care needs (Grades 4 and 5 for us, and Grade 5 for KT). In the absence of (effective) LTCI benefits, we should

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[13] We will check the endogeneity problem of these gap variables in Section 4.4.

[14] As Care Need Grade goes up, the family is entitled to a larger budget, and the care manager is usually willing to release more benefits to the elderly. This may partially explain the lower ZBIC score for higher-end Care Need Scores.

Table 8. Baseline OLS Estimation of J-ZBIC-8 Function

Variables	Model 1 (Baseline OLS)		Model 2 (OLS)	
	Coeff.	SE	Coeff.	SE
CE:Male Elderly	0.4398	0.2814	0.3913	0.2872
CE:Age	0.0138	0.0144	0.0194	0.0143
CE:Support	1.7178**	0.6754	—	
CE:Grade 1	2.6933***	0.6525	—	
CE:Grade 2	3.4240***	0.6635	—	
CE:Grade 3	3.5822***	0.6768	—	
CE:Grade 4	3.3115***	0.7265	—	
CE:Grade 5	2.8520***	0.7288	—	
CE:No Certification	1.9880***	0.6657	—	
CE:TD in Brushing Teeth	—		−0.7512	0.6814
CE:PH in Brushing Teeth	—		0.0495	0.3773
CE:TD in Dressing	—		−0.0455	0.6691
CE:PH in Dressing	—		0.8775**	0.3604
CE:TD in Eating	—		0.3771	0.6046
CE:PH in Eating	—		0.7679**	0.3117
CE:TD in Toilets	—		1.4392**	0.6622
CE:PH in Toilets	—		0.5665	0.3695
CE:TD in Bathing	—		0.7660	0.4969
CE:PH in Bathing	—		−0.1768	0.3605
CE:TD in Walking	—		−0.3595	0.5577
CE:PH in Walking	—		0.2063	0.3244
CE:Unable to Communicate	—		−0.7849	0.5540
PB:N&D Reversal	0.5151	0.3605	0.4948	0.3624
PB:Rude W&D	0.9665*	0.5408	1.0590*	0.5435
PB:Screaming	0.9448**	0.4119	0.8753**	0.4239
PB:Resisting	1.7731***	0.4061	1.6235***	0.4092
PB:Roaming	1.1099*	0.5934	1.1483*	0.5980
PB:Unable to Come Home	0.6953	0.5525	0.7228	0.5775
PB:Mistreating Fire	0.6788	0.4573	0.6809	0.4550
PB:Going Out Alone	0.8596**	0.4148	0.8014*	0.4140
PB:Unsanitary Habits	1.8475***	0.4217	1.7408***	0.4249
PB:Eating Disorders	0.4316	0.4405	0.3979	0.4437
PB:Self-Inflicting Wounds	−0.9144	0.8785	−1.1029	0.8888
PB:No Gratitude	4.6661***	0.3831	4.6782***	0.3853
PB:Animosity	1.4560***	0.4956	1.4267***	0.4954
T:Time by CG	0.0964**	0.0457	0.0711	0.0477
Gap:Home Helper	0.1295***	0.0404	0.1320***	0.0416
Gap:Home Bathing	0.0042	0.0500	−0.0259	0.0507
Gap:Home Nursing	0.0326	0.0550	0.0247	0.0547
Gap:Rehabilitation	−0.0374	0.0409	−0.0385	0.0409
Gap:Day Service	0.1123***	0.0378	0.1276***	0.0382
Gap:Short-Term Stay	0.1442***	0.0240	0.1458***	0.0240
FC:Spouse	0.1481	0.3292	0.1153	0.3338
FC:Children	−1.1579***	0.4422	−1.1506***	0.4466
FC:Other Family	−1.5013***	0.3363	−1.4909***	0.3433
FC:Relatives	−0.2222	0.4269	−0.0875	0.4251
CG:Male	−1.4789***	0.2805	−1.5056***	0.2827

Table 8. (*Continued*)

Variables	Model 1 (Baseline OLS)		Model 2 (OLS)	
	Coeff.	SE	Coeff.	SE
CG:Age	0.0196	0.0137	0.0278**	0.0136
CG:College or More	0.6188**	0.2773	0.6317**	0.2759
CG:Family Size	0.1447	0.1050	0.1105	0.1045
CG:Owner-Occupied House	0.9399**	0.3920	0.9390**	0.3869
CG:log(income)	−0.5074**	0.2412	−0.5283**	0.2438
CG:Poor and Bad Health	1.5603***	0.3191	1.5249***	0.3183
Constant	6.7235***	1.8722	7.7819***	1.8236
Number of Observations	2,232		2,232	
R-squared	0.4127		0.4163	

Note: ***significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

have found their burden to increase monotonically with the care needs. For those caring for the elderly with lower care needs, we need a slightly more general framework.

We can also see that most problem behaviors of the elderly matter to the care-givers, but general attitudes as "ingratitude" and "hostility" seem to be of particular importance to them. For instance, "ingratitude" alone raises the ZBIC score by more than 4 points, which indicates that the care-giver's burden can be a part of the complex family relationship with long history.

While the coefficient of time spent for caring is statistically significant, the magnitude of its marginal effect is modest, amounting to an increase of 0.96 points in the burden index for a 10 hour (per day) increase in care.

For our gap variables, coefficients of home-helper service gaps, day service gaps and short-term stay gaps are statistically significant: rationing in these services tends to increase ZBIC scores.

Family cooperation in the care is also an important determinant of a family care-giver: ZBIC score is reduced when the care-giver's children or other family members contribute to the care of the elderly.

On the other hand, household income has a significant negative sign: the higher the household income, the lower the burden of the family care-giver. We will analyze the implication of these coefficients in the last part of our paper.

Lastly, the health of the family care-giver seems to be important: ZBIC score increases when the self-evaluated health is poor or bad, or as the number of physical discomforts increases.

4.3. *Estimation result with ADL variables*

In the previous estimation, one may worry about the quality of the LTCI Care Need Grades as a control of the physical status of the elderly: it may suffer from regional biases or selection

biases inherent in the administrative process of the LTCI (Table 1). For this reason, in Model 2 of Table 8, we have used individual ADL dummy variables instead of the Care Need Grades. These ADL dummy variables are set to zero when no disabilities are involved.

In this result, the three gap variables and the health variables are significant, and most of the coefficients are of similar magnitude to Model 1. Not only does the result of Model 2 show that our basic model is robust, it also provides a proof that the LTCI is helping to reduce the burden of family care-givers across all care grades. The fact that the coefficients of the three gap variables are positive and significant indicates that in the absence of LTCI benefits, those who are caring for the elderly, particularly those who are receiving these three services, would have had higher burden scores.

In Model 3 of Table 9, we have crossed our gap variables with Care Need Grade dummy variables to identify the particular Care Need Grade where the effect of insufficient service quantity is most felt. Given the limited number of our sample, we grouped the six grades of care needs into three: low for Support and Grade 1, middle for Grades 2 and 3, and high for Grades 4 and 5.

Significant coefficients were obtained for day service and short-term stay for low care needs. For middle care needs, coefficients of home-helper and short-term stay services were

Table 9. J-ZBIC-8 Function with Crossed Gap Variables

Variables	Model 3 (OLS)		Model 4 (OLS)	
	Coeff.	SE	Coeff.	SE
CE:Male Elderly	0.4578	0.2835	0.4529	0.2819
CE:Age	0.0149	0.0145	0.0153	0.0144
CE:Support	1.4794**	0.6901	1.7163**	0.6751
CE:Grade 1	2.3524***	0.6782	2.6881***	0.6521
CE:Grade 2	3.4516***	0.6850	3.4060***	0.6628
CE:Grade 3	3.5979***	0.6923	3.5610***	0.6762
CE:Grade 4	3.3472***	0.7669	3.2955***	0.7277
CE:Grade 5	2.8670***	0.7517	2.8493***	0.7289
CE:No Certification	2.4630***	0.6780	1.9961***	0.6658
PB:N&D Reversal	0.4757	0.3638	0.5355	0.3612
PB:Rude W&D	0.9627*	0.5442	0.9911*	0.5455
PB:Screaming	1.0136**	0.4140	0.9728**	0.4152
PB:Resisting	1.8007***	0.4102	1.7509***	0.4064
PB:Roaming	1.0999*	0.6021	1.1071*	0.5973
PB:Unable to Come Home	0.6594	0.5665	0.6593	0.5550
PB:Mistreating Fire	0.7425	0.4659	0.6700	0.4587
PB:Going Out Alone	0.8026*	0.4170	0.8420**	0.4162
PB:Unsanitary Habits	1.7217***	0.4297	1.8781***	0.4233
PB:Eating Disorders	0.5392	0.4481	0.4227	0.4427
PB:Self-Inflicting Wounds	−0.6139	0.8926	−0.9680	0.8863
PB:No Gratitude	4.6800***	0.3825	4.6581***	0.3838
PB:Animosity	1.4782***	0.5004	1.4227***	0.4990
T:Time by CG	0.0950**	0.0462	0.0998**	0.0461

Table 9. (*Continued*)

Variables	Model 3 (OLS)		Model 4 (OLS)	
	Coeff.	SE	Coeff.	SE
Gap:Home Helper in Low Care Grades	0.1228	0.0993	—	
Gap:Home Bathing in Low Care Grades	−0.0153	0.1172	—	
Gap:Home Nursing in Low Care Grades	−0.1026	0.1180	—	
Gap:Rehabilitation in Low Care Grades	0.0543	0.0737	—	
Gap:Day Service in Low Care Grades	0.1151**	0.0578	—	
Gap:Short-Term Stay in Low Care Grades	0.2194***	0.0454	—	
Gap:Home Helper in Middle Care Grades	0.1323**	0.0604	—	
Gap:Home Bathing in Middle Care Grades	0.0216	0.0650	—	
Gap:Home Nursing in Middle Care Grades	0.1305	0.1077	—	
Gap:Rehabilitation in Middle Care Grades	−0.1396*	0.0738	—	
Gap:Day Service in Middle Care Grades	0.0404	0.0582	—	
Gap:Short-Term Stay in Middle Care Grades	0.1607***	0.0327	—	
Gap:Home Helper in High Care Grades	0.1034	0.0935	—	
Gap:Home Bathing in High Care Grades	−0.1207	0.1100	—	
Gap:Home Nursing in High Care Grades	0.0715	0.0755	—	
Gap:Rehabilitation in High Care Grades	−0.0258	0.0799	—	
Gap:Day Service in High Care Grades	0.2607***	0.0922	—	
Gap:Short-Term Stay in High Care Grades	0.0620	0.0468	—	
Gap:Home Helper	—		0.1346***	0.0442
Gap:Home Bathing	—		0.0270	0.0533
Gap:Home Nursing	—		−0.0154	0.0663
Gap:Rehabilitation	—		−0.0542	0.0458
Gap:Day Service	—		0.1157***	0.0415
Gap:Short-Term Stay	—		0.1598***	0.0249
Gap:Home Helper in Low Income	—		0.0040	0.1087
Gap:Home Bathing in Low Income	—		−0.1051	0.1239
Gap:Home Nursing in Low Income	—		0.1525	0.1107
Gap Rehabilitation in Low Income	—		0.0445	0.0991
Gap:Day Service in Low Income	—		0.0034	0.0944
Gap:Short-Term Stay in Low Income	—		−0.1010	0.0724
FC:Spouse	0.1656	0.3283	0.1665	0.3294
FC:Children	−1.1208**	0.4455	−1.1481***	0.4432
FC:Other Family	−1.4607***	0.3373	−1.4900***	0.3365
FC:Relatives	−0.1772	0.4306	−0.2339	0.4279
CG:Male	−1.5257***	0.2836	−1.4748***	0.2816
CG:Age	0.0189	0.0137	0.0196	0.0138
CG:College or More	0.7235***	0.2792	0.6192**	0.2781
CG:Family Size	0.1455	0.1051	0.1372	0.1054
CG:Owner-Occupied House	0.9316**	0.3942	0.9259**	0.3909
CG:log(income)	−0.5177**	0.2439	−0.5744**	0.2516
CG:Poor and Bad Health	1.6638***	0.3223	1.5816***	0.3191
Constant	6.7897***	1.8879	7.0436***	1.9250
Number of Observations	2,232		2,232	
R-squared	0.4094		0.4143	

Note: ***significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

significant. For high care needs, only day service coefficient was significant. We can conclude that rationing of short-term stay service is significantly felt by families caring for low and middle care needs, as is rationing of home-helper service by families caring for middle care needs, and rationing of day services by families caring for high care needs. Other results are roughly identical to those in Model 1 of Table 8, confirming the robustness of our result.

In Table 9 (Model 4), we examined if the ZBIC scores of care-givers in low-income families are differentially affected by these gaps: in particular, we wanted to find out if the out-of-pocket cost is keeping them from using the LTCI benefits, and increasing their burden score. For this purpose, we have crossed low-income dummy variable (household income less than 3 million yen) with our gap variables, and added them to our regressors. Our results in the table show that the only significant coefficient was obtained for home nursing, but for such LTCI benefits for which gap variables were significant, as home-helper, day service and short-term stay, the low-income households were not different from other households.

In Table 10, we examined the relationship between the gap variables and the household income class. While we observe larger gaps in home nursing for the low-income households, the differences between the two income classes seem to be modest in other services, including day service and short-term stay.

4.4. Possible endogeneity problems

4.4.1. Endogeneity in care-givers' health

Our results so far (Model 1 through Model 4) have consistently indicated that the poor or bad self-reported health of the care-givers adds to their subjective burden. Although this result is consistent with those in KT, we should worry about the endogeneity of the self-reported health variable. In other words, it is the higher subjective burden that may be lowering self-evaluated health.

In order to test this possibility, in Table 11 (Model 5), we have treated the "poor or bad" health variable as an endogenous variable and 12 chronic disease dummies as its instruments: they are (1) Hypertension, etc., (2) Heart Diseases, (3) Diabetes, etc., (4) Strokes, etc., (5) Gastritis, etc., (6) Asthma, Bronchitis, (7) Rheumatism, (8) Glaucoma and Cataract, (9) Kidney Diseases, (10) Hemorrhoid, (11) Alzheimer's, and (12) Depression. We have adopted this specification on the assumption that most of these diseases had predated the start of the care-giving, and hence they are independent of the ZBIC. In fact, in our sample,

Table 10. Household Income and LTCI Benefit Gaps

Household Income	Home Helper	Home Bathing	Home Nursing	Rehabilitation	Day Service	Short-Term Stay
Less than 3 million yen	1.59	0.91	0.91	1.35	1.85	2.66
3 million < < 6 million	1.45	1.04	0.78	1.46	1.89	3.01
6 million < < 10 million	1.19	0.75	0.82	1.18	2.15	3.07
10 million <	1.49	0.78	0.79	1.25	1.93	2.93

Table 11. IV 2SLS Estimation of J-ZBIC-8 Function

Variables	Model 5 (IV 2SLS)		Model 6 (IV 2SLS)	
	Coeff.	SE	Coeff.	SE
CE:Male Elderly	0.4332	0.2831	0.8687*	0.5011
CE:Age	0.0131	0.0145	0.0243	0.0226
CE:Support	1.7118**	0.6775	1.5136**	0.6850
CE:Grade 1	2.6891***	0.6541	2.3319***	0.6714
CE:Grade 2	3.4108***	0.6664	2.8452***	0.6993
CE:Grade 3	3.5696***	0.6799	2.8002***	0.7183
CE:Grade 4	3.3002***	0.7301	2.4789***	0.7822
CE:Grade 5	2.8429***	0.7320	1.9768**	0.8099
CE:No Certification	1.9854***	0.6669	1.6221**	0.6813
PB:N&D Reversal	0.5191	0.3611	0.4716	0.3625
PB:Rude W&D	0.9734*	0.5422	1.0457*	0.5447
PB:Screaming	0.9539**	0.4129	0.9088**	0.4199
PB:Resisting	1.7907***	0.4092	1.6585**	0.4109
PB:Roaming	1.0982*	0.5953	1.0976*	0.6032
PB:Unable to Come Home	0.6950	0.5509	0.6253	0.5722
PB:Mistreating Fire	0.6768	0.4569	0.6647	0.4559
PB:Going Out Alone	0.8995**	0.4231	0.9081**	0.4254
PB:Unsanitary Habits	1.8669***	0.4245	1.7789***	0.4240
PB:Eating Disorders	0.4316	0.4411	0.3936	0.4417
PB:Self-Inflicting Wounds	−0.8910	0.8705	−0.9872	0.8744
PB:No Gratitude	4.6872***	0.3906	4.6636***	0.3918
PB:Animosity	1.4573***	0.4958	1.4866***	0.4982
T:Time by CG	0.0980**	0.0461	0.0703	0.0469
Gap:Home Helper	0.1313***	0.0408	0.3761	0.4185
Gap:Home Bathing	0.0054	0.0501	−0.3944	0.6585
Gap:Home Nursing	0.0333	0.0553	1.5645	1.0232
Gap:Rehabilitation	−0.0355	0.0409	0.0740	0.4937
Gap:Day Service	0.1120***	0.0379	−0.6586	0.6148
Gap:Short-Term Stay	0.1446***	0.0241	0.5430*	0.3191
Residual:Home Helper	—		−0.2458	0.4244
Residual:Home Bathing	—		0.3766	0.6602
Residual:Home Nursing	—		−1.5322	1.0190
Residual:Rehabilitation	—		−0.1126	0.4943
Residual:Day Service	—		0.7787	0.6153
Residual:Short-Term Stay	—		−0.4047	0.3188
FC:Spouse	0.1282	0.3350	0.0773	0.3383
FC:Children	−1.1668***	0.4448	−1.2122***	0.4445
FC:Other Family	−1.5048***	0.3369	−1.5488***	0.3404
FC:Relatives	−0.2124	0.4248	−0.2034	0.4249
CG:Male	−1.4867***	0.2818	−1.5130***	0.2817
CG:Age	0.0209*	0.0143	0.0236*	0.0142
CG:College or More	0.5948**	0.2827	0.6081**	0.2813
CG:Family Size	0.1404	0.1057	0.1199	0.1053
CG:Owner-Occupied House	0.9262**	0.3904	0.8790**	0.3899
CG:log(income)	−0.5277**	0.2488	−0.5302**	0.2489

Table 11. (*Continued*)

Variables	Model 5 (IV 2SLS)		Model 6 (IV 2SLS)	
	Coeff.	SE	Coeff.	SE
CG:Poor and Bad Health	1.2057	0.9895	1.1417	0.9913
Constant	6.9525***	1.9807	5.5053*	2.4098
Number of Observations	2,232		2,232	
R-squared	0.4123		0.4172	

Notes: ***significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

Gap function is based on the following equation:

$$\text{Gap} = \beta_0 + \beta_1{}^*\text{CE:Male Elderly} + \beta_2{}*\text{CE:Age} + \beta_3{}^*\text{CE:TD in Brushing Teeth}$$
$$+ \beta_4{}^*\text{CE:PH in Blushing Teeth} + \beta_5{}^*\text{CE:TD in Dressing}$$
$$+ \beta_6{}^*\text{CE:PH in Dressing} + \beta_7{}^*\text{CE:TD in Eating} + \beta_8{}^*\text{CE:TD in Eating}$$
$$+ \beta_9{}^*\text{CE:TD in Toilets} + \beta_{10}{}^*\text{CE:PH in Toilets}$$
$$+ \beta_{11}{}^*\text{CE:TD in Bathing} + \beta_{12}{}^*\text{CE:PH in Bathing}$$
$$+ \beta_{13}{}^*\text{CE:TD in Walking} + \beta_{14}{}^*\text{CE:PH in Walking}$$
$$+ \beta_{15}{}^*\text{CE:Unable to Communicate} + \mu.$$

Instrument variables for Poor and Bad Health are Individual Chronic Diseases dummies: (1) Hypertension and Others, (2) Heart Diseases, (3) Diabetes and Others, (4) Strokes and Others, (5) Gastritis and Others, (6) Asthma, Bronchitis, (7) Rheumatism, (8) Glacoma and Cataract, (9) Kidney Diseases, (10) Hemorrhoid, (11) Alzheimer's, (12) Depression.

(a) in the regression where "poor or bad" health is the dependent variable, most of these dummy variables have significant coefficients; but (b) none are significant in the equation where ZBIC is the dependent variable.

Our IV regression result in Table 11 (Model 5) now shows that poor or bad health is no longer statistically significant. On the other hand, in the IV regression of "poor or bad" health variable (Table 12), ZBIC score is statistically significant.[15] Through these analyses, we can conclude that as far as "poor or bad health" variable is concerned, the OLS results of Model 1 through Model 4 suffer from endogeneity bias. It is the higher burden that is causing the "poor or bad health" problem, rather than the other way around.

In this regard, we note that Ogura (2006) has found that, for Japanese workers, self-reported health is very sensitive to their self-reported psychological stress. If the same causality works for family care-givers, for instance, someone who feels care-giving is an unbearable burden is expected to rate their own health as "very poor". As care-giving is the dominant source of everyday stress for most family care-givers, as their ZBIC scores show, this result is consistent with Ogura's finding.

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[15] We have treated ZBIC as an endogenous variable and six gap variables as the instruments.

Table 12. IV Probit Estimation of Poor and
Bad Health Function

Variables	IV Probit	
	Coeff.	SE
CE:Male Elderly	−0.0946	0.0750
CE:Age	−0.0051	0.0039
CE:Support	−0.0455	0.2054
CE:Grade 1	−0.0068	0.2040
CE:Grade 2	−0.1777	0.2143
CE:Grade 3	−0.1438	0.2178
CE:Grade 4	−0.1075	0.2256
CE:Grade 5	−0.0411	0.2189
CE:No Certification	0.0431	0.1993
PB:N&D Reversal	0.0479	0.0926
PB:Rude W&D	−0.0709	0.1263
PB:Screaming	0.1138	0.1075
PB:Resisting	−0.0268	0.1119
PB:Roaming	−0.2982*	0.1544
PB:Unable to Come Home	−0.0195	0.1363
PB:Mistreating Fire	−0.0072	0.1172
PB:Going Out Alone	0.2073*	0.1067
PB:Unsanitary Habits	0.0040	0.1113
PB:Eating Disorders	−0.0176	0.1132
PB:Self-Inflicting Wounds	0.1214	0.2122
PB:No Gratitude	−0.0743	0.1392
PB:Animosity	−0.1388	0.1268
T:Time by CG	−0.0052	0.0103
CG:Male	−0.0974	0.0795
CG:Age	0.0043	0.0036
CG:College or More	−0.2936***	0.0771
CG:Family Size	−0.0571**	0.0254
CG:Owner-Occupied House	−0.1599	0.1000
CG:log(income)	−0.2446***	0.0636
Hypertension and Others	0.2592**	0.1059
Heart Diseases	0.0730	0.1860
Diabetes and Others	0.7072***	0.1459
Strokes and Others	0.2039	0.2929
Gastritis and Others	0.6093***	0.1149
Asthma, Bronchitis	0.0823	0.1266
Rheumatism	0.4564***	0.0730
Glacoma and Cataract	0.1559	0.1819
Kidney Diseases	0.9375***	0.2835
Hemorrhoid	−0.1152	0.1147
Alzheimer's	−1.1338*	0.6158
Depression	0.9902***	0.1176
J-ZBIC-8 Score	0.0555***	0.0197
Constant	0.4698	0.5109
Number of Observations	2,232	
Log likelihood	−947.6331	

Note: ***significant at the 1% level; **significant at the 5% level;
*significant at the 10% level.

While our result may depend on the good health (Table 6) of our relatively younger care-givers (Table 4), we can still claim that most of the positive correlation between higher subjective burden and poor or bad health we have observed in our sample is due to the endogeneity problem in the subjective health. We will not go so far as to claim that this result holds in all or most datasets, but simply point out that endogeneity of self-reported health is an issue that has to be tested in each estimation.

4.4.2. *Exogeneity of gap variables*

We want to address ourselves to another possible endogeneity problem; namely, that of our gap variables. They had been obtained as the difference between the actual LTCI benefits and the quantities desired by care-givers, both of which may depend on the subjective burden of the care-givers. Fortunately, this is not the case as the result of Wu-Hausman tests on our specification shown in Table 11 (Model 6). None of the residuals of the gap variables are significant, and we can safely assume that the endogeneity problem for our gap variables is not serious.

4.5. Further implications

Our estimation results provide a way to improve the efficiency of the current LTCI benefit structure. In the burden function, the coefficient of unit gap for home-helper service is around 0.13, that of day service is around 0.11 and that of short-term stay is around 0.15. The cost of home-helper service is around 3,000 yen, that of day service depends on the care grade ranging from around 5,400 yen to 9,300 yen, and that of short-term stay also depends on the care grade ranging from around 6,400 yen to 10,800 yen. Given these cost figures, we can rank the three services as follows:

(i) A comparison of home-helper service and day service reveals that home-helper service is two or three times more efficient than the day service, as home-helper service costs only one-half or a third of day service for comparable effects on the burden.

(ii) In comparing home-helper service to short-term stays, we have to recall that unit gap for short-term stays is measured for a six-month period. Thus, for a one-month period, the cost of filling unit gap of the short-term stay is only one-sixth of the list price, or around 1,400 yen, which is only one-half of the home-helper service. Thus, short-term stays are the most efficient service among the three, followed by home-helper service, and day service.

Thus, our estimation indicates that it is still possible to reduce the care-giver's burden without increasing the total costs of LTCI benefits: simply increase the short-term stays and home-helper services and reduce the day services enough to keep the total costs constant.

5. Concluding Remarks

In November 2005, a law entitled "Act for the Prevention of Abuse of the Elderly" quietly passed the Diet and was enacted in April 2006. The legislation was proposed, not by the

government as most Japanese laws were, but from the floor by the Diet members, in view of the apparent failure of the Long-Term Care Insurance to stop the tragic instances of abuses of the elderly.[16] The law has mandated the municipalities to adopt necessary measures to prevent the abuses against the elderly and detect abuses of elderly cared for in institutions and in their own homes. The municipalities must investigate if an elderly is in danger, place the abused elderly in long-term care institutions if necessary, or provide additional supports to the family care-givers when necessary.

In the only national survey on the abuses of the elderly (IHEP, 2004), in 1,991 cases of abuse of the elderly cared for at home, the care managers who discovered the abuses took concrete measures in 1,470 cases:

(i) Naturally, in almost 40% of these cases, the care managers chose to put them in long-term care institutions, but they also chose to increase the short-term stays (32%), home-helper services (30%) and day services (28%). These three at-home services are precisely the services we have found whose reduction of "gaps" are expected to reduce the burden of family care-givers.

(ii) When asked to identify the factors contributing to the abuses, next to the abuser's characteristics (50%), the care managers chose (a) the preexisting hostility between the elderly and the abuser (48%), and (b) the characteristics of the elderly (39%). These findings (a) and (b) are consistent with our finding that ingratitude and animosity are dominant factors, and antisocial behaviors are important factors in the burden function of care-givers. The care managers also chose (c) overworked care-givers (37%). Furthermore, they reported that in more than half (54%) of the cases, the care-givers were not even conscious of their own abusive behaviors.

From these observations, it is difficult not to conclude that care-givers' burden and abuses of the elderly are closely related: first, the same set of factors contribute to a high burden of care-givers' and their abusive behaviors. Second, the effective instruments to remove the abuses are identical to those that lower the care-givers' burden. We believe that in many cases there is a causal relationship between the two; namely, a high burden triggers the abuses of the elderly.[17] To prevent such abuses, we think we should consider mandating the care managers to spend an extra ten minutes or so to ask J-ZBIC-8 as a part of their preparation for making up good care plans under the LTCI.

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[16] According to Yomiuri-Shimbun, in one year since the enactment of the law, about 19,000 cases have been brought to the attention of municipalities, of which 9,400 had been determined to be abuses (25 March). Only 80 involved cases of the elderly in institutions.

[17] In fact, Kumamoto *et al.* (2004) have shown that in their small sample (169) of family care-givers, abusers have much higher J-ZBIC-8 scores than non-abusers.

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