

Analysis of the Relationship between Depression and Changes in ADL Status among the Japanese Aged

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Abstract

In 2006 the Ministry of Health, Labor and Welfare (MHLW) has launched the 2006 Health care reform plan. One of the characteristics of this plan is to value the preventive activities. Most of these programs mainly focus to the disease specific symptoms and outcomes such as pain, weakness of muscle, and little attention is paid to the mental depression. In order to evaluate the effect of depressive situation on changes in Activity of Daily Living (ADL) level, we have organized and analyzed a two year's panel data (2004–2005) that contains about 1800 aged living in a city of western Japan. For evaluation of ADL level and depression status, Typology of Aged with Illustration (TAI) and Geriatric Depression Scale five item version (GDS5) were used, respectively. After evaluating the results of descriptive analyses, logistic regression analyses were conducted in order to analyze the factors associated with aggravation of ADL levels between 2004 and 2005. The results indicated that depressive status has significant influence on changes in ADL independency status, that is, the person with higher depression situation showed the higher possibility of worsening the ADL level. higher depression situation were related to the worsening of mobility (OR=0.749, 95%CI=0.655–0.857), mental status (OR=0.606, 95%CI=0.489–0.750), eating (OR=0.603, 95%CI=0.458–0.793), toileting (OR=0.564, 95%CI=0.456–0.698), and bathing (OR=0.647, 95%CI=0.551–0.760). The results of our study have suggested that the health promotion activities for the aged must pay enough attention for the depression problem in order to improve and to maintain their ADL independency.

Key words: depression, ADL, aged, prevention, Japan

❖ Introduction

Japan has a universal coverage of public pension, medical insurance and Activity of Daily Living (ADL) care insurance (Long term care insurance; LTCI). Along with the rapid ageing of society, today, the aged are responsible for one half of medical expenditures. For example, the medical expenditures for the aged was 16.5 trillion USD (1USD=100 JY) in 2004¹⁾.

In addition to the medical expenditures, the aged used 50 trillion USD for pension²⁾, and 5.6 trillion for LTCI coverage³⁾. These expenditures for social security system will expand more rapidly within the coming 10 years, because the post-war baby boomers will enter their third age.

Thus, it is an urgent task for the Japanese government to re-organize the social security system in order to make it sustainable under the coming highly aged society. In 2006 the Ministry of Health, Labor and Welfare (MHLW) has launched the 2006 Health Care Reform Plan⁴⁾. One of the characteristics of this plan is to value the preventive activities. As a main program of health promotion, for example, “Health checkups and healthcare advice with a particular focus on the metabolic syndrome” program has been intro-

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duced from 2008. All public health insurers have to organize health check-up and the following health promotion programs for the insured over 40 years old. The main target of screening is “Metabolic syndrome”. If an insured is evaluated as high risk, he/she must follow a standardized disease management program that is offered by the health support organization contracted with the insurers.

For LTCI, the special program for maintenance and amelioration of ADL status has been introduced^{5,6}. The slightly frail aged has to receive the preventive ADL services. As the osteo-muscular problems i.e., knee-joint disorders, are the most important reasons for them to receive LTCI services, the physical fitness program is included in the new scheme.

Most of these programs mainly focus to the disease specific symptoms and outcomes such as pain, weakness of muscle, and little attention is paid to the mental depression. Chapman et al have indicated that depressive disorders assume an important role in the etiology, course and outcomes associated with chronic diseases⁷. Based on the results of previous articles, we have hypothesized that the same relationship may exist between depression and ADL independency levels among the Japanese aged. To test this hypothesis, we have organized a panel data that contains about 1800 aged living in a community of western Japan. In this article, we present the results of this study.

❖ Studied Population and Method

The population studied was inhabitants of a city of Fukuoka prefecture. The 2,000 inhabitants more than 65 years old were randomly selected from citizen registration by the city council. We have received data from 1,821 peoples with sufficient information both for 2004 and 2005. There was no case of rejection in 2004. Reasons of exclusion in 2005 were as following; 36 were already institutionalized, 27 moved outside the city, 23 died and 57 were due to insufficient information. There were no significant differences between the included and excluded persons for the distribution of age and sex distribution.

The trained interviewers visited to chosen inhabitants and gathered information using a structured questionnaire from June to September 2004 and 2005. The questionnaire composes of items regarding demographic data (sex, age, address), health status,

ADL (Typology of Aged with Illustration: TAI^{8,9}), and Depression status measured by GDS5 (Geriatric Depression Scale five item version)¹⁰.

After evaluating the results of descriptive analyses, we conducted a series of logistic regression analysis in order to clarify the factors associated with aggravation of ADL levels between 2004 and 2005. Independent variables and dependent variables are as follow:

Independent variables

Age category:

0 = 65–74 years old, 1 = 75 years old and more

Sex:

0 = Male, 1 = Female

CVD (Cerebro-vascular diseases):

0 = No disability due to CVD,

1 = Disability due to CVD

OMD (Osteo-muscular diseases):

0 = No OMD, 1 = Existence of OMD

Other diseases:

0 = No other diseases,

1 = Existence of other diseases

Depression score:

0 = highest level of depression,

5 = lowest level of depression

Dependent variable

Change in each of TAI score (Mobility, Mental status, Eating, Toileting, Bathing, House affairs):

0 = maintained/improved, 1 = worsened

The name of studied people was excluded from the data for analysis in order to assure the privacy.

The statistical analyses were conducted by SPSS 14.0J.

The ethical board of University of Occupational and Environmental Health approved this study and the written consent was obtained from all participants after the explanation of objectives of study by document.

❖ Results

Table 1 shows the demographic status of studied population. The mean and standard deviation were 74.3 ± 5.9 for male, 74.3 ± 5.9 for female and 74.3 ± 5.9 for total. For the age distribution, persons in 70s were the largest (1021, 56.1%), followed by 60s (414, 22.7%), 80s (347, 19.1%) and 90s (39, 2.1%). The percentage of female increased after 80s (more than

Table 1 Sex and age distribution of studied population

Age category		65–69	70–79	80–89	90–	Total
Male	N	177	434	126	13	750
	% age	23.6	57.9	16.8	1.7	100.0
	% sex	42.8	42.5	36.3	33.3	41.2
Female	N	237	587	221	26	1071
	% age	22.1	54.8	20.6	2.4	100.0
	% sex	57.2	57.5	63.7	66.7	58.8
Total	N	414	1021	347	39	1821
	% age	22.7	56.1	19.1	2.1	100.0
	% sex	100.0	100.0	100.0	100.0	100.0

Table 2 Prevalence rates of chronic diseases by sex

		CVA	HD	OMD	Others	Total
Male	N	83	116	132	497	750
	%	11.1	15.5	17.6	66.3	100.0
Female	N	83	116	132	497	750
	%	5.5	15.3	36.6	66.9	100.0
Total	N	83	116	132	497	750
	%	7.8	15.4	28.8	66.7	100.0

CVA: Cerebro-vascular diseases, HD: Heart diseases, OMD: Osteo-muscular diseases.

60%).

Table 2 shows the prevalence rate of chronic diseases. The cerebro-vascular diseases were more dominant among the male elderly (11.1% vs 5.5%). On the contrary, the osteo-muscular diseases were more dominant among the female elderly (36.6% vs 17.6%). About 15% of both sex had the heart diseases and 67% had other diseases such as hypertension and diabetes mellitus.

Table 3 shows the distribution of ADL level measured by TAI. 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. For mobility level, 1420 (78.0%) persons were categorized into “5”, 288 (15.8%) were “4”, 93 (5.1%) were “3”, 9 (0.5%) were “2”, 7 (0.4%) were “1” and 4 (0.2%) were “0”. Male persons showed a higher percentage of level 5 (83.6% vs 74.0%).

For mental status, 1762 (96.8%) persons were categorized into “5”, 43 (2.4%) were “4”, 6 (0.3%) were

“3”, 4 (0.2%) were “2”, 3 (0.2%) were “1” and 3 (0.2%) were “0”. There was no apparent sex difference in distribution.

For eating independence, 1790 (98.3%) persons were categorized into “5”, 20 (1.1%) were “4”, 4 (0.2%) were “3”, 3 (0.2%) were “2”, 0 (0.0%) were “1” and 4 (0.2%) were “0”. There was no apparent sex difference in distribution.

For toileting independence, 1741 (95.6%) persons were categorized into “5”, 56 (3.1%) were “4”, 11 (0.6%) were “3”, 6 (0.3%) were “2”, 4 (0.2%) were “1” and 3 (0.2%) were “0”. There was no apparent sex difference in distribution.

For bathing independency, 1629 (89.1%) persons were categorized into “5”, 142 (7.8%) were “4”, 30 (1.6%) were “3”, 11 (0.6%) were “2”, 6 (0.3%) were “1” and 3 (0.2%) were “0”. There was no apparent sex difference in distribution.

For independency of house affairs, 1052 (58.3%) persons were categorized into “5”, 194 (10.7%) were “4”, 245 (13.5%) were “3”, 32 (1.8%)

Table 3 ADL independency level of studied population

			0	1	2	3	4	5	Total
Mobility level	Male	N	2	5	3	35	78	627	750
		%	0.3	0.7	0.4	4.7	10.4	83.6	100.0
	Female	N	2	2	6	58	210	793	1071
		%	0.2	0.2	0.6	5.4	19.6	74.0	100.0
	Total	N	4	7	9	93	288	1420	1821
		%	0.2	0.4	0.5	5.1	15.8	78.0	100.0
Mental status	Male	N	1	0	0	2	24	723	750
		%	0.1	0.0	0.0	0.3	3.2	96.4	100.0
	Female	N	2	3	4	4	19	1039	1071
		%	0.2	0.3	0.4	0.4	1.8	97.0	100.0
	Total	N	3	3	4	6	43	1762	1821
		%	0.2	0.2	0.2	0.3	2.4	96.8	100.0
Eating independence	Male	N	2	0	2	3	12	731	750
		%	0.3	0.0	0.3	0.4	1.6	97.5	100.0
	Female	N	2	0	1	1	8	1059	1071
		%	0.2	0.0	0.1	0.1	0.7	98.9	100.0
	Total	N	4	0	3	4	20	1790	1821
		%	0.2	0.0	0.2	0.2	1.1	98.3	100.0
Toileting independence	Male	N	1	3	2	5	28	711	750
		%	0.1	0.4	0.3	0.7	3.7	94.8	100.0
	Female	N	2	1	4	6	28	1030	1071
		%	0.2	0.1	0.4	0.6	2.6	96.2	100.0
	Total	N	3	4	6	11	56	1741	1821
		%	0.2	0.2	0.3	0.6	3.1	95.6	100.0
Bathing independence	Male	N	1	5	2	14	53	675	750
		%	0.1	0.7	0.3	1.9	7.1	90.0	100.0
	Female	N	2	1	9	16	89	954	1071
		%	0.2	0.1	0.8	1.5	8.3	89.1	100.0
	Total	N	3	6	11	30	142	1629	1821
		%	0.2	0.3	0.6	1.6	7.8	89.5	100.0
Independence of housing affairs	Male	N	7	240	14	184	68	237	750
		%	0.9	32.0	1.9	24.5	9.1	31.6	100.0
	Female	N	7	34	18	61	126	825	1071
		%	0.7	3.2	1.7	5.7	11.8	77.0	100.0
	Total	N	14	274	32	245	194	1062	1821
		%	0.8	15.0	1.8	13.5	10.7	58.3	100.0

were “2”, 274 (15.0%) were “1” and 14 (0.8%) were “0”. There was an apparent sex difference in independency level. Only 31.6% of male persons were categorized into level 5.

Table 4 shows the changes in each of ADL level between 2004 and 2005. For mobility, 11.1% of level 5 and 7.6% of level 4 decreased in independency. For

house affairs, 12.0% of level 5, 12.9% of level 4, 18.0% of level 3 and 15.6% of level 2 decreased in independency. For other ADL items, such as mental status, eating, toileting and bathing, most of studied elderly kept their independency level between the two years.

Table 5 shows the results of depression score. On

Table 4 Changes of ADL level between 2004 and 2005

		0	1	2	3	4	5	Total
Mobility level in 2004								
Maintained/Improved	N	4	5	9	89	266	1263	1636
	%	100.0	71.4	100.0	95.7	92.4	88.9	89.8
Worsened	N	0	2	0	4	22	157	185
	%	0.0	28.6	0.0	4.3	7.6	11.1	10.2
Mental status in 2004								
Maintained/Improved	N	3	3	3	6	40	1721	1776
	%	100.0	100.0	75.0	100.0	93.0	97.7	97.5
Worsened	N	0	0	1	0	3	41	45
	%	0.0	0.0	25.0	0.0	7.0	2.3	2.5
Eating independence in 2004								
Maintained/Improved	N	4	0	3	4	20	1765	1796
	%	100.0	0.0	100.0	100.0	100.0	98.6	98.6
Worsened	N	0	0	0	0	0	25	25
	%	0.0	0.0	0.0	0.0	0.0	1.4	1.4
Toileting independence in 2004								
Maintained/Improved	N	3	4	4	9	53	1703	1776
	%	100.0	100.0	66.7	81.8	94.6	97.8	97.5
Worsened	N	0	0	2	2	3	38	45
	%	0.0	0.0	33.3	18.2	5.4	2.2	2.5
Bathing independence in 2004								
Maintained/Improved	N	3	6	8	27	129	1548	1721
	%	100.0	100.0	72.7	90.0	90.8	95.0	94.5
Worsened	N	0	0	3	3	13	81	100
	%	0.0	0.0	27.3	10.0	9.2	5.0	5.5
Independence of housing affairs								
Maintained/Improved	N	14	270	27	201	169	935	1616
	%	100.0	98.5	84.4	82.0	87.1	88.0	88.7
Worsened	N	0	4	5	44	25	127	205
	%	0.0	1.5	15.6	18.0	12.9	12.0	11.3

Table 5 Depression score of the studied population

	Mean	SD	Min	Max
Male	4.4	0.9	0	5
Female	4.3	1.0	0	5
Total	4.3	1.0	0	5

average, the studied persons were in relatively good conditions. There were no apparent sex differences in the scores.

Table 6 shows the comparison of score of depression score stratified by existence of CVA, heart dis-

eases, OMD and other diseases. The depressive status were more apparent for the persons with CVA ($p < 0.001$; Mann-Whitney's U), heart diseases ($p = 0.002$), and OMD ($p < 0.001$).

Table 7 shows the results of multivariate logistic regression analysis about the factors associated with aggravation of ADL level. For mobility level, persons ≥ 75 years old (OR=1.663, 95%CI=1.333–2.076), with CVD (OR=1.872, 95%CI=1.130–3.101), OMD (OR=1.932, 95%CI=1.394–2.676), other diseases (OR=2.102, 95%CI=1.427–3.097) and higher depression situation (OR=0.749, 95%CI=0.655–0.857) showed a significantly higher probability of de-creas-

Table 6 Depression score stratified by existence of diseases

		N	Average rank	Rank sum	Mann-Whitney's U	p
CVA	No	1679	926.6	1555743.0	93035.0	0.000
	Yes	142	726.7	103188.0		
HD	No	1541	925.7	1426498.5	193092.5	0.002
	Yes	280	830.1	232432.5		
OMD	No	1297	941.1	1220582.0	300799.0	0.000
	Yes	524	836.5	438349.0		
Other diseases	No	607	955.3	579867.0	341559.0	0.004
	Yes	1214	888.9	1079064.0		

CVA: Cerebro-vascular diseases, HD: Heart diseases, OMD: Osteo-muscular diseases.

ing independency.

For mental status, persons ≥ 75 years old (OR=3.672, 95%CI=1.796–7.511) and with higher depressive situation (OR=0.606, 95%CI=0.489–0.750) showed a significantly higher probability of decreasing independency.

For eating independency, persons with CVD (OR=3.719, 95%CI=1.507–9.178), higher depressive situation (OR=0.603, 95%CI=0.458–0.793), and ≥ 75 years old (OR=2.938, 95%CI=1.151–7.501) showed a significantly higher probability of decreasing independency.

For toileting independency, persons with CVD (OR=2.814, 95%CI=1.355–5.847), higher depressive situation (OR=0.564, 95%CI=0.456–0.698), and ≥ 75 years old (OR=4.540, 95%CI=2.079–9.913) showed a significantly higher probability of decreasing independency.

For bathing independency, persons with CVD (OR=2.008, 95%CI=1.095–3.683), heart diseases (OR=1.915, 95%CI=1.188–3.086), OMD (OR=1.884, 95%CI=1.228–2.889), higher depressive situation (OR=0.647, 95%CI=0.551–0.760), and ≥ 75 years old (OR=2.152, 95%CI=1.367–3.388) showed a significantly higher probability of decreasing independency.

For independency of housing affairs, persons with OMD (OR=1.638, 95%CI=1.193–2.248), ≥ 75 years old (OR=2.072, 95%CI=1.527–2.811) and male (OR=0.726, 95%CI=0.535–0.985) showed a significantly higher probability of decreasing independency.

Discussion

The present results have indicated that people with chronic disease condition, such as disability due to CVA and OMD show significantly higher depressive status. The most interesting finding of our study is that the depressive status has significant influence on changes in ADL independency status, that is, the person with higher depression situation showed the higher possibility of worsening the ADL level.

These findings are consistent with most of the previous literatures. Husaini and Moors reported that arthritis disability was significantly influential to depression and life satisfaction among the elderly¹¹. Another literature has indicated that depression and/or anxiety are among the most commonly reported concerns by persons with arthritis¹².

For stroke, there are several reports indicating that persons with depressive symptoms show statistically significant higher possibility to have a stroke. In addition to being a predictor of stroke, depression commonly develops after a stroke. For example, Berg et al clarified that more than half of patients experiencing a stroke reported depressive symptoms within 18 months of having a stroke¹³. Furthermore, post-stroke depression has been associated with increased mortality up to two years following the stroke¹⁴.

Increased rate of depression have consistently been associated with diabetes¹⁵. Depressive symptoms have been associated with diabetes-related complication¹⁵, and social adaptation of diabetic patients¹⁶.

As these literatures have indicated, there would be no doubt that depressive disorders assume an impor-

Table 7 Factors associated with worsening of mobility level

		Beta	SE	Wald	OR	95% of OR
Mobility	Age category	0.509	0.113	20.285	1.663	1.333–2.076
	CVD	0.627	0.258	5.923	1.872	1.130–3.101
	OMD	0.658	0.166	15.679	1.932	1.394–2.676
	Other Diseases	0.743	0.198	14.116	2.102	1.427–3.097
	Depression score	–0.289	0.069	17.795	0.749	0.655–0.857
Mental status	Depression score	–0.501	0.109	21.143	0.606	0.489–0.750
	Age category	1.301	0.365	12.698	3.672	1.796–7.511
Eating	CVD	1.314	0.461	8.124	3.719	1.507–9.178
	Depression score	–0.506	0.140	13.068	0.603	0.458–0.793
	Age category	1.078	0.478	5.079	2.938	1.151–7.501
Toileting	CVD	1.035	0.373	7.693	2.814	1.355–5.847
	Depression score	–0.572	0.109	27.771	0.564	0.456–0.698
	Age category	1.513	0.398	14.418	4.540	2.079–9.913
Bathing	CVD	0.697	0.309	5.075	2.008	1.095–3.683
	Heart diseases	0.650	0.243	7.116	1.915	1.188–3.086
	OMD	0.633	0.218	8.426	1.884	1.228–2.889
	Depression score	–0.436	0.082	28.223	0.647	0.551–0.760
	Age category	0.766	0.231	10.959	2.152	1.367–3.388
House affairs	OMD	0.493	0.162	9.319	1.638	1.193–2.248
	Age category	0.729	0.156	21.909	2.072	1.527–2.811
	Sex	–0.321	0.156	4.218	0.726	0.535–0.985

Independent variables

Age category:	0: 65–74 years old, 1: 75 years old and more
Sex:	0: Male, 1: Female
CVD (Cerebro-vascular diseases):	0: No disability due to CVD, 1: Disability due to CVD
OMD (Osteo-muscular diseases):	0: No OMD, 1: Existence of OMD
Other diseases:	0: No other diseases, 1: Existence of other disease
Depression score:	0: lowest level of depression, 4: highest level of depression

Dependent variable

Change in each of TAI score:	Mobility, Mental status, Eating, Toileting, Bathing, House affairs
Score:	0: lowest, 5: highest

tant role in the etiology, course and outcomes associated with chronic diseases.

The Health Care Reform Plan 2006 in Japan values preventive activities. However, most of programs under the new scheme focus to the physically functional improvement and do not pay enough attention to depression and/or depressive symptoms. Although a positive effect of physical activity on mental status have been reported¹⁷⁾, more interventions such as depression prevention program will be needed.

Ageing is the process of losing. Along with time, the aged peoples lose their health, family members, role in occupational and social life. All these events

of losing would cause the depression or depressive symptoms for the aged. In order to realize an active aged society, thus, it is necessary to implement the more integrated programs that cover whole life aspect of the aged. Especially we think that necessary is the program facilitating the social participation of the aged. Along with the large scale intra-immigration along with the economic development after the Second World War, most of the Japanese communities have lost the social tie. Expansion of nuclear family has deprived the traditional familial role of the aged.

Japan belongs to the high suicide countries around the world. Especially the suicide rate is very

high among the aged. It is well known that there are depression or depressive conditions behind most of the suicide cases. Depression caused by the losing process may contribute to the high suicide prevalence among the Japanese aged.

Therefore, we have to re-create the opportunities of social participation for the aged. Under the Confucianism tradition, the Japanese values the work. It is reported that the Japanese aged have very high willingness to continue to work¹⁸⁾. The economic aspect is not the most important reason for them. They want to work in order to keep the relationship with the society. Crimmins et al have showed that the working aged people keep their physical and mental health compared with the non-working aged¹⁹⁾.

In order to promote physical and mental health of the aged, it will be one reasonable solution to extend the retirement age up to 70 years old or more drastically to abandon the retirement age²⁰⁾. Most of the employees are reluctant to this proposal, because it may mean the higher labor cost relative to productivity. It will be necessary to re-organize the wage structure and labor contract that permit to balance cost and productivity.

Another solution is to create small works for the aged in the community, such as gardening, house-keeping, teacher-assistant in the public school, assistant work in the agricultural sector. We call this policy as “new work-fare program” and it is beginning in some communities and by NPOs as voluntary basis. In fact, most of the programs indicated that the participating aged people are becoming more active.

There are some limitations for this study. First, as we used self-evaluation on diagnosis and depression situation, the existence of information bias cannot be excluded. For example, depressive person might evaluate their ADL level less than the objective level. Second, we did not obtain information on a number of important possible confounding and pathway variables, including smoking, drinking, physical exercise, nutritional intake, economic status, education status, marital condition and formal/informal care. For example, the economic situation is one of the most anxious issues among the aged and might be associated with depression and accessibility of ADL and formal care. This limited adjustment weakens the conclusion. Third, the study population is relatively small to derive a definitive conclusion. These limitations must be taken into account for evaluation of the

present study.

In conclusion, the results of our study have suggested that the depressive status has significant influence on changes in ADL independency status. The health promotion activities for the aged must pay enough attention for the depression problem in order to improve and to maintain their ADL independency.

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