Draft paper

Trends of Disability-free Life Expectancies of Chinese Elderly, 1987-2006

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Abstract

The main objective of this paper is to explore the disability-free life expectancies changed over the time period from 1987 to 2006, by using two national disability surveys in China was conducted in 1987 and 2006. The sampling rate for the first survey was 1.5% and 1.58 million people were sampled in China. The sampling rate for the second survey was 1.93% and it covered 2.53 million people in China. The proportions of disabled increased from 4.9 percent in 1987 to 6.4 percent in 2006 as population aging. In order to assess the real change by overcoming the effect of change of age structure within the 19 years, we calculate the disability-free life expectancies by type and severity of the disability of the elderly, by using Sullivan Method, and discuss their trends, measurement, and the policy implications.

Introduction

By the end of 2005 China's population had reached 1.3 billion. Even though restricted family planning policy led to the pace of the population increase slowed down, however, the total number of elderly population is increasing rapidly and the speed of aging are accelerated. The elderly aged 60 and over in China numbered 145 million, and those aged 65 and over numbered 101 million in 2005 (Qiao and Ren, 2006), accounting for 7.7 percent of the China's total population and over 20 percent of the world's population of those ages. As the transition of the population structure, the health issues, especially the disability, in terms of the increased elderly are more obvious. The large number of elderly will present serious problems early in the century, because of a lack of governmental and societal support for the elderly, especially the lack of support from their children owing to the prevalence of one-child families. However, health is the key to settling the issues of aging. Evaluating the health status of China's elderly could be the first step toward a solution.

The most serious problem for the elderly could be caused by the extent of disability. The National Sampling Survey of the Disability, approved by the State Council of China in 1987,

was the first survey concerning the disabled in China. This work was undertaken chiefly by the Ministry of Civil Administration, the State Statistics Bureau, the Ministry of Health, and other Ministries. This was the only survey relating to health proposed by State Council, rather than by one section of the national government. International experts from the World Health Organization served as consultants regarding the technical design and implementation. National and international publications reveal few published papers that review the survey, and those analyses are very general because they use only tabulated data published by the office of the survey. According to the REVES Bibliography Series and related country reports (REVES 1994), Frab Grab and Dowd Michel (1991) were the first researchers to use the data of the National Sample Survey of the Disability to estimate, referring to the 1982 census life table, the disability-free life expectancy in China. Dr. Wang conducted systematic study on health expectancies in China in her 1993 dissertation (Wang, 1993). Using 1990's life table, she computed disability-free life expectancies of the elderly by gender and urban and rural areas. Qiao presented a paper at the tenth International meeting on Health Expectancy held at Tokyo in 1997 that estimated disability-free life expectancies in China by the exact ages 0, 65, and 80, using the adjusted life table of 1987(Qiao, 1997). Having taken advantage of the data from the 1987 sampling survey of disability, Qiao calculated the type-severity-specific disability free life expectancy and presented the paper at the annul meeting of REVES in 2000 (Qiao, 2000). As the micro data of the 1987 survey have never been published and few Chinese scholars focused on the disability related field at that time, the data analysis for the 1987 survey data of disability were not sufficient in respect to scientific research.

However, as the Chinese government is very much focusing on the settlement of the problems faced by disabled people, the government decided to conduct the Second National Sampling Survey on Disability in 2006. Due to the similar definition and classification of the disability between the two surveys, we can use both data from 1987 and 2006 surveys to explore the changes of disabled people, especially the changes of the disability free life expectancy between 1987 and 2006, even though the definition of the disability in the surveys is not quite matched with the model of ICF. The purpose of this paper is to calculate the disability free life expectancy, further to decompose the disability life expectancy by types and degrees of disability for both surveys, and to compare the changes of type-severity-specific disability life expectancies between 1987 and 2006 in order to test if the morbidity of the elderly is compressed or expanded. It should be noted that comparative duration from 1987 to 2006 might be too long, from which it is unable to show the fluctuations within the period, to reflect the stable situation. As the restriction of the time of the survey, this analysis can just reflect general situation and trend of the disability free life expectancy between the two points of time.

Data and Method

Data of the two surveys are nationally representative. The 1987 and 2006 surveys covered 424 and 743 counties, respectively, in all mainland China. About 369,816 households for 1987 and 771,797 household for 2006 (persons living in institutions were not included in both surveys), and 1,579,314 individuals for 1987 and 2,526,145 individuals for 2006 were initially interviewed. The interviewers found 11.4 percent of suspicious disabled in 1987 and 15.7 percent in 2006. Based on "Screening Regulation of the Disability" the persons who were initially identified as suspicious disabled underwent medical examinations by professional doctors to determine if they are really disabled and test the specific nature of the disability from mild to severe disabilities for both surveys. The disability was divided into six categories, such as vision, hearing and speech[1], intellectual, physical, mental, and multiple disabilities in 1987 survey, and seven categories, separating hearing and speech into two individual categories, in 2006.

The definitions of the disability and each type of the disability for the two surveys were similar, with some minor differences, which can be compared directly in disability and within the same type of the disability. The proportions of confirmed disabled finally were 4.9 percent in 1987 and 6.4 percent in 2006. The proportions of individual categories within the disabled population were 14.61 percent for vision, 34.2 percent for hearing and speech, 14.66 percent for physical, 19.70 percent for intellectual, 3.76 percent for mental, and 13.03 percent for multiple disability for 1987 survey. The proportion changed to 14.86 percent for vision, 24.16 percent for hearing, 1.53 percent for speech, 29.07 percent for physical disability, 6.68 percent for intellectual, 7.40 percent for mental, and 16.30 percent for multiple disability[2] in 2006 survey. However, when we make comparison in the following content, we divided the hearing and speech into three parts, that is, hearing, speech, and both disabilities, in 1987 data, which was comparable with the classification in 2006.

It was inferred from the samples to populations by point estimates that there were about 51.64 million and 82.96 million disabled persons lived in Mainland China in 1987 and 2006, respectively. Among the disabled, the structures of the type of disability were also changing between the two years. Roughly speaking, the proportions of hearing and speech, intellectual, and multiple disabilities decreased; while the proportions of physical and mental increased

[1] We separate hearing and speech into two categories at following calculations based on the tabulated data published.

[2] Persons with both hearing and speaking disabilities were attributed to multiple disability in 2006, but to the hearing and speech category in 1987.

within the 19 years.

For each survey, the types of disability - vision, hearing, speech, intellectual, physical, and mental disabilities - were classified into four degrees from severe to mild. The first degree is the most severe part, and the fourth is the mildest. The multiple disabilities were not classified by degree in 1987 survey, but classified in 2006.

We use Sullivan method (Sullivan 1971) to calculate the disability-free life expectancies so as to decompose the disability life expectancies into different types and degrees of disability[3]. The method requires both prevalence rates of various disabilities and life tables around the time of the surveys. The data of those two surveys provide the age-type-severity-specific prevalence rates of the disabled populations. We calculated the life tables from both 1987 and 2005 One Percent National Population Survey conducted by National Statistical Bureau. The age-specific death rates were directly calculated from published data by the government, without any adjustment.

As the sample sizes for both surveys are huge, we did not calculate the standard error of the disability free life expectancy, which means that the confidence interval with a certain probability of confidence for the estimated results would be small, and the differences between and among comparative parameters would be easily statistically significant. In regard to the data sources, we obtained the 1987 data from CHINA DATA OF 1987 SAMPLING SURVEY OF THE HANDICAPPED published by The Office of National Sampling Survey of the Handicapped in 1989. The tabulations of the 2006 data were processed from the original data provided by the Office of National Sampling Survey of the Disability. When dealing with the sources of following tables of the two surveys in this paper, we will not list the sources again and again.

Changes of Disability-free Life Expectancy

In 1987 the life expectancies of China's population at birth were 69.7 years for males and 72.2 years for females, over 2.5 years longer for females than for males (see table 1). However, the healthy life expectancy at birth was 64.4 years for males and 65.7 years for females, 1.3 years longer for females than for males. The differences between life expectancy and healthy life expectancy were significant. A male could expect to be healthy with 92.4 percent of his life and a female could expect to be healthy with 91.1 percent of hers. This

[3] Thanks for Ms Yuan Zhang, a master student at Institute of Population Research, Peking University, who helped me to conduct the calculations for this paper.

general result, a higher percentage of healthy years for males than for females, has appeared in most of the countries in the world (REVES 1993).

In regard to the elderly in 1987, life expectancy at age 65 was 13.6 years for males and 16.2 years for females, 2.6 years longer for females than for males. However, for the same age, disability-free life expectancy was 9.6 years for females and 11.1 years for females, 1.5 years longer for females than for males. However, the proportions of healthy duration among the remaining life at age 65 were 70.4 percent for males and 68.2 percent for females, 2.2 percentage point higher for males than for females. We can also see that following the age increased, the proportions of healthy life were decreasing for both males and females. After age 80 as oldest old, men and women can expect less than 50 percent of life without disabilities, which means that over half of the remaining years of life of the people over age 80 might be living with disabilities. This problem was more serious for females than for males.

Table 1 Disability-free Life Expectancy by Exact Age, 1987

Age	Male				Female			
	LE	DLE	DFLE	DFLE/LE	LE	DLE	DFLE	DFLE/LE
0	69.70	5.27	64.43	92.44	72.15	6.43	65.72	91.08
60	16.95	4.17	12.78	75.38	19.95	5.38	14.58	73.05
65	13.60	4.02	9.58	70.44	16.21	5.15	11.06	68.24
70	10.63	3.82	6.82	64.11	12.80	4.83	7.97	62.24
75	8.23	3.58	4.65	56.47	9.90	4.44	5.46	55.15
80	6.28	3.19	3.08	49.12	7.46	3.85	3.61	48.38
85	4.87	2.75	2.12	43.52	5.48	3.12	2.36	43.11

Note: LE = life expectancy; DLE = disability life expectancy; DFLE = disability free life expectancy; DFLE/LE = the proportion of the DFLE among the LE. Here, LE = DLE + DFLE

Nearly 20 years late, in 2006, the life expectancies at birth reached 73.4 years for males and 78.1 years for females (see table 2). The difference of life expectancy at birth between males and females increased from 2.5 years in 1987 to 4.7 years in 2006. It showed that the higher the life expectancy, the higher the difference of life expectancies between men and women. The disability free life expectancies at birth increased from 64.4 percent in 1987 to 67.0 percent in 2006 for males and from 65.7 percent in 1987 to 71.0 percent in 2006 for females, respectively, while the proportions of the duration of disability free life expectancy at birth among the LE decreased from 92.4 percent in 1987 to 91.3 percent in 2006 for males and from 91.1 percent in 1987 to 90.9 percent in 2006. Life expectancies at age 65 reached 15.6 years for males and 18.2 years for females in 2006. At the same time, the disability free life

expectancies at age 65 were 11.0 years for males and 12.7 for females.

Table 2 Disability-free Life Expectancy by Exact Age, 2006

Age	Male				Female			
	LE	DLE	DFLE	DFLE/LE	LE	DLE	DFLE	DFLE/LE
0	73.40	6.39	67.02	91.30	78.10	7.10	71.00	90.91
60	19.39	4.97	14.43	74.39	22.27	5.86	16.41	73.70
65	15.64	4.67	10.97	70.15	18.17	5.52	12.66	69.64
70	12.30	4.27	8.03	65.25	14.41	5.04	9.36	64.99
75	9.43	3.73	5.70	60.42	11.07	4.34	6.72	60.76
80	7.02	2.97	4.05	57.64	8.26	3.41	4.85	58.73
85	5.06	1.89	3.16	62.54	5.95	2.10	3.86	64.77

When we look at the gains at age 0 for all the indicators from 1987 to 2006, we found that LE, DLE and DFLE were increasing (with positive sign) and the proportion was decreasing (with negative sign). Through the perspective of theoretical hypotheses, it means that following the expansion of the LE, both DLE and DFLE were expanded, and the DFLE/LE was compressed at same time. As Gain of LE = Gain of DLE + Gain of DFLE, we can say that the contribution to the gain of LE came a great amount (70 percent for males and 89 percent for females) from the gain of DFLE and a few amount from the gain of DLE. Even though we conclude that the trend of health expectancies meet the hypothesis of expansion of morbidity as the DLE increased, whatever the gain of DFLE was, higher gain in DFLE than in DLE simultaneously causing the gain of LE should be the ideal of our pursuit, rather than the pursuit of the absolute decrease or stability in DLE. If such trends were ideal, the situation for females would be more ideal than that for males as the amount of gain in DLE was much less for females than for males. However, the proportion of healthy duration among the whole life was decreasing for both males and females as the gains of DFLE/LE were negative.

The life expectancies at age 65 increased 2.04 years for males and 1.96 years for females, while the disability free life expectancies at age 65 increased 1.39 years for males and 1.60 years for females from year 1987 to 2006. Because of the different gain between the life expectancies and disability free life expectancies, the proportion of the healthy period in remaining life at age 65 decrease by 0.29 percent point for males and increased by 1.40 percent point for females from year 1987 to 2006. Based on the hypotheses of morbidity dealing with the absolute increase of DLE, the morbidities were expanded at age 65 for both males and females. In dealing with the relative or percentage increase of DLE, the results

showed that the morbidity are little “expanded” for males and “compressed” for females.

Table 3 Gains of Various Indicators, 1987-2006

Age	LE	DLE	DFLE	DFLE/LE
		Male		
0	3.70	1.12	2.59	-1.14
65	2.04	0.65	1.39	-0.29
80	0.74	-0.22	0.97	8.52
		Female		
0	5.95	0.67	5.28	-0.17
65	1.96	0.37	1.60	1.40
80	0.80	-0.44	1.24	10.35

For higher ages, such as at age 80, as the gains of DLE were all negative, the morbidity was compressed for both males and females. Correspondingly, the proportions of disability free life expectancy (DFLE/LE) increased dramatically from 49.1 percent in 1987 to 57.6 percent (8.52 percent point gains) in 2006 for males and from 48.40 percent in 1987 to 58.7 percent (10.36 percent point gains) in 2006 for females. This has showed that the higher the ages, the more compressed the morbidity.

Changes of Type Specific Disability Life Expectancy of Elderly

We compared the differences of disability-free life expectancy between the year 1987 and 2006 above. Now, in order to decompose the health expectancy by types of disability, we use disability life expectancy (DLE), the opposite part of the disability-free life expectancy (DFLE), as the total duration in disability within remaining years of life.

Decomposing the remaining years of life with disabilities yields the expected remaining years of life for each types of disability (see table 4 and 6) and their proportions (see table 5 and 7). Let us take look at the disability life expectancy at age 65 for both males and females and for the year 1987 and 2006. We can see that the total numbers of remaining years of life with disability at age 65 were 4.02 years for males and 5.15 years for females in 1987, and were 4.67 years for males and 5.52 years for females in 2006. We are trying to decompose the total duration in the duration with different types of disability and to see which type of disability hold the higher level of disability in duration. Table 4 gives the number of the duration and the table 5 gives the proportion of the duration by types of disability in 1987.

Table 4 Disability Life Expectancy by Exact Age and Type of Disability by Gender, 1987

Male								
age	Total	Vision	Hearing	Speech	Intellectual	Physical	Mental	Multiple
60	4.174	0.703	2.170	0.014	0.047	0.465	0.038	0.738
65	4.021	0.675	2.114	0.013	0.037	0.396	0.029	0.757
70	3.816	0.632	2.008	0.010	0.030	0.318	0.021	0.797
75	3.584	0.576	1.868	0.007	0.026	0.244	0.016	0.848
80	3.193	0.502	1.619	0.008	0.020	0.178	0.011	0.855
85	2.752	0.392	1.363	0.014	0.023	0.134	0.000	0.826
					Female			
	Total	Vision	Hearing	Speech	Intellectual	Physical	Mental	Multiple
60	5.378	1.354	2.165	0.011	0.076	0.420	0.060	1.287
65	5.149	1.268	2.073	0.008	0.065	0.366	0.045	1.319
70	4.834	1.141	1.942	0.007	0.054	0.304	0.032	1.349
75	4.441	0.976	1.741	0.004	0.043	0.245	0.025	1.403
80	3.852	0.761	1.420	0.002	0.035	0.185	0.014	1.427
85	3.117	0.549	1.071	0.002	0.018	0.123	0.009	1.333

For both males and females at age 65 in 1987, the longest period of disability was associated with hearing disability. Males could expect hearing disabilities for 2.11 years of their 4.02 disability years at exact age 65, and females could expect 2.07 years of hearing disabilities during their 5.15 disability years. Hearing disability affected around half of the disability years, 52.6 percent for males and 44.3 percent for females. Comparing disabilities between males and females, the impairment of hearing was a bit of more serious for males than for females in absolute result and was much more serious for males than for females in proportion, due to longer duration of disability. Of the total number of years with disability at age 65, the durations of vision and multiple disabilities accounted for just over 0.70 years respectively for males and accounted for about 1.3 years for females respectively, which means that the durations of vision and multiple disability were higher for females than for males in both absolute and relative results. Vision and multiple disabilities together accounted for around 35 percent of the duration of the disability for males, while accounted for over 50 percent for females in 1987.

Even though the absolute numbers and proportions of remaining years in each type of disability were decreasing, except for the multiple disabilities, due to the decrease of total number of disability life expectancy, the multiple disabilities were increasing in both absolute and relative results, as the age increased for both males and females. The increases of the multiple disabilities were more serious for females than for males in 1987.

Table 5 Proportions by Type of Disability 1987

Age	Vision	Hearing	Speech	Intellectual	Physical	Mental	Multiple
				Male			
60	16.8	52.0	0.3	1.1	11.1	0.9	17.7
65	16.8	52.6	0.3	0.9	9.9	0.7	18.8
70	16.6	52.6	0.3	0.8	8.3	0.5	20.9
75	16.1	52.1	0.2	0.7	6.8	0.5	23.7
80	15.7	50.7	0.3	0.6	5.6	0.3	26.8
85	14.2	49.5	0.5	0.8	4.9	0.0	30.0
				Female			
60	25.2	40.3	0.2	1.4	7.8	1.1	23.9
65	24.6	40.3	0.2	1.3	7.1	0.9	25.6
70	23.6	40.2	0.1	1.1	6.3	0.7	27.9
75	22.0	39.2	0.1	1.0	5.5	0.6	31.6
80	19.8	36.9	0.1	0.9	4.8	0.4	37.0
85	17.6	34.4	0.1	0.6	3.9	0.3	42.8

In regarding to the disability in 2006, the longest period and the highest proportion of disability was associated with the hearing disability (see table 6) for both males and females. Vision and mental problems and multiple disabilities were more serious for females than for males for all exact ages. At age 65, among 4.67 years with disabilities, males could expect to spend 0.68 of their remaining years with vision disability, 1.99 years with hearing disability, 0.03 years with speech, 1.21 years with intellectual problems, 0.05 years with physical disability, 0.07 years with mental disorder, and 0.78 years with multiple disabilities, while females, among 5.52 years with disability, could expect to spend 1.26 years with vision problem, 1.72 years with hearing disability, 0.02 years with speech disability, 1.22 years with intellectual disability, 0.05 years with physical problems, 0.13 years with mental disorder, and 1.12 years with multiple disabilities. When taking look of the proportions, we can see that vision, mental, and multiple disabilities were more serious for females than for males. In contrast, the hearing, speech, intellectual, and physical disabilities were more serious for males than for females.

Table 6 Disability Life Expectancy by Exact Age and Type of Disability, 2006

					Male			
Age	Total	Vision	Hearing	Speech	Intellectual	Physical	Mental	Multiple
60	4.967	0.729	2.044	0.035	1.207	0.062	0.092	0.799

65	4.670	0.682	1.994	0.027	1.068	0.047	0.071	0.780
70	4.275	0.618	1.883	0.020	0.900	0.037	0.054	0.763
75	3.732	0.526	1.662	0.014	0.717	0.033	0.038	0.742
80	2.974	0.411	1.325	0.008	0.522	0.023	0.023	0.662
85	1.894	0.238	0.836	0.003	0.290	0.015	0.014	0.497
					Female			
Age	Total	Vision	Hearing	Speech	Intellectual	Physical	Mental	Multiple
60	5.856	1.336	1.771	0.022	1.360	0.065	0.167	1.135
65	5.517	1.259	1.721	0.017	1.224	0.051	0.125	1.120
70	5.043	1.144	1.608	0.012	1.041	0.044	0.096	1.098
75	4.342	0.949	1.401	0.008	0.825	0.037	0.070	1.052
80	3.407	0.673	1.110	0.005	0.590	0.030	0.045	0.954
85	2.097	0.367	0.666	0.002	0.322	0.018	0.024	0.699

Table 7 Proportions by Type of Disability, 2006

Age	Vision	Hearing	Speech	Intellectual	Physical	Mental	Multiple
				Male			
60	14.7	41.1	0.7	24.3	1.2	1.8	16.1
65	14.6	42.7	0.6	22.9	1.0	1.5	16.7
70	14.5	44.0	0.5	21.1	0.9	1.3	17.8
75	14.1	44.5	0.4	19.2	0.9	1.0	19.9
80	13.8	44.6	0.3	17.6	0.8	0.8	22.2
85	12.6	44.1	0.2	15.3	0.8	0.8	26.3
				Female			
60	22.8	30.3	0.4	23.2	1.1	2.8	19.4
65	22.8	31.2	0.3	22.2	0.9	2.3	20.3
70	22.7	31.9	0.2	20.6	0.9	1.9	21.8
75	21.9	32.3	0.2	19.0	0.8	1.6	24.2
80	19.7	32.6	0.1	17.3	0.9	1.3	28.0
85	17.5	31.7	0.1	15.4	0.9	1.1	33.3

When comparing the change of the disability in quantity and in structure, we can see that the duration number with disability at age 65 increased from 1987 to 2006 for both males (0.649) and females (0.368). The gains were decomposed by the gains of all types (see table 8), from which we can see that the highest gain appeared in intellectual disability for both males (1.031) and females (1.159) and the lowest (with negative sign) gain appeared in physical and hearing for both males and females. For age 80, as the total gains were negative, that is, the DLE was decreasing, the dominant contributions from different types of disability were those numbers with highest negative or positive values. We can see that the highest values at age 80

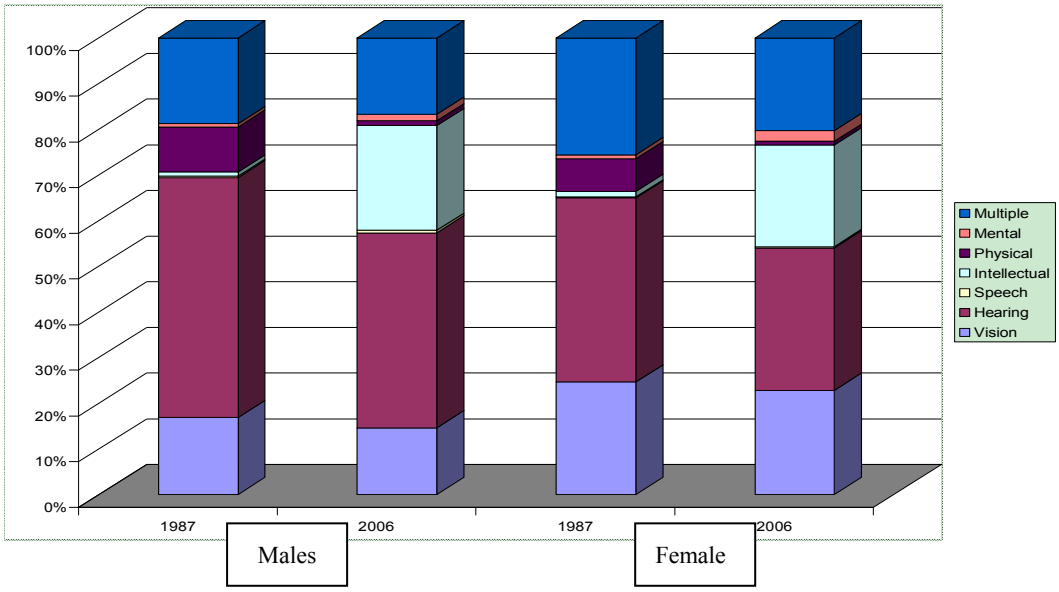
were appeared in intellectuals and hearing disabilities for males and in intellectual and multiple disabilities for females.

Table 8 Gains of DLE by Types, 1087-2006

age	Total	Vision	Hearing	Speech	Intellectual	Physical	Mental	Multiple
				Male				
65	0.649	0.007	-0.12	0.014	1.031	-0.349	0.042	0.023
80	-0.219	-0.091	-0.294	0	0.502	-0.155	0.012	-0.193
				Female				
65	0.368	-0.009	-0.352	0.009	1.159	-0.315	0.08	-0.199
80	-0.445	-0.088	-0.31	0.003	0.555	-0.155	0.031	-0.473

However, the composition of the type specific disability were changed obviously which can be seen from the comparison of the two disabilities of the two years at age 65 (see Chart 1). Even thought there were some differences in the composition between males and females, the huge differences in the composition of the disabilities appeared between the year 1987 and 2006. Most significant increase was seen in the intellectual disability, from 0.9 percent to 22.9 percent for males and from 1.3 percent to 22.2 percent for females between 1987 and 2006, while most decrease was seen in physical disability, from 9.9 percent to 1.0 percent for males and from 7.1 percent to 0.9 percent for females between the two years.

Chart 1. Proportional Changes in Type of Disability at Age 65, by Gender and Years



Changes of Degree Specific Disability Life Expectancy of Elderly

We have tested that the morbidity or DLE was expanded based on the results of disability free life expectancy even though DFLE expanded much greater than DLE. Under such

circumstances, however, we intend to test if the expansion was progressively highly contributed by milder disability, from which the severe disability would be stable and even decrease. This was the dynamic-equilibrium hypothesis (Montan, 1982).

Due to a lack of degree classification for multiple disability in 1987 survey, we assume that the degree distribution of multiple disability in 1987 equals to the distribution in 2006. Then, we calculated the age-gender-degree specific disability for both 1987 and 2006, as well as their differences (see table 9).

Table 9 Age-Gender-Degree Specific Disability and their Differences between 1987 and 2006

Year	Age	Male					Female				
		1	2	3	4	DLE	1	2	3	4	DLE
2006	60	0.73	0.64	1.72	1.90	4.99	1.09	0.77	1.68	2.36	5.89
	65	0.69	0.62	1.66	1.73	4.69	1.05	0.73	1.62	2.16	5.56
	70	0.65	0.58	1.57	1.50	4.30	1.01	0.68	1.53	1.87	5.09
	75	0.62	0.54	1.41	1.19	3.76	0.95	0.60	1.38	1.45	4.39
	80	0.56	0.46	1.17	0.83	3.02	0.85	0.52	1.13	0.96	3.47
	85	0.42	0.35	0.75	0.44	1.96	0.65	0.36	0.72	0.47	2.19
1978	60	0.69	0.91	1.19	1.38	4.17	1.13	1.27	1.36	1.62	5.38
	65	0.68	0.91	1.15	1.28	4.02	1.10	1.26	1.31	1.48	5.15
	70	0.66	0.91	1.12	1.13	3.82	1.06	1.26	1.25	1.27	4.83
	75	0.68	0.90	1.05	0.95	3.58	1.02	1.25	1.13	1.03	4.44
	80	0.69	0.85	0.93	0.72	3.19	0.95	1.25	0.94	0.71	3.85
	85	0.66	0.80	0.80	0.50	2.75	0.84	1.14	0.73	0.41	3.12
2006-1987	60	0.04	-0.27	0.53	0.52	0.82	-0.04	-0.50	0.32	0.74	0.52
	65	0.02	-0.30	0.51	0.45	0.67	-0.05	-0.53	0.30	0.68	0.41
	70	-0.01	-0.33	0.45	0.37	0.48	-0.05	-0.58	0.28	0.59	0.25
	75	-0.06	-0.37	0.36	0.24	0.18	-0.07	-0.65	0.25	0.43	-0.05
	80	-0.13	-0.39	0.23	0.10	-0.18	-0.09	-0.74	0.19	0.25	-0.38
	85	-0.24	-0.45	-0.05	-0.06	-0.79	-0.19	-0.78	-0.01	0.06	-0.93

Note: DELs for both 1987 and 2006 were a little difference as results given in other tables due to rounding error.

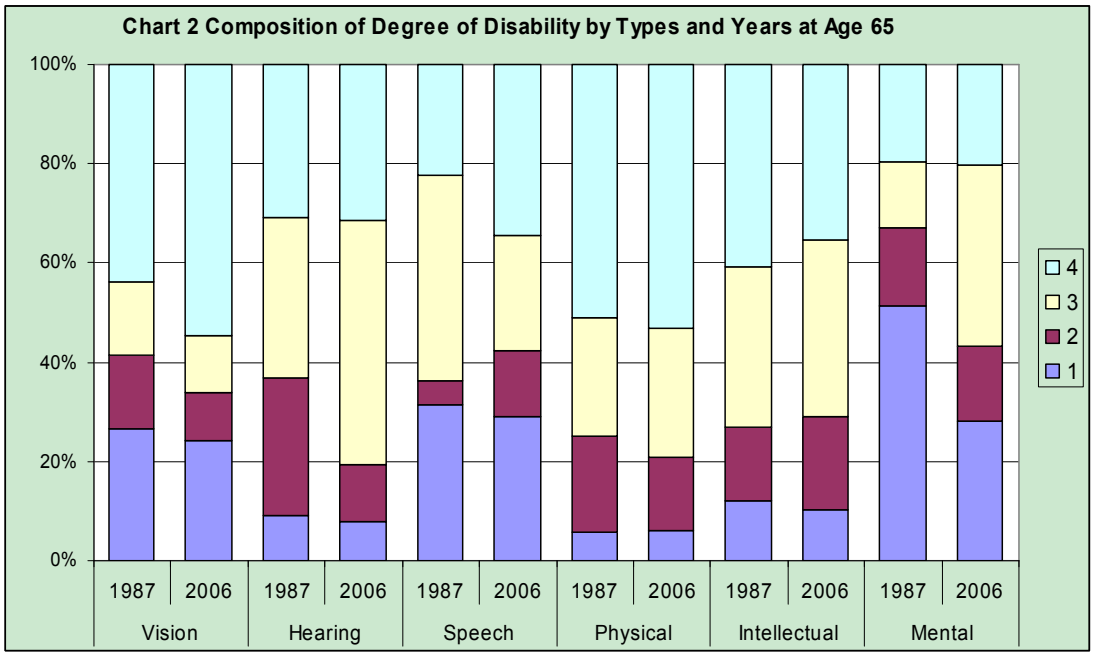
From the difference of the age-gender-degree specific disability, we can see that even though the duration of disabilities, in general, were expanded in younger elderly and were compressed in older elderly, the a large amount of the contribution to the expansion of the morbidity was coming from degree 3 and 4, which even led to the severe disability with degree 1 and 2 unchanged (with positive sign and very small gain) and even mostly compressed (with negative sign). From such results, we can see that the direction of the changes between mild and severe disabilities are different. The general trend is that the expansion appeared in mild part and the compression appeared in severe part no matter

whether the DLEs were expanded or compressed or not. In matter of fact, the expansion and compression can happen simultaneously at different ages in a population.

Changes of Type-Degree Specific Disability Life Expectancy of Elderly

We decomposed the disability life expectancy by type and by degree separately above. Further, we can decompose the duration of each type of the disability life expectancy by its degree with mild (degree 4) to severe (degree 1). In order to see the structural changes by degree, the proportions in degrees of disability by types, age, gender, and time were calculated (see Table 10 and 11).

Now, taking the proportions at age 65 as an example, we can compare both the differences of the composition of the degree among the types of disability in same year and the changes of the composition of the degree of disability for males between 1987 and 2006 (see Table 12 and Chart 2). Table 12 also gives the mean score of the degree of disability in each type, which reflects the general level of the severity of the disability, the smaller the score, the severer the disability.



Based on the table 10, 11, and 12, as well as chart 2, we can find that 1) following the age increases, the mean scores of the degree for all types were decreasing, which means that the health status of the elderly is worsening as getting old, especially for the 2006 data in table 11. 2) There were a little difference in mean score between males and females, which mean that

the severity of disability seemed very small between male and female elderly, except for speaking. That is, the ability in speaking is better for male than for female elderly. 3) The highest mean score, the mildest status, appeared in physical disability for both males and females and for two surveys; whereas the lowest mean score, the severest status, appeared in mental disability for all classifications. 4) Comparing between the year 1987 and 2006, we can see from Chart 3 and Chart 4 that the scores for almost all types of disability, except for the intellectual disability, were increasing, which means that the disability status were improving from 1987 to 2006 for both males and females. Such improvement was more significant for females than for male

Table 10 Proportions in Degrees of Disability by Age, Gender, and Type, 1987

Type\Degree	Age	Male					Female				
		1	2	3	4	Mean	1	2	3	4	Mean
Vision	60	26.7	14.5	14.9	43.9	2.76	31.5	15.5	14.2	38.8	2.60
	65	26.6	14.8	14.8	43.7	2.75	32.7	15.5	14.2	37.6	2.57
	70	27.4	14.9	14.6	43.1	2.73	34.0	15.9	14.1	35.9	2.52
	75	29.0	14.5	13.9	42.7	2.71	36.2	15.6	13.8	34.4	2.46
	80	30.4	15.0	15.0	39.6	2.64	38.2	16.8	13.7	31.3	2.38
	85	32.9	15.3	17.1	34.7	2.54	39.8	17.1	14.9	28.2	2.32
Hearing	60	8.8	26.5	32.7	32.0	2.88	8.9	32.3	30.2	28.6	2.79
	65	9.1	27.7	32.4	30.8	2.85	8.9	33.9	30.2	27.0	2.75
	70	9.4	29.6	33.0	28.0	2.80	9.3	36.7	29.9	24.1	2.69
	75	10.8	32.2	32.7	24.3	2.71	9.9	41.4	28.5	20.2	2.59
	80	13.5	35.0	31.9	19.5	2.57	11.2	49.1	25.0	14.6	2.43
	85	15.0	38.2	32.3	14.6	2.47	12.4	55.6	22.3	9.7	2.29
Speaking	60	35.1	4.6	39.1	21.1	2.46	50.7	3.1	41.4	4.7	2.00
	65	31.3	5.0	41.3	22.4	2.55	55.3	1.4	38.5	4.8	1.93
	70	33.1	2.6	32.2	32.1	2.63	56.7	2.0	34.6	6.7	1.91
	75	24.0	2.3	6.9	66.8	3.17	65.3	0.0	24.0	10.7	1.80
	80	13.7	0.0	0.0	86.3	3.59	74.3	0.0	25.7	0.0	1.51
	85	0.0	0.0	0.0	100.0	4.00	100.0	0.0	0.0	0.0	1.00
Physical	60	5.4	18.7	24.3	51.5	3.22	8.7	19.2	24.3	47.8	3.11
	65	5.6	19.6	23.7	51.1	3.20	9.0	19.5	24.5	47.1	3.10
	70	4.8	19.8	23.5	51.8	3.22	9.6	19.3	26.2	44.9	3.06
	75	4.7	19.5	23.8	52.0	3.23	10.0	19.1	26.6	44.3	3.05
	80	5.1	19.5	21.1	54.3	3.25	9.1	18.3	27.8	44.9	3.09
	85	1.9	22.9	20.8	54.5	3.28	9.1	23.8	28.0	39.0	2.97
Intellectual	60	9.8	13.7	32.5	44.1	3.11	9.5	14.0	30.0	46.5	3.14
	65	12.0	14.8	32.5	40.7	3.02	10.4	15.8	29.8	44.1	3.08
	70	13.0	14.7	35.1	37.1	2.96	11.3	15.9	28.7	44.0	3.05
	75	14.8	15.1	33.0	37.2	2.93	14.3	17.7	28.1	39.8	2.93

	80	18.4	12.8	35.1	33.6	2.84	15.3	19.3	24.2	41.2	2.91
	85	25.0	12.5	33.3	29.2	2.67	18.4	18.4	30.6	32.7	2.78
Mental	60	52.4	14.8	12.4	20.4	2.01	56.5	12.5	12.2	18.8	1.93
	65	51.3	15.8	13.2	19.6	2.01	60.6	12.0	11.6	15.8	1.83
	70	57.6	12.2	13.8	16.4	1.89	61.0	13.5	11.5	14.0	1.79
	75	45.2	13.8	20.0	21.0	2.17	65.1	12.2	9.8	12.9	1.71
	80	38.9	22.2	16.7	22.2	2.22	77.0	7.4	6.5	9.1	1.48
	85					0.00	75.7	10.4	3.5	10.4	1.49

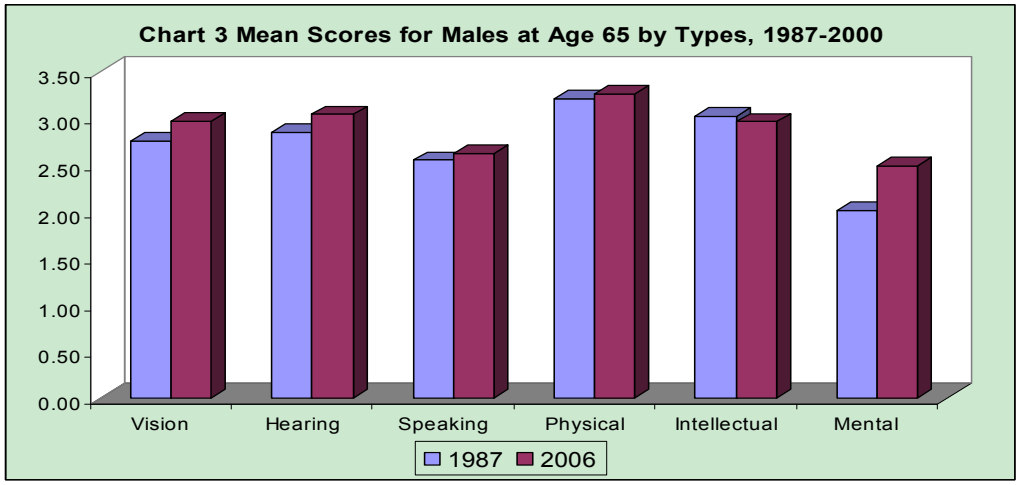
Table 11 Proportions in Degree of Disability by Age, Gender, and Type, 2006

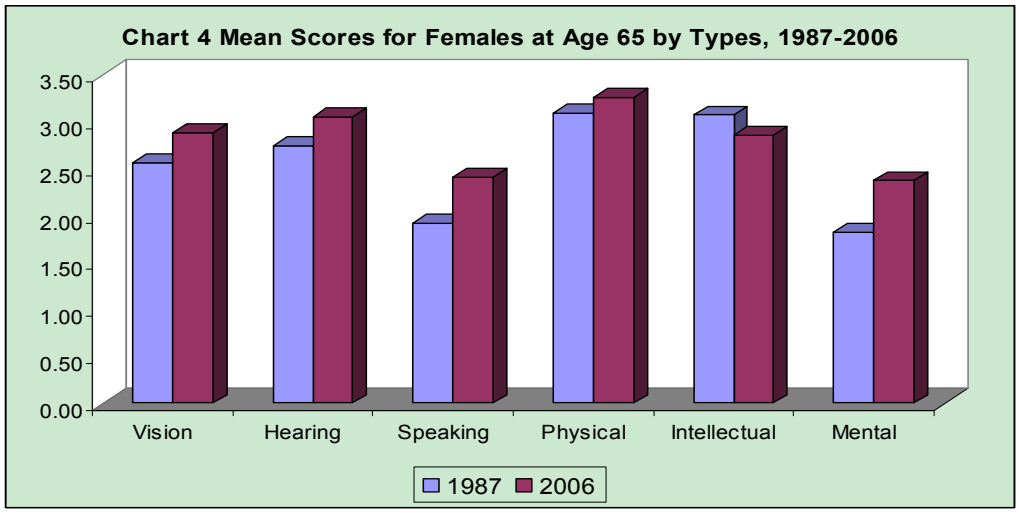
Type\Degree	Age	Male					Female				
		1	2	3	4	Mean	1	2	3	4	Mean
Vision	60	23.9	9.4	11.6	55.1	2.98	25.9	10.1	11.1	52.9	2.91
	65	24.3	9.4	11.7	54.6	2.97	26.7	10.2	10.9	52.2	2.89
	70	25.2	9.3	11.8	53.7	2.94	27.9	10.2	11.1	50.8	2.85
	75	27.9	9.5	11.5	51.1	2.86	30.6	10.3	11.2	47.9	2.76
	80	32.3	9.5	12.0	46.3	2.73	36.3	10.3	10.6	42.8	2.60
	85	37.2	9.1	11.4	42.3	2.59	43.1	10.4	10.3	36.2	2.40
Hearing	60	8.1	11.1	48.5	32.3	3.05	8.5	10.5	46.2	34.8	3.07
	65	8.0	11.3	49.4	31.3	3.04	8.6	10.6	46.9	33.9	3.06
	70	8.2	11.6	50.6	29.6	3.02	8.9	10.8	48.2	32.1	3.04
	75	8.8	12.5	52.2	26.4	2.96	9.8	11.3	50.3	28.6	2.98
	80	9.9	14.3	54.0	21.7	2.87	11.4	12.7	52.2	23.8	2.89
	85	11.4	17.0	54.1	17.5	2.78	14.6	14.7	53.1	17.6	2.74
Speaking	60	27.3	12.2	23.3	37.1	2.70	37.5	13.1	25.7	23.7	2.36
	65	29.1	13.3	23.2	34.3	2.63	36.5	11.6	26.1	25.8	2.41
	70	29.7	13.3	23.3	33.8	2.61	38.7	9.5	26.2	25.7	2.39
	75	29.1	15.6	20.1	35.2	2.61	40.1	2.7	32.3	24.9	2.42
	80	32.7	15.7	20.3	31.3	2.50	43.9	6.1	31.1	18.9	2.25
	85	0.0	25.0	25.0	50.0	3.25	50.0	0.0	25.0	25.0	2.25
Physical	60	5.5	14.3	25.6	54.6	3.29	5.8	15.0	23.5	55.7	3.29
	65	5.9	14.9	26.1	53.1	3.26	6.2	15.5	23.8	54.5	3.27
	70	6.4	15.9	26.3	51.4	3.23	6.8	16.1	24.6	52.5	3.23
	75	7.3	16.4	26.7	49.6	3.19	7.8	16.7	25.6	50.0	3.18
	80	8.0	16.9	27.8	47.3	3.14	8.6	18.7	26.4	46.3	3.10
	85	8.5	21.2	28.8	41.5	3.03	9.5	19.7	26.4	44.5	3.06
Intellectual	60	9.2	18.2	36.2	36.3	2.99	10.8	20.3	37.0	31.9	2.90
	65	10.4	18.6	35.7	35.3	2.96	11.7	20.6	37.3	30.4	2.86
	70	11.4	19.6	38.1	30.9	2.89	12.7	21.7	38.9	26.7	2.80
	75	12.4	22.6	39.7	25.2	2.78	12.7	25.4	38.1	23.8	2.73
	80	13.0	29.5	37.3	20.2	2.65	15.3	23.9	41.4	19.3	2.65
	85	21.1	31.6	31.6	15.8	2.42	25.0	27.5	37.5	10.0	2.33
Mental	60	26.5	14.1	38.5	20.9	2.54	33.7	15.3	15.4	35.6	2.53
	65	28.2	14.9	36.6	20.3	2.49	38.4	16.0	15.1	30.6	2.38
	70	30.9	14.3	35.2	19.6	2.44	43.2	17.1	14.5	25.2	2.22

	75	32.5	13.2	31.2	23.0	2.45	49.6	17.4	13.9	19.1	2.03
	80	40.2	10.6	24.5	24.8	2.34	55.1	18.6	13.8	12.4	1.83
	85	37.5	8.3	20.8	33.4	2.50	69.8	18.9	7.5	3.8	1.45
Multiple	60	35.5	18.0	32.1	14.4	2.25	38.2	17.1	28.7	15.9	2.22
	65	34.2	18.2	32.9	14.7	2.28	37.8	17.2	29.1	15.9	2.23
	70	33.3	18.6	33.7	14.3	2.29	37.7	17.3	29.5	15.6	2.23
	75	33.4	19.2	34.2	13.2	2.27	38.8	17.2	30.0	14.0	2.19
	80	34.4	19.9	33.9	11.8	2.23	40.5	18.1	29.9	11.5	2.12
	85	37.6	21.9	30.5	10.0	2.13	44.8	19.3	28.8	7.1	1.98

Table 12 Proportions and Mean Score in Degree of Disability by Age, Gender, Type, and Year

		Males					Females				
		1	2	3	4	Mean	1	2	3	4	Mean
1987	Vision	26.60	14.80	14.80	43.70	2.75	32.70	15.50	14.20	37.60	2.57
	Hearing	9.10	27.70	32.40	30.80	2.85	8.90	33.90	30.20	27.00	2.75
	Speaking	31.30	5.00	41.30	22.40	2.55	55.30	1.40	38.50	4.80	1.93
	Physical	5.60	19.60	23.70	51.10	3.20	9.00	19.50	24.50	47.10	3.10
	Intellectual	12.00	14.80	32.50	40.70	3.02	10.40	15.80	29.80	44.10	3.08
	Mental	51.30	15.80	13.20	19.60	2.01	60.60	12.00	11.60	15.80	1.83
2006	Vision	24.30	9.40	11.70	54.60	2.97	26.70	10.20	10.90	52.20	2.89
	Hearing	8.00	11.30	49.40	31.30	3.04	8.60	10.60	46.90	33.90	3.06
	Speaking	29.10	13.30	23.20	34.30	2.63	36.50	11.60	26.10	25.80	2.41
	Physical	5.90	14.90	26.10	53.10	3.26	6.20	15.50	23.80	54.50	3.27
	Intellectual	10.40	18.60	35.70	35.30	2.96	11.70	20.60	37.30	30.40	2.86
	Mental	28.20	14.90	36.60	20.30	2.49	38.40	16.00	15.10	30.60	2.38





Conclusions

We have compared the disability free life expectancies, disability life expectancies by type, disability life expectancy by degree, and disability life expectancies by both type and degree between year 1987 and 2006. We found that even though the morbidity or the disability defined here for the whole population and for the population age 65 appeared to be expanded, the morbidity for the oldest old population appeared to be compressed for both males and females. Furthermore, the higher the ages, the more compressed the morbidity. Hearing disability accounted for the largest proportion of the duration of the disability for both males and females, and it accounted for higher for males then for females. The most significant change appeared in intellectual disability, such that the proportion of intellectual disability increased from 0.9 percent to 22.9 percent for males and from 1.3 percent to 22.2 percent for female at age 65. The direction of the changes between mild and severe disabilities were different. The general trend is that the expansion appeared in mild part and the compression appeared in severe part no matter whether the DLEs were expanded or compressed or not. In fact, the expansion and compression happened simultaneously at different ages in same population. The severity of disability was improving from 1987 to 2006 for both males and females. Such improvement was more significant for females than for males.

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