Micro data analysis of medical and long-term care utilization among the elderly in Japan

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Introduction

1) Ageing Society and End-of-life Medical Care Cost

Medical and long-term care use before death has been attracting research and policy concerns with rising social expenditure in the ageing society. Early studies by Lubitz and his colleague（Lubitz and Prihoda, 1984）using Medicare dataset estimated that end-of-life medical expenditure shared 28% of total annual medical expenditure in the U.S. and was consumed intensively within one month before death. Following analysis using updated Medicare dataset have been reproduced（Lubitz&Riley, 1993; Hogan, et al. 2001）to find the share of end-of-life medical expenditure has been almost constant over time in spite of newly introduced alternative services such as hospice and homecare. Barnato, McClellan, Kagay, & Garber (2004) attributed this to increased treatment intensity of hospital care that offset the decrease in deaths in hospitals.

In Japan, rising expenditure in medical and long-term care has evoked serious policy debate, where ageing has been accused as the major driving force to raise the expenditure. Figure 1 shows the projection of share of population aged over 65, and Figure 2 shows the trend of medical and long-term care since 80's. As the figures show, Japan experienced the most rapid pace of population ageing among OECD countries; the share of those aged 65 and over already reaches 22% in 2007. Thus, it is indispensable for Japanese policy makers to precisely understand how and to what extent population ageing influences social expenditure on medical and long-term care.

The first estimation of end-of-life medical expenditure was reported by Ogura et al. (1994). Using claim bill data in late 80's derived from local public health insurers they estimated that the end-of-life medical expenditure for those aged 70 and over amounted to 19.2% of annual medical expenditure. Fukawa (1998) conducted a similar analysis with claim data in early 90'S from 12 prefectural authority for beneficiaries aged 70 and over. He found that the share of end-of-life medical care (hospital and outpatient

services) amounted 12% of total annual expenditure, that the majority of expenditure were consumed within three months before death, and that the rise in expenditure before death was attributed to the increase both in admission probability and in cost per case. The study by Konno (2006) used claim bill data from company-driven health insurance in late 90's, and estimated the share of end-of-life as 22.4% of expenditure for those age 65 and over, and that the ratio of medical expenditure of decedents to that of survivors was about 5.3 times among those age 70 and over. Institute of Health Economics and Policy (2000) estimated that the average medical expenditure one month before death was about 1,120,000JPY. Based on this number and estimated number of hospital death in 2002 (roughly 0.8 million), the Bureau of Insurance in the Ministry of Health, Welfare, and Labour simply multiplied these numbers and estimated that annual "end-of-life expenditure in hospital service" amounted 900 billion JPY as of 2002. This estimation provided a ground for a newly introduced government policy since 2008 to encourage end-of-life medical care for elderly at home as a countermeasure against rising medical expenditure.

2) "Red herring" debate; review

Apparently, the number announced by MHLW is likely overestimated because end-of-life medical expenditure declines over age (Lubitz & Riley, 1993: Fukawa 1998: Masuhara 2004: Konno 2006). The decline in end-of-life medical care among elderly-elderly is due to decreased probability of service use (Seshamani & Gray, 2004) or decreased intensity of care (Levinsky, Yu, Moskowitz, Gazelle, Saynina, &Emanuel 2001; Fukawa, Kodama, & Izumi 1994). Thus, naïve growth projection of future medical expenditure, simply multiplying current age-specific medical expenditure by estimated future population structure, is likely to be overestimated compared to more sophisticated model taking consideration of end-of-life expenditure (Serup-Hansen, Wickstrom, Kristiansen, 2002; Polder, Barendregt, & van Oers, 2006)

So-called "red herring" debate (Zweifel, Felder, & Meiers, 1999) argued further that time-to-death (TTD), rather than population ageing per se, is the cause of rising medical expenditure. Following studies with more sophisticated econometric methods (Seshamani & Gray 2004, Sterns and Norton 2004) confirmed that TTD is a significant factor, though they argued that ageing per se is also a significant contributor.

These studies focused only on medical services, and ignored cost for long-term care, thus failed to provide a whole picture of total health cost before death among elderly. Hoover, Crystal, Kumar, Sambamoorthi, & Cantor (2002) used Medicare Current Beneficiary Survey 92-96, and found that medical expenditure on end-of-life care was

lower, but non-Medicare cost was higher among the older beneficiaries. They also revealed that end-of-life medical cost rapidly increased at the month of death, while non-Medicare cost was spent in a stable amount over the year. They concluded that custodial and chronic care, which was covered by non-Medicare expenditure, should also be seriously and distinctively considered to improve resource allocation for the end-of-life care for the elderly. Liu, Wiener, & Neifeld (2006) confirmed the same trend in medical care and long-term care cost before death, using the claim data of dual beneficiaries for Medicare and Medicaid in 10 states.

Polder, Barenderegt, & van Oers (2006) used a large representative sample of public insurance data in the Netherlands, and estimated a total health care cost including both medical care and long-term care. They also confirmed that medical care cost decreased and long-term care cost increased over age among the decedents. They additionally found that survivor elderly spent less medical care compared to decedents, but their medical cost did not differ across age. Furthermore, since long-term care increased over age among survivor elderly, total health cost of survivors amounted about 50% of that of decedents among those aged 80 and over. The authors thus concluded that ageing per se is not ignorable as the cause of health care expenditure.

Werblow, Felder, & Zweifel (2007) using Swiss claim data argued that impact of time-to-death and age on end-of-life health care cost differs according to survivorship and use of long-term care. Among decedents without long-term care use, annual medical expenditure was large, yet decreased over age, while among survivors without long-term care the expenditure increased over age until age 85, then decreased. For decedents and survivors with long-term care use, expenditure was lower compared to that used by long-term non-users, but monotonously increased over age. However, Swiss claim data only covered medical component of long-term care, and failed to include custodial care at home and accommodation cost at nursing homes.

3) Purpose of this study

The purpose of this study is two fold. First, to estimate total health cost of end-of-life care for the elderly in Japan, and compare the pattern of expense over time-to-death across service components; outpatient and hospital services, home care, and institutional care. Second, to compare annual expense of decedent and survivor elderly, and see how survivorship, use of long-term care, and age discriminates expenditure of each service component.

For this purpose, Japanese data are unique and relevant since Japan has public medical and long-term care insurance, and the public insurance is the only dominant

insurance that covers formal care for medical and long-term care. Although private insurances exist, the current law only allows them to cover a limited part of out-of-pocket payment. Thus, the claim data of public insurance should precisely and comprehensively cover a whole picture of cost spent to provide formal services for medical and long-term care for the elderly. Besides, this is the first detailed analysis on total health care cost for the elderly in non-European settings, using a large database.

2. Analytic Model, Data, and Methods

We basically follow the two-part model, estimating the probability of service use and the amount of expenditure conditional on service use. However, in this study, we adopt the strategy similar to Polder, Barenderegt, & van Oers (2006), and rely on descriptive analysis rather than using econometric modeling, because we believe it better provides a picture of cost use pattern in intuitively understandable manner.

Claim data was provided by a public authority of a prefecture in Kyushu district, a southern part of Japan. The data covered claim data on medical care and long-term care use by National Health Insurance beneficiaries aged 65 and over in the prefecture during the period of 2000-2004. National Health Insurance is a public insurance driven by municipalities, and covers those with self-employed and retired. Those who are employees of large companies are covered by Employee Health Insurance, and are not included in the current dataset. Medical insurance covers hospital fees, physician fees, dental services and prescription. In this study, we excluded dental services from the analysis. Long-term care insurance covers home care services such as housekeeping assistance and other custodial care, visiting nurse and rehabilitation services, respite services and care at institutions. At the time of survey, accommodation and meal fees at respite service centers and nursing homes were also covered by public long-term care insurance, and included in the expenditure.

The data includes unique identifier, age, types of used service, month of service use, monthly amount of service use, and exit information (death, or move-out). Using unique identifier and month, we prepare a panel data. From this master database, we further prepared two sub-datasets for analysis. The first dataset is for the analysis of decedents. We identified those who died in the year of 2001, 2002, and 2003, then prepared their claim data for 12 months before their death month. This first dataset included 50,857 decedent cases.

The second dataset is for the comparative analysis between decedents and survivors. We identified those who survived as of March 2004, and collected their annual expenditure by service type during the period from April 2002 to March 2003.

Thus these survivor elderly had at least 12 month survivorship after the time of their actual service use reflected in the claim data. This second dataset included 364,484 survivors.

For simplicity, age was categorized into three levels (65-74, 75-84, and 85-). Medical care was subcategorized into outpatient and hospital care. Prescription and drug fee was included in either outpatient or hospital fee according to the site of prescription issue. In Japanese case, drugs had been sold by clinics/hospitals who issued prescription until 80's. Since then, the government policy was introduced to promote distinctive drug sale at the pharmacy to prevent over-prescription. However, there still remained clinics that sold medication in rural areas where pharmacy was less available. Thus, we chose to combine prescription and drug fee with medical care fee. Long-term care was subcategorized into home care (including respite care) and institutional care at nursing homes.

Analysis of decedents was conducted as follows. For each service type, use probability and amount of monthly expenditure conditional on service use was calculated by age and month-to-death. The results were plotted on a graph to show the trend of use probability and monthly expenditure changes over 12 months before death.

For the comparison of decedents and survivors, annual expenditure was calculated for each service type. The use probability was calculated where no service use throughout a full year was counted as 0. The estimated probability and amount of service use conditional on probability >0 were plotted over age categories by decedent/survivor statuses, comparing how differently age affected the probability and expenditure by survivorship. Similar analysis was conducted for outpatient and hospital service use further stratified by survivorship and long-term care use, to follow Werblow, Felder, & Zweifel (2007).

Finally, average annual cost was obtained by multiplying use probability and annual expenditure for each service type, and was summed up to obtain "total health cost" including both medical and long-term care. The obtained number was compared by age and survivorship. In the population level, the share of total health cost for decedents was roughly estimated. Since the decedents were sampled for three year period, average annual expenditure of decedents was multiplied by a third of decedent number to obtain the sum of annual total health cost for decedents, and compared to the corresponding number obtained for survivors.

3. Results

Table 1 shows basic characteristics of decedent and survivors. Apparently, decedents were older than survivors. Majority of decedents (nearly 70%) were died in hospitals. The number is close to, but lower than 81%, the estimated number for the whole Japanese population by Ikegami (2006) using 2002 vital statistics. As our sample is limited to elderly cases, we could expect the share of institutional death rather than hospitals death was higher than that by Ikegami. For a sub-sample where causes of death were available, neoplasm shared 22.1% of death cases, followed by stroke (13.9%) and heart diseases (12.1%).

Figure 3 shows the use probability and monthly expenditure conditional on service use for outpatient services over months to death. Use probability was constant over time, then decreased in the last two months. Monthly expenditure was almost constant and slightly increased in the last two months. Older decedents had lower probability and lower amount of monthly expenditure over time until death.

Figure 4 shows the use probability and monthly expenditure conditional on service use for hospital services over months to death. Use probability and monthly expenditure gradually increased over months, and sharply rose in the last two months. The trend was quite similar to those reported in previous studies. Again older decedents had lower probability and lower amount of monthly expenditure over time until death.

Figure 5 shows the use probability and monthly expenditure conditional on service use for homecare services over months to death. Use probability and monthly expenditure were constant over months until death. Quite contrary to medical service, the probability and amount of expenditure were highest among the oldest category.

Figure 6 shows the use probability and monthly expenditure conditional on service use for institutional services over months to death. Use probability and monthly expenditure were constant over months until death, a trend similar with homecare service. However, the monthly expenditure was not different across age categories, which is a distinctive finding in institutional care. It would be reasonable since institutional care comprises of custodial care and accommodation cost, which should be simply dependent on functional levels rather than on age.

Figure 7 presents annual service use for outpatient care among decedents and survivors. Use probability decreased over age, and constantly was higher among survivors than decedents. The amount of expenditure conditional on probability>0 decreased over age among decedents, though that seemed constant over age among survivors.

Figure 8 exhibits annual service use for hospital care among decedents and survivors. Two points are noted. First, the use probability and expenditure| prob>0

were higher among decedents than among survivors. Second, both probability and expenditure decreased in the older category among decedents, while both probability and expenditure increased over age in the case of survivor elderly.

Figures 9 and 10 respectively show annual service use for homecare and institutional care. Again two points are similarly observed. First, both probability and expenditure|prob>0 increased as age gets older. Second, decedents had higher probability of service use compared to survivors, but expenditure|prob>0 was almost comparable between decedents and survivors.

Figure 11 summarizes average annual expenditure by age, service types, and survivorship. Among decedents, average expenditure on medical care (outpatient and hospital services) drastically decreased over age. However, as increasing expenditure for long-term care cancelled out the difference, and results in moderate decrease in total health cost over age. To the contrary, mainly due to increase in long-term care cost, average total health cost monotonously increased over age in the case of survivors.

For comparative purpose with the result from Werblow, Felder, & Zweifel (2007), we conducted similar analysis, further stratified by long-term care (LTC) use. Results are provided in Figures 12, 13, and 14. Use probability of outpatient service was dependent on LTC use rather than survivorship, and LTC users were less likely use outpatient service. Expenditure|prob>0 was higher in LTC users.(Figure 12)

As with hospital service (Figure 13), use probability was more dependent on survivorship rather than on LTC use. Actually LTC use status does not quite discriminate use probability among survivors. In decedent case, LTC users were less likely to use the service compared to LTC non-users. Expenditure|prob>0 for hospital service seemed more complicated. Decedents spent larger amount of average expenditure than survivors. Decedents with LTC use spent the largest expenditure, and the amount only slightly differed across age category. Decedents without LTC use spent the second largest average expenditure, and the amount decreased drastically over age. For survivors, the expenditure slightly increased over age among LTC users, and slightly decreased over age among LTC non-users. However, as Figure 14 summarizes, LTC use status does not result in remarkable difference in average annual medical expenditure. Instead, survivorship clearly discriminates the expenditure, and it differentially interacts with age category. To be specific, annual expenditure did not vary across age category in case of survivors, while it sharply decreased over age in case of decedents.

Finally, we obtained a rough estimation of the share of total health cost for decedents. The share was 0.100 in age 65-74, 0.124 in age 75-84, and 0.217 in age 85

and over. If we calculated the numbers separately for medical and long-term care, the number was about the same. That is, the share did not different by service type, but was dependent on age.

4. Discussion

Surprisingly, our results look quite similar with those by Polder, Barenderegt, & van Oers (2006) in spite of difference in health care systems and insurance coverage between the Netherlands and Japan. Survivor elderly spent less medical care compared to decedents, but their medical cost did not differ across age. Furthermore, since long-term care increased over age among survivor elderly, total health cost of survivors amounted about 50% of that of decedents among those aged 80 and over. Our results, however, present a different picture of medical expenditure pattern by LTC use status as Werblow, Felder, & Zweifel (2007) reported based on Swiss data. In their case, LTC use was related to larger annual expenditure among decedents, while our case showed the reverse. Swiss case showed that LTC users, both decedents and survivors, spent smaller medical expenditure compared to LTC non-users, again our case showed no remarkable difference by LTC use status. This difference is not surprising since LTC in Swiss data corresponds to medical service for chronic care in Japanese case where medical services provided at long-term care institute are still covered by public medical insurance. Actually, Swiss data failed to incorporate custodial and chronic care provided at home and institutions, while our case as well as the Netherlands case provides a comprehensive data on "total health cost" at the end of life by including both medical and long-term care.

Our results and the results from the Netherlands suggest that although time-to-death is a strong predictor of higher medical expenditure among elderly, and age per se is negatively related to medical expenditure among decedents, long-term care that increases over age among decedents and survivors does contribute to higher health cost among elderly that increases as beneficiary gets older. If we just focus on medical expenditure, time to death, or survivorship in our case, clearly discriminates the amount of expenditure, and age per se is negatively associated with the expenditure, where "red herring" theory may hold true.

Medical care and long-term care play a distinctive function to support lives of elderly in ill conditions. Medical care contributes to longer life by eliminating ill conditions that may lead to death, while long-term care contributes by compensating for lost function in daily lives. By these definitions, it would be simply understandable that medical care cost is more likely to relate to time to death, while long-term care cost is more likely to

related to age.

One could counter-argue that increase of long-term care use over age may also be related to time to death since older people has a shorter time until they die. Although there may be some truth in such an argument, we cannot completely distinguish time to death and age of people in their later life because nobody can tell when they die. In our study, survivors had at least survived at least for 12 months, and their total health cost was still different from that of decedent counterpart in the same age category.

The results presented so far suggested that population ageing would have an impact on increasing social expenditure through increased demand for long-term care. The Implication of these findings for medical and long-term care policy in this country will be that simply substituting long-term care with medical care in the end of life may not automatically lead to efficient resource use, and that policy should be based on clear and distinctive goals of two public services to support the later life of the elderly.

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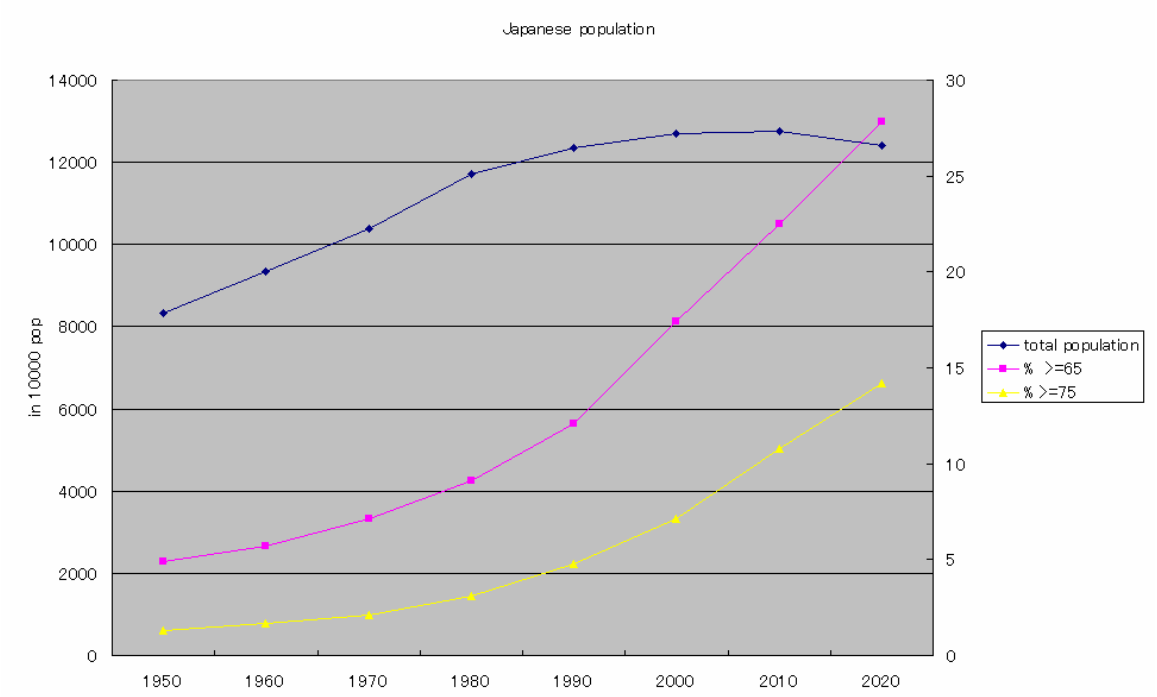
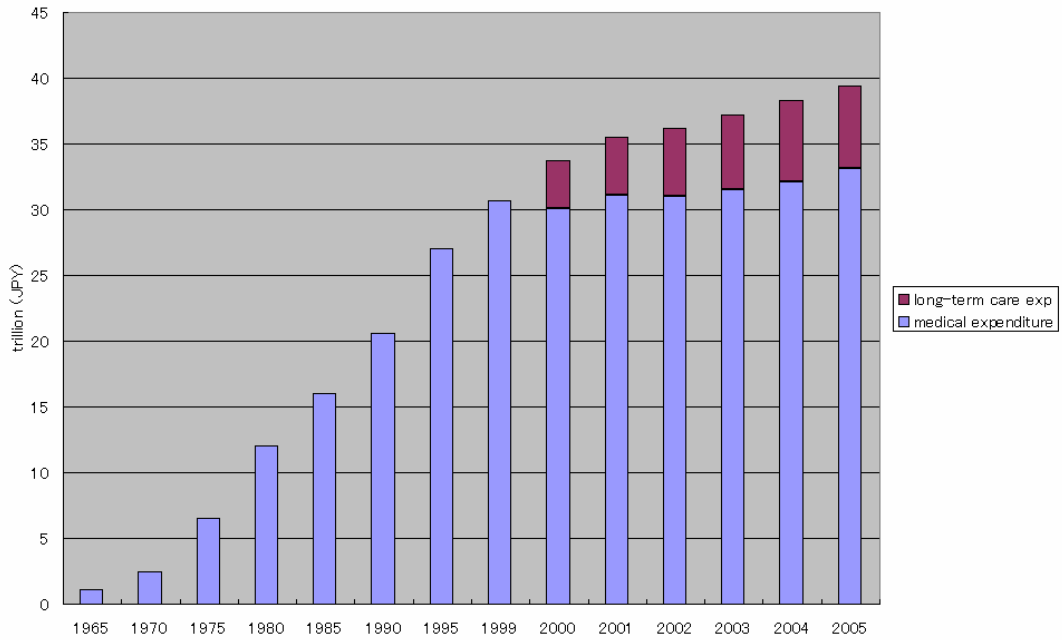
Table 1	Basic characteristics of decedents and survivors					
		Decedents	%		Survivors	%
	Sampled year	2001-2003			Apr.2002-Mar.2003	
	Total number	50,857			364,484	
	Age					
	65-74	8,558	(16.8)		125,941	(34.6)
	75-84	19,968	(39.3)		177,720	(48.7)
	>=85	22,331	(43.9)		60,823	(16.7)
	Death place					
	nursing homes	6,218	(12.2)			
	hospitals	35,199	(69.2)			
	others	9,440	(18.6)			
	Cause of death (available only for subsample)					
	N	3,244				
	Stroke	452	(13.9)			
	Heart disease	392	(12.1)			
	Neoplasm	717	(22.1)			
	Other diseases	1,723	(53.1)			

Figure 1. Proportion of elderly population in Japan; 1950-2020



Data Source; Vital statistics and population projection, National Research Institute of Social Security and Population.

Figure 2. Medical and Long-term Care Expenditure in Japan; 1965-2005



Data Source; National Medical Expenditure and Annual Report of Long-term Care Provision (Ministry of Health, Labour, and Welfare)

Figure 3. Outpatient Service Use and Month to Death

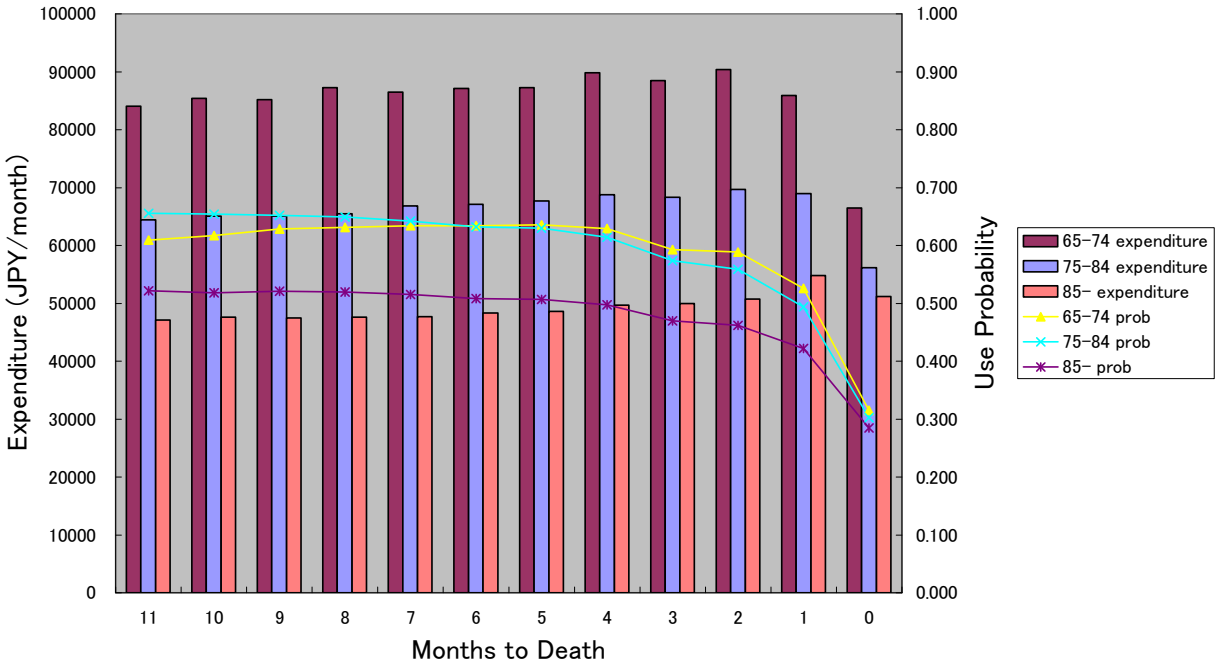


Figure 4. Hospital Service Use and Month to Death

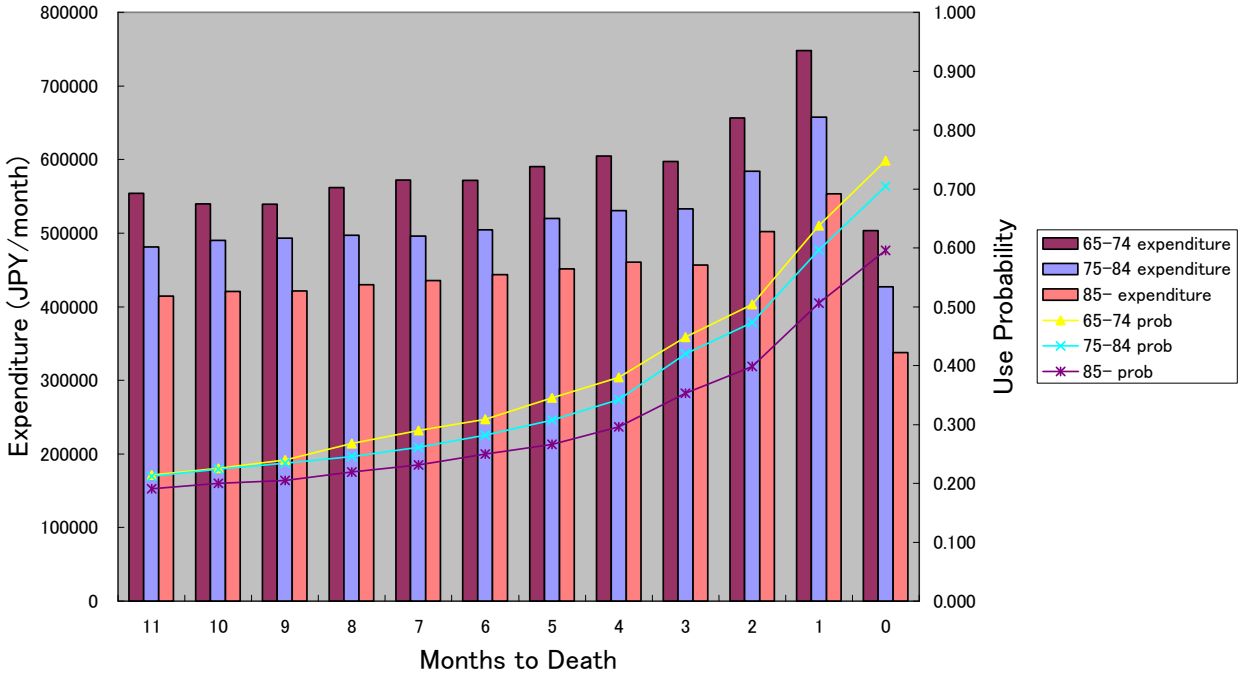


Figure 5. Homecare Use and Month to Death

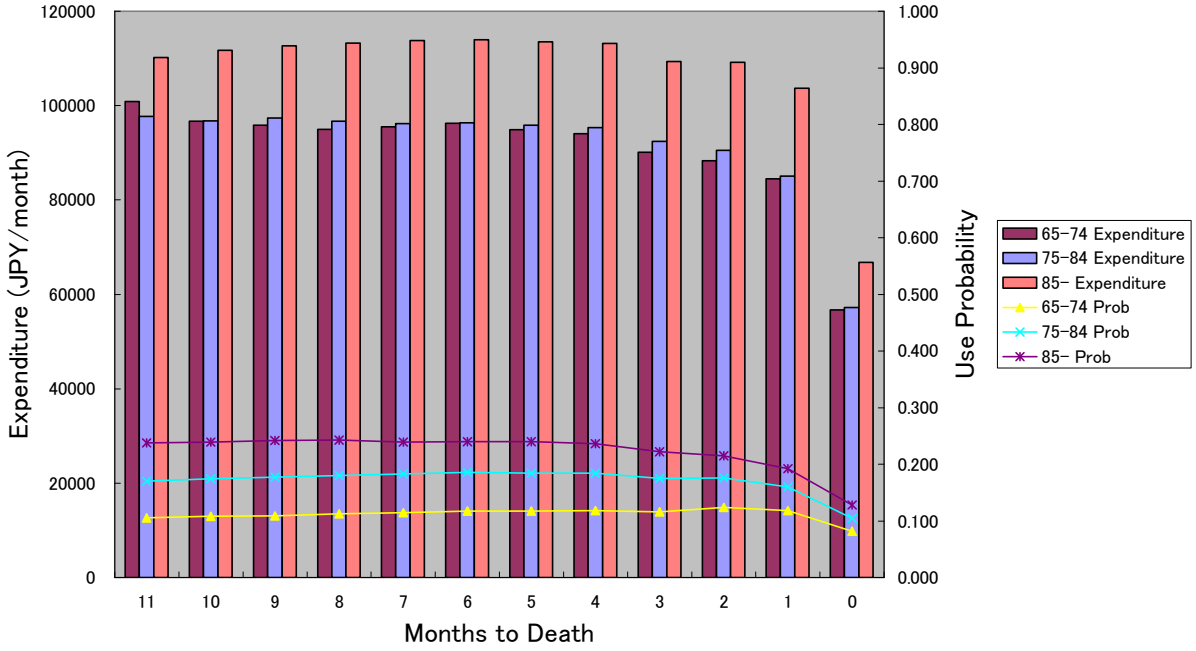


Figure 6. Institutaional Care Service Use and Month to Death

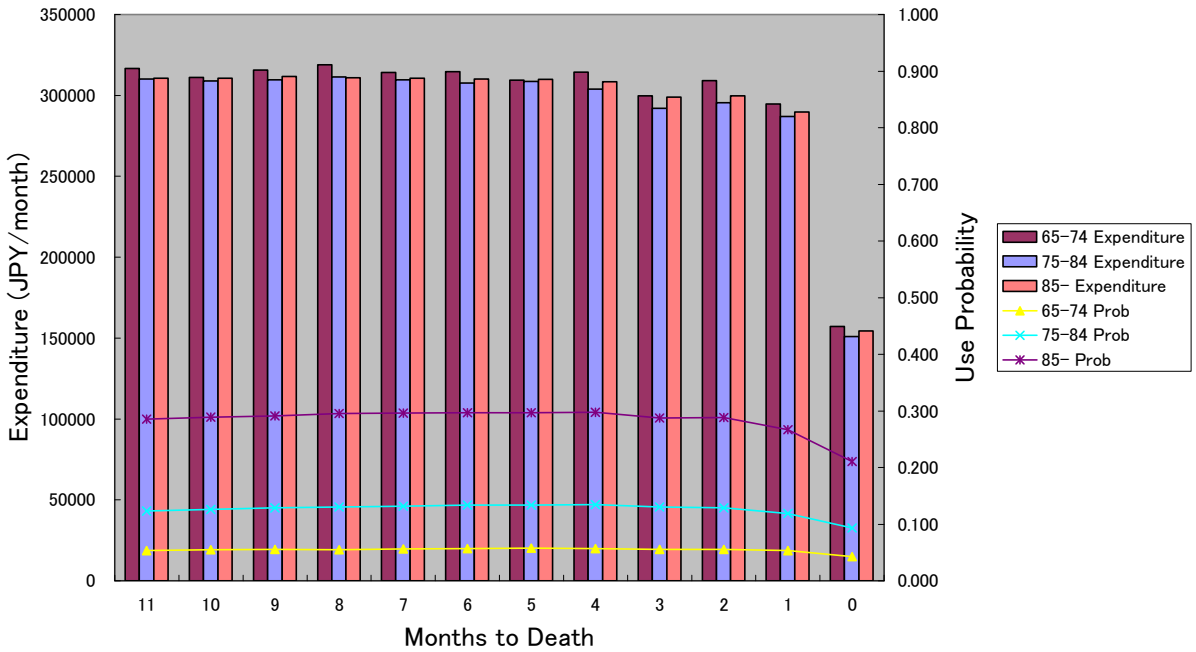


Figure 7. Outpatient Service Use by Survivorship and Age

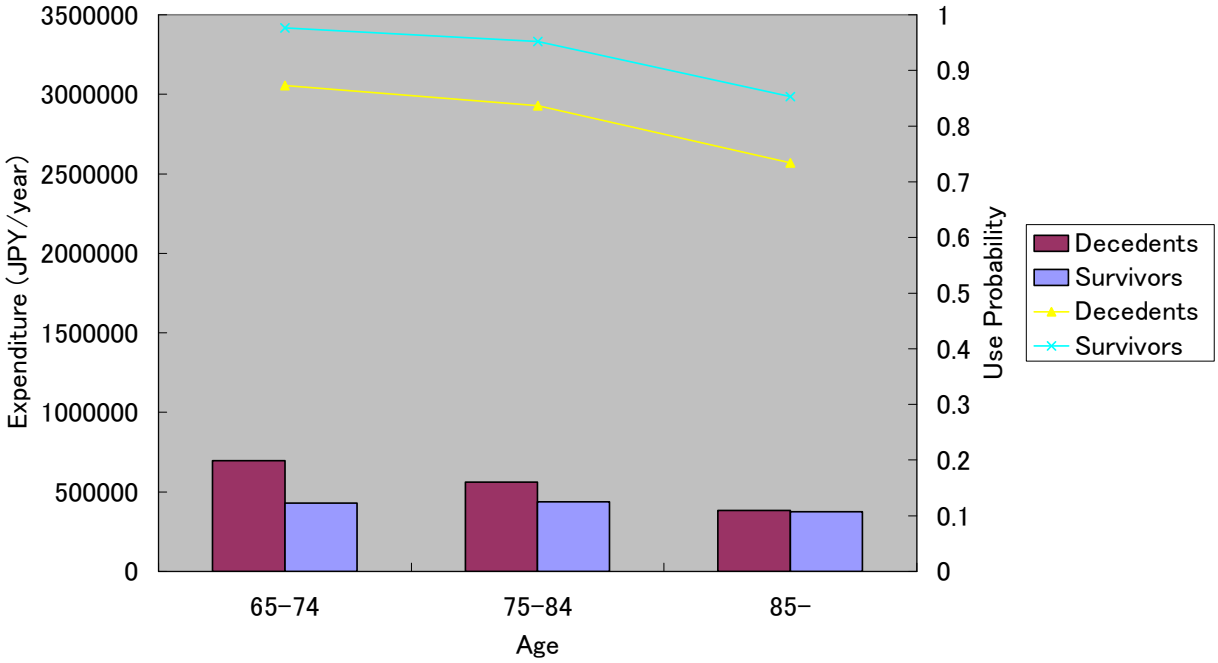


Figure 8. Hospital Service Use by Survivorship and Age

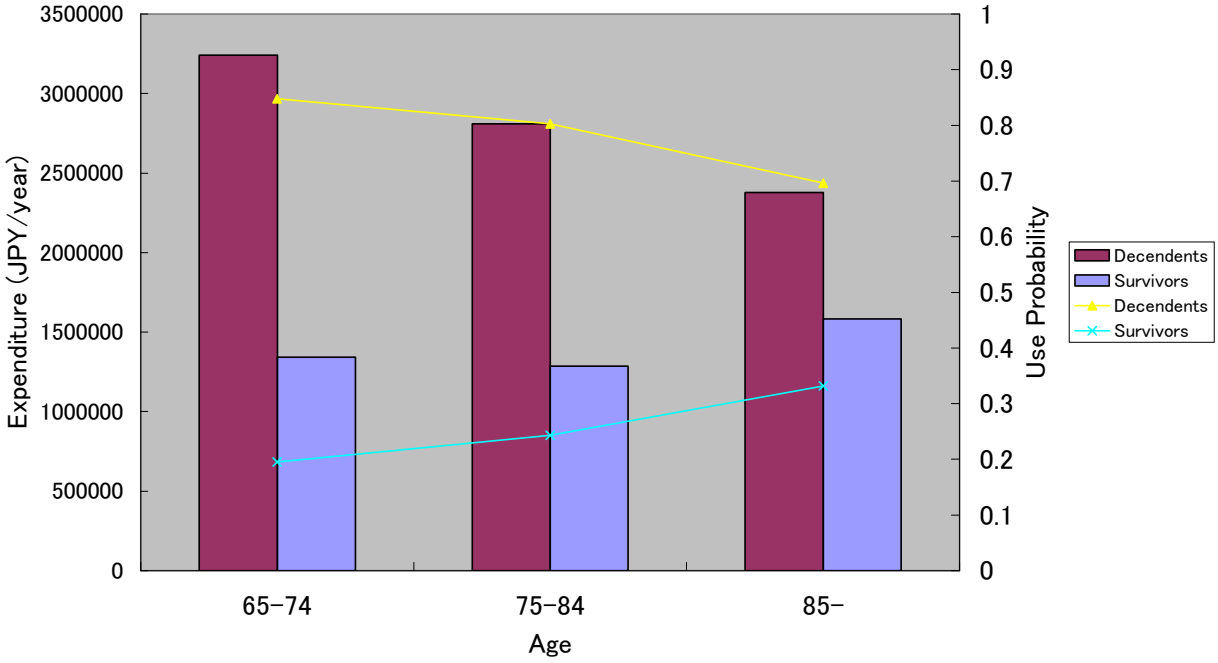


Figure 9. Homecare Service Use by Survivorship and Age

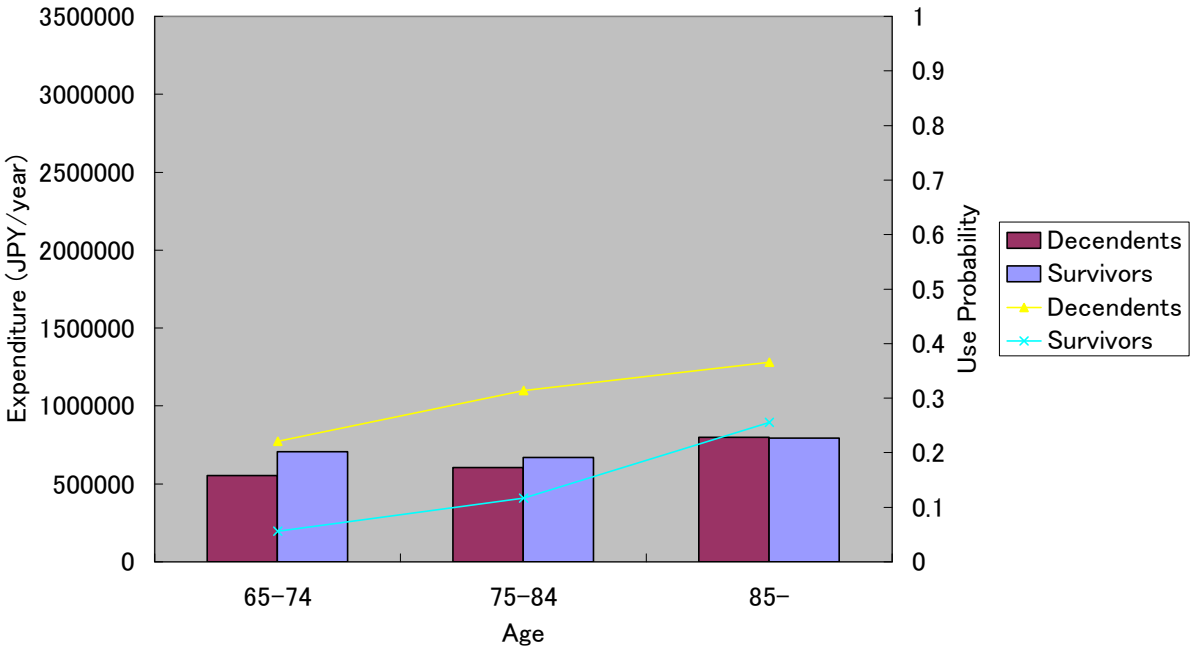


Figure 10. Institutional Care Use by Survivorship and Age

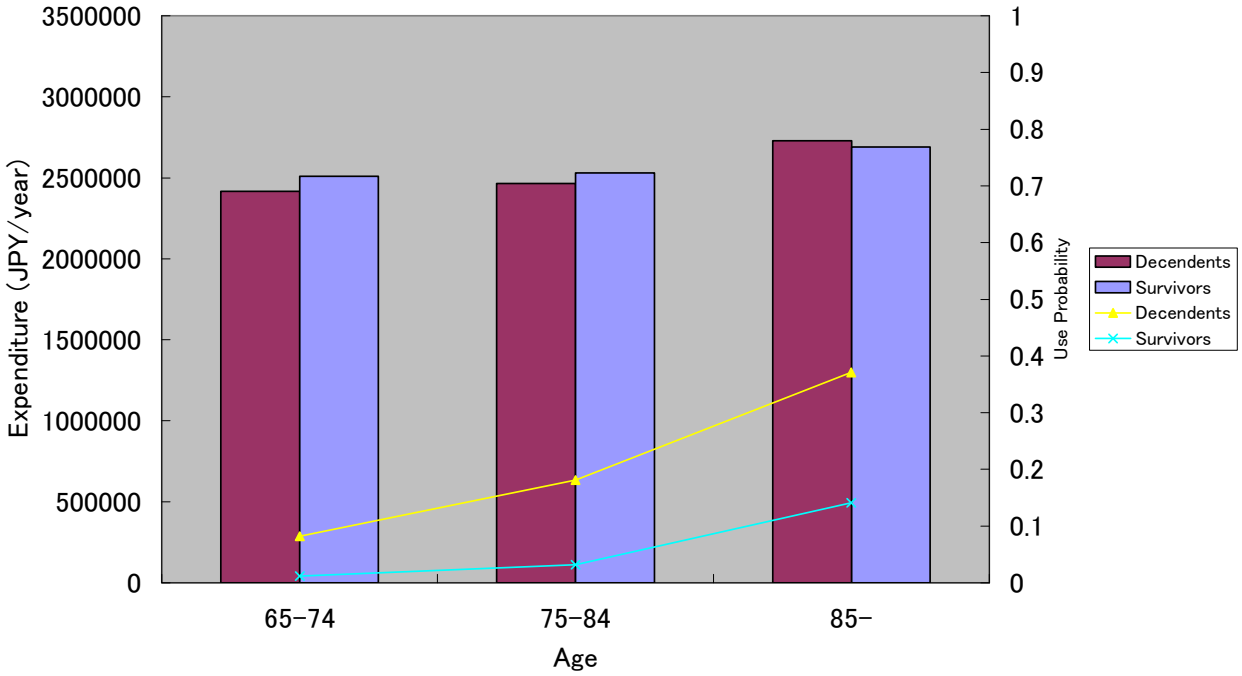


Figure 11. Average Annual Expenditure; by Service Types, Age, and Survivorship

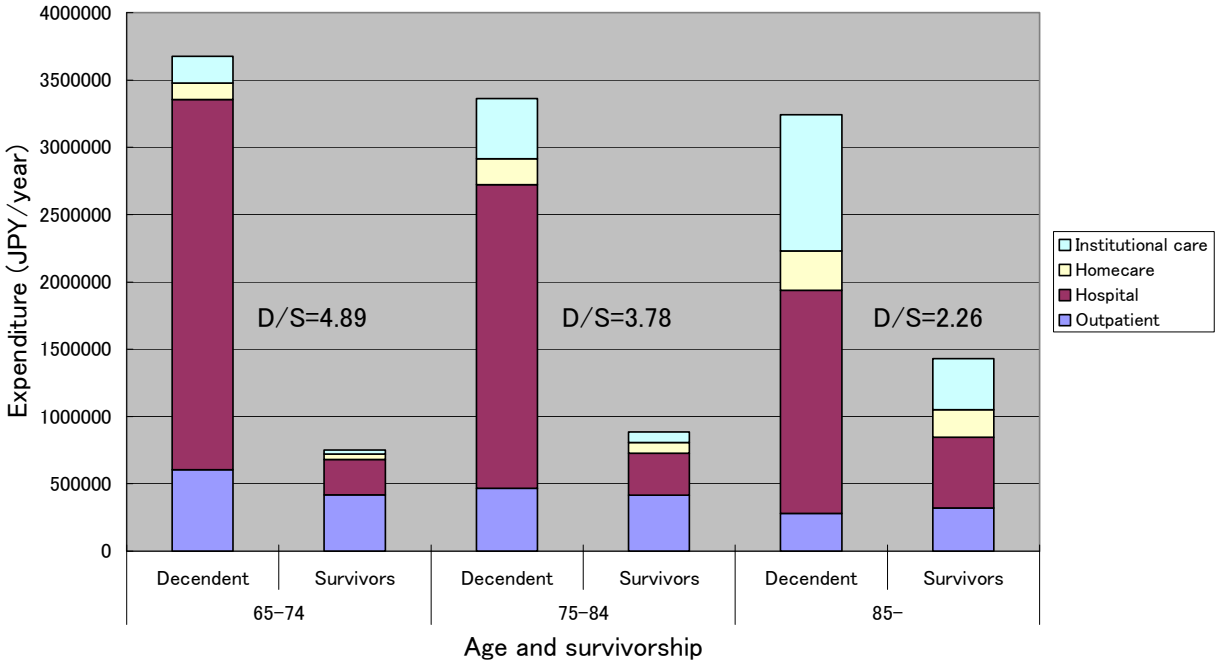


Figure 12. Outpatient Service Use by Age, Survivorship, and LTC use

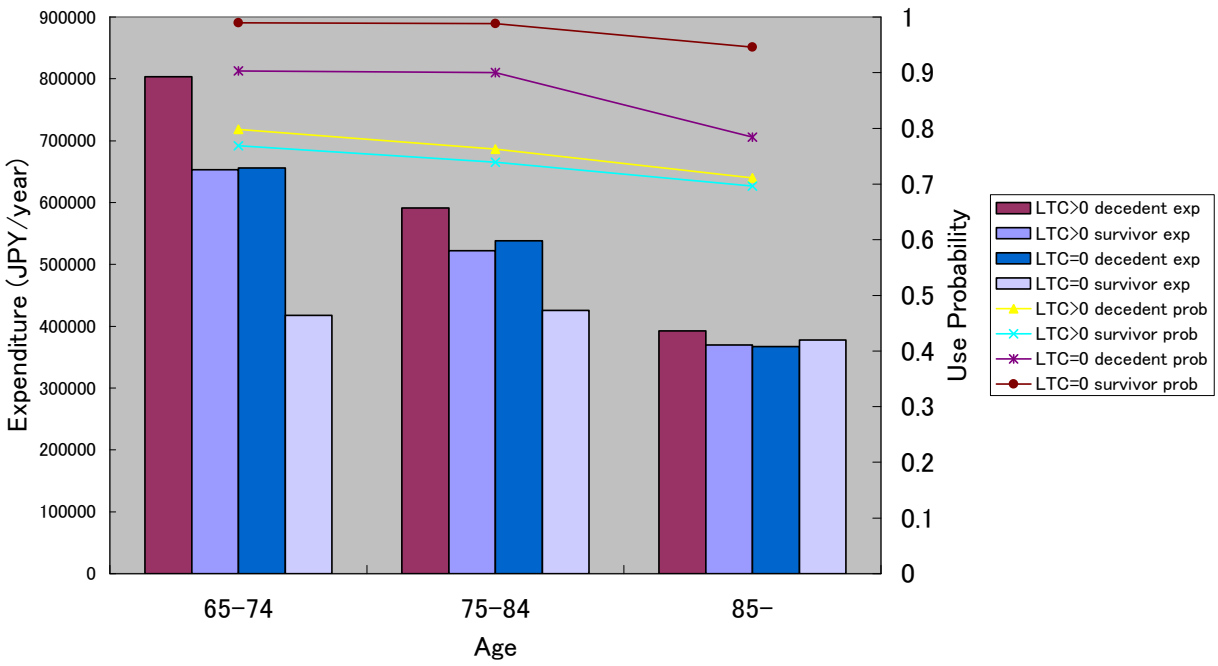


Figure 13. Hospital Service Use by Age, Survivorship, and LTC use

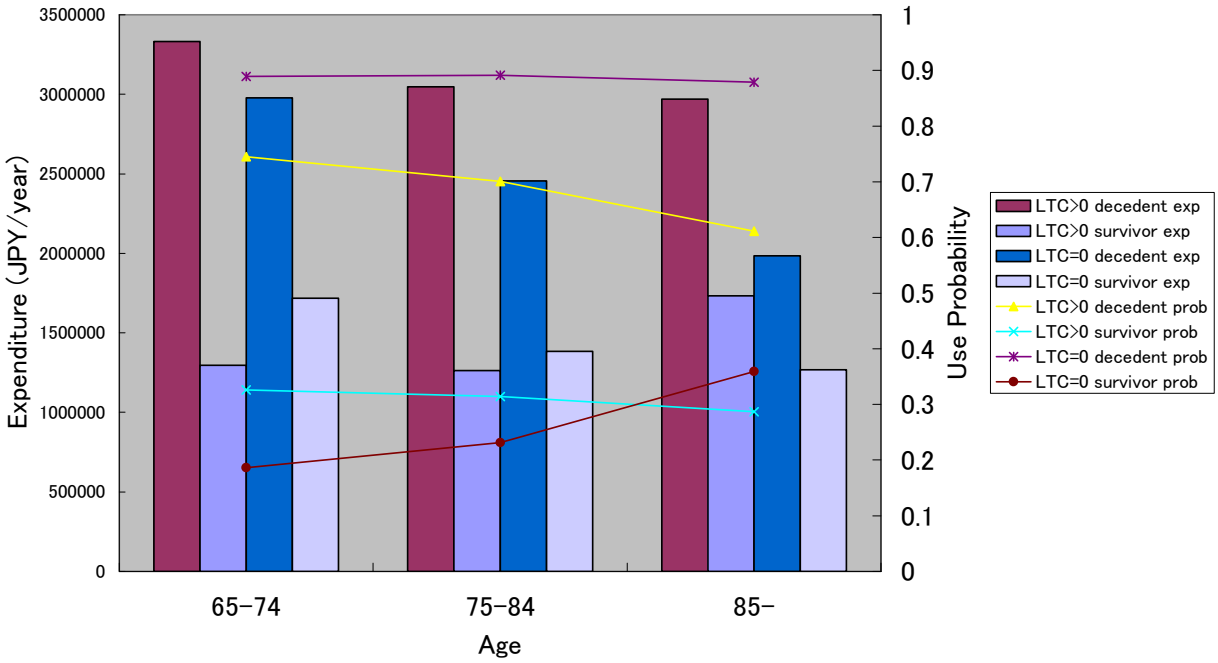


Figure 14. Average Medical Service Use by Age, Survivorship, and LTC use