Mortality Experience of Three Senior Populations
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Executive Summary

Senior mortality, while increasingly relevant to society, is still a mystery to a large extent. This paper examines three distinct populations: the U.S. population, though an annual sample of the Medicare database of the Centers for Disease Control and Prevention (CDC); the life settlement population of an independent life settlement underwriter, 21st Services LLC; and the population implied by the Society of Actuaries' 2008 Valuation Basic Tables (VBT). These three populations exhibit varying characteristics with respect to early duration survival that are consistent with the level of underwriting involvement in each population; however, the mortality/survival rates of all three populations seem to converge within 10 years. Further study of the Medicare data suggests there is a clear wealth effect on survival as evidenced by progressively higher survival rates as the socioeconomic status of the population subgroups increases.

Introduction

Acknowledgements

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Much of the primary research regarding Medicare data was performed by the CDRG and will be published by the group at a later date.

Senior Mortality

Senior mortality is increasingly important and relevant in modern U.S. society. Seniors represent a larger proportion of the population as the baby boom generation matures. Seniors are living longer as well, which accentuates this trend. The impact of this phenomenon is significant. Social insurance systems, such as Medicare and Social Security, are directly impacted. The demand for medical services increases with an older population as well.

Senior insured mortality is challenging to define. Traditional sources of mortality information, such as life insurance experience, do not provide much insight. In the case of life insurance, many seniors no longer need life insurance at advanced ages and, therefore, never apply for coverage. Further, many if not most seniors are rejected in the underwriting process for health reasons and never enter the pool of insured individuals.

The insurance industry's most recent Valuation Basic Tables in 2001 and 2008 graded mortality rates to population mortality rates at the upper ages.

Because of the above, data on senior insured mortality is scarce. Traditional wisdom regarding the select period, the wealth effect on mortality, etc. may apply in the sweet spot of insured data, which is ages 35 to 55. However, intuitively one can accept that these conventions may not apply at ages above 65. As the mortality curve steepens, relationships that hold at younger ages may not hold here. This paper will explore the select period and the wealth effect at older ages. It will also examine mortality (or survival) rates for three different senior populations.

Life Settlement Market

In the late 1990s, the viatical settlement market began to evolve into what is now known as the life settlement market. Viatical settlements were born out of the need for funds of HIV-infected individuals who incurred large medical expenses seeking treatment. If these individuals owned life insurance policies, they sought to sell them to accelerate the death benefit to pay for needed medical care. Often, private individuals would purchase the life insurance policies of HIV-infected people whose life expectancies were three years or less. By discounting expected outflows of premiums and inflows of death benefits, market prices for these insurance policies were determined. The source of these life expectancy estimates was often the insured's personal physicians, who were knowledgeable regarding the insured's health but may not have been independent or expert in actuarial/underwriting matters. With the advent of protease inhibitors, the HIV-infected population saw large increases in life expectancies, which destroyed the market for HIV policies and the market value of portfolios of these policies.

From there, the focus of the secondary life insurance market shifted to impaired seniors. Insureds that no longer needed their insurance policies were offered market values far in excess of statutory cash values and were willing sellers. Due to relatively high transactional costs and long time frames for transactions to close, policy sizes tended to be quite large, often over $1 million of face amount. While pricing methodology remained similar to that utilized by viatical investors, life settlement investors required independent assessment of life expectancies. Life expectancy providers arose to meet this requirement. These companies were independent underwriters who utilized the life insurance industry-accepted debit/credit underwriting model, but with adjustments that reflected a clinical understanding of senior impairments.

However, life expectancy providers did not have significant volumes of life settlement data on which to set their base mortality tables. Therefore, they naturally gravitated to life insurance tables, such as the 2001 VBT. This was a logical result. Both life settlements and life insurance involved underwriting of medical information. As life settlement experience emerged, there were key differences noted. In particular, early duration mortality was much lower than that of the 2001 VBT. Two theories emerged. One stated that the early experience would be offset by much higher mortality in later durations. Another theorized that anti-selection was evident in the life settlement population because insureds who were close to death would not settle their policies and collect a fraction of the face amount that would be payable to beneficiaries upon their death. However, neither theory could be validated at that time due to the small amount of available life settlement.

The life settlement market grew from its inception in 1997 to $12.9 billion (face amount of policies sold) in 2008.[1] With this increase in transactional flow came statistically powerful data and experience data for longer durations. Also in 2008, the SOA released the 2008 VBT, which showed significant mortality improvement from the 2001 VBT. Life expectancy providers produced new mortality tables based on modifications to the 2008 VBT that exhibited lower mortality than their old tables and this led to the revaluation of many life settlement portfolios and it affected market values for life insurance policies on the secondary market. Life expectancy extensions varied by age and gender, with younger, healthy male individuals exhibiting the

largest extensions. Just as the viatical market was shaken by extensions in life expectancies, these events threatened the life settlement industry.

Coupled with the credit crunch in late 2008, these events created a perfect storm to cripple the secondary market for life insurance. The face amount of policies sold fell 46 percent to $7.0 billion.[2] Investors became focused on the life expectancy estimates, which underpinned the valuations of life insurance policies. The issue arose of whether another extension of the magnitude seen in 2008 would occur again. Life expectancy providers, such as 21st Services,[3] pointed to three main reasons for the 2008 extensions:

1. Lack of life expectancy data early on and over-reliance on static life insurance mortality tables;
2. Lower mortality rates in the 2008 VBT relative to the 2001 VBT; and
3. Emerging life settlement experience, which showed lower early duration mortality due to anti-selection on the part of sellers of life insurance policies and the existence of a preferred segment of the life settlement population mixed in with the impaired segment.

As for postulating on future extensions, participants commented that:

1. Advances in health care and medical treatments are certainly probable; however, those of the magnitude necessary to meaningfully influence senior life expectancies are improbable.
2. Life settlement mortality is better defined and the industry has its own tables and does not need to begin with life insurance mortality tables.
3. Mortality improvement factors are used by life expectancy providers, which means that the tables will not become obsolete solely by the passage of time.
4. Although overall mortality levels for life settlement populations are well defined, the data for various impairments is not yet voluminous enough to allow for tight confidence intervals with respect to individual impairments and, therefore, investors should diversify by impairment.

Investors generally received this explanation very well although the question of late duration mortality for life settlement populations remained of keen interest as the immaturity of the life settlement industry means late duration mortality does not exist. A major thrust of this paper is to study the possible convergence of life settlement mortality with that of other more mature populations to determine if a consistent relationship can be observed. Such a relationship would allow for the use of outside data at later durations to supplement the early duration experience observed in the life settlement data. This paper will examine life settlement mortality in more detail and compare it to other populations toward that end.

Review of Literature

Berin, Stolnitz and Tenenbein (1989) provide a historical perspective on U.S. mortality trends. In particular, they focus on the evolution of mortality differences between males and females. Their work provides a firm foundation for research that is beyond the current scope of this paper by examining how survival rates have evolved for each gender. However, the overall trend of consistently increasing survival rates that they observe by gender applies to the overall population as well.

Portnoy (1986) is also focused on differences in male and female longevity. However, her research utilizes Medicare data and she provides support for its use as a credible source of data for longevity research. In particular, the large sample size allows for tight confidence intervals and high statistical significance of the analysis utilizing Medicare data.

Wade (2008) provides a historical context for the increasing numbers of the U.S. population at 65 and older. Although this phenomenon begins with trends in birth rates, many other factors influence the observed improvement in mortality, including medical advances and improvements in education and standard of living that lower mortality rates of the population. Wade also discusses the wealth effect and notes the difficulty in correctly assigning observed mortality improvement to its cause; for example, is it income or education that drives lower mortality or is it that healthier individuals gain easier access to better education and jobs.

Methodology

The Centers for Disease Control and Prevention 5 percent random Medicare sample (approximately 1.2 million individuals) for 1996 forms the basis for the Medicare/U.S. population data in the study. This includes people 70 and older who were alive on Dec. 31, 1996, enrolled in parts A and B continuously from January 1992 through December 1996. To assess its comparability with insured populations, certain adjustments were made. First, any subjects who had enrolled in either an HMO or Medicaid in this period were excluded. Diagnosis codes are not used for billing and collection by medical personnel for HMOs, which precludes their inclusion in this study. Medicaid enrollees are generally of the lowest socio-economic status, which suggests their inclusion in this study, especially when studying the wealth effect; however, the data was not available. These exclusions reduced the sample to approximately 1.1 million individuals. This age group was studied from inception until the present (subject to the normal lag in obtaining Medicare data). Claim history for each individual in the database is available in the Centers for Medicare and Medicaid Services (CMS) standard analytical file. Practically speaking, the follow-up period for the 1996 age group was 10 years.

In this Medicare cohort, we subsequently defined the socioeconomic status (SES) of each subject. Specifically, we identified the median household income (MHI) in each ZIP code, according to the results of the 2000 U.S. Census. We then ranked MHI across all ZIP codes, on a percentile scale (i.e., from 0 to 100). We subsequently defined the SES of each subject as the percentile rank of the MHI in the ZIP code in which the subject resided. With this definition, we divided the Medicare cohorts into 10 sub-cohorts, each representing deciles of the population, ranked by median household income.

The underwriting process for insurance and life settlements involves examination of medical records. In the case of life settlements, an average of five years of records is examined. To replicate this process for Medicare data, the study began in 1992 for this data. The period from 1992-96 was utilized as an observation period to collect medical information. International Classification of Diseases, ninth revision (ICD-9) codes in the data served as the medical records that were analogous to the records available to life settlement underwriting. Because of this, we excluded those participants who were 65 to 69 on Dec. 31, 1996, because those people would not have five years of past medical records available in the database. This cohort is thus defined as subjects of age greater than or equal to 70 years on Dec. 31, 1996, with both continuous Medicare parts A and B coverage from January 1992 to December 1996, and no periods of enrollment in either a health maintenance organization or Medicaid during the interval.

Comorbid conditions were ascertained from Medicare parts A and B administrative claims in the following manner. First, all ICD-9 diagnosis codes from claims were gathered for each subject. All diagnosis codes were rounded to three digits. A condition was defined to be present if a subject submitted either at least one Medicare Part A in-patient, home health, hospice or skilled nursing facility claim during the observation period with the relevant diagnosis code listed therein or at least two Medicare Part A outpatient or Part B claims with the relevant diagnosis code listed therein. Conditions with overall prevalence in the cohort exceeding 0.1 percent (i.e., one in 1,000 subjects) were included in this analysis. For those conditions where

there is no compensation to the doctor for their treatment, the doctor has little incentive to include the ICD-9 code. Although Medicare fraud is also likely, there are penalties for filing fraudulent claims.

Kaplan-Meier techniques were used to develop survival curves for the Medicare population.

The database for life expectancy provider, 21st Services LLC, serves as the basis for life settlement population in the study. It consists of over 77,000 unique individuals, complete with an average of five years of medical records for each life. The U.S. Social Security death database has been searched to determine if any of these people have died. Life settlement populations consist of principally impaired individuals but there are also those who might qualify as preferred class due to the absence of impairments (considering the age of the insured), a vigorous lifestyle (again taking age into consideration) or a favorable family history of longevity. This population includes all those who have been underwritten in anticipation/exploration of a life settlement transaction but that does not mean that every member actually sold a policy on the secondary market. A more relevant population would be the subset of this population that actually sold their policy, but investors have not made this information available to life expectancy providers.

Kaplan-Meier techniques were utilized to develop survival curves for the life settlement population.

The 2008 VBT (age nearest birthday) serves as the basis for insured mortality in the study. Because it reflects individual life insurance mortality of freshly underwritten individuals, adjustments must be made to afford appropriate comparison to life settlement or population data. Where indicated, the table has been age/gender/smoking status to 21st Services' database. Figure 1 presents the age/gender/smoking status breakdown of the 21st Services database. The table labeled LifeIns-1Mult is the 2008 VBT, with age/gender/smoker status matched to the 2009 21st Services' database. This table has an implicit mortality multiplier of 1, suggesting freshly underwritten individuals with no impairments to speak of. Ultimately, additional matched mortality tables will be created for this analysis; for example, a table based on matching mortality multipliers to the 21st Services' database, as well as age, gender and smoking status.

Normalized survival curves are derived by choosing a point in time and resetting the cumulative survival to 100 percent at that point by simply dividing all cumulative survival percentages by the cumulative survival percentage at the point of normalization. This allows for comparison of the slope of the survival curves from the point of normalization. Similar slopes among different populations would suggest similar survival rates.

Discussion

Prevalence of Conditions

Figure 2 presents the most common conditions in the Medicare database and the 21st Services database for all conditions where the prevalence is more than 10 percent. A more complete list of all conditions with prevalence of at least 0.1 percent is included in Appendix 1. The first set of conditions pertains to the Medicare database and the second to the 21st Services database. The odds ratio is calculated as the odds (prevalence / [1 – prevalence]) of the comorbid condition in 21st Services subjects, divided by the odds of the comorbid condition in Medicare subjects. Odds ratios greater than 1 are indicative of relatively higher prevalence of the comorbid condition in 21st Services subjects, while odds ratios less than 1 are indicative of lower prevalence in 21st Services subjects.

While many comorbid conditions show similar prevalence in both databases, others do not. This may be indicative of true differences in the populations but not in all instances. For example, obesity is more prevalent in the 21st Services database than in the Medicare database due presumably to the fact that Medicare does not compensate doctors for treatment of obesity. On the other hand, diseases of the esophagus, many of which are related to smoking, are more prevalent in the Medicare population, which likely includes more smokers than the 21st Services database.

Prevalence of conditions in the life insurance database was unavailable. On one hand, as these individuals had been freshly underwritten, it is logical to assume zero conditions exist. However, this is not likely. For example, in the 21st Services' database, conditions are underwritten for age. For example, virtually all 90-year-olds will exhibit some coronary heart disease. These conditions are assessed relative to what level is expected of a 90-year-old. The condition is noted in the underwriting process, but no additional debits are assessed unless the level of heart disease is greater than what is expected of a 90-year-old. Another way of looking at this issue is from the standpoint of the base mortality table. In the 21st Services' table, certain age-appropriate levels of conditions are built into those tables. The same might be true of life insurance mortality tables.

Survival Curves for Three Senior Populations

Figure 3 illustrates survival curves for three senior populations. Two curves are presented for the life settlement population—both observed and predicted from a pooled age/gender matched cohort of 21st data and SES 90th to 99th percentile data. The latter curve allows for a more complete view of later-duration mortality, where data is scarce in the observed population. The life insurance curve is derived from the 2008 VBT ANB with a mortality multiplier of 1 that was age/gender/smoking status matched to the life settlements population. The Medicare survival curve is also age and gender matched to the life settlement population.

Convergence of Survival Curves in Later Durations

Figures 4 and 5 present the survival curves in Figure 1, normalized after 72 and 84 months. Figure 6 presents three of the survival curves normalized after 96 months. The 21st Observed curve was omitted as its volatility was evident in this portion of the graph. The 21st Predicted curve is well within the confidence interval of the observed experience.

The Wealth Effect in Medicare Population

It is accepted that wealthy individuals exhibit higher survival than those who are less well off. Figure 7 presents a breakdown of the Medicare database into 10 groups. Each group represents a tenth of the Medicare population, ranked by average household income. Comparisons of survival curves among these groups will provide data to analyze whether a wealth effect is evident in the Medicare population. By noting the point in time where each decile subgroup passes the same cumulative survival percentages, the wealth effect can be studied. For example, if the wealthiest subgroup crossed 80 percent cumulative survival at the same point as the poorest subgroup that would suggest no wealth effect was present. If, on the other hand, the wealthiest subgroup passed 80 percent cumulative survival much later than the poorest subgroup, that would support the existence of a wealth effect.

Figures 8 through 12 provide further breakdowns of male population experience, broken by both SES and age. Each figure illustrates the wealth effect for quinquennial age groups, beginning with ages 70 to 74 and ending with 90 and older. Data is less plentiful at the older ages, introducing increasing levels of statistical fluctuation.

Early Duration Differences in Survival Curves

Figure 13 presents a graphical representation of early duration survival rates between the general population and the life settlement population. It has been theorized that insureds considering selling their policies on the secondary market exhibit higher survival rates because those insureds who feel that their death is close at hand will avoid selling their policy (and receiving a fraction of the face amount) if at all possible.[4] To test this theory, we noted the points at which the cumulative survival curves cross 90 percent, 80 percent, 70 percent and so on. The difference, expressed in months, is a measure of the anti-selection effect.

It is possible to attribute some of this difference to the fact that the Medicare population is of a lower average socioeconomic status than the life settlement population.

Results

Survival Curves for Three Senior Populations

The survival curves follow a predictable pattern with population data exhibiting the lowest cumulative survival of any cohort in this study. The life insurance proxy, on the other hand, exhibits the highest cumulative survival, which is intuitively consistent. Insured individuals are underwritten and only those who are not impaired are issued policies. The life settlement population cumulative survival fits in between the others. As this population consists of people who once qualified for life insurance policies, it is expected that they experience lower cumulative survival patterns than the insured population. The life settlement population is also presumed to be among the highest socio-economic status, due to the relatively large face amounts involved. The general population proxy exhibits the lowest cumulative survival as this population includes those who never qualified for life insurance as well as those who have.

Convergence of Survival Curves in Later Durations

A review of Figure 3 suggests that there were significant differences in early duration survival among the populations studied. However, as the duration increases, it appears that the slopes of the four survival curves tend to converge, indicating that mortality rates converge after a point in time. Figures 4 and 5, normalized after 72 and 84 months, respectively, show close convergence among all four populations. However, the life insurance population still exhibits slightly higher survival rates at those points. Figure 6 shows that after 96 months, mortality converges for all subject populations.

The 2008 VBT exhibits a select period that varies at older ages from 20 years at age 70 to zero at age 90. This differs from the observed select periods in the underlying data, which range from approximately 20 years at age 70 to four years at age 90.[5] Observed convergence of male data suggests similar patterns as that of the data underlying the VBT.

The Wealth Effect in Medicare Population

Figure 7 illustrates clear differences in the Medicare survival curves when the data is broken down by socio-economic status. Although the general shape of the survival curves of each decile of the Medicare population is similar, the wealthiest subgroup's survival curve is at the far right, the poorest is at the far left and the others fall in line between those extremes in order of socio-economic level. The segment representing the tenth of the population with the highest household income enjoys meaningfully higher survival rates than the poorest segment over the study period. The wealth effect increases as the cumulative survival rate declines, with the difference between the lowest SES and highest SES increasing to 13 months at the point where 50 percent of each population remains.

Male population data broken down by quinquennial ages and SES shows that the wealth effect reduces as age increases. The wealth effect at 70 percent cumulative survival is 24 months for ages 70 to 74, but shrinks to four months by age 85. Similar observations can be made at 60 percent cumulative survival.

Anti-Selection in Early Durations

As seen in Figure 13, the population survival curve approaches 90 percent cumulative survival after 22 months, which is 21 months earlier than life settlement populations. At 80 percent, the difference is 24 months, which remains relatively stable thereafter. Further research on the relationship between the life settlement population and the life insurance population is indicated; however, this is beyond the scope of this paper due to the need to match the populations for the degree of impairment.

As noted above, it is possible to ascribe some of the observed anti-selection in early durations to the wealth effect because the Medicare population in Figure 13 includes all socio-economic segments while the life settlements population presumably includes only high wealth individuals. Inferring from Figure 7, where SES is broken out, and applying this inference to Figure 13, it is possible to conclude that five to six months of anti-selection are due to the wealth effect.

Conclusions

1. Mortality among life settlement, life insurance and general populations is quite different from the onset, due to many factors, primarily selection, time since underwriting, impairments and the wealth effect.

2. Mortality rates for these populations converge over time and become very similar, suggesting that whatever early duration factors are present, these factors wear off.

3. The convergence of mortality between older insured individuals, be they from traditional individual life insurance or life settlement populations, and seniors in the general population occurs much sooner than the typical 25-year select period prevalent in life insurance populations and tables. Further study is ongoing to better define the select period in these populations.

4. The wealth effect is evident in Medicare population data, and it progressively increases with SES.

5. The wealth effect is most pronounced at younger ages (70 to 74) and stabilizes after age 85.

Figures

Appendices

1. Prevalence of all conditions in the 21st Services' and Medicare databases with 0.1 percent or greater prevalence.

2. 21st Services' Client Notes, February 2010.

References

Berin, Barnet N., George J. Stolnitz, and Aaron Tenenbein. 1989. "Mortality Trends of Males and Females over the Ages," *Transactions of the Society of Actuaries* 41: 9-27.

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Endnotes

1. U.S. Government Accountability Office Special Report to the U.S. Senate Committee on Aging, July 2010.

2. Ibid.

3. See, for example, Appendix 2 for 21st Services' Client Notes on the subject.

4. Ibid.

5. The Society of Actuaries, 2008 Valuation Basic Table Report and Tables, 12-13.

Figure 1

Composition of the 21st Services Data Base

	Count				Percentage			
Age	MN	MS	FN	FS	MN	MS	FN	FS
65	641	81	222	20	66.5%	8.4%	23.0%	2.1%
66	887	94	335	17	66.5%	7.1%	25.1%	1.3%
67	992	83	405	16	66.3%	5.5%	27.1%	1.1%
68	1,212	103	514	32	65.1%	5.5%	27.6%	1.7%
69	1,459	114	692	20	63.9%	5.0%	30.3%	0.9%
70	2,194	145	1,141	31	62.5%	4.1%	32.5%	0.9%
71	2,326	157	1,475	49	58.0%	3.9%	36.8%	1.2%
72	2,494	164	1,506	40	59.3%	3.9%	35.8%	1.0%
73	2,863	164	1,560	46	61.8%	3.5%	33.7%	1.0%
74	2,862	191	1,672	56	59.9%	4.0%	35.0%	1.2%
75	2,939	157	1,769	47	59.8%	3.2%	36.0%	1.0%
76	2,871	157	2,127	59	55.1%	3.0%	40.8%	1.1%
77	2,804	135	2,132	53	54.7%	2.6%	41.6%	1.0%
78	2,629	97	2,040	58	54.5%	2.0%	42.3%	1.2%
79	2,553	96	1,851	43	56.2%	2.1%	40.7%	0.9%
80	2,398	91	1,784	36	55.7%	2.1%	41.4%	0.8%
81	2,112	70	1,632	27	55.0%	1.8%	42.5%	0.7%
82	1,850	50	1,432	32	55.0%	1.5%	42.6%	1.0%
83	1,553	49	1,326	21	52.7%	1.7%	45.0%	0.7%
84	1,309	32	1,088	31	53.2%	1.3%	44.2%	1.3%
85	1,046	36	898	13	52.5%	1.8%	45.1%	0.7%
86	806	26	682	3	53.1%	1.7%	45.0%	0.2%
87	504	20	503	6	48.8%	1.9%	48.7%	0.6%
88	391	9	359	8	51.0%	1.2%	46.8%	1.0%
89	265	8	254	2	50.1%	1.5%	48.0%	0.4%
90	177	8	160	3	50.9%	2.3%	46.0%	0.9%
91	116	2	123	2	47.7%	0.8%	50.6%	0.8%
92	49	-	65	-	43.0%	0.0%	57.0%	0.0%
93	32	2	29	2	49.2%	3.1%	44.6%	3.1%
94	9	-	30	1	22.5%	0.0%	75.0%	2.5%
95	9	-	14	1	37.5%	0.0%	58.3%	4.2%
96	3	-	3	3	33.3%	0.0%	33.3%	33.3%
97	1	-	4	1	16.7%	0.0%	66.7%	16.7%
98	1	-	1	1	33.3%	0.0%	33.3%	33.3%
Total	44,357	2,341	29,828	780	57.4%	3.0%	38.6%	1.0%

Figure 2

Conditions Prevalent in >10% of Each Population

Medicare

ICD-9	Disease	% Having Condition Medicare	21st Services	OR
401	ESSENTIAL HYPERTENSION	60.89	65.43	1.22
786	SYMPTOMS INVOLVING RESPIRATORY SYSTEM AND OTHER CHEST SYMPTOMS	47.92	3.54	0.04
780	GENERAL SYMPTOMS	38.59	21.15	0.43
272	DISORDERS OF LIPID METABOLISM	34.09	75.41	5.93
414	OTHER FORMS OF CHRONIC ISCHEMIC HEART DISEASE	31.27	23.74	0.68
427	CARDIAC DYSRHYTHMIAS	26.80	11.30	0.35
729	OTHER DISORDERS OF SOFT TISSUES	19.52	0.16	0.01
285	OTHER AND UNSPECIFIED ANEMIAS	19.29	3.61	0.16
250	DIABETES MELLITUS	18.74	12.67	0.63
428	HEART FAILURE	16.96	2.67	0.13
429	ILL-DEFINED DESCRIPTIONS AND COMPLICATIONS OF HEART DISEASE	15.94	29.58	2.21
413	ANGINA PECTORIS	13.15	1.07	0.07
787	SYMPTOMS INVOLVING DIGESTIVE SYSTEM	12.44	2.84	0.21
530	DISEASES OF ESOPHAGUS	11.76	1.42	0.11
785	SYMPTOMS INVOLVING CARDIOVASCULAR SYSTEM	11.71	0.47	0.04
424	OTHER DISEASES OF ENDOCARDIUM	11.00	8.27	0.73
733	OTHER DISORDERS OF BONE AND CARTILAGE	10.89	13.00	1.22

21st Services

ICD-9	Disease	Medicare	21st Services	OR
272	DISORDERS OF LIPID METABOLISM	34.09	75.41	5.93
401	ESSENTIAL HYPERTENSION	60.89	65.43	1.22
429	ILL-DEFINED DESCRIPTIONS AND COMPLICATIONS OF HEART DISEASE	15.94	29.58	2.21
414	OTHER FORMS OF CHRONIC ISCHEMIC HEART DISEASE	31.27	23.74	0.68
780	GENERAL SYMPTOMS	38.59	21.15	0.43
278	OVERWEIGHT, OBESITY, AND OTHER HYPERALIMENTATION	2.86	14.95	5.98
585	CHRONIC KIDNEY DISEASE (CKD)	1.48	14.10	10.96
733	OTHER DISORDERS OF BONE AND CARTILAGE	10.89	13.00	1.22
250	DIABETES MELLITUS	18.74	12.67	0.63
427	CARDIAC DYSRHYTHMIAS	26.80	11.30	0.35
435	TRANSIENT CEREBRAL ISCHEMIA	7.55	10.63	1.46

Figure 3 - Cumulative Survival

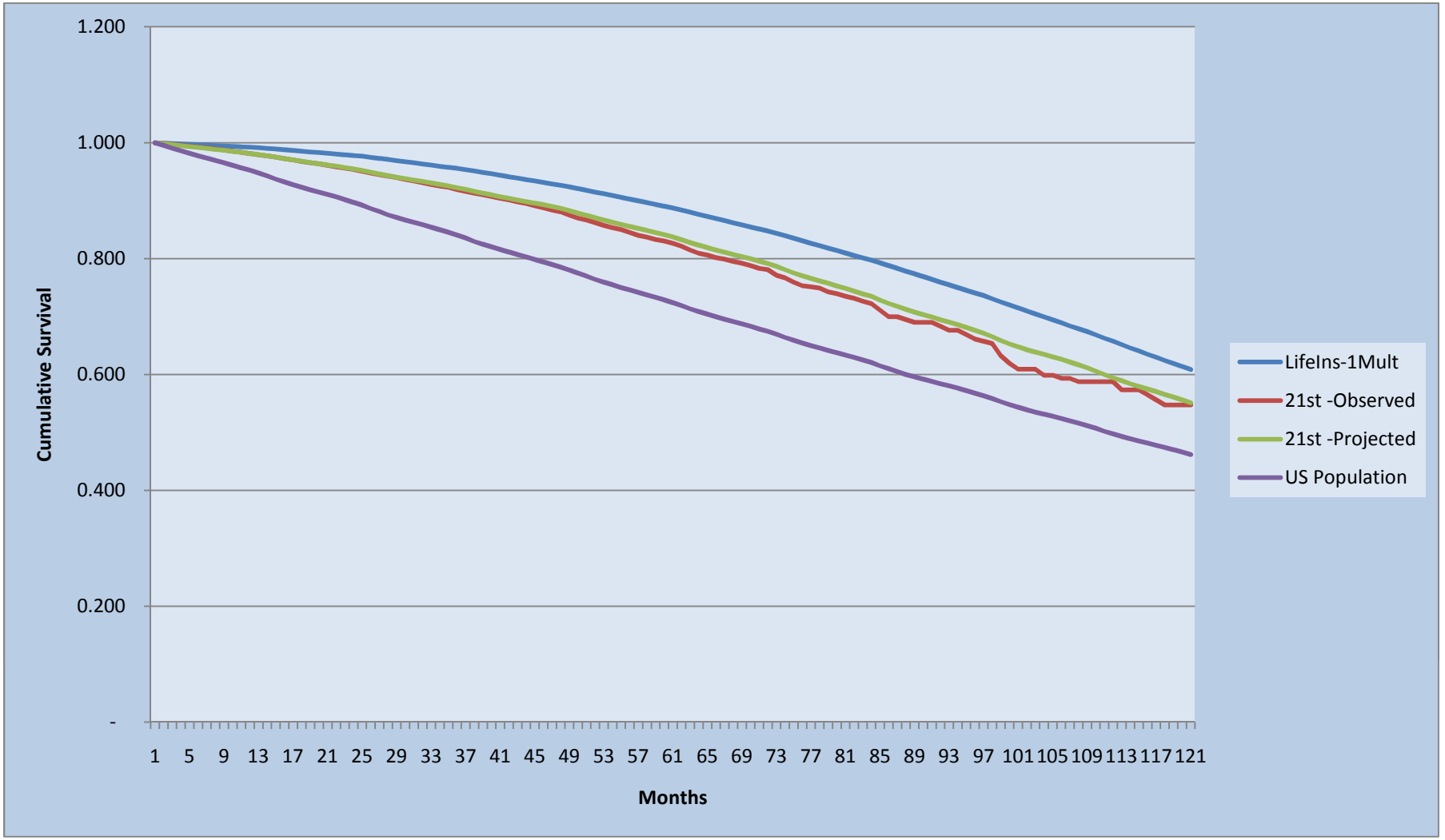


Figure 4 - Cumulative Survival Normalized After 72 Months

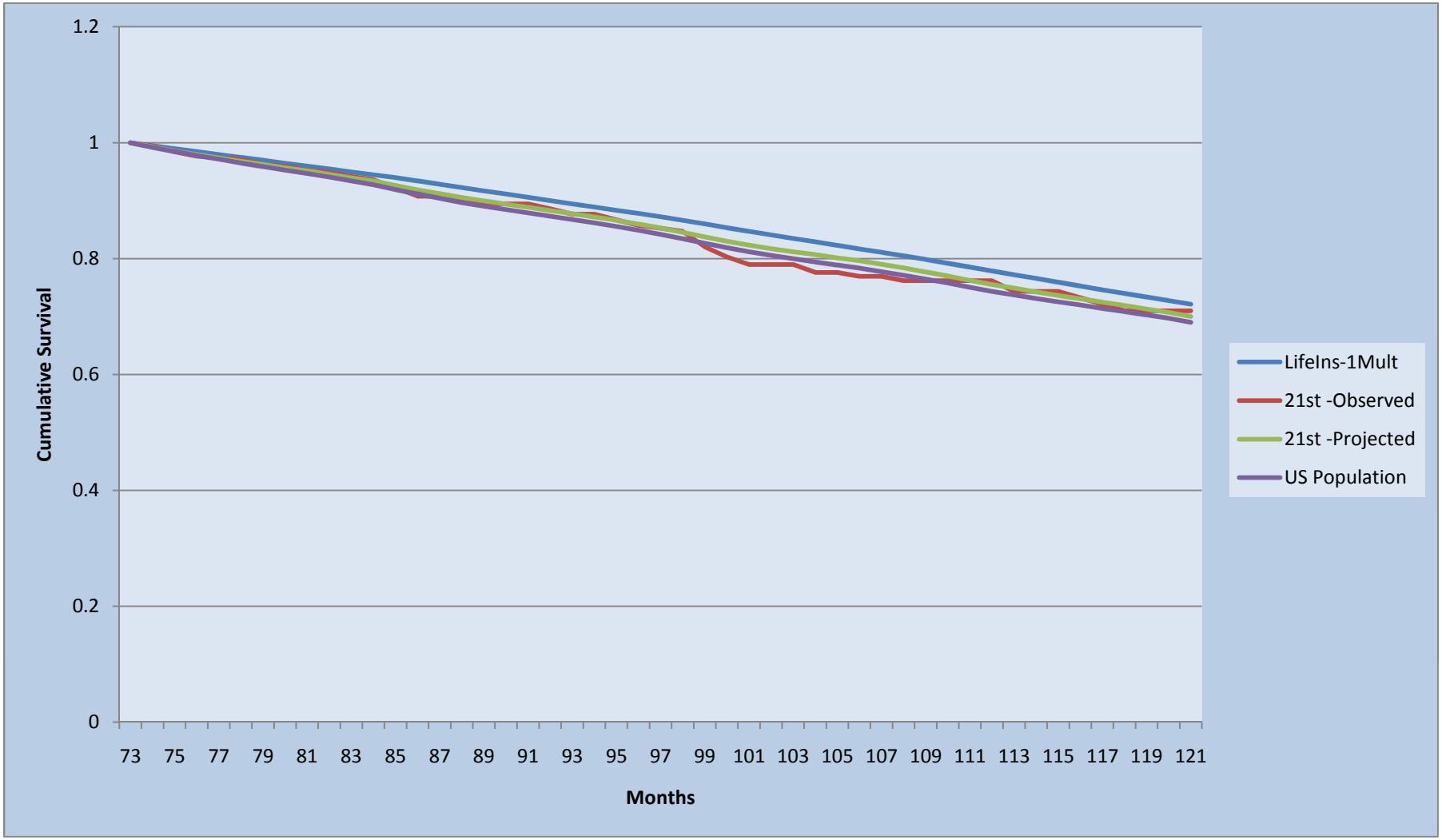


Figure 5 - Cumulative Survival Normalized After 84 Months

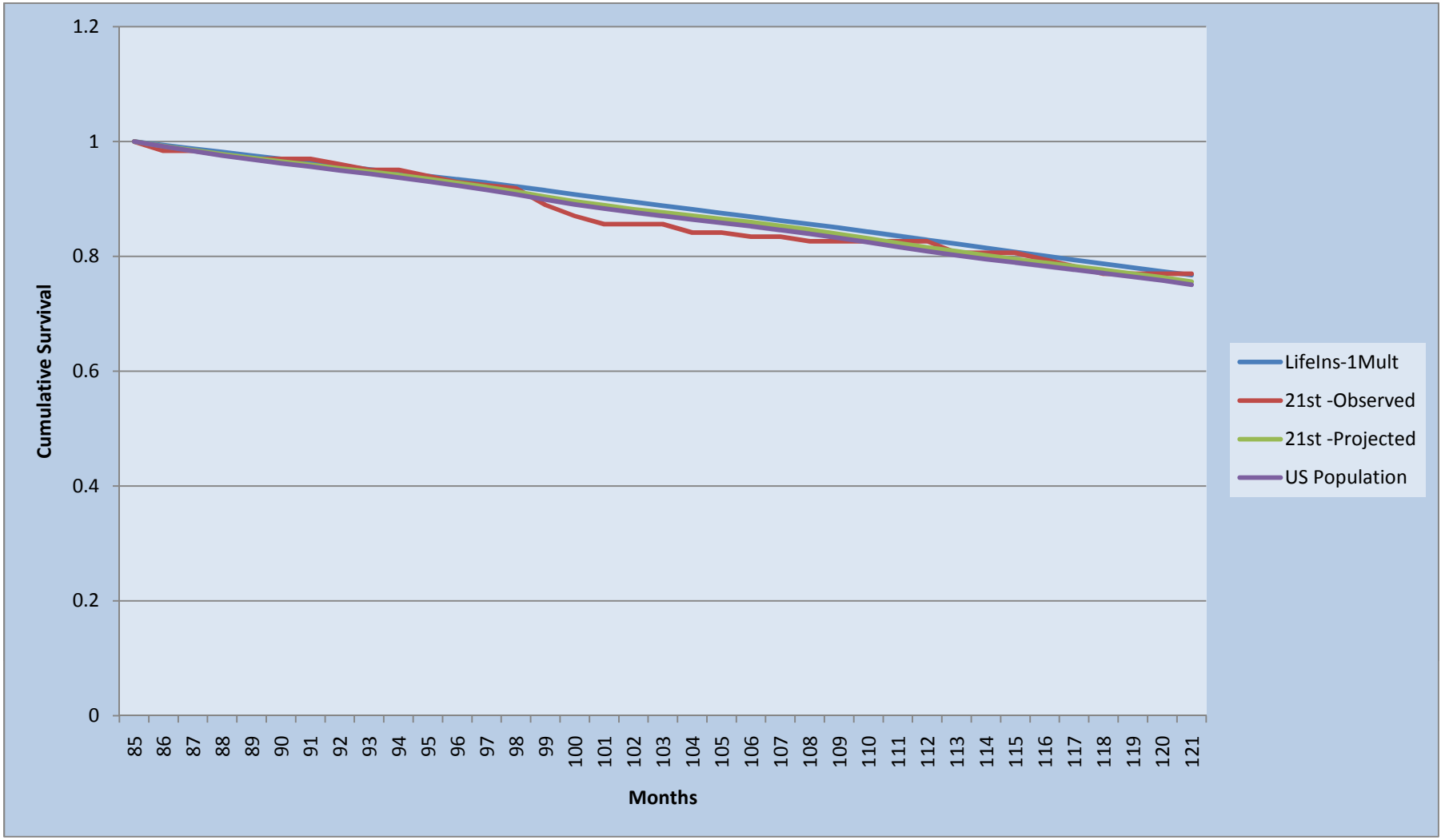


Figure 6 - Cumulative Survival Normalized After 96 Months

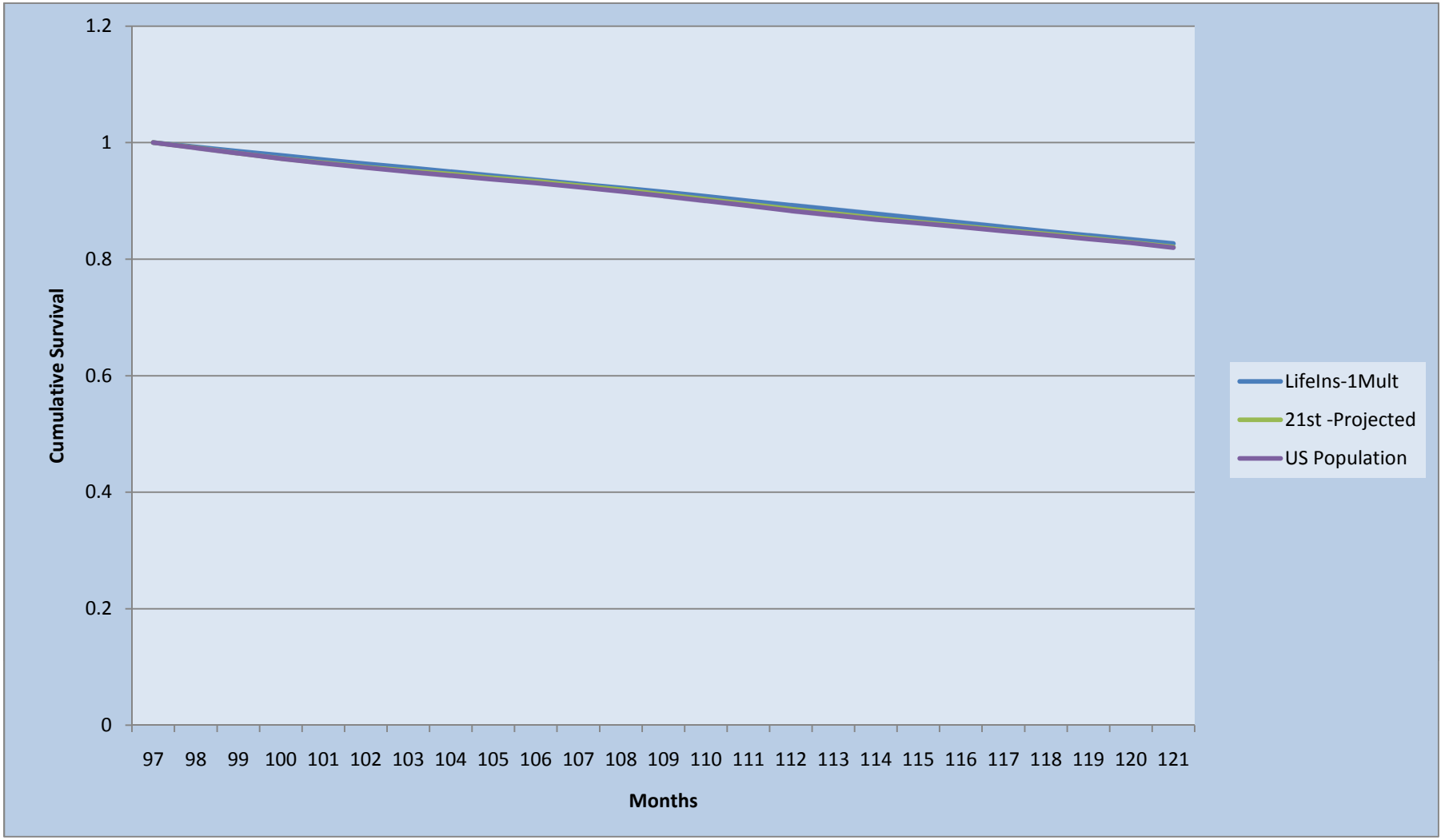
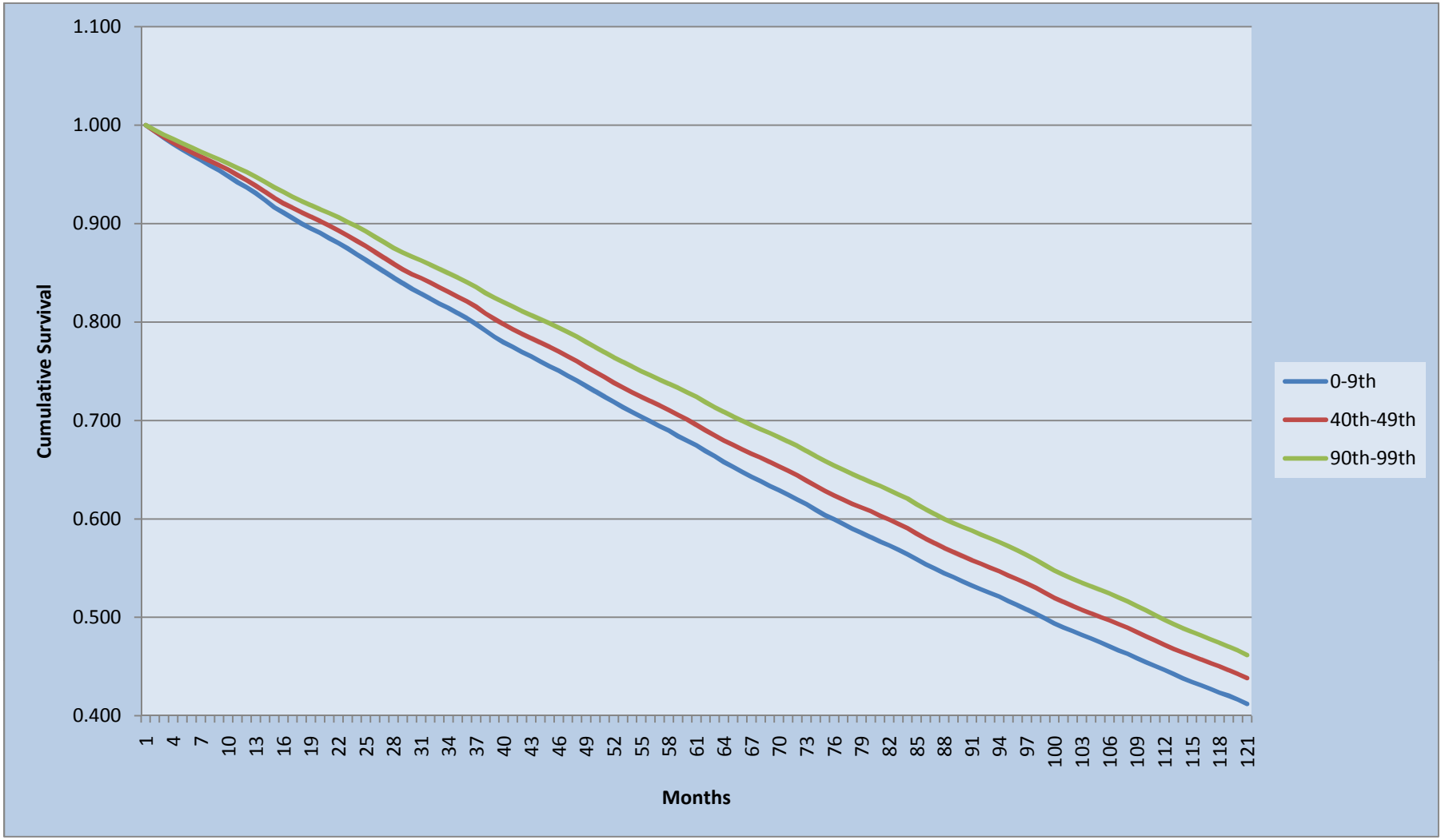
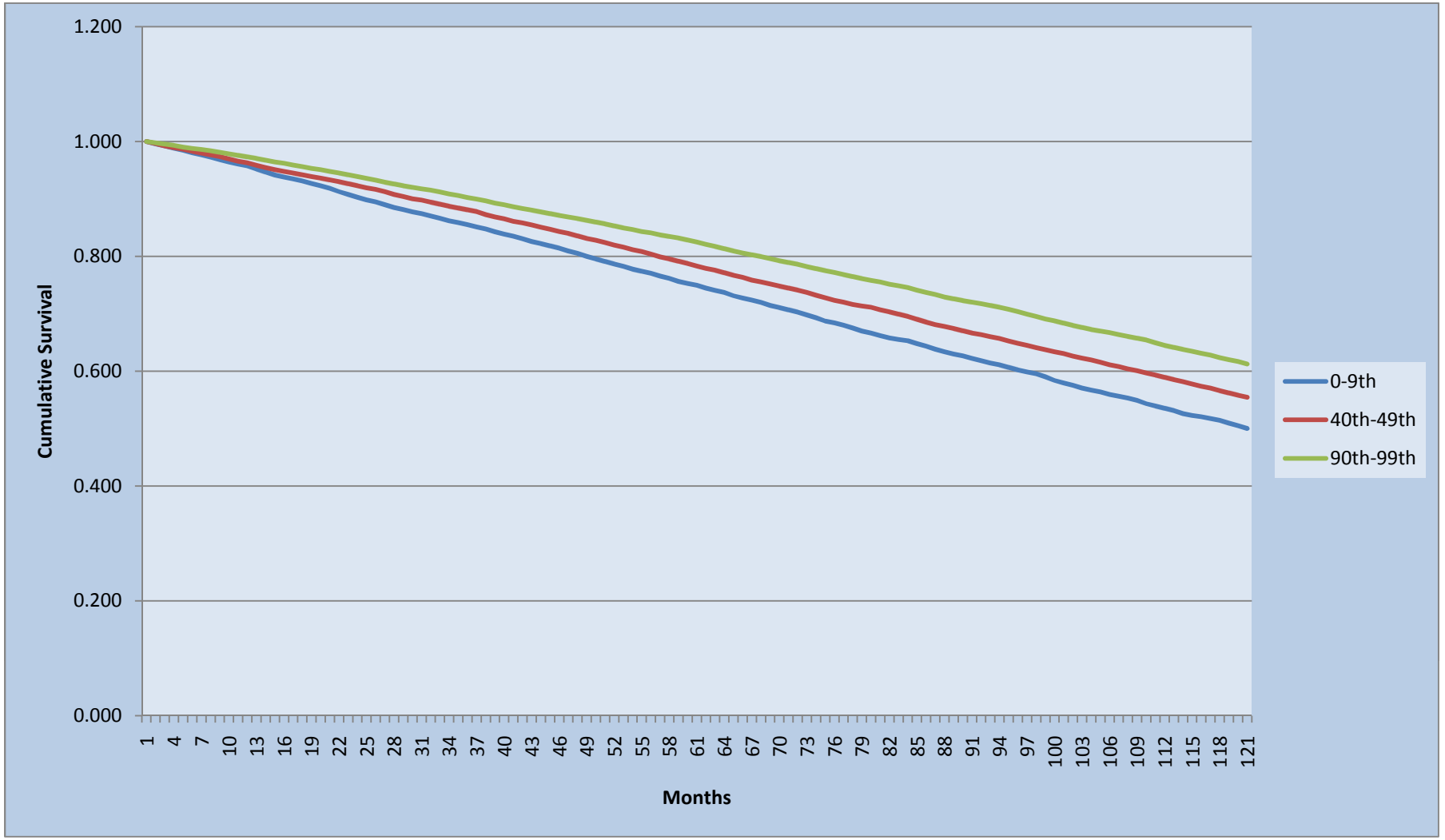


Figure 7 - Wealth Effect in Medicare Data



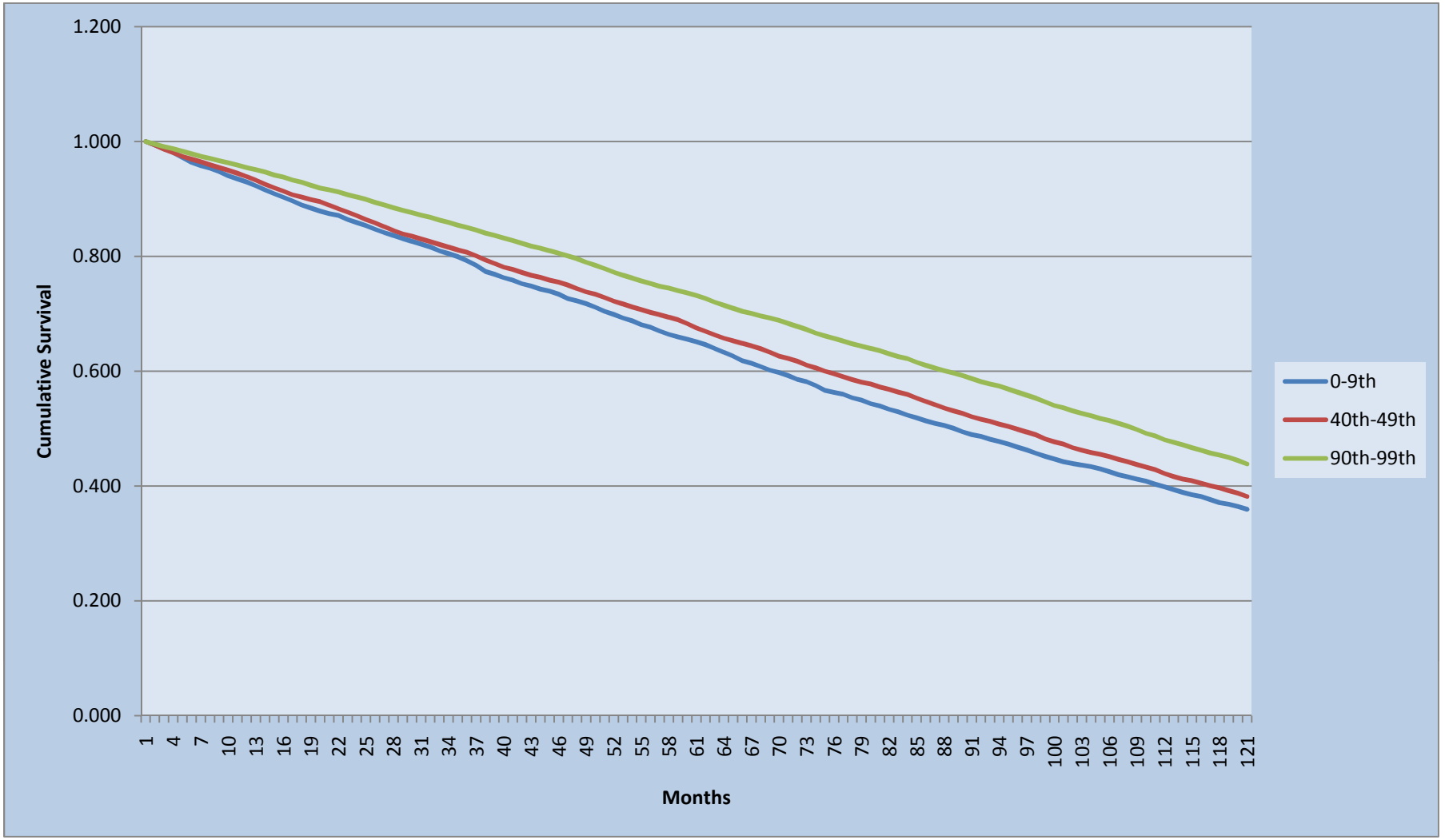
Distinct differences in survival by SES

Males 70-74 Wealth Effect in Medicare Data



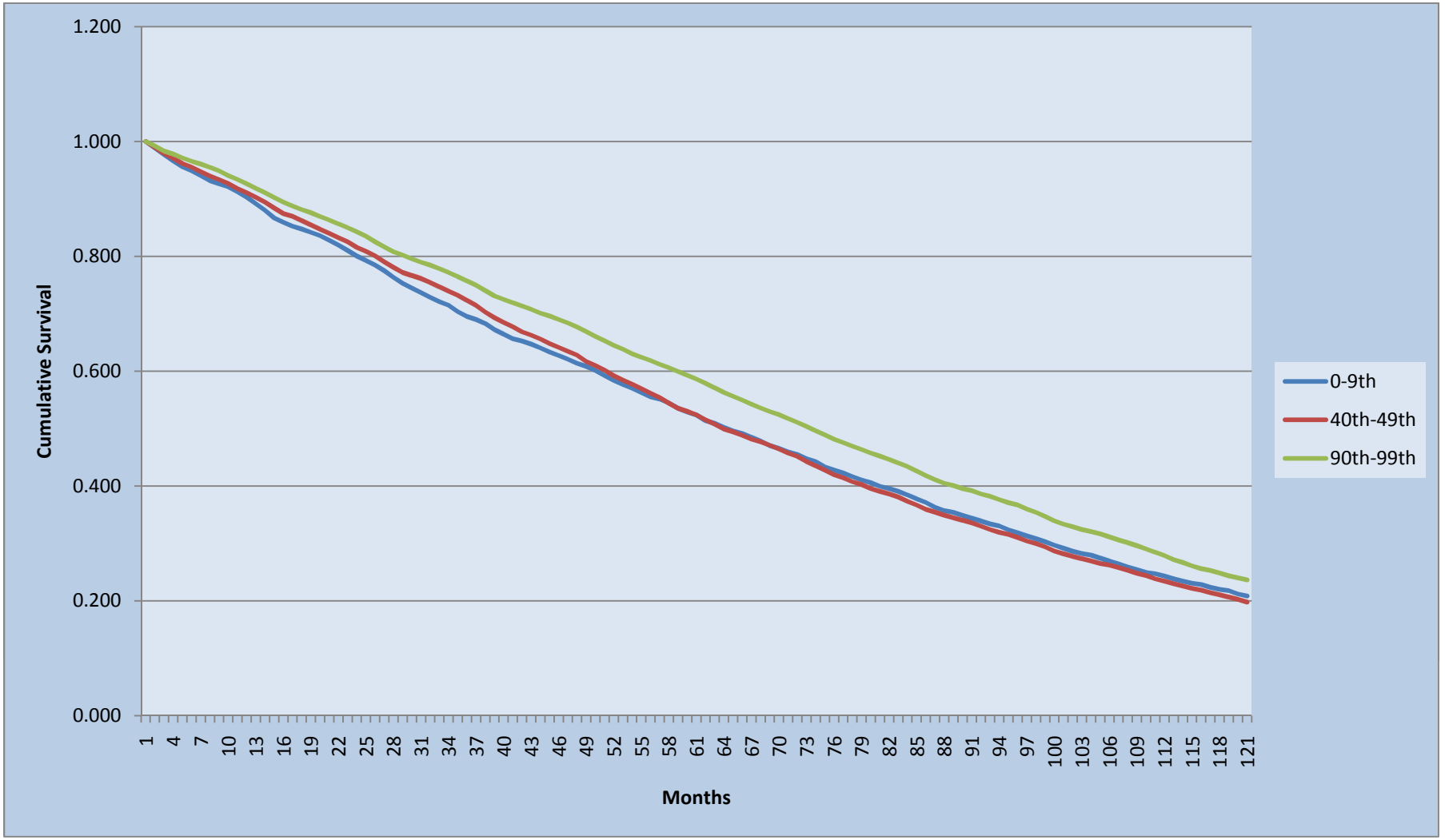
Wealth effect of over 25 months at 60% survival

Males 75-79 Wealth Effect in Medicare Data



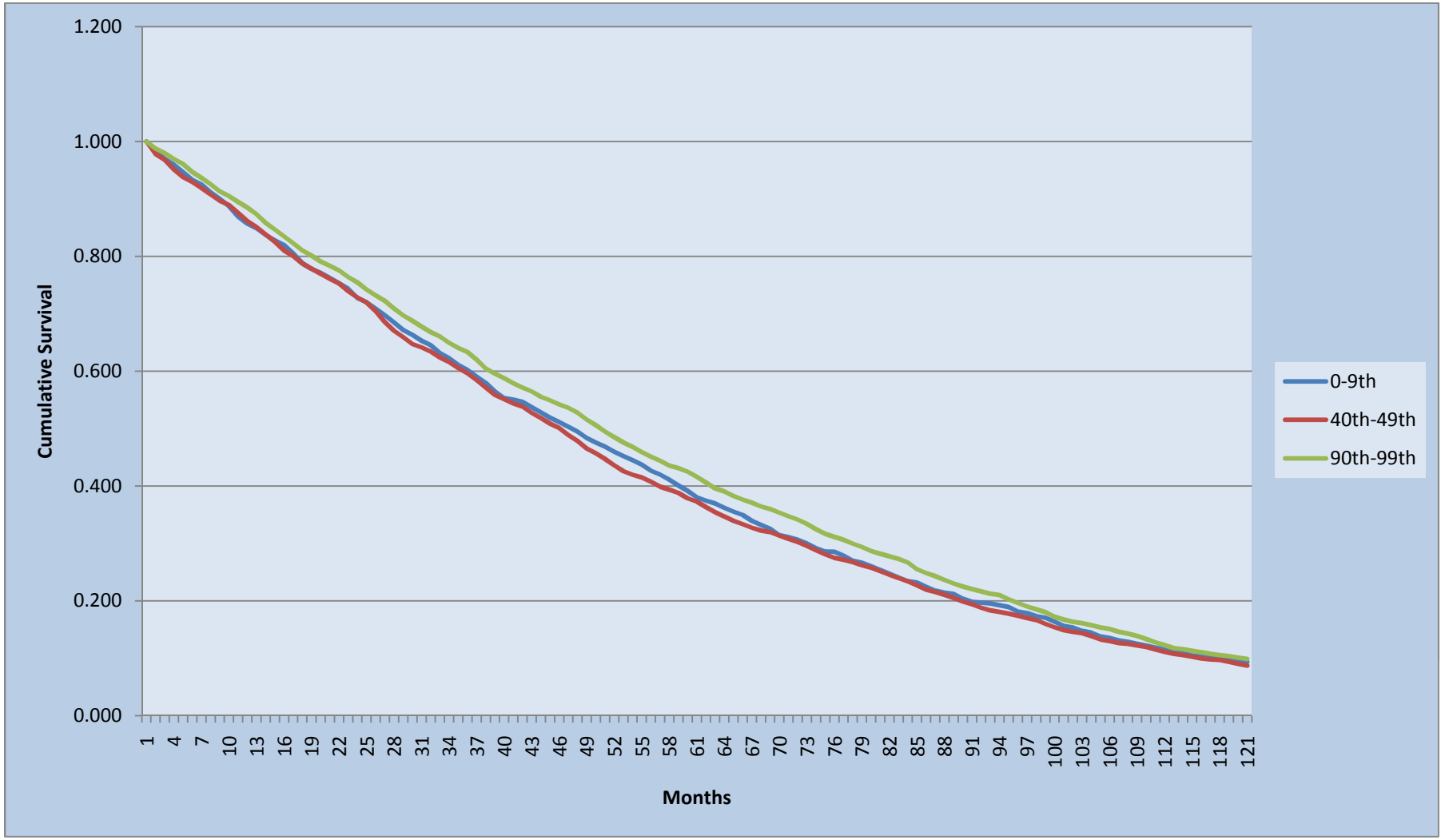
Wealth effect of 19 months at 60% survival

Males 80 - 84 Wealth Effect in Medicare Data



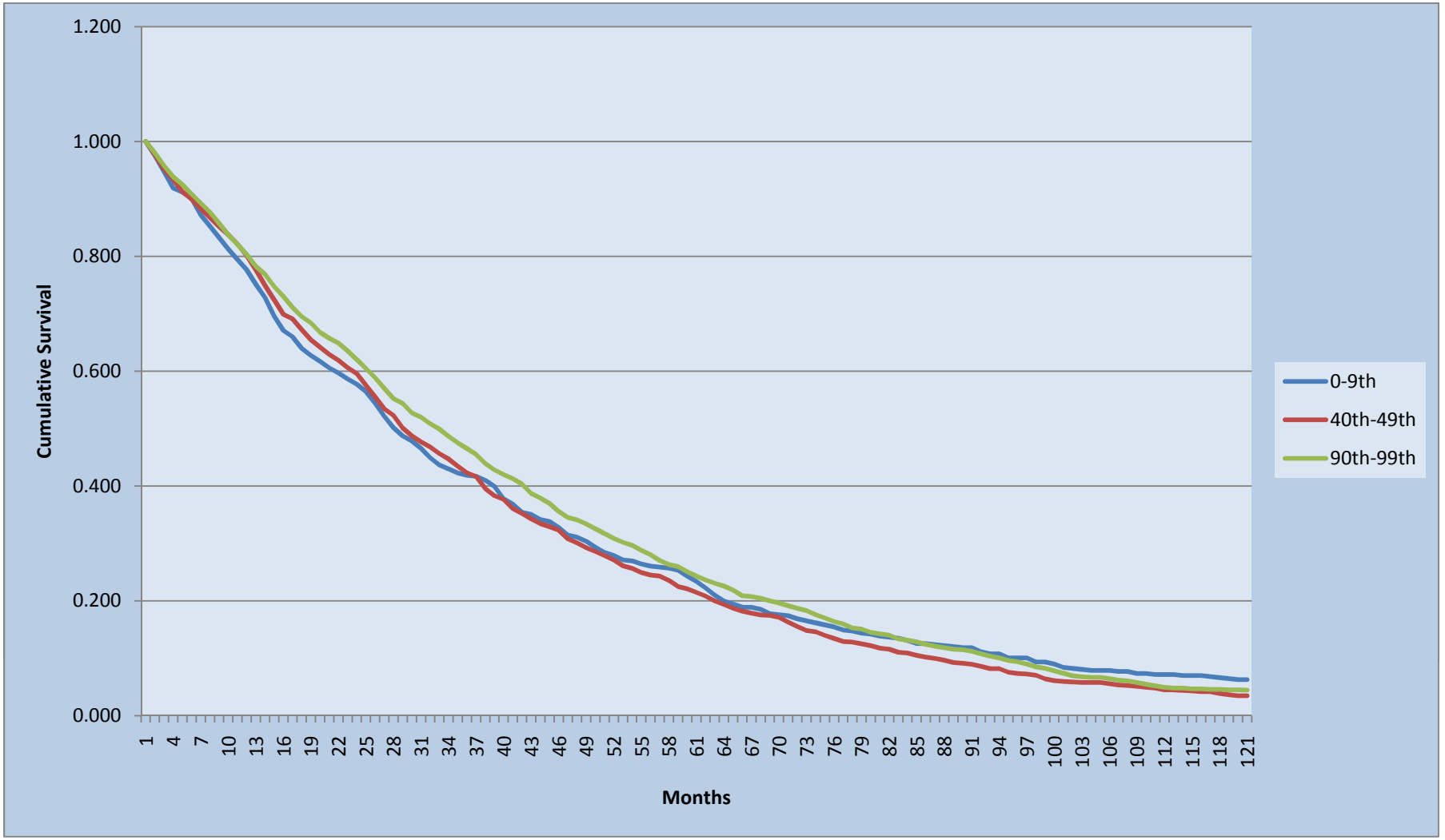
Observed weakening of wealth effect at lower percentiles

Males 85 - 89 Wealth Effect in Medicare Data



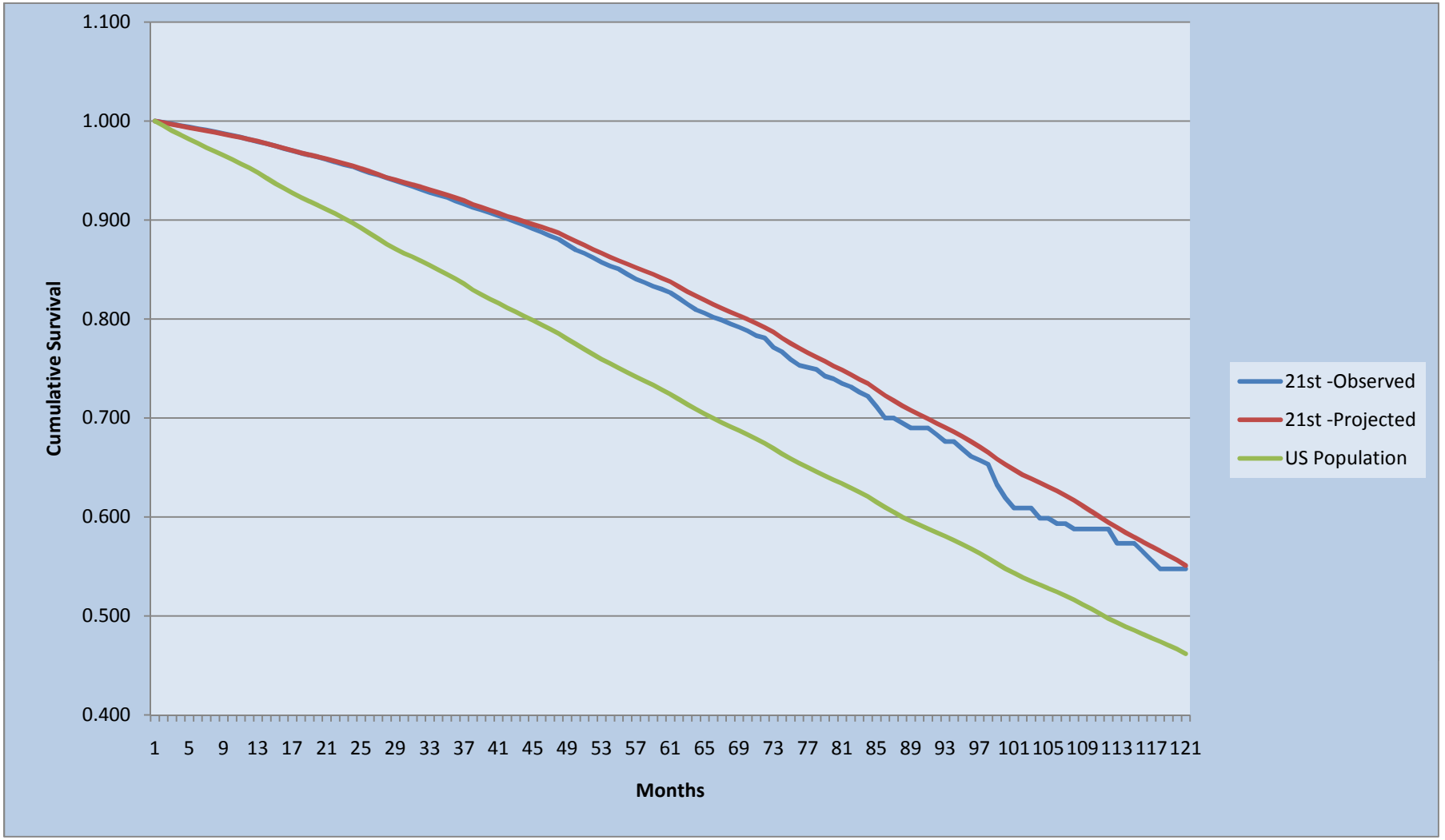
Wealth effect is still evident, yet weaker

Males 90+ Wealth Effect in Medicare Data



Scarce data and early convergence of survival is evident

Figure 13 - Antiselection



Appendix 1

Prevalence of Comorbidity in Medicare vs. 21st Services Cohort

ICD-9	Disease	Medicare	21st Services	OR
401	ESSENTIAL HYPERTENSION	60.89	65.43	1.22
786	SYMPTOMS INVOLVING RESPIRATORY SYSTEM AND OTHER CHEST SYMPTOMS	47.92	3.54	0.04
780	GENERAL SYMPTOMS	38.59	21.15	0.43
272	DISORDERS OF LIPID METABOLISM	34.09	75.41	5.93
414	OTHER FORMS OF CHRONIC ISCHEMIC HEART DISEASE	31.27	23.74	0.68
427	CARDIAC DYSRHYTHMIAS	26.80	11.30	0.35
729	OTHER DISORDERS OF SOFT TISSUES	19.52	0.16	0.01
285	OTHER AND UNSPECIFIED ANEMIAS	19.29	3.61	0.16
250	DIABETES MELLITUS	18.74	12.67	0.63
428	HEART FAILURE	16.96	2.67	0.13
429	ILL-DEFINED DESCRIPTIONS AND COMPLICATIONS OF HEART DISEASE	15.94	29.58	2.21
413	ANGINA PECTORIS	13.15	1.07	0.07
787	SYMPTOMS INVOLVING DIGESTIVE SYSTEM	12.44	2.84	0.21
530	DISEASES OF ESOPHAGUS	11.76	1.42	0.11
785	SYMPTOMS INVOLVING CARDIOVASCULAR SYSTEM	11.71	0.47	0.04
424	OTHER DISEASES OF ENDOCARDIUM	11.00	8.27	0.73
733	OTHER DISORDERS OF BONE AND CARTILAGE	10.89	13.00	1.22
518	OTHER DISEASES OF LUNG	9.70	1.13	0.11
443	OTHER PERIPHERAL VASCULAR DISEASE	9.54	7.23	0.74
440	ATHEROSCLEROSIS	9.04	0.50	0.05
411	OTHER ACUTE AND SUBACUTE FORMS OF ISCHEMIC HEART DISEASE	8.82	1.69	0.18
435	TRANSIENT CEREBRAL ISCHEMIA	7.55	10.63	1.46
433	OCCLUSION AND STENOSIS OF PRECEREBRAL ARTERIES	6.73	5.14	0.75
426	CONDUCTION DISORDERS	6.52	5.18	0.78
493	ASTHMA	6.28	3.62	0.56
783	SYMPTOMS CONCERNING NUTRITION, METABOLISM, AND DEVELOPMENT	5.66	0.24	0.04
412	OLD MYOCARDIAL INFARCTION	5.31	7.68	1.48
185	MALIGNANT NEOPLASM OF PROSTATE	5.21	0.34	0.06
593	OTHER DISORDERS OF KIDNEY AND URETER	4.95	0.97	0.19
781	SYMPTOMS INVOLVING NERVOUS AND MUSCULOSKELETAL SYSTEMS	4.88	5.55	1.14
238	NEOPLASM OF UNCERTAIN BEHAVIOR OF OTHER AND UNSPECIFIED SITES AND TISS	4.59	0.34	0.07
290	DEMENTIAS	4.44	2.06	0.45
437	OTHER AND ILL-DEFINED CEREBROVASCULAR DISEASE	4.08	1.60	0.38
596	OTHER DISORDERS OF BLADDER	3.90	0.40	0.10
492	EMPHYSEMA	3.82	2.01	0.52
714	RHEUMATOID ARTHRITIS AND OTHER INFLAMMATORY POLYARTHROPATHIES	3.80	1.06	0.27
820	FRACTURE OF NECK OF FEMUR	3.75	1.12	0.29
174	MALIGNANT NEOPLASM OF FEMALE BREAST	3.54	0.41	0.11
331	OTHER CEREBRAL DEGENERATIONS	3.44	2.48	0.71
298	OTHER NONORGANIC PSYCHOSES	3.17	0.51	0.16
296	EPISODIC MOOD DISORDERS	3.16	1.49	0.46
425	CARDIOMYOPATHY	2.92	1.16	0.39
278	OVERWEIGHT, OBESITY, AND OTHER HYPERALIMENTATION	2.86	14.95	5.98
454	VARICOSE VEINS OF LOWER EXTREMITIES	2.70	0.81	0.29
453	OTHER VENOUS EMBOLISM AND THROMBOSIS	2.52	0.28	0.11
592	CALCULUS OF KIDNEY AND URETER	2.27	0.11	0.05
441	AORTIC ANEURYSM AND DISSECTION	2.17	1.50	0.69
305	NONDEPENDENT ABUSE OF DRUGS	2.17	3.06	1.42
153	MALIGNANT NEOPLASM OF COLON	2.01	0.18	0.09
332	PARKINSON'S DISEASE	1.99	1.20	0.60
289	OTHER DISEASES OF BLOOD AND BLOOD-FORMING ORGANS	1.64	1.57	0.95
287	PURPURA AND OTHER HEMORRHAGIC CONDITIONS	1.64	0.11	0.07
416	CHRONIC PULMONARY HEART DISEASE	1.56	2.42	1.56
585	CHRONIC KIDNEY DISEASE (CKD)	1.48	14.10	10.96
725	POLYMYALGIA RHEUMATICA	1.44	1.13	0.78
577	DISEASES OF PANCREAS	1.22	0.23	0.18
415	ACUTE PULMONARY HEART DISEASE	1.10	0.59	0.53
162	MALIGNANT NEOPLASM OF TRACHEA, BRONCHUS, AND LUNG	1.02	0.22	0.21
710	DIFFUSE DISEASES OF CONNECTIVE TISSUE	0.91	1.02	1.13
571	CHRONIC LIVER DISEASE AND CIRRHOSIS	0.87	3.53	4.18
485	BRONCHOPNEUMONIA, ORGANISM UNSPECIFIED	0.86	0.26	0.30
591	HYDRONEPHROSIS	0.75	0.86	1.15
195	MALIGNANT NEOPLASM OF OTHER AND ILL-DEFINED SITES	0.71	0.13	0.19
446	POLYARTERITIS AND NODOSA AND ALLIED CONDITIONS	0.66	0.21	0.31
273	DISORDERS OF PLASMA PROTEIN METABOLISM	0.66	0.57	0.86
442	OTHER ANEURYSM	0.64	2.82	4.48
172	MALIGNANT MELANOMA OF SKIN	0.58	0.11	0.19
277	OTHER AND UNSPECIFIED DISORDERS OF METABOLISM	0.53	0.14	0.27
556	ULCERATIVE COLITIS	0.53	0.97	1.85
432	OTHER AND UNSPECIFIED INTRACRANIAL HEMORRHAGE	0.47	0.24	0.50
225	BENIGN NEOPLASM OF BRAIN AND OTHER PARTS OF NERVOUS SYSTEM	0.40	0.36	0.91
204	LYMPHOID LEUKEMIA	0.37	0.23	0.63
555	REGIONAL ENTERITIS	0.35	0.97	2.76
349	OTHER AND UNSPECIFIED DISORDERS OF THE NERVOUS SYSTEM	0.29	0.53	1.86
200	LYMPHOSARCOMA AND RETICULOSARCOMA AND OTHER SPECIFIED MALIGNANT TUI	0.25	0.29	1.18
501	ASBESTOSIS	0.21	0.20	0.96
358	MYONEURAL DISORDERS	0.18	0.11	0.62
430	SUBARACHNOID HEMORRHAGE	0.13	0.11	0.83

Client Notes from our CFO & Chief Actuary, Vince Granieri

I'd like to share an excellent question that I was asked recently by one of our clients: "What is the likelihood of a fifteen to twenty-five percent extension in life expectancies in a single year similar to what we saw in 2008?" I'll answer by first providing some context –

What caused the September 2008 extensions in life expectancy estimates?

1. Lack of data early on – LE estimates were first based on life insurance mortality data because life settlement data or mortality tables did not exist. However, life insurance companies really didn't have much senior data since they often rejected older applicants and issued policies only to the healthiest seniors. In fact, both the 2001 VBT and the 2008 VBT used population data at older ages. But this life insurance data was the best information available since both life insurance populations and life settlements populations did undergo medical underwriting. As time went on, it appeared that early duration life settlement mortality was lower than anticipated and for certain impairments, much different than expected. However, it was not clear until 2008 whether these observations were statistical outliers or meaningful characteristics.
2. The 2008 VBT – Even for insured populations, senior mortality was declining due to medical advances, better health care/nutrition, etc. Although improvements varied by age (greater for younger ages), the 2008 VBT showed that senior mortality had become lower. This needed to be reflected and provision made for future mortality improvements.
3. Emerging life settlement experience – As data became credible, two important themes emerged. First, the observed early duration anti-selection was indeed occurring in life settlements. Second, the life settlements market was not homogeneous – i.e. there were very healthy segments mixed in with the impaired groups that dominated the market early on. Importantly, we had enough data to rely on our internal statistics for early durations and this was reflected in the mortality table changes we implemented.

Now I'll answer the question:

1. The probability of advances in health care/nutrition is clearly significant, but it would take a medical breakthrough along the lines of protease inhibitors (the AIDS cocktail) to move the needle that far for the entire industry. This is highly unlikely. In fact, members of our Medical Advisory Board indicated that if a cure for cancer were found, it would only extend the average life expectancy in the United States by two years and would not have nearly that impact on seniors' life expectancies.
2. Life settlement mortality is better defined. Since we are now using our own data and tables, rather than appropriately adapting someone else's as was done above, the likelihood of a shock due to emerging mortality experience is much lower than before. Also, we have included explicit annual mortality improvement factors, reducing the likelihood that the tables will become outdated. Additionally, in the intervening time period since September 2008, our data base has grown, further enhancing its credibility.
3. Our data on over a million Medicare lives analyzed in conjunction with our own 100,000+ life data base suggests that the select period for seniors is shorter than that of younger folks and the early anti-selection we observed does not continue or reverse itself in later durations. Importantly, in later durations, the slopes of the two curves are very similar. This reinforces point two.
4. Although we have statistically significant data overall, if we parse it down to the various impairments, our confidence intervals grow. Therefore, I believe that certain impairments will see extensions and others will see reductions as data emerges.

From my perspective, the probability of a major medical breakthrough is much less than 5%. So that is the short answer to this excellent question. However, I envision a higher probability that +/- 20% changes in mortality multipliers might occur for various impairments. This underscores the importance of building diversified portfolios of policies by major impairment to ensure expected performance.

21st Services

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21st Services, LLC