

# **MORTALITY BY CAREER-AVERAGE EARNINGS LEVEL**

ACTUARIAL STUDY NO. 129

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# MORTALITY BY CAREER-AVERAGE EARNINGS LEVEL

## I. Introduction

Research has shown that higher income levels are associated with lower mortality rates.<sup>1</sup> Higher lifetime earnings are also associated with lower mortality rates. This relationship is important for analyzing and projecting costs for the Social Security program because a worker's career-average earnings level is a critical factor in determining the level of monthly benefits that will be payable to the worker and his or her dependents. Average indexed monthly earnings (AIME) is a particularly useful measure of a person's lifetime, or career-average, earnings.<sup>2</sup> In this study, we analyze the relationship between AIME levels and mortality rates for Social Security retired-worker beneficiaries.

The Office of the Chief Actuary's projections of the actuarial status of the Social Security trust funds, for annual Trustees Reports<sup>3</sup> and other purposes, have for many years included the effects of lower mortality for beneficiaries with higher AIME and higher mortality for beneficiaries with lower AIME. These effects are incorporated into our projections by the use of "post-entitlement factors", which reflect the change in benefit levels beyond cost-of-living adjustments (COLA) for retirement cohorts as they age.<sup>4</sup> Our projections also include the effects of higher mortality for disabled-worker beneficiaries, both before and after their conversion to retired worker status at normal retirement age (NRA). The primary objective of this study is to provide another measure of, and perspective on, the extent of variation in mortality rates by AIME and changes over time. A secondary objective of this study is to provide results to inform and improve our recurring internal rate of return and money's worth ratio analyses.<sup>5</sup>

In this study, we show that death rates are generally lower for retired-worker beneficiaries with higher-than-average AIME levels and higher for retired-worker beneficiaries with lower-than-

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1. The *Trends in Mortality Differentials and Life Expectancy for Male Social Security-Covered Workers, by Socio-economic Status* paper by Hilary Waldron includes a survey of literature on this topic.

See: <https://www.ssa.gov/policy/docs/ssb/v67n3/v67n3p1.html>.

2. Another very closely related value that reflects the level of a worker's lifetime earnings is the primary insurance amount (PIA). Because of the way the PIA is calculated directly from the AIME, lower AIME levels lead directly to lower PIA levels and higher AIME levels lead directly to higher AIME levels. As will be seen later in the study, ordering individuals by either AIME or PIA is equivalent for those born in the same year.

See <https://www.ssa.gov/oact/cola/Benefits.html> for information on the AIME and PIA calculations.

3. See <https://www.ssa.gov/OACT/TR/2024/index.html>.

4. For more information on post-entitlement factors, see the Long-Range OASDI Projection Methodology documentation at [https://www.ssa.gov/oact/TR/2024/2024\\_LR\\_Model\\_Documentation.pdf](https://www.ssa.gov/oact/TR/2024/2024_LR_Model_Documentation.pdf).

5. See recurring Actuarial Notes 5 and 7 at <https://www.ssa.gov/OACT/NOTES/actnote.html>.

average AIME levels. At older ages, the differences in death rates across AIME levels are smaller. This is most likely due to the healthier individuals being more likely to survive, so at older ages beneficiaries are more homogeneous, causing a gradual shift in AIME level quintiles as those who were in high quintiles at younger ages move into lower quintiles at older ages.

Our basic approach for this study is to compare the death rates across retired-worker beneficiaries by sex, age group, and career-average earnings level (i.e., the AIME) to annual death rates among all retired-worker beneficiaries for that sex and age group, for every year from 1995 to 2022. The actual numbers of deaths and exposure used to calculate the annual death rates come from the Social Security Administration’s Master Beneficiary Record (MBR). For each sex and age group, we also calculated relative mortality ratios at various AIME levels. A relative mortality ratio of 1.00 for an AIME level indicates that the death rate was the same as the death rate for all in that sex and age group. A relative ratio of less than 1.00 means that the death rate for that AIME level was lower than the death rate for all in that sex and age group, and a ratio of greater than 1.00 means that the death rate for that AIME level was higher than the death rate for all in that sex and age group.

The remainder of this study discusses our data, methods, results, and conclusions.

## II. Data and Methods

### A. Data

In this study, we included retired-worker beneficiaries for years 1995 to 2022 from the Social Security Administration’s June 2023 100-percent MBR file where a primary insurance amount (PIA) was available, allowing direct computation of the worker’s AIME.<sup>1</sup> We excluded beneficiaries affected by the Windfall Elimination Provision<sup>2</sup> and totalization agreements,<sup>3</sup> because such individuals generally have relatively low AIMEs that do not accurately represent their true career-average earnings levels. We excluded beneficiaries who reached age 62 prior to 1993 and beneficiaries whose benefits are based on earlier calculation methods that are not comparable with the current PIA and AIME approach. We also excluded retired-worker beneficiaries previously entitled for a disability benefit, because such individuals generally have a shorter work history and AIMEs that are not comparable to individuals in the same birth cohort included in the study. A detailed description of the codes used to select the records from the MBR can be found in Appendix A.

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1. Results for calendar year 2022 (and to a lesser extent, results for earlier years) may change slightly with the use of later MBR files, as additional data is reported.

2. As described in the Windfall Elimination Provision publication, <https://www.ssa.gov/pubs/EN-05-10045.pdf>: “If you work for an employer who doesn’t withhold Social Security taxes from your salary, such as a government agency or an employer in another country, any retirement or disability pension you get from that work can reduce your Social Security benefits.”

3. See [https://www.ssa.gov/international/agreements\\_overview.html](https://www.ssa.gov/international/agreements_overview.html).

### **B. AIME Level Quintiles**

We analyzed retired-worker beneficiaries for each age group based on AIME level, splitting them into quintiles at their current age. To do this, we first determined retired worker records that had exposure and were receiving benefits during the selected calendar year, and sorted the records by AIME level for each sex and single year of age. We then determined the record number for each quintile breakpoint and the corresponding AIME value for that record number. Next, we determined the quintile interval using the earnings quintile breakpoints (which define the AIME ranges) for each sex and single year of current age.

The following tables show how the AIME quintile intervals are defined for men and women who attained age 65 in 2020. Note that the AIME quintile ranges vary across ages and calendar years.

**Table A.—AIME Quintile Intervals for Men Who Attained Age 65 in 2020**

Male Quintiles	AIME Range	Percentage of Beneficiaries
Lowest AIME Quintile	AIME $\leq$ \$1,840	20%
2nd AIME Quintile	\$1,840 < AIME $\leq$ \$3,294	20%
3rd AIME Quintile	\$3,294 < AIME $\leq$ \$4,679	20%
4th AIME Quintile	\$4,679 < AIME $\leq$ \$6,391	20%
Highest AIME Quintile	\$6,391 < AIME	20%

**Table B.—AIME Quintile Intervals for Women Who Attained Age 65 in 2020**

Female Quintiles	AIME Range	Percentage of Beneficiaries
Lowest AIME Quintile	AIME $\leq$ \$1,044	20%
2nd AIME Quintile	\$1,044 < AIME $\leq$ \$1,873	20%
3rd AIME Quintile	\$1,873 < AIME $\leq$ \$2,835	20%
4th AIME Quintile	\$2,835 < AIME $\leq$ \$4,224	20%
Highest AIME Quintile	\$4,224 < AIME	20%

### **C. Calculations**

For each record in a given year, we determined the sex, age, AIME interval, exposure, and death status.

- Sex and age – This study includes male and female retired-worker beneficiaries at ages 62 and older.

- AIME interval – As described in the previous section, we grouped the records based on the AIME level quintiles for those at each age in each year.

When determining the AIME level quintiles, each quintile interval, by definition, should have exactly 20 percent of record exposure at that age. We determined the quintile AIME-range levels for groups based on age, calculated as the calendar year minus the birth year. However, when calculating exposure by age, exposure is assigned based on age at last birthday for each month in the calendar year. Thus, each quintile interval may not contain exactly 20 percent of the exposure.

- Exposure – To determine the exposure for each age and year, we grouped the records into three categories: Active, Death, and Termination Other than Death. Active records are those that are in benefit entitled status during the selected calendar year and end the year in benefit entitled status. Death records are those with a reported death during the calendar year. Terminations Other than Deaths are records in a terminated category, other than a death termination category, during the calendar year. (For example, a record could be categorized as terminated if the beneficiary was entitled to other benefits.) Terminations Other than Deaths are less than 0.01 percent of the number of records.

Exposure is measured in terms of years; a month is equal to 1/12 of an exposure year. Deaths receive a full year of exposure at the age when the death occurs, unless the record becomes active at the same age as the death occurs. In that case, exposure starts when the record becomes active and ends at the end of the age period. Exposure is calculated for the record's age based on the birth month, but not the day of the month, so that exposure is only calculated in 1/12 year increments. Thus, for example, if a record is active all year and the claimant turns age 65 on July 25th, the record will receive one-half year of exposure for age 64 and one-half year of exposure for age 65. The exposure is calculated only during the selected calendar year (January 1 – December 31). For each record, we determined the first month of the selected calendar year that the record was active, which month the record terminated for death, and which month the record terminated for reasons other than death.

Exposure calculation details and examples are presented in Appendix B.

- Death status – A death is recorded if the date of death is during the selected calendar year. If the date of death is after the selected calendar year and the record was in entitled status during the entire calendar year, the record will receive a full year of “Active” exposure, and the death is not recorded for that year.

We grouped the records by sex, age group, and AIME interval for the selected calendar year, and calculated annual death rates by dividing the number of deaths by the years of exposure during the selected calendar year. Then, we calculated the relative mortality ratio by dividing those death rates for each AIME interval by the death rate for all records included in the sex and age group at all AIME levels.

### III. Death Rates by AIME Quintile Level

Records are assigned to the following quintile intervals using the breakpoints described in Section II:

- Lowest AIME Quintile,
- 2nd AIME Quintile,
- 3rd AIME Quintile,
- 4th AIME Quintile, and
- Highest AIME Quintile.

In the study, we only analyze death rates and relative mortality ratios for workers reaching age 62 in 1993 and later. Workers reaching age 62 in earlier years had different benefit calculations, which makes consistent assignment into career-average earnings levels difficult.

As previously noted, we first calculate the annual death rates by sex, age group, and AIME interval for exposed workers in each selected year. These death rates are shown in tables 1-6 in Appendix C for every fifth year from 1995 through 2020. For example, Table 6 shows that for men in 2020, the 65-69 age group death rates are 0.0306, 0.0203, 0.0156, 0.0126, and 0.0093 for the Lowest AIME Quintile through the Highest AIME Quintile, respectively. Generally, death rates are lower for those in higher AIME quintiles and higher for those in lower AIME quintiles, for both men and women within any age group for any year.

Figures 1-6 in Appendix D illustrate death rates for each age group, by sex and quintile level, for each calendar year from 1995 to 2022. As seen in Figure 1, for age group 62-64, death rates generally decrease for all AIME quintiles for both men and women from 1995 through around 2012, and then increase through 2019. Death rates then increased dramatically in 2020 and 2021 due to the COVID-19 pandemic, but dropped somewhat in 2022.

Note that the 62-64 age group consists solely of retired workers who retired prior to NRA,<sup>1</sup> the age at which a person first becomes entitled to retirement benefits without an age-based reduction. Some of the individuals who retired prior to the NRA may have retired because they have physically demanding jobs and are no longer able to work, or because they have knowledge about being in poor health. This means that retired workers in the 62-64 age group are likely to be unhealthier as a group compared to other workers eligible for benefits at those ages, and will therefore tend to have higher death rates than those other workers at that age. Also note that the share of all workers that are entitled to benefits represented in this age group has been decreasing over time, as starting receipt of retired worker benefits prior to NRA has dramatically decreased since about 1995. In 1995, about 66 percent of male workers had started benefits by age 64. This percentage decreased to 53 percent in 2010 and further decreased to 33 percent in 2020.<sup>2</sup> One rea-

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1. The NRA is 65 for those born in 1937 and earlier, 66 for those born in 1943-54, and 67 for those born in 1960 and later. For the intervening birth years, the NRA increases by 2 months per year.

2. Office of the Chief Actuary calculations based on Social Security Administration data used for the 2024 Trustees Report.

son for the decrease is that, with the increase in NRA, a retired worker starting benefits at age 62 today receives a larger benefit reduction than an equivalent worker would have received when the NRA was 65.

The male and female 65-69 death rates, shown in Figure 2, generally decreased through around 2010 and then remained relatively steady before increasing during the COVID-19 pandemic. The male and female death rates for age groups 70-74, 75-79, and 80-84, shown in Figures 3-5, generally decreased through 2019 before increasing during the pandemic. Figure 6 shows the male and female 85-89 death rates since the pandemic.

The Appendix D death rate figures 1-5 clearly illustrate the effects of the COVID-19 pandemic in years 2020 through 2022. In general, death rates increased for both men and women in 2020 across all age groups and AIME quintiles. For age groups 62-64, 65-69, 70-74, and 75-79, death rates generally increased in 2021 before decreasing in 2022. For ages 80-84, death rates peaked in 2020 and then declined in years 2021 and 2022. For ages 85-89, death rates also declined in 2021 and 2022 relative to the prior year.

#### **IV. Relative Mortality Ratios by AIME Quintile Level**

Using the death rates, we calculated the relative mortality ratio for each AIME quintile in each age group by dividing the death rate for each AIME quintile by the death rate for all retired workers included in the sex and age group at all AIME levels for the specific year. The trends from 1995 to 2022 show that the spread in death rates across the AIME intervals for men has slightly increased. For women, in general, the spread in death rates has increased in recent years for all ages.

##### ***A. Mortality Differences by AIME Level***

Tables 7-12 in Appendix E show the relative mortality ratios by sex, age group, and AIME quintile interval for every fifth year from 1995 through 2020. For example, Table 12 shows that for men in 2020, the 65-69 age group ratios are 1.72, 1.14, 0.88, 0.71, and 0.52 for the Lowest AIME Quintile through the Highest AIME Quintile, respectively. Generally, as seen in the tables, higher AIME levels are associated with lower relative mortality ratios (due to lower mortality rates) for both men and women.

Figures 7-12 in Appendix F illustrate the relative mortality ratios for each age group, by sex and AIME quintile level, for each calendar year from 1995 to 2022. For each age group, the figures show how the relative mortality ratio by AIME quintile level has changed over time. The figures also display the variation across the AIME quintile intervals. For example, in Figure 8, for men at ages 65-69, the difference between the Lowest and 2<sup>nd</sup> AIME Quintiles and the 2<sup>nd</sup> and 3<sup>rd</sup> AIME Quintiles generally increases over time, the difference between the 3<sup>rd</sup> and 4<sup>th</sup> AIME Quintiles remains fairly constant, and the difference between 4<sup>th</sup> and Highest AIME Quintiles slightly decreases over time. At older ages, there is less of a difference in relative mortality ratios among

the AIME levels. This may be because the healthiest individuals in each quintile are more likely to survive to older ages and that the advantages associated with higher career-average earnings tend to dissipate with increased years after retirement.

In the Appendix F figures, the difference between the relative mortality ratios for the Lowest and Highest AIME Quintiles for male age groups 62-64 and 65-69 has remained relatively constant since 2010. At the same time, there is an increase in the spread of relative mortality ratios for male age groups 70-74, 75-79, and 80-84. For women, there is a significant increase in the spread of relative mortality ratios since 2005 in all age groups (except for the oldest age group, 85-89, for which there are too few years of data to be able to discern a trend).

### **B. Male / Female Comparison**

Historically, the majority of women worked in paid employment less consistently than men, and thus, often became dually entitled<sup>1</sup> for worker and spouse benefits in retirement. Therefore, their personal career earnings (as summarized by the AIME) may not have closely aligned with their family income level, or their potential career earnings level. For example, when considering her spouse's income, a woman with personal career earnings in the Lowest AIME Quintile may have had socioeconomic status equivalent to a woman whose career earnings were in the Highest AIME Quintile. Despite this, we find that women generally follow the same relative mortality pattern as men, in that higher earners have lower mortality.

With the exception of ages 62-64 in a few select years between 1995 and 2010, women have the same relative mortality patterns as men, with higher AIME beneficiaries having lower mortality. However, it is interesting to note that the spreads in relative mortality ratios for women across AIME quintiles are smaller than those for men. The relative mortality ratios for women in the Lowest and 2nd AIME Quintiles are lower (closer to the overall average) than those for men, and the ratios for women in the 4th and Highest AIME Quintiles are higher (also closer to the overall average) than those for men. As previously noted, this may be because the level of personal career earnings for married women may not correspond to their socioeconomic status. Another possible reason for this is that, historically, most men worked consistently. Therefore, the sample of retired-worker beneficiaries tends to capture a male population that is very representative of the general population. However, many women did not work consistently, or did not work enough to be eligible for a retired-worker benefit.

### **C. Age Groups**

As briefly noted in the previous section, the spread in the relative mortality ratios across the quintiles decreases at older ages. For example, as seen in Table 12, in 2020, the male age 62-64 relative mortality ratios are 1.79 and 0.46 for the Lowest and Highest AIME Quintiles, respectively. The Lowest AIME Quintile relative mortality ratio steadily decreases (until the pandemic years)

1. A person may be entitled to more than one benefit at the same time. For example, a person may be entitled as a retired worker on their own record and as a spouse on another record. In dual entitlement cases where the spouse benefit is higher than the worker benefit, the dually entitled beneficiary receives his or her full worker benefit in addition to a partial spouse benefit. The total benefit is the same amount as the full spouse benefit. See <https://secure.ssa.gov/apps10/poms.nsf/lnx/0300615020> for details.



for older age groups, while the Highest AIME Quintile relative mortality ratio increases. The male 85-89 relative mortality ratios are 1.14 and 0.81 for the Lowest and Highest AIME Quintiles, respectively. For women, in 2020, the relative mortality ratio for the Lowest AIME Quintile decreases from 1.62 for age group 62-64 to 1.04 for age group 85-89, while the relative mortality ratio for the Highest AIME Quintile increases from 0.65 for age group 62-64 to 0.92 for age group 85-89. Note that the spread in the female 85-89 age group relative mortality ratio is very small, with mortality ratios ranging from 0.92 to 1.04. Again, this convergence at older ages is consistent with the fact that those initially in the lower AIME quintiles at age 62 and shortly thereafter are less likely to survive to older ages, meaning that the surviving retired-worker beneficiaries tend to be more homogeneous across earnings levels. Thus, the relative mortality ratios at older ages are not as strong an indication of higher or lower than average mortality rates.

As previously noted, the 62-64 age group consists solely of people retiring prior to NRA. With the NRA increasing, life expectancy increasing, and more accommodating jobs, workers who can wait to retire may do so to receive a higher monthly Social Security benefit, while those with physically demanding jobs or health issues may still decide to retire prior to attaining NRA.

#### **D. COVID-19 Pandemic**

This study compares the relative mortality ratios for years 1995 through 2022. The COVID-19 pandemic significantly affected death rates beginning in 2020. While the acute stage of the pandemic is over, we expect there to be residual effects on mortality for years to come. As previously described, the figures in Appendix F illustrate the relative mortality ratios for each age group, by sex and quintile AIME level. Generally, the trends in the relative mortality ratios are steady during the pandemic years 2020 through 2022, despite the significantly increased death rates during those years. For a small number of age-sex groups in 2020 and 2021, such as women ages 65-69, we see in Figure 8 an increase in the spread between the Lowest and Highest AIME Quintiles. However, the spread then decreases in 2022, indicating that the changes in the relative mortality ratios due to the pandemic seem to be temporary.

## **V. Conclusion**

As seen in this analysis, higher AIME levels correlate with lower mortality rates, while lower AIME levels correlate with higher mortality rates, at all ages in essentially all years. The trends from 1995 to 2022, shown in the figures in Appendix F, show that the spread in relative mortality ratios across the AIME quintiles varies by age group and sex. The spread has remained relatively steady for male age groups 62-64 and 65-69 since 2010, while it has slightly increased in recent years for age groups at ages 70 and older. For women, in general, the spread in relative mortality ratios has increased in recent years for all ages.

Currently, the Office of the Chief Actuary's projections of the actuarial status of the Social Security trust funds include the assumption of continued lower relative mortality for beneficiaries with higher AIME and continued higher relative mortality for beneficiaries with lower AIME. These effects are incorporated into our projections by the use of "post-entitlement factors", which reflect the change in benefit levels beyond COLAs for retirement cohorts as they age, as seen in actual

past experience. Our projections also include the effects of higher mortality for disabled-worker beneficiaries, both before and after their conversion to retired worker status at NRA. This study provides another measure of, and perspective on, the extent of variation in mortality rates by AIME and changes over time. We continue to evaluate ways to incorporate the results of this study into our main projections of actuarial status. The results of this study are used to incorporate mortality differences into our annual internal rate of return and money's worth ratio analyses, beginning with the versions of these actuarial notes released in late 2024.<sup>1</sup>

The results presented in this study illustrate death rates and relative mortality gradients by career-average earnings levels (i.e., the AIME). Other studies have generally been done based on partial career earnings levels, which are not reflective of the earnings that determine Social Security benefit levels. Trends in the relative mortality gradients are, generally, slowly growing. We plan to extend the analysis presented here as additional data become available, to continue assessing the trends in the mortality gradient by AIME and to better inform our projections of Social Security cost.

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1. See recurring Actuarial Notes 5 and 7 at <https://www.ssa.gov/OACT/NOTES/actnote.html>.

## VI. Appendices

### A. Code Details

1. *Data: 100 percent MBR file for June 2023*

2. *We created a file containing records that may contribute exposure during the selected calendar year:*

- The first position of the BIC (Beneficiary Identification Code) is A (Primary Claimant), and the TOC (Type of Claim) is 1, 2, 3, or 4. This filter allows only retired-worker beneficiaries.
- First position of LAF (Ledger Account File) is C, E, S, D, or T (Current Pay, Current Pay Railroad, Suspended, Deferred, or Terminated).
- Only include records with a current entitlement date less than or equal to the selected calendar year.
- If the first position of LAF is T, then the year of termination must be greater than or equal to calendar year.
- Windfall Elimination Provision, Totalization, and AME table PIA records, i.e., those with PIFC (PIA Factor Code) of 5, V, K, or B, are eliminated since they may have a relatively low AIME that does not accurately represent their earnings level, or they have a different benefit calculation that makes it difficult to compare.
- The record is classified as “Not Previously Entitled” if the date of initial entitlement equals the date of current entitlement. Otherwise, the record is classified as “Previously Entitled”. Previously Entitled records have had an entitlement due to disability and are excluded from the study.
- If the PIED (PIA Effective Date) is out of date, add COLA increases so the PIA value is consistent with the other records in the file.

3. *For each record, we determined:*

- Sex
- Age – 62-100+
- Exposure – Active, Death, and Termination Other than Death
  - o Exposure: 1 = full year (12 months), 1/12 = one month
  - o Deaths receive 1 full year of exposure at the age when the death occurred, unless a record becomes active at the same age as the death occurs. In that case, the exposure is the full year other than the months prior to when the record became active.
  - o For records with suspension codes S6, S8, S9, SF, SJ, SK, SD, and SL, if the record was suspended less than a year ago (that is, after June 2022), the record is treated as Active; otherwise, as Termination Other than Death.

- PIA Level and AIME Level
- The sum of exposure and the sum of deaths for each sex, age, and earnings interval.

4. *Data Review and Final Calculations:*

- We determined the death rate by dividing the deaths by the exposure. We then grouped the data as needed (by sex, age group, and earnings interval) and determined the relative mortality ratios.

## **B. Exposure Calculation Examples**

Exposure is measured in terms of years; a month is equal to 1/12 of an exposure. Deaths receive a full year of exposure at the age when the death occurs, unless the record becomes active at the same age as the death occurs. In that case, the exposure is the full year other than the months prior to when the record became active. Exposure is calculated for the record's age based on the birth month, but not the day of the month, so that exposure is only calculated in 1/12 year increments. Thus, for example, if a record is active all year and the claimant turns age 65 on July 25th, then the record will receive one-half year of exposure for age 64 and one-half year of exposure for age 65. The exposure is calculated only during the selected calendar year (January 1 – December 31). For each record, we determined the first month of the calendar year that the record was active, which month the record terminated for death, and which month the record terminated for reasons other than death.

The exposure is tabulated as follows:

### Active

- If a record is active at the beginning of the year through the whole year, then the exposure is 1.
- If a record becomes active sometime during the year and is active through the rest of the year, then the exposure is the fraction of the year the record was active. (Exposure: Start Month through End of Year)

### Death

- If a record is active at the beginning of the year and a death occurs during the year, then the death record receives exposure for the fraction of the year the record was active before the death and continued exposure to the end of the age at which the death occurred. (Exposure: Beginning of Year through End of Death Age)
- If a record becomes active sometime during the year and then a death occurs, then the exposure starts when the record becomes active and continues until the end of the age at which the death occurred. (Exposure: Start Month through End of Death Age)

### Termination Other than Death

- If a record is active at the beginning of the year and terminates for a reason other than death, then the exposure is the fraction of the year the record was active. (Exposure: Beginning of Year through Month Prior to Termination Date)
- If a record becomes active sometime during the year and terminates for a reason other than death, then the exposure is the fraction of the year the record was active. (Exposure: Start Month through Month Prior to Termination Date)

Below are exposure calculation examples by age for records with Active, Death, and Termination Other than Death statuses. In each example, the calendar year is 2010 and the date of birth is May 15, 1945.

Active

Calendar Year – 2010  
 Date of Birth – 5/15/1945  
 Date of Current Entitlement – 2/2010

<u>Age</u>	<u>Exposure</u>	
64	0.250	Feb, March, April
65	0.667	May - Dec
Total	0.917	Feb - Dec = 1/12 * 11

Death

Calendar Year – 2010  
 Date of Birth – 5/15/1945  
 Date of Current Entitlement – 2/2009  
 Date of Death – 8/2010

<u>Age</u>	<u>Exposure</u>	
64	0.333	Jan - April
65	1.000	Full year of exposure
Total	1.333	

Termination Other than Death

Calendar Year – 2010  
 Date of Birth – 5/15/1945  
 Date of Current Entitlement – 2/2009  
 Date of Suspension/Termination (other than death) – 8/2010

<u>Age</u>	<u>Exposure</u>	
64	0.333	Jan - April
65	0.250	May - Jul
Total	0.583	Jan - Jul

**C. Death Rate Table by AIME Quintiles**

**Table 1.—1995 Death Rates by Age Group for Retired-Worker Beneficiaries**

Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0245	-	-	-	-	-
2nd AIME Quintile	0.0164	-	-	-	-	-
3rd AIME Quintile	0.0135	-	-	-	-	-
4th AIME Quintile	0.0112	-	-	-	-	-
Highest AIME Quintile	0.0088	-	-	-	-	-
<b>Total</b>	<b>0.0150</b> <i>53.7%</i>	-	-	-	-	-
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0106	-	-	-	-	-
2nd AIME Quintile	0.0080	-	-	-	-	-
3rd AIME Quintile	0.0067	-	-	-	-	-
4th AIME Quintile	0.0059	-	-	-	-	-
Highest AIME Quintile	0.0061	-	-	-	-	-
<b>Total</b>	<b>0.0075</b> <i>46.3%</i>	-	-	-	-	-

Note: Includes only workers reaching age 62 in 1993 and later.

**Table 2.—2000 Death Rates by Age Group for Retired-Worker Beneficiaries**

Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0237	0.0289	-	-	-	-
2nd AIME Quintile	0.0152	0.0214	-	-	-	-
3rd AIME Quintile	0.0116	0.0181	-	-	-	-
4th AIME Quintile	0.0094	0.0153	-	-	-	-
Highest AIME Quintile	0.0071	0.0106	-	-	-	-
<b>Total</b>	<b>0.0135</b>	<b>0.0189</b>	-	-	-	-
	<i>15.0%</i>	<i>39.3%</i>				
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0097	0.0141	-	-	-	-
2nd AIME Quintile	0.0069	0.0117	-	-	-	-
3rd AIME Quintile	0.0057	0.0106	-	-	-	-
4th AIME Quintile	0.0055	0.0095	-	-	-	-
Highest AIME Quintile	0.0055	0.0088	-	-	-	-
<b>Total</b>	<b>0.0067</b>	<b>0.0110</b>	-	-	-	-
	<i>13.9%</i>	<i>31.9%</i>				

Note: Includes only workers reaching age 62 in 1993 and later.



**Table 3.—2005 Death Rates by Age Group for Retired-Worker Beneficiaries**

Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0233	0.0270	0.0398	-	-	-
2nd AIME Quintile	0.0144	0.0190	0.0335	-	-	-
3rd AIME Quintile	0.0110	0.0152	0.0286	-	-	-
4th AIME Quintile	0.0084	0.0127	0.0233	-	-	-
Highest AIME Quintile	0.0062	0.0084	0.0173	-	-	-
<b>Total</b>	<b>0.0127</b> <i>9.0%</i>	<b>0.0164</b> <i>23.6%</i>	<b>0.0285</b> <i>20.4%</i>	-	-	-
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0091	0.0128	0.0210	-	-	-
2nd AIME Quintile	0.0065	0.0101	0.0186	-	-	-
3rd AIME Quintile	0.0055	0.0090	0.0176	-	-	-
4th AIME Quintile	0.0053	0.0086	0.0163	-	-	-
Highest AIME Quintile	0.0048	0.0074	0.0148	-	-	-
<b>Total</b>	<b>0.0063</b> <i>8.9%</i>	<b>0.0096</b> <i>20.3%</i>	<b>0.0177</b> <i>17.8%</i>	-	-	-

Note: Includes only workers reaching age 62 in 1993 and later.

**Table 4.—2010 Death Rates by Age Group for Retired-Worker Beneficiaries**  
 Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0221	0.0251	0.0360	0.0537	-	-
2nd AIME Quintile	0.0134	0.0169	0.0290	0.0488	-	-
3rd AIME Quintile	0.0101	0.0135	0.0239	0.0431	-	-
4th AIME Quintile	0.0079	0.0111	0.0198	0.0363	-	-
Highest AIME Quintile	0.0065	0.0078	0.0146	0.0284	-	-
<b>Total</b>	<b>0.0120</b> <i>7.0%</i>	<b>0.0149</b> <i>18.1%</i>	<b>0.0247</b> <i>15.0%</i>	<b>0.0421</b> <i>11.6%</i>	-	-
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0084	0.0115	0.0186	0.0312	-	-
2nd AIME Quintile	0.0056	0.0092	0.0160	0.0292	-	-
3rd AIME Quintile	0.0050	0.0081	0.0154	0.0289	-	-
4th AIME Quintile	0.0050	0.0074	0.0148	0.0274	-	-
Highest AIME Quintile	0.0044	0.0064	0.0124	0.0247	-	-
<b>Total</b>	<b>0.0057</b> <i>7.2%</i>	<b>0.0085</b> <i>16.5%</i>	<b>0.0154</b> <i>13.7%</i>	<b>0.0283</b> <i>10.8%</i>	-	-

Note: Includes only workers reaching age 62 in 1993 and later.

**Table 5.—2015 Death Rates by Age Group for Retired-Worker Beneficiaries**

Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0254	0.0246	0.0344	0.0523	0.0801	-
2nd AIME Quintile	0.0164	0.0168	0.0274	0.0465	0.0787	-
3rd AIME Quintile	0.0120	0.0133	0.0226	0.0401	0.0711	-
4th AIME Quintile	0.0093	0.0108	0.0184	0.0342	0.0631	-
Highest AIME Quintile	0.0072	0.0076	0.0131	0.0259	0.0519	-
<b>Total</b>	<b>0.0141</b> <i>4.6%</i>	<b>0.0147</b> <i>15.9%</i>	<b>0.0232</b> <i>13.7%</i>	<b>0.0398</b> <i>9.6%</i>	<b>0.0690</b> <i>6.7%</i>	-
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0097	0.0114	0.0178	0.0302	0.0526	-
2nd AIME Quintile	0.0063	0.0088	0.0158	0.0284	0.0507	-
3rd AIME Quintile	0.0054	0.0079	0.0143	0.0270	0.0502	-
4th AIME Quintile	0.0051	0.0072	0.0132	0.0257	0.0498	-
Highest AIME Quintile	0.0045	0.0061	0.0110	0.0222	0.0449	-
<b>Total</b>	<b>0.0062</b> <i>5.1%</i>	<b>0.0083</b> <i>15.3%</i>	<b>0.0144</b> <i>13.0%</i>	<b>0.0267</b> <i>9.3%</i>	<b>0.0496</b> <i>6.7%</i>	-

Note: Includes only workers reaching age 62 in 1993 and later.

**Table 6.—2020 Death Rates by Age Group for Retired-Worker Beneficiaries**

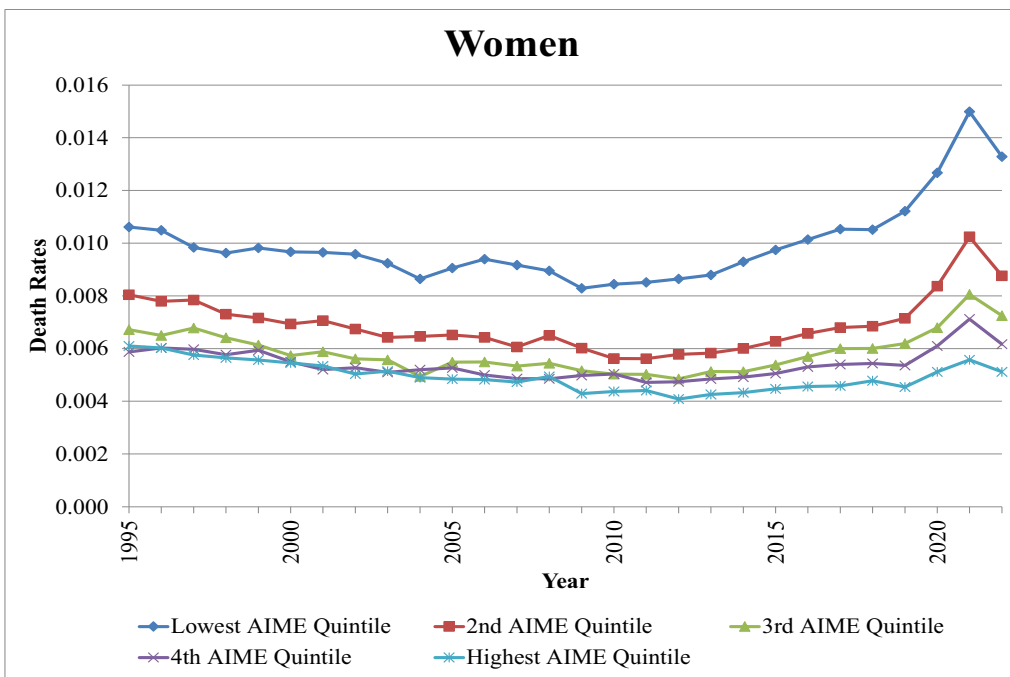
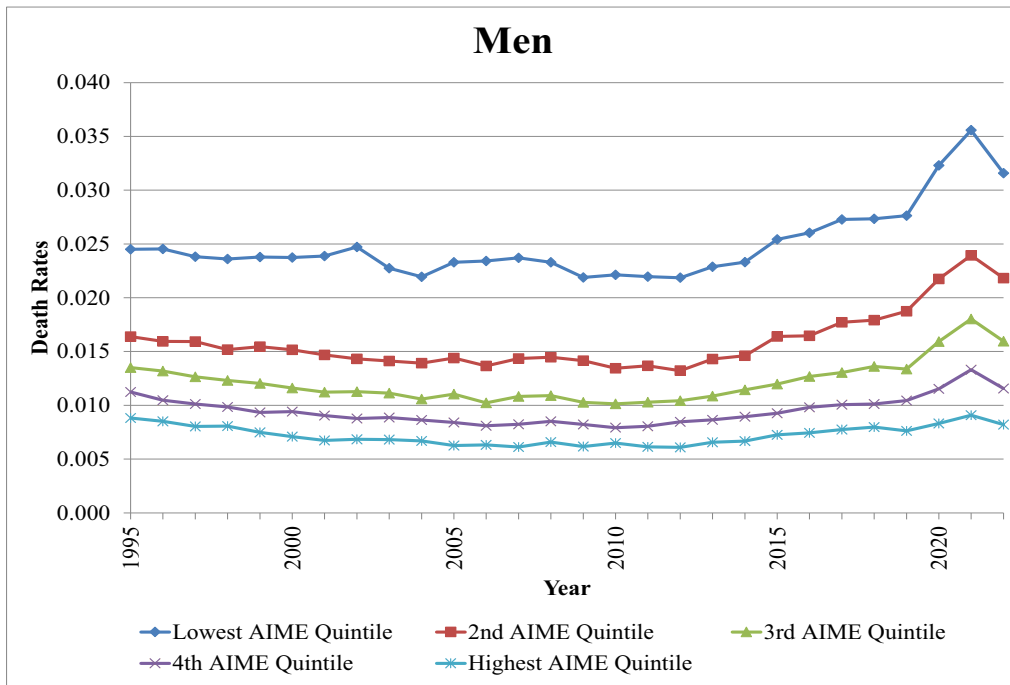
Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0323	0.0306	0.0394	0.0614	0.0944	0.1464
2nd AIME Quintile	0.0217	0.0203	0.0294	0.0510	0.0853	0.1417
3rd AIME Quintile	0.0159	0.0156	0.0236	0.0434	0.0768	0.1306
4th AIME Quintile	0.0115	0.0126	0.0191	0.0363	0.0665	0.1199
Highest AIME Quintile	0.0083	0.0093	0.0131	0.0268	0.0539	0.1046
<b>Total</b>	<b>0.0181</b> <i>3.3%</i>	<b>0.0178</b> <i>13.2%</i>	<b>0.0249</b> <i>14.0%</i>	<b>0.0438</b> <i>9.6%</i>	<b>0.0754</b> <i>6.0%</i>	<b>0.1287</b> <i>3.5%</i>
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	0.0127	0.0134	0.0195	0.0325	0.0572	0.1024
2nd AIME Quintile	0.0084	0.0102	0.0166	0.0301	0.0553	0.1013
3rd AIME Quintile	0.0068	0.0090	0.0151	0.0289	0.0545	0.1003
4th AIME Quintile	0.0061	0.0079	0.0135	0.0270	0.0509	0.0982
Highest AIME Quintile	0.0051	0.0066	0.0106	0.0222	0.0455	0.0907
<b>Total</b>	<b>0.0078</b> <i>3.6%</i>	<b>0.0095</b> <i>13.0%</i>	<b>0.0151</b> <i>13.9%</i>	<b>0.0281</b> <i>9.6%</i>	<b>0.0527</b> <i>6.3%</i>	<b>0.0986</b> <i>3.9%</i>

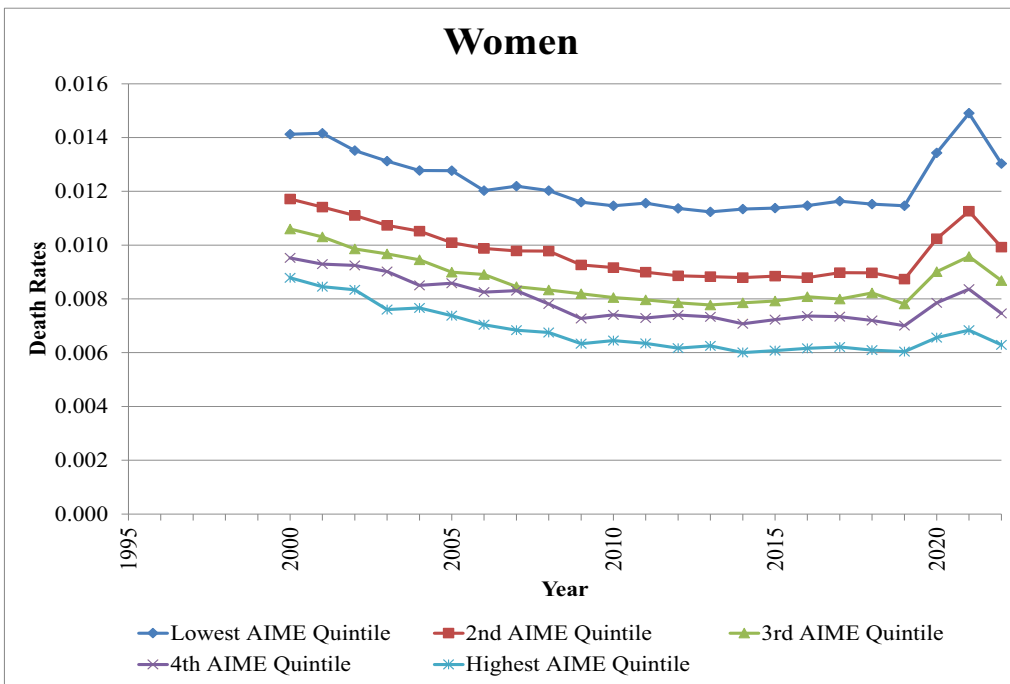
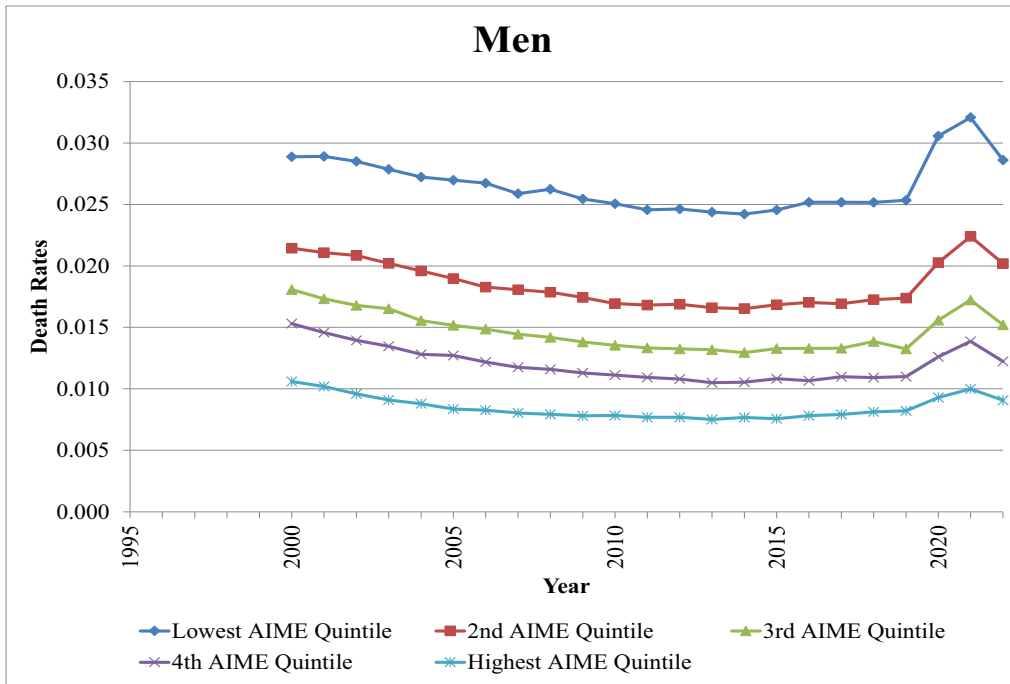
Note: Includes only workers reaching age 62 in 1993 and later.

**D. Age Group Death Rate Figures by AIME Quintiles**

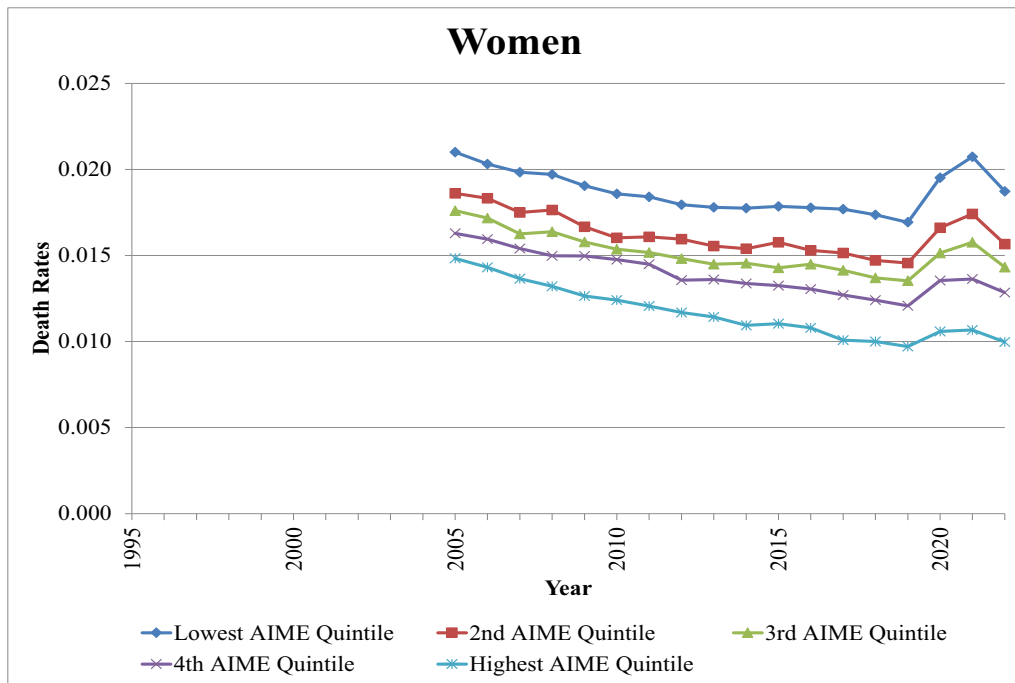
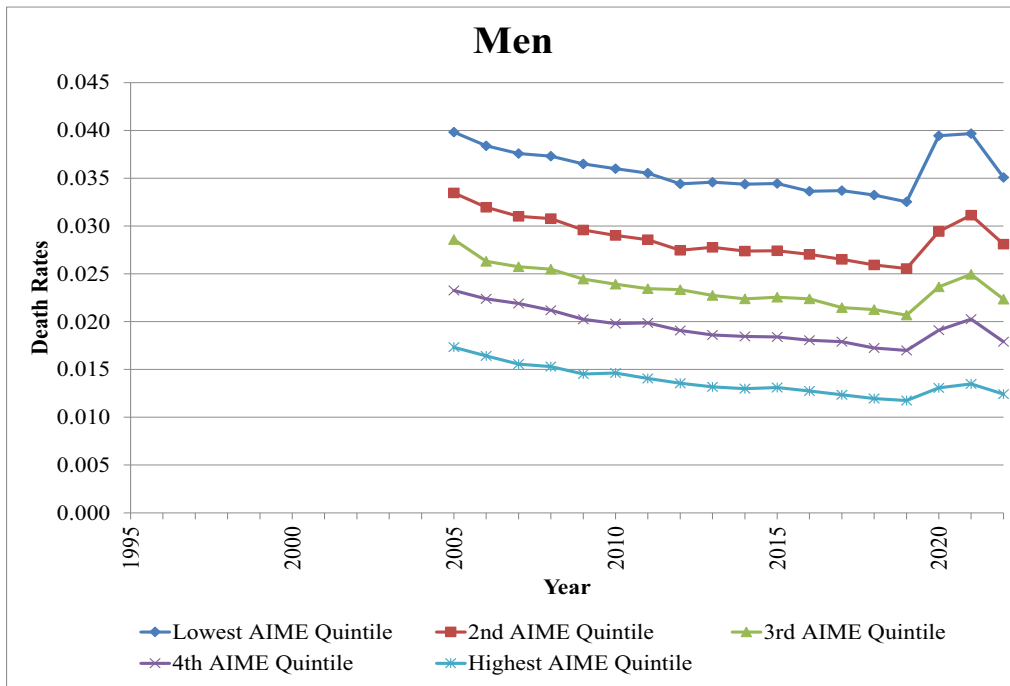
**Figure 1.—Age Group 62-64 Death Rates for Retired-Worker Beneficiaries**



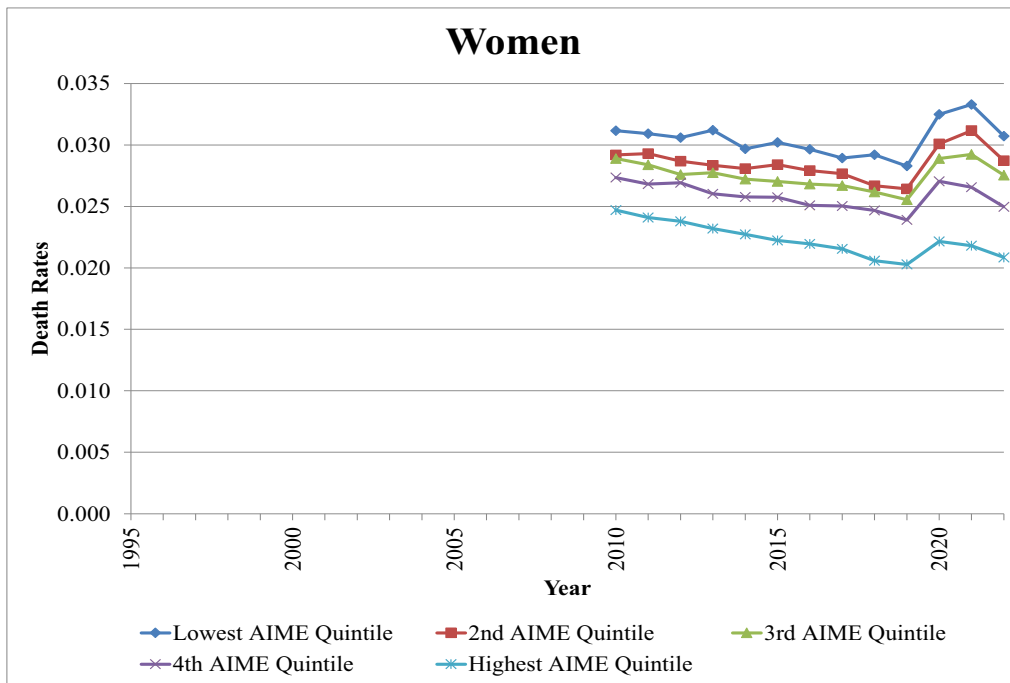
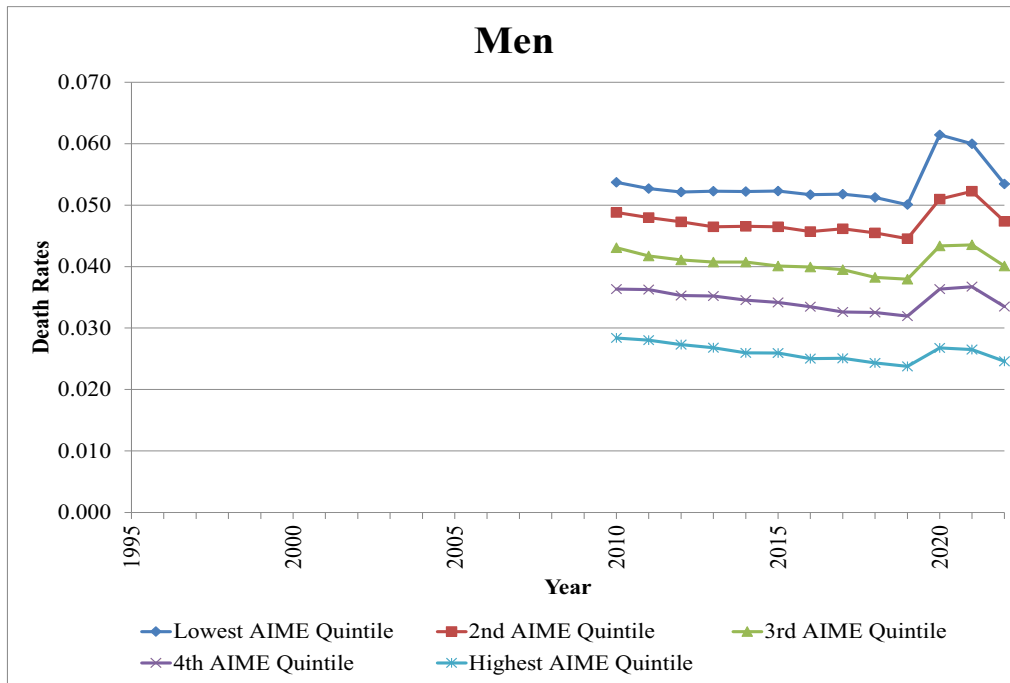
**Figure 2.—Age Group 65-69 Death Rates for Retired-Worker Beneficiaries**



**Figure 3.—Age Group 70-74 Death Rates for Retired-Worker Beneficiaries**

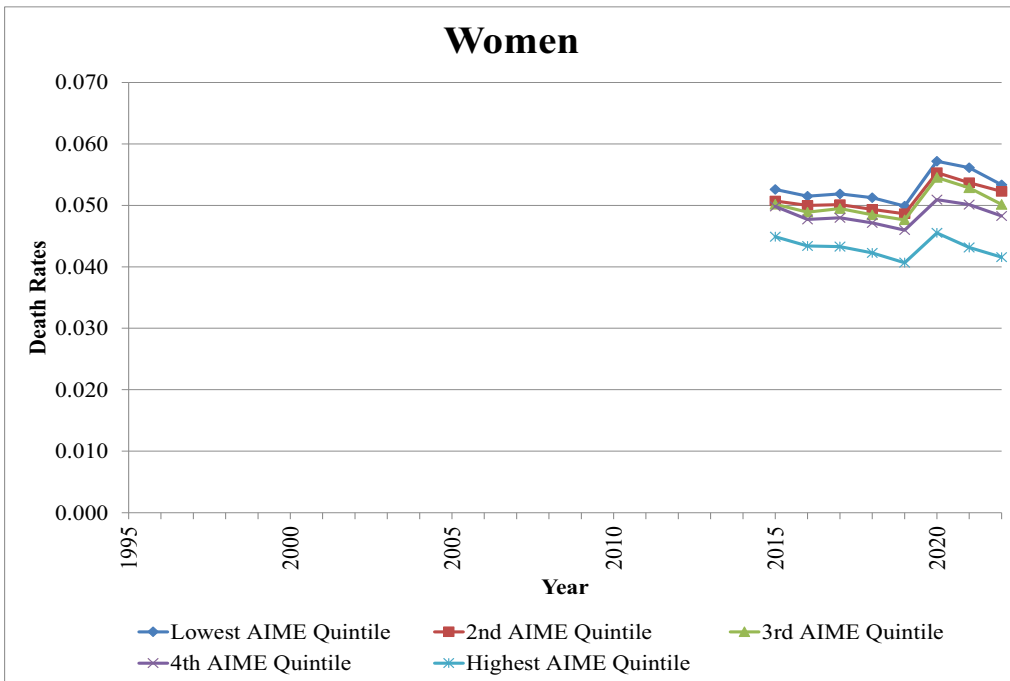
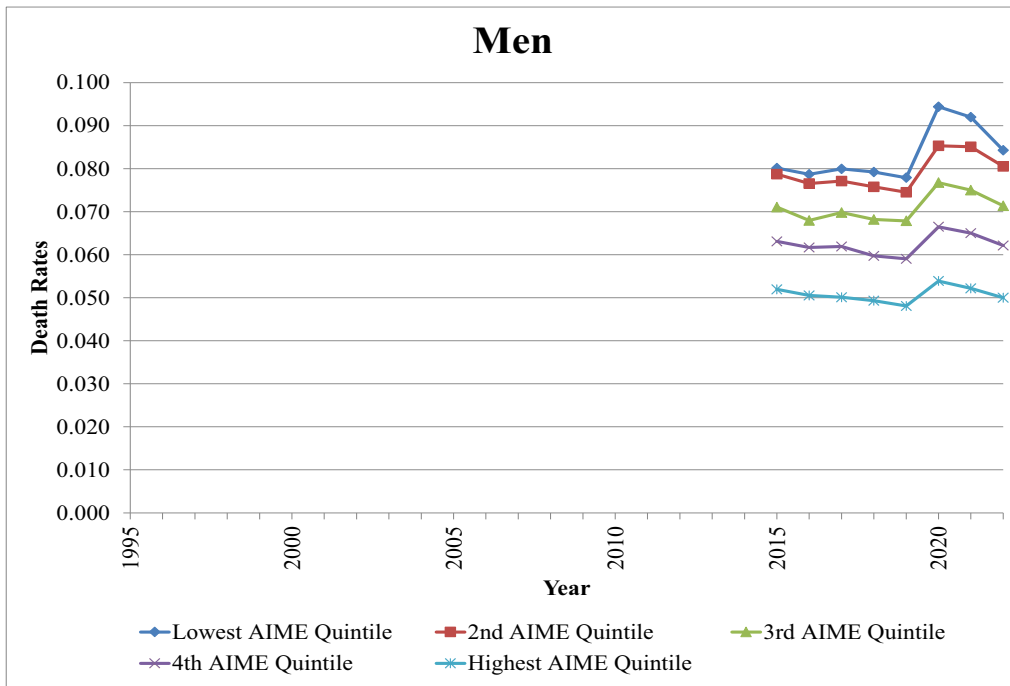


**Figure 4.—Age Group 75-79 Death Rates for Retired-Worker Beneficiaries**

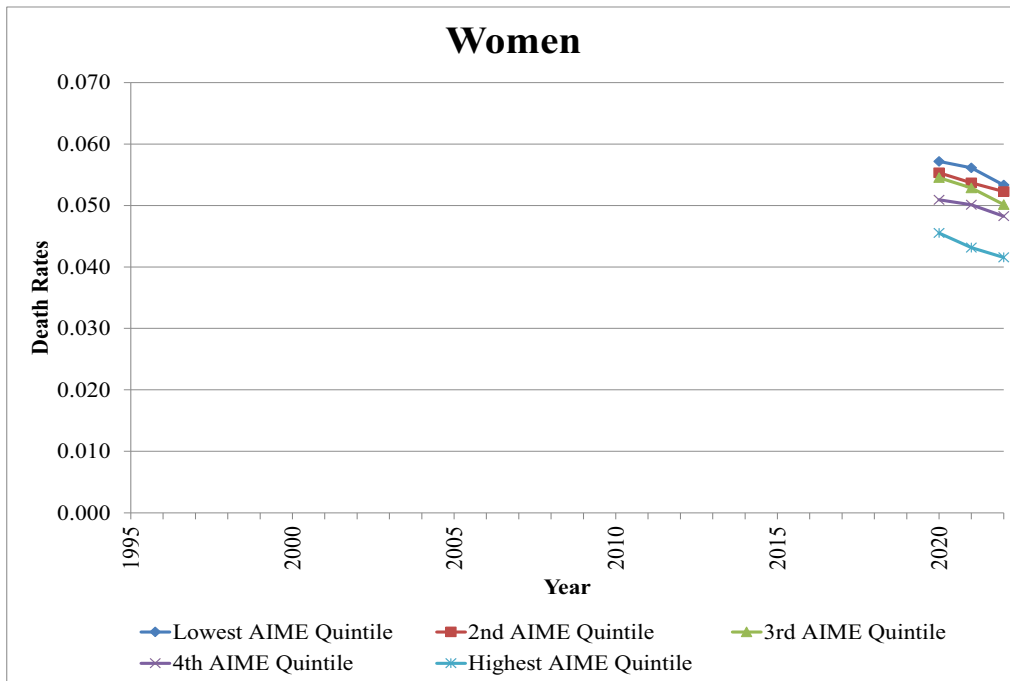
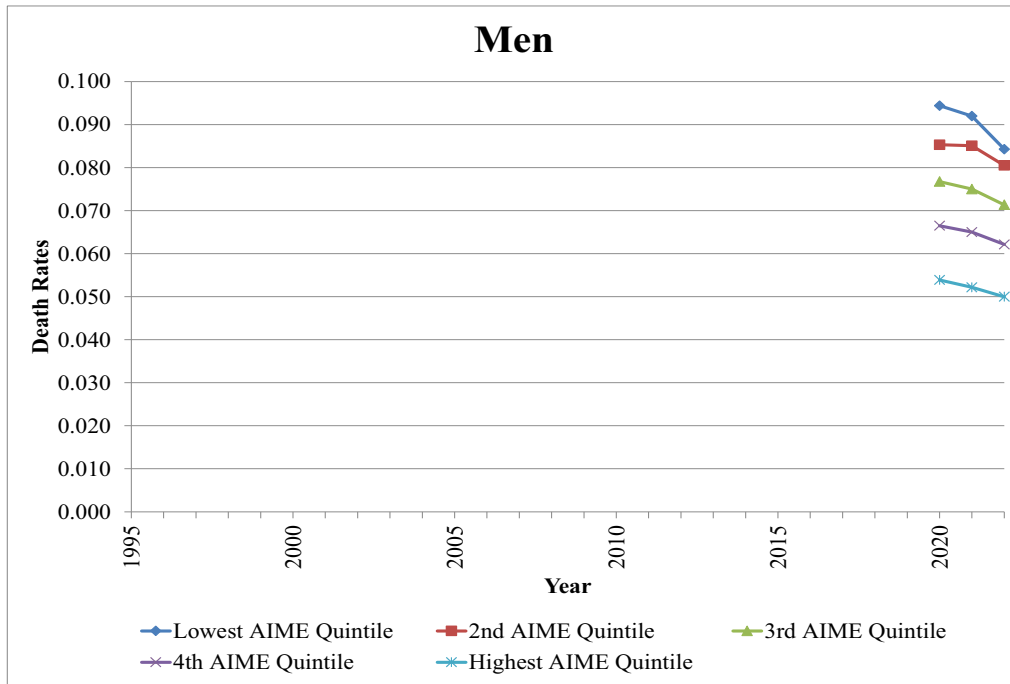




**Figure 5.—Age Group 80-84 Death Rates for Retired-Worker Beneficiaries**



**Figure 6.—Age Group 85-89 Death Rates for Retired-Worker Beneficiaries**



***E. Relative Mortality Ratio Tables by AIME Quintile Levels***

**Table 7.—1995 Relative Mortality Ratios by Age Group for Retired-Worker Beneficiaries**

Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.64	-	-	-	-	-
2nd AIME Quintile	1.10	-	-	-	-	-
3rd AIME Quintile	0.90	-	-	-	-	-
4th AIME Quintile	0.75	-	-	-	-	-
Highest AIME Quintile	0.59	-	-	-	-	-
<b>Total</b>	<b>1.00</b>	-	-	-	-	-
	53.7%					
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.42	-	-	-	-	-
2nd AIME Quintile	1.07	-	-	-	-	-
3rd AIME Quintile	0.90	-	-	-	-	-
4th AIME Quintile	0.78	-	-	-	-	-
Highest AIME Quintile	0.81	-	-	-	-	-
<b>Total</b>	<b>1.00</b>	-	-	-	-	-
	46.3%					

Note: Includes only workers reaching age 62 in 1993 and later.

**Table 8.—2000 Relative Mortality Ratios by Age Group for Retired-Worker Beneficiaries**  
 Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.76	1.53	-	-	-	-
2nd AIME Quintile	1.12	1.14	-	-	-	-
3rd AIME Quintile	0.86	0.96	-	-	-	-
4th AIME Quintile	0.70	0.81	-	-	-	-
Highest AIME Quintile	0.52	0.56	-	-	-	-
<b>Total</b>	<b>1.00</b> <i>15.0%</i>	<b>1.00</b> <i>39.3%</i>	-	-	-	-
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.45	1.29	-	-	-	-
2nd AIME Quintile	1.04	1.07	-	-	-	-
3rd AIME Quintile	0.86	0.97	-	-	-	-
4th AIME Quintile	0.82	0.87	-	-	-	-
Highest AIME Quintile	0.82	0.80	-	-	-	-
<b>Total</b>	<b>1.00</b> <i>13.9%</i>	<b>1.00</b> <i>31.9%</i>	-	-	-	-

Note: Includes only workers reaching age 62 in 1993 and later.

**Table 9.—2005 Relative Mortality Ratios by Age Group for Retired-Worker Beneficiaries**  
 Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.83	1.64	1.40	-	-	-
2nd AIME Quintile	1.13	1.15	1.17	-	-	-
3rd AIME Quintile	0.87	0.92	1.00	-	-	-
4th AIME Quintile	0.66	0.77	0.82	-	-	-
Highest AIME Quintile	0.49	0.51	0.61	-	-	-
<b>Total</b>	<b>1.00</b> <i>9.0%</i>	<b>1.00</b> <i>23.6%</i>	<b>1.00</b> <i>20.4%</i>	-	-	-
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.45	1.33	1.19	-	-	-
2nd AIME Quintile	1.04	1.05	1.05	-	-	-
3rd AIME Quintile	0.88	0.94	1.00	-	-	-
4th AIME Quintile	0.84	0.90	0.92	-	-	-
Highest AIME Quintile	0.77	0.77	0.84	-	-	-
<b>Total</b>	<b>1.00</b> <i>8.9%</i>	<b>1.00</b> <i>20.3%</i>	<b>1.00</b> <i>17.8%</i>	-	-	-

Note: Includes only workers reaching age 62 in 1993 and later.

**Table 10.—2010 Relative Mortality Ratios by Age Group for Retired-Worker Beneficiaries**

Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.84	1.68	1.46	1.28	-	-
2nd AIME Quintile	1.12	1.13	1.18	1.16	-	-
3rd AIME Quintile	0.84	0.91	0.97	1.02	-	-
4th AIME Quintile	0.66	0.74	0.80	0.86	-	-
Highest AIME Quintile	0.54	0.52	0.59	0.67	-	-
<b>Total</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	-	-
	<i>7.0%</i>	<i>18.1%</i>	<i>15.0%</i>	<i>11.6%</i>		
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.48	1.34	1.20	1.10	-	-
2nd AIME Quintile	0.99	1.08	1.04	1.03	-	-
3rd AIME Quintile	0.88	0.94	1.00	1.02	-	-
4th AIME Quintile	0.88	0.87	0.96	0.97	-	-
Highest AIME Quintile	0.77	0.76	0.80	0.87	-	-
<b>Total</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	<b>1.00</b>	-	-
	<i>7.2%</i>	<i>16.5%</i>	<i>13.7%</i>	<i>10.8%</i>		

Note: Includes only workers reaching age 62 in 1993 and later.

**Table 11.—2015 Relative Mortality Ratios by Age Group for Retired-Worker Beneficiaries**

Percentages represent the share of workers in that sex and age group

	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.81	1.67	1.49	1.31	1.16	-
2nd AIME Quintile	1.16	1.15	1.18	1.17	1.14	-
3rd AIME Quintile	0.85	0.90	0.97	1.01	1.03	-
4th AIME Quintile	0.66	0.74	0.79	0.86	0.91	-
Highest AIME Quintile	0.51	0.51	0.57	0.65	0.75	-
<b>Total</b>	<b>1.00</b> <i>4.6%</i>	<b>1.00</b> <i>15.9%</i>	<b>1.00</b> <i>13.7%</i>	<b>1.00</b> <i>9.6%</i>	<b>1.00</b> <i>6.7%</i>	-
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.57	1.37	1.24	1.13	1.06	-
2nd AIME Quintile	1.01	1.06	1.09	1.06	1.02	-
3rd AIME Quintile	0.87	0.95	0.99	1.01	1.01	-
4th AIME Quintile	0.82	0.87	0.92	0.96	1.00	-
Highest AIME Quintile	0.72	0.73	0.76	0.83	0.90	-
<b>Total</b>	<b>1.00</b> <i>5.1%</i>	<b>1.00</b> <i>15.3%</i>	<b>1.00</b> <i>13.0%</i>	<b>1.00</b> <i>9.3%</i>	<b>1.00</b> <i>6.7%</i>	-

Note: Includes only workers reaching age 62 in 1993 and later.

**Table 12.—2020 Relative Mortality Ratios by Age Group for Retired-Worker Beneficiaries**

Percentages represent the share of workers in that sex and age group

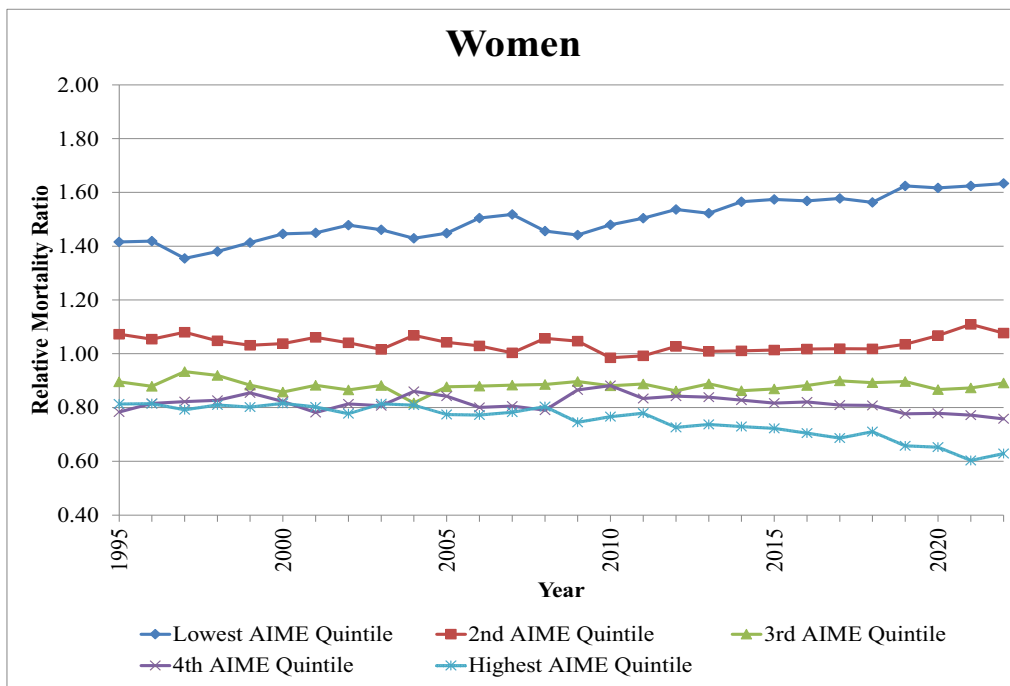
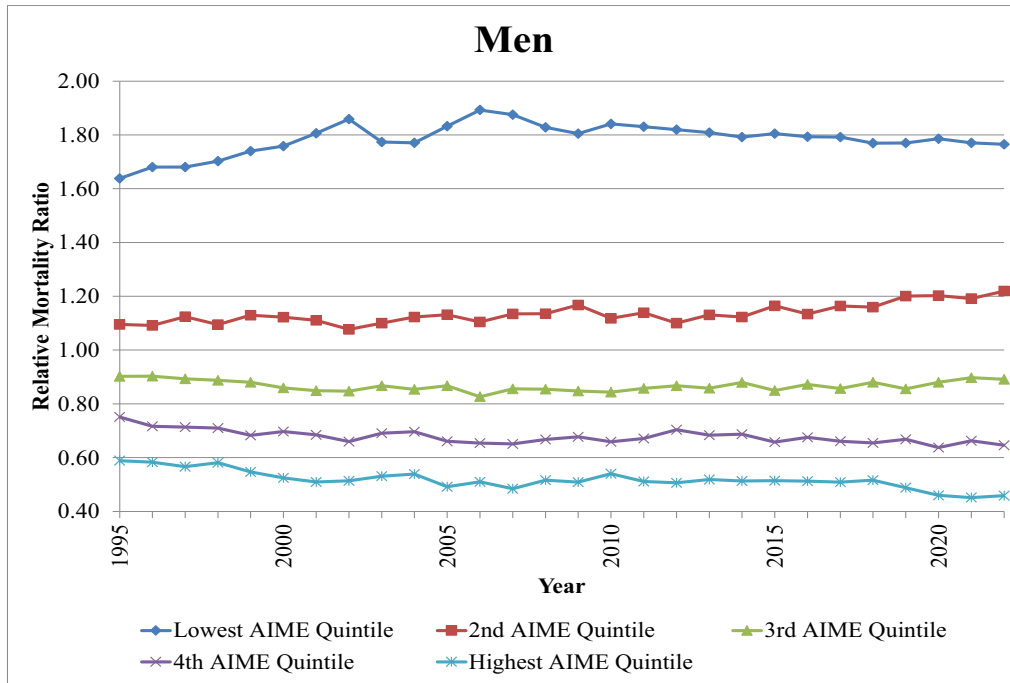
	Age					
	<u>62-64</u>	<u>65-69</u>	<u>70-74</u>	<u>75-79</u>	<u>80-84</u>	<u>85-89</u>
<b>Male Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.79	1.72	1.58	1.40	1.25	1.14
2nd AIME Quintile	1.20	1.14	1.18	1.16	1.13	1.10
3rd AIME Quintile	0.88	0.88	0.95	0.99	1.02	1.02
4th AIME Quintile	0.64	0.71	0.77	0.83	0.88	0.93
Highest AIME Quintile	0.46	0.52	0.52	0.61	0.71	0.81
<b>Total</b>	<b>1.00</b> 3.3%	<b>1.00</b> 13.2%	<b>1.00</b> 14.0%	<b>1.00</b> 9.6%	<b>1.00</b> 6.0%	<b>1.00</b> 3.5%
<b>Female Retired-Worker Beneficiaries by AIME Level:</b>						
Lowest AIME Quintile	1.62	1.42	1.29	1.15	1.08	1.04
2nd AIME Quintile	1.07	1.08	1.10	1.07	1.05	1.03
3rd AIME Quintile	0.87	0.95	1.00	1.03	1.03	1.02
4th AIME Quintile	0.78	0.83	0.90	0.96	0.97	1.00
Highest AIME Quintile	0.65	0.69	0.70	0.79	0.86	0.92
<b>Total</b>	<b>1.00</b> 3.6%	<b>1.00</b> 13.0%	<b>1.00</b> 13.9%	<b>1.00</b> 9.6%	<b>1.00</b> 6.3%	<b>1.00</b> 3.9%

Note: Includes only workers reaching age 62 in 1993 and later.

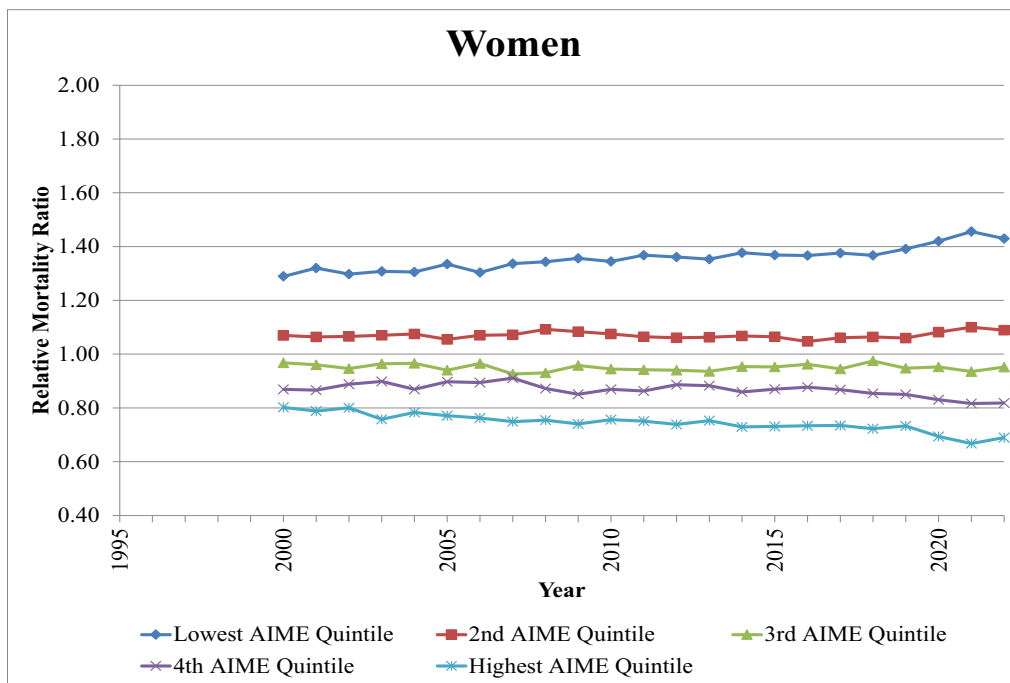
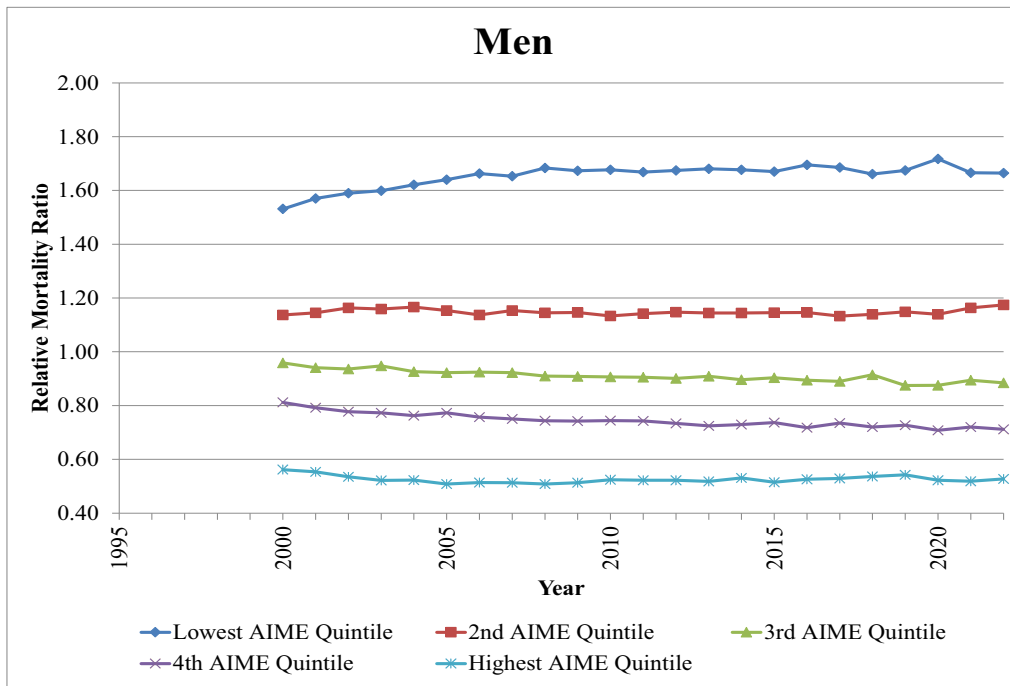


**F. Age Group Relative Mortality Ratios by AIME Quintile Levels**

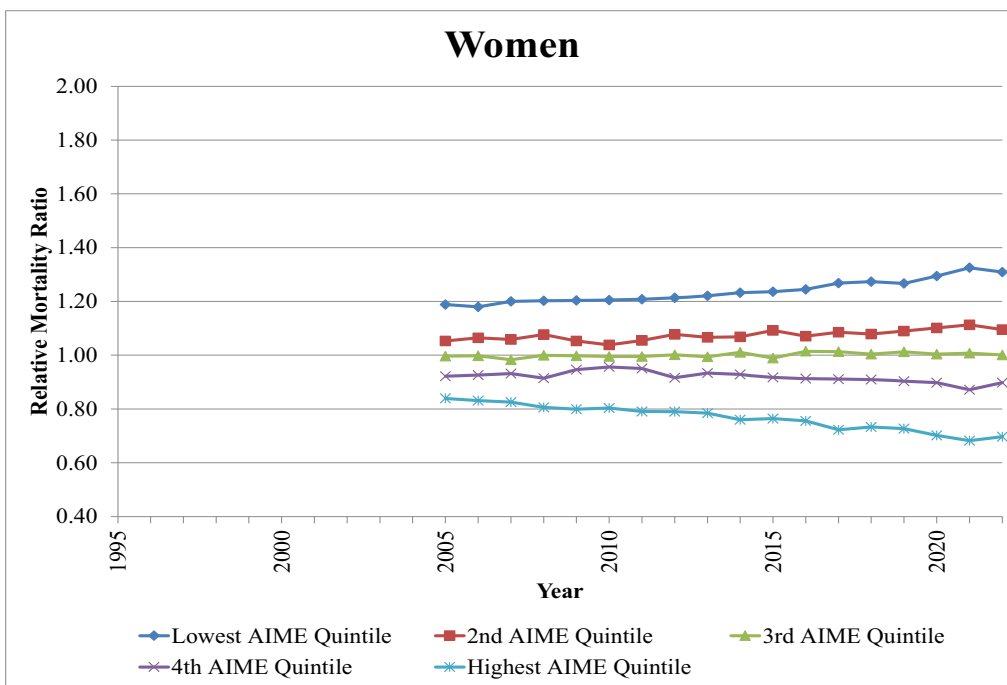
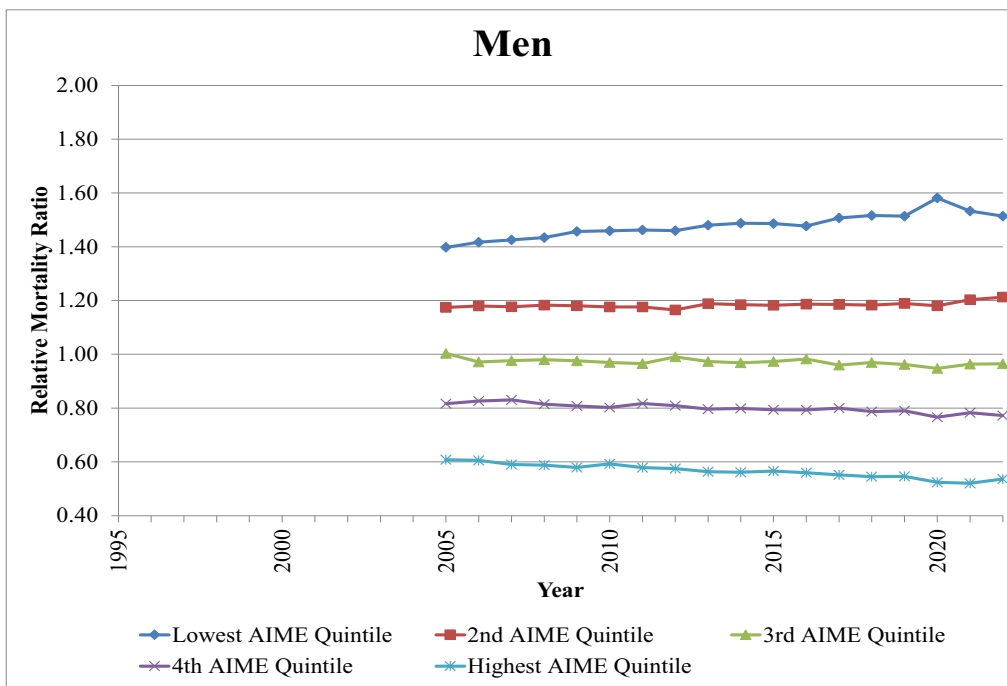
**Figure 7.—Age Group 62-64 Relative Mortality Ratios for Retired-Worker Beneficiaries**



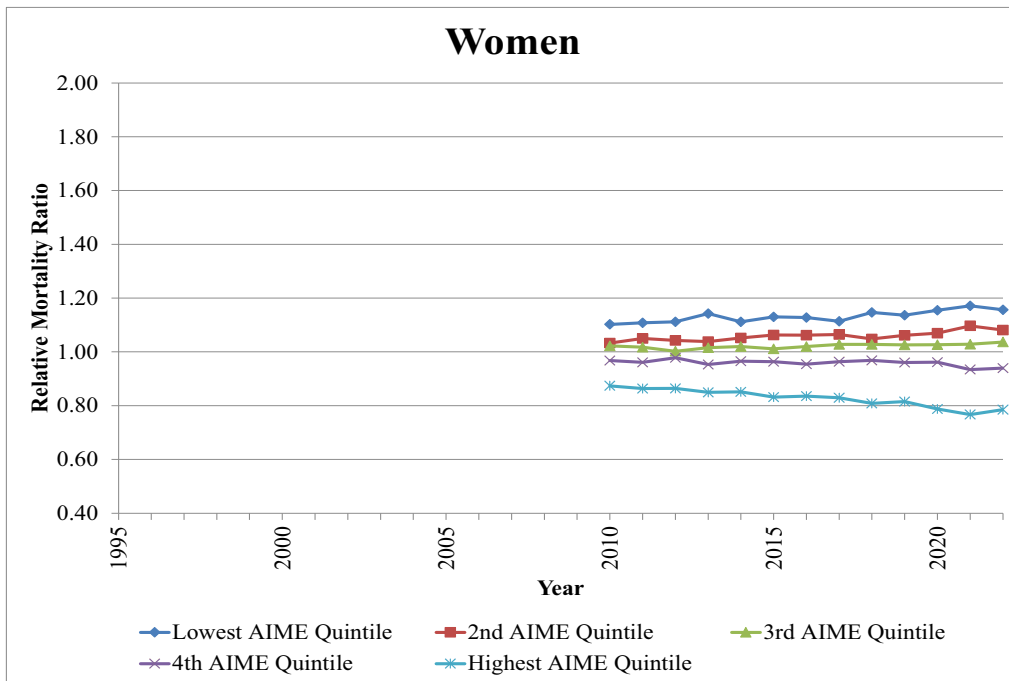
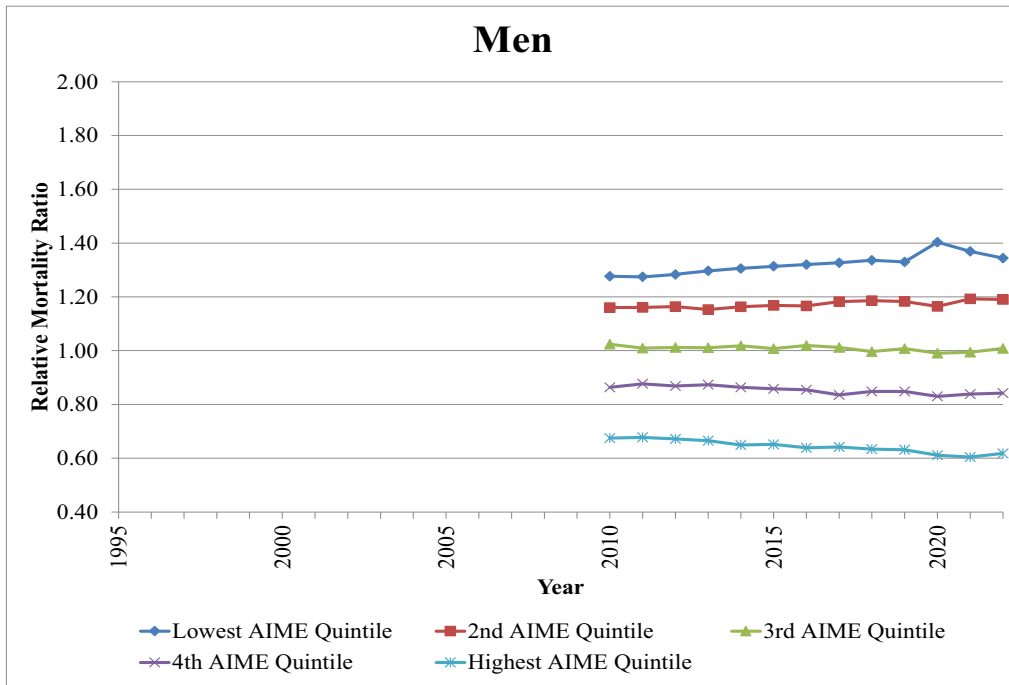
**Figure 8.—Age Group 65-69 Relative Mortality Ratios for Retired-Worker Beneficiaries**



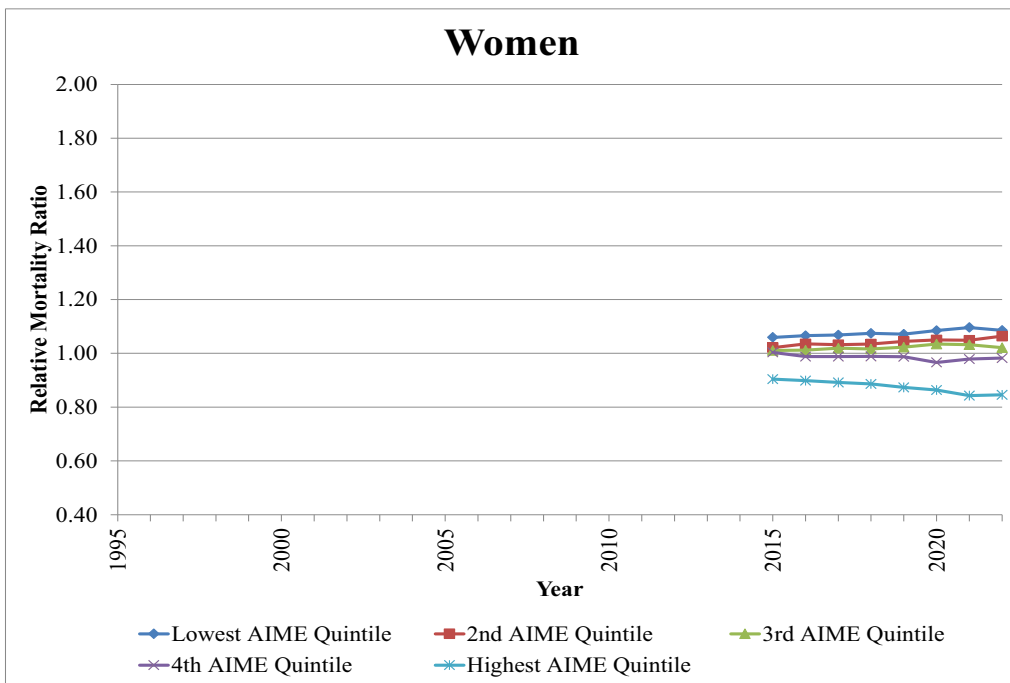
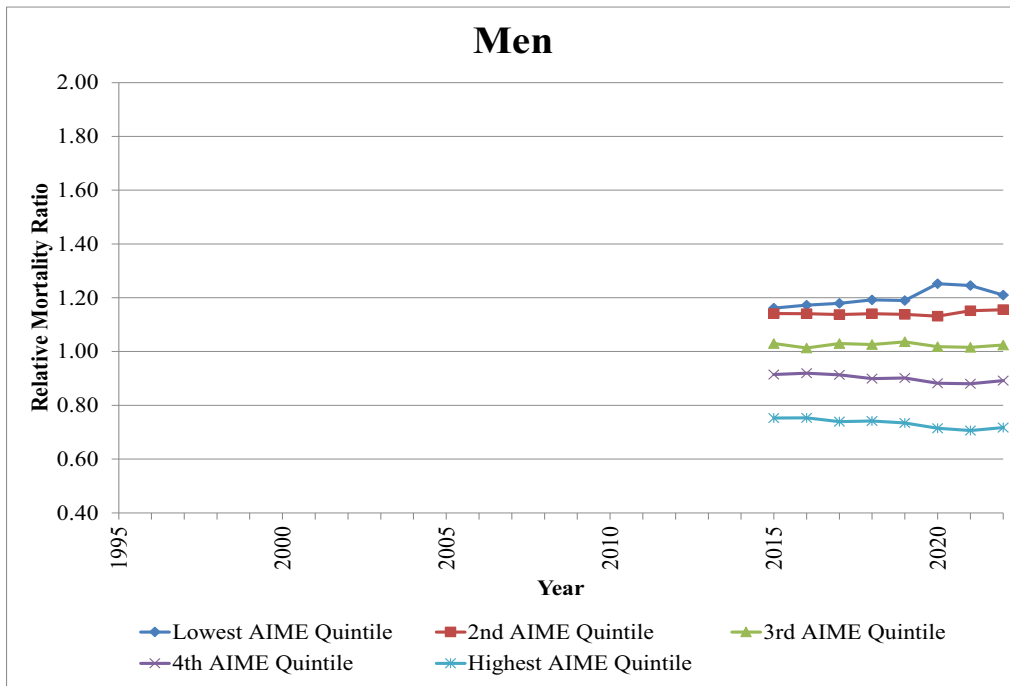
**Figure 9.—Age Group 70-74 Relative Mortality Ratios for Retired-Worker Beneficiaries**



**Figure 10.—Age Group 75-79 Relative Mortality Ratios for Retired-Worker Beneficiaries**



**Figure 11.—Age Group 80-84 Relative Mortality Ratios for Retired-Worker Beneficiaries**



**Figure 12.—Age Group 85-89 Relative Mortality Ratios for Retired-Worker Beneficiaries**

