NatEquity, Inc. Funding Aging in Place™

NatEquity Knowledge Base

What is NatEquity's Valuation Methodology and How Does It Add Value?

1 EXECUTIVE SUMMARY

Origins and History

NatEquity's NPV of future cash flows valuation methodology has a 45-year history, the last 15 of which includes presentation to the SEC, a peer reviewed and published paper, revalidation and conversion of early machine learning code to modern agentic AI code in an enterprise resource management system. This model facilitates longevity dependent product pricing and GAAP/SEC compliant valuation of Level-3 contracts and portfolios. Imbedded in this methodology is a module that accurately predicts with 96% accuracy the trajectory of morbidity and mortality in individual persons over age 65. This means NatEquity has the ability to know when each contract will mature. Combined with NatEquity's product design, this allows NatEquity to know when and how much will be collected for each loan in a portfolio. NatEquity thus controls portfolio tail risk, achieves a better credit rating and accretes substantial portfolio book but not taxable value, providing predictable returns to large institutional investors.

In 1980, the U.S. Government assembled a group of medical and applied math specialists to develop a questionnaire to assess seniors in an upcoming study called the National Long-Term Care Survey (NLTCS). The group spent a year deciding upon the makeup of the question set to evaluate medical, activity of daily living (ADL), cognitive and lifestyle characteristics of seniors aged 65 and older. This assessment surveyed, at random, 32,000 Social Security recipient seniors every five years for 20 years. Having consecutive assessments of these same individuals over a span of 15 years is the key to teaching machine learning algorithms. The data sets were de-identified in 2005.

After the third consecutive assessment, the actuary/demographer on the team, Eric Stallard from Duke University's Medical School, noticed some patterns in the consecutive assessment data sets. Stallard embarked on a 10-year process of developing machine learning algorithms to isolate patterns in the more than 30 million co-dependent variables in each individual data set. Each data set has 76 questions, many of which have 8 possible answers. Each individual snapshot data set then had to be reconciled as each person's morbidity characteristics changed in progressive 5-year intervals. In total 20,000 individuals were tracked until death in three or more consecutive data sets to validate the trajectory of those changes. The algorithm set in the model is more than 96% accurate in predicting the trajectory of morbidity and mortality in single individuals aged 65 and older.

To interpret the interdependency of the more than 30 million co-dependent variables in each individual's assessment data set Stallard used a Grade of Membership (GoM) scoring system previously developed. A full description is in Section 4. The strength of the algorithms is best understood when the reader digs into the subtleties of how different patterns of variables interact. Interpreting these differences is where the value added of the algorithms is for fields beyond determining life expectancy.

Stallard first presented his peer reviewed findings at a conference in 2005. As you can imagine, Society of Actuaries members were skeptical and challenged this new methodology which contains no usual mortality tables. The material was again peer reviewed and published in 2007[i]. In 2008 Stallard was presented with the Edward Lew Award, given biennially to one actuary worldwide for work in computer modeling. By then the algorithms had gained universal acceptance amongst actuaries worldwide. In 2007, Peter Mazonas contracted with Stallard to be a consultant. Later Mazonas diagramed the Stallard work, and in conjunction with Stallard and contractors converted the Stallard published materials into computer code and validated a PC / web-based replica of the model and named it the Longevity Cost Calculator (LCC). From 2010-2012, Mazonas and Stallard revalidated Stallard's original work with a large data set provided by a multi-site long-term care management company in the Pacific Northwest. Mazonas and Stallard continued to refine the algorithms for commercial use, but not until 2017 was the model first put to commercial use in ratings a longevity asset portfolio. NatEquity, through a third-party valuation company, L3 Analytica, has the exclusive rights to the LCC for pricing and valuations of home equity access products, portfolios and other longevity dependent commercial products and services. Stallard continues to use and revalidate the algorithms in medical research. Most recently in 2014 and again in 2017 and 2021, the original NLTCS study accuracy has been replicated in peer reviewed published journal articles, to accurately predict the trajectory toward death of persons with Alzheimer's Disease[ii][iii] NatEquity, Mazonas and Stallard are pursuing National Institutes of Health grants to advance the model.

The LCC is a component of a Bayesian Inference valuation model developed by Mazonas, Stallard and Lynford Graham. This valuation model allows users to consistently value and revalue the discounted present value of future portfolio cash flows for longevity dependent assets and liabilities. This GAAP compliant valuation model was first presented to the SEC in 2009 and peer reviewed and published in 2011[iv]. In 2020, the SEC issued Rule 2a-5, requiring companies issuing financial statements to value assets and liabilities under the discount NPV of future portfolio cash flows methodology compliant with GAPP AUC 820. SEC Rule 2a-5 became effective for financial statements issued beginning in 2024. Noncompliance subjects the issuer's auditors to SEC sanctions and issuer directors to fines.

Value Added, Part 1 – Superior Control of Portfolio Tail Risk

NatEquity adds value by using the valuation model to assess senior's life expectancy. For home equity access contracts, NatEquity uses the model to price and value portfolios of NatEquity contracts. NatEquity assembles contracts in our ERP operating platform. Upon completing each portfolio, NatEquity knows with high statistical confidence each portfolio's future cash flows. Combined with elements of contract design that limit cash flow downsides, NatEquity knows when and how much cash will be collected for each contract. NatEquity's proprietary knowledge allows NatEquity, should they choose, to balance/tranche bundles of NatEquity contracts to meet a client's portfolio duration goals. Understanding and controlling contract duration eliminates the "tail risk" of a portfolio and stabilized the internal rate of return (IRR).

Value Added, Part 2 – Accretive Portfolio Values

In 2014, accounting rules worldwide implemented changes in how assets and liabilities are priced for audited financial statements. These changes, initially begun in the 1990s, require that assets be "Marked-to-Fair Value" and no longer carried at cost on financial statements. This is easy for stocks and bonds, assets classified Level 1, where the daily traded value is published. Level 2 assets and liabilities rely upon observable market-based inputs other than Level 1 quoted prices or unobservable inputs that are corroborated by market data. All real estate and mortgages are classified as Level 3. Most difficult

are Level 3 assets where the value is dependent upon an "unknowable" future event. For senior equity access products this is the moveout or death of the homeowner(s) which controls future cash flows.

The LCC's mortality predictive abilities are a component of a GAAP and SEC compliant valuation methodology[v]. Applying Bayesian Inference provides statistical confidence in predicting future contract and portfolio cash flows allows. High statistical confidence allows NatEquity, under mark-to-fair value GAAP rules, to use a lower discount rate to arrive at the net present value (NPV) of future cash flows – the measure of value. This means NatEquity's proprietary jumbo reverse mortgage portfolios, aggregated using the LCC based valuation methodology, accretes substantial additional annual book, but not taxable, profits and cumulative balance sheet value. This financial statement value can be retained in part by the issuing banker and used as participation or to supplement reserves. Over time this accredited value normalizes.

For a hypothetical NatEquity self-sustaining $200 million dollar portfolio containing $110 of cash out toward contracts and $90 in future payment reserves, the NPV of cash flow valuation methodology allows the portfolio issuer to accrete / add approximately $15 million of portfolio value[vi].

Value Added, Part 3 – First Mover Barrier to Entry

NatEquity's valuation methodology and ability to mortality price contracts is becoming recognized as a barrier to entry for others in the regulated marketplace for senior equity access products. The combination of a strong investment grade rating based on product fundamentals, plus accreted value GAAP and SEC compliance makes NatEquity portfolios a consistent mid-teen yield investment for conventional institutional buyers like pensions, insurance companies and endowments.

Community bankers successfully lobbied to delay implementation of ASC§ 820 Mark-to-Fair value GAAP rules until 2020 for mortgages and real estate assets because the mortgage industry could not make necessary changes fast enough. Many home equity investment (HEI) and proprietary reverse mortgage products have not modified their valuation methodologies to come into GAAP compliance. Some argue their lump sum loans are Level 3 assets but continue to use Level 2 valuation methodologies. Other portfolios, held by private equity groups, are carried at cost under the premise they are held to maturity. NatEquity's lifetime income loan is clearly Level 3 and the future portfolio cash flows are mortality dependent. NatEquity will use the same mark-to-fair value methodology presented to the SEC in 2009[vii] and which has been cited in more than 75 peer reviewed and published journal articles and other academic papers.

2 RECENT SEC STATEMENTS ON VALUATION ENFORCEMENT

At a PwC webinar in July 2025, SEC commissioner and Head of Enforcement Mark Uyeda, stated that compliant valuation is an enforcement priority for the SEC in 2025-2026. This enforcement was echoed by Elise Stephanic (R- NY) when she called out Harvard University for improper valuations of its private equity and real estate related endowment assets. At the same time the Administration announced it would allow 401K and other individual pension type plans to invest in alternative assets similar to private equity firms. Similar sentiments have been expressed in court filings against private equity firms over their valuation of non-liquid assets.

At the heart of the SEC's enforcement announcement is their mandate to protect individual investors. Longevity dependent assets, like NatEquity's private shared appreciation reverse mortgage pools, are today only a small percentage of the asset types covered by this enforcement mandate. NatEquity believes that our unique ability to comply with this SEC requirement sets us apart and provides a significant competitive advantage in serving the rapidly growing senior homeowner population in

America. Although coastal California is our initial and 6 million senior household first market, expanding to meet the needs of all senior homeowners across America is our ultimate goal. We will continue to review our strategy as the regulated and unregulated HEI marketplace and government guaranteed HECM marketplace evolves and changes.

3 2026 ASC§ 326 PURCHASED LOAN RULE

FASB issued ASC 326, a clarification of the Purchased Financial Asset rule, effective December 2026. The "90-Day" test says that loans are deemed "seasoned" if acquired by other than the originator. These loans must be booked at their purchase price. For NatEquity portfolios containing accreted value this includes the accreted value purchased by the buyer and not attributed to the issuer's participation. To the extent this purchase price is in excess of cost, the accreted value must be booked at the 90-day point as balance sheet value and book, but not taxable, income.

Loan purchased by the issuer from the originator and held for 90 days, must book the accreted increment value in excess of cost. When securitized and sold, the amount of accreted value in excess of the cost value of the loans, depending upon how much the issuer retains or ascribes to their participation interest in each portfolio, must be booked.

4 LONGEVITY COST CALCULATOR (LCC) - MODEL DETAIL

To deal with the more than 30 million codependent variables in each large data set each time an individual was assessed, Stallard employed the Grade of Membership (GoM) model KG Manton[viii] and MA Woodbury and Stallard had developed at Duke's Center for Demographic Studies. The GoM model does this by estimating maximum likelihood principles, one of two types of statistical parameters. One describes the probability that a person who is exactly like one of the K (pure type) analytically defined types in a particular response on a given variable (question). The second describes each individual's degree of membership in each of the K types. This "partial" membership score reflects the logic of the fuzzy partitions (rather than discrete groups) that are employed in the machine learning analysis. This predictive modeling is an application of the Bayes Theorem where a hypothesis is backed by strong evidence over time. Once the algorithms were developed and validated, they can be applied to single data sets. By modifying the probability structure of the basic model, the procedure can be applied to a number of different types of data and analytic problems, as evidenced in Stallard's Alzheimer's work.

Mazonas and Stallard first applied this machine learning to mortality dependent life settlement contracts, life insurance annuities and reverse mortgages in 2011. This same methodology can be incorporated into predictive estimates of other mortality sets of variables. Although not tested, there is no reason to assume this does not apply to combinations and modifications of other human characteristics and variables.

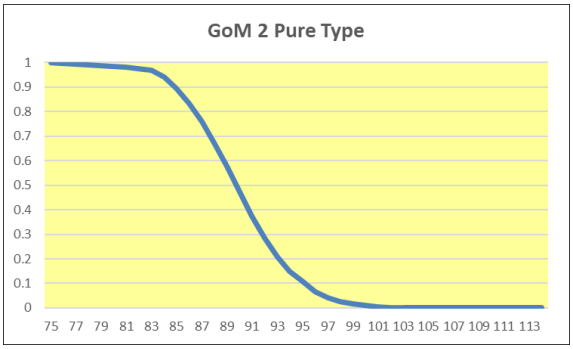
Each GoM state is described in relation to an inquiry, ideal individuals "Pure Type" score totaling 1.0. GoM scores are not crisp, they are "fuzzy". Except for rare pure type individuals, an individual's score is a blend of scores from GoM categories 1-3, where a pure type 1.0 GoM 4 score occurs at death (endpoint). GoM scores however are not probabilistic of membership – instead are grades of membership.

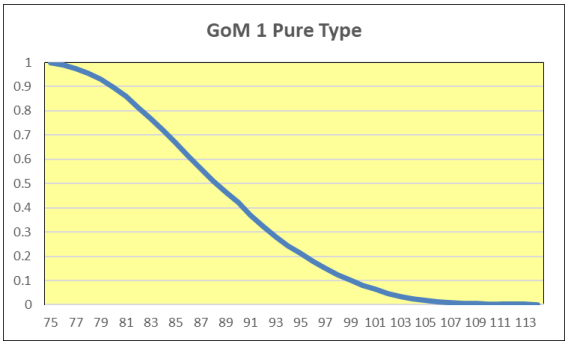
GoM pure types are rare.

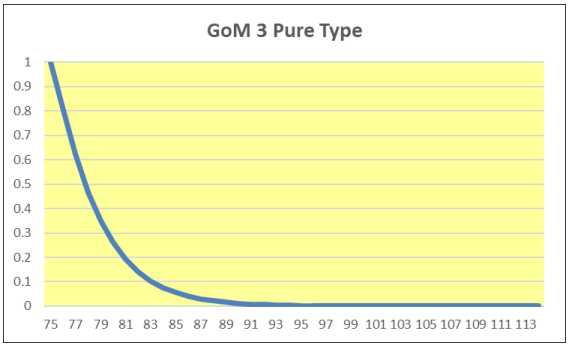
The GoM score categories are defined below:

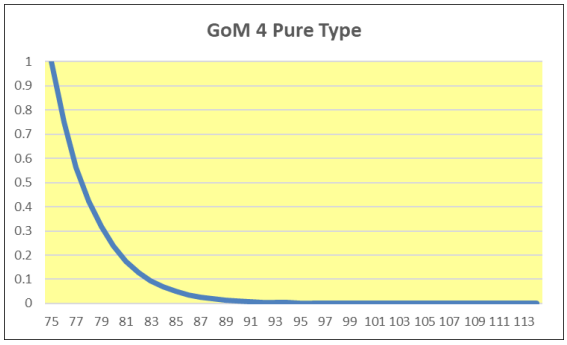
1. GoM I – Generally healthy with lowest level of impairments.
2. GoM II – Poorest subjective health, largest number of medical conditions, non-institutionalized, low mortality. These are persons who will usually outlive both longevity table mortality and mortality or life expectancy derived from medical records only commercial life expectancy underwriters.
3. GoM III – High mortality rates, few medical conditions, few impairments relatively good subjective health. These are persons with activity of daily living and cognitive impairments typically not recorded on their medical records.
4. GoM IV – High mortality rates, high levels of physical and cognitive disability and institutionalization.

Graphic Representations of GoM 1-4 Pure Type Survival Curves





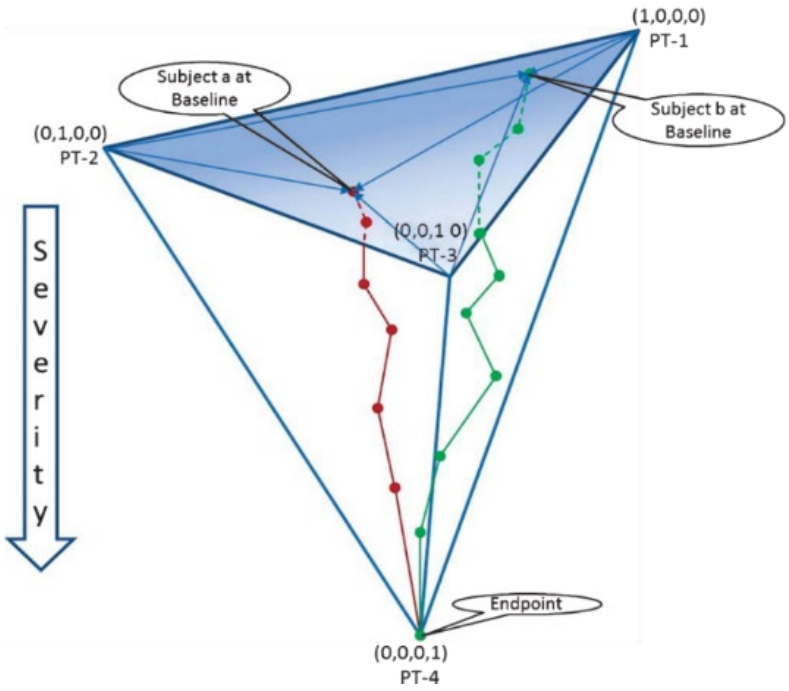




Materially Different Life Expectancies from Combinations of GoM Scores

Age	Life Expectancy in years	GoM Scores which total 1.0, but with very different combinations of frailty	
Female 75	6.20	GOM I: 0.0000000	GOM II: 0.4551105
		GOM III: 0.4194567	GOM IV: 0.1254328
Female 75	9.70	GOM I: 0.2406723	GOM II: 0.5248342
		GOM III: 0.2344935	GOM IV: 0.0000000
Female 75	11	GOM I: 0.0000000	GOM II: 0.8376996
		GOM III: 0.0000000	GOM IV: 0.1623004

The Grade of Membership (GoM) Model in Schematic
(PT-1, PT-2, PT-3, PT-4 Refer to GoM Pure Types Described Above and Below)

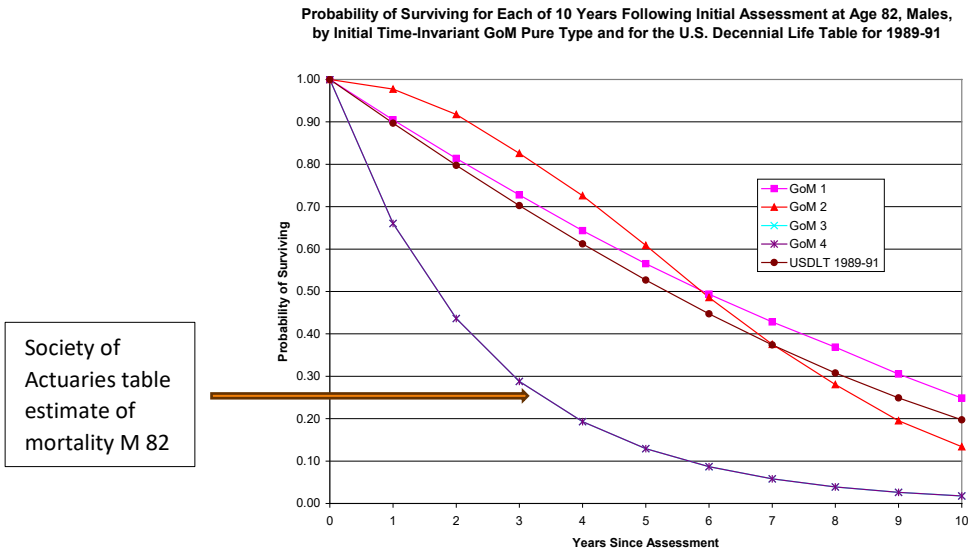


GoM 1 (also referred to as "Pure Type I" or "PT I" in the above drawing, with Roman numerals designating the rank ordering of the states by health status; we use the shorter GoM 1–4 reference throughout this document) refers to the healthiest component of the population. GoM scores 2–4 captures a range of health problems that occur at different ages, with progressive and graded transitions from GoM 2 to GoM 3 and 4. GoM 2 scores refer to people who have numerous medical problems, but few, if any ADL or other functional problems, or cognitive impairment. Persons with initial strong scores (i.e., close to 1.0, or 100%) on GoM 2 will live longer than traditional LE providers estimate; although this changes at older ages where these person's transition to strong scores on GoM 4. Persons with strong scores on GoM 3 have minor medical problems, but mild/moderate cognitive impairments, usually not indicated in their medical records, although this also changes at older ages where these persons transition to strong scores on GoM 4. Strong scores on GoM 4 identify people who have more serious medical problems, combined with serious ADL and/or cognitive impairments, usually not indicated in their medical records. People with initial strong scores on GoM 3 and GoM 4 will have shorter LE's than those issued by traditional LE underwriters.

Recall that the LE is the area under the relevant survival curve for the person or population for which the LE is being calculated. Thus, differences in LE between persons or groups of persons are best understood by examining the associated survival curves. This is illustrated in the following graph (Fig. 1) which plots the survival curves for males assessed at age 82 (i.e., age at last birthday is 82) for the next 10 years following the assessment, with a separate curve shown for each of the four time-invariant GoM pure types and also for comparison the survival curve from the U.S. Decennial Life Table (USDLT) for 1989-91.

Whether the USDLT or Society of Actuaries Variable Basic Tables (VBT) are used for comparisons makes little difference because the LCC is not table based. The changes in the VBT tables from 2001 through 2014 extrapolate an extension of the tail of mortality tail with a corresponding adjustment to early mortalities.

Figure 1



By age 82, the GoM 3 and GoM 4 curves have merged.

According to the Society of Actuaries USDLT mortality tables, the male LE at age 82 is 6.2 years. This value is less than the LEs of 6.9 and 6.3 years for GoM 1 and 2, but is substantially higher than the LEs of 2.5 years each for GoM 3 and 4 (the values are the same because an initial GoM 3 "converts" to GoM 4 prior to age 82).

Importantly, given that both the survival curve and its slope are used to price contracts, it is important to accurately estimate these quantities. Armed with this knowledge, an underwriter can accurately price each contract and the valuation team can accurately value the NPV of future portfolio cash flows. This predictability of future cash flows puts NatEquity in a uniquely favorable market position.

For other than portfolio valuation, teasing out these differences is where agentic AI can add insights by testing modifications to input variables to simulate behavior changes or the introduction of therapies. Field testing actual changes to outcomes versus computer simulated expected results is a field yet to be undertaken. Although the data set used by the model was deidentified in 2005, the consecutive assessments data set of 20,000 individuals at 5-year intervals is believed to have been consistently gathered in a routine fashion.

On the above graph, you will note that an initial GoM 2 has approximately a 16% greater likelihood of surviving through years 1 through 5 until the lines converge at year 6, near the 6.2 year LE. On the other hand, an initial GoM 3 or 4 has approximately a 75% lower likelihood of surviving through years 1 through 5, with corresponding reductions for persons who have initial *fractional* scores on GoM 3 or 4, with complementary *fractional* scores on GoM 1 and/or 2. The sum of all fractional scores must equal 1.0 (100%), with the scores for any given individual derived from his/her answers to the 76 questions on the application form.

Below are a table (Table 1) and two graphs (Figs. 3–4) reproduced from Stallard's 2007 *NAAJ* paper. Table 1 shows the predicted probability of death within each year contrasted to the observed death of individuals in the assessment population. These are shown in age brackets by the 5-year age groups (age at start of each 1-year follow-up) used for model estimation as well as the total over age of the observed vs predicted mortality for males and females.

Table 1

Probabilities of Death within One Year in Four Pure-Type GoM Model, Adjusted for Declines in Vitality, by Sex and Attained Age at Time of Exposure

Exposure Age	No. of Person-Years at Risk[1]	Annual Probability by Type I	II	III	IV	Observed Probability	Predicted Probability
Males							
65–69	20,323	0.000	0.000	0.132	0.138	0.031	0.032
70–74	38,255	0.002	0.005	0.194	0.246	0.043	0.044
75–79	31,291	0.038	0.013	0.319	0.319	0.067	0.067
80–84	19,170	0.095	0.023	0.340	0.340	0.105	0.106
85–89	8,117	0.127	0.202	0.330	0.330	0.154	0.155
90–94	2,728	0.198	0.323	0.323	0.323	0.228	0.229
95–99	793	0.226	0.434	0.434	0.434	0.301	0.301
100–104	155	0.372	0.528	0.528	0.528	0.400	0.401
Total	120,832	0.041	0.033	0.253	0.271	0.071	0.072
Females							
65–69	25,424	0.000	0.000	0.081	0.140	0.017	0.017
70–74	52,008	0.001	0.003	0.108	0.223	0.027	0.027
75–79	48,498	0.018	0.003	0.249	0.249	0.043	0.043
80–84	35,563	0.059	0.005	0.267	0.267	0.070	0.070
85–89	20,404	0.089	0.110	0.271	0.271	0.115	0.115
90–94	9,577	0.127	0.272	0.272	0.272	0.183	0.184
95–99	3,804	0.168	0.388	0.388	0.388	0.264	0.264
100–104	992	0.274	0.499	0.499	0.499	0.325	0.324
Total	196,270	0.036	0.037	0.201	0.239	0.060	0.061

[1] Includes up to four observations per respondent; excludes respondents aged 65–69 in 1999.
Source: Author's calculations based on data from the NLTCS.

The differences between the observed and predicted age-specific death probabilities are very small and are statistically nonsignificant, with chi-squared values of 1.36 and 0.29, respectively, each with 6 d.f. (reference values are 12.59 and 16.81 at the conventional 5% and 1% significance levels). The graphs show the same data but add the corresponding death probabilities from the U.S. Decennial Life Table (USDLT) for 1989-91.

Figure 3

Probability of Death within One Year, Males

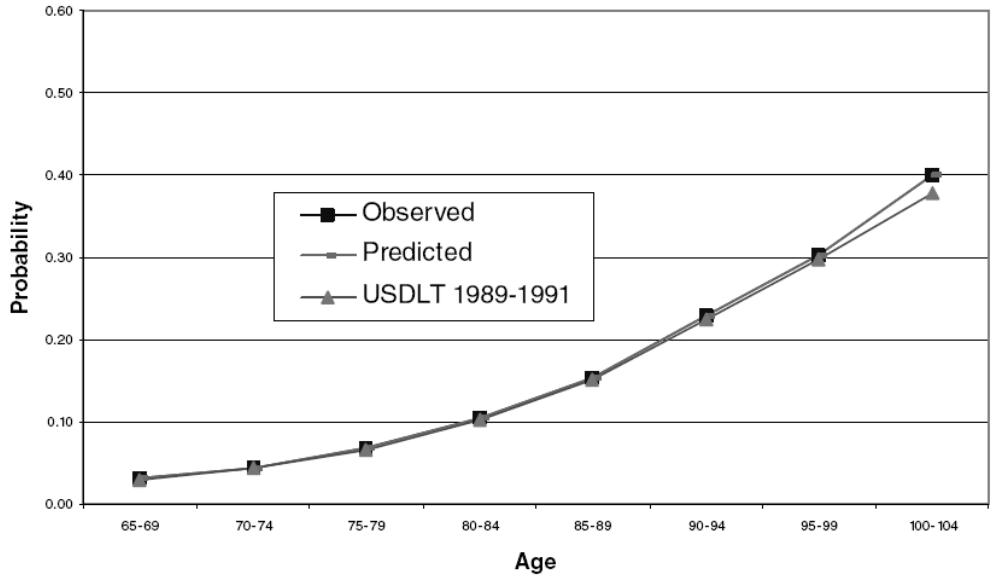
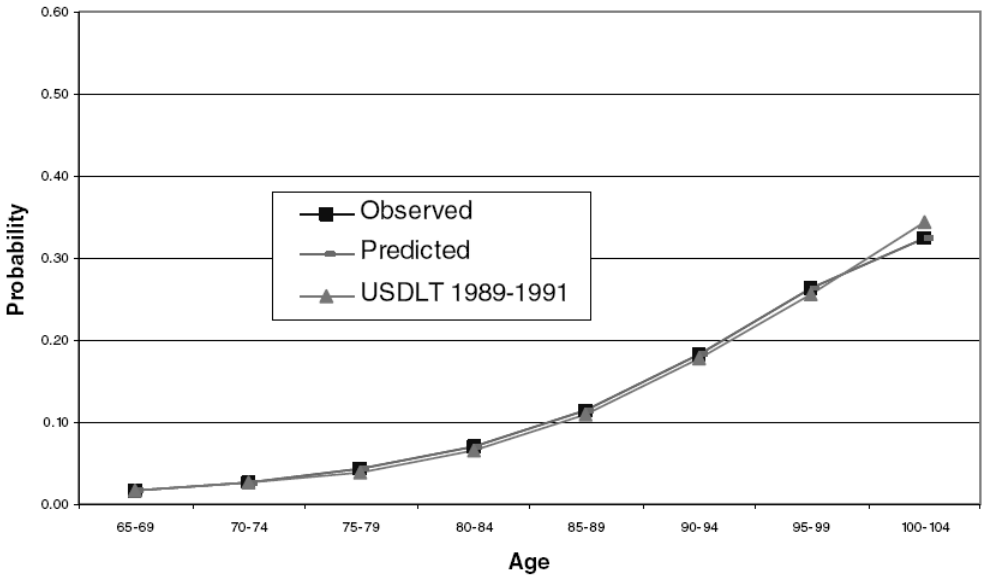


Figure 4
Probability of Death within One Year, Females



Below we attempt to translate these values into the numbers presented by commercial LE providers who represent that they are accurate 86% to 96% of the time. They do not provide or publish the basis for their estimates. Hence, we cannot be certain that our measures of accuracy are fully comparable with theirs. We do know from a 2010 study done for Deutsche Bank, where 4 independent life expectancy reports were secured from each individual's medical records, that the difference between the low and the high LE for each of 500+ persons had a delta of 30%. From the same data, when the difference between the high and low LE was more than 30%, the delta was 57%[ix].

To begin consideration of measures of accuracy, it is useful to consider the random statistical fluctuations that are expected from estimates based on the different numbers of events likely to be observed in different sized samples, assuming fixed underlying event rates. The table below shows the minimum number of expected events needed to cap the maximum relative error (e.g., [observed number of deaths minus expected number of deaths] ÷ [expected number of deaths]) with one of three levels of confidence.

Table 2
Credibility and Event Counts

Maximum Acceptable Departure from the Expected Count	Probability of Observed Count Falling Within the Acceptable Range		
	90%	95%	99%
	Minimum Required Expected Count		
+/–2.5%	4,329	6,146	**10,616**
+/–5.0%	**1,082**	1,537	2,654
+/–7.5%	481	683	1,180
+/–10%	271	384	663
+/–20%	68	**96**	166
+/–30%	30	43	74
+/–40%	17	24	41
+/–50%	**11**	15	27

Source: Based on Longley-Cook (1962).

To be 99% confident that the maximum relative error is less than 2.5%, the sample size needs to be large enough to produce 10,616 deaths (in bold in the table). The annual mortality probabilities in the *NAAJ* analysis were based on 20,428 deaths (8,583 males and 11,845 females), indicating that the total rates are very stable but the stratifications by age and other variables may be affected by random statistical fluctuations. To be 90% confident that the maximum relative error is less than 5%, the sample size needs to be large enough to produce 1,082 deaths, which is the standard size used for full credibility in actuarial literature. To be 95% confident that the maximum relative error is less than 20%, the sample size needs to be large enough to produce 96 deaths, which rounds to about 100. To be 90% confident that the maximum relative error is less than 50%, the sample size needs to be large enough to produce 11 deaths, which rounds to about 10. Thus, as the expected number of deaths falls from 10,000 to 1,000 to 100 to 10, the relative error increases from about 2.5% to 50%.

Random statistical fluctuations are inherently unpredictable. Hence, our measures of accuracy must focus on our ability to generate accurate values for the expected number of deaths among any selected set of insured lives.

The tables and graphs from the *NAAJ* paper (Table 1; Figs. 3–4) show that this can be done for groups of lives when the groups are defined on the basis of age and sex.

The next two graphs (Figs. 5–6) show the performance of the model when the NLTCS mortality-exposure data are grouped into 10 categories according to the predicted probability of death, based on the use of fixed cutpoints at multiples of .05 (5%), separately for males and females. Chi-squared statistical tests of fit of the models are presented separately in Tables 3–4.

Figure 5

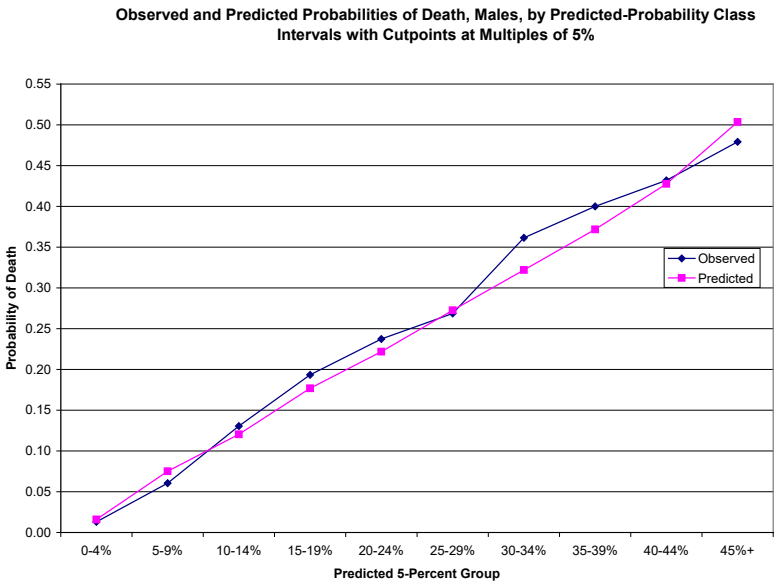
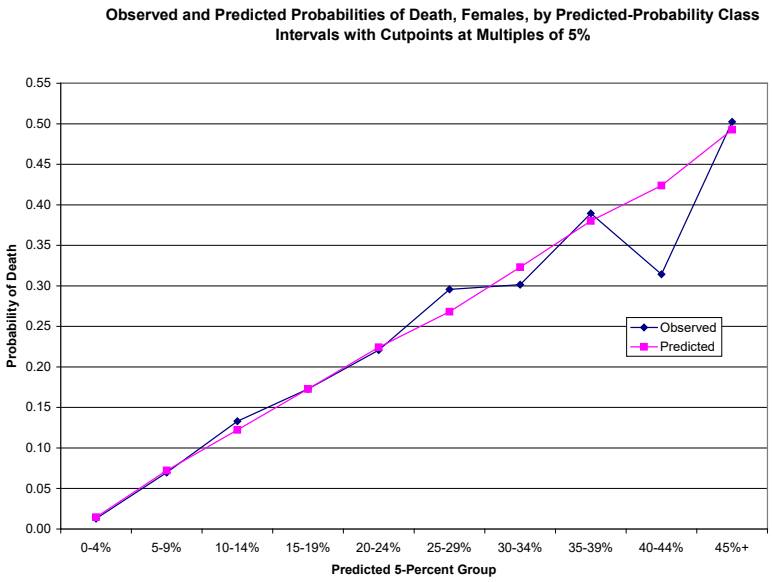


Figure 6



Visually, one can see that the observed probabilities increase across the 10 categories for both sexes, except for category 9 for females. However, the chi-square test of the deviation for that one point indicates that the difference is statistically nonsignificant, with a chi-squared value of 3.44 with 1 df (Table 4; reference values are 3.84 and 6.63 at the conventional 5% and 1% significance levels).

Table 3

Observed and Predicted Probabilities of Death, Males, by Predicted-Probability Class Intervals with Cutpoints at Multiples of 5%

Percentage Group	Number of Person-Years at Risk	Observed Number of Deaths	Expected Number of Deaths	Observed Probability	Predicted Probability	Hosmer-Lemeshow Chi-Squared
0-4%	61,463	801	981	0.013	0.016	**33.60**
5-9%	23,256	1,407	1,747	0.061	0.075	**71.73**
10-14%	20,100	2,622	2,420	0.130	0.120	**19.20**
15-19%	7,705	1,490	1,363	0.193	0.177	**14.29**
20-24%	4,557	1,082	1,011	0.237	0.222	6.44
25-29%	2,095	563	571	0.269	0.273	0.16
30-34%	1,361	492	438	0.361	0.322	**9.73**
35-39%	115	46	43	0.400	0.372	0.39
40-44%	132	57	56	0.432	0.428	0.01
45%+	48	23	24	0.479	0.504	0.11
Total	120,832	8,583	8,655	0.071	0.072	**155.65**

Table 4

Observed and Predicted Probabilities of Death, Females, by Predicted-Probability Class Intervals with Cutpoints at Multiples of 5%

Percentage Group	Number of Person-Years at Risk	Observed Number of Deaths	Expected Number of Deaths	Observed Probability	Predicted Probability	Hosmer-Lemeshow Chi-Squared
0-4%	111,425	1,434	1,614	0.013	0.014	**20.33**
5-9%	44,837	3,124	3,239	0.070	0.072	4.42
10-14%	18,004	2,396	2,202	0.133	0.122	**19.46**
15-19%	10,245	1,770	1,770	0.173	0.173	0.00
20-24%	6,536	1,443	1,465	0.221	0.224	0.43
25-29%	3,413	1,009	915	0.296	0.268	**13.17**
30-34%	617	186	199	0.301	0.323	1.32
35-39%	914	356	347	0.389	0.380	0.35
40-44%	70	22	30	0.314	0.424	3.44
45%+	209	105	103	0.502	0.493	0.08
Total	196,270	11,845	11,885	0.060	0.061	**62.99**

The Hosmer-Lemeshow chi-squared test produces statistically significant total chi-squared values of 155.65 and 62.99, respectively, for males and females, each with 8 d.f. (reference values are 15.51 and 20.09 at the conventional 5% and 1% significance levels). These corroborate the better than 96% accuracy of the model generated by linear regression.

For telephonic assessments, below are the categories of questions and their Chi-Square rankings.

The components of the questionnaire include:

- Medical conditions
- Medical conditions past 12 months
- Subjective health status
- Habits/behaviors
- Height, weight, BMI
- Activities of Daily Living (ADL)
- Instrumental Activities of Daily Living (IADL)
- Range of Motion
- Short Portable Mental Status Questionnaire (SPMSQ)
- Proxy respondent

When the top twenty elements are ranked by Chi-Square/d.f., not until number 20 do you have an element that shows up on a typical set of medical records.

1. IADL Limitations-Outside mobility	11. IADL Limitation-Phoning
2. IADL Limitations-Grocery shopping	12. ADL Personal Assistance-Bathing
3. IADL Limitations-Travel	13. ADL Personal Assistance-Indoor mobility
4. IADL Limitations-Laundry	14. ADL Personal Assistance-Continence
5. 5-year survival status	15. Race
6. IADL Limitations-Cooking	16. ADL Personal Assistance-Transferring in/out of bed
7. Residence Type-Institutional vs. noninstitutional	17. Proxy interview
8. IADL Limitation-Light housework	18. ADL Personal Assistance-Dressing
9. IADL Limitation-Managing money	19. ADL Personal Assistance-Toileting
10. IADL Limitation-Taking medication	**20. Medical-Circulation trouble in arms or legs, previous 12 months**

Several comments are in order:

1. The tests indicate that the models displayed in Figures 5 and 6 do *not* fit the data. This means that at least some of the deviations of the observed from predicted numbers of deaths are larger than expected by chance.
2. These are identified by the boldface font in the rightmost columns of Tables 3 and 4 using a cutpoint equal to the critical value of 6.63 using the conventional 1% significance level.
3. For males, the five significant deviations are for the four lowest probability groups 0–19% and 30–34%; for females, the three significant deviations are for the 0–4%, 10–14%, and 25–29% probability groups.
4. The expected counts for the eight groups with significant deviations ranged from 438 to 2,420, and five of the eight exceed the 1,082 cutpoint for highly credible data in Table 2; all eight exceed the minimum level of 300 lives recommended by A.M. Best for life settlement collateral pool sizes.

5 PRACTICAL APPLICATION – NATEQUITY'S PORTFOLIO VALUATION

In 2009 the Longevity Cost Calculator was imbedded in a Mark-to-Fair Value methodology Peter Mazonas was invited to present to a panel at the Securities and Exchange Commission. The Panel was exploring how to apply net present value of future portfolio cash flows to Level 3 longevity dependent assets where the outcome is unknowable. This methodology was published in 2011[x]. It is today widely referenced in academic, actuarial and accounting journals.

This valuation methodology uses the combination of three commercial medical records only life expectancy reports and the output of the LCC model. At the outset the Bayesian inference "priors" / assumes all four life expectancy reports have equal weightings of .25 each. The hypothesis is that the evidence over time will lead to the "posterior" prediction that the LCC has statistical significance and can be relied upon as the accurate predictor of future portfolio cash flows. Modeling the Bayesian theorem shows that at 65 contract maturities the LCC has achieved better than 95% statistical confidence.

For readers not familiar with Thomas Bayes' theorem from 1750s, I recommend the New York Times Article[xi] referenced below and two recent books: *The Signal and the Noise*, Nate Silver, Penguin Press, 2012; *and The Theory That Would Not Die: How Bayes' Rule Cracked the Enigma Code, Hunted Down Russian Submarines, and Emerged Triumphant from Two Centuries of Controversy*, Sharon Bertsch McGrayne, Yale University Press, 2011. Bayesian methodology was key to Alan Turing's creation of the Enigma decoding machine; and how Sean Connery, in *Hunt for Red October,* knew which way the Russian submarine would turn when it did a Crazy Ivan – Bayesian Inference.

6 CONCLUSION – THE BAYESIAN VALUATION BRINGS STRONG VALUE ADD TO MEASURING FUTURE CASH FLOWS

Consistently applying the Bayesian Inference valuation methodology published by Graham, Stallard and Mazonas allows, after approximately 65 maturities, the predicting of future portfolio cash flows with statistical confidence. This high level of predictable confidence attained using the LCC longevity assessment permits the valuation team to use a much lower risk premium factor in the discount rate used to NPV the future portfolio cash flows. A sample $200 million portfolio ($110 million year 1 cash out plus $ 90 million of reserves), if held to maturity, yields a weighted NPV of 7%. A lower risk premium, say 6%. (3.5%, added to a 2.5% risk-free cost of capital), yields an NPV that accretes upwards of $15,483,158[xii] (14%) value to both the balance sheet asset and the corresponding addition of income to the book balance sheet on cash expended.

Without this predictability, auditors have been known to apply a higher risk premium, say 6.5%, on top of a 2.5% risk free cost of capital. This yields a significant decrease, approximating 30%, in reported balance sheet asset valuation and large reductions in current book income. This decrease in valuation is slowly earned back over time, not time that issuers of audited financial statements will tolerate.

May 25, 2026, updated to include reference to SEC Rule 2a-5, recent SEC enforcement comments (Section 2), FASB ASC§ 326 Purchased Loan Rule (Section 3) and computation of accreted value (endnote 12).

Peter M. Mazonas, CPA
415-279-7950
peter.mazonas@NatEquity.com
https://www.NatEquity.com

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[ii] *A New Algorithm for Predicting Time to Disease Endpoints in Alzheimer's Patients,* J. Alzheimer's Dis. 2014 Jan 1, 38(3), 10.3233/JAD-131142, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3864687

[iii] *Personalized predictive modeling for patients with Alzheimer's disease using an extension of Sullivan's life table model*, E. Stallard, B Kinosian and Y Stern, Alzheimer's Research & Therapy (2017) 9:75.

[iv] *Longevity Risk in Fair Valuing Level-Three Assets in Securitized Portfolios*, Peter Macrae Mazonas, Patrick John Eric Stallard, Lynford Graham, the Geneva Papers (2011) 36, 516-543. Doi: 10.1057 / gpp 2011.25.

[v] Ibid. *Longevity Risk in Fair Valuing Level-Three Assets in Securitized Portfolios*, Peter Macrae Mazonas, Patrick John Eric Stallard, Lynford Graham, the Geneva Papers (2011) 36, 516-543. Doi: 10.1057 / gpp 2011.25.

[vi] Computation in NatEquity Moel V135, 15Nov2025, Tab $200m Portfolio, cells K41:T50.

[vii] www.NatEquity.com/Press/ November 2, 2009. Washington D.C. Testimony before the SEC

[viii] http://www.ncbi.nlm.nih.gov/pubmed/1820287

[ix] Unpublished analysis by Peter Mazonas of raw de-identified data provided by the firm who conducted the study and compiled the individual case files.

[x] http://www.palgrave-journals.com/gpp/journal/v36/n4/abs/gpp201125a.html Copies available upon request.

[xi] The Odds, Continually Updated, F. D. Flam, New York Times, September 29, 2014. http://www.nytimes.com/2014/09/30/science/the-odds-continually-updated.html?_r=0

[xii] NatEquity Model V135 w Valuation 26Jan2026, $200m Portfolio tab, cell U44.