

LATF Spring National Meeting  
**Supplemental Packet**

LIFE ACTUARIAL (A) TASK FORCE

March 31, 2022

NAIC SPRING NATIONAL MEETING Virtual

March 31, 2022

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## Agenda Item 5

Consider Adoption of Valuation Manual Amendments

## Life Actuarial (A) Task Force/ Health Actuarial (B) Task Force Amendment Proposal Form\*

1. Identify yourself, your affiliation and a very brief description (title) of the issue.

Identification:

PBR Staff of Texas Department of Insurance

Title of the Issue:

APF to fix language that is hard to follow.

2. Identify the document, including the date if the document is “released for comment,” and the location in the document where the amendment is proposed:

Section 3.F.9.h.ii

January 1, 2022 NAIC *Valuation Manual*

3. Show what changes are needed by providing a red-line version of the original verbiage with deletions and identify the verbiage to be deleted, inserted or changed by providing a red-line (turn on “track changes” in Word®) version of the verbiage. (You may do this through an attachment.)

**VM-31 Section 3.F.9.h.ii:**

ii. Documentation that the implied volatility scenarios generated do not result in a lower TAR than that obtained by assuming that the any realizable spread between implied volatility – at all ITM levels – at a given time step in a given scenario is equal to the and realized volatility of the underlying asset scenario over the same time period as required by VM-21 Section 8.D.3.

4. State the reason for the proposed amendment? (You may do this through an attachment.)

VM-31 Section 3.F.9.h.ii: Sentence is confusing and doesn’t make sense grammatically. Revised based on the parallel language in VM-21, which this VM-31 reporting item is intended to verify:

For a company not using the safe harbor described in Section 9.B.5, any implied volatility scenarios generated using a non-prescribed scenario generator shall not result in a TAR less than that obtained by assuming that the implied volatility level – at all ITM levels – at a given time step in a given scenario is equal to the realized volatility of the underlying asset scenario over the same time period. In other words, the TAR shall not be reduced by assumptions of any realizable spread between implied volatility and realized volatility. For the purposes of demonstrating compliance with this standard, a company may rely on only the values from the stochastic calculations and exclude impacts from the additional standard projection and the alternative methodology.

\* This form is not intended for minor corrections, such as formatting, grammar, cross–references or spelling. Those types of changes do not require action by the entire group and may be submitted via letter or email to the NAIC staff support person for the NAIC group where the document originated.

NAIC Staff Comments:

Dates: Received	Reviewed by Staff	Distributed	Considered
1/31/2022	RM		
Notes: APF 2022-02			

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<b>Dates:</b> Received	Reviewed by Staff	Distributed	Considered
2/2/2022	RM		
<b>Notes:</b> APF 2022-03			

## Life Actuarial (A) Task Force/ Health Actuarial (B) Task Force Amendment Proposal Form\*

1. Identify yourself, your affiliation and a very brief description (title) of the issue.

**Identification:**

PBR Staff of Texas Department of Insurance

**Title of the Issue:**

General cleanup, including updating cross-references, better consistency between VM-20 and VM-21, where reasonable, and making clarifying edits:

1. **Update cross-references:** Add a reference to the newly added VM-21 Section 12 (general assumption setting) alongside the reference to Section 10 in the Guidance Note after Principle 3 in VM-21.
  2. **Update cross-references:** Existing section references are too general to be useful for the asset spread assumptions discussed in VM-21 Section 4.D.4.a.iii and 4.D.4.a.iv.
  3. **VM-20/VM-21 Consistency:** VM-21 Sections 4.D.5.a and 4.D.5.b should be made consistent with VM-20; new Sections 4.D.5.c and 4.D.5.d were also added to be consistent with VM-20 where appropriate.
  4. **Clarifying Edits:** Avoid the SPA partial withdrawal assumptions from requiring modeling less than the RMD amount for tax qualified contracts with ages greater than or equal to the RMD age in VM-21 Section 6.C.4.
  5. **Update cross-references:** Correct section reference errors in VM-21 Sections 6.C.4 and 6.C.5.
  6. **Clarifying Edits:** Revenue sharing income assumption requirements need clarification, and language needs cleaning up in VM-20, VM-21, and VM-31.
2. Identify the document, including the date if the document is “released for comment,” and the location in the document where the amendment is proposed:

Issue 1: VM-21 Section 1.B  
Issue 2: VM-21 Section 4.D.4.a.iii and 4.D.4.a.iv  
Issue 3: VM-21 Section 4.D.5  
Issue 4: VM-21 Section 6.C.4  
Issue 5: VM-21 Section 6.C.4 and 6.C.5  
Issue 6: VM-20 Sections 9.G.7 and 9.G.8, VM-21 Section 4.A.5.f, and VM-31 Sections 3.D.7.c and 3.F.7.c

January 1, 2022 NAIC Valuation Manual
  3. Show what changes are needed by providing a red-line version of the original verbiage with deletions and identify the verbiage to be deleted, inserted or changed by providing a red-line (turn on “track changes” in Word®) version of the verbiage. (You may do this through an attachment.)

See attached.
  4. State the reason for the proposed amendment? (You may do this through an attachment.)

1. Add a reference to the newly added Section 12 (general assumption setting Section 12 added by APF 2021-11 for the 2023 Valuation Manual) alongside the reference to Section 10 in the Guidance Note after Principle 3.
2. Existing section references are too general to be useful for the asset spread assumptions discussed in VM-21 Section 4.D.4.a.iii and 4.D.4.a.iv. Edits refer to specific sections of VM-20 gross asset spread assumptions. References parallel those in VM-20 Sections 7.E.1.d and 7.E.1.e.
3. Update VM-21 Section 4.D.5 to be consistent with VM-20, where appropriate. Language added parallels VM-20 Sections 7.F.1, 7.F.2, 7.F.5, and 7.F.6.
4. The current SPA partial withdrawals assumption does not consider the RMD requirement for tax qualified contracts with ages greater than or equal to the federal RMD age. Some companies assumed this was intended to be reflected, but it should be clarified in VM-21.
5. Correct section reference errors in Sections 6.C.4 and 6.C.5.
6. Both VM-20 and VM-21 need to clarify that the haircut prescribed for the non-contractually guaranteed revenue sharing is only a guardrail which is neither redundant to nor a substitution for the margin determination requirements of VM-20 Section 9.G.6 and VM-21 Section 4.F.5.c. Two guidance notes from VM-20 should be added to VM-21 for appropriate consistency. The reporting requirement language which is already in VM-31 should be removed from VM-20 and the reporting requirement in VM-31 is augmented and clarified.

### **VM-21 Section 1.B (Guidance Note after Principle 3)**

**Guidance Note:** The intent of Principle 3 is to describe the conceptual framework for setting assumptions. Section 10 provides the requirements and guidance for setting contract holder behavior assumptions and includes alternatives to this framework if the company is unable to fully apply this principle. More guidance and requirements for setting assumptions in general are provided in Section 12.

### **VM-21 Section 4.D.4.a.iii and Section 4.D.4.a.iv**

iii. For purchases of public non-callable corporate bonds, use the gross asset spreads over Treasuries prescribed in VM-20 Section 9.F.8.a through Section 9.F.8.c. (For purposes of this subsection, “public” incorporates both registered and 144a securities.) ~~follow the requirements defined in VM-20 Sections 7.E, 7.F and 9.F.~~ The prescribed spreads reflect current market conditions as of the model start date and grade to long-term conditions based on historical data at the start of projection year four;

iv. For transactions of derivative instruments associated with fixed income investments, reflect the prescribed assumptions in VM-20 Section 9.F.8.d for interest rate swap spreads;

### **VM-21 Section 4.D.5**

#### 5. Cash Flows from Invested Assets

- a. Cash flows from general account fixed income assets and derivative asset programs associated with these assets, including starting and reinvestment assets, shall be reflected in the projection as follows:
  - i. Model gross investment income and principal repayments in accordance with the contractual provisions of each asset and in a manner consistent with each scenario. Grouping of assets is

- allowed if the company can demonstrate that grouping does not materially understate the modeled reserve that would have been obtained using a seriatim approach.
- ii. Reflect asset default costs as prescribed in VM-20 Section 9.F and anticipated investment expenses through deductions to the gross investment income.
  - iii. Model the proceeds arising from modeled asset sales and determine the portion representing any realized capital gains and losses.
  - iv. Reflect any uncertainty in the timing and amounts of asset cash flows related to the paths of interest rates, equity returns or other economic values directly in the projection of asset cash flows. Asset defaults are not subject to this requirement, since asset default assumptions must be determined by the prescribed method in VM-20 Sections 7.E, 7.F and 9.F.
- b. Cash flows from general account equity assets—i.e., non-fixed income assets having substantial volatility of returns, such as common stocks and real estate— and derivative asset programs associated with these assets, including starting and reinvestment assets, shall be reflected in the projection as follows:
- i. Determine the grouping for asset categories and the allocation of specific assets to each category in a manner that is consistent with that used for separate account assets, as discussed in Section 4.A.2.
  - ii. Project the gross investment return including realized and unrealized capital gains in a manner that is consistent with the stochastically generated scenarios.
  - iii. Model the timing of an asset sale in a manner that is consistent with the investment policy of the company for that type of asset. Reflect expenses through a deduction to the gross investment return using prudent estimate assumptions.
- c. Determine cash flows for each projection interval for all other general account assets by modeling asset cash flows on other assets that are not described in Sections 4.D.5.a and 4.D.5.b using methods consistent with the methods described in Sections 4.D.5.a and 4.D.5.b. This includes assets that are a hybrid of fixed income and equity investments.
- d. Determine cash flows or total investment returns as appropriate for each projection interval for all separate account assets as follows:
- i. Determine the grouping for each variable fund and subaccount (e.g., bonds funds, large cap stocks, international stocks, owned real estate, etc.) as described in Section 4.A.2.
  - ii. Project the total investment return for each variable fund and subaccount in a manner that is consistent with the prescribed returns described in Section 4.A.2 and Section 8.C.3.

## **VM-21 Section 6.C.4 (Intro)**

### 4. Partial Withdrawals

Partial withdrawals required contractually or previously elected (e.g., a contract operating under an automatic withdrawal provision, or that has voluntarily enrolled in an automatic withdrawal program, on the valuation date) are to be deducted from the Account Value in each projection interval consistent with the projection frequency used, as described in Section 6.D4.F, and according to the terms of the contract. However, if a GMWB or hybrid GMIB contract’s automatic withdrawals results in partial withdrawal amounts in excess of the GMWB’s guaranteed maximum annual withdrawal amount or the maximum amount above which withdrawals reduce the GMIB basis by the same dollar amount as the withdrawal amount (the “dollar-for-dollar maximum withdrawal amount”), such automatic withdrawals shall be revised such that they equal the GMWB’s guaranteed maximum annual withdrawal amount or the GMIB’s dollar-for-dollar maximum withdrawal amount. However, for tax qualified contracts with ages greater than or equal to the federal RMD age, if the prescribed withdrawal amount is below the RMD amount, the withdrawal amount may be reset to the RMD amount.

**Guidance Note:** Companies are expected to model withdrawal amounts consistent with the RMD amount where applicable and where practically feasible; however, it is understood that this level of modeling sophistication may not be available for all companies.

For any contract not on an automatic withdrawal provision as described in the preceding paragraph, depending on the guaranteed benefit type, other partial withdrawals shall be projected as follows but shall not exceed the free partial withdrawal amount above which surrender charges are incurred and may be floored at the RMD amount for tax qualified contracts with ages greater than or equal to the federal RMD age:

## **VM-21 Section 6.C.5**

### 5. Withdrawal Delay Cohort Method

To model the initial withdrawal for certain GMWBs and hybrid GMIBs as discussed in Sections 6.C.4.h and 6.C.4.j-6.C.4.f, the actuary shall adopt a modeling approach whereby a contract is split into several copies (referred to as “cohorts”), each of which is subsequently modeled as a separate contract with a different initial withdrawal period. The contract Account Value, bases for guaranteed benefits, and other applicable characteristics shall be allocated across the cohorts based on different weights that are determined using the method discussed below in this section.

## **VM-21 Section 4.A.5.f**

1. The amount of net revenue-sharing income assumed in a given scenario shall be applied with a margin to reflect any uncertainty but shall not exceed the sum of (i) and (ii), where:
  - i. Is the contractually guaranteed net revenue-sharing income projected under the scenario; and
  - ii. Is the company’s estimate of non-contractually guaranteed net revenue-sharing income before reflecting any margins for uncertainty multiplied by the following factors:
    - 1.00 in the first projection year.
    - 0.95 in the second projection year.
    - 0.90 in the third projection year.
    - 0.85 in the fourth projection year.
    - 0.80 in the fifth and all subsequent projection years.

**Guidance Note:** Provisions such as one that gives the entity paying the revenue-sharing income the option to stop or change the level of income paid would prevent the income from being guaranteed. However, if such an option becomes available only at a future point in time, and the revenue up to that time is guaranteed, the income is considered guaranteed up to the time the option first becomes available.

**Guidance Note:** If the agreement allows the company to unilaterally take control of the underlying fund fees that ultimately result in the revenue sharing, then the revenue is considered guaranteed up until the time at which the company can take such control. Since it is unknown whether the company can perform the services associated with the revenue-sharing arrangement at the same expense level, it is presumed that expenses will be higher in this situation. Therefore, the revenue-sharing income shall be reduced to account for any actual or assumed additional expenses.

## **VM-20 Section 9.G.7, 9.G.8**

7. The ~~qualified actuary to whom responsibility for this group of policies is assigned~~company is responsible for reviewing the revenue-sharing agreements that apply to that group of policies ~~and~~, verifying compliance with these requirements ~~and documenting the rationale for any source of the GRSI used in the projection for that group of policies.~~
8. The amount of net revenue-sharing income assumed in a given scenario shall be applied with a margin to reflect any uncertainty but shall not exceed the sum of (a) and (b), where:
  - a. Is the contractually guaranteed GRSI, net of applicable expenses, projected under the scenario.
  - b. Is the company's estimate of non-contractually guaranteed net revenue-sharing income before reflecting any margins for uncertainty multiplied by the following factors:

## **VM-31 Section 3.D.7.c**

- c. Revenue-Sharing Margins – The level of margin in the prudent estimate assumptions for revenue-sharing income and description of the rationale for the margin for uncertainty. Also, a demonstration that the amounts of net revenue-sharing income, after reflecting margins, do not exceed the limits set forth in VM-20 Section 9.G.8.

## **VM-31 Section 3.F.7.c**

- c. Revenue-Sharing Margins – The level of margin in the prudent estimate assumptions for revenue-sharing income and a description of the rationale for the margin for uncertainty. Also, a demonstration that the amounts of net revenue-sharing income, ~~and after reflecting~~ margins, ~~included~~ do not exceed the limits set forth in VM-21 Section 4.A.5.f.

<b>Dates:</b> Received	Reviewed by Staff	Distributed	Considered
11/16/20	RM		
<b>Notes:</b> APF 2020-12			

## Life Actuarial (A) Task Force/ Health Actuarial (B) Task Force Amendment Proposal Form\*

1. Identify yourself, your affiliation and a very brief description (title) of the issue.

**Identification:**

Hedging Drafting Group of LATF

**Title of the Issue:**

Reflect all future hedging strategies in VM-20 and VM-21. Revise hedge modeling to increase E factor (VM-21) or residual risk (VM-20) when future hedging strategies are not clearly defined.

2. Identify the document, including the date if the document is “released for comment,” and the location in the document where the amendment is proposed:

VM-01, VM-20 Section 6.A.1.b, VM-20 Section 7.E.1.g, VM-20 Section 7.K, VM-20 Section 7.L, VM-21 Section 1.D.2, VM-21 Section 4.A.4, VM-21 Section 4.D.4.b, VM-21 Section 6.B.3.a.ii, VM-21 Section 6.B.3.b.ii, VM-21 Section 6.B.5, VM-21 Section 9, VM-31 Section 3.C.5, VM-31 Section 3.D.6.f, VM-31 Section 3.D.14.a and 3.D.14.b, VM-31 Section 3.E.5, VM-31 Section 3.F.8, VM-31 Section 3.F.12.c, VM-31 Section 3.F.16.a and Section 3.F.16.b

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3. Show what changes are needed by providing a red-line version of the original verbiage with deletions and identify the verbiage to be deleted, inserted or changed by providing a red-line (turn on “track changes” in Word®) version of the verbiage. (You may do this through an attachment.)

See attached.

4. State the reason for the proposed amendment? (You may do this through an attachment.)
  1. Consistent definition of CDHS for use in VM-20 and VM-21.
  2. Add a definition for “future hedging strategy,” consistent with the definition for CDHS and the current VM-01 definition of “derivative program”, which VM-01 notes includes hedging programs.
  3. Add a definition for “hedging transactions,” taken from the APPM but modified slightly to be consistent with Valuation Manual terminology.
  4. Reflect all of a company’s future hedging strategies, but reflect the additional error (VM-21) or residual risk (VM-20) that is presented by a future hedging strategy not being clearly defined.
  5. Remove optionality for liquidating currently held hedges if the company does not have a future hedging strategy. Language has been added for consideration to keep this optionality for the adjusted run for a company that does have a future hedging strategy (which would not be modeled in the adjusted run), as the drafting group is interested in additional input on this item. A reporting item to disclose the impact of any such liquidation is added, to provide additional regulator comfort if this optionality is included in the final adopted edits.
  6. New hedging strategies (those without at least 12 months experience or 3 months of experience and robust mock testing) have an E factor of 1.0 for VM-21, unless they are new hedging strategies backing a newly introduced or newly acquired product or block of business, which may have an E factor as low as 0.3. Moreover, with prior domestic regulator approval, which should mitigate regulator concerns that strategy changes implemented just before year end may allow for manipulation of results, robust

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<b>Notes:</b> APF 2020-12			

mock testing is sufficient to allow an E factor lower than 1.0. Note that the current draft VM-22 only allows modeling hedges after they have been in place for 6 months, and we would recommend that be revised to be in line with these changes. When only CDHS were modeled in VM-21, new hedging strategies with no experience had E factors as low as 0.5 even without meaningful analysis. This treatment was much too lenient for new hedging strategies.

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\* This form is not intended for minor corrections, such as formatting, grammar, cross-references or spelling. Those types of changes do not require action by the entire group and may be submitted via letter or email to the NAIC staff support person for the NAIC group where the document originated.

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NAIC Staff Comments:

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11/16/20	RM		
<b>Notes:</b> APF 2020-12			

## VM-01

- The term “clearly defined hedging strategy” (CDHS) means a ~~strategy undertaken by a company to manage risks through the future purchase or sale of hedging instruments and the opening and closing of hedging positions~~ future hedging strategy for which the following attributes are clearly documented that meet the criteria specified in the applicable reserve requirement section of the Valuation Manual.:
  - a. The specific risks being hedged (e.g., cash flow, fee income, policy interest credits, delta, rho, vega, etc.).
  - b. The hedging objectives.
  - c. The material risks that are not hedged (e.g., variation from expected mortality, withdrawal, and other utilization or decrement rates assumed in the hedging strategy, etc.).
  - d. The financial instruments used to hedge the risks.
  - e. The hedging strategy’s trading rules, including the permitted tolerances from hedging objectives.
  - f. The metrics, criteria, and frequency for measuring hedging effectiveness.
  - g. The conditions under which hedging will not take place and for how long the lack of hedging can persist.
  - h. The group or area, including whether internal or external, responsible for implementing the hedging strategy.
  - i. Areas where basis, gap or assumption risk related to the hedging strategy have been identified.
  - j. The circumstances under which hedging strategy will not be effective in hedging the risks.

~~The hedge strategy may be dynamic, static or a combination thereof.~~

**Guidance Note:** For purposes of the CDHS documented attributes, “effectiveness” need not be measured in a manner as defined in *SSAP No. 86—Derivatives* in the AP&P Manual.

- The term “future hedging strategy” is a derivative program undertaken by a company to manage risks through one or more future hedging transactions, including the future purchase or sale of hedging instruments and the opening and closing of hedging positions.

A future hedging strategy may be dynamic, static or a combination thereof. A strategy involving the offsetting of the risks associated with products falling under the scope of different requirements within the *Valuation Manual* (e.g., VM-20, VM-21, or VM-22) does not qualify as a future hedging strategy.

- The term “hedging transaction” means a derivative(s) transaction which is entered into and maintained to reduce:
  - a. The risk of a change in the fair value, the value on a statutory, GAAP, or other basis, or cash flow of assets and liabilities which the company has acquired or incurred or has a firm commitment to acquire or incur or for which the company has a forecasted acquisition or incurrence; or
  - b. The currency exchange rate risk or the degree of foreign currency exposure in assets and liabilities which the company has acquired or incurred or has a firm commitment to acquire or incur or for which the company has forecasted acquisition or incurrence.

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11/16/20	RM		
<b>Notes:</b> APF 2020-12			

## **VM-20 Section 6.A.1.b**

A company may not exclude a group of policies for which there is one or more ~~future hedging strategies supporting the policies~~~~clearly defined hedging strategies~~ from SR requirements, except in the case where all ~~future hedging strategies supporting the policies~~~~clearly defined hedging strategies~~ are solely associated with product features that are determined to not be material under Section 7.B.1 due to low utilization.

## **VM-20 Section 7.E.1.g**

Notwithstanding the above requirements, the modeled reserve shall be the higher of that produced by the modeled company investment strategy and that produced by substituting an alternative investment strategy in which the fixed income reinvestment assets have the same weighted average life (WAL) as the reinvestment assets in the modeled company investment strategy and are all public non-callable corporate bonds with gross asset spreads, asset default costs and investment expenses by projection year that are consistent with a credit quality blend of 50% PBR credit rating 6 (A2/A) and 50% PBR credit rating 3 (Aa2/AA).

Policy loans, equities and derivative instruments associated with the execution of ~~a clearly defined hedging strategy~~~~future hedging strategies supporting the policies~~ (in compliance with Section 7.L) are not affected by this requirement.

## **VM-20 Section 7.K**

### K. Modeling of Derivative Programs

1. When determining the DR and the SR, the company shall include in the projections the appropriate costs and benefits of derivative instruments that are currently held by the company in support of the policies subject to these requirements. The company shall also include the appropriate costs and benefits of anticipated future derivative instrument transactions associated with the execution of ~~a future hedging strategies supporting the policies~~~~clearly defined hedging strategy~~, as well as the appropriate costs and benefits of anticipated future derivative instrument transactions associated with non-hedging derivative programs (e.g., replication, income generation) undertaken as part of the investment strategy supporting the policies, provided they are normally modeled as part of the company's risk assessment and evaluation processes.

~~**Guidance Note:** The requirements stated here for handling hedging strategies are essentially consistent with those included in the CTE methodology of VM 21 and the five principles spelled out there. The prohibition in these modeled reserve requirements against projecting future hedging transactions other than those associated with a clearly defined hedging strategy is intended to address initial concerns expressed by various parties that reserves could be unduly reduced by reflection of programs whose future execution and performance may have greater uncertainty. The prohibition appears, however, to be in conflict with Principle 2 listed in VM 21. Companies may actually execute and reflect in their risk assessment and evaluation processes hedging strategies similar in many ways to clearly defined hedging strategies but lack sufficient clarity in one or more of the qualification criteria. By excluding the associated derivative instruments, the investment strategy that is modeled may also not reflect the investment strategy the company actually uses. Further, because the future hedging transactions may be a net cost to the company in some scenarios and a net benefit in other scenarios, the exclusion of such transactions can result in a modeled reserve that is either lower or higher than it would have been if the transactions were not excluded. The direction of such impact on the reserves could also change from period to period as the actual and projected paths of economic conditions change. A more graded approach to recognition of non-qualifying hedging strategies~~

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~~may be more theoretically consistent with Principle 2. It is recommended that as greater experience is gained by actuaries and state insurance regulators with the principle-based approach and as industry hedging programs mature, the various requirements of this section be reviewed.~~

2. For each derivative program that is modeled, the company shall reflect the company’s established investment policy and procedures for that program; project expected program performance along each scenario; and recognize all benefits, residual risks and associated frictional costs. The residual risks include, but are not limited to: basis, gap, price, parameter estimation and variation in assumptions (mortality, persistency, withdrawal, etc.). Frictional costs include, but are not limited to: transaction, margin (opportunity costs associated with margin requirements) and administration. For future hedging strategies supporting the policies~~clearly defined hedging strategies~~, the company may not assume that residual risks and frictional costs have a value of zero, unless the company demonstrates in the PBR Actuarial Report that “zero” is an appropriate expectation. VM-21 Section 1.B Principle 5 applies as a general principle for the modeling of future hedging strategies.
  
3. In circumstances where one or more material risk factors related to a derivative program are not fully captured within the cash-flow model used to calculate CTE 70, the company shall reflect such risk factors by increasing the SR as described in Section 5.E.
  
4. In circumstances where documentation outlining the future hedging strategies is incomplete, the company shall reflect the future hedging strategies not being clearly defined by increasing the SR as described in Section 5.E. To support no increase to the SR, there should be very robust documentation outlining each future hedging strategy. In particular, the SR shall be at least as great as the SR that would result if a future hedging strategy were not reflected in the SR, if the documentation is materially incomplete for any of the individual CDHS attributes (a) through (j), as listed in VM-01.

Any increases required to the SR to reflect that documentation is not available to support that the future hedging strategies are clearly defined shall be in addition to increases to the SR pursuant to Section 7.K.3 above.

**Guidance Note:** Section 5.E requires that the company “Determine any additional amount needed to capture any material risk included in the scope of these requirements but not already reflected in the cash-flow models using an appropriate and supportable method and supporting rationale.” In the case of a derivative program that is a future hedging strategy, Section 7.K.3 requires such an increase for disconnects between the hedge modeling and the future hedging strategy, while Section 7.K.4 requires such an increase for disconnects between the loosely defined future hedging strategy and what may actually take place.

## **VM-20 Section 7.L (Remove entire Section 7.L)**

### ~~L. Clearly Defined Hedging Strategy~~

1. ~~A clearly defined hedging strategy must identify:~~
  - a. ~~The specific risks being hedged (e.g., cash flow, policy interest credits, delta, rho, vega, etc.).~~
  - b. ~~The hedge objectives.~~

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- ~~e. The risks that are not hedged (e.g., variation from expected mortality, withdrawal, and other utilization or decrement rates assumed in the hedging strategy, etc.).~~
- ~~d. The financial instruments used to hedge the risks.~~
- ~~e. The hedge trading rules, including the permitted tolerances from hedging objectives.~~
- ~~f. The metrics for measuring hedging effectiveness.~~
- ~~g. The criteria used to measure hedging effectiveness.~~
- ~~h. The frequency of measuring hedging effectiveness.~~
- ~~i. The conditions under which hedging will not take place.~~
- ~~j. The person or persons responsible for implementing the hedging strategy.~~
- ~~k. Areas where basis, gap or assumption risk related to the hedging strategy have been identified.~~
- ~~l. The circumstances under which hedging strategy will not be effective in hedging the risks.~~

Hedging strategies involving the offsetting of the risks associated with other products outside of the scope of these requirements is not a clearly defined hedging strategy.

**Guidance Note:** For purposes of the above criteria, “effectiveness” need not be measured in a manner as defined in *SSAP No. 86 – Derivatives* in the AP&P Manual.

## **VM-21 Section 1.D.2 (Delete entire definition and renumber subsequent sections VM-21 Section 1.D.3 and VM-21 Section 1.D.4)**

The term “clearly defined hedging strategy” (CDHS) is defined in VM-01. In order to be designated as a CDHS, the strategy must meet the principles outlined in Section 1.B (particularly Principle 5) and shall, at a minimum, identify:

- ~~a. The specific risks being hedged (e.g., delta, rho, vega, etc.).~~
- ~~a. The hedge objectives.~~
- ~~b. The risks not being hedged (e.g., variation from expected mortality, withdrawal, and other utilization or decrement rates assumed in the hedging strategy, etc.).~~
- ~~e. The financial instruments that will be used to hedge the risks.~~
- ~~d. The hedge trading rules, including the permitted tolerances from hedging objectives.~~
- ~~e. The metric(s) for measuring hedging effectiveness.~~
- ~~f. The criteria that will be used to measure hedging effectiveness.~~
- ~~g. The frequency of measuring hedging effectiveness.~~
- ~~h. The conditions under which hedging will not take place.~~
- ~~i. The person or persons responsible for implementing the hedging strategy.~~

**Guidance Note:** It is important to note that strategies involving the offsetting of the risks associated with VA guarantees with other products outside of the scope of these requirements (e.g., equity-indexed annuities) do not currently qualify as a clearly defined hedging strategy under these requirements.

## **VM-21 Section 4.A.4**

### Modeling of Hedges

- a. For a company that does not have a CDHS future hedging strategy supporting the contracts:

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- i. The company shall not consider the cash flows from any future hedge purchases or any rebalancing of existing hedge assets in its modeling, since they are not included in the company's investment strategy supporting the contracts.
- ~~ii. Existing hedging instruments that are currently held by the company in support of the contracts falling under the scope of these requirements shall be included in the starting assets. The hedge assets may then be considered in one of two ways:~~
  - ~~ii. \_\_\_\_\_~~
  - ~~a) Include the asset cash flows from any contractual payments and maturity values in the projection model; or~~
  - ~~b) No hedge positions — in which case the hedge positions held on the valuation date are replaced with cash and/or other general account assets in an amount equal to the aggregate market value of these hedge positions.~~

~~**Guidance Note:** If the hedge positions held on the valuation date are replaced with cash, then as with any other cash, such amounts may then be invested following the company's investment strategy.~~

~~A company may switch from method a) to method b) at any time, but it may only change from b) to a) with the approval of the domiciliary commissioner.~~
- b. For a company with a one or more CDHS future hedging strategies supporting the contracts, the detailed requirements for the modeling of hedges are defined in Section 9. The following paragraphs are a high-level summary and do not supersede the detailed requirements.
  - i. The appropriate costs and benefits of hedging instruments that are currently held by the company in support of the contracts falling under the scope of these requirements shall be included in the projections used in the determination of the SR.
  - ii. The projections shall take into account the appropriate costs and benefits of hedge positions expected to be held in the future through the execution of the CDHS future hedging strategies supporting the contracts. Because models do not always accurately portray the results of hedge programs, the company shall, through back-testing and other means, assess the accuracy of the hedge modeling. The company shall determine a SR as the weighted average of two CTE values; first, a CTE70 (“best efforts”) representing the company’s projection of all of the hedge cash flows, including future hedge purchases, and a second CTE70 (“adjusted”) which shall use only hedge assets held by the company on the valuation date and no future hedge purchases. These are discussed in greater detail in Section 9. The SR shall be the weighted average of the two CTE70 values, where the weights reflect the error factor ~~(E)~~ determined following the guidance of Section 9.C.4.
  - iii. The company is responsible for verifying compliance with CDHS requirements and any other all requirements in Section 9 for all hedging instruments included in the projections.
  - iv. The use of products not falling under the scope of these requirements (e.g., equity-indexed annuities) as a hedge shall not be recognized in the determination of accumulated deficiencies.

## **VM-21 Section 4.D.4.b**

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Notwithstanding the above requirements, the SR shall be the higher of that produced by the modeled company investment strategy and that produced by substituting an alternative investment strategy in which the fixed income reinvestment assets have the same weighted average life (WAL) as the reinvestment assets in the modeled company investment strategy and are all public non-callable corporate bonds with gross asset spreads, asset default costs, and investment expenses by projection year that are consistent with a credit quality blend of 50% PBR credit rating 6 (A2/A) and 50% PBR credit rating 3 (Aa2/AA).

Policy loans, equities and derivative instruments associated with the execution of ~~a~~ future hedging strategies supporting the contracts ~~clearly defined hedging strategy~~ are not affected by this requirement.

### **VM-21 Section 6.B.3.a.ii – Footnote (Footnote at Bottom of Page 21-23)**

Throughout this Section 6, references to CTE70 (adjusted) shall also mean the SR for a company that does not have a future hedging strategy supporting the contracts ~~CDHS~~ as discussed in Section 4.A.4.a.

### **VM-21 Section 6.B.3.b.ii**

Calculate the Prescribed Projections Amount as the CTE70 (adjusted) using the same method as that outlined in Section 9.C (which is the same as SR following Section 4.A.4.a for a company that does not have a future hedging strategy supporting the contracts ~~CDHS~~) but substituting the assumptions prescribed by Section 6.C. The calculation of this Prescribed Projections Amount also requires that the scenario reserve for any given scenario be equal to or in excess of the cash surrender value in aggregate on the valuation date for the group of contracts modeled in the projection.

### **VM-21 Section 6.B.5**

Cash flows associated with hedging shall be projected in the same manner as that used in the calculation of the CTE70 (adjusted) as discussed in Section 9.C or Section 4.A.4.a for a company without a future hedging strategy supporting the contracts ~~CDHS~~.

### **VM-21 Section 9**

#### **Section 9: Modeling of Hedges under a ~~CDHS~~ Future Hedging Strategy**

##### A. Initial Considerations

1. Subject to Section 9.C.2, the appropriate costs and benefits of hedging instruments that are currently held by the company in support of the contracts falling under the scope of these requirements shall be included in the calculation of the SR, determined in accordance with Section 3.D and Section 4.D.
2. If the company is following ~~a~~ one or more future hedging strategies supporting the contracts ~~CDHS~~, in accordance with an investment policy adopted by the board of directors, or a committee of board members, the company shall take into account the costs and benefits of hedge positions expected to be held by the company in the future along each scenario based on the execution of the hedging strategy, and it is eligible

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to reduce the amount of the SR using projections otherwise calculated. The investment policy must clearly articulate the company’s hedging objectives, including the metrics that drive rebalancing/trading. This specification could include maximum tolerable values for investment losses, earnings, volatility, exposure, etc. in either absolute or relative terms over one or more investment horizons vis-à-vis the chance of occurrence. Company management is responsible for developing, documenting, executing and evaluating the investment strategy, including the hedging strategy, used to implement the investment policy.

3. For this purpose, the investment assets refer to all the assets, including derivatives supporting covered products and guarantees. This also is referred to as the investment portfolio. The investment strategy is the set of all asset holdings at all points in time in all scenarios. The hedging portfolio, which also is referred to as the hedging assets, is a subset of the investment assets. The hedging strategy is the hedging asset holdings at all points in time in all scenarios. There is no attempt to distinguish what is the hedging portfolio and what is the investment portfolio in this section. Nor is the distinction between investment strategy and hedging strategy formally made here. Where necessary to give effect to the intent of this section, the requirements applicable to the hedging portfolio or the hedging strategy are to apply to the overall investment portfolio and investment strategy.
4. This particularly applies to restrictions on the reasonableness or acceptability of the models that make up the stochastic cash-flow model used to perform the projections, since these restrictions are inherently restrictions on the joint modeling of the hedging and non-hedging portfolio. To give effect to these requirements, they must apply to the overall investment strategy and investment portfolio.

~~5. Before either a new or revised hedging strategy can be used to reduce the amount of the SR otherwise calculated, the hedging strategy should be in place (i.e., effectively implemented by the company) for at least three months. The company may meet the time requirement by having evaluated the effective implementation of the hedging strategy for at least three months without actually having executed the trades indicated by the hedging strategy (e.g., mock testing or by having effectively implemented the strategy with similar annuity products for at least three months).~~

## B. Modeling Approaches

1. The analysis of the impact of the hedging strategy on cash flows is typically performed using either one of two types of methods as described below. Although a hedging strategy normally would be expected to reduce risk provisions, the nature of the hedging strategy and the costs to implement the strategy may result in an increase in the amount of the SR otherwise calculated. Particular attention should be given to VM-21 Section 1.B Principle 5 for the modeling of future hedging strategies.
2. The fundamental characteristic of the first type of method, referred to as the “explicit method,” is that hedging positions and their resulting cash flows are included in the stochastic cash-flow model used to determine the scenario reserve, as discussed in Section 3.D, for each scenario.
3. The fundamental characteristic of the second type of method, referred to as the “implicit method,” is that the effectiveness of the current hedging strategy on future cash flows is evaluated, in part or in whole, outside of the stochastic cash-flow model. There are multiple ways that this type of modeling can be implemented. In this case, the reduction to the SR otherwise calculated should be commensurate with the degree of effectiveness of the hedging strategy in reducing accumulated deficiencies otherwise calculated.
4. Regardless of the methodology used by the company, the ultimate effect of the current hedging strategy (including currently held hedge positions) on the SR needs to recognize all risks, associated costs,

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imperfections in the hedges and hedging mismatch tolerances associated with the hedging strategy. The risks include, but are not limited to: basis, gap, price, parameter estimation and variation in assumptions (mortality, persistency, withdrawal, annuitization, etc.). Costs include, but are not limited to: transaction, margin (opportunity costs associated with margin requirements) and administration. In addition, the reduction to the SR attributable to the hedging strategy may need to be limited due to the uncertainty associated with the company’s ability to implement the hedging strategy in a timely and effective manner. The level of operational uncertainty varies indirectly with the amount of time that the new or revised strategy has been in effect or mock tested.

**Guidance Note:** No hedging strategy is perfect. A given hedging strategy may eliminate or reduce some but not all risks, transform some risks into others, introduce new risks, or have other imperfections. For example, a delta-only hedging strategy does not adequately hedge the risks measured by the “Greeks” other than delta. Another example is that financial indices underlying typical hedging instruments typically do not perform exactly like the separate account funds, and hence the use of hedging instruments has the potential for introducing basis risk

5.—A safe harbor approach is permitted for ~~CDHS~~ reflection of future hedging strategies supporting the contracts for those companies whose modeled hedge assets comprise only linear instruments not sensitive to implied volatility. For companies with option-based hedge strategies, electing this approach would require representing the option-based portion of the strategy as a delta-rho two-Greek hedge program. The normally modeled option portfolio would be replaced with a set of linear instruments that have the same first-order Greeks as the original option portfolio.

C. Calculation of SR (Reported)

1. The company shall calculate CTE70 (best efforts)—the results obtained when the CTE70 is based on incorporating the future hedging strategies supporting the contracts ~~CDHS~~ (including both currently held and future hedge positions) into the stochastic cash-flow model on a best efforts basis, including all of the factors and assumptions needed to execute the future hedging strategies supporting the contracts ~~CDHS~~ (e.g., stochastic implied volatility). The determination of CTE70 (best efforts) may utilize either explicit or implicit modeling techniques.
2. The company shall calculate a CTE70 (adjusted) by recalculating the CTE70 assuming the company has no future hedging strategies supporting the contracts ~~CDHS~~, therefore following the requirements of Section 4.A.4.a.

However, for a company with a future hedging strategy supporting the contracts, existing hedging instruments that are currently held by the company in support of the contracts falling under the scope of these requirements may be considered in one of two ways for the CTE70 (adjusted):

- a) Include the asset cash flows from any contractual payments and maturity values in the projection model; or
- b) No hedge positions – in which case the hedge positions held on the valuation date are replaced with cash and/or other general account assets in an amount equal to the aggregate market value of these hedge positions.

**Guidance Note:** If the hedge positions held on the valuation date are replaced with cash, then as with any other cash, such amounts may then be invested following the company’s investment strategy.

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A company may switch from method a) to method b) at any time, but it may only change from b) to a) with the approval of the domiciliary commissioner.

3. Because most models will include at least some approximations or idealistic assumptions, CTE70 (best efforts) may overstate the impact of the hedging strategy. To compensate for potential overstatement of the impact of the hedging strategy, the value for the SR is given by:

$$SR = CTE70 \text{ (best efforts)} + E \times \max[0, CTE70 \text{ (adjusted)} - CTE70 \text{ (best efforts)}]$$

4. The company shall specify a value for *E* (the “error factor”) in the range from 5% to 100% to reflect the company’s view of the potential error resulting from the level of sophistication of the stochastic cash-flow model and its ability to properly reflect the parameters of the hedging strategy (i.e., the Greeks being covered by the strategy), as well as the associated costs, risks and benefits. The greater the ability of the stochastic model to capture all risks and uncertainties, the lower the value of *E*. The value of *E* may be as low as 5% only if the model used to determine the CTE70 (best efforts) effectively reflects all of the parameters used in the hedging strategy. If certain economic risks are not hedged, yet the model does not generate scenarios that sufficiently capture those risks, *E* must be in the higher end of the range, reflecting the greater likelihood of error. Likewise, simplistic hedge cash-flow models shall assume a higher likelihood of error.
5. The company shall conduct a formal back-test, based on an analysis of at least the most recent 12 months, to assess how well the model is able to replicate the hedging strategy in a way that supports the determination of the value used for *E*.
6. Such a back-test shall involve one of the following analyses:
  - a. For companies that model hedge cash flows directly (“explicit method”), replace the stochastic scenarios used in calculating the CTE70 (best efforts) with a single scenario that represents the market path that actually manifested over the selected back-testing period and compare the projected hedge asset gains and losses against the actual hedge asset gains and losses – both realized and unrealized – observed over the same time period. For this calculation, the model assumptions may be replaced with parameters that reflect actual experience during the back-testing period. In order to isolate the comparison between the modeled hedge strategy and actual hedge results for this calculation, the projected liabilities should accurately reflect the actual liabilities throughout the back-testing period; therefore, adjustments that facilitate this accuracy (e.g. reflecting actual experience instead of model assumptions, including new business, etc.) are permissible.

To support the choice of a low value of *E*, the company should ascertain that the projected hedge asset gains and losses are within close range of 100% (e.g., 80–125%) of the actual hedge asset gains and losses. The company may also support the choice of a low value of *E* by achieving a high R-squared (e.g., 0.80 or higher) when using a regression analysis technique.

b. For companies that model hedge cash flows implicitly by quantifying the cost and benefit of hedging using the fair value of the hedged item (an “implicit method” or “cost of reinsurance method”), calculate the delta, rho and vega coverage ratios in each month over the selected back-testing period in the following manner:

- i. Determine the hedge asset gains and losses—both realized and unrealized—incurred over the month attributable to equity, interest rate, and implied volatility movements.
- ii. Determine the change in the fair value of the hedged item over the month attributable to equity, interest rate, and implied volatility movements. The hedged item should be defined in a manner that reflects the proportion of risks hedged (e.g., if a company elects to hedge 50% of a contract’s

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market risks, it should quantify the fair value of the hedged item as 50% of the fair value of the contract).

iii. Calculate the delta coverage ratio as the ratio between (i) and (ii) attributable to equity movements.

iv. Calculate the rho coverage ratio as the ratio between (i) and (ii) attributable to interest rate movements.

v. Calculate the vega coverage ratio as the ratio between (i) and (ii) attributable to implied volatility movements.

vi. To support the company's choice of a low value of E, the company should be able to demonstrate that the delta and rho coverage ratios are both within close range of 100 % (e.g., 80–125%) consistently across the back-testing period.

vii. In addition, the company should be able to demonstrate that the vega coverage ratio is within close range of 100 % in order to use the prevailing implied volatility levels as of the valuation date in quantifying the fair value of the hedged item for the purpose of calculating CTE70 (best efforts). Otherwise, the company shall quantify the fair value of the hedged item for the purpose of calculating CTE70 (best efforts) in a manner consistent with the realized volatility of the scenarios captured in the CTE (best efforts).

c. Companies that do not model hedge cash flows explicitly, but that also do not use the implicit method as outlined in Section 9.C.6.b above, shall conduct the formal back-test in a manner that allows the company to clearly illustrate the appropriateness of the selected method for reflecting the cost and benefit of hedging, as well as the value used for E.

~~6.—7.~~ A company that does not have 12 months of experience to date shall set E to a value that reflects the amount of experience available, and the degree and nature of any change to the hedge program. For a material change in strategy, with less than 12 months of experience and without robust mock testing, E should be 1.0. For a material change in strategy, with ~~no less than 3 months of~~ history, E should be ~~at least 0.50~~1.0. However, when a material change in hedging strategy with less than 3 months history is the introduction of hedging for a newly introduced product or newly acquired block of business and is supplemented by robust mock testing, E should instead be at least 0.3. Moreover, with prior approval from the domestic regulator, material changes in hedge strategy with less than 3 months history but with robust mock testing may have error factors less than 1.0, though still subject to the minimum error factor specified in Section 9.C.4 and with an appropriate prudent estimate to account for additional uncertainty in anticipated hedging experience beyond that of a robust hedging program already in existence. However, E may also be lower than 0.501.0 if ~~some reliable experience is available and/or if the change in strategy is a~~ minor refinement rather than a substantial-material change in strategy, though still subject to the minimum error factor specified in Section 9.C.4 and with an appropriate prudent estimate to account for any additional uncertainty associated with the refinement.

**Guidance Note:** The following examples are provided as guidance for determining the E factor when there has been a change to the hedge program. These examples are not intended to be exhaustive, and a company must support the determination of whether a hedge methodology change is material based on a review of the company's specific change in methodology.:

- ~~The error factor should be temporarily large (e.g.,  $\geq 50$ 100%) for~~ substantial-material changes in hedge methodology (e.g., moving from a fair-value based strategy to a stop-loss strategy) without robust mock

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~~testing where the company has not been able to provide a meaningful simulation of hedge performance based on the new strategy.~~

- ~~An increase in the error factor may not always be needed for minor refinements to the hedge strategy (e.g., moving from swaps to Treasury futures).~~
- ~~A temporary moderate increase (e.g., 15–30%) in error factor should be used for substantial modifications to hedge programs or CDHS modeling where meaningful simulation has not been created (e.g., adding second-order hedging, such as gamma or rate convexity).~~
- ~~No increase in the error factor may be used for incremental modifications to the hedge strategy (e.g., adding death benefits to a program that previously covered only living benefits, or moving from swaps to Treasury Department futures).~~

8. ~~The company shall set the value of E reflecting the extent to which the hedging program is clearly defined. To support a value of E below 1.0, there should be very robust documentation outlining all future hedging strategies. To the extent that documentation outlining any of the future hedging strategies is incomplete, the value of E shall be increased. In particular, the value of E shall be 1.0 if documentation is materially incomplete for any of the individual CDHS attributes (a) through (j), as listed in VM-01.~~

~~Any increases required to the value of E to reflect that documentation is not available to support that the future hedging strategies are clearly defined shall be in addition to increases to the value of E to reflect a lack of historical experience or to reflect the back-testing results, subject to an overall ceiling of 1.0 for E.~~

**Guidance Note:** ~~Companies must use judgment both in determining an E factor and in applying this requirement in the case where there are multiple future hedging strategies, particularly where some may be CDHS and some may not be CDHS. In this case, the SR should be ensured to be no less than the CTE(70) reflecting the future hedging strategies that are CDHS and not reflecting those that are not CDHS. Companies with multiple future hedging strategies with very different levels of effectiveness or with multiple future hedging strategies that include both CDHS and non-CDHS should discuss with their domestic regulator.~~

#### D. Additional Considerations for CTE70 (best efforts)

If the company is following ~~a one or more future hedging strategies supporting the contracts~~ CDHS, the fair value of the portfolio of contracts falling within the scope of these requirements shall be computed and compared to the CTE70 (best efforts) and CTE70 (adjusted). If the CTE70 (best efforts) is below both the fair value and CTE70 (adjusted), the company should be prepared to explain why that result is reasonable.

For the purposes of this analysis, the SR and fair value calculations shall be done without requiring the scenario reserve for any given scenario to be equal to or in excess of the cash surrender value in aggregate for the group of contracts modeled in the projection.

#### E. Specific Considerations and Requirements

1. As part of the process of choosing a methodology and assumptions for estimating the future effectiveness of the current hedging strategy (including currently held hedge positions) for purposes of reducing the SR, the company should review actual historical hedging effectiveness. The company shall evaluate the appropriateness of the assumptions on future trading, transaction costs, other elements of the model, the strategy, the mix of business and other items that are likely to result in materially adverse results. This includes an analysis of model assumptions that, when combined with the reliance on the hedging strategy, are likely to result in adverse results relative to those modeled. The parameters and assumptions shall be

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adjusted (based on testing contingent on the strategy used and other assumptions) to levels that fully reflect the risk based on historical ranges and foreseeable future ranges of the assumptions and parameters. If this is not possible by parameter adjustment, the model shall be modified to reflect them at either anticipated experience or adverse estimates of the parameters.

2. A discontinuous hedging strategy is a hedging strategy where the relationships between the sensitivities to equity markets and interest rates (commonly referred to as the Greeks) associated with the guaranteed contract holder options embedded in the variable annuities and other in-scope products and these same sensitivities associated with the hedging assets are subject to material discontinuities. This includes, but is not limited to, a hedging strategy where material hedging assets will be obtained when the variable annuity account balances reach a predetermined level in relationship to the guarantees. Any hedging strategy, including a delta hedging strategy, can be a discontinuous hedging strategy if implementation of the strategy permits material discontinuities between the sensitivities to equity markets and interest rates associated with the guaranteed contract holder options embedded in the variable annuities and other in-scope products and these same sensitivities associated with the hedging assets. There may be scenarios that are particularly costly to discontinuous hedging strategies, especially where those result in large discontinuous changes in sensitivities (Greeks) associated with the hedging assets. Where discontinuous hedging strategies contribute materially to a reduction in the SR, the company must evaluate the interaction of future trigger definitions and the discontinuous hedging strategy, in addition to the items mentioned in the previous paragraph. This includes an analysis of model assumptions that, when combined with the reliance on the discontinuous hedging strategy, may result in adverse results relative to those modeled.
3. A strategy that has a strong dependence on acquiring hedging assets at specific times that depend on specific values of an index or other market indicators may not be implemented as precisely as planned.
4. The combination of elements of the stochastic cash-flow model—including the initial actual market asset prices, prices for trading at future dates, transaction costs and other assumptions—should be analyzed by the company as to whether the stochastic cash-flow model permits hedging strategies that make money in some scenarios without losing a reasonable amount in some other scenarios. This includes, but is not limited to:
  - a. Hedging strategies with no initial investment that never lose money in any scenario and in some scenarios make money.
  - b. Hedging strategies that, with a given amount of initial money, never make less than accumulation at the one-period risk-free rates in any scenario but make more than this in one or more scenarios.
5. If the stochastic cash-flow model allows for such situations, the company should be satisfied that the results do not materially rely directly or indirectly on the use of such strategies. If the results do materially rely directly or indirectly on the use of such strategies, the strategies may not be used to reduce the SR otherwise calculated.
6. In addition to the above, the method used to determine prices of financial instruments for trading in scenarios should be compared to actual initial market prices. In addition to comparisons to initial market prices, there should be testing of the pricing models that are used to determine subsequent prices when scenarios involve trading financial instruments. This testing should consider historical relationships. For example, if a method is used where recent volatility in the scenario is one of the determinants of prices for trading in that scenario, then that model should approximate actual historic prices in similar circumstances in history.

### **VM-31 Section 3.C.5**

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Assets and Risk Management – A brief description of the asset portfolio, and the approach used to model risk management strategies, such as hedging, and other derivative programs, including a description of any ~~clearly defined hedging strategies~~ future hedging strategies supporting the policies, and any material changes to the hedging strategies from the prior year.

### **VM-31 Section 3.D.6.f**

Risk Management – Detailed description of model risk management strategies, such as hedging and other derivative programs, including any ~~clearly defined hedging strategies and any adjustments to the SR pursuant to VM-20 Section 7.K.3 and VM-20 Section 7.K.4,~~ specific to the groups of policies covered in this sub-report and not discussed in the Life Summary Section 3.C.5. Documentation of any future hedging strategies should include documentation addressing each of the CDHS documentation attributes.

### **VM-31 Section 3.D.14.a and 3.D.14.b**

- a. Investment Officer on Investments – A certification from a duly authorized investment officer that the modeled company investment strategy, including any future hedging strategies supporting the policies, is representative of and consistent with the company’s investment policy and that documentation of the CDHS attributes for any future hedging strategies supporting the policies are accurate.
- b. Qualified Actuary on Investments – A certification by a qualified actuary, not necessarily the same qualified actuary that has been assigned responsibility for the PBR Actuarial Report or this sub-report, that the modeling of any future hedging strategies supporting the policies is consistent with the company’s actual future hedging strategies and ~~clearly defined hedging strategies~~ was performed in accordance with VM-20 and in compliance with all applicable ASOPs, and the alternative investment strategy as defined in VM-20 Section 7.E.1.g reflects the prescribed mix of assets with the same WAL as the reinvestment assets in the company investment strategy.

### **VM-31 Section 3.E.5**

Assets and Risk Management – A brief description of the general account asset portfolio, and the approach used to model risk management strategies, such as hedging and other derivative programs, including a description of any future hedging strategies supporting the contracts ~~clearly defined hedging strategies,~~ and any material changes to the hedging ~~strategy~~ strategies from the prior year.

### **VM-31 Section 3.F.8**

Hedging and Risk Management – The following information regarding the hedging and risk management assumptions used by the company in performing a principle-based valuation under VM-21:

- a. Strategies – Detailed description of risk management strategies, such as hedging and other derivative programs, including any future hedging strategies supporting the contracts ~~CDHS,~~ specific to the groups of contracts covered in this sub-report.
  - i. Descriptions of basis risk, gap risk, price risk and assumption risk.
  - ii. Methods and criteria for estimating the a priori effectiveness of the strategy.

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- iii. Results of any reviews of actual historical hedging effectiveness.
- b. CDHS – Documentation addressing each of the CDHS documentation attributes for any future hedging strategies supporting the contracts hedging strategy that meets the requirements to be a CDHS.
- c. Strategy Changes – Discussion of any changes to the hedging strategy during the past 12 months, including identification of the change, reasons for the change, and the implementation date of the change.
- d. Hedge Modeling – Description of how the hedge strategy was incorporated into modeling, including:
  - i. Differences in timing between model and actual strategy implementation.
  - ii. For a company that does not have a future hedging strategy supporting the contracts CDHS, disclosure of the method used to consider confirmation that currently held hedge assets were included in the starting assets, either (1) including the asset cash flows in the projection model; or (2) replacing the hedge positions with cash and/or other general account assets in an amount equal to the market value of the hedge positions, as discussed in VM 21 Section 4.A.4.a.
  - iii. Evaluations of the appropriateness of the assumptions on future trading, transaction costs, other elements of the model, the strategy, and other items that are likely to result in materially adverse results.
  - iii-iv. Discussion of the projection horizon for the future hedge strategy as modeled and a comparison to the timeline for any anticipated future changes in the company's hedge strategy.
  - iv-v. If residual risks and frictional costs are assumed to have a value of zero, a demonstration that a value of zero is an appropriate expectation.
  - v-vi. Any discontinuous hedging strategies modeled, and where such discontinuous hedging strategies contribute materially to a reduction in the SR, any evaluations of the interaction of future trigger definitions and the discontinuous hedging strategy, including any analyses of model assumptions that, when combined with the reliance on the discontinuous hedging strategy, may result in adverse results relative to those modeled.
  - vi-vii. Disclosure of any situations where the modeled hedging strategies make money in some scenarios without losing a reasonable amount in some other scenarios, and an explanation of why the situations are not material for determining the CTE 70 (best efforts).
  - vii-viii. Results of any testing of the method used to determine prices of financial instruments for trading in scenarios against actual initial market prices, including how the testing considered historical relationships. If there are substantial discrepancies, disclosure of the substantial discrepancies and documentation as to why the model-based prices are appropriate for determining the SR.
  - viii-ix. Any model adjustments made when calculating CTE 70 (adjusted), in particular, any liquidation or substitution of assets for currently held hedges. If there is liquidation or substitution of assets for currently held hedges, disclosure of the impact on the adjusted run.
- e. Error Factor (E) and Back-Testing – Description of *E*, the error factor, and formal back-tests performed, including:
  - i. The value of *E*, and the approach and rationale for the value of *E* used in the reserve calculation.
  - ii. For companies that model hedge cash flows using the explicit method, as described in VM-21 Section 9.C.6.a, and have 12 months of experience, an analysis of at least the most recent 12 months of experience and the results of a back-test showing that the model is able to replicate the hedging results experienced in a way that justifies the value used for *E*. Include at least a ratio of the actual change in market value of the hedges to the modeled change in market value of the hedges at least quarterly.
  - iii. For companies that model hedge cash flows using the implicit method, and have 12 months of experience, as described in VM-21 Section 9.C.6.b, the results of a back-test in which (a) actual

<b>Dates:</b> Received	Reviewed by Staff	Distributed	Considered
11/16/20	RM		
<b>Notes:</b> APF 2020-12			

hedge asset gains and losses are compared against (b) proportional fair value movements in hedged liability, including:

- a) Delta, rho and vega coverage ratios in each month over the back-testing period, which may be presented in a chart or graph.
- b) The implied volatility level used to quantify the fair value of the hedged item, as well as the methodology undertaken to determine the appropriate level used.
- iv. For companies that do not model hedge cash flows using either the explicit method or the implicit method, as described in VM-21 Section 9.C.6.c, and have 12 months of experience, the results of the formal back-test conducted to validate the appropriateness of the selected method and value used for E.
  - v. For companies that do not have 12 months of experience, the basis for the value of *E* that is chosen based on the guidance provided in VM-21 Section 9.C.7, considering the actual history available, mock testing performed, and the degree and nature of any changes made to the hedge strategy.
  - v.vi. The basis for the magnitude of adjustment or lack of adjustment for the value of E chosen based on the robustness of the documentation outlining the future hedging strategy.
- f. Safe Harbor for Future Hedging Strategies CDHS – If electing the safe harbor approach for a future hedging strategy supporting the contracts CDHS, as discussed in VM-21 Section 9.C.8, a description of the linear instruments used to model the option portfolio.
- g. Hedge Model Results – Disclosure of whether the calculated CTE 70 (best efforts) is below both the fair value and CTE 70 (adjusted), and if so, justification for why that result is reasonable, as discussed in VM-21 Section 9.D.

### **VM-31 Section 3.F.12.c**

CTEPA – If using the CTEPA method, a summary including:

- i. Disclosure (in tabular form) of the scenario reserves using the same method and assumptions as those used by the company to calculate CTE 70 (adjusted) as outlined in VM-21 Section 9.C (or the SR following VM-21 Section 4.A.4.a for a company that does not have a future hedging strategy supporting the contracts CDHS), as well as the corresponding scenarios reserves substituting the assumptions prescribed by VM-21 Section 6.C.
- ii. Summary of results from a cumulative decrement projection along the scenario whose reserve value is closest to the CTE 70 (adjusted), as outlined in VM-21 Section 9.C (or the SR following VM-21 Section 4.A.4.a for a company that does not have a future hedging strategy supporting the contracts CDHS), under the assumptions outlined in VM-21 Section 6.C. Such a cumulative decrement projection shall include, at the end of each projection year, the projected proportion (expressed as a percent of the total projected account value) of persisting contracts as well as the allocation of projected decrements across death, full surrender, account value depletion, elective annuitization, and other benefit election.
- iii. Summary of results from a cumulative decrement projection, identical to (ii) above, but replacing all assumptions outlined in VM-21 Section 6.C with the corresponding assumptions used in calculating the SR.

### **VM-31 Section 3.F.16.a and Section 3.F.16.b**

- a. Investment Officer on Investments – A certification from a duly authorized investment officer that the modeled asset investment strategy, including any future hedging strategies supporting the contracts CDHS, is

<b>Dates:</b> Received	Reviewed by Staff	Distributed	Considered
11/16/20	RM		
<b>Notes:</b> APF 2020-12			

consistent with the company’s current investment strategy except where the modeled reinvestment strategy may have been substituted with the alternative investment strategy, and ~~also any CDHS meets the~~that documentation of the requirements of a CDHS attributes for any future hedging strategies supporting the contracts are accurate.

- b. Qualified Actuary on Investments – A certification by a qualified actuary, not necessarily the same qualified actuary that has been assigned responsibility for the PBR Actuarial Report or this sub-report, that the modeling of any ~~clearly defined hedging strategies~~ future hedging strategies supporting the contracts ~~is~~ consistent with the company’s actual future hedging strategies and was performed in accordance with VM-21 and in compliance with all applicable ASOPs.

## Agenda Item 7

Discuss the Economic Scenario Generator (ESG)



# Key GEMS<sup>®</sup> Equity Model Considerations

3/31/22

**NAIC** NATIONAL ASSOCIATION OF  
INSURANCE COMMISSIONERS

# Agenda



1. Review Summary of Recommended ESG Models for Field Testing
2. Discuss Key Differences between the GEMS<sup>®</sup> and AIRG Equity Models
  - a. Expected Mean Return and Standard Deviation
  - b. Link between Equity and Treasury Model
  - c. Equity Model Jump Process
3. Questions and Comments

# Summary of Recommended ESG Models for Field Testing

Model	Field Test Recommendation
Treasury	1. Field test two GEMS® Treasury model candidates <ul style="list-style-type: none"> <li>a. Conning Calibration and Generalized Fractional Floor</li> <li>b. Alternative Calibration and Shadow Floor               <ul style="list-style-type: none"> <li>i. Note: The Alternative Calibration will be adjusted ahead of field testing</li> </ul> </li> </ul>
Equity	2. Utilize the existing GEMS® equity model with equity-Treasury linkage based on the short Treasury rate for field testing. Additionally, apply the following calibration updates: <ul style="list-style-type: none"> <li>a. Update the equity model calibration to account for changes made to the Treasury model</li> <li>b. Apply a Sharpe-ratio approach with a 5% corridor to set the expected returns for the diversified international equity, aggressive international equity, and US aggressive equity indices</li> </ul>
Corporate	3. Include GEMS® corporate model in initial field testing with the calibration updated for consistency with other generated returns on a risk/reward basis.

# Key Differences between the GEMS<sup>®</sup> and AIRG Equity Models

- Model office testing presented by the American Academy of Actuaries has shown that the scenario sets proposed for field testing resulted in significant impacts to reserves and capital for the Variable Annuity (VA) model office as compared to the results produced with scenarios from the prescribed generator
- Today's presentation will focus on some of the potential drivers of reserve and capital differences resulting from moving to the GEMS<sup>®</sup> Equity Model from the ESG prescribed in VM-20 and VM-21. The discussion will also provide some information on a recalibrated version of the GEMS<sup>®</sup> Equity Model with lower volatility.

# Expected Mean Return and Standard Deviation

- The AIRG Equity Model is calibrated using historical data generally from 1955 - 2003\* to set the expected mean return and volatility. The GEMS® Equity Model uses historical data back 25 years, but also considers the expected returns and volatility of other domestic and international equity funds to ensure alignment on a risk/reward basis.
- The GEMS® Equity Model has higher volatility than the AIRG in the steady state - which could be a significant source of differences in reserves between the GEMS® and AIRG scenarios. The GEMS® higher volatility leads to returns that are both higher and lower across the scenarios in each period. Over time and across scenarios, those higher and lower returns compound to produce a wider distribution of cumulative equity returns, or wealth ratios, in both tails of the scenario distribution.
- The GEMS® Equity model has similar returns to the AIRG in the steady state, but lower expected returns in the earlier projection period due to the Equity-Treasury linkage and low interest rate environment. Lower mean returns shift the entire distribution of returns lower.

ESG Model	Year 1 Mean	Year 1 St. Dev.	Steady State Mean	Steady State St. Dev.
AIRG	8.8%	16.4%	8.6%	16.1%
GEMS®	5.2%	13.7%	8.6%	17.3%

\*Source: CONSTRUCTION AND USE OF PRE-PACKAGED SCENARIOS TO SUPPORT THE DETERMINATION OF REGULATORY RISK-BASED CAPITAL REQUIREMENTS FOR VARIABLE ANNUITIES AND SIMILAR PRODUCTS, Revised 2006, AAA C-3 Phase II Working Group

# Expected Mean Return and Standard Deviation Model Results vs. Select Historical Time Periods

## Model Results

ESG Model	Steady State Mean	Steady State St. Dev.
AIRG	8.6%	16.1%
GEMS®	8.6%	17.3%

## Historical United States Large Cap Stock Returns

Historical Period	Mean	Standard Deviation
1900-2003	11.8%	21.1%
3/1957-2003	11.9%	16.5%
1900 -2021	11.8%	20.4%
3/1957-2021	12%	16.2%

- Both GEMS® and the AIRG have long-term expected returns (8.6%) that are lower than historical returns. The historical periods below show similar average returns (11.8%-12%) that are significantly higher.
- The volatility in the AIRG aligns with the historical data since 1957 (the start of the S&P 500).
- Volatility in the GEMS® ESG is higher than the historical volatility since 1957, but lower than the volatility that considers data back to 1900.
- The inclusion of data after 2003 does not dramatically change the mean but would reduce the volatility slightly

# Historical Prolonged Periods of Negative Cumulative Returns

- After a recession or depression, there have been some extended periods of equity market recovery. This is important to reflect in the scenarios due to the long-term nature of some insurance liabilities.
- The graph on the right illustrates a time period from the late 1920s to the mid 1940s where an investor in the S&P index would not have been able to recoup the original investment value upon sale

Historical S&P Index Cumulative Total Returns  
1929-1945

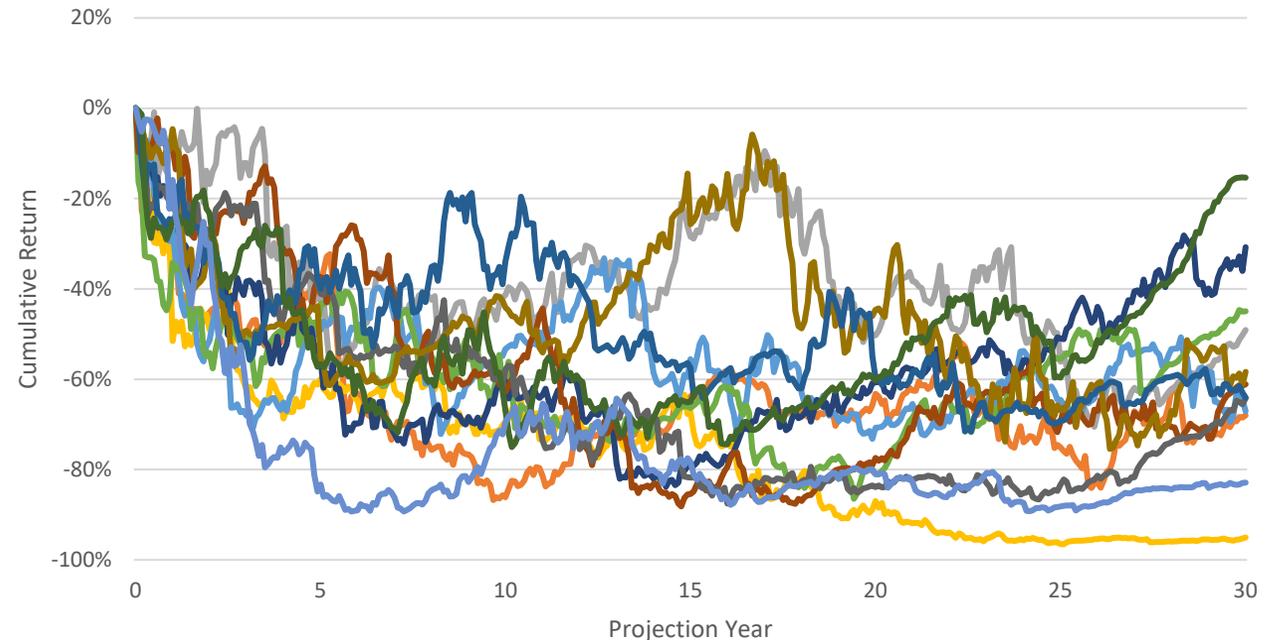


Prepared by Conning. Source: Bloomberg.

# Modeled Prolonged Periods of Negative Cumulative Returns

- Both the AAA ESG and GEMS® can produce equity scenarios that exhibit low returns over an extended period of time. This is largely driven by volatility and the expected return. If there is enough volatility or if there are low enough expected returns, low for long equity scenarios will be produced.
- As of 12/30/20, GEMS® produced 12 scenarios with cumulative negative returns over a 30-year projection compared to 3 scenarios for the AAA ESG out of 10,000 scenario projections.
- Reserves and capital are driven by scenarios in the tail. The extreme scenarios illustrated on the right represent significant risks to companies that issue guarantees on separate equity fund allocations.

Conning Calibration and Generalized Fractional Floor 12/31/20  
Equity Scenarios with Negative Cumulative Returns over First 30 Years



Prepared by Conning. Source: GEMS® Economic Scenario Generator scenarios.

# GEMS® Equity Model Returns and Gross Wealth Factors when Recalibrated with Lower Volatility

<b>GEMS Calibration</b>			
Percentile	Year 1	Year 30	Year 30 GWF
1%	-28.8%	-33.8%	39.1%
5%	-18.0%	-20.2%	95.9%
25%	-3.4%	-2.0%	295.1%
50%	5.9%	8.9%	588.2%
75%	14.4%	18.2%	1140.7%
95%	26.4%	36.3%	3214.5%
99%	35.3%	55.6%	6896.9%
Mean	5.2%	8.6%	1015.3%
St Dev	13.7%	17.3%	1599.2%

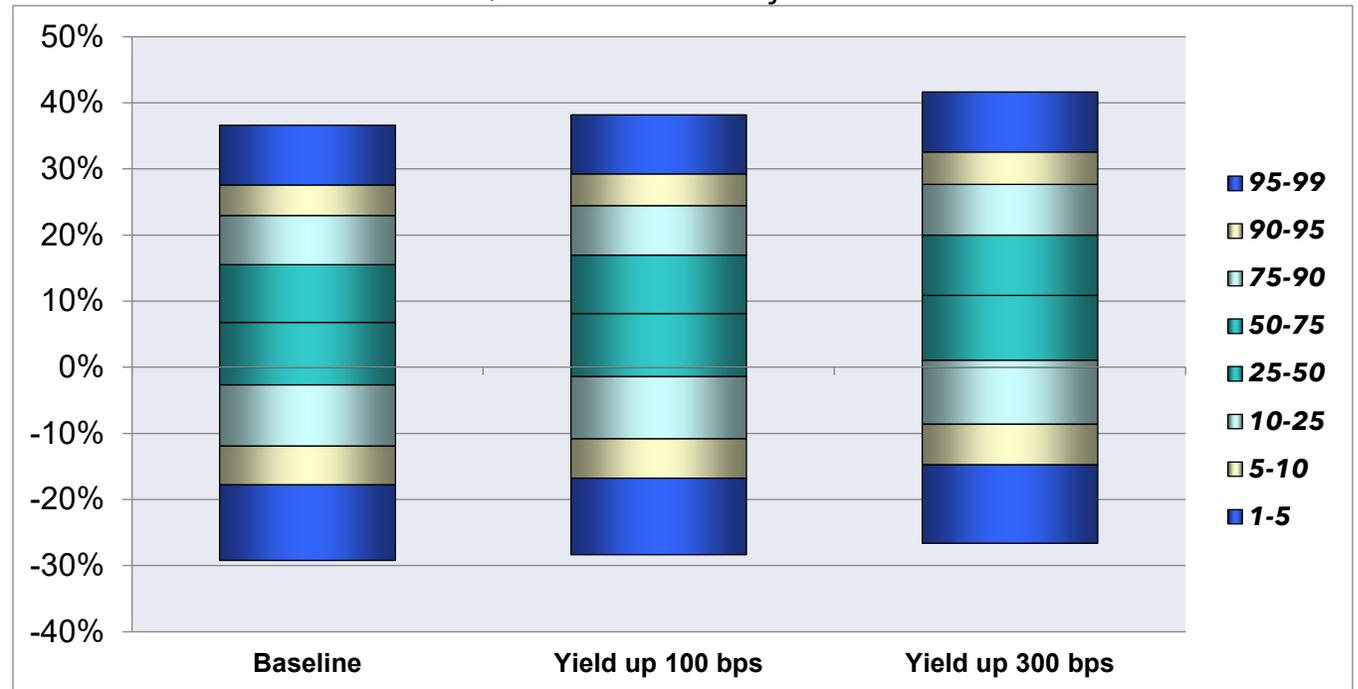
<b>GEMS Recalibrated to Target Lower AIRG Volatility</b>			
Percentile	Year 1	Year 30	Year 30 GWF
1%	-28.1%	-30.1%	55.3%
5%	-17.7%	-18.3%	118.7%
25%	-3.5%	-1.7%	317.7%
50%	5.8%	8.7%	610.3%
75%	14.4%	18.1%	1149.7%
95%	26.2%	34.3%	3063.7%
99%	34.8%	51.6%	6679.6%
Mean	5.2%	8.4%	1013.1%
St Dev	13.4%	16.2%	1496.7%

- VA model office testing shows a large increase to reserves and capital for the recommended field test model candidates. To help understand the extent to which equity model volatility impacts the results, Conning adjusted the volatility parameters of the model so that the resulting steady state standard deviation was in-line with the current AIRG model (i.e. 16.1% vs the GEMS® Baseline of 17.3%). The chart below shows the material impact that this change can have on long-term, cumulative equity returns, especially at the lower percentiles. For example, the 1st percentile of the Gross Wealth Factor at the end of the 30th projection year is up from a little over 39% to a little over 55%.
- If regulators would like to pursue changes to the GEMS® Equity Model volatility, a next step would be to determine the desired level of volatility.
- Additionally, if a change is made to the volatility in the U.S. Diversified Large Cap fund, other funds will need to be adjusted to ensure alignment on a risk/reward basis across funds.

# Link between Equity and Treasury Model

- It is difficult to see strong relationships between equities and Treasuries because the equity market is so volatile. However, investors typically demand equity returns in excess of those offered by risk-free assets to compensate for bearing risk. Today's low yields imply lower equity returns.
- The graph on the right illustrates how changing the initial Treasury levels can influence the distribution of equity returns at the end of the 12<sup>th</sup> month of the projection. Increases to interest rate levels will shift the equity distribution upwards, and vice-versa.
- Several commenters have noted that the equity-Treasury linkage could cause reserve and capital volatility from period to period.

\*Impact of Changing Initial Treasury Yield  
S&P 500 Total Return, 12 Month Projections with 9/30/20 Start

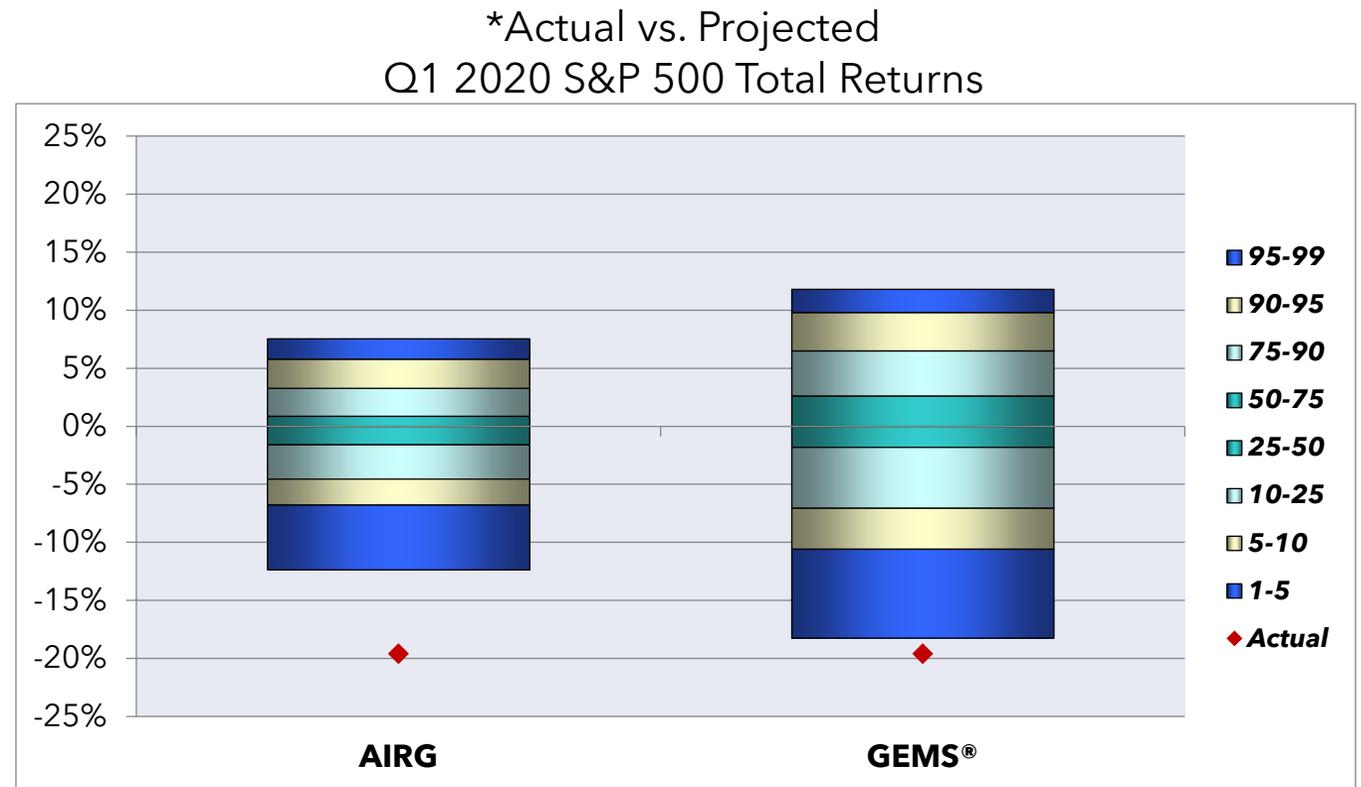


Prepared by Conning. Source: GEMS® Economic Scenario Generator scenarios.

\*Illustrative results only, these charts have not been updated for the latest calibration

# Equity Model Jump Process

- The graph on the right depicts quarterly total returns from the S&P 500 equity scenarios generated by the AIRG and GEMS® models as compared to the actual Q1 2020 S&P 500 quarterly total return
- While both ESGs failed to capture the severe downside Q1 2020 actual return, the jump process in the GEMS® equity model included scenarios with larger negative quarterly returns



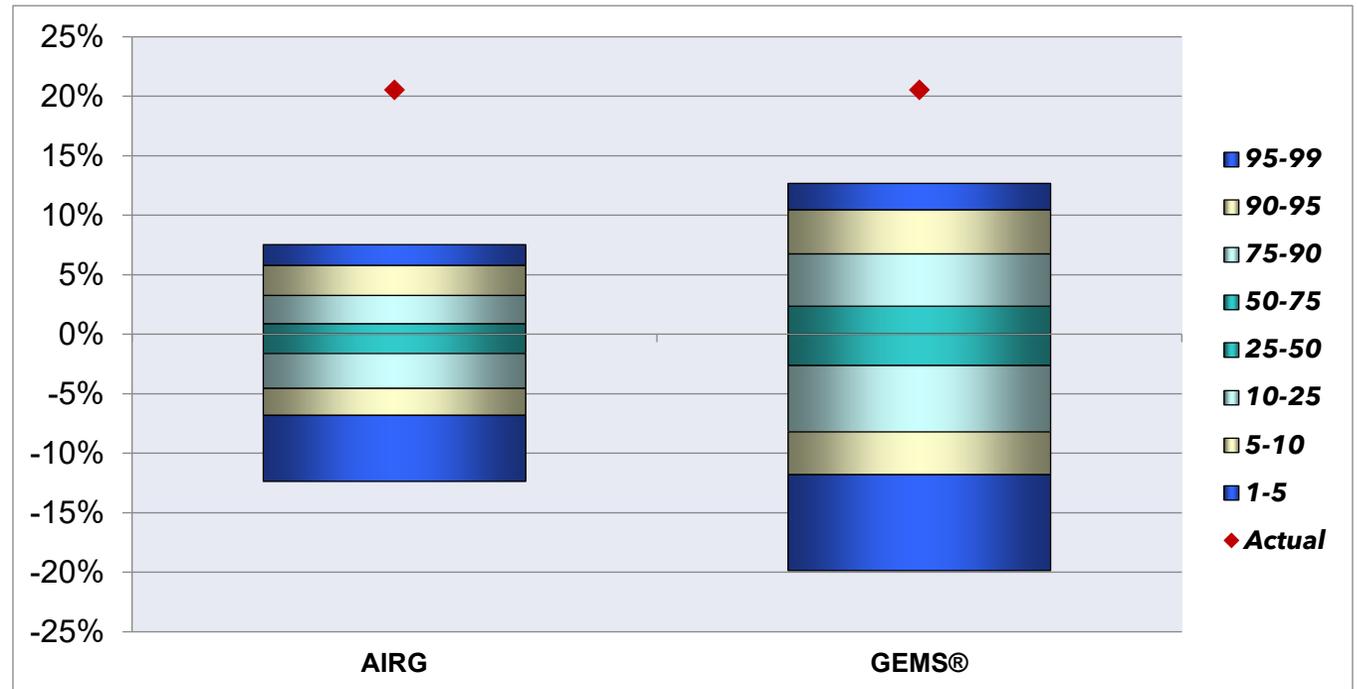
Prepared by Conning. Sources: Academy Interest Rate Generator v 7.1.201905 and GEMS® Economic Scenario Generator scenarios

\*Illustrative results only, these charts have not been updated for the latest calibration

# Equity Model Jump Process, continued

- For Q2 2020, both ESGs again missed the large Q2 2020 S&P 500 quarterly total return, but the jump process in the GEMS® equity model produced scenarios with higher quarterly S&P 500 returns.
- Some commenters have suggested that the large up and down equity market movements produced from ESG models with a jump process may “wash out” over the long term.
- However, the potential impacts of large equity market movements on hedging programs that are rebalanced periodically or GMXB in-the-moneyness warrant inclusion in field testing.

\*Actual vs. Projected  
Q2 2020 S&P 500 Total Returns



Prepared by Conning. Sources: Academy Interest Rate Generator v 7.1.201905 and GEMS® Economic Scenario Generator scenarios

\*Illustrative results only, these charts have not been updated for the latest calibration

# Questions and Comments

## Agenda Item 8

Hear an Update on SOA Research and Education

Revised 3/30/2022



# SOCIETY OF ACTUARIES RESEARCH UPDATE TO LATF

March 31, 2022

R. DALE HALL, FSA, MAAA, CERA, CFA  
Managing Director of Research

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## SOA, Academy, ACLI, NAIC Communication Group

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## SOA, Academy, LATF, ACLI, NAIC Communication Group

- Replaces Preferred Mortality Project Oversight Group (PM POG)
- Purpose
  - Monthly calls with entities involved in valuation table/assumption development
  - Covers all life and annuity valuation needs
  - Provide status updates on current valuation efforts
  - Discuss anticipated future efforts
  - Coordinate resources
  - Charter, in development, to clarify purpose/roles/membership term
- Membership
  - SOA, Academy, LATF, ACLI & NAIC representatives
  - Valuation/assumption work group leaders



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## Preliminary 2015-2018 Group Annuity Mortality

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## Preliminary 2015-2018 Group Annuity Mortality

- Current study indicates higher A/E ratios on a lives basis, lower A/E ratios on an income basis compared to 2011-2014 study

Expected Basis	Actual-to-Expected Ratios (2015-2018)		Actual-to-Expected Ratios (2011-2014)	
	By Lives	By Income	By Lives	By Income
1983 GAM	89.0%	81.6%	91.7%	80.9%
1994 GAM Basic with Projection	103.5%	97.2%	104.8%	95.3%
1994 GAR	111.2%	104.5%	112.7%	102.4%
Pri-2012 Projected with MP-2020 to Experience Year	102.7%	97.2%	N/A	N/A
Pri-2012 Projected with MP-2020 to Study Midpoint	102.6%	97.2%	N/A	N/A



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## Preliminary 2015-2018 Group Annuity Mortality

- Mortality improvement in 2015-2018 study data
  - 0.3% slower than Scale AA during 2015-2018 on both a lives and income basis
  - Roughly the same as Scale MP-2020 on a lives basis, 0.1% faster on an income basis
  - For the 2007-2014 study, improvement was 2.0% faster than Scale AA by lives and 0.9% faster by income
- Pri-2012 annuitant table produces smoother A/E ratio pattern by age at younger retiree ages
  - GAM 1994 developed as a blend of experience for active and retiree lives, so there is a spike in A/E ratios under age 65.



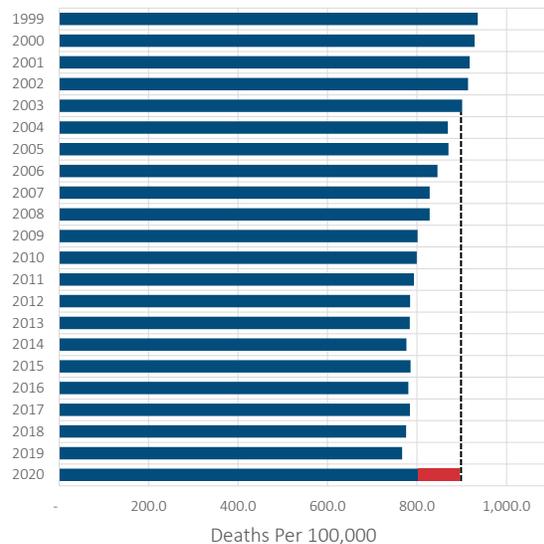
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# U.S. Population Mortality Observations: Updated with 2020 Experience

## 2020 Overall U.S. Population Historical Mortality Rates

- 2020 Mortality Rate = 895.4/100,000 (0.9%)
- First time in U.S. history over 3 millions deaths in one year
- 91.3 deaths/100,000 due to COVID
- 16.8% increase over 2019
- Highest increase on record (1918: +11.7%)
- 2020 highest rate since 2003
- Without COVID, increase over 2019 = 4.9% (last highest 1936: +5.6%)



## 2020 U.S. Population Mortality Rates by Age

- Mortality rates were lower in 2020 than 2019 for ages under 5
- Younger adults, aged 15-44, saw most of their increase from non-COVID CODs
- Older ages were impacted by COVID much more than non-COVID CODs

Age Group	Change in Mortality Rates 2019-2020		
	All CODs	w/o COVID	COVID
Less than 1	-5.2%	-5.4%	0.2%
1-4	-2.6%	-2.6%	0.0%
5-14	2.3%	1.4%	0.9%
15-24	20.7%	19.0%	1.7%
25-34	23.8%	20.0%	3.8%
35-44	24.5%	17.2%	7.3%
45-54	20.7%	10.0%	10.7%
55-64	17.6%	6.4%	11.2%
65-74	17.4%	4.2%	13.2%
74-84	16.0%	2.3%	13.7%
85+	15.0%	2.5%	12.5%
All Ages	16.8%	4.9%	11.9%



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## 2020 U.S. Population Mortality Rates by Cause of Death

- Heart disease had 4.2% increase – largest increase in 20 years
- Cancer continued its steady improvement
- Accidents, diabetes, liver, hypertension, assaults had very large increases
- Deaths from suicides down but story varies by age group

Cause of Death	Deaths	%	Change in Age-Adjusted Mortality Rates 2019-2020
Heart Disease	696,962	20.6%	4.2%
Cancer	602,350	17.8%	-1.4%
COVID	350,831	10.4%	n/a
Alzheimer's/Dementia	259,200	7.7%	7.8%
Accidents	200,955	5.9%	16.3%
Stroke	160,264	4.7%	5.2%
Pulmonary	152,657	4.5%	-4.5%
Diabetes	102,188	3.0%	14.9%
Flu & Pneumonia	53,544	1.6%	5.7%
Liver	51,642	1.5%	16.0%
Suicide	45,979	1.4%	-3.5%
Hypertension	41,907	1.2%	13.3%
Assault	24,576	0.7%	28.6%
Other	640,674	18.9%	6.2%
All COD	3,383,729	100.0%	16.8%



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# Heart Disease – Historical Annual Death Rates

- Steady decrease until 2012; relatively flat thereafter
- 2015 and 2020 only years with an increase
- Heart Disease is #1 cause of death and key driver of historical overall improvement in mortality

\*Age-adjusted



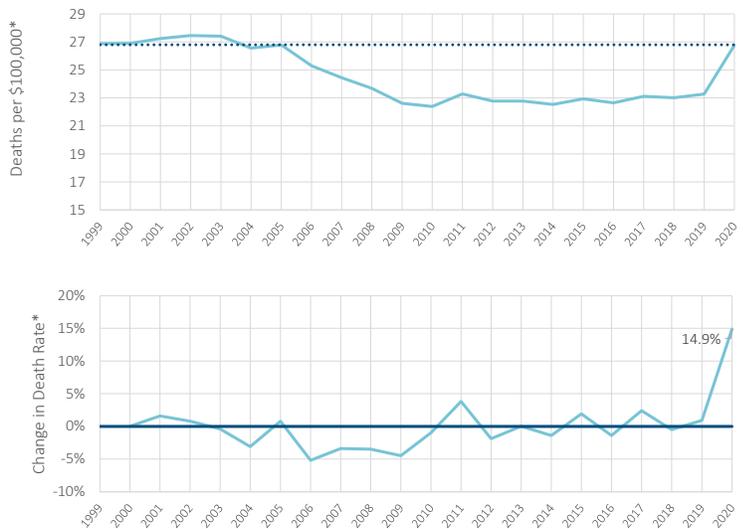
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# Diabetes – Historical Annual Death Rates

- 2005-2009 saw decreasing mortality rates
- Fairly level rates over 2009-2019
- 2020 mortality rate at 2005 levels

\*Age-adjusted

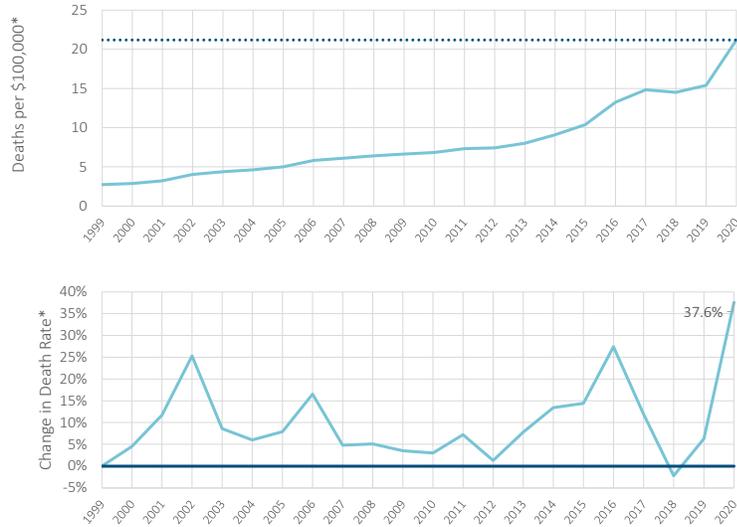


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# Opioid Deaths – Historical Annual Death Rates

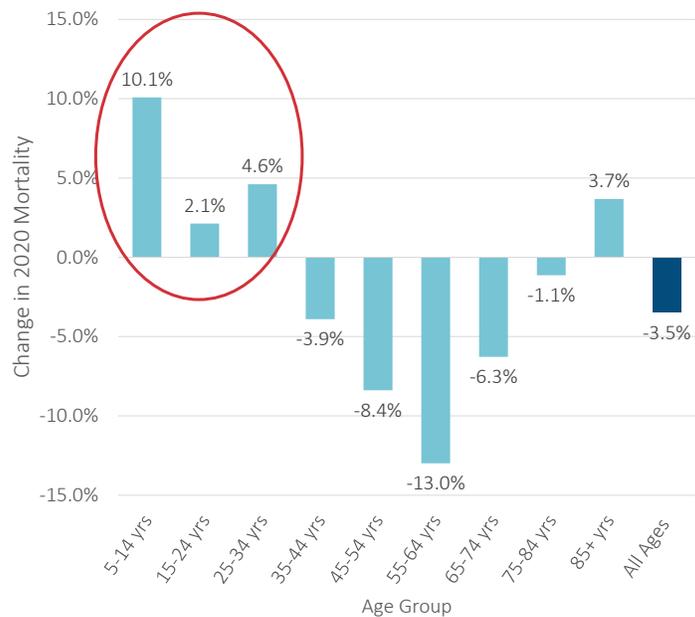
- Steady increase, excluding 2018
- 2018 was only year with improvement
- Big portion of accidental death increase
  - Accidental deaths increased 16.3%
  - Accidents w/o Opioid increased 6.8%



\*Age-adjusted

# Suicides

- Suicides saw improvement of 3.5% over all ages
- Younger age groups saw an increase in mortality



## U.S. Population Mortality Observations: Updated with 2020 Experience

[www.soa.org/resources/research-reports/2022/us-population-mortality/](http://www.soa.org/resources/research-reports/2022/us-population-mortality/)



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## Group Life COVID-19 Mortality Study

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## Group Life COVID Mortality Study

- Updated through September 2021

COUNT-BASED INCURRED INCIDENCE RESULTS RELATIVE TO 2017-2019 BASELINE PERIOD

Count-Based	2Q20	3Q20	4Q20	1Q21	2Q21	3Q21	4/20-9/21
Total / Baseline	115.4%	115.1%	128.1%	122.0%	106.9%	137.7%	120.8%
COVID-19 Claims	12,972	9,820	23,555	24,441	6,868	18,623	96,278
COVID / Baseline	12.4%	9.6%	21.7%	21.8%	6.6%	18.7%	15.1%
Non-COVID / Baseline	103.0%	105.5%	106.4%	100.2%	100.3%	119.0%	105.7%

GROUP LIFE AND U.S. POPULATION EXCESS MORTALITY PERCENTAGES BY QUARTER

Age	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021
Group Life	15%	15%	28%	22%	7%	38%
U.S. Population	20%	16%	21%	17%	5%	25%
Difference	-5%	-1%	7%	5%	2%	13%



<https://www.soa.org/resources/experience-studies/2022/group-life-covid-19-mortality/>

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## Group Life COVID Mortality Study

- Updated through September 2021

EXCESS MORTALITY BY DETAILED AGE BAND

Age	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	4/20-9/21	% COVID	% Non-COVID	% Count
0-24	119%	127%	108%	102%	121%	129%	118%	2.7%	15.2%	2%
25-34	129%	135%	124%	120%	131%	181%	136%	11.4%	25.1%	2%
35-44	124%	136%	129%	129%	132%	217%	144%	19.8%	24.7%	4%
45-54	123%	127%	130%	133%	121%	208%	140%	23.8%	16.5%	10%
55-64	117%	123%	130%	129%	116%	170%	131%	21.0%	10.0%	18%
65-74	116%	115%	133%	130%	108%	133%	122%	16.8%	5.6%	17%
75-84	113%	113%	132%	122%	105%	116%	117%	13.3%	3.7%	20%
85+	111%	102%	123%	110%	90%	98%	106%	10.4%	-4.6%	27%
All <sup>10</sup>	116%	115%	128%	122%	107%	139%	121%	15.6%	5.7%	100%



<https://www.soa.org/resources/experience-studies/2022/group-life-covid-19-mortality/>

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## Group Life COVID-19 Mortality Study

[www.soa.org/resources/experience-studies/2022/group-life-covid-19-mortality/](http://www.soa.org/resources/experience-studies/2022/group-life-covid-19-mortality/)



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## U.S. Individual Life COVID-19 Mortality Study

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# U.S. Individual Life COVID-19 Reported Claims Analysis

- Updated through 3<sup>rd</sup> Quarter 2021

Table 1 Reported Claims – Ratio of 2020 and 2021 Claims by Quarter to Historical Average (2017-2019)  
By Claim Count and Claim Amount

	Quarter	Group Life*	Individual Life
Claim Count			
	2020 Quarter 1	99%	101%
	2020 Quarter 2	111%	117%
	2020 Quarter 3	114%	117%
	2020 Quarter 4	122%	125%
	2021 Quarter 1	129%	121%
	2021 Quarter 2	110%	102%
	2021 Quarter 3	120%	107%



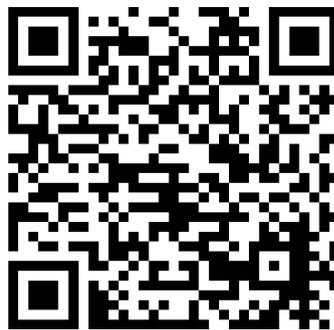
<https://www.soa.org/resources/experience-studies/2022/us-ind-life-covid-19-reported-claims/>

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# U.S. Individual Life COVID-19 Mortality Study

[www.soa.org/resources/experience-studies/2022/us-ind-life-covid-q1/](https://www.soa.org/resources/experience-studies/2022/us-ind-life-covid-q1/)



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## Additional Life Research

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## Experience Studies

Project Name	Objective	Link/Expected Completion Date
COVID-19 Individual Life Mortality Study - Experience Study Report - 2021 Q1	Complete a mortality study assessing the impact of COVID-19 on Individual Life Insurance.	<a href="https://www.soa.org/resources/experience-studies/2022/us-ind-life-covid-q1/">https://www.soa.org/resources/experience-studies/2022/us-ind-life-covid-q1/</a>
COVID-19 Reported Claims Analysis	Draft a research study reviewing Covid-19 reported deaths by quarter	<a href="https://www.soa.org/resources/experience-studies/2022/us-ind-life-covid-19-reported-claims/">https://www.soa.org/resources/experience-studies/2022/us-ind-life-covid-19-reported-claims/</a>
Group Life COVID-19 Mortality Survey Update - Report	Complete an update on a mortality study assessing the impact of COVID-19 on Group Life Insurance.	<a href="https://www.soa.org/resources/experience-studies/2022/group-life-covid-19-mortality/">https://www.soa.org/resources/experience-studies/2022/group-life-covid-19-mortality/</a>
ILEC Mortality Experience Report Update for 2009 - 2017	Draft a report updating the ILEC mortality experience reporting for 2017	<a href="https://www.soa.org/resources/research-reports/2021/2017-mortality-experience/">https://www.soa.org/resources/research-reports/2021/2017-mortality-experience/</a>
Mortality Improvement Survey	Complete a survey to learn how companies are reacting to the slowdown in the level of mortality improvement within the general population.	<a href="https://www.soa.org/resources/research-reports/2022/mortality-improvement-survey/">https://www.soa.org/resources/research-reports/2022/mortality-improvement-survey/</a>
US Population Mortality Observations: Updated with 2020 Experience	Explore observations from the release of the 2020 U.S. population mortality data.	<a href="https://www.soa.org/resources/research-reports/2022/us-population-mortality/">https://www.soa.org/resources/research-reports/2022/us-population-mortality/</a>
Cause of Death Study	Prepare a cause of death study.	3/30/2022
2009-2015 Individual Life Experience Committee Lapse and Mortality Study	Study mortality and lapse experience in the database of 2009-2015 individual life experience data and release a report with the findings.	4/30/2022
COVID-19 Individual Life Mortality Study - Experience Study Report - 2021 Q2	Complete a mortality study assessing the impact of COVID-19 on Individual Life Insurance.	4/30/2022
Individual Life Waiver of Premium Study	Review mortality and lapse experience where waiver of premium provisions apply.	4/30/2022

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## Practice Research

Project Name	Objective	Link/Expected Completion Date
2021 Emerging Risks Survey-Key Findings	Provide highlights of the 2021 Emerging Risk Survey that tracks the trends and thoughts of risk managers across time.	<a href="https://www.soa.org/resources/research-reports/2022/15th-survey-emerging-risks/">https://www.soa.org/resources/research-reports/2022/15th-survey-emerging-risks/</a>
Obesity Trends and Morbidity and Longevity Impacts	Develop an estimate of the impact of obesity in mortality and morbidity costs in the US and Canada.	<a href="https://www.soa.org/resources/research-reports/2021/2021-obesity-morbidity-mortality/">https://www.soa.org/resources/research-reports/2021/2021-obesity-morbidity-mortality/</a>
US Mortality by Socioeconomic Category—2019 Update	Update the set of detailed life tables by socioeconomic category across all US counties for 2019 data.	<a href="https://www.soa.org/resources/research-reports/2020/us-mort-rate-socioeconomic/">https://www.soa.org/resources/research-reports/2020/us-mort-rate-socioeconomic/</a>
US Cause of Death Mortality By Socioeconomic Category	Develop US age-adjusted death rates by cause of death and socioeconomic category from 1982-2018.	4/29/2022
2022 MIM-2021 update	Update MIM-2021 based on user feedback.	4/30/2022
2022 Mortality Improvement Company Survey	Survey life insurers and annuity companies to see how mortality improvement assumptions have changed in light of COVID.	5/2/2022
ALM Practices	Conducts a survey of current ALM practices focused on various life insurance company products with attention paid to issues such as general account vs. separate account product distinctions.	6/30/2022
Expert Opinion on Impact of COVID-19 on Future Mortality	Survey panel of experts on short and mid term thoughts on future population and insured mortality.	4/30/2022
Mortality Improvement Trends Analysis	Identify how mortality improvement varies by driver.	6/30/2022



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