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2006 Report of the SOA International Experience Survey Working Group

International Experience Survey / Studies

September 30, 2006

APPENDICES

A. Data submission template
B. Country initiative
C. Programming Specifications

Appendix A

International Experience Survey Phase I

Data Submission Template
Data Fields Requested

Definitions

A. General

Input Fields: All fields in the Excel worksheet that require a company to provide data have a Yellow background. Companies may find that some of the Grey background cells will be useful for checking the reasonability of the data input.

Currency: Please report requested data items in local currency. Please indicate the currency used in your data submission. If policy information is reported in multiple currencies, please use a separate data specification worksheet for each currency.

Currency Name: Please provide the currency name

Monetary Units: If a company is unable to provide financial data in single units and a multiple of the local currency unit is used to report the data (for example, 1,000's or millions) please clearly specify the units used.

Conversion Rate: Please provide the average conversion rate to a US dollar for each year in the period the data was compiled.   Conversion rates used for financial reporting purposes and other approximations are acceptable.

Additional Subdivisions: Companies are welcome to provide additional data specification worksheets based upon criteria that they wish to have the study incorporate.

Prepared BY: Please specify the name of the person that should be contacted to answer questions about the data submitted along with their email address and phone number.

Prepared On: Please provide the date the company prepared the worksheet

Exceptions: Please describe any exceptions taken from these instructions to compile the data.

B. Actual to Tabular Mortality

Policies & Insurance: Mortality is studied separately by policies (or contracts) and by insurance (sum assured).

Periodic / Single Premium: Please report actual single premium received and annualized recurrent premium. Please fill in Total rows only if the subdivision is not available.

Policies / Insurance: Only exposure for life risk should be used; do not include additional face amounts for accidental benefits or other non-life risks assumed. Policy counts should similarly exclude riders.

Expected Deaths: To determine "Expected Deaths", multiply the ultimate mortality rate, "q_x", from the Expected Death Mortality Table by the average exposure. Please do not use select and ultimate mortality.

Actual Deaths: Please include only claims related to death.   Accident & sickness claims and additional accidental death benefits should be excluded from the data submitted.

C. Persistency

Policies / Premium / Insurance: Persistency is studied separately by policies (or contracts) insured, premium and insurance (sum assured). For premium figures, use the original single premium for flexible premium product and use the annualize premium for periodic premium products.

The comments above concerning periodic/single premium subdivisions and exclusion of additional benefits apply to the persistency data as well as mortality data.

D. Agent Retention / Production

Agent Type: Please specify the sales distribution system used in the agent retention study and any differences that exist between the retention and productivity data. Examples of distribution systems include career agents, part-time salesmen, brokers, direct marketing, group insurance, association, etc.

Agent Retention: Please provide the number of agents hired during each of the calendar years 1995 to 2003 as well as the number of agents remaining at December 31 of each year from 1999 to 2003.

Agent Productivity: Please provide the data requested. The average number of agents should be specified for each year as well as the total production. Production figures include the number of policies sold, the amount of premium received (single premium) or to be received during the 1st policy year (annualized periodic premium). Insurance should be the sum assured on the issue date.

The comments above concerning periodic/single premium subdivisions and exclusion of additional benefits apply to the productivity data as well as mortality and persistency data.

E. Expenses

This data is being obtained solely to conduct a preliminary study of total company expense levels. The intention is to compare total company expenses to the expense level based upon standard expense factors applied to measures of the company's size and sales. The IESWG will evaluate the results prior to publication and may need to revise the data request finalizing this portion of the study.

Please note that expenses are studied on a total company basis, so figures reported in this section of the study may not equal figures reported earlier.

Basis: Since expense accruals are measured under many different bases, please specify the basis used to measure expenses. Statutory expenses may be the preferred methodology since it improves comparability among companies.

Year End Data: Please provide the total number of policies and the insurance in force (sum assured) at each year-end from 1999 to 2005.

Policy Sales: Please provide the number of policies sold (both single and periodic premium combined) as well as the premium received (separately for single and periodic premium). Please provide premiums on a cash received basis and do not annualize premiums.

Total Premium: Please provide the total premium received on a cash basis during the year, regardless of its origin.

Expenses: Acquisition costs on a cash basis should be separated into those related to single premium contracts (column J) and periodic premium contracts (column K). Total expenses (column L) include all expenses, regardless of source.

Note – Standard Expenses: Standard expenses are contained are based upon the SOA's 2001 Expense study for permanent insurance. These factors are converted to a local country basis in proportion to the average policy size.

F. Mortality and Exposure

Expected Death Mortality Table: For each experience year reported, please provide the mortality table assumed in determining the reported expected death data. Please use a country specific experience table if available. If a country specific experience table is not available, please use a country specific valuation table. Please use ultimate mortality

(not select and ultimate).   If only one table is reported, the SOA will assume that it was used for all experience years reported.

Distribution of Exposure by Sex and Age: The distribution of insurance in force would ideally be based upon the entire 2000-2005 mortality study period, but a company may provide an alternate distribution (such as the distribution at December 31, 2005 if the ideal data is not readily available. If tabular mortality is measured on a unisex basis, then exposure may be reported on a unisex basis.

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Appendix B

**International Experience Study
Country Initiative**

**Mortality / Persistency Studies
Discussion of Approach**

1. Overview
2. Data integrity
3. Exposure definitions
4. Data analysis
5. Table Construction
6. Data definitions

1. Overview

The Society of Actuaries (SOA) International Experience Study country initiative is intended to expand the survey to additional countries while assisting local actuaries in studying mortality and persistency in greater depth or detail than the data included in the International Experience Survey (IES).

This document provides technical specifications for conducting both mortality and persistency studies using seriatim (policy by policy) policy data provided by companies contributing to a local mortality / persistency study. The SOA is also evaluating whether tools can be developed to facilitate such studies and, in the event such tools are created, this document would serve as preliminary programming specifications.

A combined mortality / persistency study may be subdivided into four parts:

- Ensuring data integrity ("data scrubbing")
- Measurement of exposure to risk (of either death or premature termination)
- Data analysis and presentation (steps to process the data)
- Possible graduation ("smoothing") and extension of results beyond parameters where credible data exists

The first part is intended to ensure (to the extent practical) that study results will be accurate and representative of historical experience. The second part determines measurements of exposure to risk of either death or premature lapsation that will be compared against actual deaths and premature terminations in order to calculate mortality and lapse rates (relating to age and duration). The third part describes the types of steps that may be followed once data becomes available in summary (matrix) form. The fourth and final part of the specifications addresses approaches taken to transform crude data (mortality and lapse rates) into rates that are consistent with other credible experience.

Actuarial studies require considerable judgment to ensure that results are accurate, internally consistent and reasonable for the purposes intended. Hence, this document should be considered as a starting point for any study, rather than as definitive guidelines that must be rigidly applied to any situation.

2. Data Integrity

The data to be used in any mortality or persistency study must be accurate, internally consistent and reasonable for the purposes of the study. It should be recognized that insurance company systems may not have been developed with the intention of conducting such studies, so controls may not exist to ensure that data submitted to the study are appropriate and of sufficient quality.

The process of reviewing data for accuracy and modifying the data as necessary may be referred to as "data scrubbing." Seriatim contract data should be validated in at least two manners:

- The total contract data should equal or match totals available from accounting, administration and other routine company systems.
- Individual records should be internally consistent. That is, all the information should be reasonable under company practices.
- Reasonability tests of entire data

Several totals should be identical (or approximately so) between the file of contract records and independent company records, such as financial statements and valuation files:

- The number of policies in force at each year-end, along with the sum assured, etc.
- The number and amount of death claims paid or recorded during each calendar year
- The number and surrender value of surrenders and contract maturities during each calendar year

In the event that validations cannot be performed, additional work will be required to identify the source of differences. If these differences are reasonable and if they can be documented, then the data can be included in the study.

Individual records should be internally consistent:

- The issue ages should be within the company's normal parameters.
- The birth date should precede the issue date, which should precede both the end of the study date, the contract maturity date, and, if applicable, the termination date.
- The sex should be male, female or, possibly, unisex.
- All fields should be consistent with data definitions (for example, date fields should be valid dates)

It is expected that some internal inconsistencies will be found. When inconsistencies occur, a company may consider several options including (1) excluding a small number of records with inconsistencies, (2) limiting the study (for example, conducting the study

on a unisex basis if the sex field is generally inaccurate, and (3) manually correcting invalid records.

Reasonability tests of summaries of individual data fields ensure that the data is reasonable compared to both business practices and other similar study data. For example,

- Exceptionally large amounts of insurance on some policies may indicate an error coding sum insured data
- An unexpected distribution of ages or sexes may indicate a problem coding age or sex data
- Changes in company practices like changing from using age nearest birthday to age last birthday for pricing may impact the data.

The same approach may be taken to deal with unreasonable results as is taken to address internal inconsistencies.

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3. Exposure Formulas

General Life Insurance Exposure Formulas

The SOA international experience survey measures exposure in terms of policy duration for each issue age. Exposure formulas in terms of the following variables:

S = start date of the study period and
E = end date of the study period
x = age at policy issue
ID = issue date
TD = termination date
   = E if not terminated

Variables DS and DE are calculated from the variables above in terms of the time elapsed between two dates where time elapsed is measured in years (or fractions thereof):

DS =   policy duration at start of study period
   =   maximum (ID, S) – ID

DE =   policy duration at end of study period
   =   minimum (E, TD) – ID

Note 1: In case of a claim, the policy contributes a full year of exposure in the year of claim, so DE is then rounded up to the next higher integer.

For example, if exposure is being measured in terms of death claims for a mortality study and if the policyholder terminated on 4/1/2001 for a study period that ended on 12/31/2001 then:

DE = 0.75 if the policyholder voluntarily terminates, but
DE = 1 if the policyholder died

Each policy contributes exposure for durations within the range starting at its DS and ending at its DE. In particular, a policy contributes exposure at duration "t" (column "t" in the exposure matrix) as follows:

Let E(t) = exposure contributed to policy year "t" where t = 1, 2, … then:

$E(t) = 0$ if $t \le DS$
                    or if $t \ge DE + 1$

$E(t) = \min(DE, t) - \max(DS, t-1)$ otherwise

<u>Note 2:</u> Policy years are integers, starting with 1 while durations (DS, DE) are fractions starting at 0 (the time when the policy is issued). For example, policy year 1 includes durations from 0 until just under 1.

However, in case of a claim occurring during policy year "t" set $E(t) = 1$.

In the prior example,

- *The policy contributes 0.25 = 0.75 – 0.5 years exposure to policy year 1 if the policyholder voluntarily terminates, but*
- *0.5 = 1 – 0.5 years exposure are contributed to policy year 1 if the policyholder died.*

<u>Note 3:</u> Separate exposure tables need be created for exposure to the risk of death and lapsation because deaths generate a full year of exposure in the year of death only for purposes of mortality studies and lapses generate a full year of exposure in the year of lapse only for purposes of persistency studies.

We will also use the notation $E(x,t)$ to denote the exposure during policy year "t" for an insured age "x" at policy issue.

<u>Note 4:</u> Durations may not be relevant for certain studies, such as studies of group life insurance and immediate annuity mortality where no selection is expected. In this case exposure and deaths are associated with attained ages instead of issue age and duration.

Let $E'(y)$ = exposure to the risk of death at attained age "y" and let "x" continue to represent the age at policy issue, then

If we define $t = (y - x) + 1$, then $E'(y) = E(t)$ in the prior formula

Alternatively, exposure may be calculated by issue age and duration and later summarized in Excel by attained age.

Life Insurance Exposure by Amounts

The general formulas above produce exposure by contracts insured (by lives insured if no policyholder has more than one contract). Studies can also reflect the size of the policy, measured either in terms of insurance in force (sum assured) or premium. Let:

$E^{SA}(t)$ = exposure measured in terms of sum assured, SA
$E^{P}(t)$ = exposure measured in terms of premium, P (annualized or single premium)

Then:

$E^{SA}(t) = SA * E(t)$

$$E^P(t) = P * E(t)$$

Exposure by amount (sum assured) can be influenced by bonuses credited to policies. Two separate options are available:

Option 1: calculate exposure based upon sum assured (SA) at issue (that is, ignore bonuses)

Option 2: calculate exposure using average sum assured (SA(t)) during each policy year:

$$E^{SA}(t) = SA(t) * E(t) \text{ where } SA(t) = \text{sum assured during year t}$$

It is expected that the choice between these two options will be based upon practical considerations; that is, whichever approach is simpler.

A similar situation may occur when policies are "transformed" into a different policy, in which case the same two options are available.

Note 1: the exposure calculations should be consistent with decrement calculations. For example, if exposure is based upon sum assured at issue, then death claims should also use sum assured at issue.

Note 2: For bonus paying policies the sum assured changes as bonuses are credited. This may occur continuously, at policy anniversaries or at a fixed calendar date. In this case, sums assured at issue may not be available and the average sum assured during a policy year may also not be available. For example, sums assured may only be available at calendar year ends. In this case, the calculations of exposure must be based upon available data, perhaps with an adjustment to reflect the impact of bonuses on average exposure.

Other Approaches to Defining Life Insurance Exposure

The above outlines a particular methodology for determining exposure based on the assumption that the goal of the study is to analyze annual mortality and persistency rates. Alternative definitions of exposure exist and may be applied to the study if all participants agree. For example, exposure may be calculated for complete policy years, ignoring exposure that spans either before the study start date or after the study end date. The participants' decision for selecting the method for calculating exposure will depend on the detail of the data available as well as study objectives.

Annuity Exposure

The study exposure to risk for immediate (i.e. in payment) annuities is somewhat different from life insurance in the following respects:

  (1) Duration from contract issue is normally not studied

(2) Exposure is measured either in terms of contracts (or lives) or amount of annuity (monthly payments, annual equivalents, etc.)

The same exposure formulas developed above may be used for immediate annuities by disregarding durations and by utilizing periodic amounts paid for exposure by amounts.

Definition of Lapses

The definition of a policy lapse is expected to be different for periodic premium and flexible premium products.

- *Periodic Premium* policies require that each scheduled premium be paid, otherwise the policy lapses or is converted to another benefit. A periodic premium policy should be considered to be terminated on the first premium due date (with any "grace period" added to this date) during the study period where a payment has not been made.

- *Flexible Premium* policies lapse when either the contract expires due to lack of value or the policyholder withdrawals all funds. For these products, alternative definitions for lapsation exist based on contract terms and company practices. For example, a company may terminate the contract once the value falls below a defined level.

The concept of lapsation normally does not apply to immediate annuities and frequently is not applied to group insurance contracts.

Output from Life Insurance Exposure Calculation

After processing a policy master file and calculating exposures to risk for each contract, the data should be summarized in an "M x N" matrix, where the M rows represent issue ages and the N columns represent policy durations (1, 2, 3, …) such as the example below:

Age / Duration	1	2	3	….
18	E(18,1)	E(18,2)	E(18,3)	E(18,…)
19	E(19,1)	E(19,2)	E(19,3)	E(19,…)
20	E(20,1)	E(20,2)	E(20,3)	E(20,…)
…	E(…,1)	E(…,2)	E(…,3)	E(…,…)

Separate exposure matrices should be created for deaths and lapses as mentioned in Note 2 above.

Corresponding Output of Death and Lapse Data

Similar tables for deaths and lapses need also be created. Deaths for issue age "x" during policy year "t" may be denoted as D(x,t) and lapses for issue age "x" during policy year "t" may be denoted as L(x,t).

4. Data Analysis

Once summary data has been accumulated in matrices, that data need be analyzed. There may not be a single best methodology to apply to the data, however some typical analysis issues and procedures should be considered.

Grouping and Subdividing Data

Data should be subdivided into reasonable groups that have some logical relationships among the members. The grouping and subdividing of data corresponds to classes of policies in which the local companies expect a difference in mortality or lapsation. Examples include:

- Separating policies exposed to the risk of excessive deaths (e.g. term life insurance) from policies exposed to the risk of excessive longevity (e.g. in-payment status immediate annuities)
- Separating life insurance policies involving medical underwriting (e.g. term life insurance) from policies that do not (e.g. unit linked policies with no guaranteed minimum benefits).
- Separating policies between those sold on an individual basis from those sold on a group (collective) basis
- Groups of policies that have minimal experience may also be added to the experience of larger groups of policies

It is anticipated that this grouping would be established based upon practices in each individual country participating in the SOA IES. However, one subdivision of the study should be underwritten life insurance sold by agents in order to maintain comparability between countries participating in the IES.

The initial grouping and subdividing the data will be based upon groups that are expected to be credible. The credibility of data obtained will be evaluated again once the data is compiled.

Types of Analysis

High Level Analysis: The highest level of analysis may consist of the following types of analysis:

- Gross mortality rates and lapse rates calculations such as:

  $q_{x+t} = q(x, t) = D(x, t) / E(x, t)$ = death rate for policy issued at age x during policy year t

  $l_{x+t} = l(x, t) = L(x, t) / E(x, t)$ = lapse rate for policy issued at age x during policy year t

where: $D(x, t)$ = deaths for policies issued at age x during policy year t

E(x, t) = exposure to death for policies issued at age x during policy year t

When viewing this type of analysis for mortality, additional insight may be obtained by taking the logarithm of the results and graphing them.

- Actual to expected (tabular) mortality rates

  A/T ratio = $\sum$ actual deaths / $\sum$ expected deaths

  where: $\sum$ actual deaths = sum of all deaths during the study period

  $\sum$ expected deaths = $\sum q_{x+t} E(x,t)$

  where q_{x+t} is taken from a recognized mortality table

These high level types of analyses may be subdivided further, for example into age groups or duration groups.

Graphical Analyses

It is recommended that graphical analyses be prepared and that consideration should also be given to viewing $\ln(q_{x+t})$ in place of $q_{x+t.}$

One approach that may be valuable is to compare the experience to a recognized mortality or persistency table. For example, mortality may be expressed using a linear relationship to a published mortality table:

$q_x^{observed} = a * q_x^{published} + b$ or

$\ln(q_x^{observed}) = a * \ln(q_x^{published}) + b$

where the factors a and b are chosen to minimize differences between the modified published table and the observed data.

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5. Table Construction

It is not expected that a credible mortality or persistency table can be created in all instances. Reasons for this may include limited data, unexplained differences between companies, lack of data at the younger or older ages, etc.

Mortality and persistency studies are performed from the exposure and claim matrices in a similar manner. In the discussion that follows, we will focus on mortality studies with the understanding that a similar process applies to persistency studies. However, in building a lapse/persistency table, care must be taken to reflect the impact of external factors such as surrender charges and policy taxation effects.

This section will discuss several issues relating to table construction including: grouping of data, an example of select & ultimate mortality table construction, reasons to adjust data, graduation and extension of mortality tables.

Grouping of Data

Most studies involve a limited volume of data, which can introduce random fluctuations that do not represent the underlying relationships. For this reason, data is frequently grouped into groups that are large enough to reduce the probability of significant random fluctuations. For example

- Issue ages may be grouped quinquennialy (in 5 year age groups) or decennially (10 year age groups).
- Policy durations after the first few (2 to 5 year, or longer if extensive underwriting is performed) may also be grouped.

We expect to use quinquenial age groups while the select mortality period may be determined by (1) calculating A/T ratios for policies of longer duration than each potential select period (d = 0, 1, 2, …) and then (2) selecting as the select period the period from issue to the period after which A/T ratios start to be substantially the same.

Table Construction

One approach to developing a select and ultimate mortality table is described below.

A. Determining Ultimate Policy Duration

1. Calculate the A/T ratio separately for all possible ultimate durations (t=1, 2, …) including just those policies that are at or beyond the possible ultimate duration.
2. The ultimate policy duration would be set at the duration when A/T ratios become approximately constant.

B. Ultimate Mortality Table Construction

1. Calculate "ultimate" mortality rates using the subset of data consisting of policy durations higher than t years where t was determined in A above. These mortality rates would have no distinction by policy durations.
2. Apply graduation techniques to the rates determined above to create a "smooth" set of mortality rates.
3. At durations without a credible volume of data, apply techniques to extend the "smooth" mortality rates above to these ages.
4. Review the mortality rates determined above for reasonability and then make adjustments as necessary.

   Graduation and table extensions are discussed in more detail later.

C. Select & Ultimate Table Construction

1. In addition to the steps described in A and B above, calculate mortality rates for each age and duration less than the ultimate duration used above (for example, we may set the ultimate duration at t = 5 years)
2. Calculate the ratio of select mortality to ultimate mortality for each age and duration combination:

   $F(x,t)$ = select factor duration t for policy issued at age $x = q_{x+t} \, / \, q^{ultimate}_{x+t}$

   where q_{x+t} are calculated in step 1 above and $q^{ultimate}_{x+t}$ are calculated in A above.

3. Apply graduation techniques to the selection factors calculated in step 2 above.
4. Review the select factors for reasonability and then make adjustments as necessary.

Alternative approaches may be taken to the approach just described.

Adjusting Data

In developing a mortality table it is important to consider adjusting the table for any demonstrated trends in mortality that are expected to continue in the future. Table projections are particularly important for annuitant mortality since mortality has demonstrated an extended period of improvement. Without including projected improvements, the rates may be insufficient for pricing or reserving purposes. Several issues should be considered when projecting mortality improvements:

1. Mortality improvement differs by attained age with little or no improvement normally exhibited at the highest ages (e.g. 90 and above).
2. Mortality improvement may differ by sex.

Alternative approaches may be taken that are different from the ones described above.

Applying Graduation Techniques to the Data

Samples of data normally exhibit fluctuations around the population's true expected results. Graduation techniques are applied to "smooth" observed fluctuations.

A number of different graduation techniques are available (for example, the graphic method, the interpolation method, the adjusted-average method, the difference equation method, and mathematical formula method). The choice of the particular method will be based upon both the nature of the data collected and the purpose of the table construction.

However, we intend to begin by calculating the A/T ratio for each study, where the tabular mortality is based upon a recognized table and then compare a graph of the study data to the tabular mortality rates adjusted to equal the A/T ratio calculated. A review of this graph may provide insight into the appropriate procedures to follow or – in some cases – may lead us to conclude that the "adjusted" table is a reasonable conclusion to the study.

Extending Data

Data is frequently concentrated in limited ranges of issue ages. For example, risk bearing life insurance (term, whole life, etc.) is frequently issued in the age 25 to 45 range, and savings products (deferred annuities, etc.) are most frequently issued in the age 45 to 65 range. The scarcity of data outside these ranges requires that mathematical techniques be applied to extend the results from the credible range of ages to all issue ages.

No formal extension of data is required in the case that the mortality table will be expressed as a percentage of a recognized mortality table (see # 2 above).

Alternative Analysis

As alluded to above, in situations where there is insufficient data to construct a mortality table or a persistency table, alternative approaches may be applied. For example, mortality may be expressed using a linear relationship to a published mortality table:

$$q_x^{observed} = a * q_x^{published} + b \text{ or}$$

$$\ln(q_x^{observed}) = a * \ln(q_x^{published}) + b$$

where the factors a and b are chosen to minimize differences between the ratios and the observed data.

6. Data Definitions

Availability of Data

Optimal results will be obtained if the company professionally maintains a data warehouse, however, the SOA is prepared to process sub-optimal data and in many cases may still be able to produce satisfactory results.

The data should include a record for each policy in force during the year being studied indicating the status at the close of the year with variables that can be matched exactly to control totals used in audited financial statements.

Lacking optimal data, reasonable results should be possible using historical electronic data files at various dates in the past (i.e. "snap shots"). Such files should be available for companies following customary data retention standards. Control totals from the data should be reconcilable to accounting records or other records maintained by the company.

In the worst case, no such historical data files will be available. In this case, generic procedures can be developed for the company that will enable them to accumulate appropriate data for future studies

The data needed for the study should include information for each policy in force during the year being studied indicating the status at the close of the year. The information for the study includes

Required Data

1. Policy Identification Number
   - may be encoded if desired to enhance confidentiality
2. Policy Issue Date
3. Original Policy Face Value (sum assured)
   - Amount at issue – if the sum assured is re-valuable by crediting bonuses, either use the original amount or store a value for each policy year
4. Policy Type
   - The company may use their own coding of policy forms and then provide a mapping of these forms to the subdivisions to be used in the study, or
   - the company may provide a code for the study subdivisions
5. Underwriting basis
   - Specify whether no underwriting, simplified underwriting or full underwriting
6. Policy Status
   - in force,
   - lapsed, surrendered,
   - death
7. Policy Status Date
   - Not required if policy is in force at end of study period

8.   Insured's Date of Birth
- Alternatively, age at issue may be provided (specifically identify this practice)
- Leave blank if unknown
9.   Insured's Sex
- Male, female, or unknown
10.   Modal Premium Amount
- Total premiums paid for flexible premium product
11.   Premium Mode
- frequency of payment
- weekly, biweekly, monthly, quarterly, semi-annual, annual for periodic premium policies
- denote flexible otherwise

While these fields are optimal if the data is available, a subset of the data can be worked with to still achieve satisfactory results. For example, this could be a snapshot taken from various dates in the past and limited supplementary manual information (e.g. deaths during an accounting period). The information may be extracted from company files or the entire files may be provided and do the extraction.

In addition, the company may wish to include additional data fields that the home or country office will use for other purposes.

Appendix C

Programming Specifications

**Society Of Actuaries
International Experience Study
Software Specifications**

The Society of Actuaries (SOA) developed a "tool" that actuaries can use to conduct mortality and persistency studies . Using the experience study "tool" both reduces the amount of effort required by the local actuary while guaranteeing that study results will be uniform among all companies participating in the SOA International Experience Study (IES).

I. Overview of the IES Tool

The "tool" is an application of Microsoft Access and Excel that the actuary uses to prepare an appropriate actuarial database and then utilize this data base to conduct mortality and persistency studies.

Actuarial Data Base

IES Tool (Microsoft Access)

Validation / Editing Reports
(Microsoft Access and Excel)

Experience Study Reports
(Microsoft Excel)
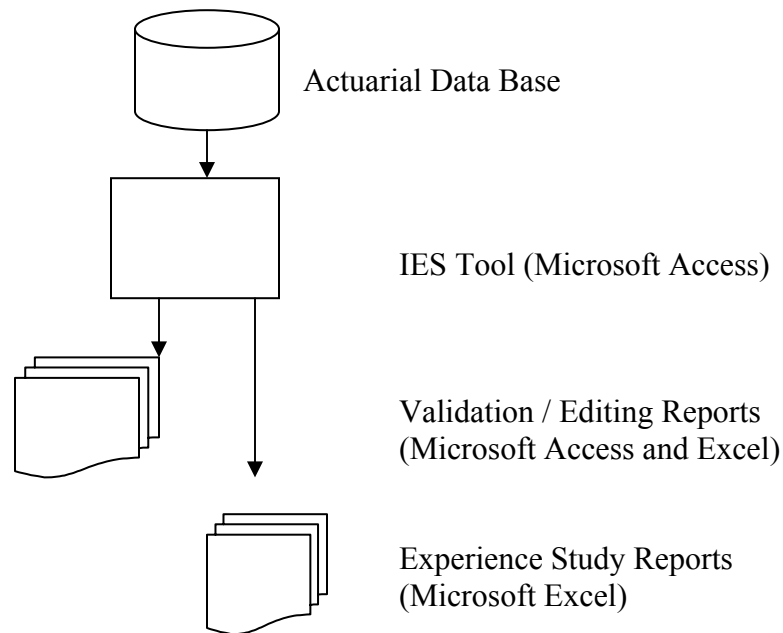
- Mortality and persistency studies start with an actuarial database containing policy information obtained from the company's administrative and other systems.
- The IES experience study tool prepares reports (in Access and Excel workbooks) that facilitate actuarial review of the actuarial database's quality. The actuary may

wish to make changes or corrections to the actuarial database to improve the quality of the data (this may be referred to as "data scrubbing").

- Once the actuary is comfortable with the quality of the actuarial database, then mortality and experience study reports are output from the Access program into Excel workbooks. The output may be used by the actuary to conduct studies of the company's own experience as well as be sent to the SOA for compilation of an industry study of experience.

IES Tool Development Strategy

The IES "tool" is being developed by the SOA following standard development procedures:

- A local country experience study document was distributed to interested parties during early 2005. This document described in general terms how a country wide experience study would be performed
- More detailed programming specifications were then developed for an outside vendor to create the "tool" and a request for funding was made to companies participating in the IES.
- The "alpha" version of the "tool" has been created and is being released to "beta sites" that will test the "tool" and work with the programmer to finalize the "tool".
- After completing "beta" testing, the final version of the tool will be released to all companies interested in participating in the SOA's IES.

A separate document titled "SOA International Experience Study - Country Initiative - Mortality / Persistency Study Specifications" provides additional information concerning the study. This document was prepared to inform participating company actuaries about how a local study can be conducted.

II. Input Data

The SOA will determine the period of time that the study involves and the subdivision of policy types that will be studied. Each company will provide the following input:

(1) Individual policy file containing the information shown in Appendix A for all policies in force at any time during the study period
(2) A mapping of policy form codes to SOA study parameters (see Appendix B)
(3) A list of valid parameters for each policy form described in Appendix C
(4) Certain financial statement information that will be used to validate the individual policy file, as described in Appendices D and E

It is expected that all of this information will be available electronically (including Excel spreadsheets) or readily convertible into an electronic format by each company participating in the study.

III. Quality Control

The program will perform checks and other steps to ensure that the quality of the data provided by a company is sufficient for the purposes at hand. These tests include:

(1) Tests of the validity or reasonability of data contained in each individual policy file when compared to the parameters described in II. (3) above. An exception report is prepared by the Access program for all policies that fail to pass the reasonability tests.

(2) Distributions of data by age or policy durations that facilitate the identification of anomalies. In addition, an actual to expected tabular mortality report will be provided.

(3) Totals will be summarized from the policy records and compared to the independent information in II. (4) above which will be input into an Excel spreadsheet. Excel reports and graphs should be prepared that illustrates comparisons.

See Appendix C, D and E for additional information on quality control testing.

IV. Exposure Formulas

The document "SOA International Experience Study - Country Initiative - Mortality / Persistency Study Specifications" provides exposure formulas. The discussion below was summarized from that document.

The SOA international experience survey measures life insurance exposure in terms of policy duration for each issue age. Exposure formulas are defined in terms of the following contract or study variables:

Study Parameters

S = start date of the study period
E = end date of the study period

Contract Variables

x = age at policy issue
ID = issue date
TD = termination date
= E if not terminated

These variables are used to determine each policy's duration at the start and end of the study period. Policy durations are measured in years (or fractions thereof) between two dates:

DS   = policy duration at start of study period
                 = maximum (ID, S) – ID

DE   = policy duration at end of study period
                 = minimum (E+1, TD) – ID

Note 1: In case of a claim (i.e. a death for the mortality study or a lapse for the persistency study), the policy contributes a full year of exposure in the year of claim, so DE is then rounded up to the next higher integer. The exception is the case of a lapse on the policy issue date, where it is presumed the policy is not issued, and the exposure is zero.

Exposure is defined as follows:

Let E(t) = exposure contributed to policy year "t" where t = 1, 2, … then:

$$E(t) = 0 \qquad \text{if} \quad t \leq DS \quad \text{or if} \quad t \geq DE + 1$$
$$E(t) = \min(DE, t) - \max(DS, t\text{-}1) \qquad \text{otherwise}$$

We will use the expanded notation E(x, t) to denote the exposure during policy year "t" for insureds aged "x" at policy issue.

Note 2: Policy years are integers, starting with 1 while durations (DS, DE) are fractions starting at 0 (the time when the policy is issued).

Note 3: Separate exposure tables need be created for exposure to the risk of death and lapse.

Note 4: Durations may not be relevant for certain studies, such as studies of group life insurance and immediate annuity mortality where no selection is expected. In this case exposure and deaths are associated with attained ages instead of issue age and duration.

Let E'(y) = exposure to the risk of death at attained age "y" and let "x" continue to represent the age at policy issue, then

If we define t = (y – x) + 1, then   E'(y) = E(t) in the prior formula

Alternatively, exposure may be calculated by issue age and duration and later summarized in Excel by attained age (this may be the preferred approach since it simplifies Access).

Similarly, persistency studies would not normally be performed for group insurance or immediate annuities.

In cases such as these mentioned the Access program should be able to (a) output mortality data (both exposure and claims) solely by attained age and (b) not perform persistency studies.

Exposure by Amounts

The general formulas above produce exposure by contracts insured. Studies may also reflect the size of the policy, measured either in terms of insurance in force (sum assured), premium or benefits (immediate annuities only). Let:

> SA $\quad$ = sum assured (face amount of policy)
> P $\quad$ = annualized premium
> B $\quad$ = annualized annuity benefit (immediate annuities)

then:

> $E^{SA}(t)$ = exposure measured in terms of sum assured $\quad$ = SA * E(t)
> $E^{P}(t)$ = exposure measured in terms of premium $\quad\quad$ = P $\quad$ * E(t)
> $E^{B}(t)$ = exposure measured in benefits, B $\quad\quad\quad$ = B $\quad$ * E(t)

Note 5: Premiums and immediate annuity benefits are annualized based upon payment mode:

> Annual amount $\quad$ = 2 * semi-annual amount
> $\quad\quad\quad\quad\quad\quad\quad$ = 4 * quarterly amount
> $\quad\quad\quad\quad\quad\quad\quad$ = 12 * monthly amount
> $\quad\quad\quad\quad\quad\quad\quad$ = 24 * biweekly amount
> $\quad\quad\quad\quad\quad\quad\quad$ = 52 * weekly amount

V. Claims

The document "SOA International Experience Study - Country Initiative - Mortality / Persistency Study Specifications" provides information on claims.

For each contract included in the study, the company is responsible for determining the following:

> (1) whether a contract has terminated,
> (2) the reason for termination (e.g. death, lapse, surrender)
> (3) the date of termination (if terminated).

The duration at termination is calculated as time elapsed between the issue date and the termination date:

> $t = TD - ID$

and is measured in complete years (roundup fractions up to the next higher integer).

VI. Output Specifications

The access program outputs an Excel workbook that contains separate pages for exposure and claim matrices.

The discussion on this topic from the document "SOA International Experience Study - Country Initiative - Mortality / Persistency Study Specifications" is summarized below.

Output from Exposure Calculation

After processing a policy master file and calculating exposures to risk for each contract, the data should be summarized in an "120 x 50" matrix, where the 120 rows represent issue ages (0, 1, 2, …, 120) and the 50 columns represent policy durations (1, 2, 3, …, 50) such as the example below:

Duration =	1	2	3	…	50
Age					
0	E(0,1)	E(0,2)	E(1,3)	…	E(1,50)
1	E(1,1)	E(1,2)	E(1,3)	…	E(1,50)
2	E(2,1)	E(2,2)	E(2,3)	…	E(2,50)
…	…	…	…	…	…
120	E(120,1)	E(120,2)	E(120,3)	…	E(120,50)

Separate exposure matrices should be created for deaths and lapses as mentioned in Note 2 above.

Output of Death and Lapse Data

Similar tables for deaths and lapses need also be created.

- Deaths for issue age "x" during policy year "t" may be denoted as D(x,t)
- Lapses for issue age "x" during policy year "t" may be denoted as L(x,t)

The death matrix would follow the same format as the exposure matrix.

Duration =	1	2	3	…	50
Age					
0	D(0,1)	D(0,2)	D(1,3)	…	D(1,50)
1	D(1,1)	D(1,2)	D(1,3)	…	D(1,50)
2	D(2,1)	D(2,2)	D(2,3)	…	D(2,50)
…	…	…	…	…	…
120	D(120,1)	D(120,2)	D(120,3)	…	D(120,50)

The lapse matrix would be the same with D(x,t) replaced by L(x,t).

Appendix C-A
Individual Policy/Contract Information

The following information should be provided for each policy (contract) included in the study.

Required Data (Sufficient for Study by Contract)

12. Policy Identification Number
    • may be encoded if desired to enhance confidentiality

13. Policy Type
    • The company should use their own coding of policy forms and then provide a mapping of these forms to the subdivisions to be used in the study (see Appendix B)

14. Insured's Sex
    • Male, female, unisex (M, F, O)
    • Leave blank if unknown

15. Date of Birth
    • Year / month / day
    • Alternatively, age at issue may be provided in (5) below
    • Leave blank if unknown

16. Issue Age
    • Alternative to date of birth in (4) above
    • Age may be Age Nearest Birthday (ANB) or Age Last Birthday (ALB)
    • Leave blank if unknown

17. Policy Issue Date
    • year/month/day

18. Policy Status
    • in force (IF)
    • lapsed (L)
    • surrendered (S)
    • matured (M)
    • reduced paid up (RPU)
    • extended term (ET)
    • death (D)
    • paid up (PU)

19. Policy Status Date
    • Year / Month / Day

- Not required if policy is in force at end of study period

Additional Data – Study by Sum Assured

20. Policy Face Value of Insurance (sum assured)
    - Options: use either (a) amount at issue or (b) current sum assured
    - Optional: If the sum assured is re-valuable by crediting bonuses, store a value for each policy year included in the study

21. Benefit Paid
    - If sum assured for exposure is based upon original amount at issue convert to original amount at issue.

Additional Data – Study by Premium

22. Modal Premium Amount
    - Total premiums paid for flexible premium product
    - Modal (weekly, biweekly, monthly, quarterly, annual) for recurrent premium products

23. Premium Mode
    - frequency of payment
    - weekly, biweekly, monthly, quarterly, semi-annual, annual for periodic premium policies (W, B, M, Q, S, A)
    - denote flexible premium otherwise (FP)

Additional Data – Study by Underwriting / Distribution System

24. Underwriting basis
    - Specify whether no underwriting, simplified underwriting or full underwriting
    - Smoking status
    - Other options may be developed

25. Distribution system
    - Agent, independent broker or financial advisor, bancassurance, group insurance, mass marketing etc.

26. Miscelanous
    - Optional coding

File Date

16. Date that the actuarial study data file was last updated.
    - Recommended that this date be after the normal IBNR claim reporting lag

- Recommended that this date be after the normal period with unpaid premiums to classify a policy as being lapsed

Appendix C-B
Mapping Table

A mapping table should be provided that maps each policy form / type (see Appendix A, item 2) to the SOA policy types.

Policy Form Number	Description	SOA Grouping

The SOA groupings will be set for each study based upon local considerations. For example, a primary grouping may be between savings and risk products with risk products having a secondary grouping based upon underwriting classifications.

Appendix C-C
Reasonability Tests – Performed on Each Policy/Contract Record

The following tests should be performed on each policy (contract). Exception reports should be produced that present:

- Summaries of exceptions by type of exception
- Details for each contract with an exception

The tests are as follows:

1. Reasonable dates
(a) 1875 < Birth date < Issue Date < Status Date < File Date < Current Date
(b) All date fields are valid dates (year / month / day)

2. Reasonable sex
(a) Male, Female, Unisex (M, F, U)

3. Reasonable status
(a) See Appendix A item 7

4. Reasonable sum assured
(b) 0 < Sum Assured < *maximum issue amount*

5. Reasonable premium amount
(c) 0 < Modal Premium < *maximum issue amount*

6. Reasonable premium mode
(d) Flexible premium (includes single premium), FP
(e) Recurrent premium (weekly, biweekly, monthly, quarterly, semi-annual, annual), W, B, M, Q, S, A

Note: Company must provide

- *Maximum insurance issued*
- *Maximum premium issued*

Appendix C-D
Data Reasonability Tests Performed at Aggregate Level
Tests Against Independent Company Data

These tests are performed by comparing

(a) data compiled from the policy records in Access

against

(b) information independently provided by the company.

A test is passed if the two figures are identical. A test is failed if the two figures are substantially different.

Excel reports should be created that provides these comparisons including the values, the differences between values and the difference as a percentage of the independent information:

Year End Reports

(1) Sum assured
    a. New policies
    b. Policies in force at prior year end
(2) Policy Count
    a. New policies
    b. Policies in force at prior year end
(3) Premiums In Force
    a. Flexible premium
        i. New policies
        ii. Policies in force at prior year end
    b. Periodic (recurrent) premium
        i. New policies
        ii. Policies in force at prior year end
(4) Policy Reserve (optional)

Calendar Year Reports

(1) Policy Counts
    a. In force at beginning of year
    b. Sales (+)
    c. Deaths (-)
    d. Lapses (-)
    e. Surrenders (-)
    f. Maturity (-)
    g. Expiry (-)

        h. In force at end of year (hopefully a+b-c-d-e-f-g = h)
(2) Premiums received
        a. New policies
        b. Policies in force at prior year end (renewal premium)
(3) Benefits paid
        a. Death benefits
            i. Original sum assured
        b. Surrender benefits

Reports should be prepared for each year during the study period as well as a summary of all years within the study period.

Appendix C-E
Reports used to Test without comparison to separate information

Reports should be created and graphs created for each test

1. Distributions by age
    a. Provided at calendar year for each contract in force (number of contracts, sum assured, annual premium, flexible premium)
    b. Provided for each calendar year for deaths and lapse / surrender
    c. May be grouped into quinquenial or decennial age groups

2. Distributions by amount or annualized premium or benefits (immediate annuities)
    a. Same as above

3. Claim rates
    a. Calculated for quinquenial or decennial age groups for both mortality and persistency
    b. Also calculate the natural log of the mortality claim rate
    c. Mortality may be expressed as a ratio of a "standard" mortality table. Separate "standard" tables may be required for:
        a. Underwritten life insurance (select & ultimate)
        b. Non underwritten life insurance (e.g. group insurance)
        c. Immediate (in payment) annuities
    d. The "tool" will be delivered with the ultimate 75-80 Select & Ultimate table, but the user will have the option of inputting other tables.