

Chapter 903

Survival Parameter Conversion Tool

Introduction

The Survival Parameter Conversion tool is used to convert between the hazard rate, proportion surviving past a given time, mortality, and median survival time, since these four parameters are functionally related. This tool may also be used to convert rates and proportions to different time units.

In many of the **PASS** procedures there are several options for input parameters, but in others only one survival parameter may be used. This tool can be useful to quickly convert any of these survival parameters to any of the others.

Functional Relationship of Survival Parameters – One Group and Two Groups Tabs

The parameter conversions in this tool assume the event times follow an exponential survival distribution. Using the hazard rate equations below, any of the four survival parameters can be obtained from any of the other parameters.

Exponential Distribution

The density function of the exponential is defined as

$$f(t) = he^{-ht}$$

The probability of surviving the first t years is

$$S(t) = e^{-ht}$$

The mortality (probability of an adverse event during the first t years) is

$$M(t) = 1 - e^{-ht}$$

For an exponential distribution, the mean survival is $1/h$, and the median is $\ln(2)/h$.

Based on these formulas it is straightforward to translate between the hazard rate, the proportion surviving, the mortality, and the median survival time.

Hazard Rate from Median Survival Time

The median survival time is transformed to a hazard rate using the relationship $h = \ln(2) / MST$.

Hazard Rate from Proportion Surviving

In this case, the proportion surviving until a given time T_0 is specified. The proportion surviving is transformed to a hazard rate using the relationship $h = -\ln(S(T_0)) / T_0$.

Hazard Rate from Mortality

Here, the mortality until a given time T_0 is specified. The mortality is transformed to a hazard rate using the relationship $h = -\ln(1 - M(T_0)) / T_0$.

Hazard Ratio

The hazard ratio is the simple ratio of two hazard rates: $HR = h_2 / h_1$.

Mortality Ratio

The mortality ratio is the simple ratio of two mortalities: $MR = M_2 / M_1$.

Example

Convert a median survival time of 2.3 to the corresponding hazard rate.

1. Load the **Survival Parameter Conversion Tool** window by clicking on **Tools** and then clicking on **Survival Parameter Conversion Tool**. Click on the **One Group** tab.
2. Under **Enter**, select **Median Survival Time**.
3. Under **Input**, enter **2.3** for **Median Survival Time**.
4. The output hazard rate value under **Hazard Rate** becomes 0.301368339373889. This is the value of the corresponding hazard rate.

Rates and Proportions Tab

The two conversion tools on this tab allow the user to convert proportions and/or rates from one time unit to another, e.g., annual to monthly.

Rate Conversion

The rate conversion section is typically used to convert hazard rates based on one time unit to hazard rates based on another. A common example would be to change a yearly hazard rate to a monthly hazard rate. The conversion calculation is very simple.

Main Rate (e.g., Annual)

This is the rate corresponding to the main time unit (e.g., annual rate).

The main rate and the sub rate are related by the formula

$$\text{Main Rate} = \text{Sub Rate} \times K$$

where K is the number of sub time units in each main time unit.

Range: Main Rate > 0

Sub Rate (e.g., Monthly)

This is the rate corresponding to the sub time unit (e.g., monthly rate).

The sub rate and the main rate are related by the formula

$$\text{Sub Rate} = \text{Main Rate} / K$$

where K is the number of sub time units in each main time unit.

Range: Sub Rate > 0

Example

Convert an annual hazard rate of 1.2 to the corresponding monthly hazard rate.

1. Load the **Survival Parameter Conversion Tool** window by clicking on **Tools** and then clicking on **Survival Parameter Conversion Tool**. Click on the **Rates and Proportions** tab.
2. Under **Rate Conversion**, select **Convert Main Rate to Sub Rate**.
3. Enter **1.2** for **Main Rate**.
4. Enter **12** for **Number of Sub Time Units in Each Main Time Unit**.
5. The value in **Sub Rate** becomes 0.1. A monthly hazard rate of 0.1 corresponds to a yearly hazard rate of 1.2.

Proportion Conversion

The proportion conversion section may be used to convert proportions based on one time unit to proportions based on another. A common example would be to change a yearly proportion lost to follow-up to a monthly proportion lost to follow-up.

Main Proportion (e.g., Annual)

This is the proportion corresponding to the main time unit (e.g., annual proportion).

The main proportion and the sub proportion are related by the formula

$$M = 1 - (1 - S)^K$$

where M is the main proportion, S is the sub proportion, and K is the number of sub time units in each main time unit.

Range: $0 < \text{Main Proportion} < 1$

Sub Proportion (e.g., Monthly)

This is the proportion corresponding to the sub time unit (e.g., monthly proportion).

The sub proportion and the main proportion are related by the formula

$$S = 1 - (1 - M)^{(1 / K)}$$

where S is the sub proportion, M is the main proportion, and K is the number of sub time units in each main time unit.

Range: $0 < \text{Sub Proportion} < 1$

Example

Convert an annual proportion lost of 0.18 to the corresponding monthly proportion lost.

1. Load the **Survival Parameter Conversion Tool** window by clicking on **Tools** and then clicking on **Survival Parameter Conversion Tool**. Click on the **Rates and Proportions** tab.
2. Under **Proportion Conversion**, select **Convert Main Proportion to Sub Proportion**.
3. Enter **0.18** for **Main Proportion**.
4. Enter **12** for **Number of Sub Time Units in Each Main Time Unit**.
5. The value in **Sub Proportion** becomes 0.0164015831883879. If this proportion of the (remaining) total is lost each month, the total proportion lost at the end of 12 months is 0.18.