A Confidence Interval for the Median Survival Time

Source: Ron Brookmeyer and John Crowley (1982),

Biometrics 38, pages 29-41

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The following tables are an example of how to compute a confidence interval for median survival time. These pages are an attempt to clarify the computations.

**SIGN TEST FOR CENSORED DATA OF Ho:**  = 1/2



|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Xi | Xi > M | Xi ≤ M | δi |  |  |  |  |
| 1 | 20+ | No | Yes | 0 | .26667 | 1.0000 | .26667/1 | .26667 |
| 2 | 21 | No | Yes | 1 | .26667 | .80000 | 0 | 0 |
| 3 | 26+ | No | Yes | 0 | .26667 | .80000 | .26667/.8 | .33334 |
| 4 | 27 | No | Yes | 1 | .26667 | .53333 | 0 | 0 |
| 5 | 34 | No | Yes | 1 | .26667 | .26667 | 0 | 0 |
| 6 | 35+ | Yes | No | 0 | .26667 | .26667 | .26667/.26667 | 1.0000 |

Sum = 1.6000075

**TEST STATISTIC U**



**GREENWOOD’S CONSISTENT ESTIMATE OF THE VARIANCE of** .



|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| i | Xi |  |  | n | di | Nx(Xi) | Nx(Xi){Nx(Xi)+ di} |  |  |
| 1 | 20+ | .26667 | .071113 | 6 | 0 | 5 | 5(5+0)=25 | 0 | .000000 |
| 2 | 21 | .26667 | .071113 | 6 | 1 | 4 | 4(4+1)=20 | 1/20 = .05000 | .050000 |
| 3 | 26+ | .26667 | .071113 | 6 | 0 | 3 | 3(3+0)=09 | 0 | .050000 |
| 4 | 27 | .26667 | .071113 | 6 | 1 | 2 | 2(2+1)=06 | 1/6 = .16667 | .216667 |
| 5 | 34 | .26667 | .071113 | 6 | 1 | 1 | 1(1+1)=02 | 1/2 = .50000 | .716667 |
| 6 | 35+ | .26667 | .071113 | 6 | 0 | 0 | 0(0+0)=00 | 0 | .716667 |

**APPROXIMATE ALPHA LEVEL TEST OF Ho: The median = M or So(M)= 1/2**

**using K\_M Estimator**

**Decision Rule** under the null hypothesis is not to Reject Ho when



Thus for a **test** that the survival of a lifetime = 34 is equal to 1/2 is computed as

(.26667-.5)2 ≤ 3.8415(.07113)(.716667)

(.23333)2 ≤ 3.8415(.07113)(.716667)

.0544 ≤ .19583 is True

**Decision: Do not reject Ho:**



**95% CONFIDENCE INTERVAL FOR THE MEDIAN**

**USING EQUATIONS IN BROOKMEYER AND CROWLEY**

**AN ASYMPTOTIC 1-" CONFIDENCE REGION FOR THE MEDIAN IS THE SET OF ALL PARAMETER VALUES NOT REJECTED BY THE SIGN TEST AT LEVEL ". THAT IS,**

**,** m=time, SO(m)=survival



m SO(m) (SO(m)-.5)² C" (SO(m))²



21 0.8000 0.0900 3.8415 .6400 1/20=.05000 .050000 3.8415 x .03200 = .12295

27 0.5333 0.0011 3.8415 .2844 1/6 =.16667 .216667 3.8415 x .06163 = .23684

34 0.2667 0.0544 3.8415 .0711 1/2 =.50000 .716667 3.8415 x .05096 = .19569

**SAS OUTPUT:**

**Point 95% Confidence Interval**

**Percent Estimate [Lower Upper)**

75 . 27.0000 .

50 34.0000 21.0000 .

25 27.0000 21.0000 34.0000

**A CONFIDENCE INTERVAL FOR THE MEDIAN**

**AN ASYMPTOTIC 1-" CONFIDENCE REGION FOR THE MEDIAN IS THE SET OF ALL PARAMETER VALUES NOT REJECTED BY THE SIGN TEST AT LEVEL ". THAT IS,**

, m=time, SO(m)=survival



**CONFIDENCE INTERVAL FOR THE MEDIAN USING EQUATIONS IN SAS**

**95% Confidence Interval for the Median**

Time Survival

m So(m) (So(m)-,5)2 Cα StdErr(So(m))2 Var(So(m)) Cα Var(So(m))

21.0000 0.8000 0.0900 3.8415 .1789 .03200 .12295

27.0000 0.5333 0.0011 3.8415 .2483 .06163 .23684

34.0000 0.2667 0.0544 3.8415 .2257 .05096 .19569

**SAS OUTPUT:**

**Point 95% Confidence Interval**

**Percent Estimate [Lower Upper)**

75 . 27.0000 .

50 34.0000 21.0000 .

25 27.0000 21.0000 34.0000