

Genstat 64-bit Release 24.2 ( PC/Windows 11) 04 October 2025 14:38:59  
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Genstat Twenty-fourth Edition  
Genstat Procedure Library Release PL33

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```
1 SET [WORKINGDIRECTORY='C:/Varie/GenStat'; DIAGNOSTIC=messages]
2 JOB
```

End of job.

```
6936
6937 "filter the dataset to CIK and LD recipients"
6938 RESTRICT eGFR_EPI2021, pz_categoria, mese, don_quality_score, don_eta, ric_CIT, C[1], C[2],
\
6939 ric_eta, ric_sesso, ric_PRA; CONDITION=pz_categoria.IN.!T('CIK recipient','LD
recipient')
6940
6941 "generate continuous variable time"
6942 DELETE [REDEFINE=yes] cmese2
6943 CALCULATE cmese2 = !(#mese)
6944
6945 "Random Coefficient Regression"
6946 DELETE [REDEFINE=yes] _vcs, _vcst, _cst, _effs, _effst, _sigma2, _cinit
6947 "Calculating the Initial Values"
6948 VCOMPONENTS [FIXED=pz_categoria * cmese2 + don_quality_score + don_eta + ric_CIT + C[2]\
6949 + ric_eta + ric_sesso + ric_PRA; SPLINE=pz_categoria.cmese2; FACTORIAL=9] id/cmese2;
CONSTRAINTS=positive
6950 REML [PRINT=*; MAXCYCLE=30; FMETHOD=automatic; PTERMS=pz_categoria.cmese2;
PSE=differences;\
6951 METHOD=AI] eGFR_EPI2021
6952 VKEEP [SIGMA2 = _sigma2] id/cmese2; COMPONENT = _vcs, _vcst; EFFECTS=_tes, _test
6953 CALC _vcs, _vcst = _vcs, _vcst / _sigma2
6954 VARIATE _effs, _effst; VALUE=_tes, _test
6955 CALC _cst = CORR(_effs, _effst)*SQRT(_vcs*_vcst)
6956 VARIATE [VALUE=_vcs, _cst, _vcst] _cinit
6957 "Fit the model and check it"
6958 VCOMPONENTS [FIXED=pz_categoria * cmese2 + don_quality_score + don_eta + ric_CIT + C[2]\
6959 + ric_eta + ric_sesso + ric_PRA; SPLINE=pz_categoria.cmese2; FACTORIAL=9] RANDOM=id/cmese2
6960 VSTRUCTURE [TERMS=id/cmese2; CORRELATE=unrest; FORM=whole; CINITIAL=_cinit]
6961 REML [PRINT=model, components, deviance; MAXCYCLE=30; FMETHOD=automatic;\
6962 PTERMS=pz_categoria.cmese2; PSE=differences; METHOD=AI] eGFR_EPI2021; SAVE=wsave
```

## REML variance components analysis

Response variate: eGFR\_EPI2021  
Fixed model: Constant + cmese2 + pz\_categoria + cmese2.pz\_categoria + don\_quality\_score + don\_eta + ric\_CIT + C['volume\_attivitàDEC\_centrotx'] + ric\_eta + ric\_sesso + ric\_PRA  
Random model: id + id.cmese2  
Spline model: Spline(cmese2).pz\_categoria  
Number of units: 244 (260 units excluded due to zero weights or missing values)

Residual term has been added to model

Sparse algorithm with AI optimisation  
All covariates centred  
Analysis is subject to the restriction on eGFR\_EPI2021

## Covariance structures defined for random model

Correlated terms:

Set Correlation across terms  
1 Unstructured

Set Terms	Covariance model within term
1 id	Identity
1 id.cmese2	Identity

## Estimated variance components

Random term	component	s.e.
Spline(cmese2).pz_categoria	0.69	1.76

## Estimated parameters for covariance models

Random term(s)	Factor	Model(order)	Parameter	Estimate	s.e.
id + id.cmese2	Across terms	Unstructured	v_11	4.200	1.110
			v_21	-0.03919	0.02537
			v_22	0.003364	0.001217
	Within terms	Identity	-	-	-

Note: the covariance matrix for each term is calculated as  $G$  or  $R$  where  
 $\text{var}(y) = \text{Sigma2}( \text{ZGZ}' + R )$ , i.e. relative to the residual variance,  $\text{Sigma2}$ .

## Residual variance model

Term	Model(order)	Parameter	Estimate	s.e.
Residual	Identity	Sigma2	70.04	8.07

## Deviance: -2\*Log-Likelihood

Deviance	d.f.
1501.89	228

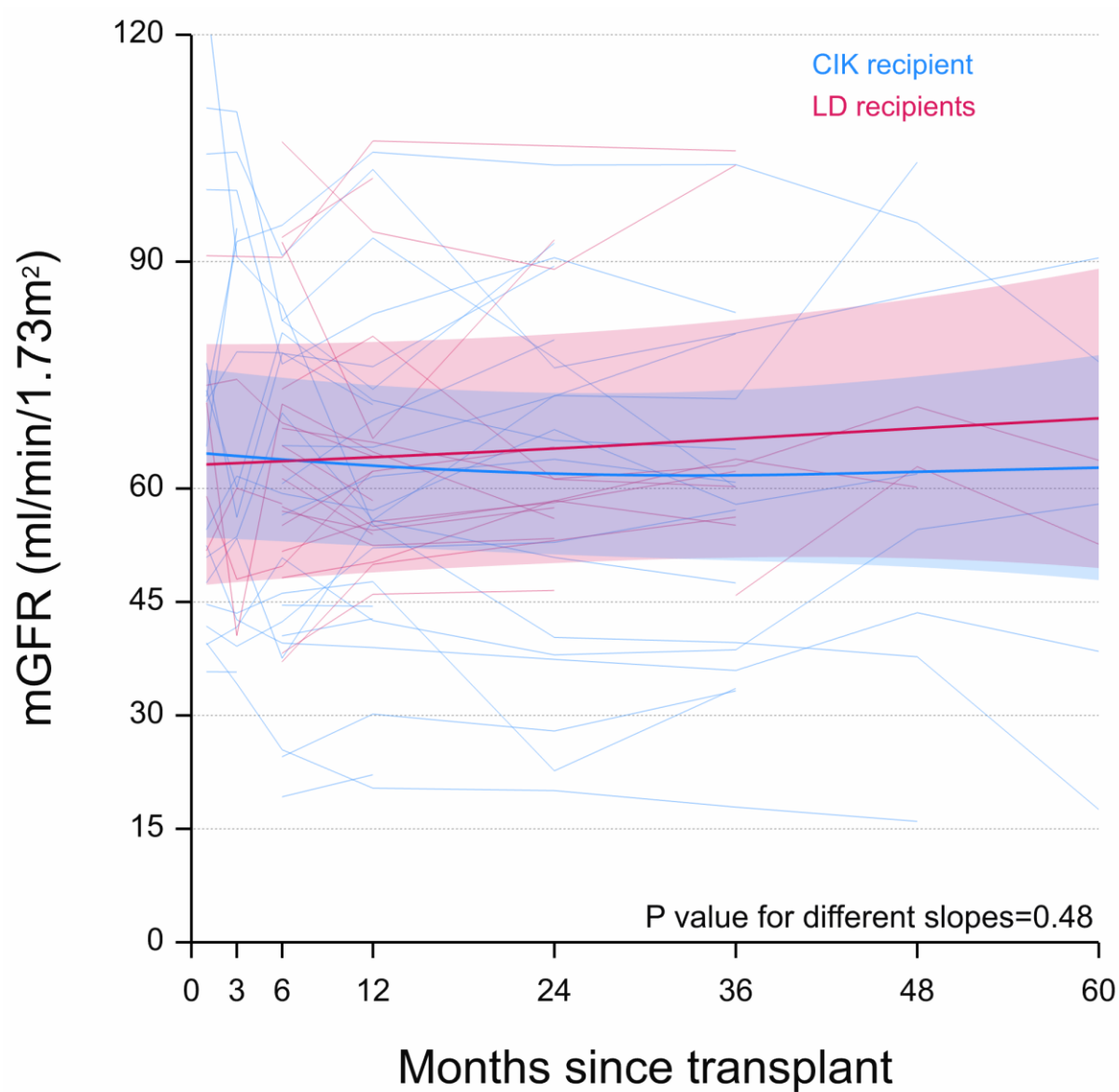
Note: deviance omits constants which depend on fixed model fitted.

```
6963 VPLOT
6964
6965
6966 "calculate and save P value and text for the plot (The P value includes non linear spline
component)"
6967 SCALAR [MODIFY = yes] IDENTIFIER = rdf
6968 VKEEP [DF= rdf] pz_categoria.cmese2; EFFECTS=beta; SEDEFFECTS=se; NDF=ndf; DDF = ddf;
FSTATISTIC = f; WALD = w
6969 CALC _Pval_f = CUF(f;ndf;ddf;0)
6970 TXCONSTRUCT [TEXT=text_Plin_diff] 'P value for different slopes=', #_Pval_f; DECIMALS = 2
6971
6972
6973 "Get the mean population curve via VPREDICT for the plot"
6974 VPREDICT [PREDICTIONS = mgfr; SE = semgfr] pz_categoria,cmese2; LEVELS=!T('CIK
recipient','LD recipient'),!(1,2...60)
```

```

6975 VTABLE TABLE= mgfr, semgfr; VARIATE = MGFR, SEMGFR; CLASSIFICATION = CAT
6976
6977 "Graph setting for the plot (colours, pattern of mean trajectories lines, axes settings"
6978 CALC red = RGB(212; 17; 89)
6979 & blue = RGB(26; 133; 255)
6980 PEN [RESET=yes] 1,2; METHOD=line; COLOUR=#blue,#red; CFILL='match'; SYMBOLS='none';
THICK=2
6981 YAXIS [RESET=yes] WINDOW=1; TITLE='mGFR (ml/min/1.73m2)'; LOWER=0; UPPER=120;
MARKS=(0,15,30,45,60,90,120 )
6982 XAXIS [RESET=yes] WINDOW=1; TITLE='Months since transplant'; LOWER=0; UPPER=60;
MARKS=(0,3,6,12,24,36,48,60)
6983 FRAME [GRID=yx; RESET=yes] WINDOW=1; BOX=omit
6984
6985 "Calculations to plot Individual trajectories for recipients only"
6986 SUBSET [pz_categoria .in. !T('CIK recipient','LD recipient'); SETLEVELS=yes] \
6987 id,pz_categoria,eGFR_EPI2021,cmese2; iid,icat,iY,iX
6988 TABULATE [CLASS=iid; PRINT=*) !(#icat); MEANS=tid "Get category for individuals"
6989 VTABLE tid; idcat
6990 GROUPS [REDEFINE=yes] idcat
6991 CALC nidpen = NVALUES(idcat)
6992 CALC idcolour = NEWLEVELS(idcat;!(blue,red))
6993
6994 "Calculations to plot 95% confidence intervals as coloured regions by reversin lower bound
and appending
-6995 to the upper bounds to define a region to be shaded "
6996 SCALAR IDENTIFIER = t
6997 CALC t = ABS(EDT(0.025; rdf; 0))
6998 SORT [INDEX=CAT[1,2]] CAT[1,2],MGFR
6999 CALC LB = MGFR - t * SEMGFR
7000 CALC UB = MGFR + t * SEMGFR
7001 CALC RLB,RCAT[1,2] = REVERSE(LB,CAT[1,2])
7002 APPEND [AY] UB,RLB
7003 APPEND [AX] CAT[2],RCAT[2]
7004 APPEND [AP] CAT[1],RCAT[1]
7005
7006 "Make the plot"
7007 DSTART
7008 DGRAPH [WINDOW=1; KEYWINDOW=0] Y=MGFR; X=CAT[2]; PEN=CAT[1]; LAYER=3 "Mean lines"
7009 PEN 1,2; METHOD=fill; JOIN=given; TAREA = 200
7010 DGRAPH [WINDOW=1; KEYWINDOW=0; SCREEN=keep] Y=AY; X=AX; PEN=AP; LAYER=2 "95% Confidence
region"
7011 PEN 1...nidpen; COLOUR=#idcolour; METHOD=line; SYMBOL='none'; THICK=0.9;
LINESTYLE='solid'; TLINE = 150
7012 DGRAPH [WINDOW=1; KEYWINDOW=0; SCREEN=keep] Y=iY; X=iX; PEN=iid; LAYER=1 "Individuals
lines"
7013 PEN 1,2; COLOUR=#blue,#red
7014 DKEY [WINDOW=6; NCOLUMNS=1; PENLABELS=(1,2); BORDER=none; XOFFSET=-6] \
7015 !T('CIK recipient','LD recipients'); METHOD='none'
7016 PEN 2; COLOUR=1; SYMBOL=0; ROTATION=0; SIZE=1; LABELS= text_Plin_diff
7017 DGRAPH [WINDOW=1; KEYWINDOW=0; SCREEN=keep] 3; 30; PEN=2 "text"
7018 DFINISH

```



```

7019
7020
7021  "Print linear difference between CIK and LD eGFR slopes per year FROM THE REGRESSION TABLE
(NOT INCLUDING SPLINES)"
7022  VRSETUP [SAVE = wsave]
7023  VRFIT [PRINT=model] pz_categoria * cmese2 + don_quality_score + don_eta + ric_CIT + C[2]\
7024    + ric_eta + ric_sesso + ric_PRA

```

# Regression analysis of REML fixed model

```
Response variate:  eGFR_EPI2021
Weight matrix:    REML weights
Fitted terms:    Constant + pz_categoria + cmese2 + cmese2.pz_categoria +
don_quality_score + don_eta + ric_CIT + C['volume_attivitàDEC_centrotx'] + ric_eta + ric_sesso +
ric_PRA

7025  VRKEEP [RDF = rrdf] pz_categoria.cmese2; ESTIMATES = rb_lin_diff; SE = rse_lin_diff; DDF
= ddf
7026  CALC  rt = ABS(EDT(0.025; rrdf; 0))
7027  SCALAR [MODIFY=yes] zt
7028  CALC  zt = ABS(#rb_lin_diff$[2] / #rse_lin_diff$[2])
7029  CALC  _Pval_t = 2* CUT(zt;rrdf;0)
7030  CALC  erb_lin_diff = #rb_lin_diff$[2] * 12 * -1  "Difference in slopes per
ml/min/1.73m2/year CIK vs LD recipients"
7031  CALC  erse_lin_diff = #rse_lin_diff$[2]* 12
7032  CALC  erlb_lin_diff = erb_lin_diff - rt * erse_lin_diff
7033  &      erub_lin_diff = erb_lin_diff + rt * erse_lin_diff
7034  PRINT erb_lin_diff, erse_lin_diff, rt, erlb_lin_diff, erub_lin_diff; DECIMALS = 2

      erb_lin_diff      erse_lin_diff          rt      erlb_lin_diff      erub_lin_diff
      -2.02             2.21             1.97      -6.37             2.34

7035  TXCONSTRUCT [TEXT=ertext_lin_diff] 'Adjusted linear diff. between CIK and LD recipients:',
#erb_lin_diff, \
7036  ' (95%CI: ', #erlb_lin_diff, ' to ', #erub_lin_diff, '; P=', #_Pval_t, '); DECIMALS =
*,1,*,1,*,1,*,2,*
7037  PRINT [IPRINT=*] ertext_lin_diff

      Adjusted linear diff. between CIK and LD recipients:-2.0 (95%CI: -6.4 to 2.3; P=0.36)

7038
7039
```

```

1053 SUBSET [pz_categoria .in. !T('CIK recipient','LD recipient'); SETLEVELS=yes] \
1054     id, _d, _t, pz_categoria, don_quality_score, ric_CIT; r_id, r_d, r_t,
r_pz_categoria, r_don_quality_score, r_ric_CIT
1055 FACTOR [MODIFY=yes; REFERENCELEVEL = 2] r_pz_categoria
1056
1057 CALC n = NVALUES(r_d)
1058 VARIATE [NVALUES = n] CENSOR
1059 RESTRICT CENSOR; r_d.EQ.1
1060 CALC CENSOR = 0
1061 RESTRICT CENSOR
1062 RESTRICT CENSOR; r_d.EQ.0
1063 CALC CENSOR=1
1064 RESTRICT CENSOR
1065 PRINT n

      n
56.00

1066 CALC r_mese = r_t * 12
1067 ESPREADSHEET [BOOK=0]
CENSOR,r_d,r_don_quality_score,r_id,r_pz_categoria,r_ric_CIT,r_t,r_mese
1068
1069 "Prepare setting and text for the Kaplan-Meier plot"
1070 CALC red = RGB(212; 17; 89)
1071 & blue = RGB(26; 133; 255)
1072 PEN [RESET=yes] 1,2; METHOD=line; COLOUR=#blue,#red; CFILL='match'; SYMBOLS='none';
THICK=2
1073 YAXIS [RESET=yes] WINDOW=1; TITLE='Transplant Survival(%)'; LOWER=0; UPPER=1;
MARKS=!(0,.2,.4,.6,.8,1 ); LABELS=!T('0','20','40','60','80','100')
1074 XAXIS [RESET=yes] WINDOW=1; TITLE='Months since transplant'; LOWER=0; UPPER=60;
MARKS=!(0,3,6,12,24,36,48,60)
1075 FRAME [GRID=yx; RESET=yes] WINDOW=1; BOX=omit
1076 RSTEST [METHOD=logrank] TIME=r_mese; CENSOR=CENSOR; GROUPS=r_pz_categoria; TESTS= LOGR

```

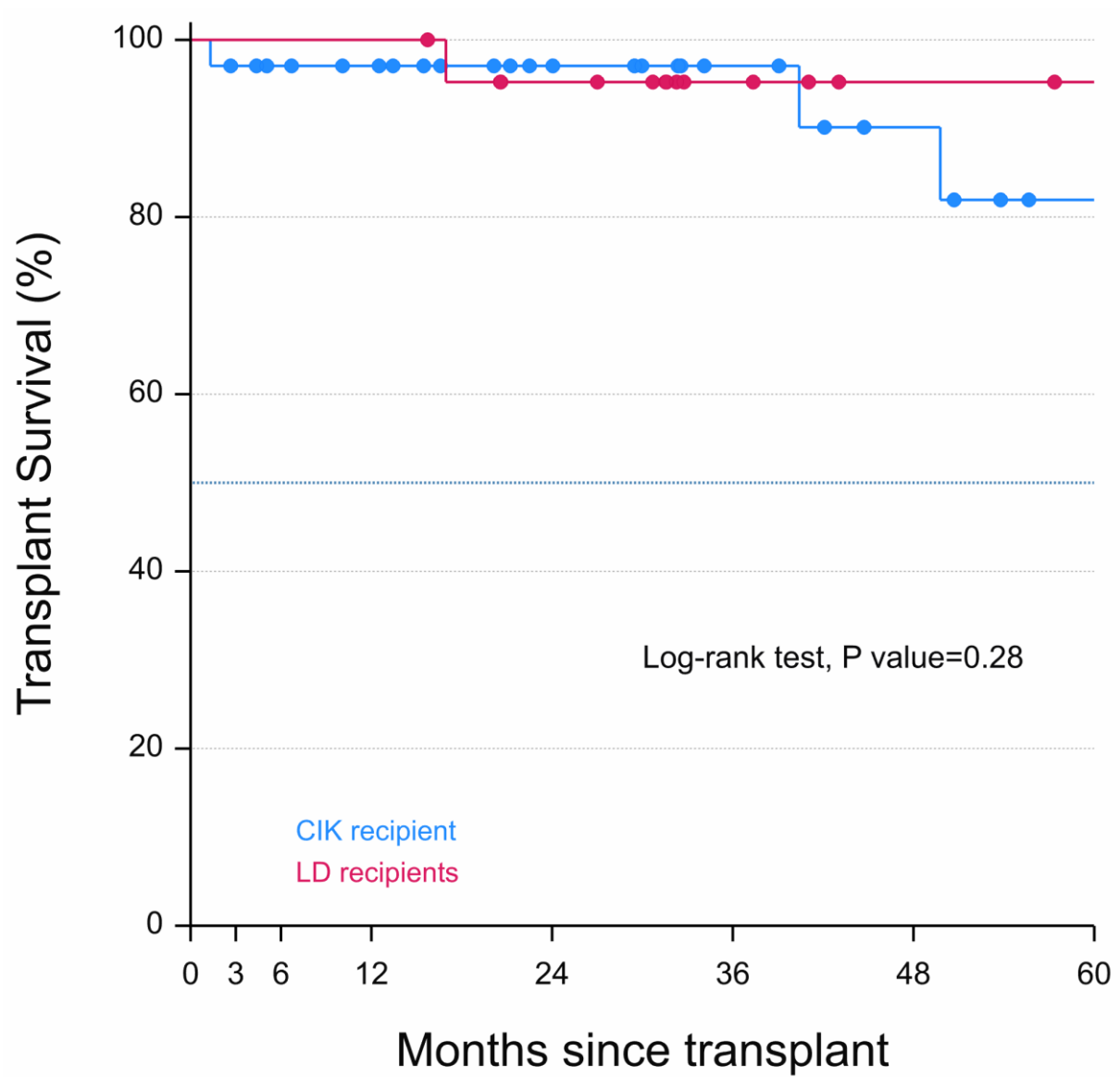
Test statistics for equality of survival curves for r\_pz\_categoria

	Statistic	d.f.	probability
Log-rank	1.161	1	0.281

```

1077 CALC _lrpval = LOGR['logrank']$[3]
1078 TXCONSTRUCT [TEXT=text_logrank] 'Log-rank test, P value=', #_lrpval; DECIMALS = *,2
1079
1080 "Kaplan-Meier Plot"
1081 DSTART
1082 KAPLANMEIER [PRINT=graph; XUPPER=60; KEYWINDOW=0; WINDOW=1;\
1083     PLOT=reference,censored]\
1084     TIME=r_mese; CENSOR=CENSOR.ne.0; GROUPS=r_pz_categoria
1085 DKEY [WINDOW=7; NCOLUMNS=1; PENLABELS=!(1,2); BORDER=none; XOFFSET=12; TPOSITION =
'inside'] \
1086     !T('CIK recipient','LD recipients'); METHOD='none'
1087 PEN 2; COLOUR=1; SYMBOL=0; ROTATION=0; SIZE=1; LABELS= text_logrank
1088 DGRAPH [WINDOW=1; KEYWINDOW=0; SCREEN=keep] 0.3; 30; PEN=2 "text"
1089 DFINISH

```



```
1090  
1091 "Crude PH Model (Cox regression estimated via GLM)"  
1092 RPHFIT [PRINT=model; TIME=r_mese; SUBJECTS=r_id; CENSORED=CENSOR] r_pz_categoria
```



## Regression analysis

Response variate:   
Distribution: Poisson  
Link function: Log  
Grouping factor: Interval  
Fitted terms: r\_pz\_categoria

```
1093 RPHKEEP [estimate= cbHR; SE=cbse]
1094 DELETE [REDEFINE=yes] CHR, lbcHR, ubcHR, cZ, cpval
1095 SCALAR [MODIFY=yes] CHR, lbcHR, ubcHR, cZ, cpval
1096 CALC  CHR = exp(cbHR$[6])
1097 CALC  lbcHR = exp(cbHR$[6] - 1.96 * cbse$[6])
1098 &      ubcHR = exp(cbHR$[6] + 1.96 * cbse$[6])
1099 &      cZ = ABS(cbHR$[6]/cbse$[6])
1100 &      cpval = 2* (1 - CLNORMAL(#cZ;0;1))
1101
1102 TXCONSTRUCT [TEXT=crude_hr] 'Crude HR:', #cHR, \
1103   ' (95%CI: ', #lbcHR, ' to ', #ubcHR, '; P=', #cpval, ')'; DECIMALS = 2
1104 PRINT [IPRINT=*] crude_hr

      Crude HR:3.13 (95%CI: 0.36 to 26.98; P=0.30)

1105
1106 "Adjuted PH Model (Cox regression estimated via GLM)"
1107 RPHFIT [PRINT=model; TIME=r_mese; SUBJECTS=r_id; CENSORED=CENSOR]
r_pz_categoria+r_don_quality_score+r_ric_CIT
```

## Regression analysis

Response variate:     
Distribution: Poisson  
Link function: Log  
Grouping factor: Interval  
Fitted terms: r\_pz\_categoria + r\_don\_quality\_score + r\_ric\_CIT

```
1108 RPHKEEP [estimate= abHR; SE=abse]
1109 DELETE [REDEFINE=yes] aHR, lbaHR, ubaHR, aZ, apval
1110 SCALAR [MODIFY=yes] aHR, lbaHR, ubaHR, aZ, apval
1111 CALC  aHR = exp(abHR$[6])
1112 CALC  lbaHR = exp(abHR$[6] - 1.96 * abse$[6])
1113 &      ubaHR = exp(abHR$[6] + 1.96 * abse$[6])
1114 &      aZ = ABS(abHR$[6]/abse$[6])
1115 &      apval = 2 * (1 - CLNORMAL(#aZ;0;1))
1116
1117 TXCONSTRUCT [TEXT=adjusted_hr] 'Adjusted HR:', #aHR, \
1118   ' (95%CI: ', #lbaHR, ' to ', #ubaHR, '; P=', #apval, ')); DECIMALS = 2
1119 PRINT [IPRINT=*] adjusted_hr
```

Adjusted HR:2.25 (95%CI: 0.12 to 43.13; P=0.59)