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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  
 $\text{var}(y) = \text{Sigma2}(ZGZ' + R)$ , i.e. relative to the residual variance, 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

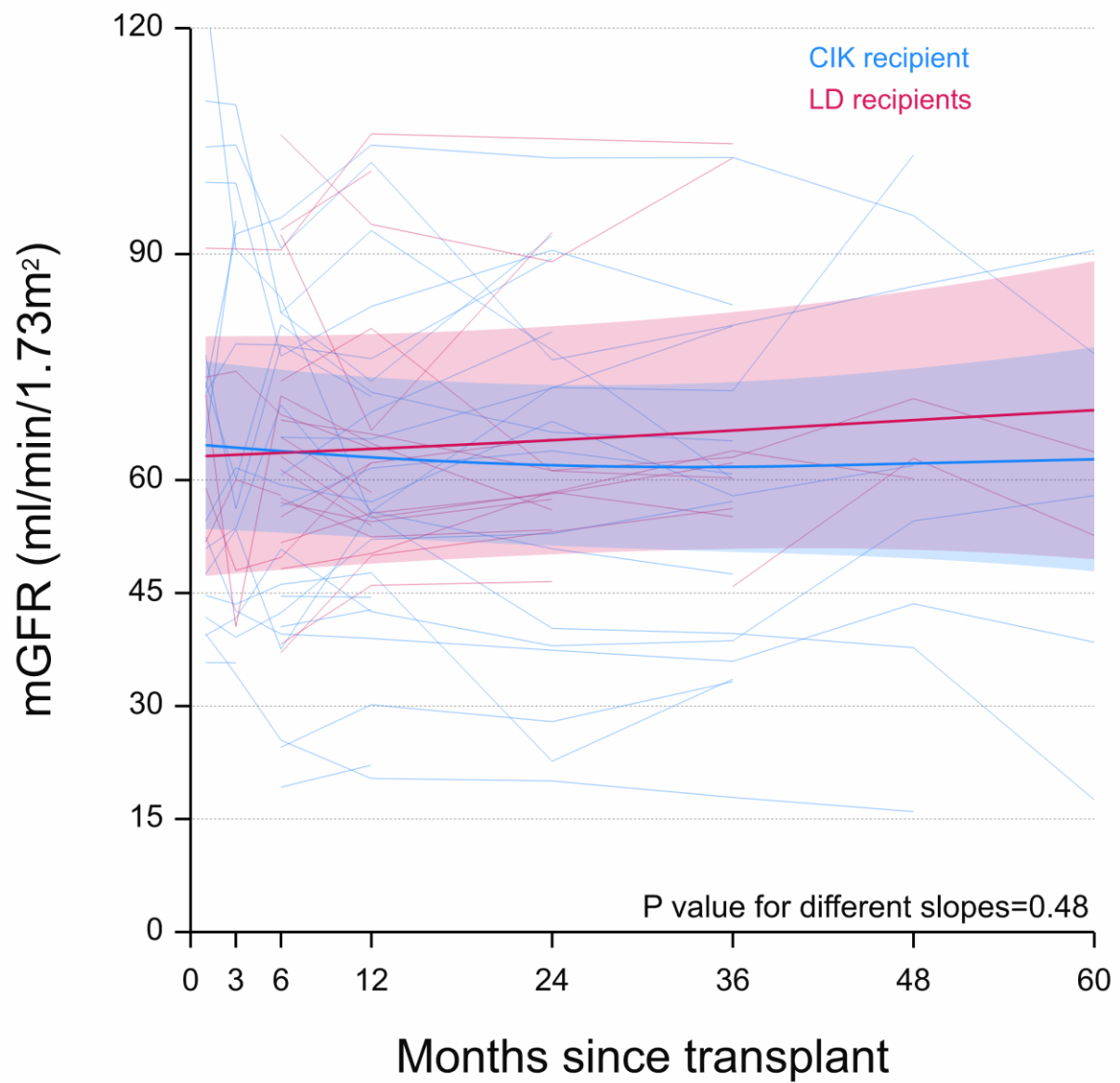
Note: deviance omits constants which depend on fixed model fitted.

```
6963 VPLOTT
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
```