Supplementary

SAS programs: correlation for repeated measures from the 8 critically ill patients: pH and PaCO2 [3].

data data_wide;
input ID visit U W @@;
cards;
1 1 6.68 3.97 1 2 6.53 4.12 1 3 6.43 4.09 1 4 6.33 3.97 2 1 6.85 5.27 2 2 7.06 5.37 2 3 7.13 5.41 2 4 7.17 5.44
3 1 7.40 5.67 3 2 7.42 3.64 3 3 7.41 4.32 3 4 7.37 4.73 3 5 7.34 4.96 3 6 7.35 5.04 3 7 7.28 5.22 3 8 7.30 4.82
3 9 7.34 5.07 4 1 7.36 5.67 4 2 7.33 5.10 4 3 7.29 5.53 4 4 7.30 4.75 4 5 7.35 5.51
5 1 7.35 4.28 5 2 7.30 4.44 5 3 7.30 4.32 5 4 7.37 3.23 5 5 7.27 4.46 5 6 7.28 4.72 5 7 7.32 4.75 5 8 7.32 4.99
6 1 7.38 4.78 6 2 7.30 4.73 6 3 7.29 5.12 6 4 7.33 4.93 6 5 7.31 5.03 6 6 7.33 4.93
7 1 6.86 5.85 7 2 6.94 5.64 7 3 6.92 6.52
8 1 7.19 5.28 8 2 7.29 4.56 8 3 7.21 4.34 8 4 7.25 4.32 8 5 7.20 4.41 8 6 7.19 3.69 8 7 6.77 6.09 8 8 6.82 5.58
;
run;

data data_long (drop=U W i);
set data_wide;
array var[2] U W;
do i = 1 to 2;
mtype = i;
Outcome = var[i];
output;
end;
run;

proc format;
value mtypea
1="U"
2="W"
;
run;
data data_long;
set data_long;
format mtype mtypea .;
run;

/*------------------------------------------------*/
/* CS correlation, mixed-effects models*/
/*------------------------------------------------*/
proc mixed data=data_long method=ml;
class ID mtype visit;
model Outcome = mtype / solution ddfm=kr;
random mtype / type=un subject=ID v vcorr;
repeated mtype visit / type=un@cs subject=ID;
ods output VCorr=VCorr ConvergenceStatus=CSraw CovParms=CovParms FitStatistics=AICraw;
run;

/*------------------------------------------------*/
/* AR correlation, mixed-effects models*/
/*------------------------------------------------*/
Correlation for repeated measures

```sas
proc mixed data=data_long method=ml;
   class ID mtype visit;
   model Outcome = mtype / solution ddfm=kr;
   random mtype / type=un subject=ID v vcorr;
   repeated mtype visit / type=un@ar(1) subject=ID;
   ods output VCorr=VCorr ConvergenceStatus=CSraw CovParms=CovParms FitStatistics=AICraw;
run;
/

/* Approach 1, I correlation */

proc corr data=data wide;
   var U W;
run;
/

/* Approach 2, naive approach */

proc summary data=data wide;
   var U W;
   by ID;
   output out=corrB mean(U)=avg_x mean(W)=avg_y;
run;

proc corr data=corrB;
   var avg_x avg_y;
run;
/

/* Approach 3, Partial correlation adjusting for patient effect */

proc mixed data=data_long method=ML;
   class mtype ID visit;
   model Outcome = mtype*ID / noint notest s;
   repeated mtype / subject=ID(visit) type=un;
   ods output VCorr=VCorr ConvergenceStatus=CSraw CovParms=CovParms FitStatistics=AICraw;
run;
/

/* Approach 4, Partial correlation by Lipsitz, y=x */

proc mixed data=data wide method=ml;
   class ID visit;
   model W =U / solution ddfm=kr;
   repeated visit / type=CS subject=ID;
   ods output SolutionF=out4a Dimensions=out4a;
run;

proc mixed data=data wide method=ml;
   class ID visit;
   model U =W / solution ddfm=kr;
   repeated visit / type=CS subject=ID;
   ods output SolutionF=out4b Dimensions=out4b;
run;
```
