

Supplementary Material to article “Bivariate
semiparametric mixed models to longitudinally
measured systolic and diastolic blood pressure of
adult diabetic patients

A: Variance-covariance selection

Table S1: Variance selection and model comparison criteria for
BRIM and BRISM models fitted with independent error assump-
tion

Model	Variance Structure	AIC	BIC	$-2\loglik(df)$
M ₁	BRIM	67524.95	67716.05	67470.94 (df=27)
M ₂	BRISM	67494.17	67734.82	67426.18 (df=34)

B: Nonlinearity Test

Table S2: Likelihood ratio test nonlinearity effects
of time, age and weight on blood pressure level of dia-
betic patients in JUMC, September 2011-June 2014

Model	Smoothing	$-2\logLik$	LRT	p-value
M ₃	—	67347.37		
	f(t)	66425.48	921.89	< .0001
M ₃ +	f(a)	66443.95	903.42	< .0001
	f(w)	66426.21	921.16	< .0001

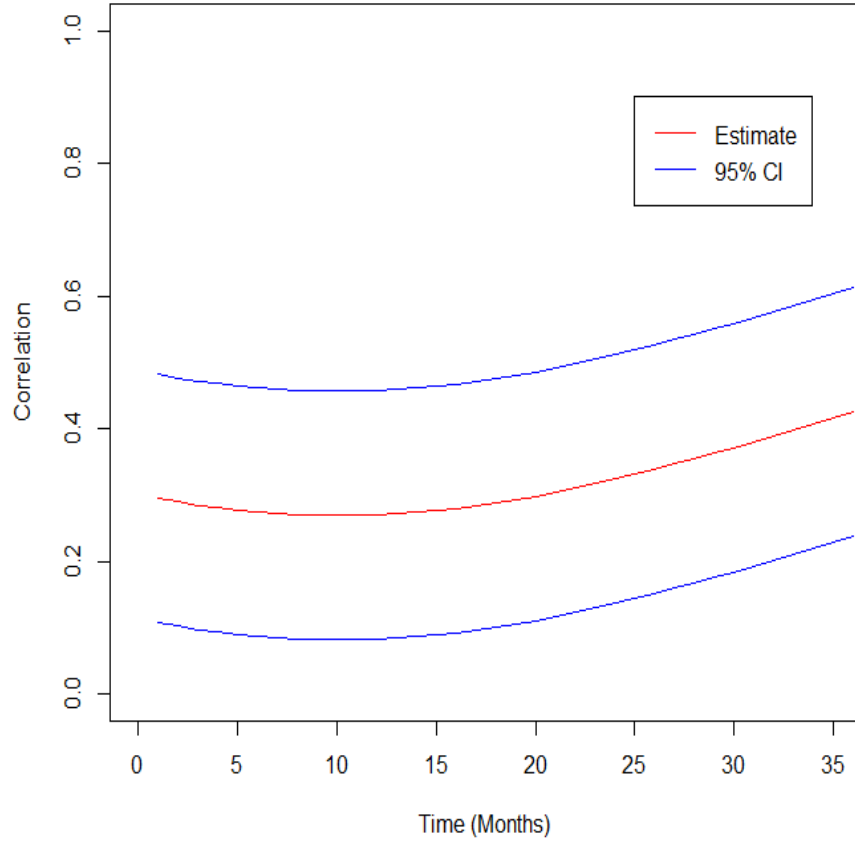


Fig S1: Estimated marginal correlation and 95% CI of SBP and DBP of adult diabetic patients during the follow up in JUMC, September 2011 - June 2014.

C: Model diagnostics

We have conducted model diagnostic for the assumptions and goodness of fit assessment for selected bivariate semi-parametric mixed model. We assessed the normality of random effects through the Q-Q plots and histogram of predicted patient-specific random effects. The predicted values of patient-specific random effects vectors were $(\hat{\mathbf{b}}_i^T, \hat{\mathbf{u}}_i^T)^T$, where $\mathbf{b}_i^T$ is vector of random effects for the i th patient related to their SBP values, and $\mathbf{u}_i^T$ is vector of random effects for the i th patient related to their DBP values.

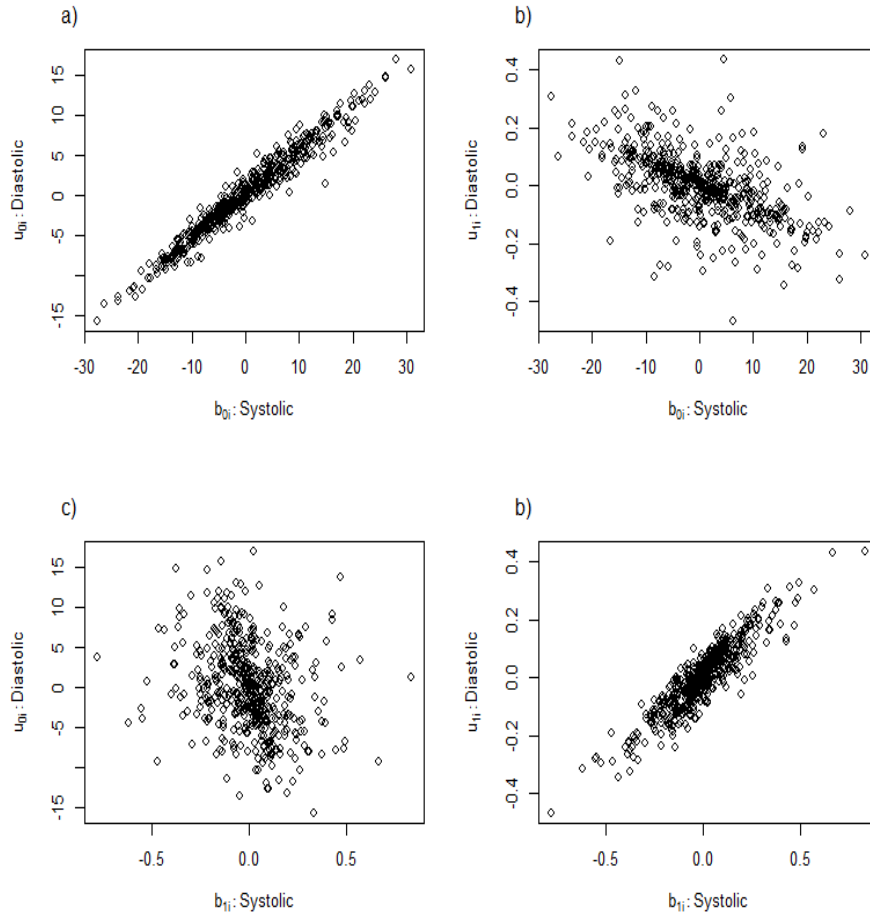


Fig S2: Scatter plot of the predicted bivariate patient specific random effects $\{b_i\}$ versus $\{u_i\}$ of SBP and DBP of adult diabetic patients in JUMC, September 2011 - June 2014.

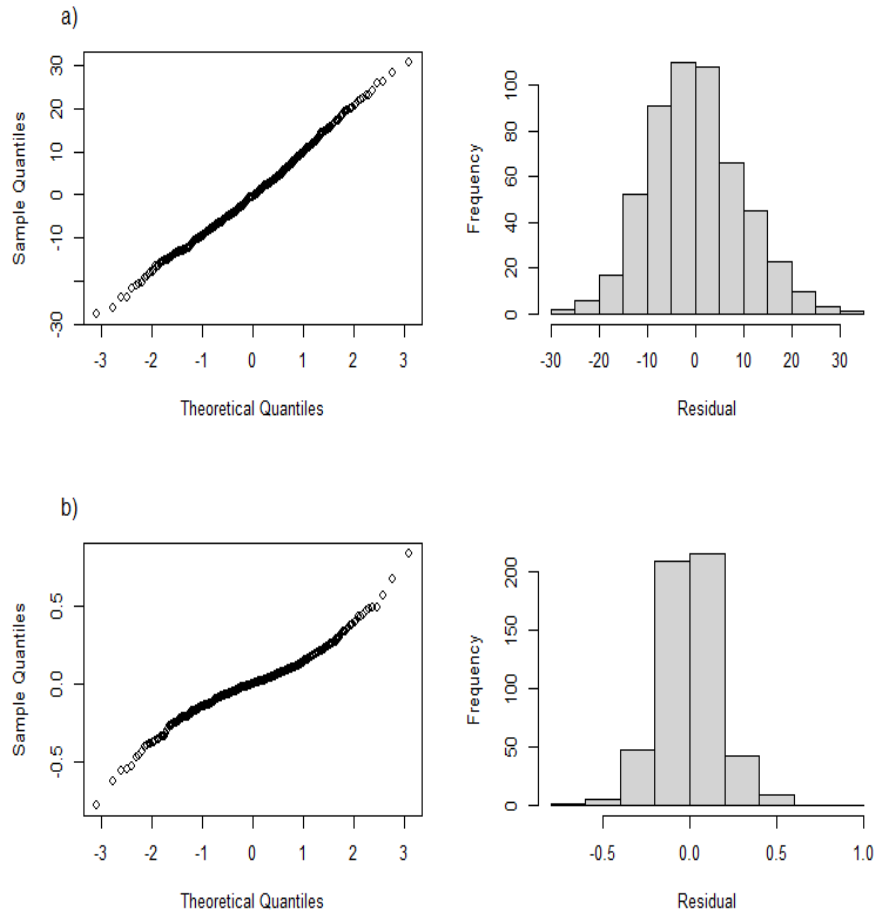


Fig S3: Normality Q-Q plots and histogram of the predicted random effects, **a)** patient-specific intercept, and **b)** patient specific-slope for systolic blood pressure of adult diabetic patients in JUMC, September 2011 - June 2014.

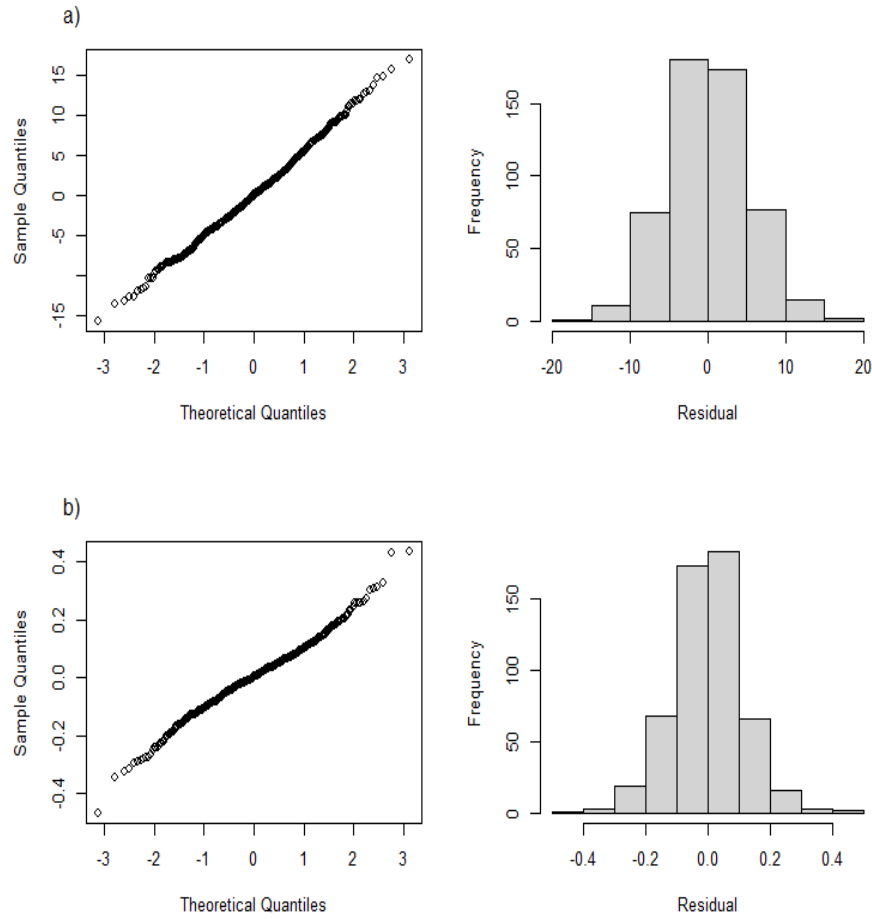


Fig S4: Normality Q-Q plots and histogram of the predicted random effects, **a)** patient-specific intercept, and **b)** patient specific-slope for diastolic blood pressure of adult diabetic patients in JUMC, September 2011 - June 2014.

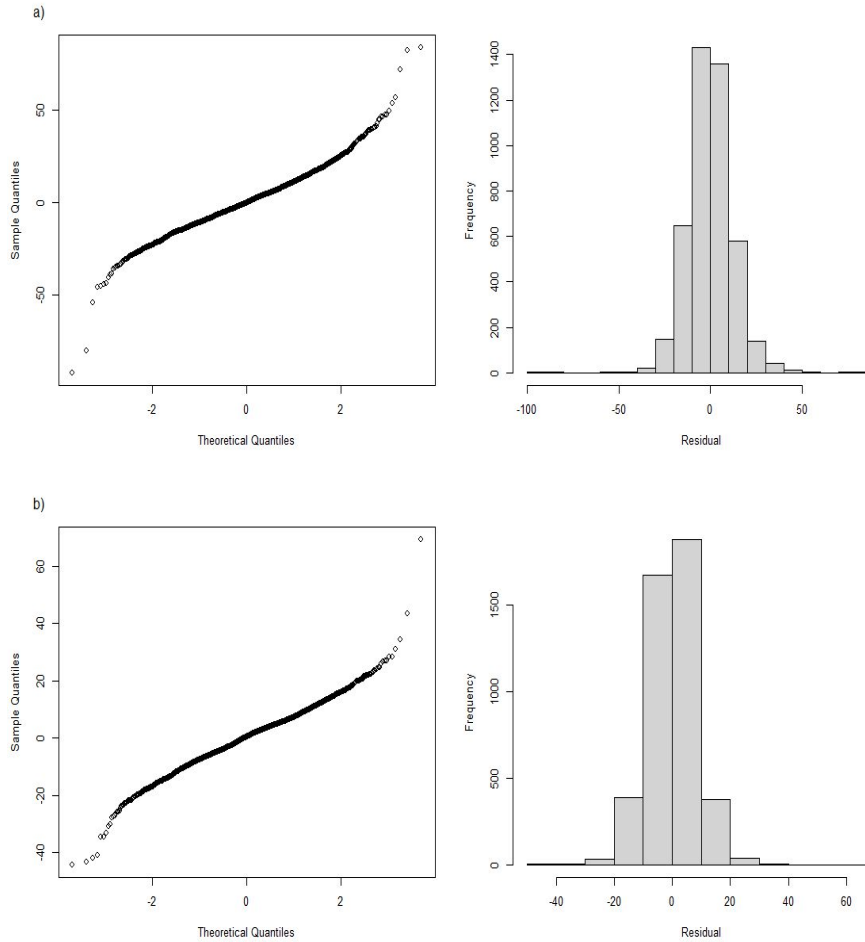


Fig S5: Normality Q-Q plots and histogram of the estimated residuals, **a)** systolic blood pressure, and **b)** diastolic blood pressure of adult diabetic patients in JUMC, September 2011 - June 2014.

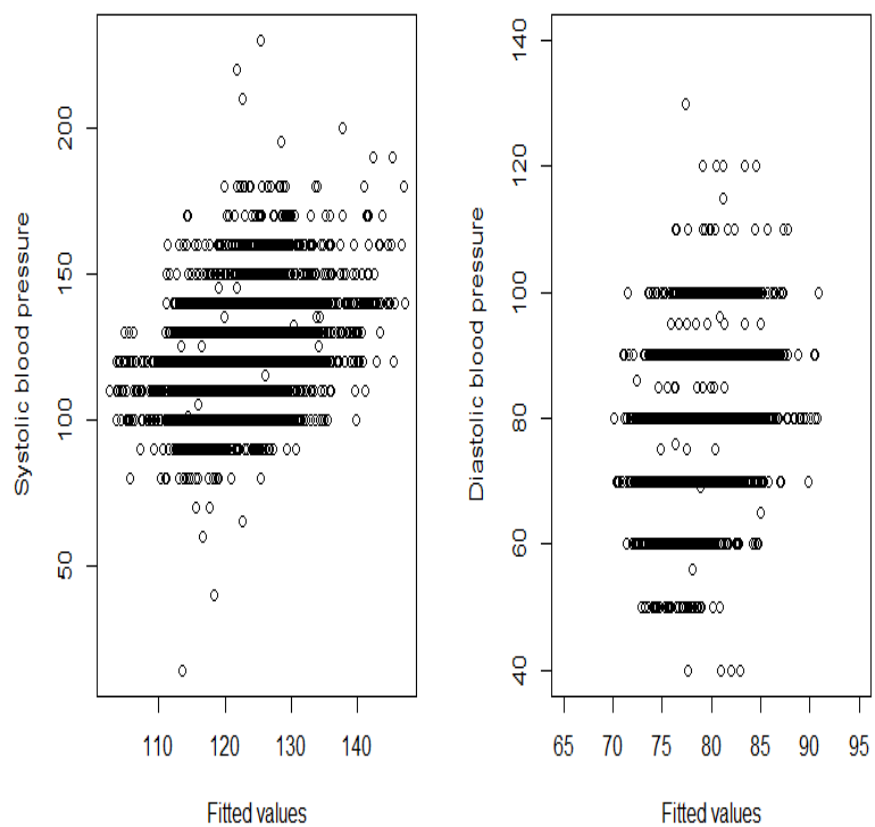


Fig S6: Plots of Responses vs. fitted values, **a)** systolic blood pressure, and **b)** siastolic blood pressure of adult diabetic patients in JUMC, September 2011 - June 2014.

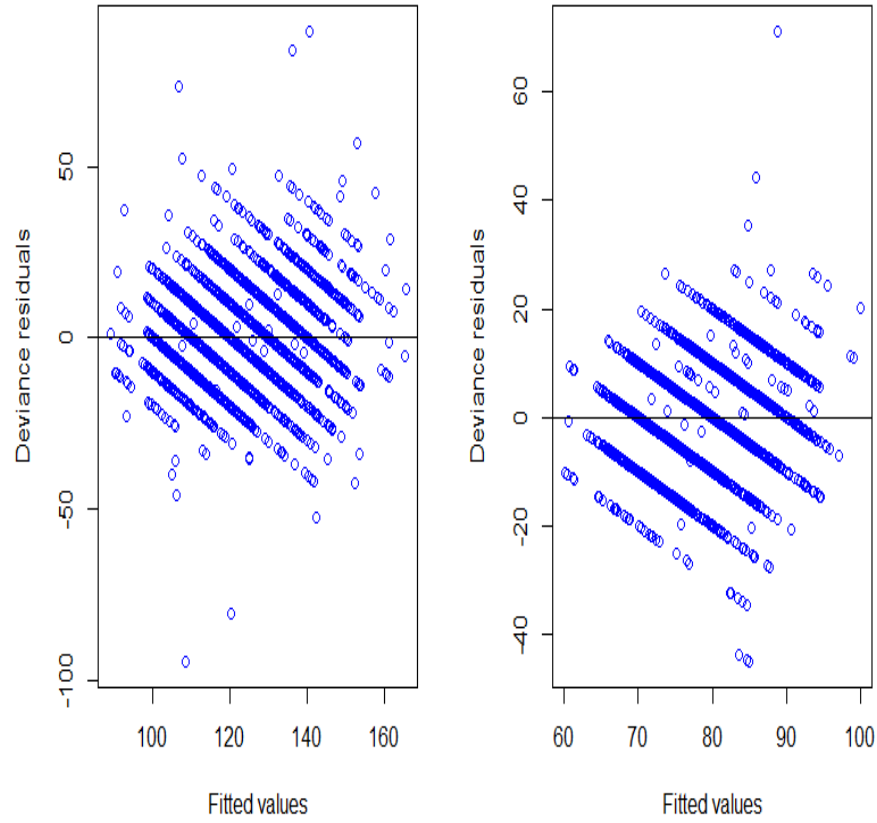


Fig S7: Deviance residuals vs. fitted values for **a)** systolic blood pressure, and **b)** diastolic blood pressure of adult diabetic patients in JUMC, September 2011 - June 2014.