Exploring the determinants of high pulse pressure

BY

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Background of the study

➢ A healthy population is critical to economic development of every country

➢ Quality of health is associated with the following:

  ▪ High life expectancy rate

  ▪ High productivity

  ▪ High economic growth (Bayraktar et al, 2022)

➢ Cardiovascular diseases is one of the leading causes of death in the U.S.

➢ According to the CDC, one person dies in every 33 seconds due to cardiovascular illness

Purpose of the study

➤ According to the National Center for Health Statistics, $239.9 billion was lost due to heart disease related cost as well as lost of productivity due to death.

➤ High pulse pressure has been found to be one of the significant indicators of risk of heart disease (Glynn, 2000)

➤ The study therefore seeks to examine some possible predictors of pulse pressure.

Data and variables

➤ The study will utilize a subset of baseline data (n=699) from FRAMINGHAM Heart study

➤ A Bayesian multiple linear regression will be conducted

➤ The outcome variable is pulse pressure

➤ The independent variables are:

- Age
- Cholesterol level
- Systolic blood pressure

Descriptive statistics

Variables	N	Mean	Standard Deviation	Minimum	Maximum
Pulse pressure	699	50.25	15.50	18	142
Age	699	46.40	8.58	31	66
Systolic blood pressure	699	133.16	22.68	92	240
Cholesterol level	699	230.11	43.57	124	386

Correlation and distributions
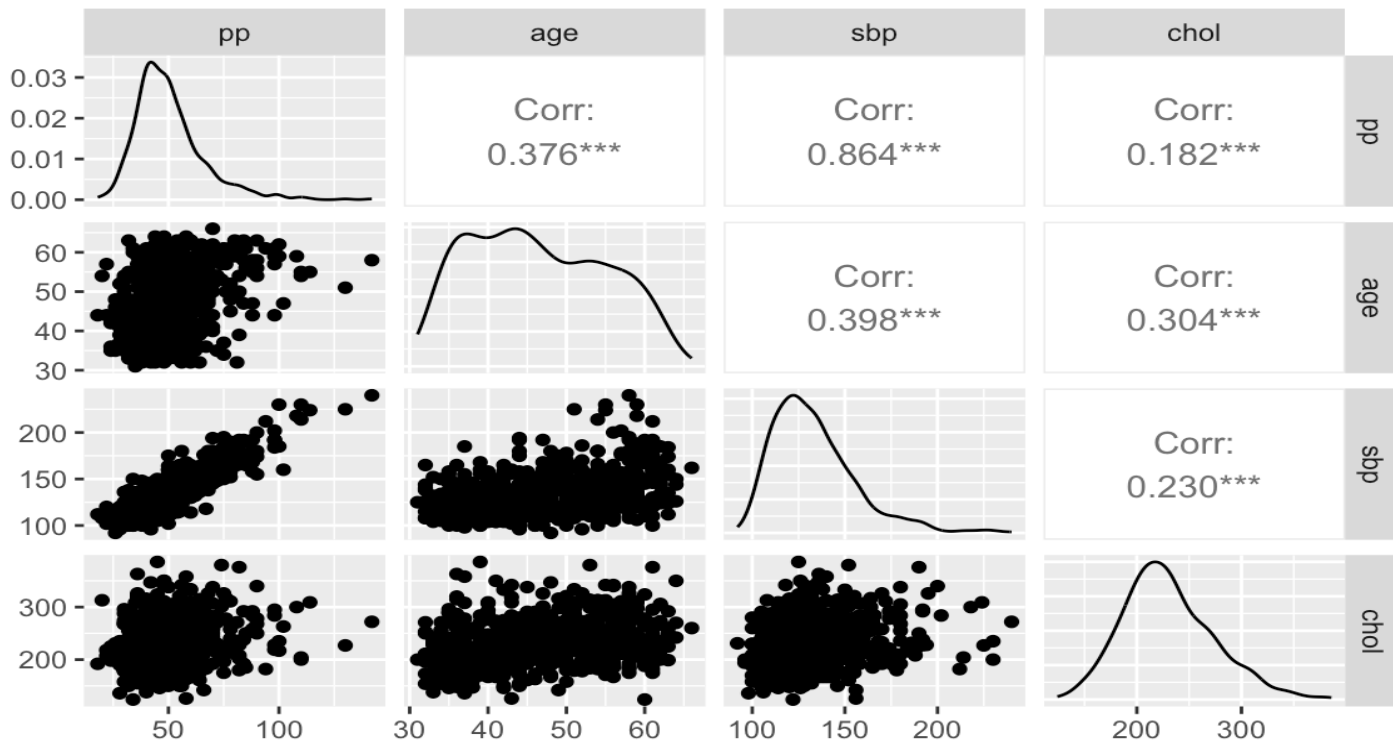
Summary of the competing models

Models	## IVs	error	#prm	DIC	pD	PVAF
M1	3	t-dist	6	1013.96	6.15	0.703
M1x(a)-Int	4	t-dist	7	1009.99	7.24	0.69
M1x(b)- squ	4	t-dist	7	1006.16	7.23	0.66
M1h	3	t-dist	7	1013.90	6.13	0.723
M1n	3	norm	5	1029.04	5.03	0.723
M1x(a)-n	4	norm	6	1026.01	6.08	0.65
M1x(b)- n	4	norm	6	1021.82	5.98	0.66
M1h-n	3	norm	6	1029.01	5.01	0.714

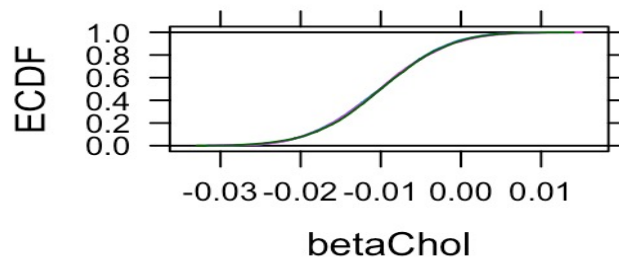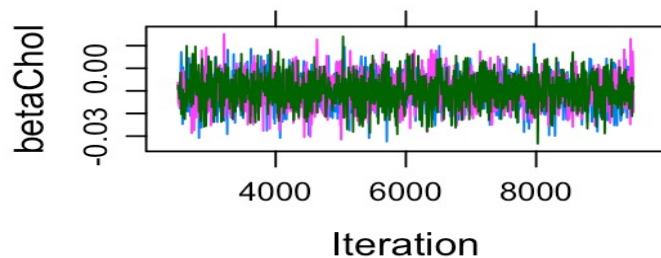# Posterior distributions ("Systolic blood pressure")
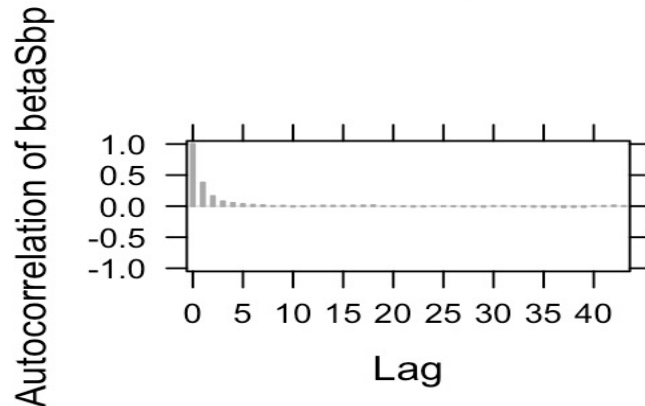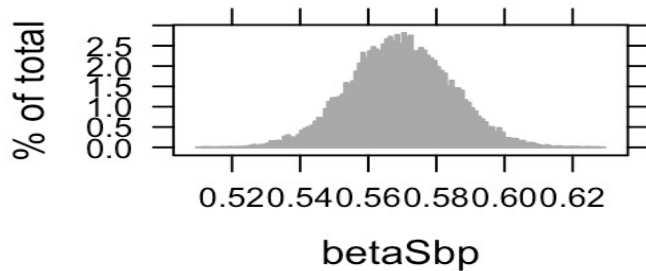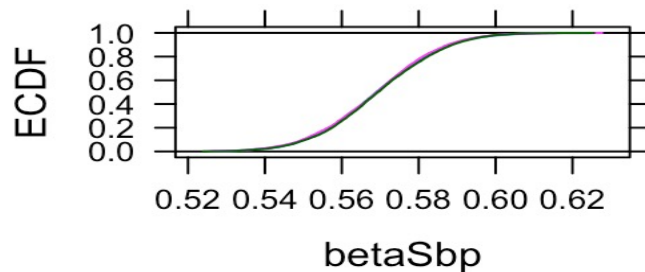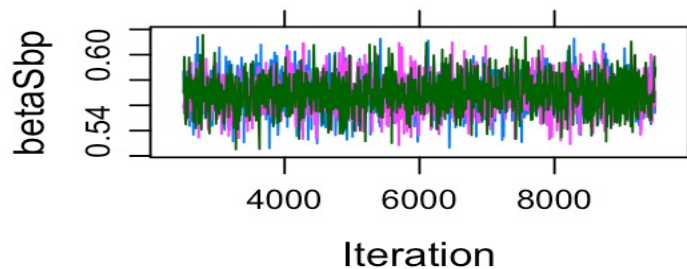
Posterior distributions ("AGE")
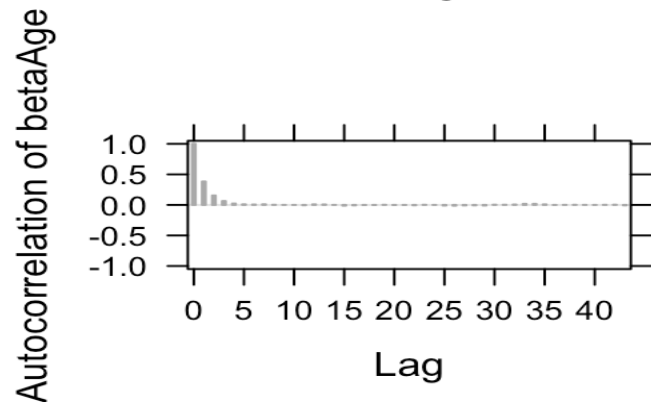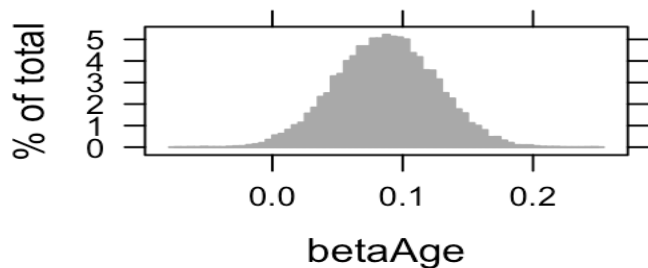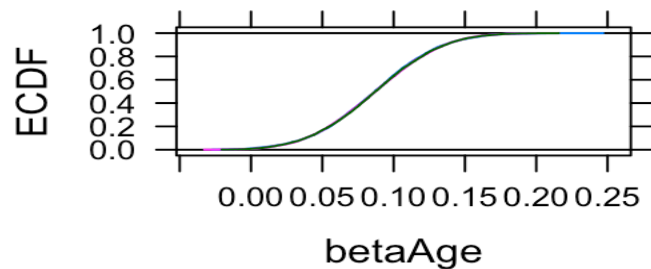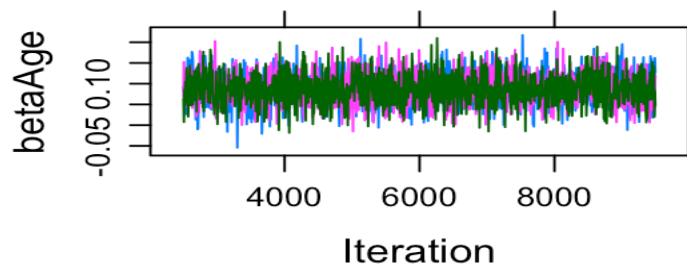
Posterior distributions ("Cholesterol")
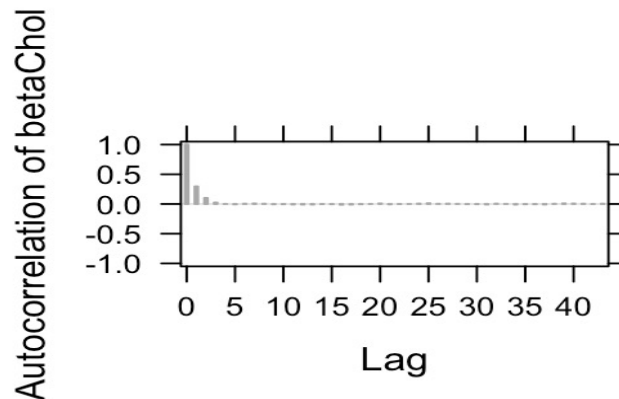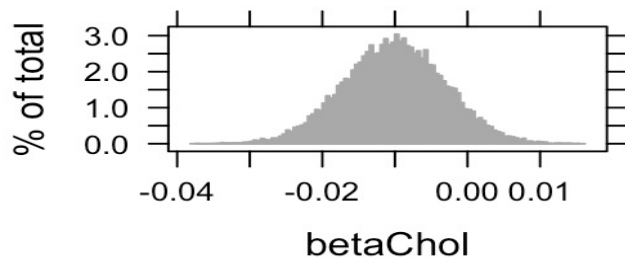
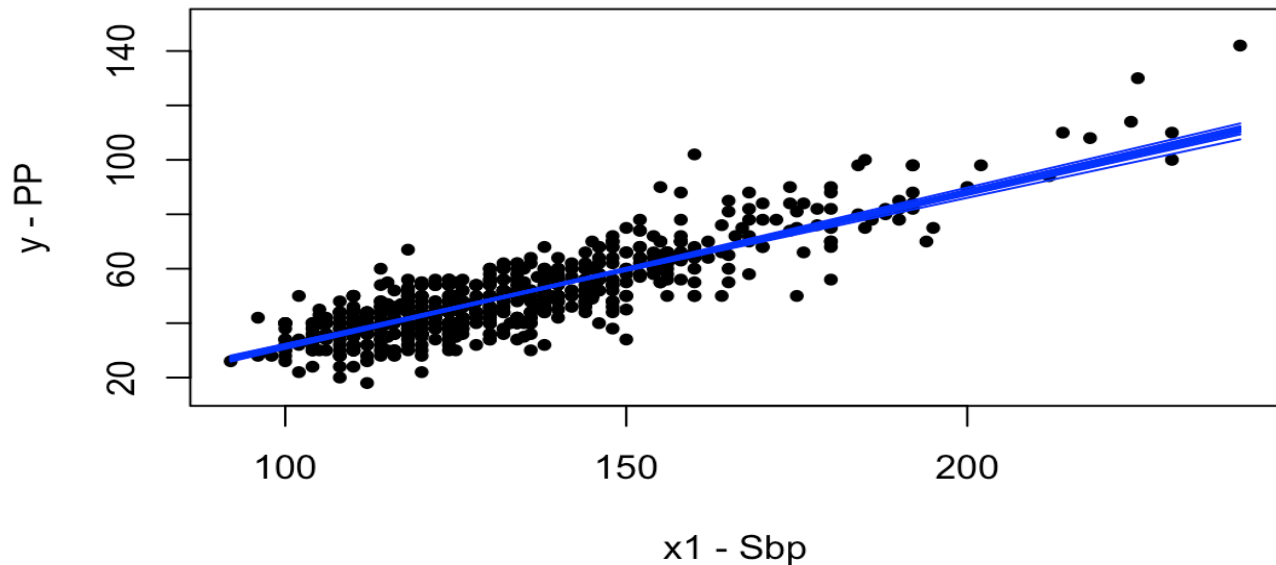# Summary of the posterior distributions M1h

Variables	Mean	Lower95	Upper95
Systolic BP	0.5693*	0.5410	0.5993
Age	0.0870*	0.0134	0.1619
Cholesterol	-0.0101	-0.0238	0.0035

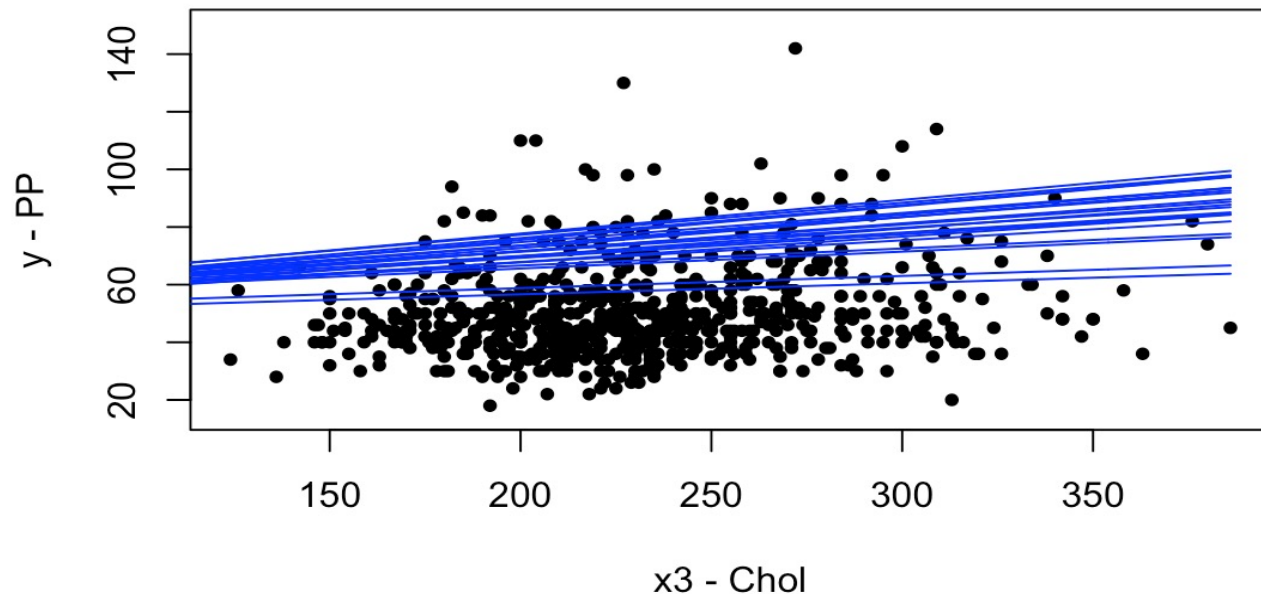# Posterior Predictive Check ("Systolic blood pressure")

Posterior Predictive Check ("Age")

Posterior Predictive Check
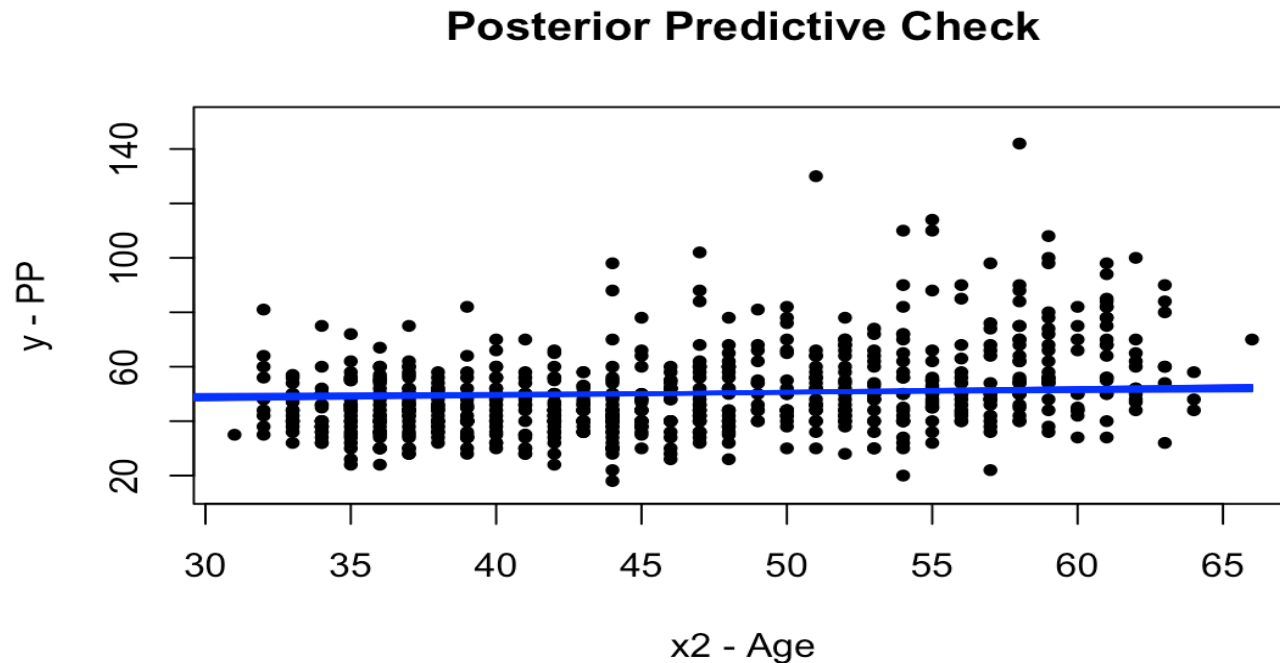
Posterior Predictive Check ("Cholesterol")

Posterior Predictive Check

Summary of the Posterior Predictive Checks

➢ The model appears to capture the relationship between systolic blood pressure and pulse pressure

➢ Also, the relationship between age and pulse pressure is captured fairly well.

➢ The relationship between Cholesterol and pulse pressure is however not clear (although the HDI captures 0).

➢ The PPD shows a positive relationship, but the mean of the posterior is negative.

Normality check (Q-Q Plot)
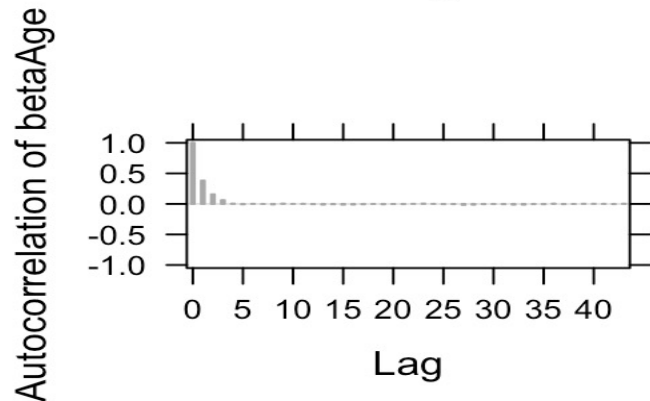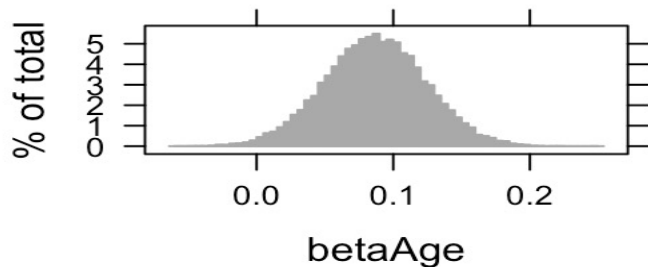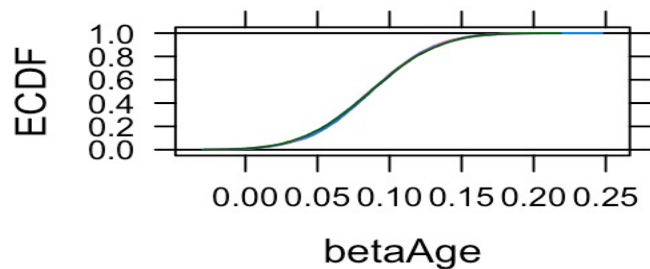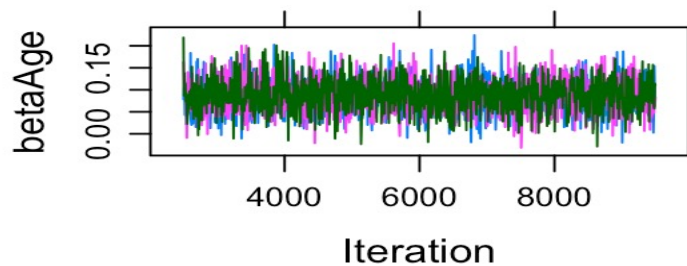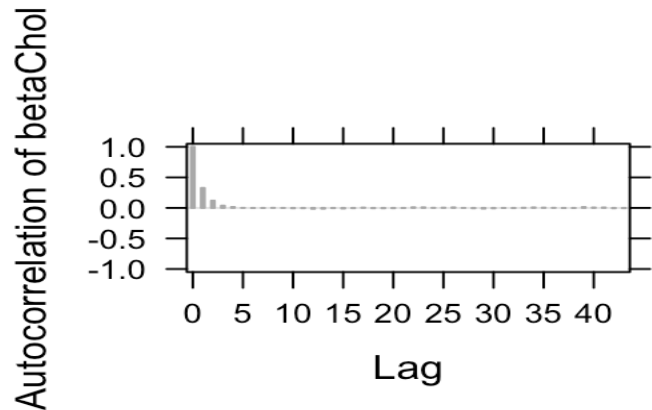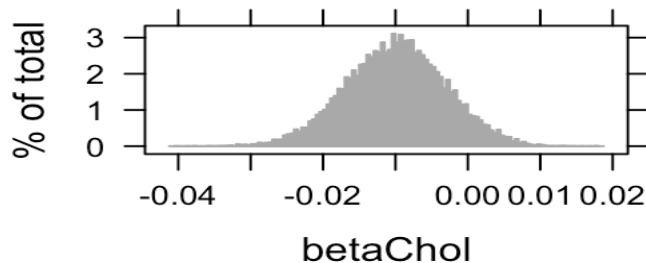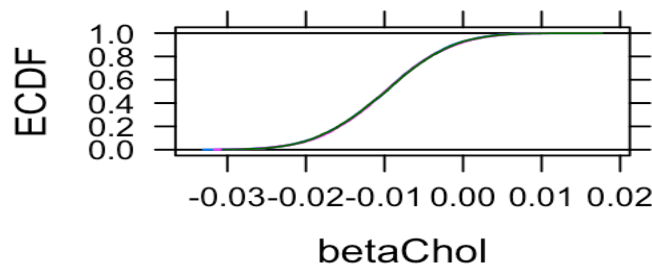

Normal Q-Q Plot
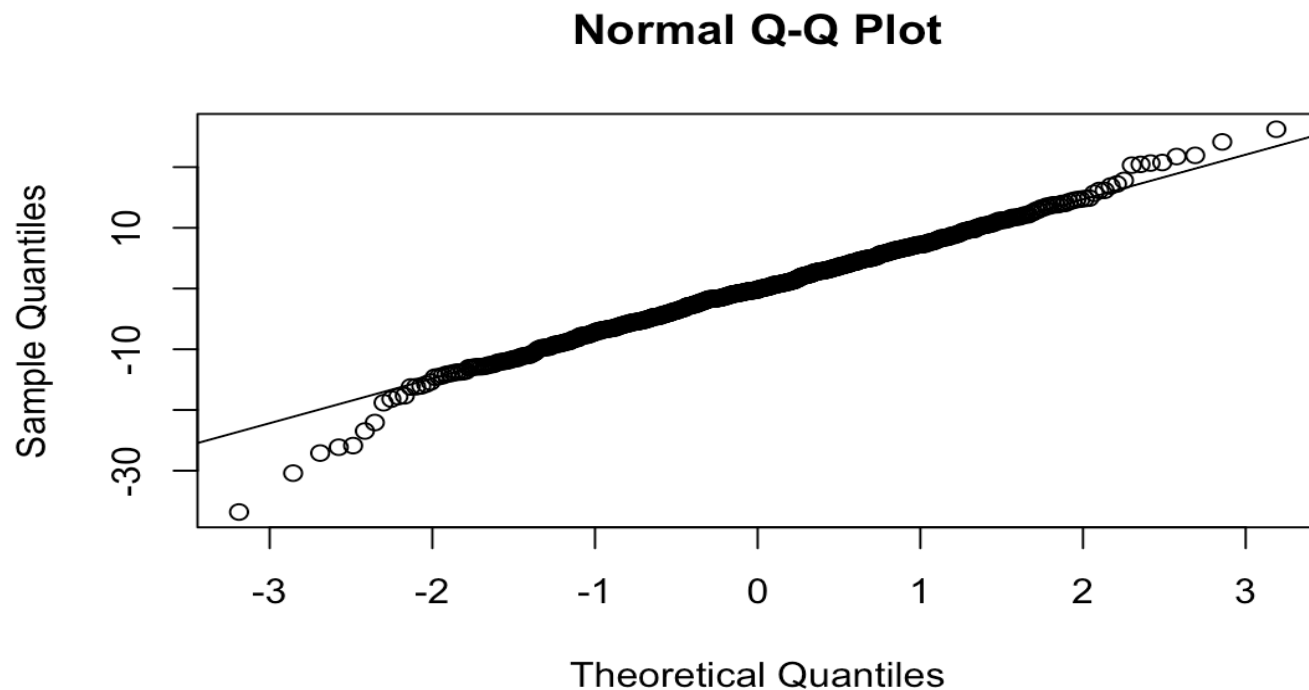
Normality check (Histogram)
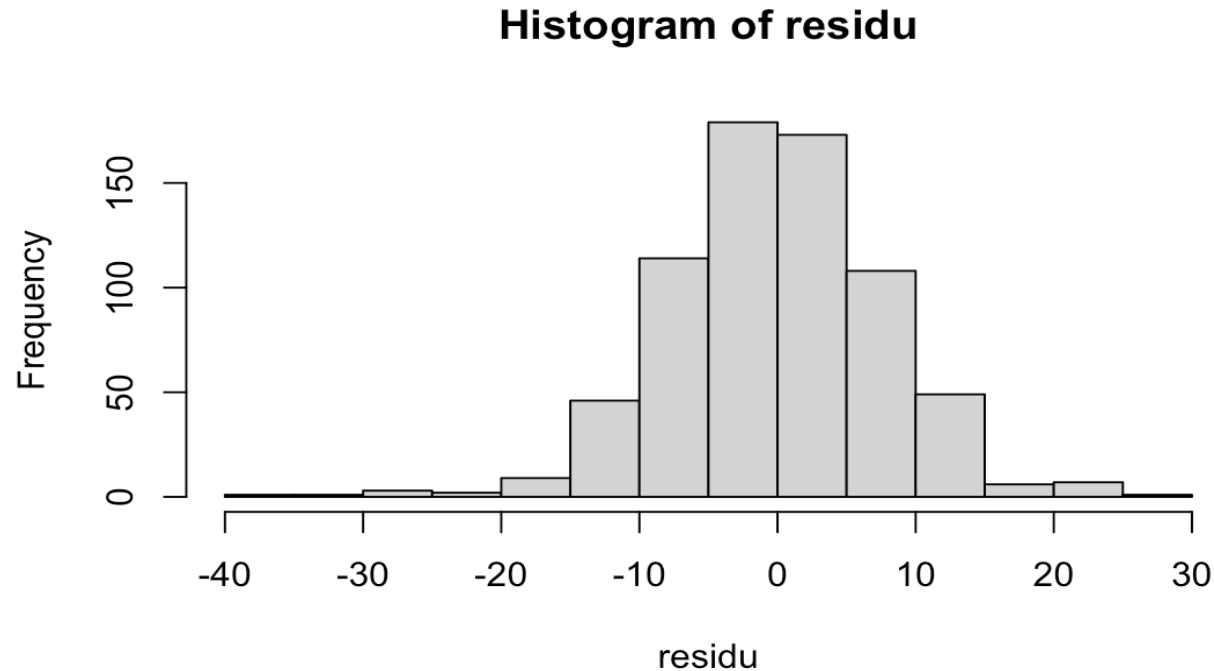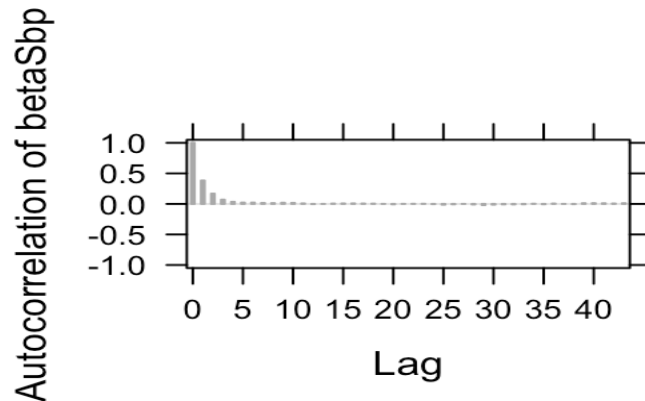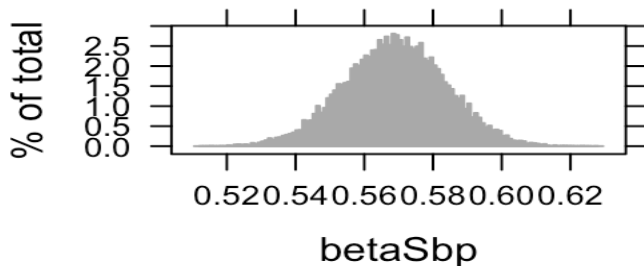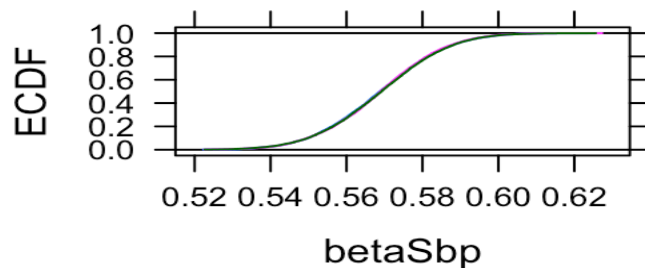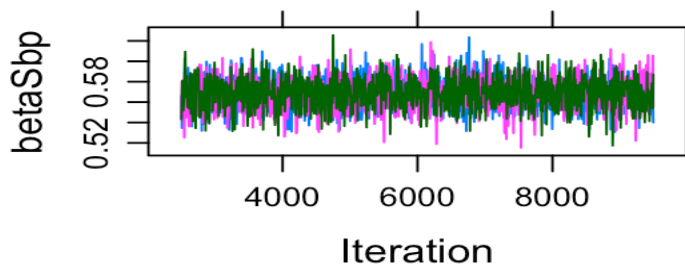
Histogram of residu

Sensitivity analysis (using less informative priors: SD=4)
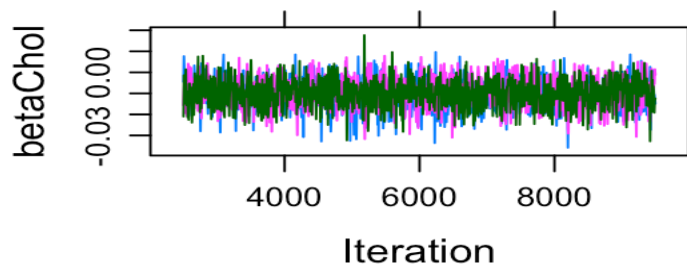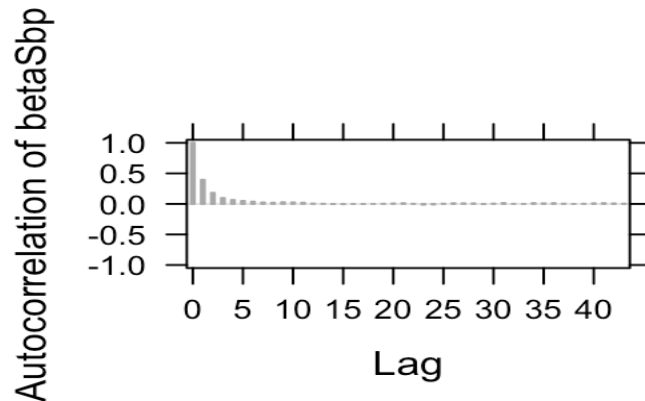
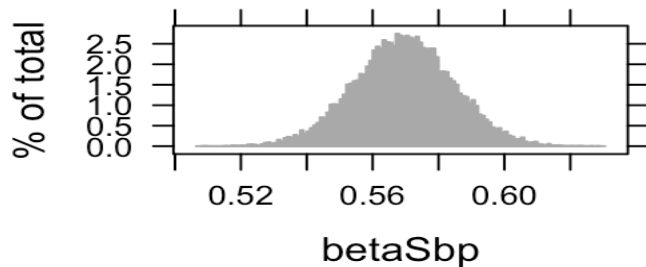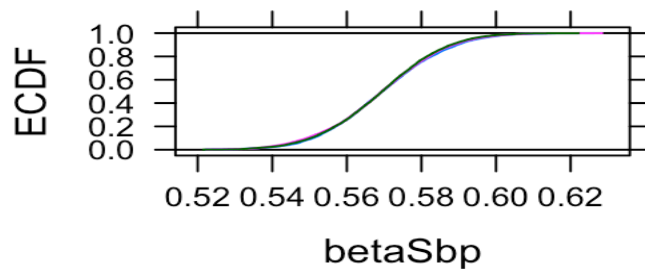# Sensitivity analysis (using less informative priors: SD=4)

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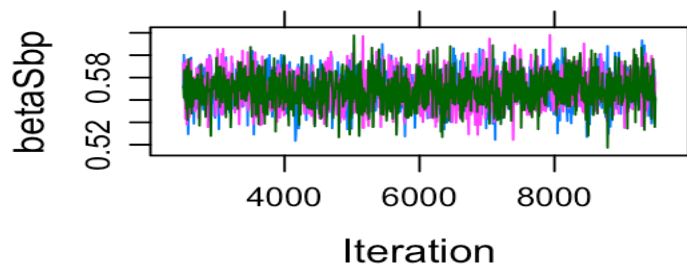
Sensitivity analysis (using less informative priors: SD=4)

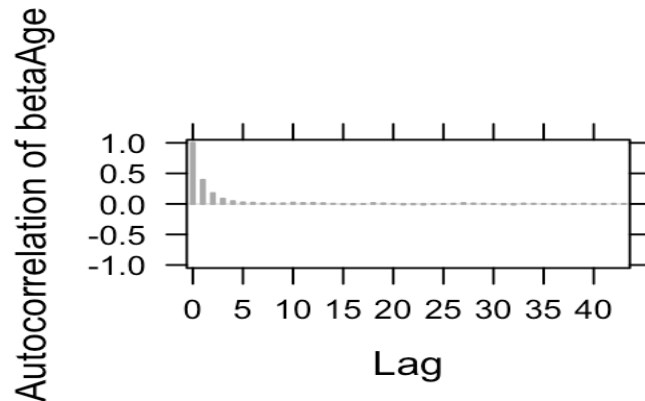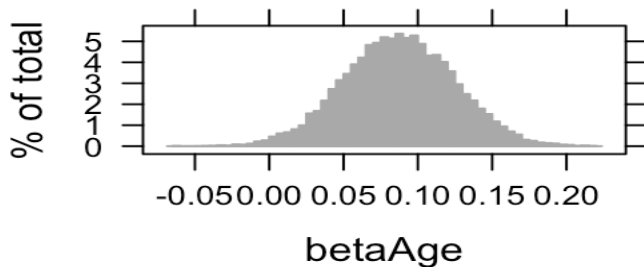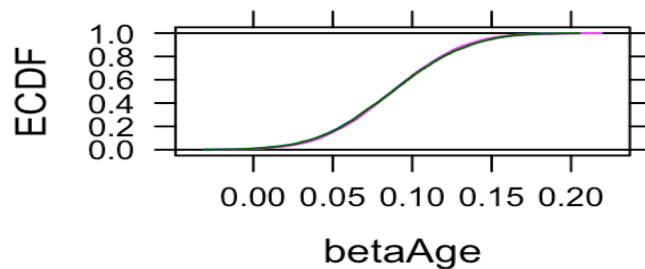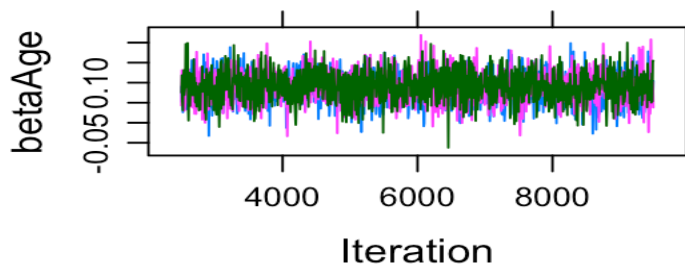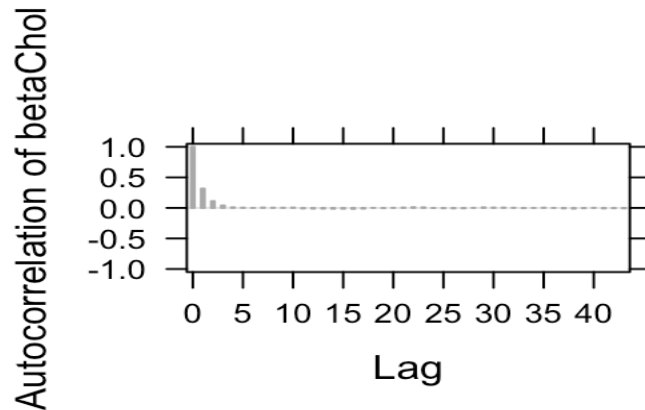# Sensitivity analysis (using more informative prior: SD=0.5)

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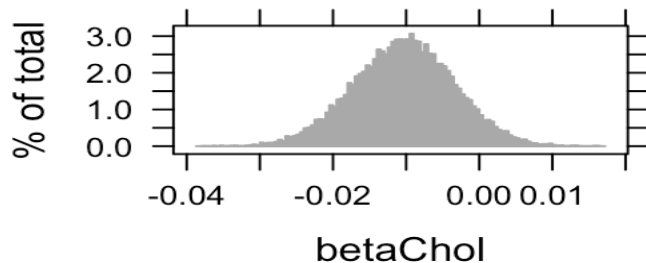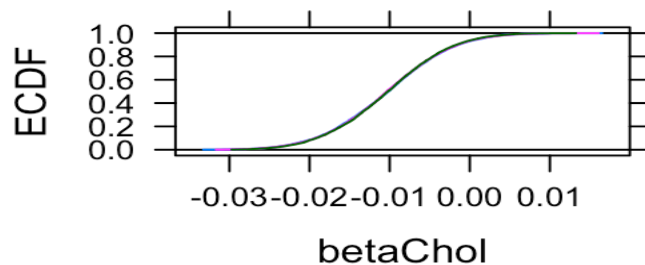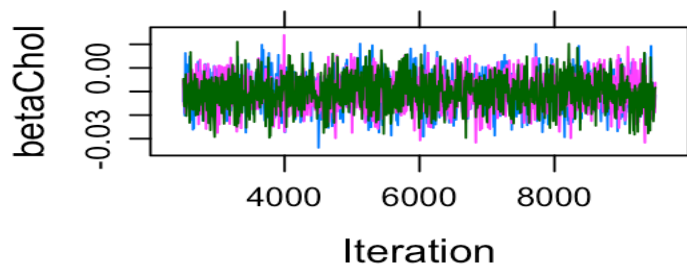
Sensitivity analysis

Variables	Original Mean	Increased Sd from 2 to 4(less informative prior)	Decreased SD from 2 to 0.5 (More informative prior)
Systolic BP	0.5693*	0.5688*	0.5993
Age	0.0870*	0.0867*	0.1619
Cholesterol	-0.0101	-0.0100	0.0035
DIC	1013.90	1014.04	1013.92
PVAF	0.723	0.726	0.721

Summary of findings

➢ An increase in age predicts high levels of pulse pressure

➢ A high systolic blood pressure is associated with high pulse pressure

➢ Cholesterol appears not to have strong relationship with pulse pressure

➢ Results of the sensitivity analysis showed that the findings are generally robust to specification of priors (both informative and non-informative).

Limitations

➢ Old data

Questions for the class

➢ How big of a difference in the results from sensitivity analysis compared to the original results should be of a concern?

➢ Is it purely subjective or there is some literature about that?

References

- Ozyilmaz, A., Bayraktar, Y., Isik, E., Toprak, M., Er, M. B., Besel, F., ... & Collins, S. (2022). The relationship between health expenditures and economic growth in EU countries: empirical evidence using panel fourier toda–yamamoto causality test and regression models. International Journal of Environmental Research and Public Health, 19(22), 15091.

- https://www.cdc.gov/heartdisease/facts.htm#:~:text=Heart%20disease%20is%20the%20leading,groups%20in%20the%20United%20States.&text=One%20person%20dies%20every%2033,United%20States%20from%20cardiovascular%20disease.

- Glynn, R. J., Chae, C. U., Guralnik, J. M., Taylor, J. O., & Hennekens, C. H. (2000). Pulse pressure and mortality in older people. Archives of internal medicine, 160(18), 2765-2772.

Merci !