

Biostatistics 706

Midterm Exam, February 26, 2024

Due Friday, March 8, 5:00 PM.

Please upload your Statistical Analysis Report to Sakai no later than 5 PM on Friday, March 8th.

This is an **individual** assignment so I expect each person to complete their own analysis and report. You may use your group template if you like.

Please limit your document to 10 pages (but shorter is okay too). You will need to make thoughtful choices about what to include and what to leave out.

In this assignment you will explore the role of Vitamin D and blood pressure. Vitamin D is an important fat soluble vitamin that helps the body absorb calcium and phosphorus to build strong bones. Vitamin D supplements are given to prevent or treat bone diseases such as rickets or osteoporosis. Vitamin D is made naturally when skin is exposed to sunlight and there are few dietary sources of Vitamin D. There is debate on the definition of Vitamin D deficiency with no consensus definition. The Institute of Medicine recommended the levels shown in Table 1 (1).

Vitamin D deficiency is relatively common and risk factors for Vitamin D deficiency include being elderly, dark skin, being overweight, a diet low in fish or dairy and limited exposure to sunshine either through sunscreen or by staying indoors. Vitamin D deficiency has been associated in observational studies with a wide variety of health conditions, including musculoskeletal conditions, cancer, diabetes, multiple sclerosis, cardiovascular disease, hypertension and mortality. However, the evidence of these relationships is extremely equivocal for all conditions with the exception of bone health. Clinical trials of Vitamin D supplementation have not shown conclusive benefit of Vitamin D supplementation on most conditions. Thus many questions remain about the effect of Vitamin D on common, chronic conditions.

You will use cross-sectional data from the Chinese Longitudinal Healthy Longevity Study (CLHLS) to explore the relationship between Vitamin D and blood pressure. CLHLS is a study of longevity in China. Long-lived individuals, many of them centenarians, in longevity areas in China have been ascertained and followed over almost 20 years. Middle-aged individuals from these same longevity areas were used as controls. A detailed physical exam and lifestyle questionnaire was administered at each visit. Blood was drawn in a subset of individuals for a battery of biomarkers, including Vitamin D levels. Your dataset includes blood pressure, health conditions, Vitamin D levels and covariates thought to be related to Vitamin D. We are interested in exploring the relationship between Vitamin D levels and blood pressure and whether Vitamin D deficiency is a risk factor for hypertension in this dataset, taking into account other risk factors for hypertension.

Please conduct a statistical analysis to evaluate the follow questions:

- 1) Are any variables related to Vitamin D levels?
- 2) Is Vitamin D level associated with blood pressure?
- 3) Is Vitamin D deficiency associated with hypertension?

Please prepare a Statistical Analysis Report to evaluate these questions. Limit your report to 10 pages including tables and figures.

References

- 1) <https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/>

Table 1: Serum 25-Hydroxyvitamin D [25(OH)D] Concentrations and Health*
[1]

nmol/L**	ng/mL*	Health status
<30	<12	Associated with vitamin D deficiency, leading to rickets in infants and children and osteomalacia in adults
30 to <50	12 to <20	Generally considered inadequate for bone and overall health in healthy individuals
≥50	≥20	Generally considered adequate for bone and overall health in healthy individuals
>125	>50	Emerging evidence links potential adverse effects to such high levels, particularly >150 nmol/L (>60 ng/mL)

* Serum concentrations of 25(OH)D are reported in both nanomoles per liter (nmol/L) and nanograms per milliliter (ng/mL).

** 1 nmol/L = 0.4 ng/mL