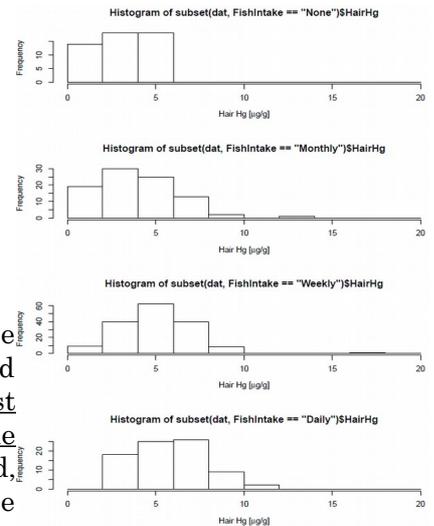


Department _____ Registration No. _____ Name _____

1. Please specify the wrong points in explanation and/or method to analyze and suggest how to improve it (if no wrong point, answer so) for each issues underlined below.

(1) In R district with population size of about 38,000 located along the sea in a developing country, the civil registration system has been established since several decades ago. When we see there with Google Earth, almost equal-sized 50 villages are scattered. Recently the people with high fish and whale intake are reported to suffer from neural damage symptoms. Due to the possibility of mercury poisoning, (A) randomly selected 1% sample of civil registration, 380 residents were interviewed about the frequency of fish/whale intake, such as [1] none or rarely, [2] monthly, [3] weekly, [4] daily, and the hair mercury concentrations of them were measured. The results (of which raw data are available from <http://minato.sip21c.org/fish-Hg-2017.txt>; variables are PID as personal ID number, HairHg as hair mercury concentration, HighHairHg is 1 if HairHg>=5, otherwise 0, and FishIL is one of 4 categories shown above) were summarized below.

Eating fish or whale frequency	N	Median (Hg µg/g hair)	Mean ± SD (Hg µg/g hair)	High Hg ≥5 µg/g hair
1. None	50	3.31	3.14 ± 1.74	8
2. Monthly	90	3.84	3.92 ± 2.21	29
3. Weekly	160	4.97	5.04 ± 2.15	80
4. Daily	80	5.82	5.73 ± 1.94	52



There are two approaches to analyze the relationships between fish/whale intake and hair mercury. First, the independence between High Hg and eating fish/whale frequency can be analyzed. (B) Fisher's exact test resulted in $p < 0.001$ and the null hypothesis was rejected, so that the relationship between the two variables is statistically significant. Second, the effect of fish/whale intake on hair mercury concentration can be analyzed. (C) Welch's one-way ANOVA resulted in F-value of 25.591, first d.f. of 3, second d.f. of 163.13, and $p < 0.001$. Then pairwise comparisons of hair Hg levels between all pairs among 4 fish/whale intake frequencies can be conducted by repeated use of Welch's t-test.

- (A) _____
- (B) _____
- (C) _____

(2) In Japan, to evaluate the effect of long-term intake of the food A (the reduction of blood pressure is expected), an intervention experiment was conducted for 5 hypertension patients, where the only intervention was daily intake of food A for 6 months. The changes of systolic blood pressure (mmHg) between the 2 timings (before intervention and after 6 months) were 160→145, 150→125, 170→155, 155→135, 145→130. The result of paired t-test was $p = 0.0008$, so that the food A is proved to have a significant blood pressure reducing effects.

(3) The gold standard method A can measure the concentration of biochemical marker for disease X, where the concentration exceeds a specific threshold value. A cheaper and more rapid new method B was developed. Validity of B can be confirmed by showing the fact that the difference between the measurements by A and B for the sufficient number of X patients and healthy volunteers is not statistically significant by paired t-test.

(4) The 44 chronic hepatitis patients were randomly divided into 2 groups. Treatment group was treated by prednisolone, the other (control group) was just observed. At the end of the study, 11 patients lived in treatment group, 6 lived in control group, but the result of Fisher's exact test was not significant ($p=0.215$). The months until death or censoring (lived at the end of the study) were recorded in <http://minato.sip21c.org/hepatitis-2017.txt> as **time**, with **flag** (1 if died, 0 if still lived) and **group** (1 for treatment group, 2 for control group). Only for the patients who died during the study, the mean survival months (80 months in 11 treatment group and 31.5 months in 16 control group) were compared by Welch's t-test, then $p=0.02$, so that prednisolone has statistically significant effect of lengthen survival for chronic hepatitis patients.

2. Please explain the prevalence proportion as a disease amount in a population. Explanation for the study design needed to calculate prevalence proportion has to be included.

3. Glucose tolerance test was conducted for 10 healthy volunteers, the blood inorganic phosphate concentration was measured at 6 timings (before glucose intake, just after the glucose intake, 30 min later, 1 hour later, 2 hours later and 3 hours later). Please explain what kind of statistical method to test the change of measurement with time is applicable.

4. Whether the ability of flash memory is improved by tea drinking or not was investigated for 10 healthy volunteers. The result is shown below. Please test whether tea drinking improves flash memory or not. P-value is needed. You can use computer software or calculator, but manual calculation is possible if you use 97.5% point of t-distribution with d.f. 9 is 2.262 and either of $\sqrt{2}=1.414$, $\sqrt{3}=1.732$, or $\sqrt{5}=2.236$.

Scores before drinking tea	7	8	7	9	3	7	5	8	7	6
Scores after drinking tea	9	9	7	10	4	10	6	9	8	10

5. The RCT (Randomized Controlled Trial) to test new drug for abdominal pain relief intended to check the superiority of the new drug over the conventional drug. Based on previous studies, the pain-killer effect of the conventional drug was found in 75% people. If more than 85% people report the pain reduction by taking the new drug, the new drug has clinical importance. Please calculate needed sample size for this RCT for 2-tailed chi-square test with 5% significance level and 80% power, and assuming the same size of 2 groups.

* Please evaluate this lecture by URI-BOH-Net.