CHI-SQUARE TEST OF INDEPENDENCE, ODDS AND RATIOS

Question 1.
We wish to investigate, in a population, if the stress is a risk factor for depression. A sample of 500 people has been observed and the results presented in the next table were obtained:

	Depression $^+$	**Depression $^-$**
RF$^+$	100	120
RF$^-$	70	210

Is the stress a risk factor for depression?

1. What is the H_0? H_0:
2. What is the H_1? H_1:
4. Significance level: $\alpha = 0.05$
5. Rejection region: $[3.84, \infty)$
6. Compute the expected contingency table.
7. Calculate the χ^2 parameter

Hint: The test statistic is given by: $\chi^2 = \sum_{i=1}^{LC} \frac{(f_i^o - f_i^t)^2}{f_i^t}$, where f_i^o and f_i^t are observed and expected frequency respectively.

8. Interpret the results from statistical and clinical point of views.

Question 2 (Source: http://www.brettscaife.net/statistics/introstat/06risk/exercise.html)
The following data are taken from the paper Caries prevalence in northern Scotland before and 5 years after, water defluoridation (Stephen et al., 1987, BDJ 163: 324-326). They show the social composition of children recruited to two arms of the study one before and one after water defluoridation. What is the probability that we don't know the social class of a child in the fluoridated arm? What is the probability that a child in the defluoridated arm is from social class III?

Social class	Fluoridated	Defluoridated
I & II	16	32
III	45	53
IV & V	32	22
Not known	13	19
Total	106	126

Question 3
A recent MDentSci project was looking at a number of risk factors thought to be associated with the health of oral implants in a population of elderly patients. One factor considered was smoking. The table below shows the number of healthy and non-healthy implants for smokers an non-smokers. Calculate and interpret the risk ratio and the odds ratio. The patients were selected for the study on the basis of the health of their implants (a case-control study). Which of the two ratios you have calculated would you use to report your results? Why?

A $\chi 2$ test was performed on these data, the results were: $\chi 2 = 2.023$, df (degrees of freedom) = 1, $p = 0.16$. Interpret these results.

	Healthy implant		
	Yes	No	Total
Smoker	32	48	80
Non-smoker	10	7	17
Total	42	55	97

Question 4

A study (Erosion of dental enamel among competitive swimmers at a gas-chlorinated swimming pool, Centerwall et al., 1986, Am. J. Epid. 123: 641-647) was carried out to see if swimming in chlorinated water was linked to erosion of dental enamel. 49 swimmers with erosion of dental enamel (cases) were recruited along with 245 swimmers without erosion (controls). The data are summarized below.

	Erosion of dental enamel		
Hours of swimming per week	Yes	No	Total
6 or more	32	118	150
less than 6	17	117	134
Total	49	235	284

Calculate the appropriate ratio to show the effect of excessive swimming on erosion of dental enamel. A test was performed on these data, the results were: $\chi 2 = 4.802$, df = 1, p = 0.03. Interpret these results.

Question 5

The following data from a prospective study are taken from the paper Dental caries in pre-school children: associations with social class, tooth brushing habit and consumption of sugars and sugar-containing foods (Gibson & Williams 1999, Caries Research 33: 101-113). They show the number of children with caries according to three different risk factors: social class; tooth brushing frequency; and frequency of consumption of sugary foods. Which of these three factors has most impact on the likelihood of a child developing caries?

	Caries		
Social class	Yes	No	Total
Manual	162	574	736
Non-manual	64	574	638
Total	226	1148	1374

	Caries		
Brushing frequency	Yes	No	Total
0 or 1 per day	114	477	591
>1 per day	112	671	783
Total	226	1148	1374

	Caries		
Sugary foods	Yes	No	Total
<3 times a day	61	347	408
3 or more times a day	165	801	966
Total	226	1148	1374