Deacon's Challenge
No 177 - Answer

In a random sample of 100 pathology request cards, 36 were found to have an error associated with either the name or date of birth. What is the probability that more than 42% of pathology request cards have such errors?

The probabilities (P) for the z-scores of the upper tail of a normal distribution are:

P	*0.31*	*0.23*	*0.16*	*0.11*	*0.067*	*0.040*	*0.023*
z	*0.5*	*0.75*	*1.0*	*1.25*	*1.5*	*1.75*	*2.30*

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There are only two possible observations for each request card – either an error or no error. Therefore any sample of request cards will form part of a binomial distribution. When the sample size is large (as in this case) the data will approximate to a normal distribution in which:

Mean = np
Variance = $np(1-p)$
Standard deviation = $\sqrt{[np(1-p)]}$
where v = number in sample
p = probability of an error
$(1-p)$ = probability of no error

Since the sample size is large (n=100) the number of cards with an error (36) is a reasonable estimate of the mean and the probability (p) of an error is therefore 36/100 = 0.36. The probability of drawing a card with no error (1-p) is (1-0.36) = 0.64.

Therefore standard deviation = $\sqrt{[100 \times 0.36 \times 0.64]} = \sqrt{23.04} = 4.8$

The data can be treated as normally distributed with a mean of 36 and a standard deviation of 4.8. To calculate the probability that request cards drawn at random from the population will contain more than 42% with errors a z-score is calculated in the usual way:

$$z = \frac{42 - \text{mean}}{SD} = \frac{42 - 36}{4.8} = \frac{6}{4.8} = 1.25$$

From tables of the upper tail of the z-distribution (since we are only interested in the probability for the mean +1.25 SD) the probability of drawing 42% of cards with an error is **0.11.**

Question 178

One definition of Acute Kidney Injury stage 1 is an increase in serum creatinine of ≥26 µmol/L within 48 hours. Assuming the within-individual biological variation of creatinine is 4.7%, calculate the maximal permissible analytical variation to allow ≥95% confidence that an increase in measured creatinine from 150 to 176 µmol/L is genuine. Table of z-distribution:

P (two sided)	0.10	0.05	0.02	0.01	0.002	0.001
z	1.65	1.96	2.33	2.58	3.09	3.29

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