Calculation Skills: Lyme Disease

Lyme Disease UK (2017) identify Lyme disease as 'the most common tick-borne disease in the northern hemisphere' and is defined by NHS Choices (2107) as a bacterial infection that is spread to humans by infected ticks. NICE (2015) identify that Lyme disease is caused by the group of bacteria known as Borrelia burgdorferi sensu lato and is transmitted to humans by Ixodes ticks and most commonly, by nymphs.

Question 1

Lyme Disease UK (2107) report that out of the UK's population (currently 65.64 million) there about 1000 confirmed cases per year in the UK, although it is suspected by Public Health England (2014), that the incidence is around 3000 per year.

(i) What is the percentage difference between the lower and the higher estimations of the UK incidence?

(ii) What is the mean percentage of the UK's population that is likely to have Lyme disease? (rounded to 3 decimal places)

Question 2

NICE (2015) report successful treatment of early Lyme disease with antibiotics, with between 90 and 95% showing resolution of symptoms. In a group of 75 patients diagnosed with early Lyme disease and treated with antibiotics, how many, based upon the average success rate, would show resolution of symptoms (rounded up or down to the nearest whole number)?

Question 3

Public Health England (2014) recommend that Lyme disease should be treated with one of the antibiotics in table 1, for 2 weeks. In the event of facial palsy, treatment should continue for 3-4 weeks (PHE, 2014).

Table 1: Antibiotic Regime for Treatment of Lyme Disease (PHE, 2014)

Antibiotic	**Dose**	**Frequency**	**Available strengths**
Doxycycline	100mg	Twice daily	100mg
Amoxicillin	500mg	Three times daily	250mg, 500mg
Cefuroxime	500mg	Twice daily	250mg

(i) Which drug would require the prescriber to prescribe a total of 56 tablets or capsules in order for the patient to complete the recommended 2 week course of treatment?

(ii) In the event of Lyme disease causing facial palsy and the minimum recommended treatment length implemented, which drug would require the prescriber to prescribe 63 tablets/capsules to complete the course of treatment?

Question 4

NICE (2015) state that 15% of people treated for Lyme disease with antibiotics, develop a reaction to the toxins released as the bacteria die (known as a Jarisch-Herxheimer reaction). In a population of 250 patients who had been diagnosed with Lyme disease, 74% were symptomatic and received antibiotics.

How many patients were likely to have suffered a Jarisch-Herxheimer reaction? Round your answer up or down to the nearest whole.

Question 5

Lyme disease can lead to the development of arthritis and this can occur up to 2 years after initial onset of the symptoms of Lyme disease (World Health Organisation, 2018). Arvikar and Steere (2015) report that prior to the use of antibiotic therapy for the treatment of Lyme disease, up to 60% of infected patients went on to develop Lyme disease related arthritis. Based upon the lowest UK incidence figure from question 1, and assuming this has been constant, how many people in the UK would likely to have Lyme arthritis since (and including) 1974 to (and including) 2017 if antibiotic treatment had not been available?

Answers

Question 1

(i) The difference is 2000 which is 200%

(ii) Mean number per year is 1000 + 3000 = 4000
4000 ÷ 2 = 2000 per year

(2000 ÷ 65640000) x 100 = 0.003%

Question 2

Average success rate = (90+95) ÷ 2 = 92.5

1% of the patients = 75 ÷ 100 = 0.75

92.5 % = 0.75 x 92.5 = 69.375

69 patients (rounded down)

Question 3

(i) Cefuroxime.
Daily dose = 1000mg (4 tablets per day)
Course = 14 x 4 = 56

(ii) Amoxicillin (assuming 500mg capsules are prescribed).
Daily dose = 1500mg (3 capsules).
Course = 3 x 21 = 63 capsules

Question 4

74% of 250 patients treated = 185 patients treated

15% of treated patients with Jarisch-Herxheimer reaction = 27.75 (28 rounded up)

Question 5

Incidence = 1000

No of years = 44

Total infected with Lyme disease = 44000

60% of 44,000 = 26,400

References

Arvikar, S.L. and Steere, A.C. (2016) Diagnosis and treatment of Lyme arthritis, *Infect Dis Clin North Am*. 29(2): 269-280

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