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Creators	Nuttall, Dilyse

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Calculations Skills: Inducing Remission in Crohn's Disease

Affecting approximately 115,000 people in the UK (Crohn's & Colitis UK, 2013), Crohn's disease is a chronic inflammatory disease of the gastrointestinal (GI) tract, presenting with periods of remission and relapse (NICE, 2015). The inflammation is intermittent, with sections of unaffected GI tract between the inflamed sections. Symptoms of Crohn's disease vary between individuals but include loss of appetite, mouth ulceration, weight loss, diarrhoea, fatigue, abdominal pain and anaemia (Crohn's & Colitis UK, 2013). As well as the associated psychological impact of Crohn's disease, it can also result in a range of physical complications including malnutrition, intestinal strictures, abscesses, fistulas and cancers (NICE, 2015).

Question 1

- (i) What is the ratio of people in the UK (with a population of 65.1 million) with Crohn's disease to those without?
- (ii) Manchester has a population of 527,239. Based on the ratio identified in the previous answer, identify how people in Manchester are likely to have Crohn's disease?

Question 2

Rachel, a 38 year old nurse, has been diagnosed with Crohn's disease. In line with NICE (2016) guidance, she is to be prescribed monotherapy of a glucocorticosteroid with the aim of inducing remission. Both prednisilone and methylprednisilone are deemed appropriate, although budesonide could be given in the event of intolerance to prednisilone and methylprednisolone.

- (i) What would be the cost of a 2 week treatment of budesonide (calculated on price per capsule)? Round the final cost up or down to the nearest pence.
- (ii) What combination of methylprednisilone tablets would be required to provide the maximum daily dose with the fewest tablets?
- (iii) What would be the cost of the mid-range dose of prednisolone (using the fewest tablets) for 7 days treatment (calculated on price per tablet rounded up or down to the nearest pence)?

Drug	Dose	Cost
Prednisilone	20-40mg daily	10mg tablets £2.72 28 tablets 20mg tablets £5.43 28 tablets 30mg tablets £8.15 28 tablets
Methylprednisilone	2-40mg daily	2mg tablets £3.88 30 tablets 4mg tablets £6.19 30 tablets 16mg tablets £17.17 30 tablets
Budesonide	9mg	3mg capsules £75.05 100 capsules

Question 3

Ben, a 28 year old mechanic, weighing 70kg, is experiencing his second exacerbation of Crohn's disease in 8 months. In line with NICE (2016) guidance, he is to be prescribed an add-on treatment to a glucocorticosteroid. Azathioprine and mercaptopurine are suitable add-on treatments and the recommended dose is identified in table 2.

- (i) What would be the maximum daily dose of azathioprine for Ben?
- (ii) Based on the minimum daily dose of mercaptopurine for Ben, how much of the drug (in grams) would he have taken in a 3 week period?

Add-on treatment	Dose
azathioprine	2-2.5mg/kg daily
mercaptopurine	1-1.5mg/kg daily

Question 4

Suzie, a 25 year old teacher, has recently been receiving monotherapy for her third relapse in 12 months but this has not achieved remission. Treatment of previous relapses identified an intolerance to azathioprine and mercaptopurine, so she is to be prescribed methotrexate as an add-on treatment. The dose of methotrexate required is 25mg once weekly until remission is induced followed by a maintenance dose of 15mg once weekly.

- (i) If Suzie receives 25mg of methotrexate for 3 weeks, followed by 5 weeks on the maintenance dose, how much methotrexate would she have taken over the eight week period?
- (ii) What is the mean weekly dose over this period?

Question 5

Despite conventional therapy of monotherapy followed by a period of treatment with an add-on drug, Jacob has had little response and is therefore to commence on adalimumab as a monotherapy in order to induce remission. This is to be administered by sub-cutaneous injection. Table 3 identifies the recommended regime.

Week	Dose
1	80mg
3	40mg
Week 5 onwards, maintenance dose 2 weekly (increased if necessary to once weekly)	40mg

- (i) Assuming the regime in table 3 is followed and the maintenance dose remains at 2 weekly intervals, how much adalimumab will Jacob have received over a 10 week period?
- (ii) If the maintenance dose had been changed to weekly from week 7 onwards, how much adalimumab will Jacob have received over a 10 week period?

Answers

Question 1

(i) $65,100,000 \div 115,000 = 566$

Ratio = 1:566

(ii) $527,239 \div 566 = 932$ (rounded up)

Question 2

- (i) 100 capsules = £75.05
1 capsule = $7505 \div 100 = 75.05\text{p}$
Required number of tablets = $3 \times 14 = 42$
 $42 \times 75.05\text{p} = £31.52$
- (ii) Required dose = 40mg
 $(16\text{mg} \times 2) + (4\text{mg} \times 2) = 40\text{mg}$
- (iii) Mid-range dose = 30mg
28 tablets = £8.15
1 tablet = $£8.15 \div 28 = 29\text{p}$ (rounded down)
 $7 \times 29\text{p} = £2.04$

Question 3

- (i) $2.5\text{mg} \times 70 \text{ (kg)} = 175\text{mg}$ daily
(ii) $1\text{mg} \times 70 \text{ (kg)} \times 21 \text{ (days)} = 1470\text{mg} / 1.47\text{g}$

Question 4

- (i) $(25\text{mg} \times 3) + (15\text{mg} \times 5) = 75\text{mg} + 75\text{mg} = 150\text{mg}$
- (ii) Mean = sum of all doses divided by number of doses
 $150\text{mg} \div 8 = 18.75\text{mg}$

Question 5

- (i) $80 + 40 + 40 + 40 + 40 = 240\text{mg}$
(ii) $80 + 40 + 40 + 40 + 40 + 40 + 40 = 320\text{mg}$

References

Crohn's & Colitis UK (2013) *Crohn's Disease*. On-line available at:
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