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## Calculation Skills: Blood Glucose Lowering Therapy in Adults with Type 2 Diabetes

Approximately 90% of cases of diabetes are of Type 2 diabetes, where the body either becomes resistant to the effect of the insulin produced or produces inadequate amounts of insulin (Public Health England, 2014). Incidence of diabetes is rising, with 6% (2.7million) of people aged 17 years or over in England in 2013, diagnosed with diabetes. A range of complications are associated with type 2 diabetes, including retinopathy, neuropathy, nephropathy and cardiovascular disease (Diabetes UK, 2015). As such, the effective management of type 2 diabetes is essential and should be individualised and underpinned by patient education (National Institute of Health and Care Excellence [NICE], 2013).

### Question 1

Based on the incidence figures above, what is the total population of people aged 17 years and over, on which these figures are based?

### Question 2

Charlotte is a 46 year old administrator who was diagnosed with type 2 diabetes 10 months ago. Although classed as obese on diagnosis, she was receptive to the support given to assist in her weight loss and has maintained a normal weight for the past 4 months. However, despite making appropriate lifestyle changes, her HbA1c continues to range from 48-50 mmol/mol. It is agreed that she should commence drug therapy, which based on NICE (2015) guidance will be standard-release metformin.

(i) The regime agreed is 500mg daily for 1 week, 500mg twice daily for one week and then 500mg three times daily thereafter. How many 500mg tablets will need to be prescribed to complete the first 7 weeks of treatment?

(ii) Metformin tablets are available in two pack sizes: 28-tab pack costing 87p and 84-tab pack costing £1.00. What will be the most cost-effective pack combination for this 7 week treatment period (assuming packs will **not** be split) whilst prescribing the **least** number of tablets over the required amount?

### Question 3

Roger is a 31 year old retail manager who was diagnosed with type 2 diabetes 5 months ago. He has been unable to tolerate standard-release metformin and following an unsuccessful trial of modified-release metformin, it is agreed that sulfonylurea treatment is appropriate.

Sulfonylurea	Dose	Cost
Glibenclamide	5mg daily adjusted according to response, max. 15mg daily	2.5mg 28-tab pack £18.50 5mg 28-tab pack 97p
Gliclazide	40-80mg daily adjusted according to response up to 160mg single dose, max. 320mg daily in divided doses	40mg 28-tab pack £3.36 80mg 28-tab pack £1.04 80mg 60-tab pack £2.23
Glimepiride	1mg daily adjusted according to response, max. 4mg	1mg 30-tab pack £1.20 2mg 30-tab pack £1.12 3mg 30-tab pack £7.25 4mg 30-tab pack £1.33
Glipizide	2.5-5mg daily, adjusted according to response up to 15mg single dose, max. 20mg in divided doses	5mg 56-tab pack £5.36
Tolbutamide	0.5-1.5g (max. 2mg) in divided doses	500mg 28-tab pack £22.64

Use the data presented in the table to answer the following questions.

(i) If Roger is prescribed Glibenclamide 5mg daily for 4 weeks and this was increased to a maintenance dose of 7.5mg daily, how many tablets will he have taken in a 16 week period (assuming a tablet combination which requires the least number of tablets to be taken)?

(ii) If Roger's prescribed regime was Tolbutamide at a maintenance dose of 1.5mg daily (divided into three equal doses), how many packs (un-split) would he need for the period 1<sup>st</sup> March 2016 to 31<sup>st</sup> July 2016?

(iii) If Roger is prescribed Glimepiride with the following regime, assuming he has only 1mg tablets available to him in the first 3 weeks and 3mg tablets thereafter, what will be the cost of this 14 week treatment (assuming packs are not split)?

Weeks 1 & 2 - 1mg daily

Week 3 - 2mg daily

Weeks 4-14 (inclusive) – 3mg daily

(iv) What would be the cost difference for 2 months (assuming 30 days per month) treatment with a daily 160mg single dose of Glicazide or a daily dose of Glipizide 15mg?

## Answers

### Question 1

Based on the incidence figures above, what is the total population of people aged 17 years and over, on which these figures are based?

$$6\% = 2700,000$$

$$1\% = 2700,000 \div 6 = 450,000$$

$$100\% = 450,000 \times 100 = 45,000,000$$

Total population is 45 million

### Question 2

(i) How many 500mg tablets will need to be prescribed to complete the first 7 weeks of treatment?

Week 1: 1 tablet per day = 7 tablets

Week 2: 2 tablets per day = 14 tablets

Week 3 -7: 3 tablets per day = 21 tablets x 5 weeks = 105 tablets

Total:  $7 + 14 + 105 = 126$

(ii) What will be the most cost-effective pack combination for this 7 week treatment period (assuming packs will **not** be split) whilst prescribing the **least** number of tablets over the required amount?

Required tablets = 126

Possible combinations:

5 x 28 pack (total 140 tablets) =  $5 \times 87\text{p} = \text{£}4.35$

1 x 84 pack + 2 x 28 pack (total 140 tablets) =  $\text{£}1.00 + (2 \times 87\text{p} = \text{£}1.74) = \text{£}2.74$

2 x 84 pack (total 168 tablets) =  $\text{£}2.00$  – this is the most cost-effective.

### Question 3

(i) If Roger was prescribed Glibencamide 5mg for 4 weeks and this was increased to a maintenance dose of 7.5mg, how many tablets will he have taken in a 16 week period (assuming a tablet combination which requires the least number of tablets to be taken)?

1<sup>st</sup> 4 weeks = 1 (5mg) tablet daily x 28 days = 28 tablets

Weeks 5-16 = (1 x 5mg tablet + 1 x 2.5mg tablet) x 84 days =  $2 \times 84 = 168$  tablets

Total tablets =  $28 + 168 = 196$

(ii) If Roger's prescribed regime was Tolbutamide at a maintenance dose of 1.5mg daily (divided into three equal doses), how many packs (un-split) would he need for the period 1<sup>st</sup> March 2016 to 31<sup>st</sup> July 2016?

Number of days = 31 + 30 + 31 + 30 + 31 = 153 days

Tablets per day = 3

Total tablets required = 153 x 3 = 459

Packs required = 459 ÷ 28 = 16.4 = 17 un-split packs

(iii) If Roger is prescribed Glimepiride with the following regime, assuming he has only 1mg tablets available to him in the first 4 weeks and 3mg tablets thereafter, what will be the cost of this 14 week treatment (assuming packs are not split)?

Weeks 1 & 2 - 1mg daily

Week 3 - 2mg daily

Weeks 4-14 (inclusive) – 3mg daily

Weeks 1 & 2 = 14 1mg tablets + Week 3 = 14 1mg tablets = 28 tablets (so 1 x 30-tab pack) = £1.20

Weeks 4 -14 = 1 x 3mg tablet x 77 days = 77 tablets (so 3 x 30-tab pack)  
3 x £7.25 = £21.75

Total cost 1.20 + 21.75 = £22.95

(iv) What would be the cost difference for 2 months (assuming 30 days per month) treatment with a daily 160mg single dose of Glicazide or a daily dose of Glipizide 15mg?

Glicazide:

Daily dose: 160mg = 2 x 80mg tablets

60 days treatment = 2 x 60 = 120 tablets

Packs required = 120 ÷ 60-tab pack = 2

Cost = 2 x £2.23 = £4.46

Glipizide:

Daily dose: 15mg = 3 x 5mg tablets

60 days treatment = 3 x 60 = 180 tablets

Packs required = 180 ÷ 56-tab pack = 3.2 (4 un-split packs)

Cost = 4 x £5.36 = £21.44

Cost difference = 21.44 – 4.46 = £16.98

## **References**

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