S6 Health Management and Social Care Practice Paper (Paper 2)

S6 | Health Management and Social Care | Time: 75 minutes | Total: 100 marks | 24 questions

Part A Epidemiological Measures and Age Standardisation (18 marks)

Unless stated otherwise, express rates per 100,000 population or as percentages, and show your steps.

1. A district has a mid-year population of 250,000. During the year 1,250 new cases were diagnosed and 3,000 people were still living with the disease at year end. Find (a) the incidence rate per 100,000 population; (b) the point prevalence at year end as a percentage and per 100,000. (6 marks)

Answer: (a) Incidence = 1,250 / 250,000 x 100,000 = 500 per 100,000; (b) prevalence = 3,000 / 250,000 = 1.2%, i.e. 1,200 per 100,000. Incidence counts only new cases while prevalence counts all existing cases, so prevalence also depends on disease duration.

2. Among 1,000 smokers 120 developed the disease; among 1,000 non-smokers 30 did. Find the relative risk, the attributable risk in percentage points and the attributable fraction in the exposed. (4 marks)

Answer: Attack rates: smokers 12%, non-smokers 3%. RR = 12% / 3% = 4.0; attributable risk = 9 percentage points; attributable fraction = 9 / 12 x 100% = 75%, so about three quarters of cases among smokers are attributable to smoking.

3. In a case-control study 60 of 100 cases and 20 of 100 controls reported exposure. Find the odds ratio and interpret it. (4 marks)

Answer: Odds ratio = (60 x 80) / (40 x 20) = 4,800 / 800 = 6.0. The odds of disease among the exposed are about six times those among the unexposed, a strong association. A case-control design cannot give incidence rates directly, so the odds ratio is used instead of the relative risk.

4. Direct standardisation: the standard population is 80% aged 0-64 and 20% aged 65 or above. In the district, 220,000 people aged 0-64 had 440 deaths and 30,000 aged 65+ had 1,200 deaths. Find the crude death rate and the age-standardised death rate per 1,000 (two decimal places) and explain the difference. (4 marks)

Answer: Crude rate = (440 + 1,200) / 250,000 x 1,000 = 6.56 per 1,000; age-specific rates are 2 and 40 per 1,000, so the standardised rate = 0.8 x 2 + 0.2 x 40 = 9.6 per 1,000. The standardised rate is much higher because the district population is far younger than the standard population, which pulls the crude rate down.

Part B Screening and Biostatistics (16 marks)

Give sensitivity, specificity and predictive values as percentages to one decimal place; use 95% confidence intervals with z = 1.96.

5. A person is 1.60 m tall and weighs 76.8 kg. Find the body mass index to one decimal place and classify it using Hong Kong Chinese cut-offs (23 or above overweight, 25 or above obese). (4 marks)

Answer: BMI = 76.8 / 1.60 squared = 76.8 / 2.56 = 30.0, which is obese. BMI uses only height and weight and does not separate fat from muscle, so athletes and older adults also need waist circumference and body composition assessment.

6. In a screening programme 10,000 people were tested and 500 had the disease. Sensitivity was 90% and specificity 95%. Find (a) the number of true positives; (b) the number of false positives; (c) the positive predictive value. (4 marks)

Answer: (a) True positives = 500 x 90% = 450, false negatives 50; (b) of the 9,500 without disease, false positives = 9,500 x 5% = 475; (c) PPV = 450 / (450 + 475) x 100% = 48.6%. Even with good sensitivity and specificity, PPV is low when prevalence is low.

7. In a randomised controlled trial the two-year event rate was 20% in the control group and 14% in the treatment group. Find the absolute risk reduction in percentage points and the number needed to treat. (4 marks)

Answer: ARR = 20% - 14% = 6 percentage points; NNT = 1 / 0.06 = 16.7, so about 17 patients must be treated to prevent one event.

8. A sample of 100 people has a mean systolic blood pressure of 100 mmHg and a standard deviation of 15 mmHg. Find the 95% confidence interval for the mean. (4 marks)

Answer: Standard error = 15 / square root of 100 = 1.5; CI = 100 plus or minus 1.96 x 1.5 = 97.1 to 102.9 mmHg. The interval expresses the precision of the estimate; larger samples give narrower intervals.

Part C Cost-effectiveness and Budget Impact (18 marks)

Costs are in HK dollars; ICER = incremental cost / incremental QALY; the cost-effectiveness threshold is HK$150,000 per QALY.

9. Drug A costs HK$48,000 per patient per year and adds 0.4 QALY over standard care. Find (a) its incremental cost-effectiveness ratio; (b) whether it is cost-effective at the stated threshold. (6 marks)

Answer: (a) ICER = 48,000 / 0.4 = HK$120,000 per QALY; (b) it is below the HK$150,000 threshold, so it is cost-effective. The conclusion is about relative priority at that threshold, not an absolute clinical judgement.

10. Option A costs HK$300,000 and yields 6.0 QALYs; option B costs HK$500,000 and yields 7.5 QALYs. Find the ICER of switching from A to B and decide whether it is worth adopting. (4 marks)

Answer: Incremental cost is HK$200,000 and incremental QALYs 1.5, so the ICER is about HK$133,333 per QALY, below the HK$150,000 threshold; it is worth adopting, subject to budget capacity.

11. A new drug costs HK$2,400 per month and the old drug HK$1,200 per month. The new drug cuts hospital admissions per patient per year from 0.5 to 0.2 and each admission costs HK$30,000. Find the net change in annual cost per patient. (4 marks)

Answer: Extra drug cost = (2,400 - 1,200) x 12 = HK$14,400; admissions avoided save (0.5 - 0.2) x 30,000 = HK$9,000, giving a net increase of HK$5,400 per patient per year.

12. If 1,000 patients switch to the new drug, find the annual budget impact and explain why budget impact matters in addition to cost-effectiveness. (4 marks)

Answer: Budget impact = 5,400 x 1,000 = HK$5,400,000 per year. Cost-effectiveness compares cost per unit of health gain, while budget impact shows affordability; even with a favourable ICER, a total above the allocation forces cuts elsewhere, which is an opportunity cost.

Part D Health Behaviour and Energy Expenditure (16 marks)

Express energy expenditure in kcal (kcal = MET x body mass in kg x hours); 1 alcohol unit = 10 g pure ethanol and ethanol density is 0.789 g/mL.

13. A smoking cessation programme enrolled 1,000 people and achieved a six-month quit rate of 22%, against 8% in the control group. Find the number who quit and the relative multiple. (4 marks)

Answer: Quitters = 1,000 x 22% = 220; the quit rate is 22% / 8% = 2.75 times the control rate. Quit rates must be defined by sustained abstinence with biochemical verification, otherwise effectiveness is overestimated.

14. A person loses weight from 95 kg to 84.5 kg. Find the loss in kilograms and the percentage loss to one decimal place. (4 marks)

Answer: The loss is 10.5 kg, which is 10.5 / 95 x 100% = 11.1%. Weight loss above about 1% of body mass per week risks muscle loss and a fall in metabolic rate.

15. A person weighing 70 kg cycles at 3 METs for 30 minutes, five times a week. Find the energy expenditure per session and per week. (4 marks)

Answer: Per session = 3 x 70 x 0.5 = 105 kcal; per week = 105 x 5 = 525 kcal. MET values come from intensity tables and actual expenditure varies with fitness, skill and environment.

16. A 500 mL bottle of beer is 5% alcohol by volume. Find the mass of pure ethanol in grams and the number of alcohol units to one decimal place. (4 marks)

Answer: Volume of ethanol = 500 x 5% = 25 mL; mass = 25 x 0.789 = 19.7 g; alcohol units = 19.7 / 10, about 2.0 units.

Part E Long-term Care and Service Planning (16 marks)

Give ratios and percentages to one decimal place; old-age dependency ratio = population aged 65 or above / population aged 15 to 64 x 100%.

17. A territory has 1,400,000 people aged 65 or above and 5,600,000 aged 15 to 64. Find the old-age dependency ratio. (4 marks)

Answer: Ratio = 1,400,000 / 5,600,000 x 100% = 25.0%. Every 100 people of working age support 25 older people; a rising ratio increases pressure on health care and retirement protection.

18. Of 1,400,000 people aged 65 or above, 4% are estimated to need residential care; there are 40,000 subsidised places. Find the number of places needed and the shortfall. (4 marks)

Answer: Places needed = 1,400,000 x 4% = 56,000; shortfall = 56,000 - 40,000 = 16,000. The policy of ageing in place uses community services to avoid unnecessary residential admission.

19. A community care team handles 12,000 cases; the ideal caseload is 60 per social worker but only 160 social workers are employed. Find the ideal staffing, the actual caseload and the overload percentage. (4 marks)

Answer: Ideal staffing = 12,000 / 60 = 200 workers; actual caseload = 12,000 / 160 = 75 cases; overload = (75 - 60) / 60 x 100% = 25%. Excessive caseloads reduce the depth of assessment and follow up.

20. Residential care costs HK$22,000 per month; home care costs HK$9,000 plus HK$5,000 for a day centre. Find the monthly and annual saving. (4 marks)

Answer: The home package totals HK$14,000, saving HK$8,000 a month or HK$96,000 a year. Any comparison should also count the time cost to family carers and the quality of care.

Part F Bioethics and Priority Setting (16 marks)

Give percentages to one decimal place; essay answers must be grounded in the principles of autonomy, beneficence, non-maleficence and justice.

21. Of 2,000 brain-dead patients, 40% had suitable organs and 45% of the families consented. Find the number of actual donors and the supply ratio against 2,500 people on the waiting list. (4 marks)

Answer: Donors = 2,000 x 40% x 45% = 360; supply ratio = 360 / 2,500 x 100% = 14.4%. Most losses come from family refusal and unsuitability, so registering intent and discussing it with family both matter.

22. Three patients await the same organ with expected gains of 5, 8 and 3 QALYs and equal waiting time. Using only the principle of beneficence, who should receive it? Give one objection based on justice. (4 marks)

Answer: By beneficence the organ goes to the patient with the largest expected gain, 8 QALYs. Objection: a purely efficiency based rule ignores the claim created by waiting, and can systematically devalue the lives of older, disabled or poorer patients, breaching justice and the equal intrinsic worth of persons.

23. An influenza vaccination programme covers 500,000 older adults, achieves 45% uptake at HK$200 per dose and is expected to prevent 3,000 admissions costing HK$30,000 each. Find the programme cost and the net saving. (4 marks)

Answer: Doses given = 500,000 x 45% = 225,000; cost = 225,000 x 200 = HK$45,000,000; admissions avoided save 3,000 x 30,000 = HK$90,000,000, a net saving of HK$45,000,000. The figure excludes the value of deaths prevented, so the real benefit is larger.

24. A patient refuses the treatment his doctor considers most effective. Explain how the doctor can balance respect for the decision with professional duty, giving at least two points. (4 marks)

Answer: (1) Give full, understandable information and, once the patient is confirmed to have capacity, respect the choice, which expresses autonomy. (2) Document the discussion, offer feasible alternatives and arrange review or referral so the patient is not abandoned. (3) If capacity is lacking, act in the best interests and follow any advance directive, with non-maleficence as the floor.
