



Faculty of Public Health

of the Royal Colleges of Physicians of the United Kingdom

Working to improve the public's health

PART A EXAMINATION FOR MEMBERSHIP OF THE FACULTY OF PUBLIC HEALTH

Of the Royal Colleges of Physicians of the United Kingdom

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EXAMINATION QUESTIONS WITH KEY POINTS AND EXAMINERS' COMMENTS

N.B. Please note that these are key points, not model answers

Question 1

Define and compare each of the following pairs of terms:

- 1) standard deviation and standard error
- 2) null hypothesis and alternative hypothesis
- 3) paired t-test and t-test for 2 independent samples
- 4) statistical inference and statistical estimation.

KEY POINTS

1) The SD is a measure of the degree of variation between subjects, or among repeated measurements of the same subject. A large standard deviation implies a great degree of variation around the mean. The standard deviation is most readily interpreted when the data follow a normal (Gaussian) distribution. In this case, 68% (accept approx. two-thirds) of data are within 1 SD of the mean, approx. 95% are within 2 SD of the mean, and the interval from mean - 1.96 (or 2) SD to mean + 1.96 (or 2) SD can serve as a 95% reference interval which is expected to include 95% of the data. These interpretations depend crucially on whether the distribution really is close to Gaussian.

The SE relates to the precision within which we can estimate the mean of some population (or other parameter such as a regression coefficient) from a sample of data drawn from that population. The standard error of a mean of a sample of n observations is SD/\sqrt{n} . It is much smaller than the SD. It is used to construct hypothesis tests (t tests) and confidence intervals. The 95% CI for a mean is of the form, sample mean \pm approx. $2 \times SE$, and is much narrower than the reference range. The larger the sample size, the smaller the standard error and the narrower the CI. These inferences are relatively robust, they do not depend so crucially on distributional form.

2) Hypothesis testing sets up two hypotheses, a null hypothesis H_0 and an alternative hypothesis H_1 . Generally, the null hypothesis is a simplifying hypothesis, taking the form 'there is no difference between two means', 'there is no association between X and Y', or such like. The alternative hypothesis H_1 is that H_0 is false - there is a difference, there is an association, etc. These hypotheses relate to the underlying population from which the data are drawn. Generally H_1 does not specify the direction or magnitude of the effect, nor whether it is causal. We seek to determine whether the data give sufficient evidence to warrant rejecting H_0 in favour of H_1 .

Candidates may get some additional credit by enlarging on what happens in hypothesis testing re critical values, type I and II errors, power etc.

3) These are the two basic statistical tests used to compare means of two series of data where the variable of interest is a measurement / quantitative / has a continuous distribution. They are derived assuming the data come from a Gaussian distribution, but are quite robust: the assumption of this particular distributional form is not critical. In both cases, the test statistic relates the difference between means

to its standard error. Which test is used depends on the design of the study. If individuals in one group are specifically individually paired to those in the other group, a paired analysis is indicated. Examples include changes within individuals, in longitudinal studies and crossover trials, and some case-control studies. If no individual-level pairing exists, the unpaired test is used.

Additional credit for relevant additional points such as: formulation in terms of t rather than z takes into account uncertainty of SD, leading to tables involving df ; corresponding CIs should be given as well as hypothesis tests; (here or in relation to the next question) CI excludes null hypothesis difference of zero if and only if test is significant; alternative nonparametric tests available, advisable when seriously non-Gaussian and/or sample size small.

4) Statistical inference is the process of drawing generalisable conclusions about a population based on the evidence obtained from a sample derived from the population. It is important for the sample to be representative of the population, otherwise bias occurs.

Estimation is an important component of the inference process. Point estimates are calculated values for means and other parameters. The point estimate is what we regard as the single-figure best estimate of something from the data available. For central tendency, we may need to consider carefully whether the mean, the median or even the mode is the most informative figure to report – e.g. in summarising hospital stay data. A confidence interval should also be given. This is a range of values encompassing the point estimate, which are plausible given the data. Generally, a 95% CI is reported. This is a range of values designed to have 95% chance of including the population mean (or proportion, odds ratio etc.).

Additional credit for pointing out that traditionally hypothesis tests and p -values were the mainstay of the inference process for comparative studies, but it has been increasingly recognised that it is more informative to report point and interval estimates of appropriate measures of effect size (differences between means, odds ratios etc.).

EXAMINERS' COMMENTS

This question was often poorly answered. It was not necessary to regurgitate lots of formulae to get credit, but many candidates did so and got them wrong - garbled formulae such as $\sqrt{(\sigma^2)/n}$ were often quoted. The word 'variance' was often used generically, in such a way as to clash with its specific meaning. In trying to explain the distinction between SD and SE, what several candidates described was really the distinction between the SD based on a population (with denominator n) and the SD based on a sample (with denominator $n-1$). It was disappointing that many candidates didn't point out that the purpose of t -tests is to compare means.

Question 2

A retrospective analysis of in-patient deaths following admission for acute myocardial infarction in Nottingham from 1982-1992 (BMJ 1997; 315: 159-164) included the following results. Using 1982 as the reference year, the crude odds ratio for such mortality in 1992 was 1.38 (95% confidence interval 1.10 to 1.73). Female patients were observed to have a worse prognosis than males in this series, and case-fatality increased with age. After adjustment for age and sex in a logistic regression model an odds ratio of 1.02 was obtained, comparing 1992 to 1982.

- a) Give brief definitions of the terms "odds ratio", "95% confidence interval" and "logistic regression", and explain why these were used in this study.
- b) What do you infer from the findings, and what might explain them? Which data underlying the results given above would be helpful in interpreting them?

KEY POINTS

- The odds of death is the ratio of the number of deaths to the number of survivors. The odds ratio is obtained by dividing the odds for 1992 by the odds for 1982. It may be interpreted as a measure of relative risk and was used to represent the proportional change in mortality over the intervening 10 years.
- A 95% confidence interval is used here to express the level of imprecision in the estimated odds ratios. The interval represents the range of values for the parameter (odds ratio in this instance) that would be expected to arise 95 times out of 100 exact replications of the study.
- Logistic regression is a statistical method used to relate an exposure (risk factor) to a binary outcome using the logit (log odds) function. The exposure and other covariates can be continuous, categorical or binary variables. The methods give an odds ratio for the (binary) outcome per category or unit of the main exposure. Logistic regression can be used to adjust for potential confounding factors in the association between exposure and outcome. It is used here to adjust for changes in the age-sex composition of the in-patient population. Logistic regression is used, not linear regression, because the outcome, case-fatality, is binary.
- Before adjustment for age and sex, the odds ratio suggests a nearly 40% higher mortality in 1992 compared with 1982, which is statistically significant given that the confidence interval does not include one. Adjusting for age and sex reduces the odds ratio practically to the null value (unity). The most likely explanation is that there were higher proportions of women and older patients in 1992 compared with 1982, since these are the groups with higher mortality rates in this context. The data which would be useful at the two time points are the age-sex distributions and the age and sex-specific mortality rates.

The following additional points might improve the answer to 'good' or 'excellent':

- The odds ratio approximates closely to the relative risk for rare outcomes - won't do so here. The confidence intervals are interval estimates of the odds ratios. Logistic regression is a technique for modelling odds ratios, allowing full flexibility

for representing confounders in various ways (discrete or continuous), and also for considering interactions/effect-modification. It yields an adjusted odds ratio. Less flexible alternatives include Mantel-Haenszel techniques on mortality data stratified by for example age and sex, and standardisation.

- Before adjustment, even the lower confidence limit indicates an increase in mortality, by 10%. CI is wide - considerable uncertainty re strength of effect. Inspection of the age and sex-specific rates may shed some light on whether the finding of no change in mortality rates overall (from the adjusted odds ratio) is replicated across all sub-groups.
- Concomitant changes in caseload characteristics might not be confined to age and sex. Supplementary data on e.g. NYHA classification on admission might be informative - are they admitting a caseload of greater or lesser severity than earlier? Changes in diagnostic procedures may have occurred. But great caution needed in analyses adjusting for confounders – different choices of which variables to adjust for can lead to very different conclusions.

EXAMINERS' COMMENTS

Many candidates described the study as a case-control study, no doubt in the mistaken belief that the term 'retrospective' is synonymous with this study design. Some correctly identified logistic regression as being for binary variables, but presented the formula for linear regression, without identifying y with $\text{logit}(p)$. Two candidates came up with the bright idea that one might have expected a decrease in case-fatality due to improved technologies becoming available.

A few answers used irritating phrases ('roughly speaking' being perhaps the most obvious – prefixed to definitions!) It was surprising how many got basic definitions wrong.

Question 3

Outline the epidemiology and main control measures for two of the three diseases listed below, in the United Kingdom or another named country;

- a) Tuberculosis
- b) Hepatitis C
- c) Gonorrhoea

KEY POINTS as applied to the UK

(a) Tuberculosis

Mycobacterial infection is an important cause of illness and death world-wide. Its interaction with HIV infection in many developing countries is a source of major concern and in 1993 TB was declared a global emergency by the WHO. The majority of cases are pulmonary but any organ or tissue may be infected. The main agents are *Mycobacterium tuberculosis* from humans and rarely *M bovis* from animal reservoirs.

Incidence of infection has declined in developed countries from the early part of the century but recent increases have been described in urban areas notably London. UK rates are around 12/100,000 and over 45/100,000 in London. After infection, most people do not become ill.

Immunosuppression, such as HIV disease, increases the chance of becoming diseased after infection. TB is more common among vulnerable populations such as the homeless and alcoholics. In the UK, an increasing number of cases each year are born abroad, with more than $\frac{3}{4}$ cases born abroad and high rates in Black and Indian Subcontinent ethnic groups.

Prevention is based on the vaccination of risk groups, treatment of cases and tracing of their contacts, as well as the treatment of latent infection. Contacts may have evidence of infection, in the absence of illness, based on a skin test +/- Xray, and this is termed latent infection.

BCG vaccination protects against serious disease including meningitis and disseminated disease. National policy in the UK was changed in 2005. BCG had been offered prior to that to schoolchildren in their early teens and this was discontinued in favour of targeted selective vaccine of babies born in areas with incidence rates more than 40 per 100,000, or in contact with TB, or born to parents whose ethnic group is of a country where rates are higher than 40/100,000. Other settings are important too and BCG vaccination is necessary for those in roles involving direct patient care.

Appropriate chemotherapy taken for the right length of time [6 months usually] is generally effective. Completion of treatment is very important and WHO has recommended Directly Observed Therapy [DOT] for all pulmonary cases. In the UK, DOT is recommended for people who may fail to adhere to their treatment and more routinely for drug resistant cases

Very good or excellent answers might include:

- Mention of the distinction between new infection and reactivation, the fact that only 1 in 10 people who get infected will become diseased, that the majority who become ill after exposure do so within 2 years on average, that blood tests are now available for detecting latent infection [Gamma Interferon tests], and that molecular epidemiology is a useful tool to identify outbreaks and clusters.
- Specific mention of rates of drug resistance [occurring in about 7% cases overall] and multi-drug resistance [resistance to both Rifampicin and Isoniazid] occurs in less than 2% cases in the UK but far higher rates are reported elsewhere e.g. in Sub-Saharan Africa, Latvia and other Eastern European areas. Recently, extreme drug resistance (XDR TB) has been highlighted.

(b) Hepatitis C

Hepatitis C is the commonest cause of parenterally spread non-A, non-B hepatitis and is now a major public health issue in the UK and worldwide. The virus is transmissible parenterally with great efficiency, usually in injecting drug users. Only about 5% of reported infections are thought to have been transmitted sexually. The presence of Hep C antibodies indicates past infection but gives little indication of infectiousness.

Prevalence is of the order of 1-2% world-wide but amongst intravenous drug users is typically of the order of up to 60 to 70%. Prevalence is higher in the Middle East and in some other parts of the world. In the UK rates are <1.0 % in the general population.

The initial illness may be mild and without jaundice. However the majority of infected people go on to develop evidence of chronic hepatitis after about 15 years. Around 40% will develop an abnormal liver biopsy and by the third decade after infection 20% will have cirrhosis and an increased risk of hepatocellular carcinoma.

National policy and the National Hepatitis C plan is primarily to offer Hep C testing and treatment to Injecting Drug Users [IDUs].

Very good or excellent answers might include mention that treatment is expensive, more successful early on, and in certain genotypes, and that the National Institute for Clinical Excellence [NICE] recently recommended that not only people with advanced disease [based on liver biopsy results] but also with mild disease ought to be treated. Mention might also be made that PCTs have largely been slow to actively pursue implementation of the national guidance. Such answers might also mention that there is little prospect that a vaccine will be available in the near future.

(c) Gonorrhoea

Neisseria gonorrhoeae is a gram-negative diplococcus second in frequency only to *Chlamydia trachomatis* as a cause of bacterial sexually transmitted disease. Males typically suffer a purulent urethritis within 2 to 7 days of infection. Females commonly have non-specific symptoms or are asymptomatic but may have serious complications, including infertility. The period of communicability may last months in untreated individuals. Gonorrhoea is common among Men who have Sex with Men [MSM].

Humans are the only natural host. Incidence is increasing world-wide but some developing countries experienced a downturn in incidence in the 1980s attributed to health promotion campaigns and safer sexual behaviour. The incidence of gonorrhoea has been used as an indicator of unsafe sexual practices and recently in the UK has been used as a performance measure to judge success of efforts to improve local sexual health.

Control depends on adopting safer sexual practices including the use of condoms, treatment of patients and contact tracing of recent sexual contacts. Resistance to penicillin and tetracycline is an increasing problem, particularly in sub-Saharan Africa and in the Far East.

Very good or excellent answers might include mention of the additional sequelae of gonorrhoea infection in women, such as ectopic pregnancy and Pelvic Inflammatory Disease [PID], that the infection is more common in urban areas and among Black and Ethnic Minority groups, and that the presence of any STI facilitates the transmission of HIV. This is an important additional reason to be concerned with control of STIs. Excellent answers may also refer to the debate about inclusion of gonorrhoea testing alongside the National Chlamydia Screening Programme [NCSP].

EXAMINERS' COMMENTS

This question overall was reasonably well answered. Many candidates, however failed to stick to the question and wrote too much additional information on TB. As a result they didn't have enough time to answer a second part completely. BCG immunisation was not mentioned by a number of candidates.

For Hepatitis C, many candidates overemphasised sexual transmission, whereas IDU are at greatest risk, especially in the UK, although risk factors vary elsewhere. Many candidates incorrectly stated antenatal screening and contact tracing, which are not part of routine practice.

For gonorrhoea, many overlooked the public health significance of the long term sequelae of infection.

Question 4

Describe the health problems and health service issues that are associated with homelessness in a named country.

KEY POINTS as applied to the UK

Most or all of the following points would be required for a pass.

Candidate's answers should show a general understanding of the problem of homelessness in relation to its associated health problems:

- It is important that candidates demonstrate that they understand that homelessness is not a single entity but a spectrum of housing need, ranging from those needing to live for a short time in temporary accommodation, for instance sleeping at the house of a friend or relative, to those who are regularly rough sleeping
- Homelessness is a major public health problem, being not only common, but also commonly associated with a range of important health problems
- Housing is a well established determinant of health, especially when someone has nowhere permanent to live

There is good evidence that homelessness is associated with increased risk of physical ill health:

- Increased mortality from accidents, suicide, violence and alcoholism amongst rough sleepers
- Increased morbidity due to communicable diseases (skin infestations, pneumonias, tuberculosis), musculo-skeletal disorders, dental/oral disorders, neurological disorders (including epilepsy), gastrointestinal (including liver disorders) – all observed commonly amongst 'rough sleepers' using night shelters, common lodging houses and hostels
- Health status of the 'temporarily homeless' in bed and breakfast (B&B) hotels has been shown to be worse than age and sex matched controls who have a permanent home ('housed controls').
- Utilisation studies show that adults and children in B&B hotels have higher than expected rates of A&E use and emergency admissions. Burns/scalds and infections are more common in children living in B&B accommodation
- HIV may be a particular risk for young homeless people (who may become involved in drug use or prostitution) and hepatitis A, B and C are risks for injecting drug users

A wide range of mental health problems are common in the homeless:

- High prevalence of depression in B&B homeless
- High prevalence of behavioural disturbance amongst children in B&B accommodation
- High risk of suicide amongst rough sleepers
- Also, studies in homeless hostels show a high prevalence of schizophrenia amongst residents, as well as a high prevalence of substance abuse

Health service access and utilisation is a major issue for those who are homeless:

- It is common for the homeless not to be registered with a GP and for there to be other barriers to accessing care, such as having previously experienced negative attitudes

- The homeless may have pressing 'survival' needs or for other reasons, including low self-esteem, not see looking after their health as a priority
- Health service provision for the homeless, to be effective, may well need to be specialist in its nature, for example being provided as an outreach service, provided by specially trained staff or delivered through designated GP surgeries in town centres.
- Health service provision will need to be co-ordinated with the work of other agencies, for example via Local Strategic Partnerships or through the provision of 'one stop shops' or similarly integrated services

The following points will contribute to a candidate being judged to have given a very good or excellent answer:

- Health problems, such as severe mental health problems, may lead to homelessness, as well as homelessness leading to poor health
- Homelessness is a prime example of social exclusion and also fits clearly in to the health inequalities agenda
- The homeless are not an homogenous group. Those officially classified as homeless tend to be young families, headed by a lone female, whose health problems tend to be of a general health and mental health nature. The 'unofficially homeless' tend to be older males who are more likely to be rough sleeping or living in a hostel. Their health problems tend to be substance misuse or specific psychiatric problems
- While health service provision for the homeless is clearly important, the general social needs of the homeless may often be so profound that these may be a higher priority to ensure health, rather than health care itself

EXAMINERS' COMMENTS

This was very poorly answered by some candidates, with over a quarter of candidates scoring poorly. Many answers were presented in a scrappy manner, difficult to read and follow. Some candidates included lots of irrelevant material on sources of information on the homeless and how to carry out a survey or health needs assessment. Many candidates confined their answer to rooflessness rather than describing the range of homelessness, (rooflessness, bed and breakfast temporary accommodation etc) and also therefore the heterogeneous health and health service issues. Many failed to mention that services are often provided by other agencies overseen by partnerships. Many failed to state the obvious such as the public health need of the homeless and that housing is a determinant of health.

Question 5

Injury is an important cause of death in childhood in many countries. The table below presents information about deaths from injury to pedestrians and car occupants among British children, subdivided by an index of socio-economic status based on parental occupation (National Statistics Socioeconomic Classification).

- Describe what the data in the table below show about deaths of pedestrians and car occupants by socio-economic group. (40% marks)
- Identify two additional analyses that you would like performed and briefly explain how they would help you interpret the data more fully. (40% marks)
- Identify two additional sources of data that might be useful to build a more complete picture of injury rates to children in a named region or country? (20% marks)

Rates of death from injury per year per 100 000 children aged 0-15 years by eight socio-economic classes, 2001-3. Figures are number of deaths; rate (95% confidence interval).

Parental Occupation (National Statistics Socio-Economic Classification)	Pedestrians		Car occupants	
	No. of deaths	Rates per 100,000 (and confidence interval)	No. of deaths	Rates per 100,000 (and confidence interval)
1: Higher managerial/professional occupations	10	0.2 (0.1 to 0.4)	19	0.4 (0.3 to 0.7)
2: Lower managerial/professional occupations	15	0.2 (0.1 to 0.4)	13	0.2 (0.1 to 0.3)
3: Intermediate occupations	10	0.5 (0.2 to 0.9)	8	0.4 (0.2 to 0.8)
4: Small employers/own account workers	19	0.5 (0.3 to 0.8)	12	0.3 (0.2 to 0.6)
5: Lower supervisory/technical occupations	16	0.5 (0.3 to 0.8)	16	0.5 (0.3 to 0.8)
6: Semi-routine occupations	23	0.6 (0.4 to 0.9)	19	0.5 (0.3 to 0.8)
7: Routine occupations	41	1.1 (0.8 to 1.6)	19	0.5 (0.3 to 0.8)
8: Never worked/long term unemployed	71	4.7 (3.7 to 5.9)	36	2.4 (1.7 to 3.3)

Source: Edwards P, Green J, Roberts I, Lutchmun S. BMJ 2006;333: (15 July), doi:10.1136/bmj.38875.757488.4F (published 7 July 2006)

KEY POINTS

Most or all of the following would be required for a pass

- Commentary (4 marks)

- The number of deaths and the death rates from injuries for both pedestrians and car occupants was greater in socio-economic group 8 than in any other group.
- The confidence intervals on the rates in group 8 (and also for those pedestrians in group 7) did not overlap those in group 1, which suggest that there is a significant difference between death rates in the groups.
- The difference between group 8 and group 1 was approximately 24 times for pedestrians and 6 times for car occupants.
- Among children of employed parents (groups 1 to 7) there was a rising trend in pedestrian deaths from group 1 to group 7, but no clear trend for car occupant deaths
- Some socio-economic and cause groups had very few deaths with wider confidence intervals.

b) Two additional analyses (4 marks; 1 mark for the analysis; 1 mark for the reason why)

- Age and sex-specific death rates - Are there differences in socioeconomic trend between the sexes and age groups? Is a particular age group more vulnerable to certain causes?
- Data from previous time periods – Are the trends consistent over time, getting better or worsening? But changing socio-economic classification systems will make this difficult.
- Place of residence – Are there differences in death rates in different parts of the country?
- Death rates from other type of injury causes (e.g. all injuries, pedal cyclists, & fires). Are there also socio-economic differences in death rates from injuries of other types in childhood?

c) Two additional data sources (2 marks)

- Emergency department attendances for injury
- Hospital in-patient admissions for injury
- Police road-traffic accident reports and statistics
- Fire brigade incident reports
- Trading standard or Health and Safety Executive reports

EXAMINERS' COMMENTS

Part (a) was generally quite well done. However, some candidates seemed to be confused by the confidence intervals around the rates, with a number of candidates suggesting that statistical significance depended on whether the confidence interval did or did not 'cross 1' (rather than looking at whether the confidence intervals around the rates for different groups overlapped).

In part (b), most candidates did not think through the data presented and simply suggested further statistical tests, without attempting to explain how they would help to interpret the data more fully. Instead of the most obvious analyses described in the keypoints, the tests answered by many candidates are either inappropriate (e.g., ANOVA, paired t-test, linear regression, age-standardization without specifying

the reference) or of uncertain value (not accompanied by further explanation, e.g., logistic regression, chi square trend test).

In part (c), some candidates identified additional analyses (e.g. by age or ethnic group) or different types of data (e.g. about accidents in the home), without really identifying the sources of data. Some candidates mentioned mortality data from death records (ONS) here – but this is not an additional source of data, because the original data in the table are mortality data.

Question 6

Define three of these major indices of fertility in a population. (60% marks):

- a) Crude birth rate
- b) General fertility rate
- c) Age-specific fertility rate
- d) Total period fertility rate

Briefly discuss the public health implications of rising fertility rates and declining fertility rates. (40% marks)

KEY POINTS

a) Crude birth rate

- The number of live births, expressed per 1,000 total population per annum, is the annual crude birth rate.
- Although often quoted, it is a poor indicator of fertility because included in the denominator are males, children and post-menopausal women.
- Examples of any country rate

b) General fertility rate

- A better denominator is used in the general fertility rate, which is calculated by expressing the number of live births per annum per 1,000 women in the population of child-bearing age (by convention this is 15-44 years).
- Example of any country rate

c) Age-specific fertility rates

- It deals with age specific fertility based on the understanding that there are differences in levels of fertility amongst women of different ages within the child-bearing years
- This indicator is a more precise measure of fertility and obtained by calculating the number of births to a specified age group, per annum per 1,000 women of the same age group. For example, the fertility rate for women aged 20-24 years is calculated by taking the number of live births occurring to mothers aged 20-24 years and expressing them per 1,000 women aged between 20 and 24 years.
- Example of any country rate

d) Total period fertility rate

- The total period fertility rate is a convenient summary of all the age-specific rates. This rate summarises the age-specific fertility rates, in this case expressed as live births per woman of a single age, rather than per 1,000 women.
- It measures the average number of live-born children per woman which would occur if the current age-specific fertility rates applied over the entire 30 years of the reproductive span.
- It therefore takes account of differential fertility within the different reproductive age groups, while providing a convenient summary measure in a single figure.

- It enables comparisons to be made between countries and within the same country over time. The replacement of the British population requires a total period fertility rate of 2.1, not 2.0 as might at first be expected because it is necessary to allow for deaths which occur before the reproductive years are reached.

Public health implications of fertility trends

The effects on public health will depend on where in the world the region is, and at which point in the process it is. Effects can be on individuals, societies, countries and regions of the world.

Increasing fertility:

- Individual – increased demand for food, clean water, sanitation, and suitable housing. Potential for overcrowding in poor circumstances – risk of poverty, epidemics of illness, declining living standards etc.
- Society – increased demand for maternity and child health services; increased demand for food, clean water, sanitation, suitable housing; increasing demand for basic health services; later demand for jobs

Declining fertility:

- Individual – Puts pressure on working people to support the elderly
- Society – Elderly people have higher dependency levels and make a greater demand on health and social services. As the proportion of working age population declines relative to the elderly there will be fewer informal carers for the elderly infirm. There will be fewer health and social service workers (unless incentives are given to working in the caring industry); less income tax revenues to put into services and pensions; more demand for specialist housing; less income to spend on fuel and food; isolation of the elderly.

There may also be implications for social policy if any particular trend needs to be countered; for example there may be an increase or decrease in family-centred or family-encouraging policies, might increase or decrease access to contraception, terminations etc. Also might have knock on effect on wider policies, eg immigration.

EXAMINERS' COMMENTS

This question was generally well answered. However, although most candidates were able to give three definitions, there was often a lack of important detail (e.g. specifying 'live births' rather than just 'births'). A few candidates gave definitions for all four indices, although only three were required, and in these cases only the first three definitions given were marked. Instead of the conventional age group used for GFR (15-44 or in some countries, 15-49), and 5-year age groups in age-specific FR, many presented varying combinations of ages such as 16-44 (for GFR), 15-20, 16-20, etc. (for age-specific FR) This shows a lack of attention to details and lack of practical experience in the actual handling of data.

Some candidates gave incorrect definitions. For example, a few candidates thought that fertility rates related to numbers of conceptions rather than numbers of live births, a few thought that the denominator for crude birth rate was the total female

population rather than the total population, and a few used the definition for general fertility rate for crude birth rate.

There may also have been some errors of carelessness due to rushing under the pressure of the exam – e.g. a small number of candidates put the number of births as both the numerator and denominator.

The second part of the question was also generally well answered, although it appeared that many candidates were running short of time. A few candidates focussed on discussing the reasons for rising or declining fertility rates, rather than the public health implications.

Question 7

Write short notes on two of the following terms as used in health economics:

- a) Discounting
- b) Monetary valuation of life
- c) Price elasticity
- d) Moral hazard

KEY POINTS

Most or all of the following would be required for a pass:

a) Discounting

Discounting is an economic method to adjust when the costs and consequences of a programme occur in different time periods. E.g. the primary benefits of an influenza immunisation programme are more immediate than those of a hypertension screening programme.

Future costs and benefits are accorded a lower value ('discounted') because there is the assumption of *time preference* – that is, we prefer to have money / resources and health benefits now as opposed to later because we can benefit from them in the interim. Therefore, discounting of future outcomes should also be undertaken in cost- effectiveness and cost utility studies.

Reasons for a *positive rate of time preference*:

1. individuals can have a short term view of life – living for today
2. the future is uncertain
3. the individual may be more wealthy in the future and so costs and benefits today would be of higher value.

In practice, the choice of discount rate may be set by governments (the UK has a common discount rate for all public sector projects - 6%). The convention in health economic evaluations in the published literature has been to use a rate of 5%. The US public health service panel recommend that 3% would be the most appropriate discount rate for health economic analyses. Sensitivity analyses can include different discount rates to demonstrate the impact of different assumptions on the study results.

There is some debate about whether benefits should be discounted:

1. the concept of individuals trading healthy years through time is not intuitive
2. discounting years of life gained in the future gives less weight to future generations – this might make sense with money, when we expect to be richer in the future but less sense in the context of health
3. evidence suggests that individuals discount health at a different rate from monetary benefits.

However, the weight of argument is towards discounting benefits at the same rate as costs because people do defer health over time (eg giving up smoking later on); the effect on future generations of only discounting costs is to always defer programmes till next (and subsequent) years, as this will always be cheaper; health projects would be assessed differently from those in other sectors of the economy.

Discounting is seen as an important part of the cost-benefit analysis framework to enable decisions to be made between different programmes which deliver benefits at different rates over a period of time in the future. It says that the net benefits delivered now is worth a lot more than benefits achieved later. For example, assuming a discount rate at 10%, £100 of benefits in 20 years' time is valued now at only £15.

This favours health programmes with short term benefits over those with benefits which are only accrued over the longer term. This can discriminate against preventive and health promoting programmes.

A good answer would also include a critique of the assumptions underlying discounting – decisions which are rational from individual's point of view often cease to be so when considered from a societal perspective. That is, individual values do not necessarily coincide with population values.

The evidence supporting the view that individuals or populations prefer benefits now rather than later is not clear cut. People do evaluate multi-period outcomes very differently and certainly not at a constant discount rate. There is also evidence to suggest that some people in certain circumstances do give greater value for benefits that occur in the long term.

The following are additional points which might improve the answer to 'good' or 'excellent':

There are two competing theories regarding the proper measures for rate of discount of public projects (the social discount rate):

1. Social Opportunity Cost approach (SOC). The theory underlying the SOC is that public investments can displace or crowd out private investments or consumption, and is the real rate of return foregone in the private sector.
2. Social Rate of Time Preference (STP) – this is a measure of society's willingness to forego consumption today in order to have more consumption tomorrow. It is argued that this can be estimated from the interest rate on long term government bonds (ie a risk free investment, the interest rate representing the individual's willingness to forego the present for the future). However, it is controversial to state that society's willingness is an aggregate of individual's willingness.

b) Monetary valuation of life

Most or all of the following would be required for a pass:

The main use of valuation of life is in cost benefit analysis. In this approach it is necessary to place a financial estimate of the death which is prevented or the life which is gained.

There are three approaches to the monetary valuation of health outcomes:

1. Human capital approach
2. Revealed preferences
3. Contingent valuation (willingness to pay)

Human Capital

This approach places monetary value on healthy time using market wage rates – the intervention is assessed in terms of present value of future earnings. Problems with this approach include; imperfections in labour market – eg discrimination in wage rates; and how to value unpaid work e.g. that of a homemaker. In this latter situation, the value of the work in the home could be quantified by how much it would cost to replace this work with services from the market place, or the opportunity cost of working in the home against what could be earned in the market place.

Revealed preference

This is the wage – risk approach, where individuals' preferences regarding the value of increased (decreased) health risk (such as of death or injury at work) is traded off against increased (decreased) wages /income. The strengths of this approach is that it is based on actual consumer choices. However, the values vary widely and are very context and job-specific.

Contingent valuation

Individuals are asked directly how much they would be willing to pay for a programme that would result in reduced risk or death. This method has been used to estimate value of life from the amount people would be willing to pay to for extra safety features in cars.

The following are additional points which might improve the answer to 'good' or 'excellent':

Valuation of life for cost benefit analysis should be distinguished from the approach of authors like Rosser who use Quality Adjusted Life Years (QALYs) for cost utility analysis. The latter is concerned with the relative valuation of states of health rather than the valuation of life itself. There are also a number of important methodological issues in the valuation of life. The whole idea of valuing life is philosophically and ethically problematical.

An understanding of the Pareto principles and the application of value judgements that introduce individuals' judgements of their own welfare.

c) Price elasticity

Most or all of the following would be required for a pass:

Price elasticity is a term drawn from classical economics. Price elasticity in itself is not very meaningful. It is usually combined with the concept of demand or supply to give price elasticity of demand or price elasticity of supply. The concept denotes the degree to which demand (or supply) changes with changes of price. Thus, a highly elastic demand means demand is very sensitive to price changes. For example, food choices where there are many alternatives may be an example of highly elastic demand because as the price rises, people simply shift their purchases to an alternative food. In contrast, cigarettes and illicit drugs are relatively price inelastic because changes in price do not result in marked changes in demands. Nonetheless, almost all items show some sensitivity to cost.

The following are additional points which might improve the answer to 'good' or 'excellent':

Additional marks may be awarded for explaining the impact of this concept on health care. For example if charges are made for dental checks or prescription, how does additional cost influence demand? The price elasticity of demand for drugs will vary enormously depending on the absolute level of need for the drug. Also, the income of the patient is an important factor (poorer patients demonstrate greater price elasticity in their behaviour because they respond more to price signals).

d) Moral hazard

Most of all the following would be required for a pass:

Moral hazard is the 'effect of insurance coverage on individuals' decisions to undertake activities that may change the likelihood of incurring losses.' Insurance coverage has a tendency to alter a consumer's behaviour.

Moral hazard can be divided into 'producer moral hazard' and 'consumer moral hazard'.

Producer moral hazard can occur with fee for service situations where there are financial incentives to provide services in excess of what patients would choose to receive (supplier induced demand). (E.g. in UK system reform, with payment by results.)

Consumer moral hazard is manifested when an insured individual demands more services than if they had to pay for those services themselves. Consumer moral hazard can occur prior to sickness – the assumption is that insurance coverage removes incentives for preventive measures /healthy lifestyles. It can occur after sickness, where demands for care would be greater. If healthcare is free at the point of use, there is over-consumption of healthcare compared to under normal market conditions.

To protect themselves from moral hazard, insurance companies have different methods of cost-sharing with the consumer. Insurance premiums can be increased for all customers; a fixed co-payment with each service consumed or a set proportion of the costs of each service; an 'excess' (the deductible) where the consumer pays the full cost up to a set amount, normally determined annually, before the insurance company pays anything. Demand is also managed by introducing 'no claims' benefits, with reduced premiums for reduced demand.

The following are additional points which might improve the answer to 'good' or 'excellent':

Use of public health examples to illustrate principle of moral hazard e.g. more risky driving associated with the introduction of safety belts in cars.

Reference to different methods of funding health services.

Empirical evidence supports the higher levels of moral hazard with more generous insurance coverage, and reduction in moral hazard with the introduction of out of pocket payments.

In the UK, the impact of incentives to take up private insurance (among the better off, employed, etc) may impact disproportionately on poorer, needier sections of the population if their share of tax-based support for health services is reduced in future.

EXAMINERS' COMMENTS

Overall, this question was answered poorly. The standard of written English and grammar was frequently low, and whilst perfect prose is not expected, a basic standard is required for communication and comprehensibility.

Poor candidates gave confused explanations of the economic terms, frequently omitting important parts of definitions. Few candidates recognised that monetary value of life was related to cost benefit analysis and should be distinguished from utilities such as QALYs and DALYS, which assess relative states of health.

Better candidates related their answers to public health examples and were able to discuss areas of contention.

Question 8

What factors make people more or less likely to follow advice from health professionals to change their health-related behaviour?
Illustrate your answer with reference to one or more sociological theories.

KEY POINTS

Behaviours are the result of interaction of an individual and their social circumstances. Answers to this question should reflect both these aspects and refer to some of the theories below:

(a) The impact of:

Political, Social and economic factors

Poverty and deprivation /social class/ethnic group /work status/environment
For example : smoking cessation efforts in deprived groups tend to be less successful/need greater input –due to a social environment less conducive to quitting

Notion of autonomy – and its lack leading to behaviour harmful to health [Navarro]

Importance of effect of local environment on health seeking behaviours

[Blaxter/Macintyre]

Importance of social cohesion – positive benefit of high levels of community participation. Can impact on behaviours, patterns of disease /mortality [Wilkinson]

All of the above can affect the ways in which health advice is followed

(b) How the advice is given.

For doctors giving advice then consider:

-Social role of doctors

Parsons: patients sick role; doctors professional role. Adoption of the sick role, expectations of the sick role and of the role of the doctor
Consensual and conflict theories

-Nature of doctor –patient relationship

Patient satisfaction depends on nature of interaction 'social relationship';

Different models of relationship and doctor's style :

paternalistic/mutual/consumerist /default

Key factors are whether information relayed in doctor centric or patient centric way

-Partnerships in decision making

Patient participation in decision making and factors affecting it , including doctors style, information given, time allowed , understanding of risk

-Communication

Skills required include content skills and process skills .Framework suggested by Silverman : initiating session ; gathering information ; building relationship; explanation and planning ; closure .

This allows patients to express their fears/ask questions

-Changing doctor patient relationships

Friedson : professional autonomy and professional dominance- power now being challenged ; growth of interprofessionalism

Patient preference and concordance: notion based on concept of negotiation between equals to create [therapeutic] alliance.

EXAMINERS' COMMENTS

There were some good answers to this question but many others were disappointingly narrow in focus and lacked structure. Many candidates did not answer the question posed but merely described a number of sociological / psychological models they considered relevant.

Better answers generally were found among candidates who had written rough essay plans. These tended to be structured and include a broader range of issues.

Question 9

Describe how the public can be involved in health service planning and monitoring in a named country. Comment on potential constraints to their involvement.

KEY POINTS

To avoid a bad fail - two of the subsections from the 'Understanding of how the public can help plan and monitor health services' section (1.1 to 1.3) and 'Potential constraints' (2.1 to 2.6) with discussion

Borderline pass – four of the subsections from the 'Understanding of how the public can help plan and monitor health services' section (1.1 to 1.3), and 'Potential constraints' section (2.1 to 2.6) with discussion

Good pass – six of the subsections from the 'Understanding of how the public can help plan and monitor health services' section (1.1 to 1.3), and 'Potential constraints' (2.1 to 2.6) with discussion and brief mention of a seventh

1. Understanding of how the public can help plan and monitor health services

1.1 Groups

As members of governing Boards of accountable NHS agencies

As individuals seeking care and as members of communities, define the difference illustrated from the candidate's own health care system. Consumerism or participation?

Patient and Public Forums

Through PALS

As complainants, expect a description of a complaint system

As pressure groups, community groups and political parties

As members of health care management structures, e.g. Implementation Groups/Boards

As participants in quality appraisal systems

As focus groups

As GP/ hospital/service patient participation groups

1.2 Processes

In defining good and poor clinical practice and malpractice

In participating in the registration of and supervision of professionals

By responding to consultations determining what care is and what is not provided

Plus those implied in the roles of groups in 1.1 above

1.3 Engagement

Role of 'empowerment' in health care management

Discussion of different methods available for obtaining a patient view point as a means of overcoming the difficulties

Use of the evidence base showing differences in perceptions of what is important between patient groups, the population and professionals

2. Potential constraints

2.1 Financial/Time availability

A substantial minority of the public (including the most able) will be working in normal working hours and therefore not be able to engage during these times. There may be an associated cost to the public of engagement either through lost earnings and/or incurred costs.

2.2 Lack of knowledge

Variable access to information for the public

Variable ability to interpret information

Misinformation - the impact of the Internet, both negative and positive

2.3 Organisational

Lack of commitment of health care organisations to a patient-centred approach and therefore effective and routine methods of consultation with patients with the concomitant willingness to engage and respond to the public

2.4 Complexity

Problems with incorporating all the differing attitudes, values and opinions of population groups

Different opinions on prioritisation of what is important in healthcare and the evidence base for this

2.5 Political

The impact of pressure groups, their importance as a source of information and misinformation and the potential for distortion of priorities that can arise.

The 'political imperative' of what is important – the impact of the press, other media, politicians and the concept of 'moral panic'.

Professional resistance to patient involvement – concepts of professional power.

2.6 Psychosocial

The reluctance to complain of people receiving healthcare

Perceptions that 'complaints' are negative

Patients may have adopted the 'Sick Role' and therefore display associated passivity

EXAMINERS' COMMENTS

This question was reasonably well answered but many of the key points were made in a muddled and unsystematic way. Poor answers consisted of a skeletal list with no muscle or sinew in the form of intelligent discussion. Better answers expanded the key points with examples from real life experience. It was clear that this was an easier question to answer for candidates working in countries where the involvement of the public in their local health service is a key element of health policy. Nevertheless, candidates from countries where this was not the case generally answered the question to at least a pass standard albeit from a more theoretical perspective.

Question 10

You have been appointed as the leader of a public health team. How would you motivate the team to ensure that the innovative and creative talents of all the team members flourish for the benefit of the health of the local population?

KEY POINTS

To avoid a bad fail - two of the headings one with discussion

Borderline pass – three of the headings with discussion and brief mention of a fourth

Good pass – five of the headings with discussion and brief mention of a sixth

1. Build the team

- Engage members as a team
- Spend time on team development – may use Belbin roles, outside consultancy
- Meet regularly and frequently for a purpose
- Determine and agree team values
- Determine and agree team roles – may use Myers-Briggs Questionnaire
- Spend time inside and outside work socially
- Spoil the team with comfortable surroundings and refreshments
- Discuss, determine and agree rewards for good performance
- Agree on approach to delegation and empowerment
- Promote the team and its work within the agency and partnerships

2. Engage team through work

- Delegate and empower appropriately
- Promote debate and discussion on where we are, where we want to be, and how we should get there – use brainstorming, lateral thinking
- Ensure that all the team has discussed, contributed to and committed itself to the work tasks and objectives
- Try to reach consensus decisions
- Make sure the combined purpose and importance of the team's work is understood by everyone
- Keep everyone informed on progress

3. Ensure clarity of definition of key roles and tasks

- Develop individual roles
- Ensure job descriptions and job plans are up-to-date and accurate
- Ensure goals are realistic and achievable

4. Develop the team and organisation

- Ensure new staff are induced
- Identify individual and team training needs
- Ensure personal development plans are produced and implemented
- Engage others in wider organisational development matters

5. Foster a culture of innovation and creativity

- Challenge the culture and values of the team and agency
- Encourage 'thinking outside the box', reframing the problem, and risk taking
- Minimise criticism of failure
- Reward and publicise innovation and creativity

6. Managing performance

- Ensure staff know the governance and accountability arrangements
- Ensure staff know how team and individual performance will be managed
- Ensure all staff are appraised annually

7. Knowledge of management theory

- Maslow's hierarchy of needs, McGregor's theory X and Y management styles, Herzberg's motivation-hygiene theory, Likert's participative-group research

EXAMINERS' COMMENTS

This question was aimed to be more about team development and motivation although comments on different types of leadership were relevant. In some answers the balance was wrong with too much emphasis on 'leadership'. Generally, the question was answered relatively poorly. The most significant error was to base the answer entirely on management theory rather than to use it to illustrate stages in the task. The theories quoted were not put into context or their relevance to the task was minimal. Some based almost their entire answer on one theory for example, Belbin's team roles. However, it was pleasing to see that some knowledge of management theory was displayed compared with the relatively sparse knowledge shown in previous years.

Paper IIA

A local journalist has contacted you about a recent publication which she says shows that a very large number of pregnant women smoke during their pregnancy and there seems to be nothing that can be done to prevent this. The paper that she refers to is Tappin DM, Lumsden MA, Gilmour WH et al. Randomised controlled trial of home based motivational interviewing by midwives to help pregnant smokers quit or cut down. *BMJ* 2005;331:373-375.

1. Write a critical appraisal of this paper. (40% of marks)
2. What additional information would you like to have to help you to correctly understand the implications of this study? (15% of marks)
3. Write a general press release in response to this paper, paying attention to the points raised by this journalist. (25% of marks)
4. What sources of information could you use to find out the rates of smoking among pregnant women in your area and compare these to rates in other areas and national rates? (20% of marks)

KEY POINTS

Question 1

- This is a randomised controlled trial assessing the effects of motivational interviewing by midwives on helping pregnant smokers to quit or cut-down. It found that motivational interviews compared to standard care did not result in greater quit rates or greater rates of cutting down.
- The research question being assessed is important
- A randomised controlled trial is the most appropriate method for assessing the effectiveness of an intervention
- In non-pregnant populations nicotine replacement would be the method of choice for quitting smoking, particularly among those clearly addicted (one could assume that continuing to smoke during pregnancy is a sign of addiction). However, as the authors point out prescribing nicotine replacement to pregnant women is controversial and therefore they are assessing an intervention that does not involve giving nicotine to pregnant women.
- The authors describe attempts to ensure that the motivational interviewing is given in a standardised way and assess its quality. However, they do not provide sufficient information about the intervention or the assessment of its quality (see point below: main weakness)
- The outcome was assessed by interview undertaken by someone who was blind to whether women had received the intervention or standard care and so there can be no reason why they should deliver their interview in any different way to the two groups.
- An objective measure (cotinine levels) as well as self-report was used to determine smoking status which means it is unlikely that there is measurement error or bias (differential ascertainment of outcome in the two groups) in this outcome assessment.

- The main analysis was by intention to treat. That is, women were analysed as receiving the intervention (which was invitation to have motivational interviews) even if they did not have any interviews (26% in the intervention group did not have any interviews) [and the small proportion of women who were lost to follow-up in each group were treated as if their smoking behaviour had not changed ('same')]. This is important because an intention to treat analysis maintains the randomisation and therefore prevents confounding. A non-intention to treat analysis in this study could be confounded by factors that are related to not taking up the interviews. However, the investigators did compare those who did not take any interviews to all others and found they were not importantly different. The results were essentially unchanged when a 'compliance' analysis was undertaken.
- The main weakness of the study is a failure to fully describe what the motivational interview included. What kinds of information were provided to the women? How was it theorised to work in this population? Without more information on the intervention it is not possible to really determine whether the intervention was ever likely to work or to know just what it is that according to this study does not work.
- More information is required on the quality assessment of the motivational interviews. What was the background of the consultant who provided that training to the midwives? Had their methods been shown in other populations (non-pregnant individuals) to be successful in quitting smoking? Was the assessment of the midwives interviews undertaken by the training consultant? If it was then this may have biased the assessment; an independent assessment would give greater confidence that it was excellent.
- It is not clear who allocated eligible participants to the intervention or control group or whether this allocation was concealed. If the midwives were responsible for allocation and this were not concealed it is possible that they may have tampered with the allocation making it not random. However, the authors report that there were no differences in baseline characteristics between the two groups, which suggests that randomisation has not been importantly 'tampered' with. Further, in general lack of concealment tends to result in results that are biased towards a greater effect of the intervention. In this particular study the effect was null.
- Although a sample size calculation is presented the confidence intervals for the main and secondary effects are all wide, thus leaving a lot of uncertainty. For example, they suggest that the intervention could result in anything between a 45% reduction in quit rate (i.e. a marked negative outcome compared to standard treatment) to a 98% beneficial effect with 95% confidence.

Question 2

- Would want to know more about the content of the motivational interviews (see above)
- In the introduction the authors state that a Cochrane review of 64 trials concluded that programmes were effective at quitting smoking and increasing birth weight. Would want to read this review and find out how the studies in that review differed from the trial undertaken here. How did the interventions differ? How did the populations differ?
- Would want to know overall rates of smoking in pregnancy in Glasgow (population of this study and area where individual works) and what 'standard care' consisted of

Question 3

- Important point is the appropriate use of language for a press release
- Start by highlighting health problems associated with smoking in pregnancy (and subsequently) for mother and child
- Comment on rates of smoking among pregnant women in the area where you work.
- Describe the study and its results in lay-terms
- Use the opportunity to give a clear public health message that young women should not start smoking
- Note that the journalist who has contacted you has somewhat misinterpreted the results of the paper when she states that it shows high rates of smoking among pregnant women and that nothing can be done about this. Rates of smoking are high in the study population from Glasgow who are examined in the study, but even here the vast majority of pregnant women do not smoke. The study suggests that the particular intervention tested here was not effective in this population, but this does not mean that there is nothing that can be done to reduce smoking in pregnancy. Should use the opportunity of the press release to highlight local initiatives.

Question 4

Sources of information for local smoking rates in pregnancy:

- Local surveys may exist that have been conducted by public health, primary care or secondary (obstetric) care. Need to consider issues of coverage and correct numerator & denominator for these.
- Nationally organised surveys may collect and present (make available) smoking rates in pregnancy at a local level. As well as considering any issues relating to numerator/denominator, need to consider how up to date these results will be.
- In the UK the rates and changes in numbers of women who smoke during pregnancy is collected via Local Delivery Plan Returns.
- If there are no survey data already existing or if what does exist is out of date then would need to consider the possibility of either starting a new survey and/or being able to retrospectively collect information from routine clinical data (clearly more feasible if smoking status is recorded in electronic notes). If using clinical data need to be aware of issues of completeness of reporting (ie. If nothing recorded in notes does this mean non-smoker or information not obtained).

Sources of information for national and other regional smoking rates for comparisons with local rates:

- Similar to above ie. Already existing reports of surveys / routinely collected data
- In UK the White Paper – Smoking Kills, highlighted smoking among pregnancy women as a key area and included the target to reduce the % of women who smoke during pregnancy from 23% in 1998 to 15% in 2010. Thus, it provides national rates for 1998 and progress towards the targets set out in this white paper are measured using the national 5 yearly 'Infant Feeding Surveys'. From the Infant Feeding Surveys in 2000 – 19% of all pregnant women smoked throughout pregnancy in England, with 45% of women who had smoked previously giving up either in the year preceding pregnancy or during the first trimester. Equivalent results from the 2005

survey were 17% smoked throughout pregnancy and 48% of past smokers gave up at some time during previous year or early pregnancy. Similar national monitoring may be available in other countries.

EXAMINERS' COMMENTS

Question 1 Critical Appraisal

The majority of candidates were able to demonstrate the ability to review the peer reviewed journal paper reporting the evaluation study by applying a structured and systematic approach to critical appraisal. Sound answers were able to comment on strengths and weaknesses of all key elements of the study: clarity of research question, study design, intervention, sample, sources of bias, analysis, results, generalisability. The better answers were able to:

- Discuss the design strengths of the randomisation design and intention to treat analysis etc
- Highlight the likely nature of the sample (ie heavy committed smokers) and the limitations of the intervention for achieving cessation amongst this group
- Interpret the results with reference to wider evidence of cessation interventions
- Discuss the extent to which the study findings may or may not be relevant to other local contexts.

Question 2 Additional information

Sound answers were able to identify the full range of additional information requirements for interpretation and assessment of wider relevance of the study findings: including

- aspects of study detail particularly the nature and acceptability of the intervention;
- study local population demographics/smoking prevalence in pregnant women;
- other research and evidence on cessation interventions.

Question 3 Press release

The majority of candidates were able to make important key public health messages about smoking in pregnancy, and promote local smoking cessation services. However only a minority of candidates were able to prepare a convincing 'real time' press release, that conveyed strong public health messages as well as report and comment on the study findings; and use appropriate language (for the 'local newspaper'). Preparation for the exam should practice previous similar type of exam questions.

Question 4 Sources of information on smoking among pregnant women

Although the majority of candidates were able to identify a number of basic information sources (such as maternity services, primary care, surveys); fewer candidates demonstrated detailed understanding of specific information sources on smoking amongst pregnant women ie local monitoring/target information, use of routine midwifery data, the nature of local surveys/information systems that might be established, Infant Feeding Surveys. (Candidates in preparing for the exam should be confident about local assessment and monitoring of all types of health behaviours.)

Paper IIB

You are the public health advisor to a health authority responsible for planning health services for 750,000 people in a predominantly rural area. Emergency vascular surgery treatment for residents of this area is currently provided by five hospitals. Proposals for centralisation of specialist services, including acute vascular surgery, have raised concerns that increased travel times from home to hospital might reduce the chances of survival in rapidly life-threatening conditions, such as ruptured abdominal aortic aneurysm (RAAA).

A review of all cases of RAAA in the area over the past 4 years identified 515 cases, of whom 163 died at home or in transit before reaching hospital, 100 died in the emergency department before surgical intervention was possible, 111 died during the operation or within two days of emergency aneurysm repair, 84 died in hospital two or more days after their operation, and 57 were discharged alive from hospital.

All of the patients who reached hospital alive were treated at the hospital nearest to their home. The following table shows the frequency of each outcome in relation to the nearest hospital.

Nearest hospital:	A	B	C	D	E	Total
Died before reaching hospital	58	48	40	15	2	163
Died in hospital, before operation	51	23	20	5	1	100
Died within 2 days of operation	55	23	25	8	0	111
Died in hospital after ≥ 2 days	30	19	22	10	3	84
Discharged alive from hospital	31	14	10	2	0	57
All cases of RAAA	225	127	117	40	6	515

Q1. List the sources of information that might be used to ascertain all cases of RAAA in the area, and comment on the problems that might arise in determining the number of incident cases of RAAA. (20% of marks)

Q2. Describe the variation between the hospital catchment areas in the pattern of survival from RAAA, and comment upon possible reasons for these differences. (20% marks)

Q3. From the information in the table, evaluate and comment upon the relationship between volume of emergency RAAA repair and post-operative survival. (10% marks)

Travel times from each patient's home to the nearest hospital were estimated using a proprietary software package, which calculates the quickest route, taking into account statutory speed limits. After adjustment for age, sex, deprivation score, and nearest hospital, the odds ratio of survival to hospital discharge after RAAA was

calculated as 0.97 (95% confidence interval 0.70-1.34) per 10 minutes additional travelling time.

Q4. Outline the main strengths and limitations of this approach to estimating the effect of delays in reaching hospital. (10% of marks)

Recalculating travel times for each RAAA patient, on the assumption that all cases were transported immediately to a centralised vascular surgery service at hospital A, resulted in an average increase in travelling time from home to hospital of 20 minutes.

Q5. Estimate the likely impact of an additional 20 minutes average travelling time upon the probability of surviving RAAA. (10% of marks)

Q6. Write a 500-word report for consideration by the director of surgical services for the rural area, summarising the arguments for and against centralisation of vascular surgery services at hospital A, and outlining how you would evaluate the effect of this change upon patient outcomes and the organisation of health services. (30% of marks)

KEY POINTS

Q1. List the sources of information that might be used to ascertain all cases of RAAA in the area, and comment on the problems that might arise in determining the number of incident cases of RAAA. [20% of marks]

Main points required for a pass:

The principal sources will be death certificates and hospital admission and/or discharge records. Accident & emergency registers and operating theatre records could be used as ancillary sources, particularly for establishing the timing of death in relation to admission and surgery. The principal problems arising relate to case-definition and record linkage.

Additional points:

a) case definition

- An inclusive definition (eg. any mention of "aortic aneurysm") will be desirable to identify all cases, but the site of the aneurysm may not always be recorded or coded (eg. on death certificates).
- Distinguishing ruptured (emergency) from non-ruptured (elective) aneurysm repairs may not be possible from diagnostic codes. Reference to procedural codes, theatre records and/or case notes may be required.
- Death certification likely to be less accurate for out-of-hospital deaths, unless confirmed by autopsy.
- Capture-recapture analysis could be used to evaluate completeness of case ascertainment

b) record linkage

- In-hospital deaths are likely to appear on both the admissions and death registers. Some method of linking individual records (eg. patient names, place of residence, date of birth) is required to eliminate double-counting.
- Problems of linkage may arise from cross-border transfers to hospitals outside the health authority area.

Q2. Describe the variation between the hospital catchment areas in the pattern of survival from RAAA, and comment upon possible reasons for these differences. [20% of marks]

Main points required for a pass:

- Specific calculations of column percentages (not guesswork!)
- Numbers of cases in hospital E catchment area are very small and therefore prone to substantial sampling error. Candidates would be expected not to emphasise differences between hospital E and the other hospitals, or to combine hospitals D and E.

Patterns (across hospitals A to D):

- The proportion of all RAAAs dying occurring outside hospital is lowest for hospital A, but more die in the emergency room at this hospital, before reaching surgery.
- The proportions of all RAAAs surviving long enough for surgical intervention do not vary greatly across hospitals A to D (from 44% to 52%).
- The proportions of all RAAAs surviving for 2 or more days are similar (ranging from 26 to 30%).
- The proportions of all incident RAAAs surviving to discharge from hospital vary more widely, from 5% (hospital D) to 14% (hospital A).

Explanations:

- Geography (shorter transport times to hospital A)
- Patient characteristics (age and sex, ethnicity and socioeconomic status, co-morbidity)
- Medical care (emergency room, operating theatre, intensive care, general ward, discharge policies).

Additional credit for more detailed explanation and interpretation:

- The data suggest that post-operative mortality, rather than death before or during emergency surgery, is the main driver of the differences in survival between hospital catchment areas.
- Life table approach to analysis of survival (recalculating denominators for each stage as in Q3)

Q3 From the information in the table, evaluate and comment upon the relationship between volume of emergency RAAA repair and post-operative survival. [10% of marks]

	A	B	C	D	(D&E)
RAAA cases surviving to surgery (= volume over 4 years)	116	56	57	20	23
Survivors at 2 days (% cases operated)	61 (53)	33 (59)	32 (56)	12 (60)	15 (65)
Survivors at discharge (% cases operated)	31 (27)	14 (25)	10 (18)	2 (10)	2 (9)

Main points required for a pass:

- Although there is an inverse relationship between volume and survival to discharge, this is not seen at 2 days (peri-operative survival).
- Comparison of survival rates for hospitals A, B and C suggest that factors other than volume of emergency surgery may be more important.

Additional credit for interpretation:

- This does not support a strong association between quality and volume for emergency vascular surgery, but the weight of evidence is weak. Would need to base conclusions on a larger number of hospitals.

Q4. Outline the main strengths and limitations of this approach to estimating the effect of delays in reaching hospital [10% of marks]

Main points for a pass:

- Strengths: standardised approach, applicable to all patients (not just those who reach hospital), better than using distance.
- Limitations: Use of travel times to hospital ignores ambulance response time and travel to home, travel times vary by time of day, ambulances can ignore speed limits!

Additional credit for:

- Comment on possible confounding between travel time and type of area (urban/rural) and associated demographic and lifestyle factors
- Comment on adjustment for principal confounders.

Q5. Estimate the likely impact of an additional 20 minutes average travelling time upon the probability of surviving RAAA, and its 95% confidence interval. [10% of marks]

Main points required for a pass:

Odds ratios are multiplicative, so for 20 minute increment:

OR = $0.97 \times 0.97 = 0.94$, LCL = $0.70 \times 0.70 = 0.49$, UCL = $1.34 \times 1.34 = 1.80$.

Since the proportion surviving is low ($57/515 = 11.1\%$), odds ratios can be interpreted as prevalence ratios, to a close approximation.

Thus, a small adverse impact on survival is most likely, but the confidence intervals are wide. Since it is unlikely that prolonging transport time will improve survival, it is the lower 95% limit that is of greater relevance. A halving of the proportion surviving can't be excluded.

Additional credit should be given for more exact calculations, eg converting odds to proportions.

Q6. Write a 500-word report for consideration by the director of surgical services for the rural area, summarising the arguments for and against centralisation of vascular surgery services at hospital A, and outlining how you would evaluate the effect of this change upon patient outcomes and the organisation of health services. [30% of marks]

Main points required for a pass:

Arguments for centralisation:

- surgical and intensive care skills better maintained by higher volume
- opportunity costs of maintaining emergency vascular surgery in smaller centres
- increase in transit time unlikely to impact greatly on overall survival
- hospital A has good record of post-operative survival, compared to other centres

Arguments against:

- little evidence from this small dataset of a link between volume and quality of RAAA surgery
- possibility of substantial reduction in survival from increased transit time
- other reasons for differences in post-op survival may be more amenable to change
- hospital A has a high proportion of deaths in A&E: procedures may need attention

Evaluation:

- document changes in health service organisation
- repeat the record review 1-4 years after the policy change
- adjust before-and-after comparisons of survival patterns for changes in patient characteristics
- seek evidence from other areas undergoing similar centralisation of services

Additional credit given for:

- Balanced presentation of pros and cons
- Clear recommendations for evaluation
- Appropriate writing style
- Cautious interpretation of between-hospital differences, given small number of hospitals and no adjustment made for age, sex, comorbidity etc.
- Reference to national policies on centralisation of services
- Link to wider debate on centralisation with evidence from other diseases/procedures
- Consider implications for location, workload and training of vascular surgeons

- Consider implications for organisation of ambulance services & intensive care beds
- Consider cost-effectiveness
- Evaluation of clinical outcomes other than death
- Evaluation of opportunity costs for relatives

EXAMINERS' COMMENTS

Overall performance on this question was generally adequate, although the standard varied considerably.

It may sound obvious, but candidates need to read the question carefully and provide contextualised answers. Candidates need to demonstrate an ability to apply their knowledge and show a deeper understanding of the issues rather than just rote learning. Those with evidence of a structured approach (particularly to Q6) gained higher marks.

Some answers bordered on illegibility and although this was not explicitly penalised, there were instances where the quality of handwriting may have compromised the intended communication.