Faculty of Public Health

of the Royal Colleges of Physicians of the United Kingdom

Working to improve the public's health

EXAMINATION DOCUMENTS

JUNE 2006
COMPLETE FINAL DRAFT

(with key points and examiner comments)

MFPH PART A EXAMINATION

Paper IA

Question 1

Write short notes on three primary research methods that might be used for an epidemiological study to measure the effect of quitting smoking on coronary heart disease.

KEY POINTS

Introductory comments to show an understanding of the context of this question. These could include comments on why the question is important (preventive policies, testing of aetiological hypothesis) because these may affect the usefulness of the particular methods. Comments on possible mechanisms of such an effect would be relevant.

The three epidemiological methods will probably be trials, cohort studies and case control studies, but a well argued case for ecological studies (see below) would be acceptable. The pros and cons of each type of study should be discussed in relation to the quitting of smoking. Measurement of smoking history and smoking status, and of cardiovascular disease both require comment. Bias and confounding are important and require full discussions, as does the causal nature of any association found. A comment about how the effect could be expressed (e.g. relative or attributable risk) would be relevant.

Background or introductory comments:

Smoking and CHD: comment on presence of link, believed to be predominantly causal.
Mechanism: atheroma, clotting, arrythmias.

[Little credit is given to candidates who solely explain the investigation of the role of smoking in CHD.]

Effect of quitting; why is it important to know?
Test of epidemiological hypothesis, preventive implications.

Measurement of CHD: symptoms, myocardial infarction ECG, death certificates.

Definition and measurement of quitting smoking: questionnaire, objective validation, pattern of smoking over life.

Likely confounders of any association.
Other risk factors: BP, Lipids, FH, activity, diet.
Quitting is likely to be in a self-selected group and quitting may be associated with change in other risk factors.
Reason for quitting is important – may be event-driven.

Possible Methods:
1. Cohort study e.g. population based e.g. Doll and Hill, Framingham, BRHS or cohorts of patients with coronary event
2. Case control study

3. Randomised trial – need to explain convincingly how this could be done.
4. Ecological approaches may be useful to study the effect of some public health interventions which cannot be randomised e.g. they might be used to compare rates of CHD between areas that have introduced smoking bans and shown these to have effects on quit rates, and those that have not introduced bans.

Comment on methods
Observational methods have problems (as outlined above).
Cause and effect reversal, confounding due to association with other risk factors, bias in selection, assessment or exposure, and even events need to be considered.
Ecological comparisons may exhibit an ecological fallacy.

Experimental trials (of quitting smoking) are possible though difficult and expensive.
Test of epidemiological hypothesis, test of efficacy of prevention (both primary and secondary depending on the nature of the cohort)
Selection into the study, compliance with regime important.

Examiner Comments

Overall this question was not well answered. Some candidates did not identify three suitable study designs and some others discussed focus groups or surveys without addressing how these might address the question posed. Very few candidates mentioned several issues that were common to any research design: sample selection; how to measure smoking cessation and coronary heart disease (CHD); statistical analysis and power. Few discussed whether the studies described could distinguish causation from association.

Many candidates' answers would have been improved by using examples – it was common to simply list the pros and cons of each study type without describing how these factors might apply to the question posed. In particular, descriptions of ecological studies tended to focus on smoking in general (eg prevalence or consumption) without considering how these variables would relate to smoking cessation.

A surprisingly common mistake was to define cases in a case control study as people who smoke and controls as people who had quit smoking.

Most candidates noted problems of bias and confounding and many discussed ethical issues in relation to randomised controlled trials in this topic. A few people described cohort studies, taking as the study population people who already had CHD. As long as this was well justified, marks were given for this approach as for others.

Question 2

You have been asked to critically appraise a study report. The abstract reads as follows:

"Males aged 18-30 who received non-custodial sentences for alcohol-related violent crime were invited to participate in a randomised controlled trial comparing a brief educational intervention designed to reduce their problem drinking to a control group who received the usual service (distribution of an information leaflet about alcohol related services). 234 subjects gave informed consent. 120 were allocated to the educational intervention and 114 were allocated to the control group (usual service). Alcohol use at baseline and 3 month follow-up was measured by the well validated AUDIT questionnaire. The range of possible scores is from 0 (total abstinence) to 40 (high level of problem drinking).

The mean AUDIT score in the education intervention group was 20.3 at baseline (standard deviation 7.6).
This reduced to 17.9 (SD 7.4) at follow-up.
The mean reduction was 2.4 units, with SD 6.2, 95% confidence interval from 1.3 to 3.5, with $p<0.001$ from a paired t-test.
In the control group the mean AUDIT score reduced from 17.4 to 15.0."

(a) Explain what can and cannot be inferred from the results reported for the education intervention group alone.

(4 marks)

(b) Outline a more rigorous approach to the analysis of the data from this study.

(3 marks)

(c) State, with reasons, whether or not you accept that these results came from a well-conducted and appropriately analysed randomised trial.

(3 marks)

KEY POINTS – asterisked points correspond to what we expect in order to pass on this question.

(a) *Taking the active treatment group alone, quite small reduction overall.
*The p-value indicates this is not well explained by chance.
The high SD indicates that, though most subjects reduced their score, a minority increased. This could reflect a genuine exacerbation of problem drinking of some individuals or limited reproducibility of the instrument.
*BUT we should not base inferences primarily on what is observed in the active treatment group alone.
If this were so, it would obviate the need for RCTs.

(b) *The main interpretation of the results must be based on a comparison of changes in the active and control groups.
*The simplest analysis would be an unpaired t-test comparing reductions in the active group (mean 2.4, SD 6.2) with those in the control group (also mean 2.4).
*This would clearly not be statistically significant.

Alternative methods of adjusting for baseline such as ANCOVA are often preferred. Nonparametric methods can also be used, but the results presented here give no reason to necessitate their use.

(c) *The issue here is the difference in baseline means between the two groups.
(This difference is in fact highly significant. Good candidates will give some cogent demonstration that it is unlikely to be a chance finding, though a formal significance test is neither expected nor obtainable from the figures presented, and routine testing of baseline differences should not be standard practice).
*The difference in baseline means between the two groups casts doubt on the quality of the randomisation and/or performance of the study and hence the integrity of the results. It does not prompt outright rejection of the results, but raises questions.
It is worth exploring possible reasons, and examining baseline comparability on other factors.

Examiner Comments

This was a highly discriminatory question. The main reason for poor performance was candidates who did not look at the data (or the question) but provided a standard text on issues in trial design that were not requested. Many missed the fact and/or the importance of the differences in baseline levels.

Question 3

Briefly describe the epidemiology of obesity in adults and its consequences. *(50% marks)*

Outline the main opportunities for reducing the prevalence of adult obesity in the population of a named country. *(50% marks)*

KEY POINTS

1. EPIDEMIOLOGY (50%)

- **Definition**.
- Body mass index (weight in kg/(height in metres)^2 is used as an indicator of choice to estimate ranges in total body fat. The WHO expert committee describes BMI of 25-29.9 as overweight, 30-39.9 as obese and >40 as morbidly obese.
- Other measures e.g. Distribution of body fat around the abdomen (centralised) waist hip ratio,
- **Occurrence**. The prevalence of obesity is increasing in the developed industrialised world. Increase in prevalence in the UK in recent years. In the 2003 Health survey for England, 43.2% of men and 22.5% of women were overweight, 22.2% of men and 23% of women were obese
- **Risk factors**.
- Imbalance between energy consumption and expenditure.
- Increase in sedentary lifestyles and reduction of physical activity, greater consumption of high-calorie fast foods, probable inherited tendency to obesity.
- Lower social class and educational attainment is associated with increase in prevalence of obesity.
- Ethnicity – e.g. South Asians have greater risk of centralised obesity.
- Geography – not clear cut and may be confounded by SE class

- **Consequences of obesity**.ie increased risk for obese
  1. **Diabetes mellitus type II**. RR females 13, males 5
  2. **Hypertension**. RR females 4, males 2
  3. **Hyperlipidaemia**
  4. **Coronary heart disease**. Distribution of body fat around the abdomen (centralised) increases risk of CHD. RR MI females 3, males 2
  5. **Increased risk of other conditions** RR much less but probably increased risk e.g, gallstones and symptomatic osteoarthritis in weight bearing joints; breast and uterine cancer in women; and possibly prostate and renal cancer in men.
  6. **Other important consequences – economic (e.g. cost to health and social care), psychosocial (employment, poor self esteem etc)**

2. REDUCING PREVALENCE (50%)

Answers should be underpinned by a strategic approach and demonstration of importance in national policies to tackle obesity. Good answers should include all elements outlined below but relatively more of their answer should be focused on the national and local partnership elements. Poor answers focus purely on individual and health service approaches

- **Reducing the prevalence of obesity**. - **population**
  National approaches

1. food pricing policies;
2. food labelling policies;
3. integrated transport policies;
4. ensure sound information on diet and benefits of physical activity
5. education on diet and benefits of physical activity

- **More local partnership approaches**

6. initiatives targeted at improving access to healthier foods and tackling food 'deserts';
7. providing incentives to walk or cycle to work;
8. settings approach - encourage development of healthy schools, workplaces and environments;
9. cheaper access to leisure facilities;
10. targeted health information;
11. ensure provision and access to good quality services to those at high risk.. Developing a local strategy for obesity.

- "**Individual" evidence based approaches** May be supported at a population level by care pathways possibly for target groups/BMI levels

1. **Dietary change**. Most reliable way is with mildly hypocaloric diet (5-600kcal/day reduction from previous intake) plus modest increase in physical activity.
2. **Exercise**. Increased physical activity alone and in combination with diet can produce and maintain worthwhile weight loss.
3. **Behaviour modification**. The aim is to produce lifelong habit change. Also stages/cycle of change approach
4. **Comprehensive treatment and maintenance programmes.** Maintenance programmes have been associated with sustained weight loss.
5. **Realistic approach to weight loss–** 5-10% weight loss may be most realistic rather than attaining ideal BMI and confers health benefit
6. **Drug therapy and surgery** – mention of effectiveness and e.g. NICE guidance for those with intractable problems/morbid obesity

Examiner Comments

Generally the question was reasonably well answered. Many candidates did however appear to have taken too much time on the epidemiology section and too little time on the second part relating to reducing prevalence. Both parts carried equal marks. In the second part of the question, some candidates focused rather too much on children and schools rather than adults, although some mention was expected. Few candidates mentioned care pathways or the need to have realistic expectations about weight loss (e.g. 5-10% body weight) in those who are obese.

Question 4

Members of a local environmental pressure group are seeking your support, as a public health practitioner, to prevent the siting of a clinical waste incinerator near to their village on the grounds of the perceived risk to their children's health. Discuss how you would respond to this group.

KEY POINTS

Ascertain the facts of the situation:

- Is an incinerator to be built near to the village and if so exactly what, where, when and by whom?
- What is the membership, nature and influence of the pressure group, and what are their concerns?
- Are there likely to be other agendas?
- Who is/are the responsible authority/ies and to what extent have they been or should they be involved?
- Results of any impact assessments undertaken so far, as part of the regulatory process
- Mechanisms/processes available for obtaining the facts

Decide on whether there is a need for the involvement of a public health practitioner and if so the nature and extent of that involvement:

- Personal/professional
- Any likely conflict of interest, if incinerator is for clinical waste?
- Independent advice to the pressure group/advice to the responsible authority/ies
- Expertise/resources available
- Mechanisms/processes available for deciding on the involvement
- Scoping of the problem before embarking on full health impact assessment

Assuming a professional involvement, obtain and interpret the relevant and available data and information, make recommendations and facilitate their implementation. Answers may include need to identify:

- Emissions eg atmosphere, soil,water
- Past and current health risk and health data of the population in question
- Known health risks and health effects of exposure/proximity to clinical waste incinerator
- Likely health risks to and health effects in the population in question of exposure/proximity to the proposed clinical waste incinerator, including any sub-groups at risk
- Mechanisms for consultation/involvement
- Sources of data and expertise
- Mechanisms/processes available for implementation of findings/recommendations

Other practical points – generally improving the answer to 'good' or 'excellent':

- Demonstrated understanding of the practical and political aspects of such situations.

- Demonstrated understanding of the organisational and legislative frameworks within which such situations are dealt with in candidate's area
- Explored possible conflict between NHS role in relation to clinical waste incinerator, and public health role – issues of trust involved and possible ways round.
- Recognition of the likelihood of political involvement in any debate.
- Monitoring of health impact if incinerator built
- Probability that situation will not be resolved to everyone's satisfaction.
- Possible conflicts on types of evidence used by different interest groups.
- Communication of risk
- Comparison with other technologies e.g. landfill other waster disposal
- Importance of documentation and reports (potential future inquiry)
- wash-up and learning as with an incident might be appropriate
- managing self (and team) – likely to be a stressful and difficult period

Examiner Comments

Overall the question was poorly answered. Many candidates missed obvious points such as confirming the facts, checking the membership and agenda of the group and being clear about their own involvement in addressing a problem. Some failed to give a complete answer by stopping after they had given a holding response to the pressure group. Other candidates jumped in carrying out a full Health Impact Assessment without considering progress to date or due process. Many overlooked the wider issues such as the need for handling the media, the potential conflict of interest, political interest, the need for good documentation and learning points for future approaches by pressure groups.

Question 5

Describe three sources of information that would enable you quickly to assess the extent of mortality and morbidity from asthma in your locality. Indicate the main strengths and weaknesses of these information sources.

KEY POINTS

A quick assessment entails using information readily to hand; generally this will be from routine information sources. Moreover, an assessment should involve comparison between time and place. There may also be problems of definition differences or changes over time. (total of 1 mark)

Three possibilities are outlined below; other plausible sources are acceptable.
3 marks for each type of information – a section must include both a weakness and a strength to get the full 3 marks.

(a) Mortality statistics (e.g. death rates and SMRs):
Proxy for morbidity (how good a proxy?);
Quality of certification is an issue;
Generally not more than one year out of date
Available with health authority boundaries and wards;
Available by age and gender;
Allow comparison between time and place etc.

(b) Hospital admission statistics.
Readily available and usually reasonably timely;
Refer to morbid instances rather than just deaths;
Not as easily related to geographical populations as mortality statistics;
Problems with ascertainment;
Problem of distinguishing episodes and individuals; etc

(c) Information derived from primary care
Quality and Outcomes Framework (QoF) from April 2005 – asthma register, diagnosis by spirometry, asthma review, influenza vaccination;
May not easily relate to geographically defined populations;
Problems of case definition
Potential to identify morbidity not in contact with secondary services;
Prescribing Analysis and Cost Data (PACT)

Examiner Comments

Several students made statements about attributes of the data source selected without relating them back to the question on assessing asthma in the locality. Examiners might appreciate information on primary care source data abroad, eg. Hong Kong

Question 6

What are the uses *(50% of marks)* and limitations *(50% of marks)* of producing health data for small geographical areas?

KEY POINTS

Uses (5 marks)

May include:

- Health surveillance at small area level, particularly in relation to inequalities / health equity audit
- Health profiling of local communities
- Raising awareness of health issues, and supporting local community development and health promotion initiatives
- To support funding applications ("bids") for grants for regeneration initiatives, community development initiatives etc. often require information at small area level
- Preliminary investigation of concerns about "clusters" of disease
- Health Needs Assessment
- Planning services
- Identifying priorities
- Evaluation of health or community intervention

Limitations (5 marks)

- Data confidentiality: Safeguards (data protection rules and regulations) are needed to ensure that no information which could potentially identify an individual is released. For this reason, it may not be appropriate to release certain data for areas with small population numbers.
  (The answer may also briefly refer to methods for maintaining confidentiality, such as a minimum population size for disclosing data, or suppressing data based on small numbers.)

- Statistical issues with small numbers of events: The number of health events over short periods of time in small areas is often very low, with considerable year to year random variation in the number (and consequently the rate) of health events. Therefore, publication of an individual year's data, or even several years combined, could potentially produce a misleading view of the health of that community.
  The random variation in rates should be quantified, particularly when they are based on small numerators. - Use of confidence intervals.
  (However, even with the use of confidence intervals, large numbers of comparisons will tend to produce many high or low results due to chance.)

- Boundary definitions: Administrative boundaries, for which data is collected, may not necessarily reflect the communities of interest (for example, a community of particular interest may include parts of a number of adjacent electoral wards).

Moreover, boundary changes to small areas occur relatively frequently (e.g. reconfiguration of electoral ward boundaries), which may cause difficulties in amalgamating data from a number of years.

- Accuracy of denominator: The population of small areas might change substantially over a few years. The population of any given area is measured most accurately in the decennial census. In intervening years, population estimates may be produced, based on models which incorporate births, deaths and migration, and / or other sources of data such as NHS registration. However, at a small area level, populations can change very rapidly – for example, when housing estates are built or knocked down.

- Access to data – difficult to access, costly to produce, difficult to analyse

Paper IB

Question 7

You are asked to decide between funding for either a new multi-agency injury prevention programme or a new palliative care service for your local population. Describe and discuss the health economic methods you could use to inform the decision?

KEY POINTS

Methodologies:

- Cost Benefit
- Cost Utility
- Cost minimisation
- Cost Effective

Methods include:

Implied values approach:
- based on existing health care decision making procedures and values
- but implied values based on existing programmes, vary markedly

Human capital approach:
- based on labour costs of employment discounted & adjusted
- omits non-work values
- potential for bias towards working men

Consumer demand/willingness to pay:
- addresses consumer sovereignty
- are consumer values appropriate in health care

Essay needs to at least address the above points and for each scenario consider:

- problems of whose costs & benefits to include
- whose values to use

Excellent answers might include reference to developing a true optional appraisal process and the development of a business case approach to support the options. Reference to rationing and the ethical issues and processes for considering this would gain extra marks.

Examiners Comments

In general, we felt the standard had slightly improved from last year in that most answers at least mentioned the 4 main models of economic evaluation. Most candidates defined these methods appropriately, but to pass, something extra was required. Many candidates failed to go beyond the definitions and demonstrate they understood the purpose of these models by actually applying the theory to

answering the question. Understanding of the concepts of option appraisal and resource allocation were not well demonstrated by many candidates.

Question 8

The continuing care of people with a long term chronic illness is important. Discuss critically the issues relating to provision of services to these people within the context of current policy in a named country.

KEY POINTS

- PH burden of chronic illness
    - Prevalence
    - Cost
    - Impact on daily life, employment, social inclusion, wealth
    - Impact on family and carers
- Background
    - Community care policies and problems in implementation (in community or by community)
    - Large scale informal care, largely carried out by women, but increasingly by older people and by children as a consequence of demographic change.
    - Caring for people introduced case management - predominantly brokerage model of social care co-ordination.
- Policy Context
    - Movement of healthcare culture to more emphasis on self-care CEPP
    - Concern about rising costs of healthcare (Wanless reports)
    - NHS plan officially endorsing self care as a desired model.
    - Expert patient programmes - now part of PSA targets.
    - Supporting people with Long term conditions - NHS and Social Care model (Jan 05) - chronic disease management 'triad', including a new health 'case management' system, as a clinical rather than brokerage model.
    - NSF on Long Term Conditions - 11 standards to guide service organisation.
    - 'Choosing Health' White paper introducing individual responsibility, and health trainers, personal health plans, community matrons etc.
    - IT changes with proposed integrated patient records
- Challenges
    - Evidence base poor, proposed supports / case management processes largely untested.
    - One of drivers is to reduce emergency bed use - however identifying relevant recipients of pre-emptive care is difficult.
    - Motivation issues - gap between knowledge and practice among population.
    - Role of professionals in encouraging self care - culture changes needed, need for new ways of working that conflict with professional status.
    - Developing true partnerships, e.g. integrating support groups.

- Data Sources

Excellent answers will reference data / examples of care organisation, and will quote or make reference to relevant policy.

Examiner Comments

We were disappointed with the general standard of the answers for this question. Many candidates did not outline the public health burden of chronic diseases and were very weak on the policy context. Issues relating to service provision were on the whole better described.

Question 9

It is proposed that several small organisations providing the public health function for relatively small areas are to be merged to one large organisation covering a greater area. Drawing on management theory, outline an organisational strategy for managing such change.

KEY POINTS

Introductory Section on the structural context (eg: UK Healthcare delivery system changes: SHA's PCT's etc.) as well as the key principles that need to be kept in mind in managing change: different people react differently/anxieties need to be dealt with/functions must be delivered.

Specific points will need to be made based on a 'strategic' approach:

The Driver(s) for Change need to be identified, in terms of Public Health Implications

These changes may have positive, as well as negative connotations, (change being an opportunity).

Examples include the current UK Health Service policy changes and /or specific financial imperatives occurring locally, eg. PCT budgets being overspent.

Baseline Assessment of Current Public Health Function

Specific details of staffing, budget, as well as activities, need to be established.

Determination of Potential Options for Implementation of Merger Arrangements

The different ways in which a merged Public Health function could be delivered will need to be explored by relevant strategic decision making fora and a decision made with a defined process developed.

Implementation of the Change Management Process

A project plan with appropriate time lines will need to be prepared, consulted upon and delivered in accordance with the requirements of the organisational framework and in conjunction with the delivery of the function, whilst changes are being made.

Building In an Evaluation Process

Consideration should be given to the development of an appropriate evaluation of the change management process.

Question 10

You have been asked to be part of a team assessing applications from agencies competing to run a community service, such as a local substance misuse service. How would you assess the management capability and fitness for purpose of each agency?

KEY POINTS

The specific context within which the assessment of management capability and fitness for purpose of each agency needs to be undertaken must be specified ie. community based local substance misuse service.

Identification of Function

Each agency's function within the service should be defined in terms of partner agency's.

Ascertainment of Management Capability / Fitness for Purpose should be undertaken against specific criteria and applied to each agency:

Leadership Arrangements:

- Accountable Officer/Board details in terms of how it operates
- Governance Arrangements, Explicit Accountability Mechanisms eg Financial Probity Arrangements
- Quality Indicators of Service Delivered, which included end user participation
- Measure of Activity
- Funding Allocation – Recurring/Non-recurring, Project Work/Substantive Arrangements
- Staffing Infrastructure and Training
- Location of Service Delivery Points in relation to the Client Group eg. Outreach
- Specific Liaison Arrangements with Partner Agencies dealing with the same/overlapping Target Groups

Paper IIA

You are responsible for health protection in your area when one of the Directors of Public Health asks for your advice about responding to a number of letters they have received from a local community group concerned about three cases of cancer in a small part of your area. In particular they are concerned about the overhead power cables which run close to where they live in light of recent publicity about the attached article.

Childhood cancer in relation to distance from high voltage power lines in England and Wales: a case-control study. Gerald Draper, Tim Vincent, Mary E Kroll, John Swanson. doi:10.1136/bmj.330.7503.1290
BMJ 2005;330;1290-

1. Critically appraise the article (20 marks)
2. Using the data in table 1, calculate an estimate of the odds of all cancers for each distance category relative to the reference group. Comment on the appropriateness of this form of secondary analysis (5 marks)
3. Outline your approach to investigating the putative cluster (10 marks)
4. Write a letter to the group outlining your response to the attached article and any additional steps you might wish to take to address their concerns (15 marks)

KEY POINTS

- Paper is an aetiological (extra mark) case control study in which the outcome of interest is childhood cancer and its association with exposure to low frequency magnetic radiation from over head power cables
- Several studies both lab and population based with equivocal results, and lack of biologically plausible mechanism but persistent public concern remains over potential harm of exposure.
- Cases 29081 children aged 0-14 registered as having cancer in England & Wales, born 1962-95
- Controls matched for date of birth, sex and birth registration district (extra marks – birth registration districts may be upto 40,000 people so controls could have very different SE characteristics, exposures etc…, not clear how control births
- Exposure measure based on distance of location of postcode (Address point localizes postcodes very accurately) from nearest cable based on National Grid where this was <1 km. Distances presented as categorical variables and then ? post hoc recategorised suggesting a dose response (table 3)
- Note there is no measure of person time exposure, and it would seem more plausible that any risk should be related to inverse square distance as well as the distance per se.
- Measure of association odds ratios derived from logistic regression analysis – appropriate analysis for binary variable (presence or absence of disease) to

adjust for confounding etc. Chi squared appropriate method for assessing relationships with categorical variables.

- Cancers divided and separate control groups for each – no analysis for cancer overall although these odds ratios can be estimated from table 1.
- Results. Cases of leukaemia likely to have been born nearer to power lines than control groups. Not so for neuro cancer or other cancers. Put another way, there is an excess risk of leukaemia in each distance category. From table 1 there are no CIs, but in table 3 the unadjusted data are presented with CI for adjusted distance categories.
- From table 3 it appears that there is 70% excess risk of leukaemia within 200m of a power line, falling to 23% between 200 and 500m. These risks are sig at 95% level (CIs exclude zero).
- The only confounder adjusted for was SE status using ward level Carstairs index (which wasn't available for 1971 or 81 census so unclear how this was done). Adjusting appears to have no effect on risks, although leukaemia more frequent in higher SE groups unlike other cancers assessed.
- One other confounder addressed is "population mixing" as assessed by the frequency of change in postcode between birth and diagnosis
- There are other potential confounders or factors not adjusted for e.g. person time of exposure, age at diagnosis,
- Key results appear to be a statistically significant excess risk of leukaemia, suggestion of a dose response, and lack of effect of adjusting for confounders. => chance appears not be an explanation. Registration is likely to be complete and the sample size is large. The selection of controls seems reasonable – any source of bias here would have to produce controls which by selection or chance happened to live further from the power lines for the leukaemia cases and not the other cancers which seems unlikely although birth districts can be large populations.
- One key issue is exposure measurement – distance is used as a proxy and that can be measured with accuracy although in narrow distance bands there can still be potential for misclassification. Of more concern is what the "conceptually relevant exposure" – there seem to be a number of factors here:
    - The strength of the radiation which presumably depends on the voltage of the cables and the inverse square law– the former not adjusted for and the latter did not produce a significant result
    - Duration of exposure which could have been estimated as the time between birth and diagnosis and was not factored into estimates or risk
    - Intervening factors such as the extent to which the children were actually at home to be exposed, shielding etc.
    - The research is unsupported by any contemporary or historical measurement of magnetic fields

- The authors claim that chance could still explain the findings and bias is unlikely although still possible. Where relative risks are less than 2 residual confounding is always a likely explanation.
- The dose response which appears to emerge adds some credibility to an aetiological association, but body of equivocal previous research, relatively small risks and lack of a biologically plausible mechanism do make a strong case for action, and this is no more than an interesting finding worthy of further study or a meta-analysis of previous studies.

Distance	Leukaemia		Neuro		Other		Total		Odds ratios
	Cases	Control	Cases	Controls	Cases	Controls	Cases	Controls	
0-49	5	3	3	7	7	6	15	16	**0.940**
50-99	19	11	4	6	15	16	38	33	**1.154**
100-199	40	25	26	32	37	45	103	102	**1.012**
200-299	44	39	38	28	66	76	148	143	**1.037**
300-399	61	54	35	30	79	65	175	149	**1.177**
400-499	78	65	40	42	80	97	198	204	**0.973**
500-599	75	56	54	41	86	85	215	182	**1.184**
>600	9378	9447	6405	6419	12406	12386	28189	28252	**1.000**

1. Cluster analysis. Decision here depends on extent to which there is a true clustering of cases in spaces and time. With very few cases this is unlikely unless this some form of rare cancer where the expectation is zero. (the rule of 3). Some preliminary investigation – quick and clean - will be needed to decide this – defining the area and time period of interest, data from cancer registry on incidence, specificity of cancer types. Need some initial assessment if the number of reported cases is greater than would be expected. May need to call in expert help if investigation to proceed further e.g. for statistical analysis e.g. from SAHSU, but judgement call as to how far to take this if the number of cases exceeds expected…Standard answer
2. Letter. Key things here are that this a political as well as scientific/ technical issue – needs to take into account the audience – informed and concerned public; tone – firm and polite – lay language – risk communication, understanding of difference between association and causation; and understanding of various psychological factors which lead people to impute patterns and associations which are merely chance findings. Assuming you conclude that there is no real cluster you need to communicate that fact and a letter maybe insufficient, so you may need to meet. Depending on the resources available and the strength of feeling/ media interest will determine whether you would need to take this further e.g. ongoing monitoring, further investigation etc…
3. Marks here would be deducted for inappropriate tone – patronising etc; too technical language – need to explain risks and causation in lay terms; over commitment of resources. Marks gained for openness etc…

Examiner Comments

The paper was a relatively straightforward case control study which was well conducted. It had significant strength from using routine largely complete and unbiased data sources avoiding recall and non response bias. It was as large as it could have been and unlikely to have been significantly affected by small % of "drop outs". Many candidates criticised the lack of a sample size calculation - this was wrong - a **power** calculation was missing - the sample was (near) complete. Standard confounders were controlled for in the design (matching) and the analysis (logistic regression) and attempts were made to adjust for others such as socio economic status (using the Carstairs index) - some candidates spent far too long criticising the use of this index but it is entirely reasonable. There did appear to be a

significant negative association with the risk of leukaemia and distance from power lines but this only appeared after adjustment and seemingly arbitrary reclassification of distance categories and did not appear to concur with the inverse square law which radiation sources often exhibit. Chance and residual confounding were likely contributors to the result. One question is why the authors did not calculate risks for all cancers.

The second question sought to get candidates to calculate odds ratios and comment on the fact that there seemed to be an increasing risk of cancer with increasing distance, but that post hoc subgroup analysis should be taken with care.

The best answers to the cluster analysis were practical recognising that it was probably a chance finding that may not have needed investigating but that it was important to manage public anxiety. Some candidates wanted to set up large scale cohort studies which was not justified and not practical (resources, expertise, cost, time, sample size)

The average mark for the letter was just below a pass. On the whole there was too much technical language, the tone was some times patronising or paternalistic and some candidates made themselves hostages to fortune with unrealistic promises.

Paper IIB

A recent television series presented by a celebrity chef has excited a local and national debate about the nutritional adequacy of school meals. You are the public health advisor for a large town that is coterminous with a local education authority serving 20,000 schoolchildren (aged 5-18 years). In response to local media interest, the education authority has linked records of school meal purchases to the results of a recent routine survey of the heights and weights of children in their final year at primary school (age 10-11 years) throughout the town. The education authority has sought your advice about interpretation of these data.

School meals eaten daily?	Number of children	Percentage of boys	Mean (SD) height (cm)	Mean (SD) weight (kg)
Yes	1437	45%	140.9 (7.6)	35.4 (9.0)
No	510	54%	140.5 (7.5)	34.5 (9.2)

1. Briefly describe the principal findings in the table [5 marks]

2. Calculate a measure of the difference in body weight between the children who eat school meals daily and the remaining children, and its 95% confidence interval. [10 marks]

3. Comment on the likely effect of adjusting these comparisons for gender. [5 marks]

4. Suggest a more statistically powerful method, based on the original measurements of height and weight linked to school meal purchases, for comparing the body composition of children grouped according to consumption of school meals. [5 marks]

5. Discuss what information you would seek to include in a more definitive study of the impact of school meals on the growth and development of children in this town. [10 marks]

6. Prepare a statement of up to 500 words in the form of a press release to the local newspapers, placing the results of the education authority's survey into the context of national strategies to prevent childhood obesity in a named country. [15 marks]

KEY POINTS

Q1

a) About three-quarters (74%, 1437/1947) of children eat school meals daily.
b) Slightly more girls than boys eat school meals (chi-squares etc. not expected here).
c) Children who eat school meals are on average taller and heavier than the others.

d) Standard deviations of height and weight are similar in the two groups, so comparisons can be made using conventional statistical methods (t tests, regression models)

Q2

a) These are unpaired data, suitable for comparison using an unpaired t test.
b) Derive SEMs as SD / √(n-1) for weight in each of the two groups.
c) Derive SE(difference) as $\sqrt{[SEM_1^2 + SEM_2^2]}$
d) Derive difference between means by subtraction (D)
e) 95%CI for difference = D $\pm$ 1.96*SE(difference)
f) Comment on statistical significance

Q3

a) At age 10-11, many girls have started their pubertal growth spurt, so girls are taller and heavier than boys.
b) The data show that children eating school meals are taller and heavier, and more likely to be girls. Gender is thus a positive confounder in this situation.
c) Adjustment for gender would therefore tend to reduce or possibly reverse the relationship between school meals and height or weight.

Q4

a) Much of the between-child variation in weight may be attributable to height.
b) Suggest a height-adjusted measure of body fatness, such as body mass index (weight/height^2 - widely used but not ideal for children), ponderal index (weight/height^3), standard deviation score or percentile of weight-for-height.
c) This would improve power because the between-child variation within groups would be substantially reduced, leading to more precise measures of the difference.
d) Additional precision could be gained by adjusting for gender, or by stratifying by gender and then pooling the results.

Q5

a) Think more broadly than 10-11-year-olds – look at younger primary schoolchildren and at growth and pubertal development in teenagers
b) Consider a wider range of measurements than just height and weight, such as measures of fat distribution (skinfolds, waist/hip) or fat mass (bioimpedence). To measure <u>growth</u> (rather than height) would require longitudinal assessment (or record linkage).
c) Obtain more information on what children are actually eating for lunch (in both groups) and at other times of day (and in holidays). Thus, place the school meals into context, but also address confounding by other aspects of diet.
d) Collect information on potential confounders, including parental heights and weights, family lifestyle, child's activity patterns.
e) Compare schools serving different types of menu at lunchtime.
f) Consider a before-and-after comparison if changes are implemented to the school meals.

Q6

a) Demonstrate general knowledge of the nature and potential importance of childhood obesity, and the policy context with particular reference to diet and physical activity.

b) Describe the findings clearly, but pointing out the potential for confounding by gender.
c) Point out that the findings are age-specific and need confirmation in other age-groups.
d) Put school meals into context as only one component of diet, and one of several influences on children's growth and development.
e) Suggest how the educational authority and public health department will be taking the issue forward.
f) Present the arguments in a coherent and logical form, within the word limit.

Examiner Comments

Q1 'A brief description' should be interpreted as a 'summary' rather than a repetition of the data included in the question.

Q2 As with all questions involving calculations it is important that these are included as a candidate is left vulnerable when only the final answer is entered.

Q3 Many candidates were not merging the reported findings into population perspectives such as the earlier maturation of girls and that height is a major determinant of body weight.

Q4 Surprisingly many candidates did not mention BMI in their answers.

Q5 Many students gave a description of the components of a research proposal rather than recognising the many factors that are related to childhood nutrition and eating habits. Social and health inequalities were not mentioned as frequently as expected.

Q6 The phrasing of a press release should offer facts and interpretation and not journalistic flare which was demonstrated by many candidates. Some candidates did not mention the results of the survey. Whilst it is expected that candidates will demonstrate familiarity with the components of a press release these are not enhanced by too much imagination.