

Actuarial Society of South Africa

EXAMINATION

1 November 2013

Subject F201 — Health and Care

Specialist Applications

EXAMINER'S REPORT

Question 1

i)

This was a theory question, and was well answered by prepared candidates.

Fee-for-service

A fee is paid for each service performed

Gives rise to a perverse incentives to over-service

Risk transferred: Price risk

Per diem (per day) rates

These typically relate to hospital admissions and relates to a set rate per day (per diem) for all services provided by the hospital

The rate may be structured to allow for a higher rate in the first one or two days, as these are normally more expensive where e.g surgery is performed

Complicated cases could be carved out, reverting to fee-for-service.

Under per diems, the funder will be wary of attempts to increase LOS and may impose a maximum reimbursable LOS, requiring a motivation from the doctor if stay is prolonged

Risks transferred: Price risk, Intensity risk

Fixed fees and global fees

A fixed fee covers the hospital costs of a particular procedure or diagnosis

Inclusive of e.g. ward fees, theatre time, equipment, regardless of how long the member is actually hospitalised

Suitable when LOS variance is low

A global fee also includes professional services, in addition to hospital cost, e.g. specialist and anaesthetist fees

The hospital will now be acutely interested in managing length of stay, whereas the funder need not keep tight control as in a per diem structure

Under this reimbursement structure, funders would typically be concerned about readmission rates, which could be an attempt to charge twice for the same procedure.

The hospital will monitor quality and complication rates of surgeons

Risks transferred: Price risk, intensity risk, severity risk

Capitation

Capitation is the payment of a fixed amount per service, whether the beneficiary uses the service or not.

The provider takes the risk of more people making use of the service than expected

An incentive exists for the provider to under-serve patients. The funder may want to monitor the quality or outcomes of services provided.

Risks transferred: price risk, intensity risk, severity risk, frequency risk

Percent of premium

This model provides for a fixed percentage of premium being paid to providers, in form not dissimilar from quota share reinsurance

This form of reimbursement is not allowed in South Africa, as the provider would fall within the definition of doing the business of a medical scheme.

Risks transferred: price risk, intensity risk, severity risk, frequency risk, actuarial and marketing risk

ii)

Most submissions offered little more than a superficial statement that persistently high healthcare inflation is requires attention. Examiners were surprised to note that very few candidates reflected on the “at cost” reimbursement of PMBs in the absence of a regulated or reference tariff and/or billing guidelines.

Since 2010 Schemes have based the tariffs at which the scheme reimburses on the most recent valid RPL and made adjustments due to inflation. Because schemes are not allowed to do this collectively the adjustments have varied. This has caused these so-called “scheme tariffs” to diverge with each passing year –

...which, in turn, increases the confusion and administrative burden on providers that want to charge at a scheme rate.

The “payment in full” and “at cost” requirements of Prescribed Minimum Benefits (PMBs), as per Regulation 8, exposes schemes to significant pricing risk unless a DSP or contract with providers is in place

With no reference / regulated price in existence, it is difficult for schemes and regulatory authorities alike to intervene if providers exploit these regulations by increasing PMB charges to prohibitive levels

Price regulation could be beneficial to schemes that do not have contracts with the majority of providers.

Conversely, for schemes that have contracts in place, or schemes that have managed to negotiate better prices with providers than their competitors, price regulation could remove a competitive advantage presently being enjoyed

The tariff coding systems presently used in South Africa have not been maintained since 2010. Some codes have become outdated and require revision

...as a result many administrators/schemes have started using “in-house” tariff codes where a standard code is not available, thus making industry-wide research or benchmarking difficult

The advent of new technologies could also require new codes to be added to cater for e.g. new procedures

Given the absence of a standard tariff and billing guideline, a risk exists that providers could legitimately bundle codes or upcode or manipulate coding in ways designed to increase their revenue, to the detriment of medical scheme members.

A set of regulated tariffs could be required for purposes of reimbursement under the proposed National Health Insurance (NHI) policy trajectory.

iii)

Most candidates failed to demonstrate a basic common sense understanding of the structural approach proposed by funders. Some assumed that this methodology implied that all specialist disciplines would attract the exact same tariffs, whilst other candidates assumed that the methodology would yield a different tariff for each individual practice. Examiners looked for a deeper understanding of the incentives presented in a “cost-plus” approach to pricing. Stronger candidates were able to differentiate themselves in this question.

Providers’ proposal

A “cost plus reasonable profit” approach would likely be deemed fair by providers

The principle of linking tariffs to costs could, over time, introduce perverse incentives (akin to a moral hazard) in the sense that providers will view their own cost escalations as sufficient justification for tariff escalations

...thus reducing incentives to control costs

This approach will also require explicit consideration of an appropriate allowance for the quantum of providers' profit margins

Which in itself could be controversial and difficult to agree on

Another significant issue with this approach would be data collection

How would data be sampled in a scientific and statistically representative manner?

There is a significant risk for a "participation bias", i.e. only providers with high cost bases would choose to participate in the data gathering process

Thus skewing results in favour of more expensive practices

A cost-plus approach would need to remain cognisant of the cost of running different practices

For example, geographically: the cost of rent in Sandton compared to a rural area

as well as geographical salary differentials for administrative staff

It is difficult to allocate costs to various procedures

For example, the average time required to perform a consultation or procedure

And difficult to take account of different kinds of practices, such as a super-specialists, where the mix of procedures will be very different from others

Additional data fields that could be required

- IT hardware costs
- Software licensing costs
- Medical equipment capital costs
- Profit margin targeted
- Time taken to perform specified consultations or procedures

- Time required to attend to personal and administrative requirements
- Bad debt

The proposed approach does not consider quality or outcomes. These should ideally be taken into account.

Once data is collected, a spread in costs might be observed. Where in this spread should the tariffs be fixed? A median (or average) could be used, but may not be appropriate considering that half of providers perform more efficiently than the median. Other percentiles may deserve consideration.

(iv)

This question was very poorly answered. Very few (if any) candidates discussed relevant points such as the incentives created by the proposed system, or the fact that out-of-pocket payments would not necessarily be available from medical scheme claims data.

Funders' proposal

A demand-side approach is blind to the costs of the services, but considers the prevalent market rates instead

This has the advantage of incentivising providers to be more efficient in their cost structures

If this approach yields a price that does not realistically meet the costs of running a practice it could drive health professionals out of private practice.

The data specification provided is limited to historical medical scheme claims data

Which could already be distorted due to the inefficiencies of the current marketplace

For example, some providers might have increased fees charged for PMB claims, entrenching distortions in their billing data

Looking at claimed amount in the data might not give the full picture, as not all claimed amounts are reflective of what was actually paid

- For example, split billing (which would under-estimate the cost)
- Or, gaps in medical scheme cover (for example, once an MSA or limit is exceeded, claims might not be submitted to the medical scheme anymore)

It would be useful to have sight of the fees paid by members (in addition to amounts paid by medical schemes) to determine what is presently being paid to providers

Although this data may be hard to collect

Although quality is normally implicit in a normal “willing buyer/willing seller” approach, this may not be the case in healthcare. This is because consumers do not necessarily have access to kind of the information that would allow them assess quality before choosing a provider and agreeing on a price

Additional data fields

- Region (tariffs could vary by region)
- CPT code

NOTE: the following two points also appear in (iii) above, as these points are applicable to both approaches. Credit will be awarded to these points if raised in either (iii) or (iv) but not double-counted if provided in both.

The proposed approach does not consider quality or outcomes. These should ideally be taken into account.

Once data is collected, a spread in tariffs presently being charged might be observed. Where in this spread should the tariffs be fixed? A median (or average) could be used, but may not be appropriate considering that half of providers may be charging more efficiently than the median. Other percentiles may deserve consideration.

(v)

Many candidates lost themselves in the wrong kinds of detail (like in-length discussions on data elements) while stronger candidates were able to focus on the practicalities and incentives of the proposed reimbursement structure.

The proposed model recognises that the specialist is the key decision maker in major cost drivers (including ICU, high care, pathology, surgicals) and aims to incentivise the specialist to make decisions in an efficient manner.

Given that the current fee-for-service model is widely held to be inefficient, the proposed all-inclusive fixed fee could theoretically be set at a level below the current average cost per procedure

The proposal will introduce a significant and unfamiliar administrative burden on specialists. Specialists might not have the skills, resources and capacity to administer claim payments to hospitals, anaesthetists, etc

This could impact on the specialist’s capacity to deliver healthcare, effectively reducing the supply of services in the market

The definition of cases covered under any particular global fee needs to be carefully considered. Where cases are not defined in a homogenous manner, opportunities for “cherry picking” could emerge where specialist practices will only be willing to perform simpler procedures under the guise of the more expensive average. A clearly coded, unambiguous definition is required.

The definition of “all costs” which are included in the fixed fee needs to be considered. For example, if a psychologist consulted a patient whilst in hospital, should this also be covered, out of the specialist’s pocket, as part of the fixed fee?

Will post-operation costs be included? Doing so will create more rigorous incentives for specialists

If the global fee is all-inclusive, balance billing (from any provider) to members should be prohibited.

Specialists will need comfort that the fixed fee is reasonable. Presently specialists have little information pertaining to actual hospital / rad / path / other costs, and will have difficulty assessing this.

The calculation of an appropriate fixed fee will have to rely on existing medical scheme data sources.

Specialists do not necessarily have the capital to assume significant risk.

For example, some cases might complicate and end up incurring millions of rands in ICU expenditure

And some complications cannot reasonably be attributed to the quality of work being performed by the specialist

Conversely, some kinds of complications could be attributed to specialist – and it is important that an incentive remains for specialists to perform good quality work

This could be handled by identifying outlier cases,

...either statistically (e.g. through percentiles) or clinically through claims data (e.g. a second ICD code)

...and allowing outlier cases, as per a clear definition, to be reimbursed in the conventional fee-for-service fashion

If outliers are removed from the basis, care should be taken to ensure that the fixed fee is adjusted downwards to reflect this

An insurance or reinsurance arrangement could be contemplated to assist specialists with outliers if these are not removed from the global fee as described above

Risk-adjustment should be considered. Is it appropriate to charge the same fixed fee for older and younger patients alike?

Medical schemes could lose ownership of data (compared to the data-rich fee-for-service dispensation).

This could, over time, limit medical schemes' ability to interrogate the activity underlying surgical procedures

...which might not be an issue as the system is designed to encourage efficiencies

Specialists may not have the cashflow to finance the cost of some cases running over the fixed fee. How will this be dealt with?

Schemes could consider employing the provider debt mechanisms already in place for this purpose

Quality should be considered

The fee could be argued to introduce a risk of inferior quality work

For example, a disincentive to use the latest and most expensive technologies

To address this, some quality measurement mechanisms will be required. For example, depending on the procedure performed, the patient might be required to respond to a quality of life questionnaire a few months after discharge. Data collected from such questionnaires could be analysed to ascertain which providers are performing lower quality work

And incentives (such as enhanced fixed fees) could be considered for better quality providers

Question 2

(i)

This question required students to describe how they would cost a new set of preventative benefits and was answered relatively well.

Given that this is a new benefit and MarsMed is the only client of Phobos there will be no experience data available from other medical schemes that can be used as a basis for the calculation.

On the other hand the fact that beneficiaries may have predominantly funded these tests from their medical savings accounts (given that all options are new generation) means that we should not assume that these benefits have not been available to the scheme's beneficiaries.

Similarly some of these claims may have already been included in the risk claims – since the costs of diagnosing a PMB condition is also a PMB.

It will be helpful to get a hold of the benefit brochures of competing medical schemes to see how these benefits compare in terms of limitations and/or protocols being applied to these benefits (for example the contraceptive benefits may only be available for females above a certain age).

There are some matters that will need to be clarified:

- Is there only one flu vaccine or are there a number of different vaccines with different costs?
- Will the flu vaccine be available only from certain service providers such as pharmacies or will the scheme pay if the member obtains the vaccine from a GP or specialist?
- Will the flu vaccine benefit only cover the cost of the vaccine? What about the consultation fee if the member goes to a doctor to get the vaccination?
- Will any oral contraceptive be accepted or will the scheme limit it to a list of covered contraceptives?
- What about other contraceptive methods? Will they be benefit exclusions?
- At what rate will the scheme reimburse benefits such as maternity consultations and scans? Will the benefit be limited to the scheme rate or full cost?
- Are pregnancy consultations available from GPs or gynaecologists only or a choice of either?
- What kind of blood sugar and cholesterol tests will be covered? Will it be simple finger prick tests or lab tests?
- What are the likely costs for pre- and post-counselling sessions and the HIV blood test?

You will need to acquire the tariff and Nappi codes through which these benefits will be identified.

You will also need to obtain an estimate of the unit costs for each consultation, test or scan. In other words:

- the cost of a flu vaccine shot.
- the average cost of a maternity consultation visit. If this is limited to scheme tariff then you could simply use the current scheme tariff adjusted for the expected inflationary adjustment that the scheme will make to its tariffs for the coming year.
- If the scheme does offer a choice of service providers for pregnancy consultations you would need to estimate the costs separately for GPs and gynaecologists and then make an assumption regarding the proportion of families who would make use of each.
- what is the cost of various oral contraceptives? These should be easy to obtain once you have the list of contraceptives covered.

For each of the benefits you will also have to make an assumption regarding the utilisation of the benefit.

Maternity rates can easily be derived from data

Outside sources such as consulting actuaries could be approached for information to support assumptions.

These assumptions would have to be sensible. For example only female beneficiaries will make use of the maternity benefits.

The utilisation assumptions will be applied to the projected demographic profile of the scheme for the coming year to provide an estimate of the number of claims for each benefit.

The number of claims will then be multiplied by the applicable unit costs to provide an estimate of the total costs.

Since the utilisation assumptions are untested you may want to add a safety margin to the totals.

The figures can then be divided by the corresponding beneficiary totals to arrive at per beneficiary per month costs.

Other considerations:

- You should consider whether these benefits are likely to alter claiming patterns for other benefits.
 - For example if members have already been utilising the maternity consultation benefits via their regular day-to-day or above threshold benefits the analysis should avoid double counting the costs.

- On the other hand moving these benefits into a separate limit without adjusting the original benefits may mean that the members will have more of their original benefits available and will utilise them for other purposes.
- You should also consider what the impact of introducing these benefits will be on new business as well as retention of existing members.
- VCT is a PMB
- Consider the impact of, for example, waiting periods on maternity benefits. What impact will this have on utilisation of the benefit?
- Consider the potential impact of anti-selection for maternity benefits

(ii)

This question required students to explain how they would go about demonstrating whether each of the preventative care benefits will show a positive cost benefit. This question was generally answered poorly.

An alarmingly large proportion of the students did not approach the problem as an analytical problem that requires appropriate comparison of the experience of those who utilised the benefit and those who did not. Some candidates attempted to use general reasoning to argue that the preventative care benefits will have a cost benefit.

An alternative approach taken by some students was to suggest that historic data should be used by, for example fitting a GLM to historic claims data before a benefit was introduced. The model would then with appropriate adjustments for inflation, be applied to the exposure data after the benefit was introduced. If the actual costs were then lower than the predicted costs then the benefit was deemed to be cost effective. This methodology is not invalid but is not considered ideal as unanticipated external factors may influence the results and therefore the conclusion. For example different flu strains in different years or varying weather conditions may have an impact and would be very difficult to allow for in such a model. Nevertheless, candidates who proposed this approach received partial credit.

In essence this exercise will involve two types of analysis:

- The first will be an analysis of the utilisation of these benefits
- The second will be a comparison of the claims experience for the beneficiaries who did utilise the benefits compared to the claims experience for those who did not.

The first step will therefore be to identify those beneficiaries who did utilise the various preventative care benefits. For example you would identify the beneficiaries who made use of the oral contraceptive benefit, those who claimed for the flu vaccine etc.

The comparisons may be made based on total claims as opposed to the claims related to each preventative care benefit as this would greatly simplify the exercise.

However, this approach is exposed to bias since beneficiaries who utilise the preventative care benefits may differ from those who do not in some way that affects other (non-related) claims as well.

It would therefore be preferable to link the preventative care benefit to the types of claims that it intended to prevent.

Flu vaccine

In the case of the flu vaccine we would be interested in the difference in costs associated with the flu. This would include

- GP consultations,
- hospitalisation for flu and related diagnoses such as pneumonia (which are likely to be the big cost drivers for flu related admissions)
- utilisation of acute medication to treat flu symptoms.

These flu claims can be identified by ICD10 codes in the case of consultations and hospitalisation.

This may not be completely accurate since flu may be diagnosed as common colds or other diseases based on symptoms, which would lead to an under-estimation of flu-related costs.

In the case of medicines using ICD-10 codes be problematic in the case of medicines that are prescribed to treat symptoms that are common to various diseases – such as headaches and fever.

Oral contraceptives

Arguably there may be some benefit in terms of the prevention of unwanted pregnancies.

However, since medical schemes do not have the necessary information to distinguish between planned and unplanned pregnancies it will not be possible to quantify the savings to the scheme.

We will need to consider any potential bias that may arise due to self-selection. In other words any beneficiaries who choose to utilise this benefit may claim differently because of the fact that they have made this choice as opposed to the pharmacological working of the contraceptive.

Comparatively high rates of uptake at the lower end of the childbearing age range may be an indication that some unplanned pregnancies were prevented.

Beneficiaries who make use of the oral contraceptives are not expected to get pregnant. The benefit to the scheme is that the provision of oral contraceptives may be useful in attracting younger members to the scheme who are not currently planning to have a baby, improving the average risk profile of the scheme.

One avenue of investigation would be to determine what the utilisation of the oral contraceptive benefit is amongst new families joining the scheme compared to utilisation amongst existing families.

If this is relatively high we may have an indication that the benefit is effective in attracting new business

The benefit of attracting these members can be determined by comparing the scheme's actual average age, pensioner profile and average claims per beneficiary per month to the same figures if we excluded the new business that utilised this benefit.

Maternity benefits

In the case of the maternity preventative care benefits we are interested in the costs related to delivery and the costs of care for neonates.

The scheme would want to see a reduction in these costs in the population who utilised the maternity preventative care benefit compared to those who did not.

It is unlikely that pregnant women who have access to this benefit will not use it.

Therefore it will be necessary to compare the claims experience before the benefit was introduced to the experience since the benefit was introduced.

This will require adjustments for inflation for the different periods

Are these benefits attracting members who want to have a baby, join the scheme for the maternity benefits (including the costs of confinement) and then leave the scheme once the baby is healthy?

In such a case the 20% increase in maternity cases will be very costly for the scheme without any real benefit.

Screening and HIV VCT benefits

With all these tests the intention is that early detection will result in cost savings later on

The screening tests are aimed at identifying undiagnosed cases of diabetes and hyperlipidaemia.

These diseases have long-term cost implications and we only have a year and a bit worth of data.

At this point in time the investigation we want to perform would rather be to see if the screening benefit has been effective in identifying previously untreated and unmanaged cases of these diseases.

Ideally we would want to know what the outcomes of the tests are but it is more likely that the claims data will only indicate whether someone has been tested or not.

The information may however be available – for example if the disease management programme is structured in a way that allows for this – which is likely to be the case for HIV/AIDS managed care providers

We would therefore look at the beneficiaries who went for screening and see if the rates at which these beneficiaries registered for these conditions on the schemes chronic disease programme compared to the untested of the members.

We would also like to find some indication that HIV AIDS are being detected in the earlier stages of the disease for example if the average CD4 counts of new individuals being enrolled should be relatively high.

Similarly we would like to see some evidence that the early detection of these conditions and enrolling the beneficiaries on disease management programmes leads to a measurable improvement in the states of health of the patients.

A multi-state model could be used to estimate the benefits of early detection

For the HIV/AIDS modelling the ASSA Select model may be a good starting point

Though the model will require modification as it is intended to model HIV/AIDS in working populations rather than in a medical scheme context

For each stage of the disease progression as well as the treatment stages a state will be included in the model, with assumptions of the costs for a typical patient in that state (such as the costs of ARV treatment)

The model will need to incorporate some allowance for the difference in the progression of the disease for someone who enrolls on the disease management programme at an early stage compared to someone who only enrolls when they start showing symptoms.

Some assumptions will be required – for example whether the survival functions for individuals who start appropriate treatment early are different from those who do not.

There should be plenty of research available to inform such assumptions.

General observations

Any comparison will also have to be risk adjusted. If we compared the flu-related claims of the beneficiaries who utilised the flu vaccine, which is biased towards members aged 60 and older, to the similar claims experience of those who did not utilise the benefit (which is weighted towards the younger members) without allowing for this bias the results of the analysis may lead us to erroneous conclusions.

Similarly the evaluation of the maternity preventative care benefits should be limited to female beneficiaries who were pregnant during the period under review.

There are two approaches to the risk adjustment:

The first would be to draw a sample from the two populations (utilised the benefit or did not utilise it) and ensure that the demographic profile of the two sample populations is similar with regards to factors such as age distribution, gender and chronic status. We could then compare the average flu-related costs per beneficiary per month for these two groups.

The second approach would be to perform a GLM modelling exercise where the risk factors are incorporated into the model as well as a benefit utilisation indicator. We would then test to see if the benefit utilisation indicator is a statistically significant factor in the model.

(iii)

This question is mostly based on bookwork

A number of students missed the point that this evaluation is necessary to support a decision of “PSA benefit” or “No PSA benefit”. As such alternative interventions are not being contemplated and a cost benefit analysis is the only viable choice. Furthermore the trustee’s requirement is clearly stated in the question, but ignored by several candidates.

Cost Effectiveness Analysis

This can be used for comparison of mutually exclusive alternatives. The equation of value for service/product, “t” is:

$$\text{CEA}(t) = \frac{\text{Costs in units of money}}{\text{Benefit on scale}}$$

Benefit on scale

Note that this method does not value individuals differently. It also cannot account for multidimensional effects (i.e. the scale is linear). It cannot deal with individual projects as it relies on comparison of alternatives. So it is best used for allocating a fixed budget amongst a fixed set of alternatives.

Cost Utility Analysis

Under this method, we assign a scale value to each conceivable health status (0=death; 1=perfect health). We then need an indifferent utility function based on this scale that results in a Quality Adjusted Life Year (QALY).

The equation of value for service/product, “t” is:

$$\text{CUA}(t) = \frac{\text{Costs in units of money}}{\text{Benefits in QALYs}}$$

This method is suitable for mutually exclusive projects where the results may be arranged in League Tables. The results are very sensitive to the structure of the utility function that is very difficult to determine.

Quality Adjusted Life Years (QALYs) evaluate the cost related to a composite measure of the quality of life effect resulting from a given intervention. This is a combined measure of the quantity of years saved together with a measure of the quality of life enjoyed by the patient during those years. Quality of life is ranked from 0 to 1, where 1 is normal quality of life of a perfectly healthy individual, while 0 is equal to death.

Disability Adjusted Life Year (DALYs) uses measures of the impact of disability on people’s lives to convert disability into an adjustment on life expectancy.

Cost Benefit Analysis

This method involves assigning a monetary value to prolonged life and/or a change in health status. The equation of value for service/product, “t” is:

$$\text{CBA}(t) = \frac{\text{Cost in units of money}}{\text{Benefits in units of money}}$$

CBA(t) of less than 1 indicates a recommended project.

Unlike CBA, CEA and CUA avoid the problem of monetary evaluation of life and health. However, they provide only a relative evaluation of mutually exclusive projects, whereas CBA permits an evaluation of each project on its own.

Which method to use

In this exercise the scheme will be most interested in a cost/benefit analysis.

A cost effectiveness analysis would be more suited to evaluating alternative preventative care benefits that address the same disease or condition (in this case prostate cancer)

Similarly an open medical scheme will most likely base its decision on the relative financial benefits of providing the PSA test as opposed to whether it will result in an increase in QALYs or DALYs.

(iv)

Not all candidates chose a cost/benefit analysis in the previous question. Where students opted to use another method due credit was given. Stronger candidates were able to structure solutions specifically crafted to the quantification of the monetary consequences of early detection.

Approach

Costs in units of money'

We will need to find out what the cost of the PSA test is.

A utilisation rate assumption will be required.

This will either take the form of a fixed utilisation rate applied to the number of qualifying beneficiaries (and expected to qualify over the projected timespan of the exercise) or a more complex assumption with utilisation rates that depend on the ages at which men are likely to be tested.

Multiplying the expected utilisation with the unit costs will give us the 'Costs in units of money'.

Possible also allow for the number of tests allowed per annum

Benefits in units of money

The benefits of the intervention may only be realised months or even years after the test.

We would therefore have to consider the fact that beneficiaries may not be on the scheme and that the cost benefit of providing the test will therefore not necessarily accrue to the scheme.

The probability that a beneficiary will still be on the scheme at some time, t , in the future will need to be modelled.

This will require an assumption regarding rates of resignation from the scheme, which can be derived from the scheme's own data.

An assumption regarding mortality may also be included.

For the cost benefit part of the exercise the costs that will be saved due to the test must be modelled.

The test does not prevent prostate cancer. At best it can lead to early detection.

It is therefore necessary to distinguish between the costs of a case that is detected early as compared to one that is not.

Research regarding the incidence of prostate cancer will be required to support an incidence assumption.

Sources such as the cancer registry may be investigated. Otherwise international sources such as the WHO may have the necessary information.

The incidence rates can then give us the probability that a patient will contract prostate cancer at time t .

Finally some information regarding the expected cost of a prostate cancer case will be required.

However, because cancer claims have a low frequency and high (but extremely variable costs) this information may not be reliable.

Other sources of information could be consulted including the current treatment protocols (chemotherapy, radiation therapy and biological or other drugs) for this type of cancer.

Our cost estimates will also have to allow for the related costs such as hospitalisation, surgery and monitoring

A further assumption will be required regarding the proportion of tests that will have a positive result

A positive result will result in additional tests to confirm the diagnosis. Some clinical input will be required to determine what the follow-up tests are likely to be and how much they cost.

We will also need to allow in our calculations for the impact of false positive test results. False positives will result in unnecessary tests and possibly even unnecessary treatment which the calculation will need to offset against the benefits.

Conversely we need to allow for false negatives. In such cases detection of the cancer will be delayed.

A possible refinement to the calculation would therefore be to include results from clinical trials regarding the accuracy and reliability of the test.

The cost of a cancer case at time t will simply be the average cost from our research adjusted with an assumed inflation rate.

The cancer cost prevented by the vaccine at time t can then be calculated as:

[Number of beneficiaries] * [PSA test utilisation rate] * [Probability that beneficiary is still on the scheme (t)] * [Incidence rate of prostate cancer (t)] * [Expected cost per case (t)]

The different cash flows at time t , where $t=0, 1, 2\dots$ can then be discounted using an appropriate discount rate and summed to give us the 'Benefits in units of money' item.

If the result of the CBA formula is less than 1 then the PCA test is deemed to have a cost benefit.

END OF EXAMINERS' REPORT