

Preoperative tests (update)

Routine preoperative tests for elective surgery

NICE guideline NG45

Appendix M: Economic considerations for Delphi

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*Developed by the National Guideline Centre,
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Disclaimer

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1.1 Economic considerations

A flow chart representing the patient pathway was used as a visual aid for the potential costs and consequences for each of the preoperative tests included in the Delphi survey. This approach guided the GDG in considering the cost-effectiveness of each of the tests. Costs and health outcomes were mapped along the pathway. In the absence of data, the GDG considered the likelihood and consequences of each event. The flow chart consists of process points and the source of costs for each process, as seen in the example node below.



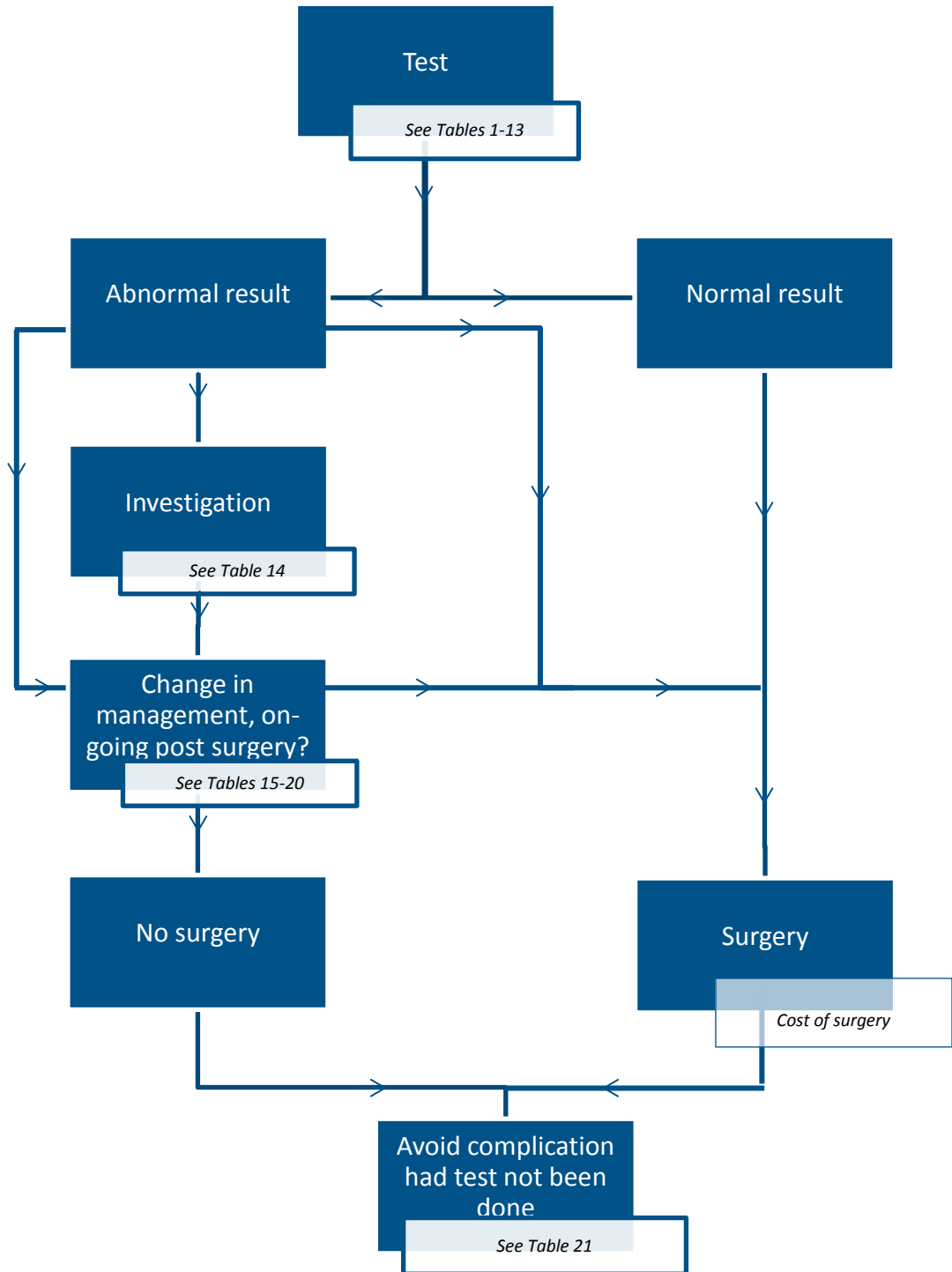
The pathway (as shown in Figure 1 below) looks at the potential costs and health outcomes for a patient receiving the test.

1. To begin with the patient can have either a normal or abnormal result.
2. If they have a normal result, they will continue with the elective surgery.
3. If they have an abnormal result, they can either continue to receive the elective surgery, undergo further investigations or immediately receive a change in management.
4. The further investigations (for example outpatient visit) could result in the patient receiving either:
 - a. A one-off change in the management prior to surgery.
 - b. A continuous change in management that continues after surgery (for example placing the individual on medication for an undiagnosed chronic condition).
 - c. No change in management (perhaps the test produces a false positive result).
 - d. No change in management, however using the result as a baseline to help manage complications post-surgery (for example using an ECG as a baseline to help decide whether an acute heart event post-surgery was due to surgery or was pre-existing).
5. From here a decision will be made as to whether the surgery will still go ahead.
6. The final point to consider will be whether any surgical complications will have been prevented had the test not been done.

In the pathway the health outcomes for preoperative testing will be:

- Prevention of surgical complications which will affect morbidity and mortality.
- Improvement in health outcomes from identifying an untreated illness.

Figure 1: Flow chart outlining all potential costs that arise through preoperative testing



1.2 Unit cost of tests

This section details the unit cost of conducting each test.

Table 1: Urine test (using dipstick)

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|------------------------------------|--------------------------|-------|--|
| Strip ^(a) | 1 | £0.22 | NHS supply chain catalogue 2014 ¹ |
| Container/collector ^(a) | 1 | £0.67 | NHS supply chain catalogue 2014 ¹ |
| Gloves ^(a) | 1 | £0.03 | NHS supply chain catalogue 2014 ¹ |
| Apron ^(a) | 1 | £0.09 | NHS supply chain catalogue 2014 ¹ |
| Nurse time ^(b) | 5 | £2.83 | PSSRU 13/14 ² |
| | Total per patient | £3.85 | |

(a) Taken as an average price from available equipment on the NHS supply chain catalogue

(b) Nurse time based on day ward nurse costing £34 per hour

Table 2: Urine test (using urinalysis analyser)

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|------------------------------------|--------------------------|-------|--|
| Urinalysis analyser ^(a) | 1 | £0.45 | NHS supply chain catalogue 2014 ¹ |
| Container/collector ^(b) | 1 | £0.67 | NHS supply chain catalogue 2014 ¹ |
| Gloves ^(b) | 1 | £0.03 | NHS supply chain catalogue 2014 ¹ |
| Apron ^(b) | 1 | £0.09 | NHS supply chain catalogue 2014 ¹ |
| Nurse time ^(c) | 5 | £2.83 | PSSRU 13/14 ² |
| | Total per patient | £4.08 | |

(a) The machine costs £44,500 and if we assume it is used 100,000 times before it is replaced the marginal cost of using this machine equates to £0.45 per patient.

(b) Taken as an average price from available equipment on the NHS supply chain catalogue

(c) Nurse time based on day ward nurse costing £34 per hour

Table 3: Renal function test

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|--|--------------------------|-------|--|
| Testing for creatinine, urea and electrolytes ^(a) | 1 | £6.00 | CG182 (Chronic kidney disease 2014) ⁶ |
| | Total per patient | £6.00 | |

(a) This cost is from a published source and includes the staff costs and equipment needed to test for these indicators

Table 4: Haemostasis

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|--|--------------------------|-----------------------|--|
| Testing prothrombin time (PT) | 1 | £26.00 ^(a) | NICE DG13 ⁷ |
| Testing activated partial thromboplastin time (APTT) | | | |
| Testing platelet count (PC) | | | |
| Testing plasma fibrinogen concentration (PFC) | | | |
| Testing activated clotting/coagulation time (ACT) | | | |
| Phlebotomy ^(b) | 1 | £3.42 | NHS reference costs 2013–14 ⁵ |
| | Total per patient | £29.42 | |

(a) This cost is from a published source and does not include staff cost of taking blood

(b) Includes staff time and equipment required to take the blood

Table 5: Chest X-ray

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|---|--------------------------|--------|--|
| Direct access plain film ^(a) | 1 | £29.60 | NHS reference costs 2013–14 ⁵ |
| | Total per patient | £29.60 | |

(a) Includes medical and staffing cost involved in the procedure

Table 6: Full blood count

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|---------------------------------|--------------------------|-------|-----------------------|
| Full blood count ^(a) | 1 | £6.00 | HTA 2012 ³ |
| | Total per patient | £6.00 | |

(a) This cost is from a published source and includes the staff costs and equipment needed to test for these indicators

Table 7: Blood glucose (HbA1c)

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|----------------------------|--------------------------|-------|--|
| Haematology ^(a) | 1 | £3.00 | NHS reference costs 2013–14 ⁵ |
| Phlebotomy ^(b) | 1 | £3.42 | NHS reference costs 2013–14 ⁵ |
| | Total per patient | £6.42 | |

(a) Includes medical and staffing cost involved in analysing the result

(b) Includes staff time and equipment required to take the blood

Table 8: Electrocardiography (cost using resources used)

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|----------------------------|--------------------------|-------|---|
| ECG machine ^(a) | 1 | £2.00 | GDG opinion |
| Disposables ^(b) | 1 | £1.00 | NHS supply chain catalogue ¹ |
| Nurse time | 10 | £5.66 | PSSRU 13/14 ² |
| | Total per patient | £8.66 | |

(a) The machine has been estimated to cost £2,000 and if we assume it is used 1,000 times before it is replaced the marginal cost of using this machine equates to £2.00 per patient

(b) Disposables incorporated with ECG testing currently estimated at £1.00 per patient. This includes resting ECG disposable electrodes at £0.03 per electrode and other equipment such as gels and cables

(c) Nurse time based on day ward nurse costing £34 per hour

Table 9: Electrocardiography (as identified in the NHS reference costs)

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|--------------------|--------------------------|------|--|
| ECG ^(a) | 1 | £37 | NHS reference costs 2010-11 ⁴ |
| | Total per patient | £37 | |

(a) The GDG noted this cost was likely to be obtained from a specialist setting and that in reality the cost is likely to be lower in a preoperative setting. Therefore this cost can be seen as a maximum.

Table 10: Lung function

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|--|--------------------------|------|-----------------------|
| Pulmonary function test ^(a) | 1 | £66 | HTA 2012 ³ |
| | Total per patient | £66 | |

(a) This cost is from a published source and includes the staff costs and equipment needed to test for these indicators

Table 11: Blood gases

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|-----------------|--------------------------|-------------|--|
| Phlebotomist(a) | 1–2 | £3.42–£6.84 | NHS reference costs 2013–14 ⁵ |
| Haematology | 1 | £3.00 | NHS reference costs 2013–14 ⁵ |
| | Total per patient | £6.42–£9.84 | |

(a) The GDG felt the test may take longer to perform than a standard blood test as some patients find it uncomfortable; the range in phlebotomist time reflects that

Table 12: Sickle cell

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|--|--------------------------|-------|--|
| Sickle cell lab testing ^(a) | 1 | £4 | HTA 2010 |
| Phlebotomy ^(b) | 1 | £3.42 | NHS reference costs 2013–14 ⁵ |
| | Total per patient | £7.42 | |

(a) This cost is from a published source and does not include staff and equipment costs of taking blood

(b) Includes medical and staffing cost involved in the procedure

Table 13: Pregnancy

| Equipment/staff | Quantity (units/minutes) | Cost | Source |
|-----------------------------------|--------------------------|-------|--|
| Pregnancy test kit ^(a) | 1 | £0.69 | NHS supply chain catalogue 2014 ¹ |
| Nurse ^(b) | 5 | £2.83 | PSSRU 13/14 ² |
| | Total per patient | £3.52 | |

(a) Average cost of pregnancy test kits available through NHS supply chain catalogue

(b) Nurse time based on day ward nurse costing £34 per hour

1.3 Other relevant unit costs

This section provides the costs outlined in the pathway above.

Follow-up investigations

Where a patient has an abnormal test they may be referred to the relevant specialist. The average cost of relevant specialist outpatient visits are provided in Table 14 below.

Table 14: Follow-up investigation

| Outpatient category | Cost | Source |
|-------------------------------------|------|--|
| General ^(a) | £125 | NHS reference costs 2013–14 ⁵ |
| Urology ^(a) | £99 | NHS reference costs 2013–14 ⁵ |
| Cardiology ^(a) | £131 | NHS reference costs 2013–14 ⁵ |
| Diabetic medicine ^(a) | £143 | NHS reference costs 2013–14 ⁵ |
| Respiratory medicine ^(a) | £150 | NHS reference costs 2013–14 ⁵ |
| Diagnostic imaging ^(a) | £42 | NHS reference costs 2013–14 ⁵ |
| Clinical haematology ^(a) | £160 | NHS reference costs 2013–14 ⁵ |
| Nephrology ^(a) | £145 | NHS reference costs 2013–14 ⁵ |

(a) Average cost of total outpatient visits

Change in management

Where a patient has an abnormal test, they may have a change in management either based on the abnormal result or further investigations. The change in management can either be a one-off or continuous. The cost of this will be a range from the least to most intensive change in management as decided by the GDG.

Chest X-ray

If a chest X-ray testing identifies an untreated respiratory condition then the costs of long-term management will be incurred, however these are highly likely to be a cost-effective use of NHS resources.

Table 15: Potential downstream costs associated with a chest X-ray

| Additional costs | Cost | Source |
|---------------------------------|----------|----------------------------------|
| Full pulmonary function testing | £174 | NHS reference costs ⁵ |
| CT scan ^(a) | £71–£146 | NHS reference costs ⁵ |

(a) Cost varies depending on contrast and number of areas

Pulmonary function tests

If pulmonary function testing identifies an untreated respiratory condition then the costs of long-term management will be incurred, however these are highly likely to be a cost-effective use of NHS resources. Individuals with known respiratory conditions will already be on the appropriate medication so change in management may mean a more intensive form of management that could increase costs prior to surgery.

Table 16: Potential downstream costs associated with pulmonary function testing

| Additional costs | Cost | Source |
|------------------------|----------|----------------------------------|
| CT scan ^(a) | £71–£146 | NHS reference costs ⁵ |

(a) Cost varies depending on contrast and number of areas

ECG

Most ECG abnormalities will result in slightly greater care/caution in perioperative anaesthetic management. The costs in Table 17 below are other downstream costs that may occur. If an ECG identifies an untreated cardiac condition then the costs of long-term management will be incurred, however these are highly likely to be a cost-effective use of NHS resources.

Table 17: Potential downstream costs associated with ECG

| Additional costs | Cost | Source |
|---|------|----------------------------------|
| Electrocardiogram monitoring and stress testing | £121 | NHS reference costs ⁵ |
| Simple echocardiogram | £65 | NHS reference costs ⁵ |
| Complex echocardiogram | £222 | NHS reference costs ⁵ |

Full blood count

It is likely that most abnormalities will result in slightly greater care/caution in perioperative anaesthetic management. The GDG noted the results may mean that the individual will be placed on intravenous iron therapy which would have significant costs.

Table 18: Potential downstream costs associated with full blood count testing

| Additional costs | Cost | Source |
|---------------------|---------|----------------------------------|
| Further blood tests | £6 each | NHS reference costs ⁵ |

Haemostasis

Minor and moderate abnormalities will likely result in slightly greater care/caution in surgical management.

Renal function tests

Most minor abnormalities are unlikely to change perioperative management, except to result in greater care/caution and slight modifications in choice/dose of some anaesthetic agents.

Table 19: Potential downstream costs associated with renal function tests

| Additional costs | Cost | Source |
|------------------|---------|----------------------------------|
| Ultrasound scan | £49–£59 | NHS reference costs ⁵ |
| Blood tests | £6 each | NHS reference costs ⁵ |

Urine tests

Abnormal results are unlikely to change perioperative management.

Table 20: Potential downstream costs associated with urine tests

| Additional costs | Cost | Source |
|------------------|---------|----------------------------------|
| Ultrasound scan | £49–£59 | NHS reference costs ⁵ |
| Blood tests | £6 each | NHS reference costs ⁵ |

HBA1c

Minor abnormalities frequently result in little, if any, change in perioperative management. Costs are likely to be associated with more frequent monitoring of finger prick blood glucose in the perioperative period or use of variable rate insulin infusions in the perioperative period, which may be required if diabetes control cannot be improved preoperatively.

Arterial blood gases

Severe abnormalities might inform the decision to operate or might lead to modifications in post-operative care, such as need for high dependency or intensive care. However, arterial blood gas testing is more likely to be performed in surgeries outside of this guideline's scope.

Surgical complications

As outlined above, the pathway looks at the surgical complications that may have been prevented by having each test. These complications have a cost dependent on patient condition and type of surgery. The costs of these are given in Table 21 below.

Table 21: Surgical complication

| | Cost | Source |
|---|--------|--|
| Complications of procedures, with CC Score 3 ^(a) | £5,168 | NHS reference costs 2013–14 ⁵ |
| Complications of procedures, with CC Score 2 ^(a) | £3,231 | NHS reference costs 2013–14 ⁵ |
| Complications of procedures, with CC Score 1 ^(a) | £2,253 | NHS reference costs 2013–14 ⁵ |
| Complications of procedures, with CC Score 0 ^(a) | £1,356 | NHS reference costs 2013–14 ⁵ |

Abbreviations: CC: complication and comorbidity

(a) CC score will be linked to the ASA score when considered in test pathways. Therefore it could be assumed that an individual who isw ASA grade 1 would have a CC score of 0. ASA grade 2 would have a CC score of 1 and ASA grades of 3 and above would have a CC score of 2 or more.

References

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