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Health Economics
C O N S O R T I U M

NHS INNOVATION HUBS

Development of Metrics for the NHS Innovation Hubs

PAUL TRUEMAN, Director
MANJUSHA HURRY, Consultant
TESHA CARDOW, Consultant

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University of York, Market Square, Vanbrugh Way, Heslington, York YO10 5NH
Tel: 01904 433620 Fax: 01904 433628 Email: yhec@york.ac.uk http://www.york.co.uk

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Executive Summary

- NHS Innovation Hubs are regional bodies with a broad remit for promoting innovation in the health service;
- Measures of the outputs of Hubs primarily focus on measures of activities, such as training courses of the number of disclosures considered;
- Little effort has been put into estimating the impact of Innovation Hubs' activities on patients, the health service or society;
- Work with a sub-group of Hubs has lead to the development of a high-level matrix of metrics which are intended to meet the needs of multiple stakeholders;
- In addition to this, case study technologies in development within the Hubs have been subject to evaluation to determine their impact on patients and the health service;
- A series of recommendations have been identified based on this research, including:
    - Hubs should ensure that they are capturing information on process outcomes, intermediate outcomes and final outcomes to meet the needs of their many stakeholders;
    - A common set of definitions for outcomes needs to be agreed across all Hubs to allow for comparative analyses of their performance and aggregation of their outputs;
    - Hubs should have a clear understanding of the problem that a technology is seeking to address and the scale of the problem to the NHS and/or society as a whole. This should be part of the disclosure process;
    - Hubs should put more emphasis on estimating the value of technologies in patient and economic terms;
    - Patient and economic outcomes should be developed annually for a sample of high-profile technologies that are significantly progressed through the stage-gate review process. Hubs should work together to identify the most appropriate candidates for this exercise;
    - Hubs should look to invest in appropriate skills and capacity to support a more robust approach to measuring their impact.

Section 1: Background

1.1 BACKGROUND

There is increasing recognition of the contribution of innovation to continuously improving health service performance and health outcomes[1]. The National Health Service (NHS) Next Stage Review[2] prepared by Lord Darzi, makes numerous references to the importance of innovation and proposes the establishment of a number of bodies and frameworks to support the identification and development of innovation at both regional and national levels.

There is a widespread belief that the health service is indifferent to the role of new technologies, being a slow adopter of innovative technologies[3] and relatively poor at identifying and commercialising technologies that are developed within the service[4]. This is often supported by references to more rapid adoption in other countries, such as the United States. However, the evidence to support this supposition remains relatively limited and initiatives have been established in the United States to improve the diffusion of innovative technologies and practices[5]. There is little evidence to suggest that a more considered approach to adopting technologies has resulted in any significant diminution of health outcomes.

A number of policies and initiatives have already been put in place to address this issue. The NHS Innovation Hubs were developed to provide regional support on innovation associated issues. The Hubs are an integral part of the National Innovation Centre, working alongside the NHS National Technology Adoption Hub and the Training Hub for Operative Technologies in Healthcare.

The role of the Innovation Hubs is manifold and includes:

- Providing education and training on innovation in the NHS;
- Identifying new technologies developed within the NHS;
- Providing support for the protection of intellectual property for such technologies;
- Where appropriate, full commercialisation of new technologies identified.

There are 9 innovation hubs in England, aligned to Regional Development Agency and Strategic Health Authority boundaries. Whilst each organisation is intended to provide leadership on innovation related issues within its region, the hubs are expected to work on a collegiate basis, sharing information on emerging technologies and best practice on matters such as commercialisation and licensing deals. The Hubs receive funding from a number of sources including the Department of Health, the Department for Innovation, University and

1 The NHS Plan: a plan for investment, a plan for reform. Department of Health, July 2000.
2 High Quality Care for All. NHS Next Stage Review Final Report. Department of Health, June 2008.
3 Wanless D. Securing our Future Health: Taking a Long-term View. HM Treasury, 2002.
4 Better Healthcare Through Partnership: Report of the Healthcare Industries Task Force. Department of Health, November 2004.
5 AHRQ Healthcare Innovations Exchange. www.innovations.ahrq.gov

Skills and the Office of Science and Technology. The funding is intended to provide support for the establishment of the Hubs. However, over time the Hubs are expected to become increasingly self-sufficient through generating revenues from licensing deals and/or the commercialisation of technologies identified within the NHS.

The ultimate aims of the Innovation Hubs are to improve patient care, enhance service delivery, increase business and enterprise in the NHS and generate revenues which NHS Trusts can re-invest in patient care[6].

The philosophy underlying the development of the Innovation Hubs is that there is a failure in the market for new medical technologies developed within the NHS. That is, technologies developed within the NHS are unrecognised and often remain undeveloped or under-utilised resulting in inefficient service delivery or sub-optimal patient care. The premise of this is that the innovator may have insufficient time, money or other resources to fully develop their idea and take it into full commercialisation.

This assumption may warrant further exploration. Many innovative technologies, particularly in surgery, have been identified by healthcare professionals and subsequently licensed and commercialised by medical device companies. Given that there is an active market for medical technologies and that such technologies can generate significant revenues and margins, this begs the question of whether there is a market failure in the system or whether the technologies that remain undeveloped are commercially unattractive. Further evaluation of the number of technologies successfully commercialised by the Hubs and the revenues generated over time is required to fully explore this issue. Given that the Hubs remain relatively immature organisations, it will only be possible to evaluate this once they have been operational for a longer period of time.

1.2 MEASURING THE PERFORMANCE OF THE INNOVATION HUBS

At the present time, the Innovation Hubs receive public funding from a number of bodies. As such, it is important that they can be shown to be accountable for using the funds in an efficient manner and that they are meeting their stated objectives. In order to do so, the Innovation Hubs, with the support of the National Innovation Centre, have sought to explore ways of measuring their outputs.

Given the range of activities conducted by the Innovation Hubs, a number of metrics are currently used to monitor their performance. These include statistics on routine activities such as:

- The number of training events completed;
- The number of disclosures received;
- The number of patent applications submitted;
- The number of licensing deals and their value.

[6] www.nic.nhs.uk

Whilst most Innovation Hubs are measuring these routinely, the use of this information is complicated by differences in terminology and definitions employed across the Hubs. For example, different Hubs employ different definitions of a disclosure. For some, this is simply a telephone contact about a new technology whilst others demand a more detailed assessment of the potential of the technology prior to characterising it as a disclosure. Similarly, Hubs employ different terminology to characterise the different stages of product development. These factors mean that it is currently virtually impossible to compare performance across Hubs or make any attempt to aggregate outputs across all Hubs.

The majority of the metrics currently in use tend to focus on activities (e.g. number of disclosures) and in some cases can introduce perverse incentives to undertake activities which are of limited value (e.g. patent applications). There has been limited effort put into quantifying the outputs of the hubs in terms of patient or economic outcomes. Given that the stated objectives of the hubs refer to improving patient outcomes and generating additional revenue for the NHS, it is important that the Hubs have more appropriate metrics that capture their outputs in these terms.

The issue of how to quantify the outputs of organisations with similarities to the Hubs has been explored previously. The Department of Health has previously sponsored the development of methods to evaluate investment in health research[7], ultimately generating a methodology for project appraisal[8]. Whilst our own research acknowledges this previous work, the objective of the Hubs differs slightly in as much as they are seeking to identify and develop products that are commercially viable, as opposed to simply generating research. However, in both cases it is hoped that the output will benefit patient health. Our own work also takes into account the capacity limitations of Hubs and acknowledges that they have limited resources to allocate to evaluation of the impact of their work. As such, we have sought to develop a pragmatic set of analyses which are intended to assist Hubs in generating evidence on their performance that meets the needs of multiple stakeholders.

The York Health Economics Consortium (YHEC) was commissioned by the National Innovation Centre to explore the potential for developing more meaningful measures of Hubs' activities. Particular attention has been paid to two specific aspects of Hubs' activities:

1. The economic impact of the Innovation Hubs' activities on the National Health Service;
2. The impact of the Innovation Hubs' activities on patient outcomes.

The research has been conducted collaboratively with four of the Innovation Hubs, namely:

- Medipex (Yorkshire and Humber);
- NHS Innovations South-East;
- Health Enterprise East;
- NHS Innovations East Midlands.

[7] Buxton M, Hanney S. Assessing Payback from Department of Health Research and Development: Preliminary Report, Vol 1: The Main Report; HERG Research Report 19, Brunel University.

[8] Harper G, Townsend J, Buxton M. The preliminary evaluation of health technologies for prioritisation of HTA; Int J Tech Ass in Health Care 1998; 14(4): 652-662.

The input of the four Innovation Hubs was vital in understanding the work of the Hubs, identifying candidates for the case studies and ensuring that the processes developed herein were relevant to their activities and pragmatic given resource constraints within the Hubs.

Details of our approach to this research are presented below along with the findings, implications and recommendations.

Section 2: Methods

The research involved two distinct stages, comprising firstly the development of a high-level framework of metrics for use by the Innovation Hubs and secondly, the development of a series of case studies to explore methods for quantifying the impact of the Hubs activities in patient and economic outcomes.

2.1 HIGH-LEVEL FRAMEWORK OF METRICS

The high-level framework of metrics was developed collaboratively between the Hubs and the research team and is intended to provide Hubs with guidance on how to value their activities. In order to develop the framework, we first sought to understand the activities, outputs and impact of the Innovation Hubs. We then sought to understand what metrics are routinely captured on each of these, building on previous work conducted on this topic[9]. Finally, working with the Hubs we sought to establish a list of stakeholders with an interest in the Innovation Hubs. In some cases stakeholders were bodies with responsibility for funding the Hubs, whilst in others they were identified as potential beneficiaries of the Hubs work (e.g. patients and carers).

These three aspects were brought together to develop a matrix of metrics, allowing stakeholders to be matched to outcomes of interest. This process was intended to assist Hubs in recognising the need for a dashboard of metrics to meet the needs of multiple stakeholders.

2.2 CASE STUDIES

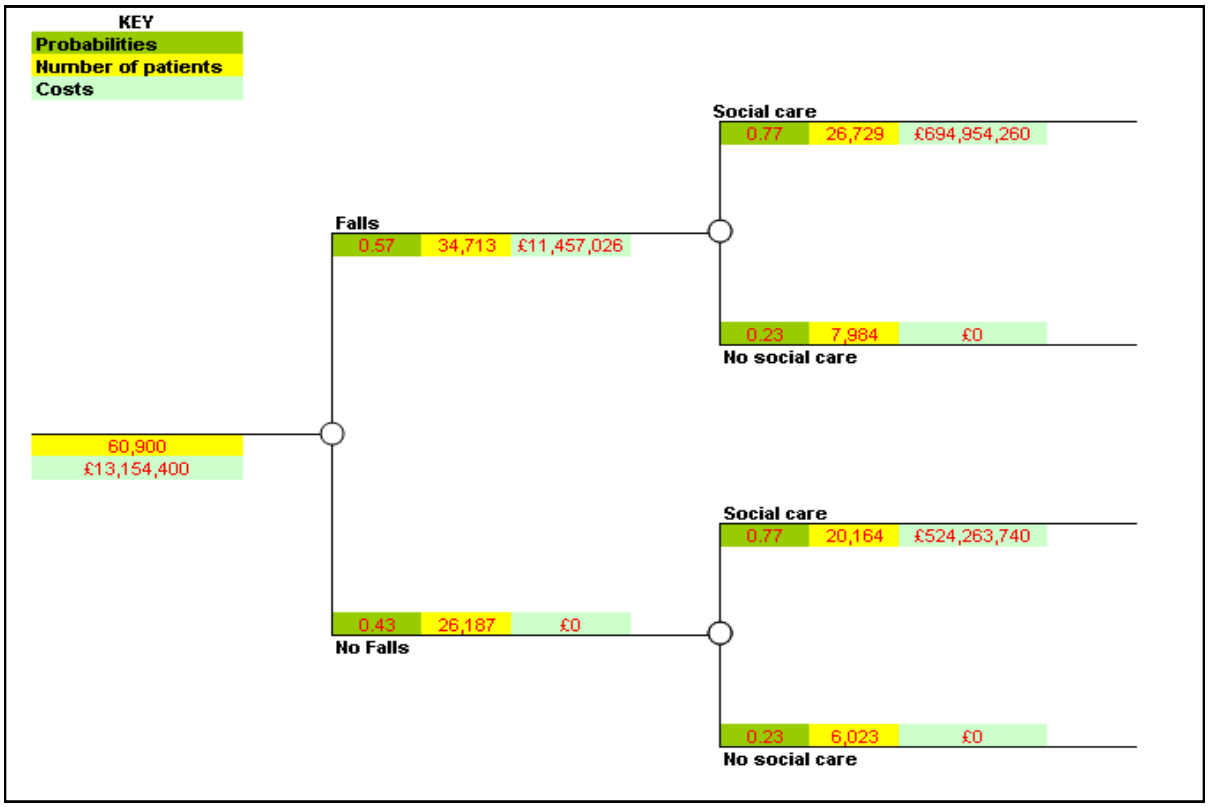
The second stage of the research comprised a series of case studies, considering technologies that were identified by the four Hubs participating in the research. The approach to the case studies included the following stages:

1. A clear definition of the 'problem' that the technology is designed to address;
2. A summary of the burden of the problem, in terms of the impact on patients and costs to the NHS and other relevant bodies;
3. An estimate of the effectiveness of the technology;
4. A summary of the potential benefits of the technology, in terms of potential events avoided and savings to the NHS and other relevant bodies.

Simple decision analytic modelling techniques were employed in order to consider the impact of the technologies on patient outcomes and NHS finances. Decision trees, similar to the one presented below, were developed to consider the value of the technologies.

[9] Survey of Performance Metrics Adopted by the NHS Innovation Hubs. York Health Economics Consortium, January 2008. (Report for the NHS Institute).

Figure 1: Example of a decision tree



The decision tree considers the number of patients able to benefit from the technology. In the above example, the innovation is intended to reduce the risk of falls and ultimately the risk of being admitted to social care. A monetary cost is allocated to each possible outcome in the model (e.g. fall, social care). This approach estimates the impact of the technology on patient outcomes (in terms of falls or admittance to social care) and the costs to the NHS and social care.

The majority of technologies under consideration were relatively novel, so there was limited data on their effectiveness. As such, assumptions were made about their effectiveness, in terms of reductions in event rates. Sensitivity analysis considered a range of values for the effectiveness of the technologies under consideration, generating a range of potential savings to the NHS and events avoided. Estimates of the potential effectiveness of the technologies were agreed with the Innovation Hubs, supplemented by expert clinical opinion where necessary.

The limitations of the case studies should be made explicit at the outset of the report. It should be emphasised that the models developed for the case studies are intended to be a simplification of the real world and as such, only capture the impact of the technologies on a selection of outcomes. The benefits presented for each technology are the *potential* benefits which may not be realised in practice for a number of reasons. For example, benefits presented in the case studies assume that technologies are fully adopted; that is all patients who could benefit have access to the technology. This is unlikely to be the case in practice

and consideration should be given to the degree in which potential benefits can be realised in practice. Furthermore, some complications were experienced when considering technologies such as software, where the cost per patient is entirely dependent on the number of patients using the system. This, coupled with the absence of robust data on the scale of the problem being addressed, meant that in some cases it was not possible to generate quantifiable estimates of the impact of technologies in terms of monetary units and patient outcomes. In these cases, qualitative assessments of the technology were developed and potential outcomes presented.

Whilst a full economic evaluation of each technology considered would have generated more robust estimates of value, this was not possible within the scope of the current research. However, it is hoped that the case studies provide some indicative figures to help determine the potential value of technologies to the NHS and where relevant, society more generally.

Section 3: Development of the High-Level Framework to Measure Hubs' Performance

The high level framework was developed to ensure that Hubs consider the full range of their activities and their relevance to different stakeholders. The framework is intended to provide Hubs with suggested performance indicators relevant to each group of stakeholders.

3.1 MEASURING HUBS' ACTIVITIES AND OUTPUTS

Discussion with the Innovation Hubs identified the full range of activities that they undertake. It became clear that the current focus of the Hubs was on measuring activities. However, as the Hubs become more mature it is important that they are able to value the impact of their work on patient and economic outcomes.

This lead to the development of a range of potential metrics for the Hubs which were categorised into 3 groups:

1. Process measures: measures of Hub activities, such as the number of disclosures considered, training courses run etc;
2. Intermediate measures: measures of Hub outputs, such as the number of patents granted or licensing deals completed;
3. Impact measures: measures of the value of Hub outputs, such as health improvements, the value of licensing deals, return on investment.

Process outcomes are useful in explaining what Hubs do on a day to day basis. Whilst this tells us little about the value of their activities, such measures can be a useful indicator of performance, particularly when organisations are relatively new. Much of the activity of the newer Hubs is associated with education on innovation and raising awareness of innovation in the NHS. Therefore, measures such as the number of training events conducted or the number of disclosures from NHS organisations within a region, provide some indication of the degree to which the Hubs have been successful in raising awareness of innovation and fostering an innovative environment within the NHS.

Intermediate measures also provide an assessment of activity and may start to move towards valuing these activities. In the field of innovation and knowledge transfer, measures such as the number of patents registered are commonly used. Once again, this may provide some indication of the level of innovation in the NHS. However, caution needs to be taken in placing too much emphasis on these measures, for fear of introducing perverse incentives. For example, focussing on patent applications may encourage Hubs to register as many

technologies as possible, regardless of their value. Anecdotal evidence suggests that many knowledge transfer organisations in the academic sector have gone down this route.

Impact measures should be considered the ultimate in performance measurement, providing a true indication of the value of the Hubs activities in monetary terms and/or patient outcomes. Such measures are inevitably more difficult to generate. Complications include the time-lag between the generation of intellectual property and the realisation of any benefits. In addition to this, it is often difficult to isolate the effect of a particular technology from confounding factors.

There is a growing recognition within the NHS that performance measurement needs to move towards measures of impact. Traditionally the health service has tended to capture routine information on easily measurable activities, such as hospitalisations and length of stay. More recently, there has been a shift towards measuring intermediate outcomes, such as death rates and infections. However, there is a growing emphasis on moving towards metrics which capture the impact of the NHS on patient health, as measured by quality of life assessments and more detailed information on clinical indicators. Metrics adopted by the Innovation Hubs need to follow a similar trend, moving from process measures to measures of their impact.

3.2 ROUTINE PERFORMANCE MEASURES ADOPTED BY THE HUBS

Hubs are already routinely collating information on process measures and intermediate measures. However, relatively little effort has been put into valuing the impact of Hubs' activities either in terms of financial returns or improvements in patient outcomes. This is at least, in part, due to the fact that Hubs are relatively immature organisations with limited capacity and many do not possess the skills or resources to be devoted to the often complex problem of generating estimates of their impact on health and the economy. Furthermore, the nature of the Hubs' work means that the impact, both in financial and patient terms, is often only realised following a significant time lag. Modelling techniques, to help project the potential future impact on patient outcomes and NHS finances, offer a potential solution to this and are explored further in the case studies presented below.

In identifying new technologies, Hubs currently employ a stage-gate review process which monitors the development of innovative ideas from disclosure to licensing or commercialisation. In theory, this review process provides an ideal foundation for capturing performance measures such as the number of disclosures made, the number of technologies taken into full development, licensing deals and their value. However, this is complicated by differences in the definitions used throughout the stage-gate review process across Hubs. This results in an inability to compare the relative performance of Hubs and aggregate their outputs.

3.3 STAKEHOLDER ANALYSIS

The Innovation Hubs need to provide information on their performance to multiple stakeholders with quite different perspectives. The table below attempts to summarise the key stakeholders with an interest in the performance of the Hubs and their preferred performance indicators.

Table 3.1: Matrix of stakeholders and their preferred performance measures

Stakeholder	Process measures	Intermediate measures	Final outcome measures
National Innovation Centre/NHS Institute			
PCTs, acute trusts and regional health authorities			
Department of Health			
Other funding bodies (DIUS, OST)			
Technology Manufacturers			
Patients/carers			
Treasury			

As the body responsible for the Innovation Hubs, the National Innovation Centre/NHS Institute wishes to see a 'dashboard' of metrics providing information on Hubs activities, outputs and their impact to ensure that it can undertake a broad-based evaluation of their performance. Other stakeholders however, have a much narrower perspective. Funding bodies are likely to want to have access to metrics on the outputs of the Hubs and their value to the NHS and/or society. Similarly, technology manufacturers are much more likely to be interested in metrics relating to intellectual property and the value of technologies to determine whether they should be investing in them.

Patients and carers are expected to be only interested in the impact of Hubs' outputs measured in terms of patient health, whilst the Treasury is much more likely to be interested in the value of the Hubs outputs measured in monetary terms in order to assess whether investment of public funds in the Hubs represents good value for money.

This table highlights that by focussing on process measures, as is currently the case, the Hubs are failing to provide performance indicators for a number of important stakeholders including their main funding bodies, patients and technology manufacturers who need to be attracted to licensing deals for new technologies.

Hubs are encouraged to consider how they can generate metrics that meet the needs of each of these stakeholders. Whilst most Hubs have already made good progress on developing measures of process and intermediate outputs, further effort is required to generate measures of the impact of Hubs' activities in terms of patient and financial outcomes. The case studies were developed in order to provide Hubs with a means of generating this information at the level of an individual technology.

Section 4: Valuing the Impact of Innovation: Case Studies

The case studies sought to estimate the value of innovative technologies in terms of their impact on patient and economic outcomes. (Brief descriptions of each case study are presented below with summaries of findings.) Decision analytic models were developed for each technology considered and these are presented in Appendix A. The models attempted to capture the costs and outcomes associated with current practice before incorporating the new technology. Attempts were then made to estimate the costs and benefits associated with the new technology. In some cases it was not possible to generate quantifiable outputs, mainly due to inadequate information on current practice or an inability to isolate the impact of the innovation from other confounding factors.

4.1 DEMENTIA TRACKING DEVICE (NHS INNOVATIONS SOUTH EAST)

Technology Description

The dementia tracking device is a pendant like device, intended to be worn by individuals with dementia who are prone to wandering. The device incorporates GPS technology that allows the location of wearers, in relation to their usual place of residence, to be tracked. The technology is intended to maintain a degree of independence for wearers whilst also ensuring that they are not wandering excessively. As such, the technology is not intended to eliminate wandering but rather to monitor wandering and ensure that the wearer's safety is not compromised. Wandering is known to lead to an increased risk of falls in the elderly and repeated wandering is often associated with admission to residential care. There may also be broader benefits for carers and society as a whole.

Findings

Evaluation of the dementia tracking device considered its impact in reducing the risk of the two adverse outcomes of wandering namely, falls which can result in fractures and repeated wandering resulting in admission to a long-term care home. A summary of the data used in the evaluation is provided in Table 4.1 overleaf.

Table 4.1: Summary data

Estimated number of individuals with dementia (based on ONS census data)	406,000
Probability of wandering in dementia (published literature)	0.15
Of which probability of fall occurring (published literature)	0.57[10]
Cost of falls no fracture (HRG Code PS17C) (weighted average of falls and fractures)	£330
Cost of fall with fracture (HRG Code H88)	£3,485
Estimated total cost of wandering related falls to the NHS	**£24,611,426**
Probability of referral to long-term care due to wandering (expert opinion)	0.77
Costs of long-term care per person year (published literature)	£26,000
Estimated total cost of long-term care per year associated with wandering	**£1,219,218,000**

Based on the above data, wandering in individuals with dementia is estimated to cost the NHS approximately £24M per year, resulting from falls and fractures. This is based on a conservative estimate of the cost of managing these individuals which only takes into account the cost of hospital treatment and excludes any care following discharge.

However, the main burden of wandering is related to social care. Repeated wandering can lead to individuals being admitted to long-term care for their own safety. For the purposes of this analysis we have assumed that 77% of individuals who suffer from repeated wandering will eventually be admitted to long-term care. (This estimate is based on expert opinion and it is accepted that admission to long-term care may be the result of multiple factors, rather than simply as a consequence of repeated wandering.) Based on these data, the estimated cost of long-term care for these individuals is in excess of £1 billion per year.

The dementia tracking device has not been subject to robust trials and as such, its effectiveness is unknown. Therefore, a number of scenarios were considered whereby the effectiveness refers to the potential for the device to reduce falls, fractures and admissions to long-term care. The analysis assumes that individuals with dementia will still be admitted to long-term care but that the tracking device may allow them to remain independent for an additional year, thus saving the costs of one year of care. The scenarios assume that all individuals able to benefit from the device have access to it. Table 4.2 presents potential cost savings for different levels of assumed effectiveness.

Table 4.2: Potential cost savings

Assumed effectiveness	Potential impact on NHS finances	Potential impact on social care finances
5%	£1.5M	£61M
10%	£2.1M	£122M
15%	£2.7M	£183M
25%	£3.8M	£305M

There is significant scope for the wandering device to generate savings for the NHS and social care sectors. Assuming that the device could reduce incidents associated with

[10] Derived from 33% chance of falls in the elderly inflated by relative risk of 1.74 for falls in individuals with dementia.

wandering by just 10%, then the potential savings to the NHS and social care sectors are in excess of £100M. At an estimated cost of £200 per patient, the acquisition cost for all individuals with dementia prone to wandering is estimated to be in the region of £12M.

Key outcomes (assuming 10% effectiveness):

- Potential wandering related falls avoided: 3,471 per year;
- Potential social care admissions delayed: 4,689 per year;
- Potential savings to the NHS: £2.1M per year;
- Potential savings to the NHS and Social Services: £122M per year.

4.2 MOTORISED DRIP STAND (MEDIPEX)

Technology Description

Drip stands are widely used to secure saline irrigation bags used in many surgical procedures, particularly bowel surgery. Currently irrigation bags are secured to the drip stand manually, usually by nursing staff. For many, this involves handling heavy bags of fluid (typically three litres each) and raising them above shoulder height to secure them to the stand. This is recognised to be a risk factor for shoulder and back injuries in nursing staff. The motorised drip stand allows the irrigation bags to be mounted at a lower level and then raised to an appropriate level to provide sufficient pressure for the surgery, thus removing the need for lifting bags above shoulder height.

Findings

The motorised drip stand will primarily benefit the NHS in terms of reductions in staff absence resulting from back injuries. Estimates generated for the House of Commons Public Accounts Committee 42nd Report put the cost of back injuries to the NHS at approximately £400 million per annum. The development of back injuries is a gradual and cumulative process and it is difficult to isolate the contribution of lifting irrigation bags. The vast majority of injuries are expected to be due to repeated manual movement of patients in hospital beds. In our analysis, we have assumed that 5% of back injuries are attributable to drip stands, although it is recognised that this is an arbitrary assumption.

Table 4.3: Summary data

Estimated cost of back injuries to the NHS (HOC report)	£400M
Proportion attributable to drip stands (assumption)	5%
Estimated cost of back injuries associated with drip stands	**£20M**

The effectiveness of the drip stand in reducing injuries is as yet unknown. Table 4.4 below presents the potential savings resulting from use of the motorised drip stand, based on different levels of assumed effectiveness.

Table 4.4: Potential cost savings

Assumed effectiveness of motorised drip stand in reducing back injuries	Potential savings to the NHS
5%	£1M
10%	£2M
20%	£4M
50%	£10M

If we conservatively assume that the motorised drip stand can reduce injuries associated with drip stands by 10%, then the potential saving to the NHS is estimated to be £2M. The cost of the motorised drip stand is approximately £1,400 compared to the cost of standard drip stands which are in the region of £100-£200. As such, its use should be prioritised in settings where there is an increased risk of back injuries occurring.

Key outcomes (assuming 5% of back injuries result from conventional drip stands and the motorised drip stand can reduce injuries by 10%):

- Potential financial saving to the NHS: £2M per annum.

4.3 LIMB STERILISATION SLEEVE (NHS INNOVATIONS EAST MIDLANDS)

Technology description

Patients undergoing hand and knee surgical procedures typically have their skin swabbed with iodine to help prevent wound complications and infections post-operatively. This is a time-consuming process that uses scarce theatre time. In the case of hand surgery, this can also run under the blood pressure cuff, resulting in burns and discomfort to patients. The limb sterilisation sleeve is a plastic disposable sleeve that leads to faster pre-operative sterilisation, the potential for improved infection control and can also prevent iodine related burns in hand surgery. The sleeve has the potential to save theatre time and improve infection control.

Findings

The limb sterilisation sleeve has the potential to generate savings for the NHS through reduced use of theatre time and reduced rates of infection in hand and knee surgery. Whilst improved use of theatre time is important, it is notoriously difficult to realise any monetary savings resulting from this. Time savings in theatre only become meaningful at the point where they release sufficient theatre time to treat additional patients.

For the purposes of this analysis, we have considered only the potential savings resulting from reductions in infections following knee surgery. It is acknowledged that this produces a conservative estimate of the potential savings of the technology to the NHS.

Table 4.5: Summary data

Number of knee replacement operations performed in the NHS (HES)	52,594
Infection rate (%) (published literature)	0.9%
Cost of an infection (published literature)	£16,503
Estimated total cost to the NHS	**£7,811,629**

Infections associated with knee replacements are estimated to cost the NHS in excess of £7M per annum. The limited evidence that is currently available on the sterilisation sleeve suggests that it can increase the elimination of harmful bacteria from around 3% to 50%, based on bench-data. These are encouraging results, although they are not proof of reduction in infection rates in practice. In the absence of such data, Table 4.6 presents the potential savings to the NHS based on differing levels of assumed effectiveness of the device.

Table 4.6: Potential cost savings

Assumed effectiveness in reducing infections	Potential savings to the NHS
5%	£0.4M
10%	£0.8M
30%	£2.3M
50%	£3.9M

The potential savings to the NHS range from approximately £0.4M to in excess of £3M per annum. The cost of the sterilisation sleeve is £15 per unit. Assuming that it is used in all knee surgery procedures, the acquisition cost to the NHS would be approximately £0.8M. To be cost saving to the NHS, the sleeve would need to reduce infection rates by just over 10%.

Key outcomes (assuming 10% effectiveness in relation to infections):

- Potential infections associated with knee surgery avoided: 47;
- Potential financial saving to the NHS: £0.8M per year.

4.4 THE 'GREEN-BAG' MEDICATION BAG (NHS INNOVATIONS EAST MIDLANDS)

Technology description

Medication errors arising due to medicines management at the point of admission and discharge are well recognised. All elective admissions should be subject to a review of their ongoing medications at the point of admission. However, often patients forget to bring their medications or are unable to provide full details of all prescription and over-the-counter medications that they are currently taking. The 'Green-Bag' is intended to provide a prompt for a more rigorous review of ongoing medication. Patients are asked to put all current medication into the Green-Bag and bring it with them when admitted. By doing so, nursing staff are able to undertake a more detailed medication review and reduce the number of

avoidable medication errors that arise following admission. This may also help to reduce unnecessary prescribing on discharge too.

Findings

The Green Bag has the potential to reduce the number of adverse drug reactions experienced in secondary care. The burden of adverse events associated with prescribing errors in secondary care is estimated below.

Table 4.7: Summary data

Total hospital admissions 2005/6 (HES)	14,423,506
Number of elective admissions >1 day (HES)	4,903,992
Proportion receiving medication reviews (assumption)	50%
Prescribing errors in secondary care admissions (NPSA)	5.04%
Cost of a prescribing error (NPSA: based on 3 day additional length of stay)	£618
Total cost of prescribing errors to the NHS	**£152,745,620**

The effectiveness of the Green Bag in reducing medication errors is unknown. Its effectiveness will largely be determined by the compliance of patients, in providing all their medicines, and of health service staff, in reviewing the contents and acting appropriately. However, the potential impact on NHS finances according to differing levels of effectiveness is reported in Table 4.8 below.

Table 4.8: Potential cost savings

Assumed effectiveness in reducing prescribing errors	Potential savings to the NHS
5%	£7.6M
10%	£15.3M
20%	£30.5M
50%	£76.4M

Even under the conservative assumption that the Green Bag only results in a 10% reduction in prescribing errors it has the potential to save the NHS over £15M.

The cost of the Green Bag is £0.10 per admission. Based on the above figures, even if the bag were used for every elective admission it would cost the NHS less than £0.5M, leading to significant potential for net savings.

Key outcomes (assuming 10% effectiveness in avoidance of prescribing errors):

- Potential prescribing errors avoided: 24,716 per year;
- Potential bed days saved: 74,148 per year;
- Potential savings to the NHS: £15M per year.

4.5 BiVENT ENDOTRACHEAL TUBE (HEALTH ENTERPRISE EAST)

Technology description

Misplacement of the endotracheal tube during surgery has the potential to cause severe complications, including pneumothorax and hernia. Provision of one lung ventilation can be technically challenging, particularly for anaesthetists who are only occasionally required to isolate one lung from the other. BiVent is a new double lumen endotracheal tube designed to enable rapid and reliable lung isolation using any bronchus blocker without the need for fibre-optic endoscopic guidance. BiVent has the potential to reduce the number of complications arising from misplacement of the ET tube in a range of surgical procedures.

Findings

The BiVent ET tube has the potential to reduce the costs associated with complications arising from misplacement of endotracheal tubes. In our analysis, misplacement of an ET tube is only associated with a cost where it results in an adverse event. ET tubes are used in a wide range of surgical procedures and in numerous settings. However, for the purposes of our analysis, we have considered only those procedures which are related to lung cancer surgery and are assumed to use ET tubes.

Table 4.9: Summary data

Number of lung surgery procedures in the NHS (HES Code E54,E55,E57)*	4,978
Proportion with misplacement of ET tube (published literature)	6.1%
Proportion of procedures resulting in an adverse event (published literature)	1.8%
Cost of an adverse event from misplacement (based on HRG for pneumothorax)	£2,307
Total cost to the NHS due to misplacement and complication	**£206,716**

The effectiveness of the BiVent tube in reducing misplacement of the ET tube remains unknown at present. The cost of the BiVent ET Tube is set at £60, while the cost of the most widely used comparator is £150. Table 4.10 (overleaf) presents the potential savings to the NHS based on differing levels of effectiveness, taking into account the potential savings from acquisition cost of the ET tube. The major savings are derived from the price of the BiVent ET Tube, rather than reduction in misplacements or complications during lung isolation. The lower price of the BiVent tube means that it can save the NHS £90 per procedure even before taking into account the potential savings from reductions in adverse events associated with misplacements.

Table 4.10: Potential cost savings

Assumed effectiveness in reducing misplacement	Potential savings to the NHS
5%	£0.45M
10%	£0.47M
20%	£0.49M
50%	£0.55M

This is a very conservative analysis, taking into account only surgical procedures for lung cancer. BiVent ET tubes can be used in a wide range of surgical procedures and as such, the potential savings to the NHS may be significantly increased.

A further opportunity has also been identified for BiVent to be used in military settings. The potential for misplacement in military hospitals is expected to be increased, due to the pressure under which military personnel are operating. Estimates of the potential in this setting are complicated due to the absence of reliable data on the number of procedures being carried out.

Key outcomes (based on an assumed level of effectiveness of 10%):

- Misplacements events avoided in surgery for lung cancer: 30;
- Potential savings to the NHS: £0.47M.

4.6 ALERT™: ACUTE LIFE-THREATENING EVENTS – RECOGNITION AND TREATMENT (NHS INNOVATIONS SOUTH EAST)

Technology description

It is now widely recognised that some in-hospital cardiac arrests, intensive care unit admissions and even deaths are avoidable. Regrettably, patients can show signs of clinical deterioration for many hours, without these necessarily being detected or adequately treated by ward staff. That failure to get the basics right – ensuring that the patient's airway is not restricted, that their breathing and circulation are not impaired, that their oxygen therapy and fluid balance are right – can seriously undermine acute care. ALERT™ is a one-day focussed training course intended to help healthcare professionals, particularly junior medical staff and nursing staff, recognise and respond better to impending clinical deterioration. The course is expected to improve the efficient use of intensive care facilities and also reduce the incidence of life-threatening events in hospital settings.

Findings

The ALERT™ training package has the potential to reduce the number of life-threatening adverse events experienced in hospital settings and their associated costs. The effect of the training package is expected to impact on the number of patients admitted to intensive care units and the risk of mortality experienced in those units. This analysis considers the impact

of the ALERT training system on ICU admissions. Table 4.11 provides an indication of the current costs and outcomes associated with intensive care treatment.

Table 4.11: Summary data

Number of ICU admissions (HES: main specialty, critical care admissions, 2006/7)	16,342
Mean length of stay in days (HES)	9.6
Mortality rate (ICNARC/Harrison)	21.5%
Cost per day (HRG Code CC1L3)	£1,716
Total cost to the NHS	**£269,211,570**

A number of publications have reported how the ALERT™ training package has been implemented in practice. However, there is as yet no evidence on what impact this has had on the development of life-threatening events or ICU admissions. Table 4.12 below provides an indication of the potential savings that might be associated with the ALERT™ training package based on differing levels of effectiveness. This assumes that a proportion of ICU admissions are avoidable through improved monitoring of patients.

Table 4.12: Potential cost savings

Assumed effectiveness in terms of reducing admissions to ICU	Potential savings to the NHS
5%	£13.5M
10%	£26.9M
20%	£53.8M
50%	£134.6M

The potential savings to the NHS of reductions in ICU admissions are very significant. If we assume that widespread adoption of the ALERT programme can lead to a 10% reduction in ICU admissions then this could save the NHS more than £26M per year. The cost of the ALERT training package is £75 per day. Clearly the cost to the NHS will be dependent on the number of staff that undergo the training. However, with judicial use of the training, there is the potential to reduce the number of ICU admissions, the number of deaths in ICU and the cost to the NHS.

Key outcomes (assuming 10% effectiveness in reducing events):

- Potential life-threatening events avoided: 351;
- Potential ICU admissions avoided: 1,634;
- Potential savings to the NHS: £26.9M.

4.7 EVALU-LOGIX RHEUMATOID ARTHRITIS ASSESSMENT TOOL (NHS INNOVATIONS SOUTH EAST)

Technology description

Anti-TNF (or biologic) therapy for rheumatoid arthritis is recognised as being an effective treatment for patients who fail conventional disease modifying anti-rheumatic drugs (DMARDs). Evalu-Logix provides an automated disease assessment tool that allows clinicians to rapidly generate repeated disease and symptom scores over time to determine whether the patient is responding to biologic therapy. Given that biologic therapy for rheumatoid arthritis costs in the region of £10,000 per patient year, it is important that patients are allocated to appropriate therapy and that biologic therapy is stopped in patients who are not responding.

Findings

Based on the target product profile of Evalu-Logix, we have assumed that it can lead to reductions in biologic prescribing by identifying non-responders to therapy earlier than routine practice. Our assessment makes the following assumptions (Table 4.13):

- Non-responders to biologic therapy would be identified after 1 year under routine care;
- Non-responders to biologic therapy would be identified after 6 months using Evalu-Logix, resulting in a saving of 6 months prescribing costs.

Table 4.13: Summary data

Patients with RA (published literature)	387,000
Proportion of patients eligible for Anti-TNF treatment (published literature)	6%
Estimated number of patients on Anti-TNF Treatment	23,220
Annual cost of TNF per patient (Etanercept/Adalimumab, NICE costing template)	£9,295
Total costs to the NHS	**£215,829,900**

Based on the above analysis, full year treatment costs for a cohort of 23,220 patients eligible for anti-TNF treatment are estimated to be in excess of £215M per.

We assume that 30% of patients fail to respond to anti-TNF therapy. If Evalu-Logix can accurately detect non-response in these patients 6 months earlier than routine care, then it has the potential to save approximately £64M in anti-TNF prescribing costs. Of course, the net saving to the NHS is considerably less than this as these patients would continue to be treated with an alternative anti-rheumatic treatment (assumed to be a DMARD or salvage therapy). In addition to this, the NHS would need to pay for the costs of the Evalu-Logix software. The software is priced at £1,800 per centre. The cost per patient is entirely dependent on the number of patients using the system; the more patients accessing it, the lower the cost per patient.

Key outcomes:

- Improved efficiency in allocating patients with rheumatoid arthritis to biologic therapy;
- Improvements in throughput at routine rheumatology clinics.

4.8 JView (MEDIPEX)

Technology description

Nuclear medicine imaging is increasingly used throughout the NHS. However, the capacity to view the resulting images is limited by the availability of appropriate technology, such as Picture Archiving and Communication systems (PACS). JView is a software system that allows for viewing of nuclear medicine images in colour on any PC in a hospital, or remotely via the internet. JView supplements PACS systems by allowing viewing and manipulation of nuclear medicine images in colour providing improved clarity and easier interpretation of images. This has the potential to lead to improved efficiency in the use of nuclear medicine, improved flexibility in planning clinics which include nuclear medicine images and potentially a more accurate diagnosis of the patient's condition.

Findings

JView offers a number of benefits to hospital trusts including:

- Ease of use in storing and accessing nuclear medicine images;
- The potential to increase the number of patients seen, where nuclear medicine images are required as part of the consultation;
- Increased flexibility with regard to scheduling and location of clinics that require access to nuclear medicine images.

These benefits are expected to lead to positive outcomes for hospital trusts that adopt the JView system in terms of the efficiency with which nuclear medicine imaging is used, patient throughput and the income associated with these consultations. JView is also expected to help address the increasing demand for nuclear medicine images that is occurring throughout the NHS.

However, without a detailed prospective study, it is virtually impossible to generate any estimate of the impact of JView on NHS finances. Similarly, there is no evidence to date to suggest that JView can improve diagnosis and resulting patient outcomes.

Key outcomes:

- Improved efficiency in the use of nuclear medicine images;
- Potential to increase the number of clinics requiring access to nuclear medicine images;
- Potential to improve throughput of patients in nuclear medicine.

4.9 E-PAQ (MEDIPEX)

Technology description

Patients often find it difficult or embarrassing to discuss their symptoms with a healthcare professional, particularly where their problems are of an uro-gynaecological nature. The e-PAQ system comprises software that allows for an electronic consultation. The system incorporates interactive questionnaires that patients are asked to complete prior to an appointment with a consultant. By completing these electronically, it is believed that patients may be more open to disclosing their symptoms and the impact on their quality of life. The findings of the questionnaire generate a patient profile for discussion between the consultant and the patient at their first face-to-face consultant appointment. The first application of e-PAQ is in the assessment of pelvic floor problems. It is believed that e-PAQ may result in improvements in the use of urological consultations and patient access.

Findings

Our assessment of the e-PAQ system was based on the following assumptions:

- Current practice, comprising face-to-face consultations, requires two consultant visits to establish the severity of symptoms and a possible diagnosis;
- Use of the e-PAQ system means that a similar outcome can be reached based on one electronic consultation using e-PAQ and one consultant visit.

The benefits of e-PAQ are therefore thought to amount to the avoidance of one consultant visit in diagnosing uro-gynaecological conditions. Table 4.14 presents the costs associated with urology out-patient consultations and individuals referred for urodynamic consultations according to the NHS reference costs.

Table 4.14: Costs associated with urology consultations

Number of face-to-face urology out-patient consultations (first attendance HRG Code 101F)	453,250
Cost of an out-patient consultation (HRG Code 101F)	£140
Number of patients referred for urodynamic out-patient episodes (HRG Code OPUDS1)	14,336
Cost of urodynamics (NHS Reference Costs)	£197
Total cost to the NHS	**£66,279,192**

e-PAQ does not aim to replace urodynamics, however, the technology has the potential to streamline referrals to urodynamics. Our analysis assumes that the use of e-PAQ could eliminate the need for a first consultation thus allowing individuals to be referred directly to urodynamics where necessary. If we assume that every individual referred for urodynamics has a prior consultation with a consultant, then e-PAQ has the potential to eliminate upto 14,000 urology consultations per year at a cost of over £2M.

The cost of the e-PAQ software is approximately £200 per centre. The cost per patient will be wholly determined by the number of patients treated.

Key outcomes:

- Improved patient management in urology;
- Reduction of upto 14,000 out-patient consultations per year;
- Potential saving to the NHS in excess of £2M.

4.10 UNDERSTANDING ENCOPRESIS (HEALTH ENTERPRISE EAST)

Technology description

Research indicates that up to 20% of children with severe learning difficulties suffer from encopresis (repeatedly passing faeces in inappropriate places) at the age of 18. This can be a major cause of embarrassment and stress for the individuals and their carers. An interactive training package has been developed to help NHS staff, social care staff and families caring for individuals with encopresis. The training pack has been tailored to the needs of individuals with learning difficulties. It is hoped that the training pack can lead to improved bowel function in individuals whilst also reducing the burden on carers and family members.

Findings

The Encopresis training kit is intended to support individuals with learning difficulties whom also suffer from encopresis. The evidence on the current management of encopresis is extremely limited. Whilst some evidence was identified on rates of faecal incontinence in children, these were not specific to individuals with learning difficulties. Nor did the evidence provide any data on the methods and costs involved in managing this condition. Some relevant clinical guidelines were identified although these too lacked specificity, addressing the much broader topic of continence or focusing on faecal incontinence in the elderly or individuals with spinal conditions.

Some local treatment protocols were identified which provided guidance on the number of incontinence products that could be prescribed to individuals, including children. However, once again, these lacked the necessary specificity to capture the impact of the training programme on resource use or NHS finances.

Encopresis is undoubtedly associated with a reduction in quality of life of both individual sufferers and their carers. One study reporting the quality of life impact of faecal incontinence highlighted the emotional impact of the condition. However, the evidence remains very limited to support any form of evaluation able to generate an estimate of improved patient outcomes.

Key outcomes:

- Improved quality of life for individuals with encopresis and their carers.

4.11 "TOP GRUB" (HEALTH ENTERPRISE EAST)

Technology description

Obesity is recognised as one of the most significant challenges to the NHS. The rapid increase in the rate of obesity, particularly in children, is cause for considerable concern. Obesity rates in children have trebled over the last ten years with the Health Survey for England reporting that approximately 16% of children aged 2-15 are now classed as obese, with 30% being obese or overweight. The majority of individuals who become obese in childhood are expected to remain overweight into adulthood.

Top Grub is a card game intended for use by children to help educate them on the nutritional value of food-stuffs. The game is based on the popular children's game *Top Trumps* and hopes to inform dietary choices in children which form the basis of improved diet and lifestyle choices into adult life. The game can be incorporated into the primary school curriculum and additional teaching resources are available to support it.

Findings

There is currently no evidence of the impact of Top Grub on the rate of weight gain or obesity in children. Furthermore, it would be virtually impossible to isolate the impact of Top Grub from the numerous other national and regional policies intended to help combat the trend towards weight gain in children in any study.

However, for the purposes of this analysis, we have assumed that Top Grub may be effective in contributing to changes in the rate of obesity in children. The analysis starts from the assumption that children who develop obesity in their early years have a high likelihood of continuing to be obese in later life. Research from the Foresight group suggests that obesity has the potential to reduce life expectancy by approximately 9 years. As such, the economic impact of obesity developed in childhood can be calculated crudely as the loss of 9 life years. These life years can be valued either in terms of productivity (i.e. at the prevailing annual wage rate) or in terms of the societal value of a life year (i.e. approximately £30,000 for a quality adjusted life year according to NICE).

Table 4.15: Summary data

Population of children (5-12 years) (ONS population statistics)	5,469,000
Estimated prevalence of obese children (Health Survey for England)	16%
Percentage of children remaining obese into adulthood (published data)	77%
Societal cost per life year lost (NICE)	£30,000
Estimated total societal cost per life years lost	**£181,920,810,000**

The estimated cost of obesity related productivity losses resulting from obesity developed in childhood runs into trillions of pounds. If Top Grub can have even a marginal impact on this then there are significant potential savings to society. Highly conservative estimates of the effectiveness of Top Grub were considered in the analysis below.

Table 4.16: Potential cost savings

Assumed effectiveness in Reducing obesity in children	Potential savings to society
0.01%	£18.1M
0.05%	£90.6M
0.10%	£181.9M
0.15%	£272.8M

Table 4.16 provides estimates of the societal gains associated with Top Grub. Given that there are numerous initiatives ongoing to combat childhood obesity we have made very conservative estimates of the potential effectiveness of Top Grub, ranging from 0.01% (that is it can avoid the development of obesity in 1/10,000 children) to 0.15% (15/10,000).

The societal gain based on the above levels of effectiveness range from around £18.1M to over £272M. The cost of Top Grub is currently £5.99 per pack although packs may be used by more than one child.

Key outcomes (assuming 0.01% effectiveness in relation to infections):

- Potential number of obese adults averted: 67
- Potential financial gain to the society: £18.1M.

Section 5: Summary and Recommendations

This research was intended to assist the Innovation Hubs in developing metrics that appropriately capture the full range of their activities and in particular help to quantify the impact of their activities in economic terms. The research comprised two main activities:

- Development of a high-level set of metrics intended to address the needs of the Hubs' many stakeholders;
- Development of a series of case studies to explore methods for assessing the value of individual technologies identified by the Hubs in terms of patient and economic outcomes.

5.1 HIGH-LEVEL METRICS

Development of the high-level metrics comprised identifying the activities and outputs of Hubs and allocating them to stakeholders with an interest in the Hubs. By doing so, we have provided Hubs with a simple guide to help them ensure that they are generating information that meets the needs of their stakeholders and can be used to evaluate whether investing public funds in the Hubs generates a return for the exchequer.

The development of the metrics was a relatively straight-forward process. However, the difficulty is expected to be the application of this in practice. Hubs already have a series of routine metrics which go some way to reporting on their activities and their outputs. However, the definition of many of these metrics varies across the Hubs creating difficulties in determining their relative performance and making any estimate of the total return on investment in the Hubs. Similarly, there has been little effort put into generating estimates of the impact of Hubs in terms of patient health or economic terms. A concerted effort is required to address this ensuring that:

1. Hubs agree to adopt unified definitions of their key activities (e.g. reporting of disclosures and stages in the development process);
2. Hubs put more emphasis on quantifying the impact of technologies on patients and health service finances, to provide a more meaningful estimate of their value.

This is a significant task and whilst this research has generated some methods and tools which may assist Hubs in this process, it was beyond the remit of this research to work with all of the Innovation Hubs. It is hoped that the Hubs that participated in the research will be able to take the lead on further development and adoption of the principles presented herein.

5.2 ASSESSMENT OF INDIVIDUAL TECHNOLOGIES

Integral to assessing the overall performance of the Hubs are techniques to more rigorously assess the value of individual technologies in terms of their impact on patient and economic outcomes. A series of case studies sought to familiarise Hubs with simple decision analytic modelling approaches that attempted to consider the impact of technologies in terms of patient and economic outcomes.

This approach stopped short of generating incremental cost effectiveness ratios or quantifying outputs in terms of quality adjusted life years (QALYs). It became apparent over the course of the research that the Innovation Hubs were sceptical about the use of QALYs as a measure of their impact on patient outcomes, despite this being the preferred measure adopted by other NHS organisations (most notably, NICE). As such, outcomes were captured in terms of event rates (e.g. hospitalisations, injuries etc) and monetary units. Where significant impacts on the broader economy were noted, such as the impact on personal social services or productivity losses, attempts were made to include these in the financial benefits.

Throughout this process it was apparent that many disclosures under consideration by the Innovation Hubs had not been subjected to rigorous assessment of their value at the time of disclosure. In some cases, there was relatively little consideration of the problem that the technology had been designed to address and the potential benefits in terms of the impact on the NHS and patients. In order to overcome this, a pro-forma was developed for the purposes of the study which asked the Hubs to consider these issues and provide quantifiable estimates of the current burden of the problem and the potential impact of the technology. Hubs are encouraged to adopt a more rigorous approach to assessing new disclosures prior to investing any significant time and resource in their development although it is acknowledged that they have insufficient capacity to rigorously evaluate all disclosures.

Where technologies were more advanced in the development process, Innovation Hubs were usually able to provide a business case estimating the likely future returns on investment. However, these were of variable quality and were often characterised by unrealistic assumptions, particularly in relation to adoption and uptake. There was also a lack of awareness of sources of routine health service data that would assist in developing the business case, such as the Hospital Episode Statistics and the NHS Reference Costs. There is an urgent need to ensure that the Innovation Hubs are made aware of such resources and provided with further training in the development of meaningful business cases.

The case studies highlighted the range of technologies considered by the Hubs, from high-tech monitoring technologies to patient education tools to computer software designed to improve the use of imaging. Whilst economic evaluation techniques are perfectly capable of evaluating the full range of technologies, some are inevitably easier than others to evaluate in patient and economic terms. Where the technology offers a clear patient benefit then this tended to present less problems (e.g. in the case of the limb sterilisation sleeve which was assumed to have the potential to reduce infections). Similarly, where the technology

presented clear potential to substitute for other NHS resources, then this too was relatively simple to evaluate (e.g. the dementia tracking device which was assumed to delay or avoid referral to social care). However, some technologies were more challenging, particularly those designed to improve service efficiency. JView provides an excellent example of this; the ability to view nuclear medicine images on any computer within a hospital undoubtedly offers the potential for service improvements. However, there is currently limited evidence that this can lead to more efficient use of nuclear medicine, improved throughput or improved patient outcomes. Similarly, patient education initiatives in childhood obesity and encopresis are both worthwhile but it is very difficult to isolate their impact where there is little knowledge of the current burden of the problem (encopresis) or whether it is difficult to isolate their impact from other initiatives in this indication (Top Grub). Just because their benefits are difficult to quantify does not mean that these technologies are of low value.

Working through the case studies with the Hubs, it became apparent that there is insufficient capacity within Hubs to rigorously evaluate all disclosures. However, the Innovation Hubs should consider developing more systematic methods for evaluating technologies, even if this means simply exploring the burden of the problem and determining the potential impact of the technology in qualitative terms.

The National Innovation Centre may wish to consider working with the Hubs to consider a sample of high-profile technologies and subject them to a more rigorous examination, building on the methods applied in the case studies presented herein. Positioned alongside the process and intermediate measures already collected by the Hubs, this would provide a more balanced scorecard of performance indicators of relevance to a wide range of stakeholders.

In the long-term, this kind of rigorous evaluation should help to identify whether the Hubs are addressing a market failure in the development of new technologies identified in the NHS. Of those innovations considered in the case studies, there were several obvious candidates for licensing deals with medical technology manufacturers or software companies. However, some of the case studies, particularly those associated with patient and professional education, are expected to have benefited from the input of the Hubs and may have otherwise struggled to find funding to support their development.

5.3 RECOMMENDATIONS

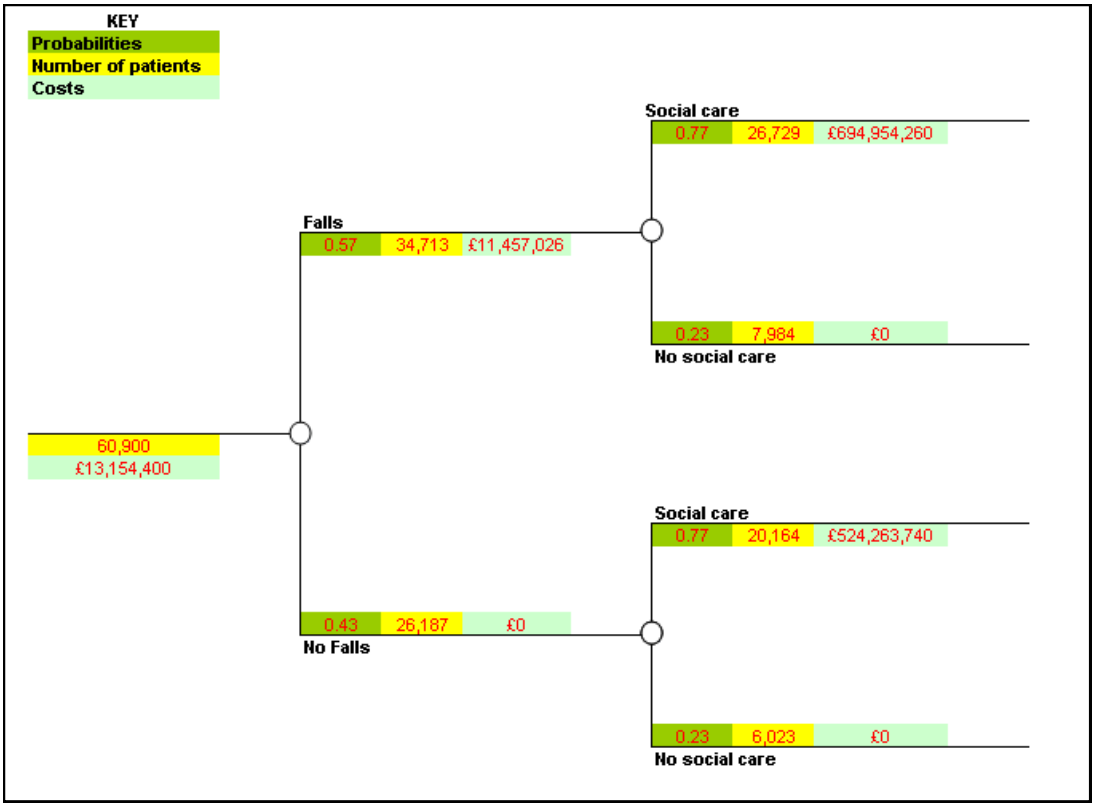
- Hubs should ensure that they are capturing information on process outcomes, intermediate outcomes and final outcomes to meet the needs of their many stakeholders;
- A common set of definitions for outcomes needs to be agreed across all Hubs to allow for comparative analyses of their performance and aggregation of their outputs;
- Hubs should have a clear understanding of the problem that a technology is seeking to address and the scale of the problem to the NHS and/or society as a whole. This should be part of the disclosure process;
- Hubs should put more emphasis on estimating the value of technologies in patient and economic terms;
- Patient and economic outcomes should be developed annually for a sample of high-profile technologies that are significantly progressed through the stage-gate review process. Hubs should work together to identify the most appropriate candidates for this exercise;
- Hubs should look to invest in appropriate skills and capacity to support a more robust approach to measuring their impact.

APPENDIX A

Case Study Decision Trees

Figure A.1: Model for dementia tracking device case study

Standard Care



Intervention

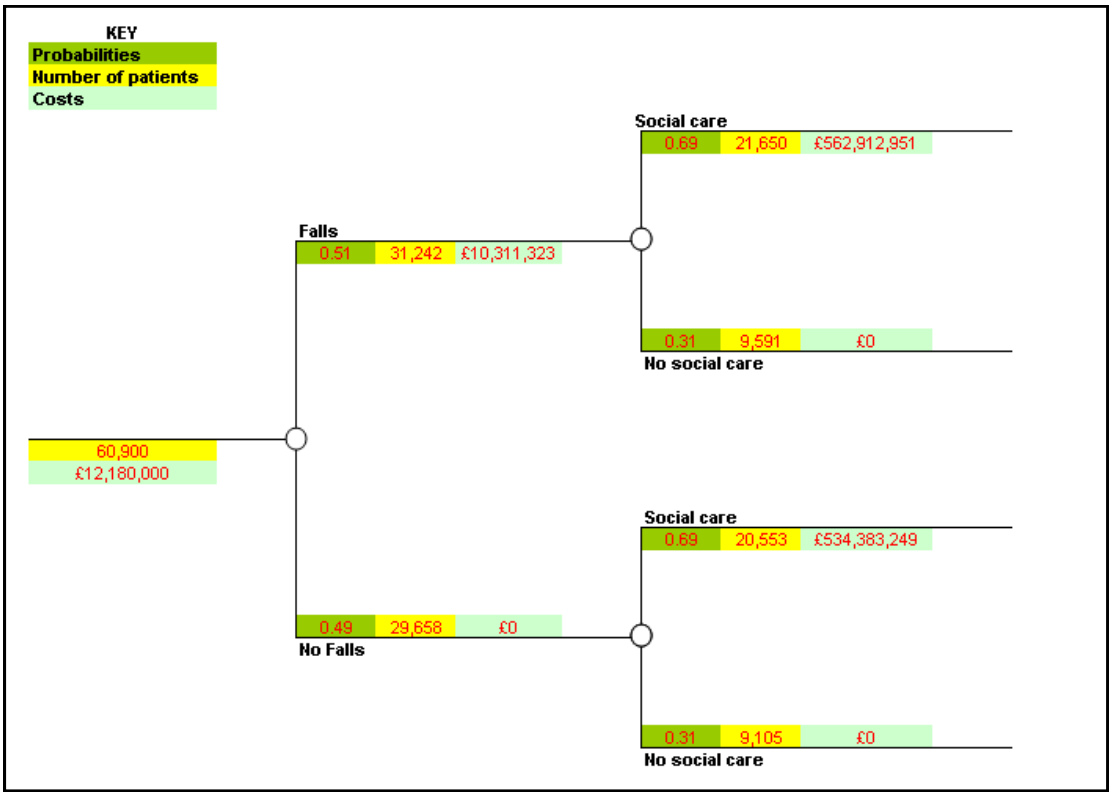
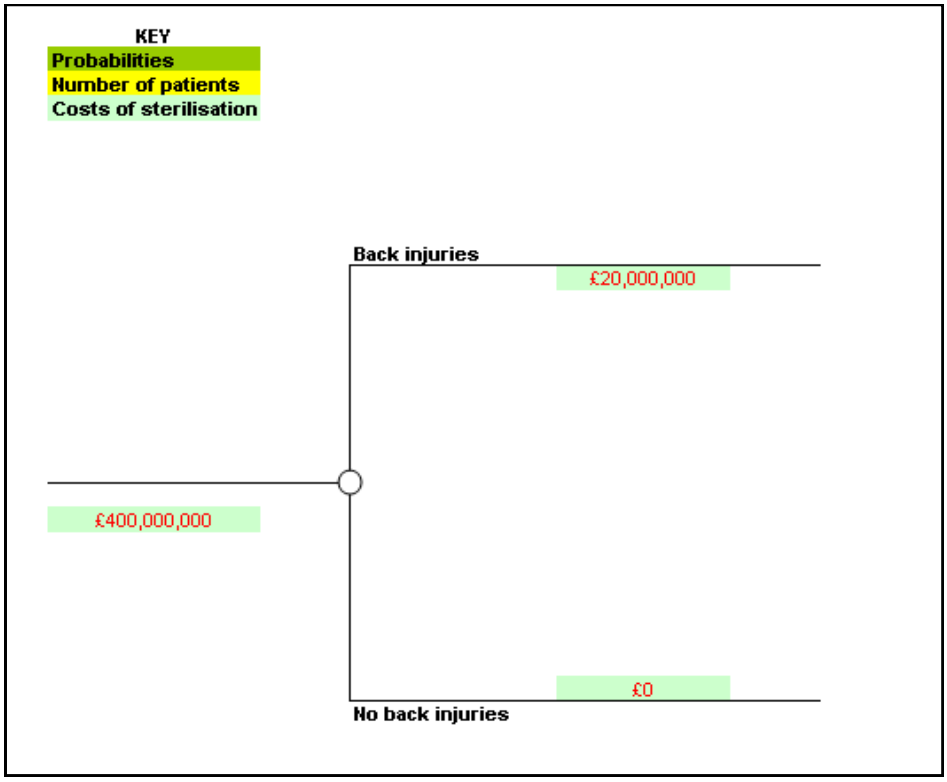


Figure A.2: Model for motorised drip stand case study

Standard Care



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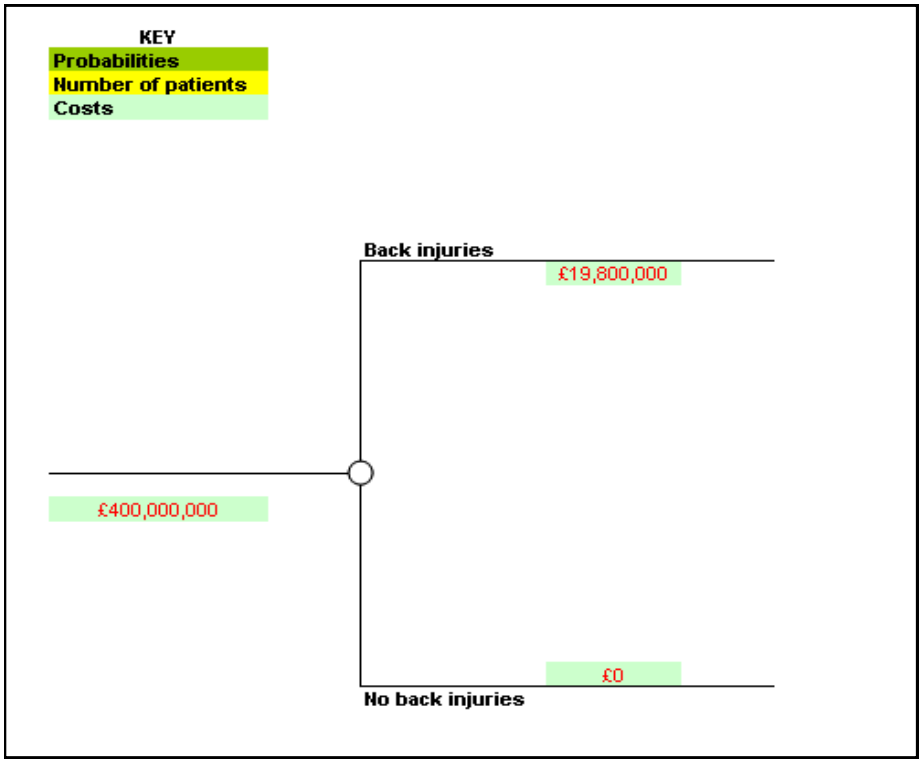
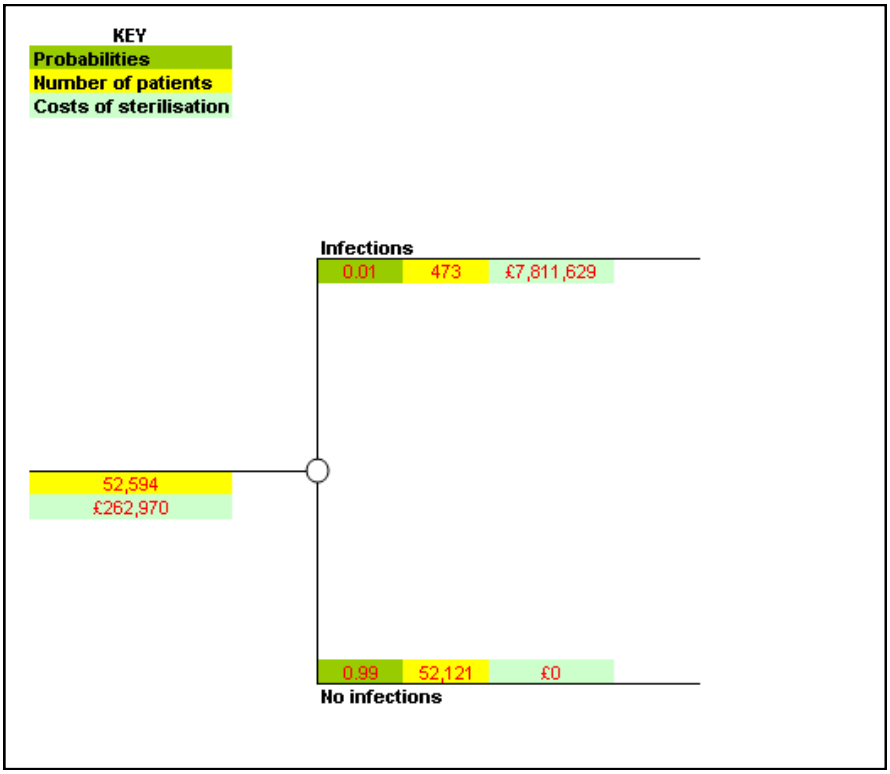


Figure A.3: Model for limb sterilisation sleeve

Standard Care



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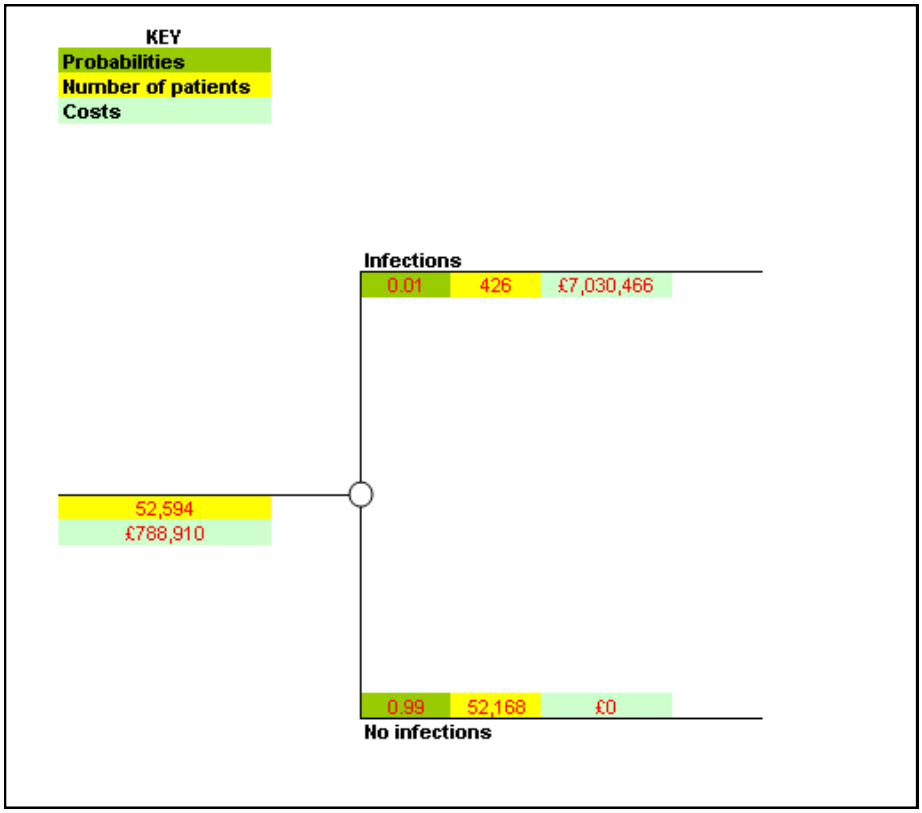
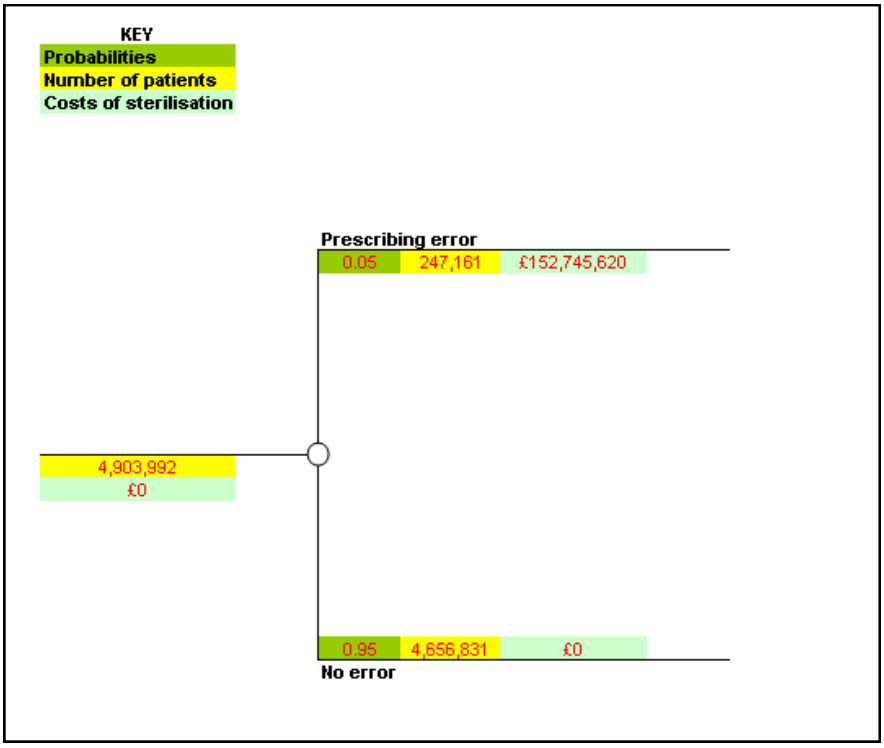


Figure A.4: Model for 'The Green Bag' case study

Standard Care



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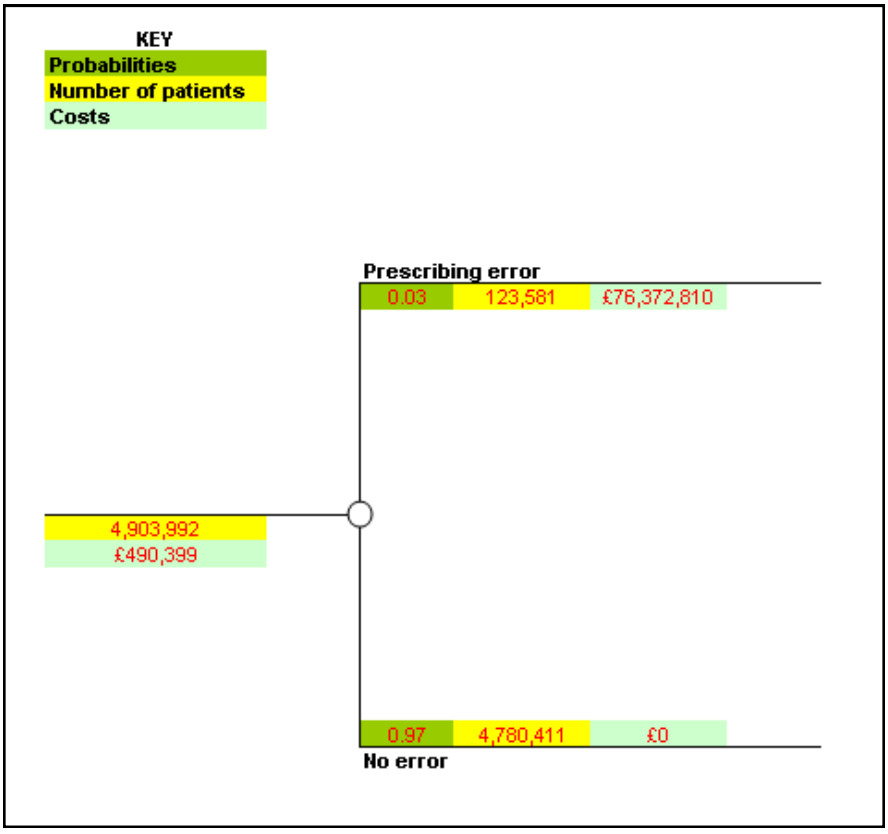
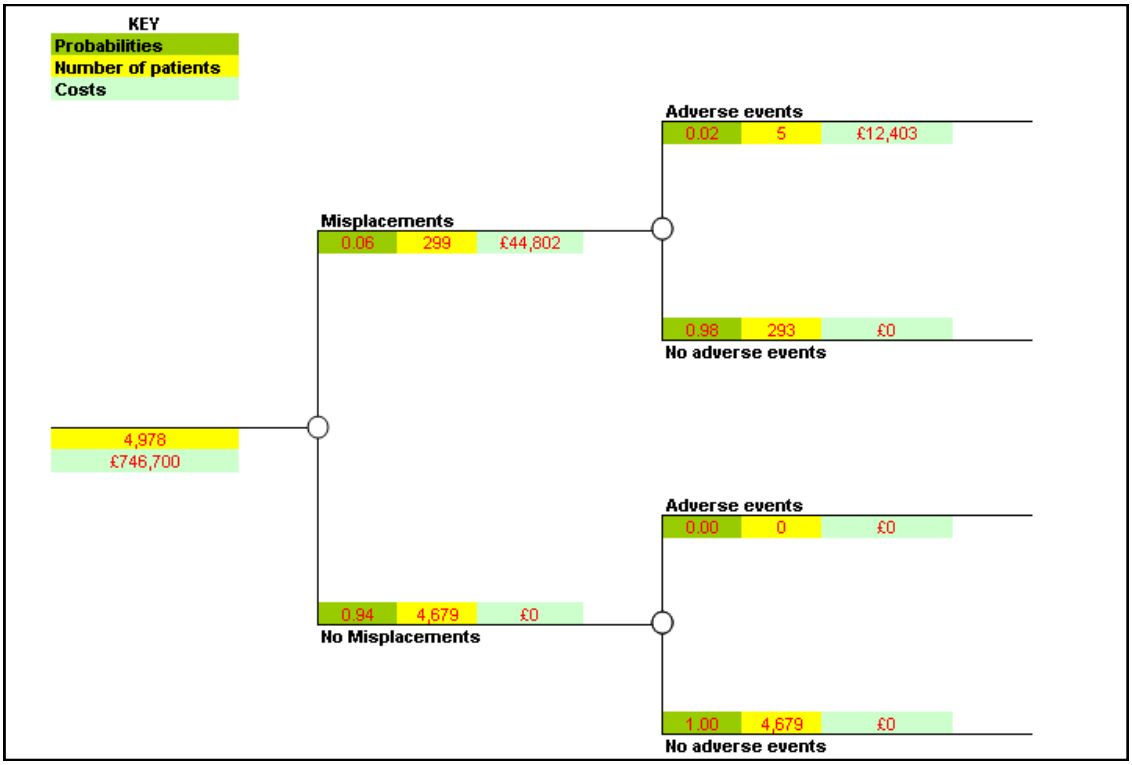


Figure A.5: Model for BiVent endotracheal tube case study

Standard Care



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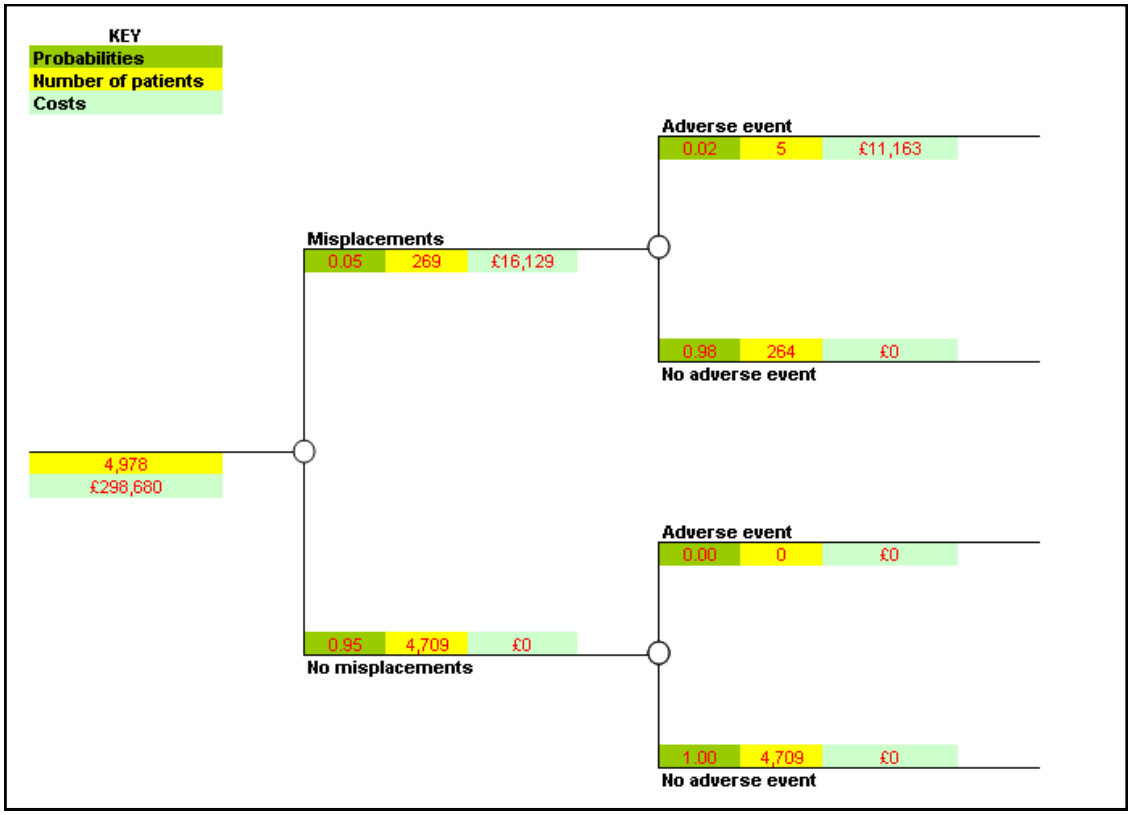
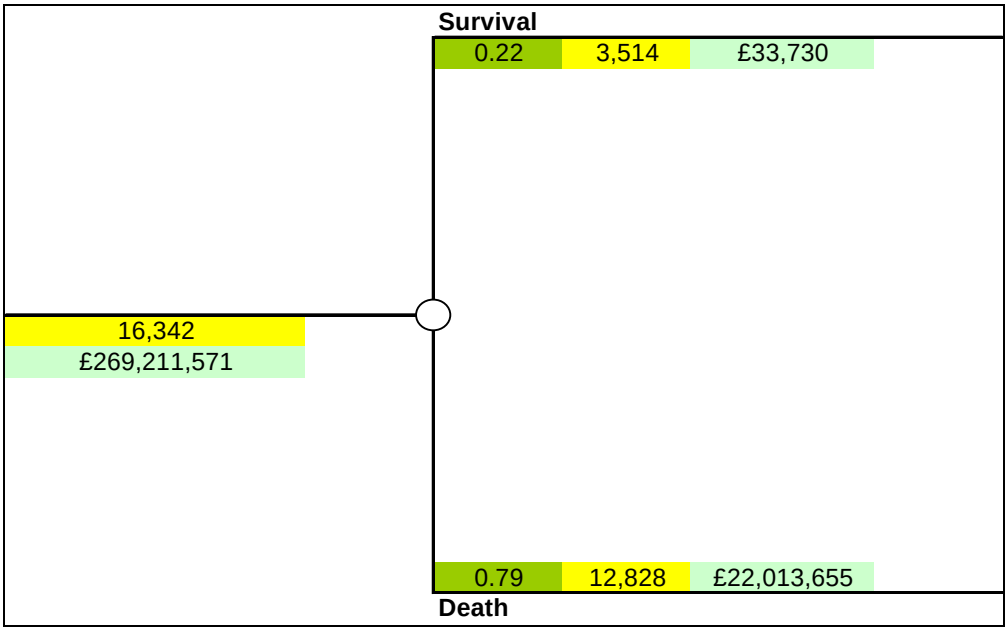


Figure A.6: Model for ALERT training package case study

Standard Care



Intervention

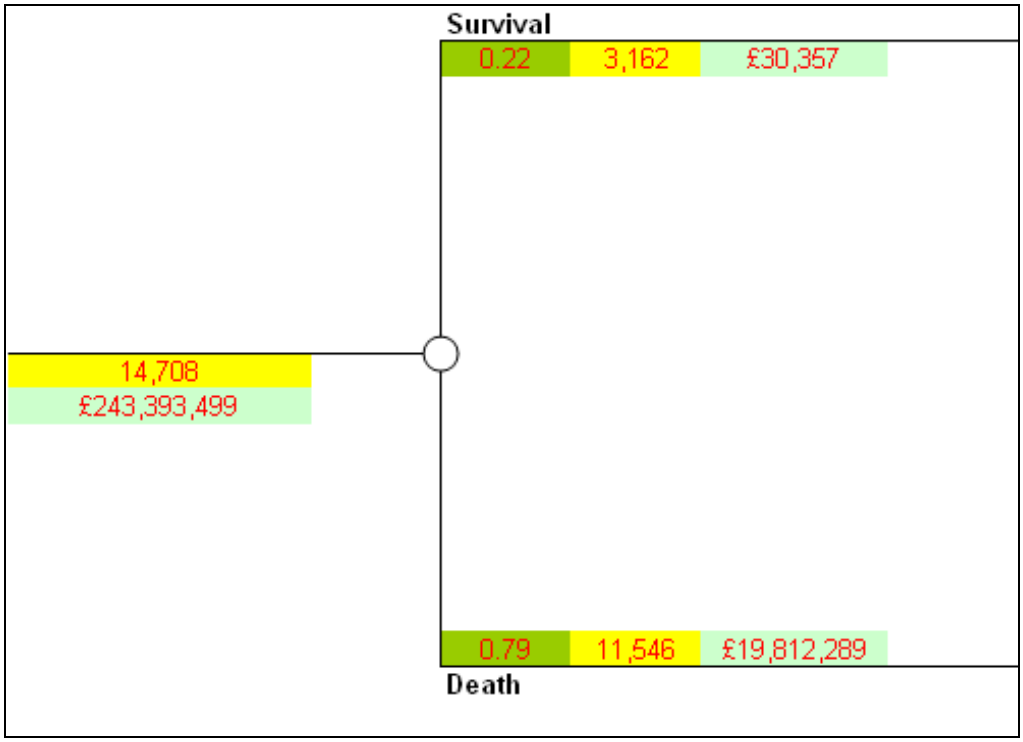
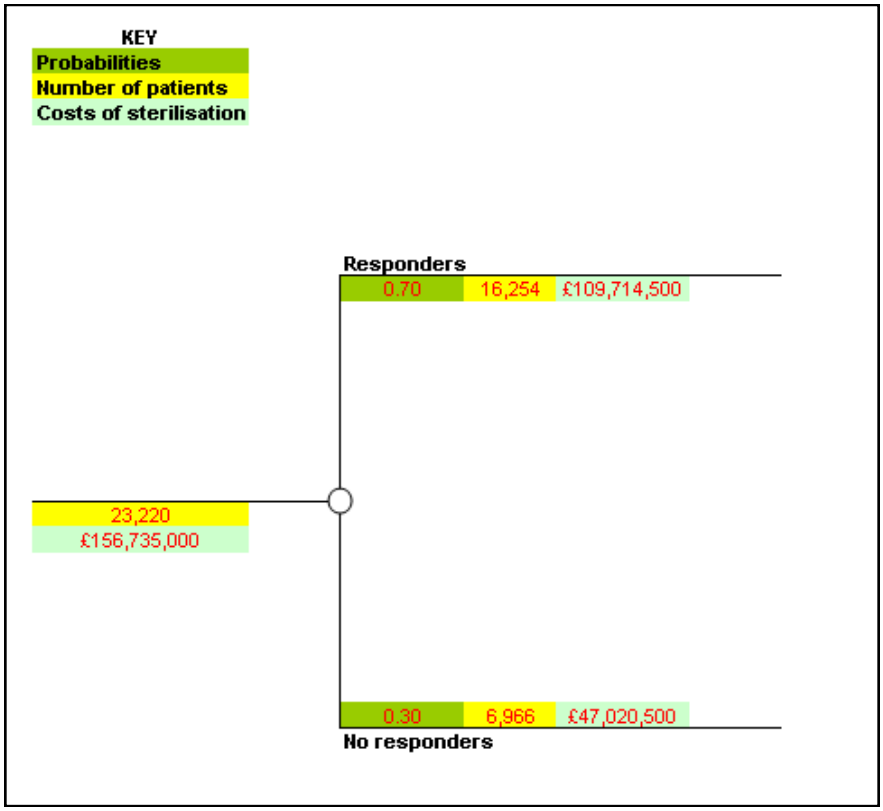


Figure A.7: Model for Evalu-Logix case study

Standard Care



Intervention

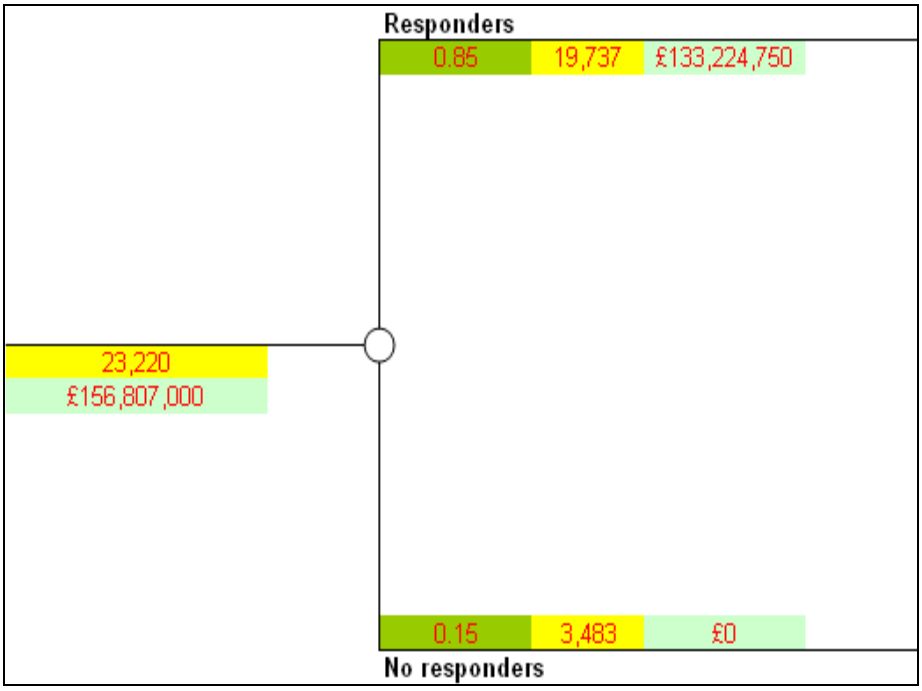


Figure A.8: Model for e-PAQ case study