Medaphor ScanTrainer transvaginal ultrasound training simulator: cost analysis

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1   Introduction

The purpose of this report is to estimate the health service costs of training in basic obstetric and gynaecology ultrasound skills using a virtual reality training simulator (Medaphor ScanTrainer), compared with the traditional approach to training during a live scanning list.

1.1   Perspective

The analysis is undertaken from the perspective of the NHS or healthcare provider and the timeframe considered is the period of initial 'hands-on' training up to the point where the trainee is considered to reach a level of competency which will allow them to scan with confidence (initially under 'watchful eye' supervision). If one method of training were superior, there might be future cost implications, but these are neglected in the analysis, therefore there is an underlying assumption that the two methods achieve equivalent training outcomes.

Figure 1 Traditional training route
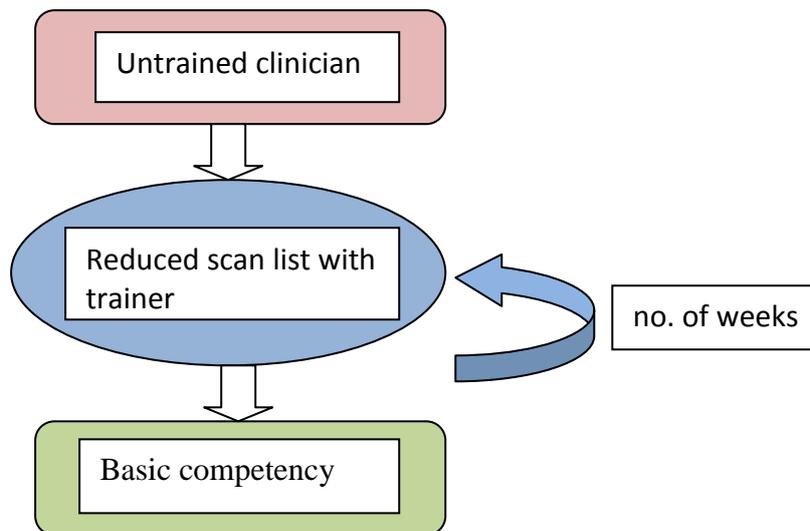
Figure 2 ScanTrainer route
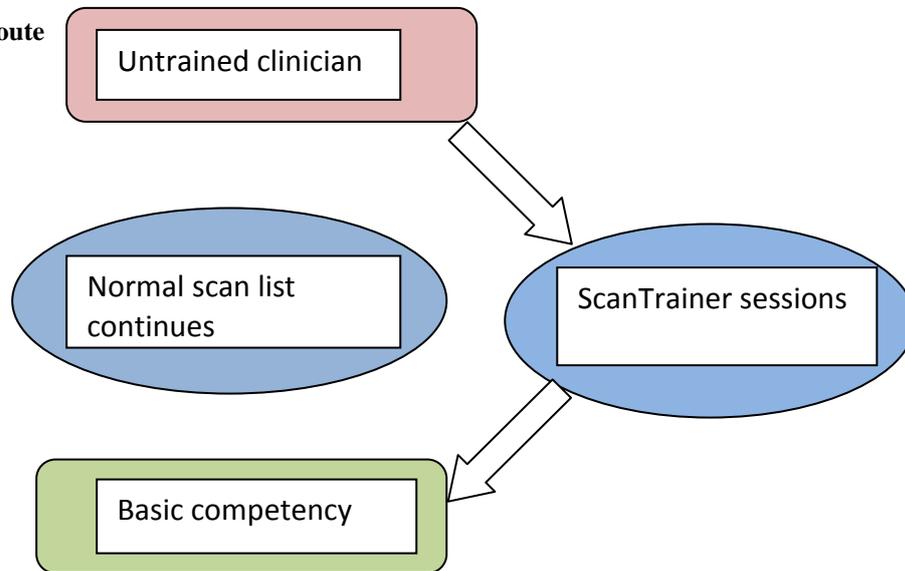
2 Methods and validity

There are three steps in cost analysis:

1. Identify the resources

2. How much of each resource is used?

3. What is the value of the resource?

The resources were identified by detailing the training pathway as it traditionally takes place and the alternative route using the simulator. The difference in resources was identified to be the potential reduction in the number of patients that can be scanned in a list with a trainee undergoing training by the traditional route. The additional resources required for the simulator route are the simulator, its maintenance and ongoing upgrades and a space in which to use it.

A rapid review of literature focusing on, but not limited to economic studies did not reveal any published studies that could be used as sources of data as regards to resource usage in UK practice in obstetric and gynaecology ultrasound.

Therefore to find out the quantity of resources that are typically used we undertook an anonymised electronic survey (Bristol online surveys) of 34 UK Consultants in Obstetrics and Gynaecology. As well as basic training the questions asked about the number of staff who would

require practical competency assessment or ongoing specialist training during 'hands-on' sessions. The questionnaire was initially tested with four clinicians in order to check that the wording was clear and that the questions could reasonably be answered either using actual data or the clinician's best estimate. Finally the value of the resources used was determined using data collected from a range of sources. Resources which were assumed to be the same between settings have been ignored. Uncertainties in the inputs are explored in sensitivity analysis.

3 Results

3.1 Questionnaire responses

Based on the responses to the pilot questionnaire, one of the questions was modified for improved clarity and was then issued to all 34 UK consultants. Responses were received from 19 (56%) of those contacted.

Question 1.

What is your estimate of the average number of scans per typical ultrasound scan list, with no trainees present?

Figure 3
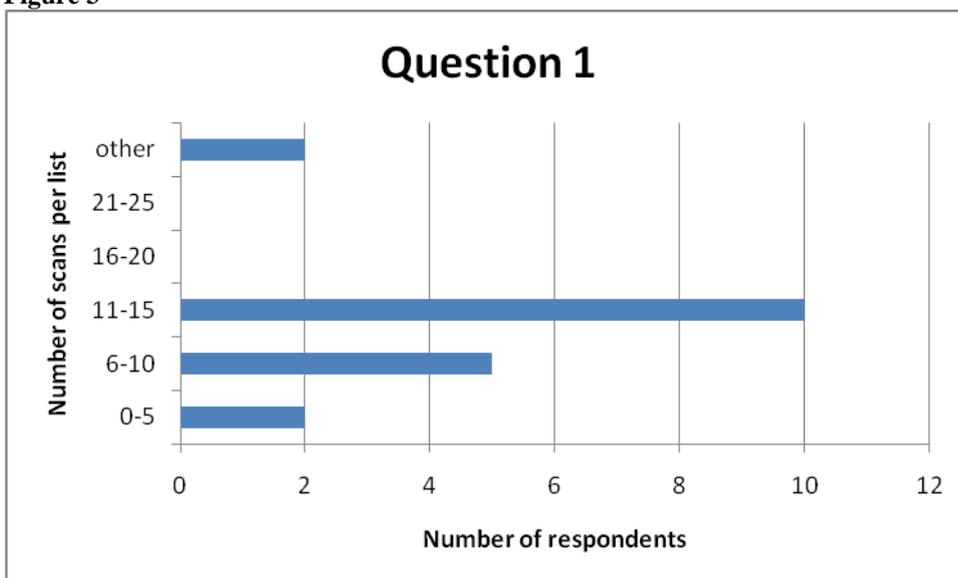
One of the respondents who checked the box 'other' added that in their clinic they do not have ultrasound lists, but incorporate scans into a single visit clinic. The second respondent who checked the 'other' box indicated that it could be one of two answers 6-10 or 11-15.

Question 2

If an inexperienced trainee is being trained in basic obstetric/gynaecology scanning skills during a 'live' scanning list, how many scans will typically be carried out during that list?

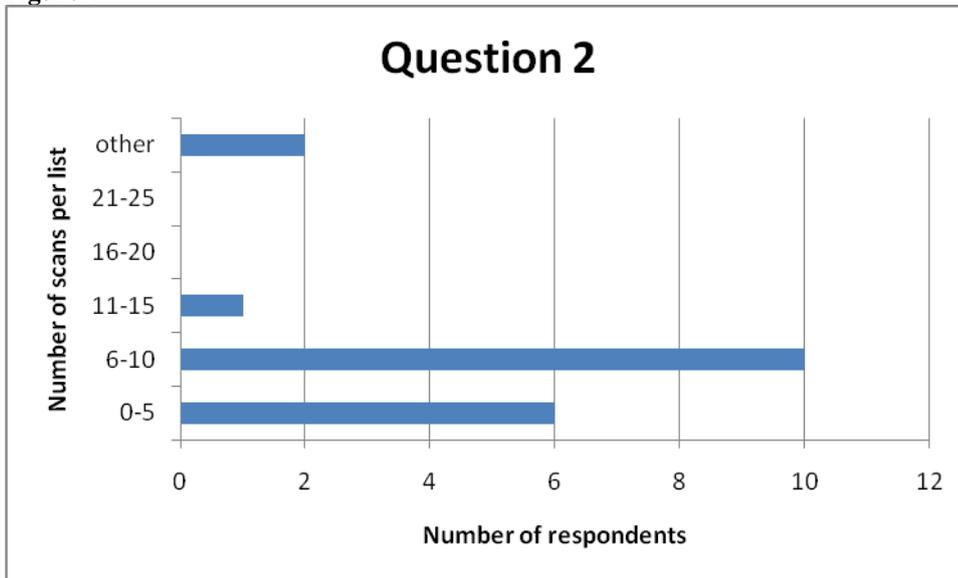**Figure 4**

As for question 1, one of the respondents who checked the box 'other' added that in their clinic they do not have ultrasound lists, but incorporate scans into a single visit clinic. The second respondent indicated it could be one of two answers 6-10 or 0-5.

Question 3

In a typical year how many trainees do you train within your Department in basic obstetric/gynaecology ultrasound scanning skills?

**Figure 5**
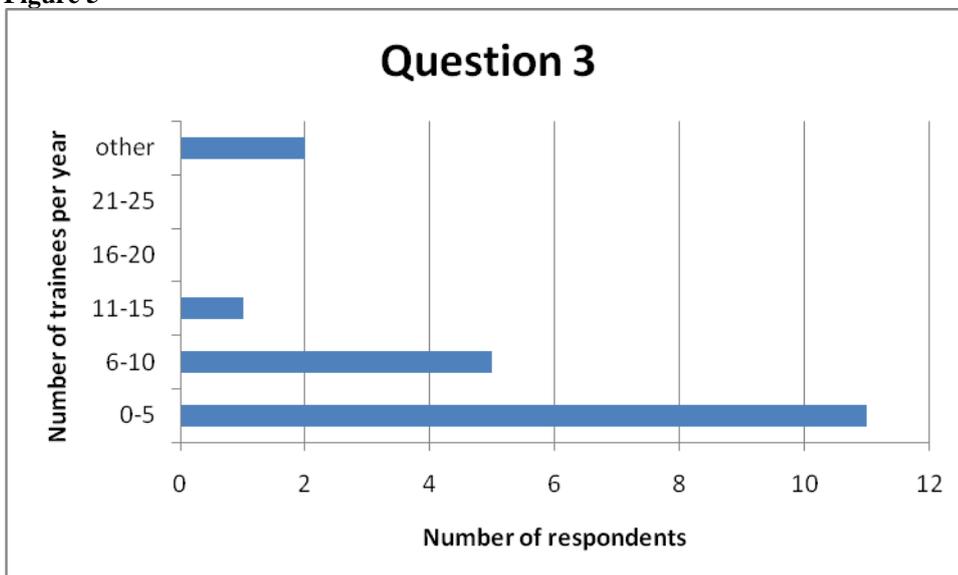
The respondents who chose other added:

'The numbers are 11-15 but we have not got a robust model that has been sustainable due to reconfiguration of services.'

'5 in obs, 2 in gynae.'

Question 4

On average, how many scan lists will each trainee need to attend before they have reached a basic level of competence which will allow them to scan with confidence (initially under 'watchful eye' supervision)?

Figure 6
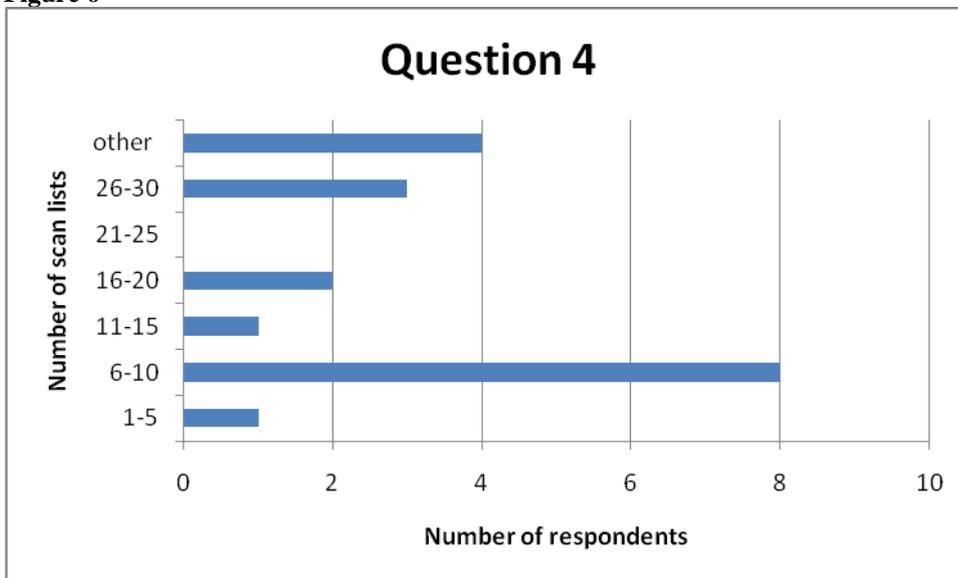
One respondent who gave the reponse 'other' added:

'They need more than we offer, which is 10 lists'

The other 3 respondents who gave the response 'other' indicated that this varies depending on how quickly individuals learn and their previous experience.

Question 5

How many staff per year in your Department require competency assessment, continuing professional development or ongoing specialist training in obstetric/gynaecology ultrasound via 'hands-on' sessions?

Figure 7
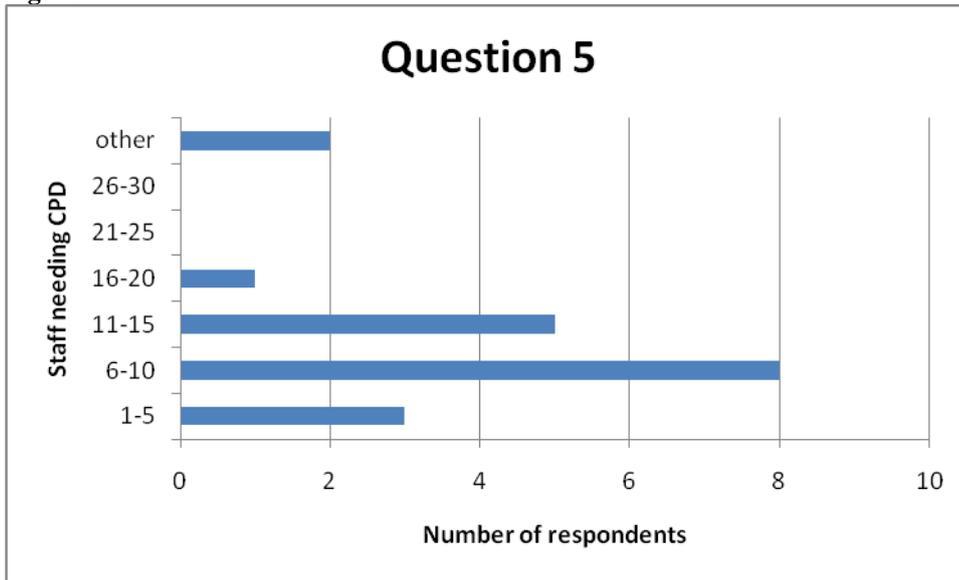
4 Analysis

The responses to questions 1 and 2 were categorised (0-5 =category 1, 6-10 = category 2, etc) and the paired responses were compared to determine if there is a significant difference in the number of patients that can be scanned when a trainee is present compared with a typical scan list with no trainee present. Data from one respondent was excluded because of selecting the 'other' box for questions 1 and 2, and clarified that this was because they don't have ultrasound lists in their one-stop clinic. Based on the clarifying comments it was assumed for the second respondent who checked 'other' that there was a 1 category difference between the numbers of patients scanned with and without trainees present.

There was a significant difference between the responses to questions 1 and 2 (Wilcoxon signed rank test) $p < 0.001$ at the 95% confidence level. In order to quantify this difference it was assumed that a difference of one category corresponds to 5 fewer patients being scanned with trainees present. The mean number of categories difference between scanning with and without trainees was 0.7. Therefore a difference of 0.7 x 5 = 3.8 patients per list was used for the base case analysis. Uncertainties around this assumption were explored in the sensitivity analysis.

4.1 What resources are required?
Resources that are the same for both training methods are not included.

Table 1

Traditional training	Simulator training
Fewer patients scanned per list	ScanTrainer
	Space to use simulator
	Equipment maintenance, software updates

4.2   How much of each resource is used?

Number of trainees requiring training was taken as 4.7 from the questionnaire.

Number of lists to achieve competence by the traditional route was 13.3 from the questionnaire.

Number of patients fewer that can be scanned per list during traditional training was 3.8 from the questionnaire.

It is assumed that the ScanTrainer can be accommodated within existing office space and therefore this has not been included as an additional cost. This may be a consideration for organisations where space is at a premium.

4.3   What is the value of the resources used?

Cost of ScanTrainer was £25,000 over a 5 year lifespan (source – Medaphor).

Software upgrades – free. Additional modules may be purchased (source – Medaphor).

Maintenance -no scheduled maintenance expected (source Medaphor).

Cost per ultrasound examination = £51 code RA23Z (ultrasound imaging less than 20 minutes) from the NHS reference costs [1]. From the survey question 1, the average number of patients scanned per half day session was 10.3. From this, given a 7.5 hour working day, we calculate the average scan duration to be 21.8 minutes with no trainees present. We have taken a conservative approach by choosing the cost/scan as ultrasound imaging less than 20 minutes. The cost/scan for ultrasound greater than 20 minutes =£73 code RA24Z from the NHS reference costs [1]. Using a higher cost/scan would increase the cost saving using ScanTrainer.

4.4   Base case analysis

The base case analysis was calculated using the best estimates of each input value. The results (Table 2) therefore represent the most likely outcome based on the data available.

Table 2

Resource	Traditional route	Simulator training	Difference
Equipment cost		£5,000	£5000
Opportunity cost of fewer patients scanned in training	£12,114		-£12,114
Total			**-£7,114**

The base case results show that the simulator training route is cost saving and a typical Department will save £7,114 per annum.

## 4.5   Sensitivity analysis

The purpose of sensitivity analysis is to explore uncertainty in the values used in the base case. The impact of each parameter was explored in turn by choosing a plausible low value and a plausible high value and then re-calculating the cost analysis. The values chosen for the low and high inputs are given in Table 3 and the impact on the cost analysis is represented on a Tornado diagram (Figure 8).

Table 3

Resource	Base case	Low value	High value
Number of trainees in department	4.7	1	15
Number of lists to achieve competence	13.3	1	30
Number of fewer patients in training list	3.8	1	10
Cost of ultrasound scan	£51	£38	£59
Lifespan of ScanTrainer	5 Years	2 years	10 years
Cost of ScanTrainer	£25,000	£18,000	£30,000

Figure 8 Tornado chart
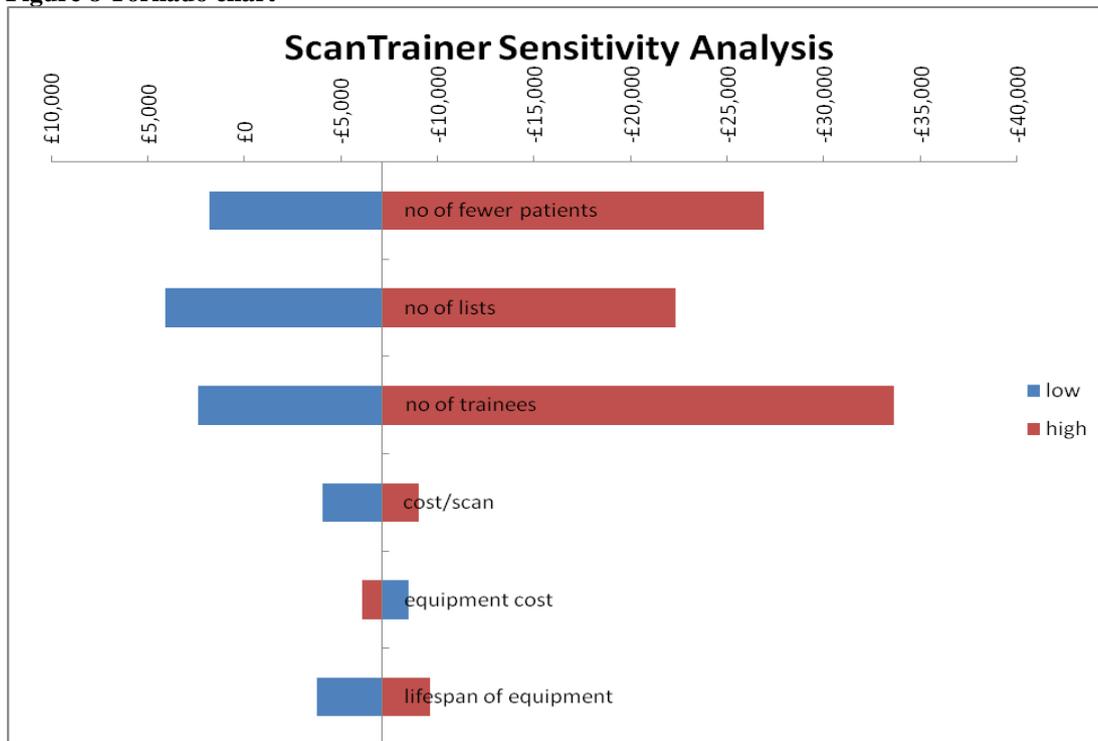
The tornado chart in Figure 8 illustrates the results of changing the inputs from the base case values to the chosen low and high values from Table 3. The longer bars highlight the parameters that have the greatest impact on the result. Only when the bar extends to the left of the £0 on the horizontal axis, does the scenario become cost incurring.

In almost all of the scenarios tested the ScanTrainer remained cost saving compared with traditional training. Three factors could change the outcome from cost saving to cost incurring:

- The number of trainees requiring training

- The number of lists required to train them

- The number fewer patients that can be scanned during a training list

These factors were further investigated to determine the point at which they became cost incurring.

It was found that provided the following conditions are met, the ScanTrainer method is cost saving:

- The Department has at least two trainees per year to train

- It would require at least six lists to train them by the traditional method

- A traditional training list has at least two fewer patients than a standard list

5 Discussion

The cost savings are driven by the opportunity cost of scanning fewer patients during traditional training using the existing ultrasound scanner and therefore it represents an efficiency saving, releasing the ultrasound scanner and trainer. Whether this becomes a realisable cost saving depends upon the circumstances of the organisation. For example, a clinic would be able to use the resource savings to scan additional patients who would otherwise have gone elsewhere, reduce the waiting time for existing patients or release the trainer for other duties.

The analysis has not used probabilistic methods, which would allow all of the parameters to be varied simultaneously. However the deterministic methods used have been applied carefully using the best available data. By presenting the conditions required for a cost saving to be made, this will enable decision-makers to make a well informed choice.

The analysis has not included further potential efficiency savings and educational benefits from the use of the ScanTrainer for continuing professional development, further skills development and competency assessment of trained staff. In the questionnaire, respondents indicated that there is a need for such training.

References

1. Department of Health NHS Reference costs 2011-12 (direct costs)