An Economic Evaluation of the use of Copper in Reducing the Rate of Healthcare Associated Infections in the UK

User Guide

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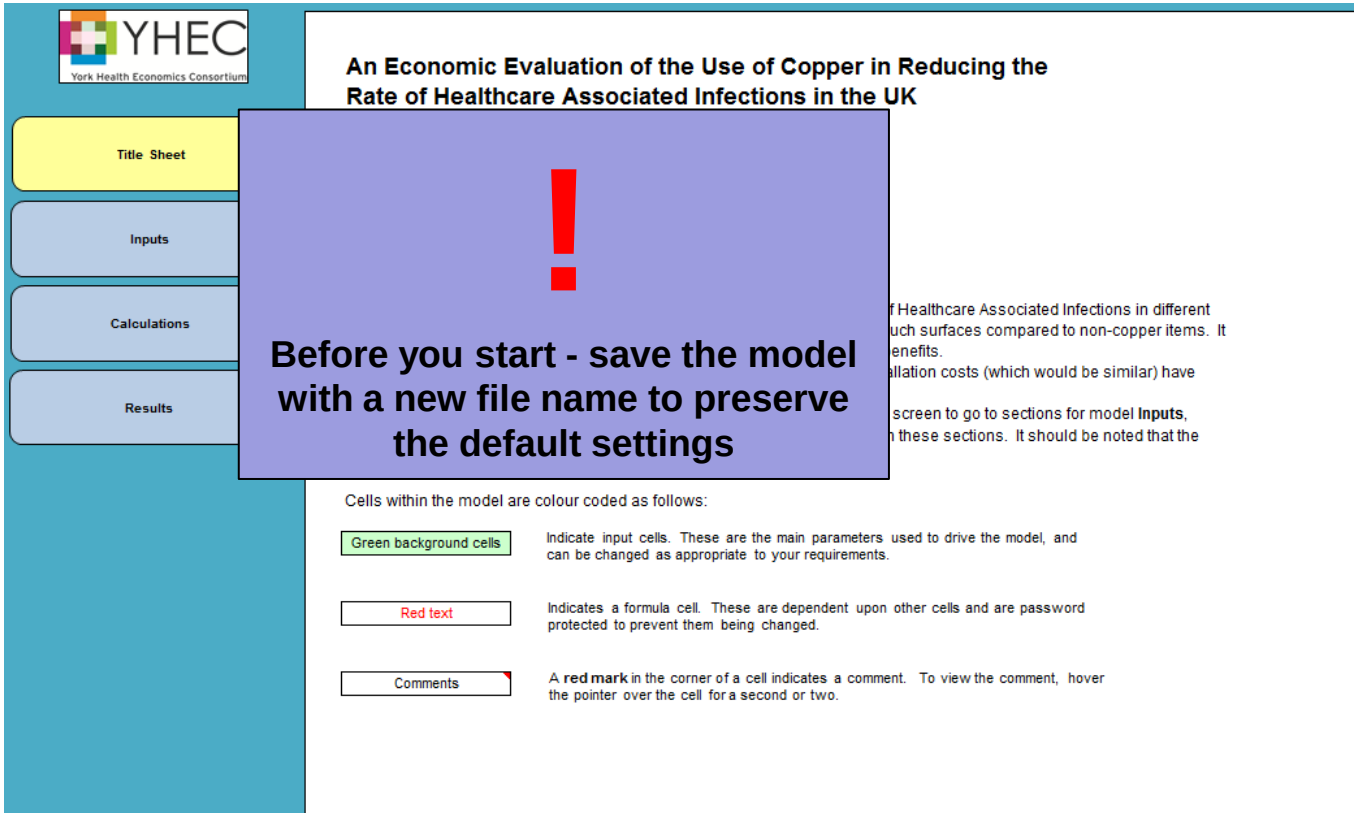
The Model



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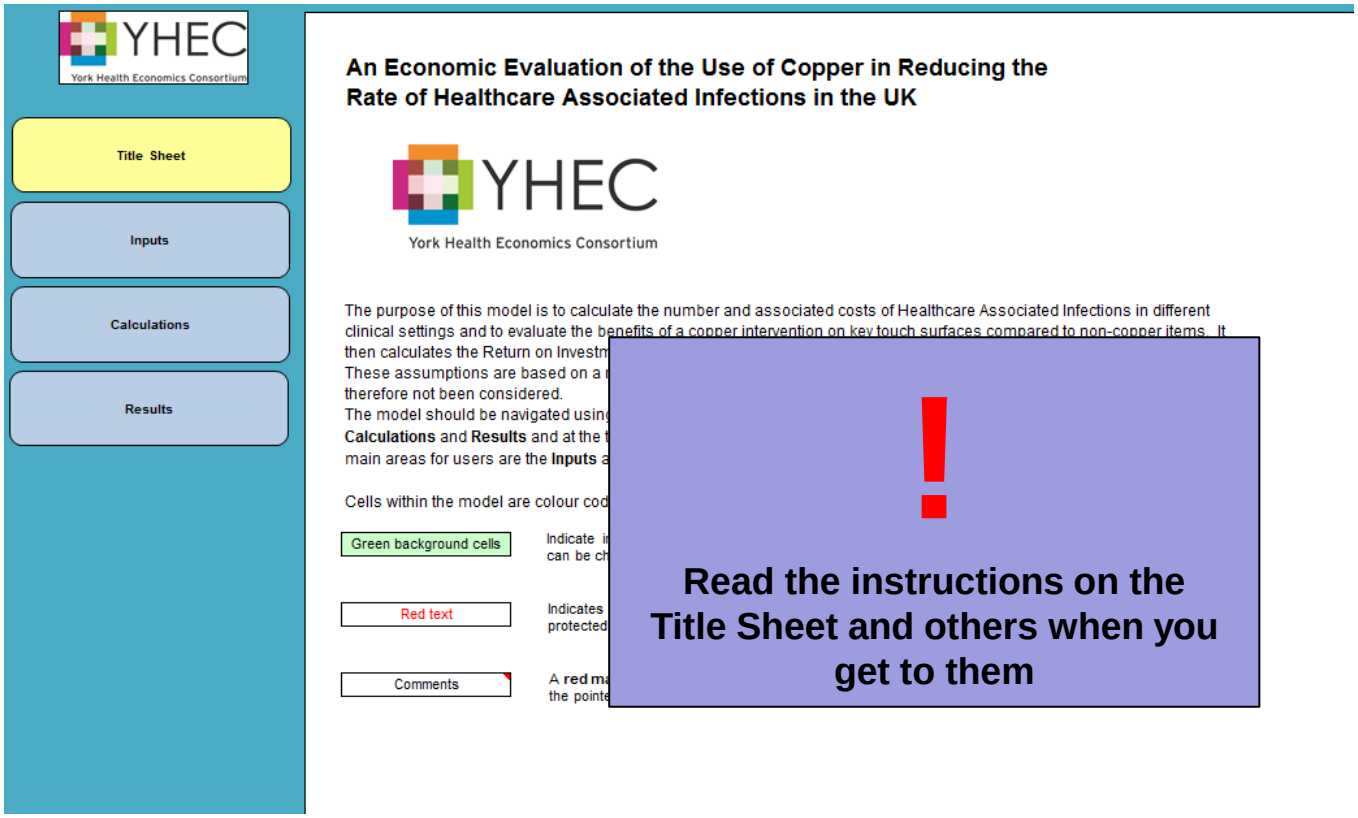
The Model



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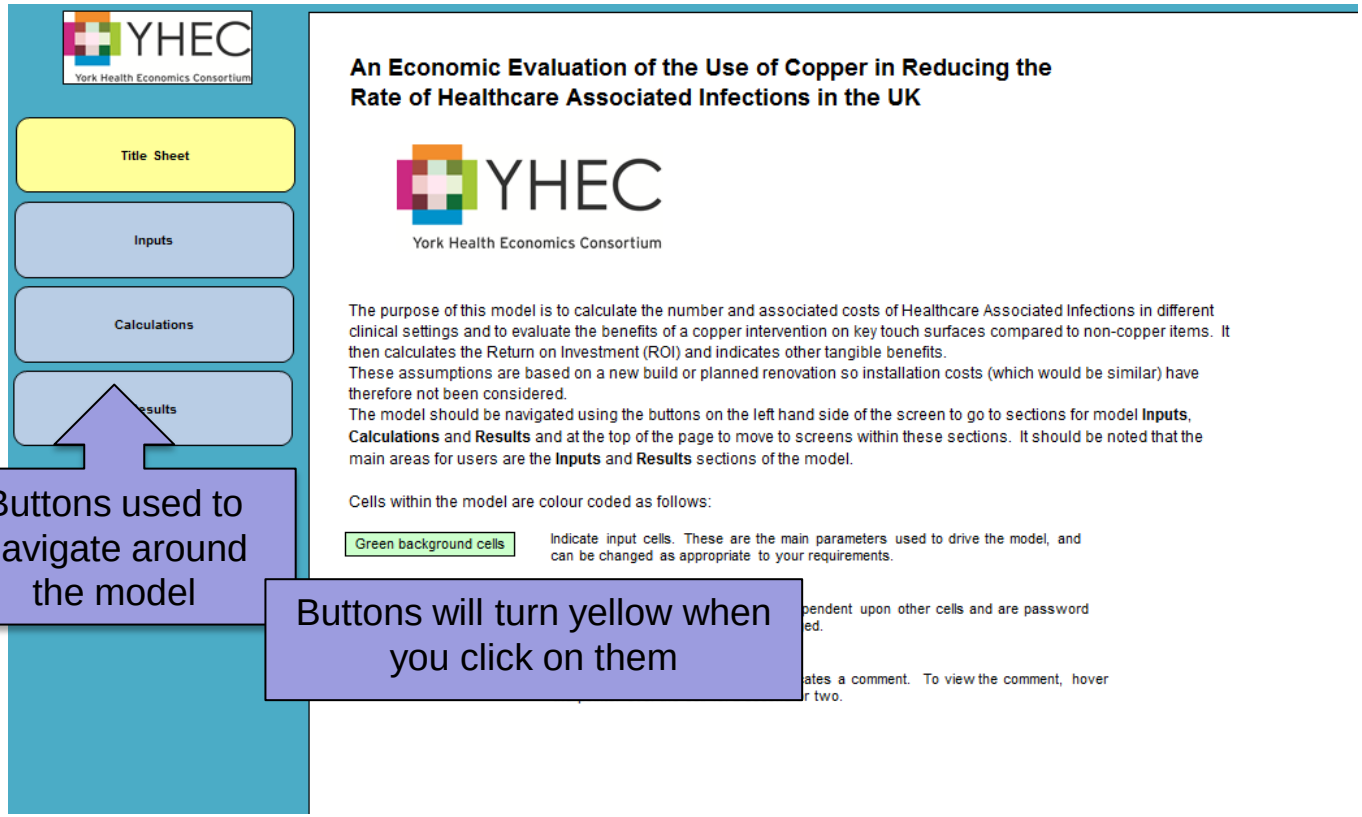

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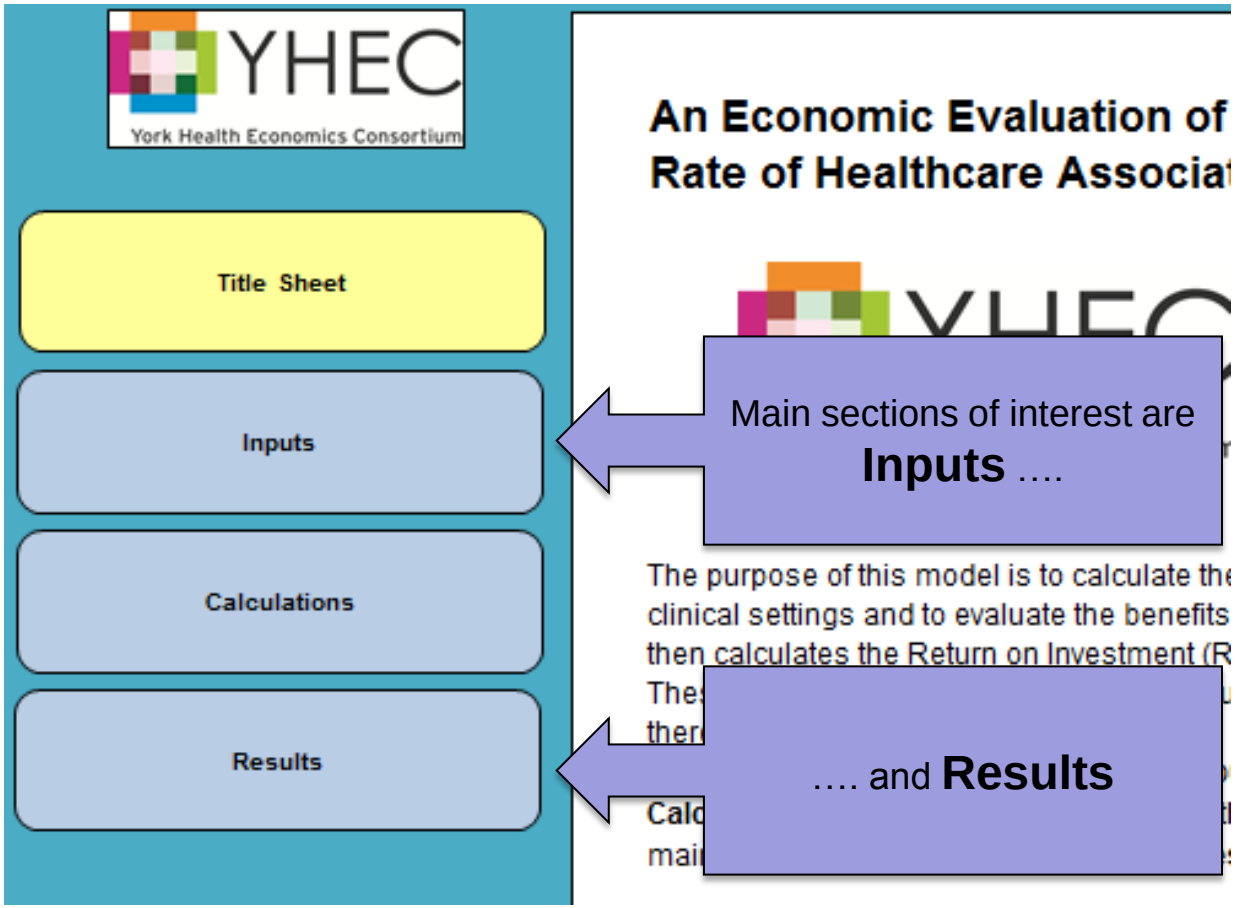

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Set-Up

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Title Sheet

Inputs

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Results

Model Inputs

Set-Up | Effectiveness | Cost | Resource Use | References

The purpose of this sheet is to set up the model for the appropriate hospital setting. The typical number of patients and any predictions for increases or decreases over time should be entered in the cells shaded in green. Whether or not copper items will be introduced to general wards, ICU or single rooms can be selected in the drop down menu and the name of the pathogen in the model can be entered in the appropriate green shaded cell .

Number of beds in unit	20
Average length of stay in ICU (days)	5.7
Average length of stay ward/single room (days)	3.0
Calculated number of patients per year (Cohort)	1,200
Yearly change in number of patients	0%

Setting: ICU

Infection to be included in the model: All Healthcare Associated Infections

Currency: GBP Pounds (£)

The Salgado (2013) study was carried out in single room Intensive Care Units (ICUs) and showed that copper alloy upgrades of key touch surfaces lead to reduced contamination on the copper and to an associated reduction in risk of HCAIs. After a microbial sampling assessment, the six most contaminated touch surfaces (hot spots) were upgraded representing 1.5 m² or 10% of the total touch surfaces in the room.

Evidence for reduced contamination is also available from a study in an open ward and single room, standard care situation (Karpanen 2011). In this clinical trial, fourteen hot spot touch surfaces were identified and upgraded; contamination reduction on these components was similar to that observed by Schmidt. To date there is no data of commensurate reduction in HCAI rates in these environments as early trials were not designed to evaluate this.

In order to allow you to explore the potential for copper in these other care configurations and environments, this model allows for single/ensuite rooms and ward situations to be assessed. It includes baseline cost data for key copper components and these can be individually selected according to your judgement and local environmental monitoring data. Whilst the model defaults to HCAI reduction data for the ICU, it allows you to enter an effectiveness value based upon your

Green background cells	Indicate input cells. These are the main parameters used to drive the model, and can be changed as appropriate to your requirements.
Red text	Indicates a formula cell. These are dependent upon other cells and are password protected to prevent them being changed.
Comments	A red mark in the corner of a cell indicates a comment. To view the comment, hover the pointer over the cell for a second or two.

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Set-Up (2)

Choose number of beds in the unit and average length of stay.
The number of patients is automatically calculated

Number of beds in unit	20
Average length of stay in ICU (days)	5.7
Average length of stay ward/single room (days)	3.0
Calculated number of patients per year (Cohort)	1,200
Yearly change in number of patients	0%

Select setting for model in drop down

Input any expected change in patient numbers

tting	ICU
Infection to be included in the model:	All Healthcare Associated Infections
Currency:	GBP Pounds (£)

All HCAIs by default

Select currency to be used

The Salgado (2013) study was carried out in single room Intensive Care Units (ICUs) and showed ... d to reduced contamination on the copper ... r a microbial sampling assessment, the six ... upgraded representing 1.5 m² or 10% of the ... e from a study in an open ward and single ... his clinical trial, fourteen hot spot touch ... surfaces were identified and upgraded; contamination reduction on these components was ... of commensurate reduction in HCAI ... to evaluate this.

In ... her care configurations and ... environ... situations to be assessed. It ... includes baseline cost data for key copper components and these can be individually selected according to your judgement and local environmental monitoring data. Whilst the model defaults to HCAI reduction data for the ICU, it allows you to enter an effectiveness value based upon your

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Set-Up (3)

Number of beds in unit	20
Average length of stay in ICU (days)	5.7
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Calculated number of patients per year (Cohort)	1,200
Yearly change in number of patients	0%

Setting	ICU
Infection to be included in the model:	All Healthcare Associated Infections
Currency:	GBP Pounds (£)

The Salgado (2013) study was carried out in single room Intensive Care Units (ICUs) and showed that copper alloy upgrades of key touch surfaces lead to reduced contamination on the copper and to an associated reduction in risk of HCAIs. After a microbial sampling assessment, the six most contaminated touch surfaces (hot spots) were upgraded representing 1.5 m² or 10% of the total touch surfaces in the room.

Evidence for reduced contamination is also available from a study in an open ward and single room, standar
surfaces were
similar
rates

In order
environments
includes base
according to your judgement and local environmental monitoring data. Whilst the model defaults to HCAI reduction data for the ICU, it allows you to enter an effectiveness value based upon your

You can enter a specific microbe or infection type by over-typing in the green box

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Effectiveness

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Title Sheet
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Model Inputs

Set-Up | Effectiveness | Cost | Resource Use | References

The following infection rates are taken from published papers. To change to hospital specific rates, the rate and the time period in months over which the infections occurred should be entered into the appropriate cells and 'user defined data' should be selected in the drop down menu. A new monthly rate will automatically be calculated.

		Monthly infection rate								
		ICU			Ward			Single room		
		Rate	Time period (months)	Monthly rate	Rate	Time period (months)	Monthly rate	Rate	Time period (months)	Monthly rate
All healthcare associated infections	Cairns 2010	27.100%	12	0.0226						
Cairns *et al*. 2010		27.100%	12	0.0226						
Health Protection Agency 2011		23.400%	12	0.0195						
User defined data										

Reduction in infections*	20.0%

Rates from Salgado (2013) showed a reduction of 58.1% for the copper arm versus non-copper arm. A conservative assumption of a reduction of 20% has been used as default in the model.

Green background cells	Indicate input cells. These are the main parameters used to drive the model, and can be changed as appropriate to your requirements.
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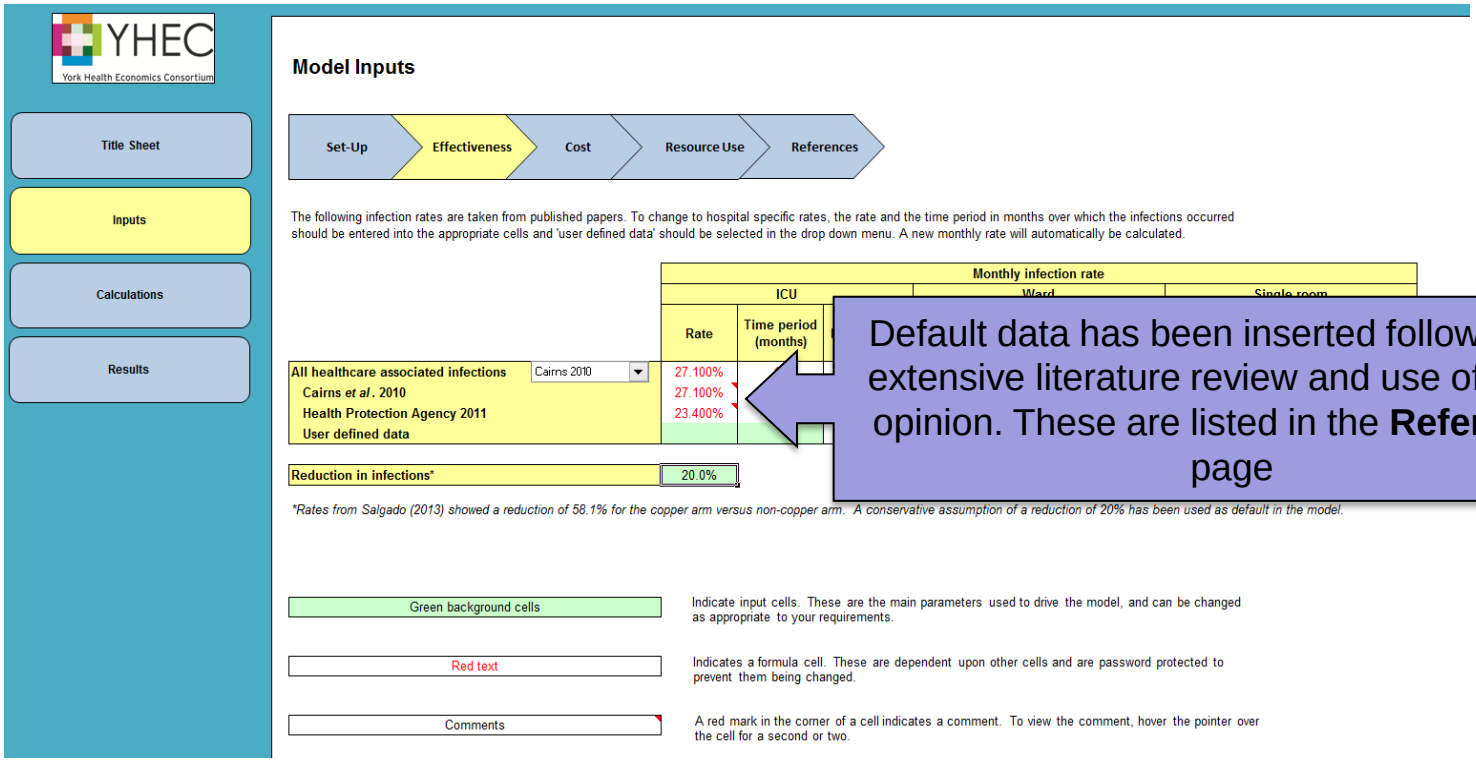
Effectiveness (2)



Default data has been inserted following our extensive literature review and use of expert opinion. These are listed in the **References** page

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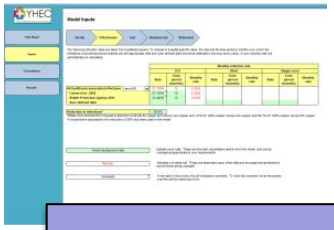
Effectiveness (3)



Infection rates for **all HCAIs in an ICU** setting are entered by default. Local data for ICU may be entered in the appropriate (green) cells.

		Monthly infection rate								
		ICU			Ward			Single room		
		Rate	Time period (months)	Monthly rate	Rate	Time period (months)	Monthly rate	Rate	Time period (months)	Monthly rate
All healthcare associated infections	Cairns 2010	27.100%	12							
Cairns *et al*. 2010		27.100%								
Health Protection Agency 2011		23.400%								
User defined data										

Cairns 2010
HPA 2011
User defined data

The **drop down box** can be used to choose either of the referenced data

Reduction in infections*	20.0%

**Rates from Salgado (2013) showed a reduction of 58.1% for the copper arm versus non-copper arm. A conservative assumption of a reduction of 20% has been used as default in the model.*

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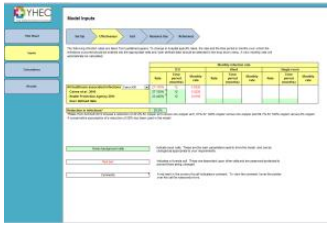
Effectiveness (4)



		Monthly infection rate								
		ICU			Ward			Single room		
		Rate								
All healthcare associated infections	Cairns 2010	27.1								
Cairns *et al*. 2010	Cairns 2010 HPA 2011 User defined data	27.100%								
Health Protection Agency 2011		23.400%	12	0.01						
User defined data										
Reduction in infections*		20.0%								

To use local data choose **"user defined data"** from the drop down

Remember to fill in the months

*Rates from Salgado (2013) showed a reduction of 58.1% for the copper arm versus non-copper arm. A conservative assumption of a reduction of 20% has been used as default in the model.

A conservative assumption of a reduction of 20% is used as default in the model

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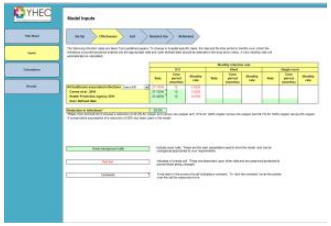
Effectiveness (5)



If you chose **Ward** or **Single Room** in the Set Up page enter data here in the green cells.

		Monthly infection rate								
		ICU			Ward			Single room		
		Rate	Time period (months)	Monthly rate	Rate	Time period (months)	Monthly rate	Rate	Time period (months)	Monthly rate
All healthcare associated infections	User defined data	0.000%	0	#DIV/0!	6.200%	12	0.0052			
	Cairns 2010	27.100%	12	0.0226						
	HPA 2011	23.400%	12	0.0195						
	User defined data				6.200%	12				

Choose **User defined data** from the drop down

Remember to fill in the months

Reduction in infections*	20.0%

*Rates from Salgado (2013) showed a reduction of 58.1% for the copp… versus non-copper arm. A conservative assumption of a reduction of 20% has been used as default in the model.

A reduction of 20% is used as default in the model; you can alter this

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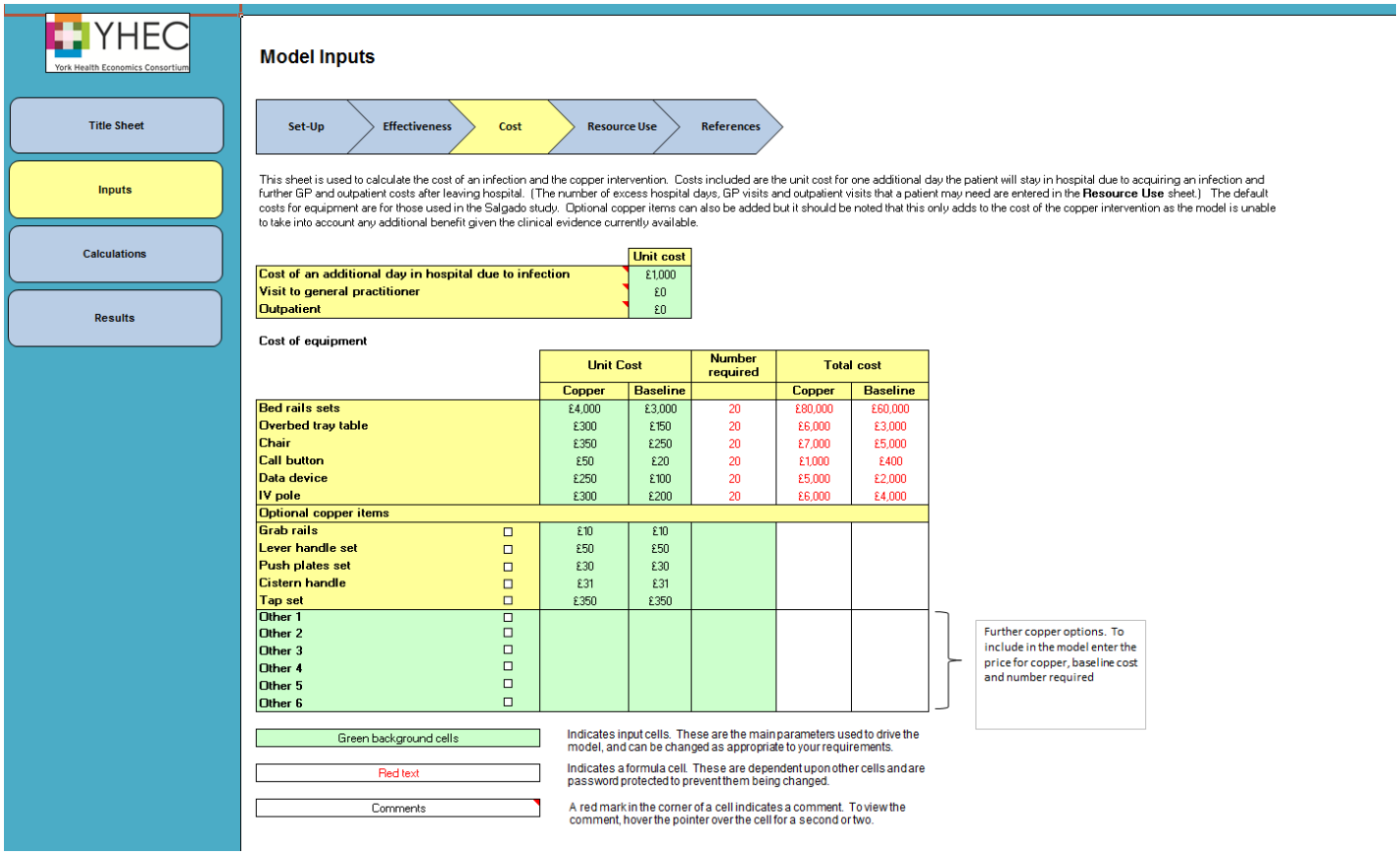
Costs



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Costs (2)

Unit costs for the treatment of infections are entered here. The default is £1,000 for an additional day in hospital

Optional costs for visits to a **GP** and **Outpatients** can also be included

	Unit cost
ditional day in hospital due to infection	£1,000
practitioner	£0
	£0

equipment

	Unit Cost		Number required	Total cost	
	Copper	Baseline		Copper	Baseline
Bed rails sets	£4,000	£3,000	20	£80,000	£60,000
Overbed tray table	£300	£150	20	£6,000	£3,000
Chair	£350	£250	20	£7,000	£5,000
Call button	£50	£20	20	£1,000	£400
Data device	£250	£100	20	£5,000	£2,000
IV pole	£300	£200	20	£6,000	£4,000
Optional copper items					
Grab rails ☐	£10	£10			
Lever handle set ☐	£50				
Push plates set ☐	£30				
Cistern handle ☐	£31				
Tap set ☐	£350	£350			
Other 1 ☐					
her 2 ☐					
er 3 ☐					
ther 4 ☐					
Other 5 ☐					
Other 6 ☐					

Tick to include specific equipment

You can enter your own text here

Further copper options. To include in the model enter the price for copper, baseline cost and number required

Cost of equipment is entered here. Additional copper items are included when the **number required** cells are completed

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Resource use

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Title Sheet
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Model Inputs

Set-Up | Effectiveness | Cost | Resource Use | References

This sheet is used to enter the resources a patient will use as a result of acquiring an infection. These are extra days in hospital and subsequent visits to a GP and/or an outpatient visit. These resources are assumptions and should be changed to reflect local care pathways

Resource use for an event

	Extra days in hospital	General practitioner visit	Follow up outpatient visit
All healthcare associated infections	6	1	1

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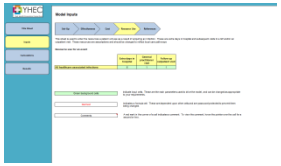
Resource use (2)

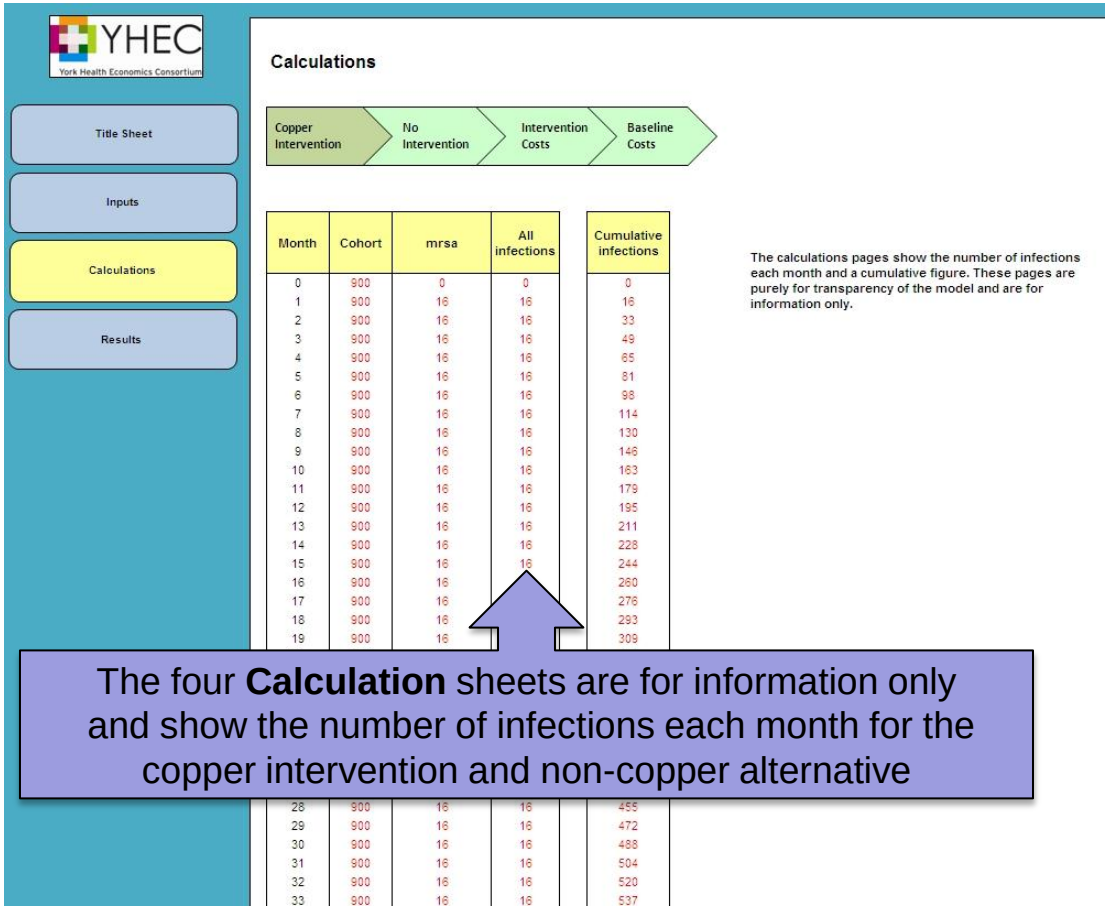


If no cost data is entered in **Costs** page then these will not influence the output

	Extra days in hospital	General practitioner visit	Follow up outpatient visit
All healthcare associated infections	6	1	1

The **Resource Use** inputs for an infected patient are assumptions and can be changed to reflect local clinical pathways. i.e. it is assumed a patient has six extra days in hospital

Calculations



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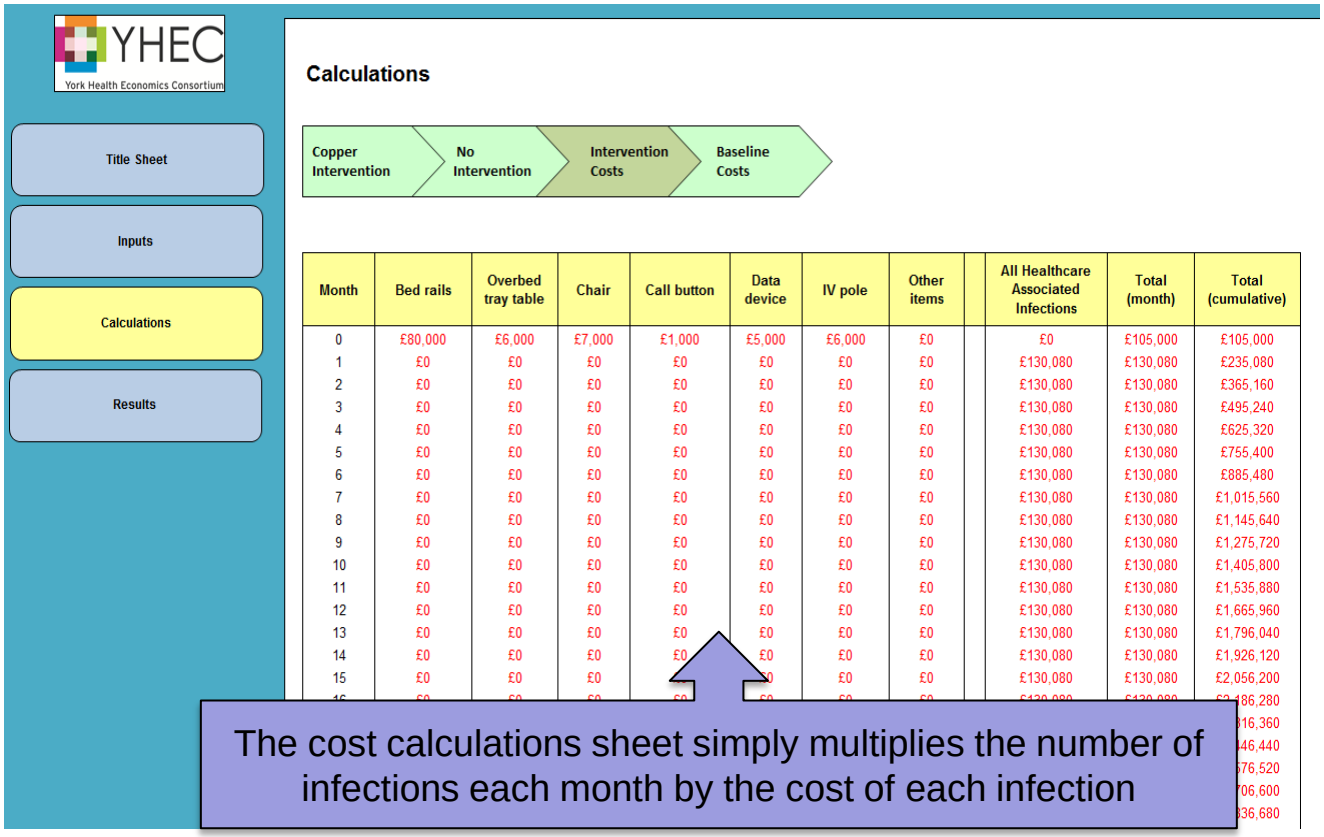
Intervention Costs



Month	Bed rails	Overbed tray table	Chair	Call button	Data device	IV pole	Other items	All Healthcare Associated Infections	Total (month)	Total (cumulative)
0	£80,000	£6,000	£7,000	£1,000	£5,000	£6,000	£0	£0	£105,000	£105,000
1	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£235,080
2	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£365,160
3	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£495,240
4	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£625,320
5	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£755,400
6	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£885,480
7	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£1,015,560
8	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£1,145,640
9	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£1,275,720
10	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£1,405,800
11	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£1,535,880
12	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£1,665,960
13	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£1,796,040
14	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£1,926,120
15	£0	£0	£0	£0	£0	£0	£0	£130,080	£130,080	£2,056,200

The cost calculations sheet simply multiplies the number of infections each month by the cost of each infection

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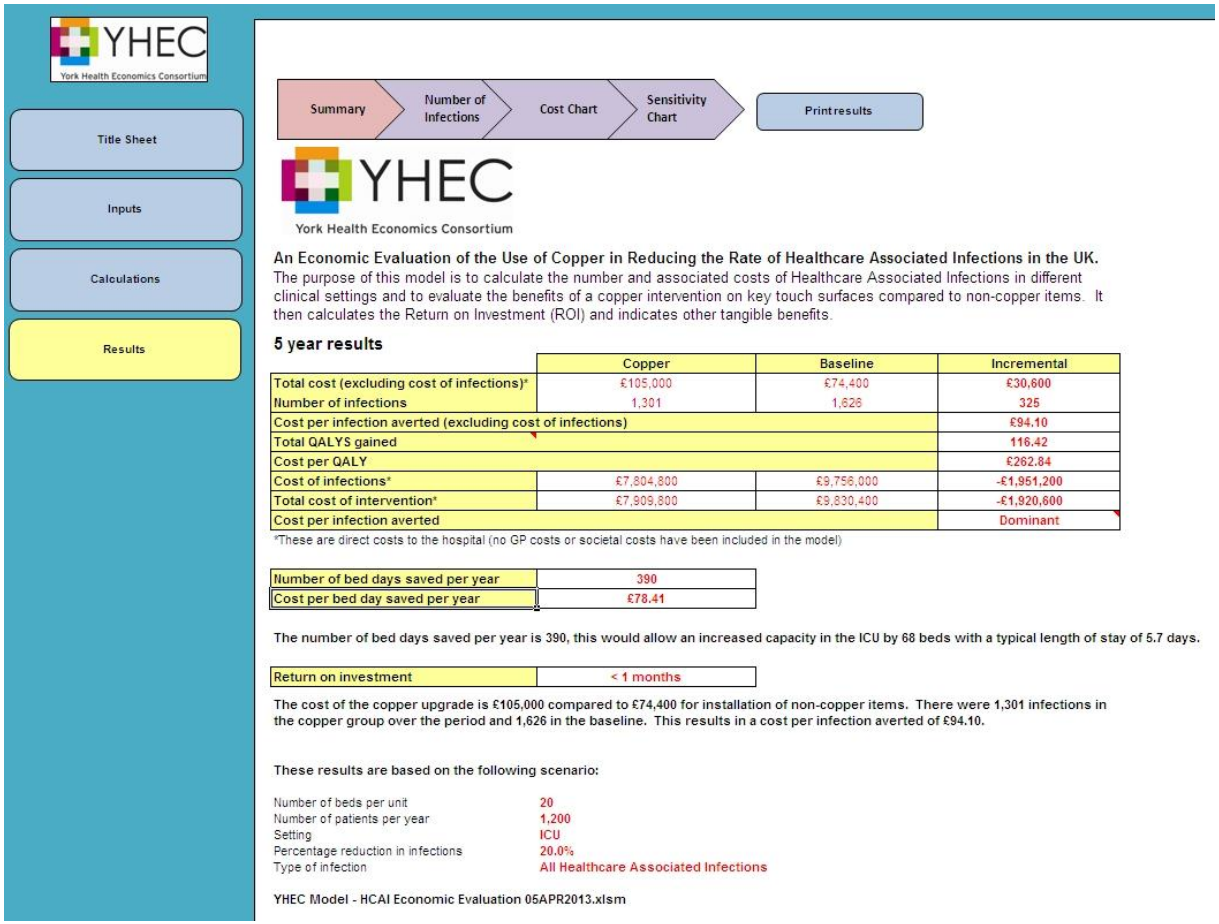
Results



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Title Sheet
Inputs
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Summary | Number of Infections | Cost Chart | Sensitivity Chart | Print results

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An Economic Evaluation of the Use of Copper in Reducing the Rate of Healthcare Associated Infections in the UK.
The purpose of this model is to calculate the number and associated costs of Healthcare Associated Infections in different clinical settings and to evaluate the benefits of a copper intervention on key touch surfaces compared to non-copper items. It then calculates the Return on Investment (ROI) and indicates other tangible benefits.

5 year results

	Copper	Baseline	Incremental
Total cost (excluding cost of infections)*	£105,000	£74,400	£30,600
Number of infections	1,301	1,626	325
Cost per infection averted (excluding cost of infections)			£94.10
Total QALYS gained			116.42
Cost per QALY			£262.84
Cost of infections*	£7,804,800	£9,756,000	-£1,951,200
Total cost of intervention*	£7,909,800	£9,830,400	-£1,920,600
Cost per infection averted			Dominant

*These are direct costs to the hospital (no GP costs or societal costs have been included in the model)

Number of bed days saved per year	390
Cost per bed day saved per year	£78.41

The number of bed days saved per year is 390, this would allow an increased capacity in the ICU by 68 beds with a typical length of stay of 5.7 days.

Return on investment	< 1 months

The cost of the copper upgrade is £105,000 compared to £74,400 for installation of non-copper items. There were 1,301 infections in the copper group over the period and 1,626 in the baseline. This results in a cost per infection averted of £94.10.

These results are based on the following scenario:

Number of beds per unit	20
Number of patients per year	1,200
Setting	ICU
Percentage reduction in infections	20.0%
Type of infection	All Healthcare Associated Infections

YHEC Model - HCAI Economic Evaluation 05APR2013.xlsm

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Results (2)

The first table shows a summary of the results, showing total costs and number of infections for copper and baseline (non-copper environment)

5 year results

	Copper	Baseline	Incremental
Total cost (excluding cost of infections)*	£105,000	£74,400	£30,600
Number of infections	1,301	1,626	325
Cost per infection averted (excluding cost of infections)			£94.10
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Total cost of intervention*	£7,909,800	£9,830,400	-£1,920,600
Cost per infection averted			Dominant

*These are direct costs to the hospital (no GP costs or societal costs have been included in the model)

A **Dominant** result means copper is both cheaper and more effective

Number of bed days saved per year	390
Cost per bed day saved per year	£78.41

The number of bed days saved per year is 390, this would allow an increased capacity in the ICU by 68 beds with a typical length of stay of 5.7 days.

Return on investment	< 1 months

The cost of the copper upgrade is £105,000 compared to £ for installation of non-copper items. There were 1,301 infections in the copper group over the period and 1,626 in the baselin results in a cost per infection averted of £94.10.

Time for the **Return on Investment** (ROI) is shown here

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Results (3)

5 year results

	Copper	Baseline	Incremental
Total cost (excluding cost of infections)*	£105,000	£74,400	£30,600
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Number of bed days saved per year	390
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The number of bed days saved per year is 390, this would allow an increased capacity in the ICU by 68 beds with a typical length of stay of 5.7 days.

Return on investment	< [illegible]ths

The [illegible] re 1,301 infections in the [illegible].

Further analysis shows the cost per infection averted, number of bed days saved and QALYs gained

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Results (4)

These results are based on the following scenario:

Number of beds per unit	20
Number of patients per year	1,200
Setting	ICU
Percentage reduction in infections	20.0%
Type of infection	All Healthcare Associated Infections

YHEC Model - Copper Intervention - Economic Evaluation 03APR2013.ICU x 20 beds .xlsm

This text shows selected inputs and scenario for the model

The file name is automatically printed for your reference

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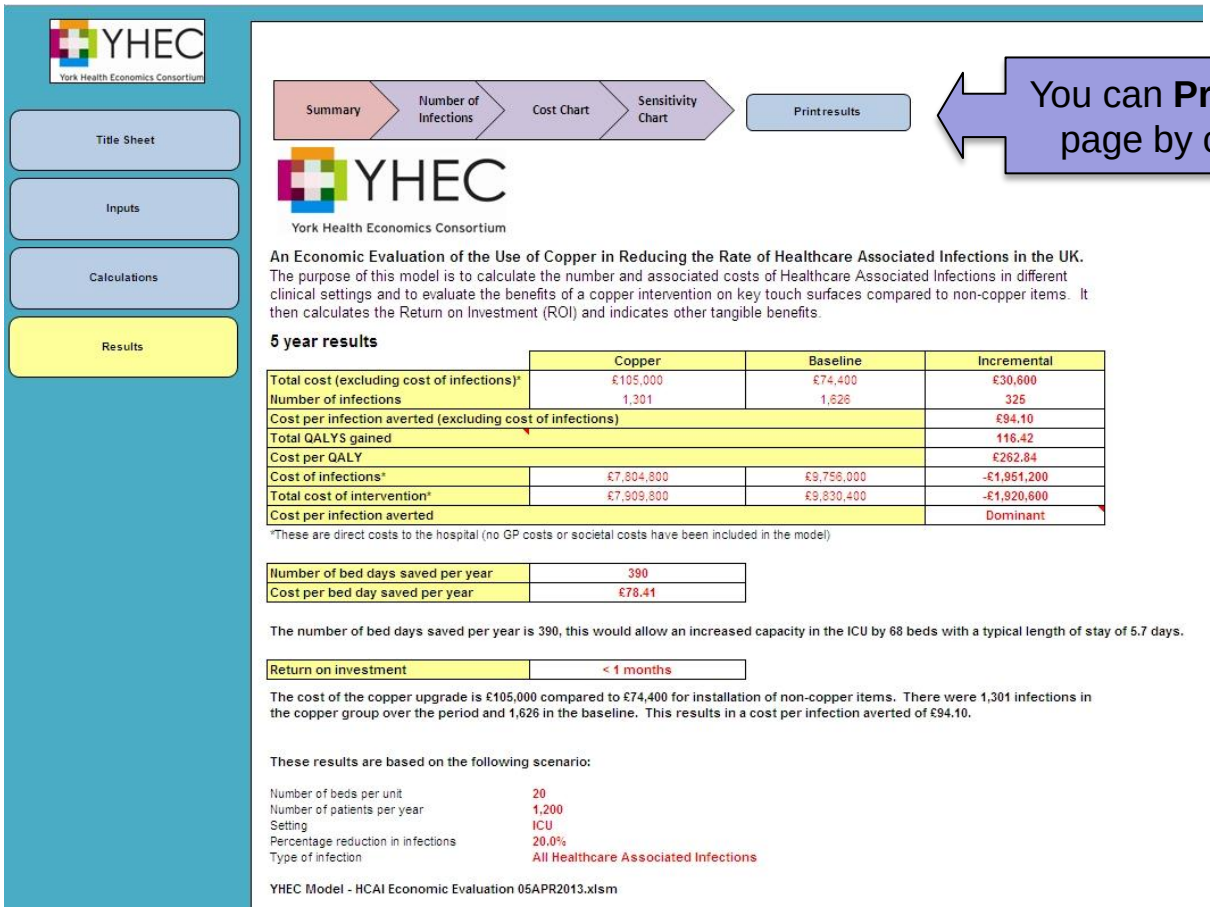
Results (5)



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Title Sheet
Inputs
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Summary | Number of Infections | Cost Chart | Sensitivity Chart | Print results

You can **Print** the results page by clicking here

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5 year results

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Cost per infection averted (excluding cost of infections)			£94.10
Total QALYS gained			116.42
Cost per QALY			£262.84
Cost of infections*	£7,804,800	£9,756,000	-£1,951,200
Total cost of intervention*	£7,909,800	£9,830,400	-£1,920,600
Cost per infection averted			Dominant

*These are direct costs to the hospital (no GP costs or societal costs have been included in the model)

Number of bed days saved per year	390
Cost per bed day saved per year	£78.41

The number of bed days saved per year is 390, this would allow an increased capacity in the ICU by 68 beds with a typical length of stay of 5.7 days.

Return on investment	< 1 months

The cost of the copper upgrade is £105,000 compared to £74,400 for installation of non-copper items. There were 1,301 infections in the copper group over the period and 1,626 in the baseline. This results in a cost per infection averted of £94.10.

These results are based on the following scenario:

Number of beds per unit	20
Number of patients per year	1,200
Setting	ICU
Percentage reduction in infections	20.0%
Type of infection	All Healthcare Associated Infections

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Discussion

- Readmission costs have not been considered although some workers report about 30% of patients who have been diagnosed with an HCAI are readmitted within 30 days with associated complications.
- 'Opportunity costs' accruing from beds being released have not been calculated but these might include more potential for elective surgery, reduced antibiotic use and staff availability
- Mortality has not been considered
- Bed blocking can lead to breaching of 4 hour transfer times = more fines.
- There are fines for missing targets for HCAI reductions.

Thank you

stephen.chaplin@york.ac.uk

Telephone: +44 1904 324825

Website: www.yhec.co.uk

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