Evaluation of the economic impact of initial diagnostic modality selection for patients suspected of having colorectal cancer liver metastases or hepatocellular carcinoma in the UK

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Introduction

- Imaging modalities for hepatocellular cancer (HCC; primary liver cancer) and colorectal cancer liver metastasis (CRCLM) differ in terms of diagnostic accuracy, availability and resource requirements; this leads to differences in the proportion of patients who receive true, false and inconclusive results
- False-positive results may lead to unnecessary treatment, while false-negative results lead to missed opportunities to treat. Inconclusive results lead to additional diagnostic procedures
- **This study uses decision tree models to compare the per patient costs of diagnosis and treatment of HCC and CRCLM in a UK setting, according to initial diagnostic modality selection**

Methodology

- UK base case, decision tree models were developed to simulate the clinical pathway from the first diagnostic test to the initial treatment decision for HCC and CRCLM (Figure 1; adaptation with UK data of Blankenburg *et al.* [1])
- **Table 1** shows the contrast agent-enhanced diagnostic modality utilisation proportions for each diagnostic modality, for both current practice, and an alternative scenario with an increased proportion of patients on EOB-MRI. EOB-MRI proportion was increased by 35% to enable comparison between lower and higher levels of EOB-MRI use
- The sensitivity and specificity of each diagnostic modality, in addition to patient survival, were sourced from our previous publication [1]
- **Table 2** gives the UK costs used in the decision tree models. Contrast agent costs were sourced from PharmOnline International (POLI) and Drugs.com databases [2], [5]. Diagnostic and treatment costs were sourced from the latest NHS reference costs [3]
- Patient characteristics, the utilisation proportions of each diagnostic modality, and model assumptions were elicited and/or validated from interviews with three UK expert clinical radiologists

Figure 1: Diagnostic and clinical pathway for HCC and CRCLM; solid boxes represent a decision between modalities

Table 1: Proportion of patients on each contrast modality for HCC and CRCLM (current practice and alternative scenario with +35% EOB-MRI)

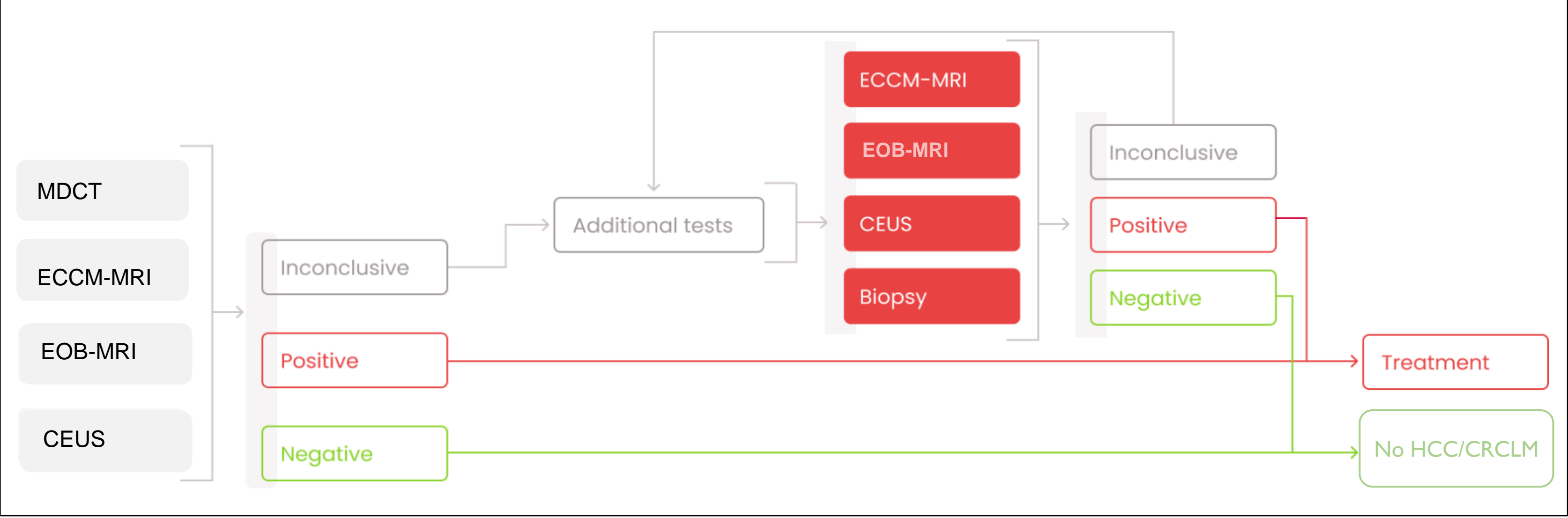| Contrast agent modality	HCC		CRCLM	
	Current practice	Alternative scenario	Current practice	Alternative scenario
MDCT	39.0%	23.8%	71.4%	44.1%
ECCM-MRI	41.0%	25.1%	17.9%	11.0%
CEUS	10.0%	6.1%	1.4%	0.9%
EOB-MRI	10.0%	45%	9.3%	44.0%

Table 2: Input costs for HCC and CRCLM models; unless specified, the same costs are used in both HCC and CRCLM

| Contrast agent per diagnostic modality	Cost	Diagnostic modality	Cost	Treatment modality	Cost	Other Treatment modality	Cost
MDCT	£17[2]	CT scan	£146 [3]	Surgical resection	£930[3]	SBRT	£3,928[3]
ECCM-MRI	£51.08[5]	MRI scan	£240 [3]	Ablation	£1587 [3]	Systematic therapy	£2,073[3]
CEUS	£65[2]	US scan	£69[3]	TACE/TARE	£3,802[3]	Best supportive care	HCC: £2,750[3]
EOB-MRI	£96.10[2]	Biopsy	£930 [3]	Liver transplant	HCC: £28,560[3]	Hepatic arterial infusion	CRCLM: £2,073[3]

Results (presented as per patient, unless otherwise stated)

Biopsies

HCC

- For HCC, EOB-MRI had the fewest number of patients undergoing biopsies (Figure 2A), and the increased use of EOB-MRI in the alternative scenario (Table 1), resulted in fewer patients undergoing biopsies (Figure 2B)

Figure 2: The total number of HCC patients undergoing biopsy by A) contrast agent modality B) scenario (Table 1); results are based on 1,000 suspected HCC patients per scenario
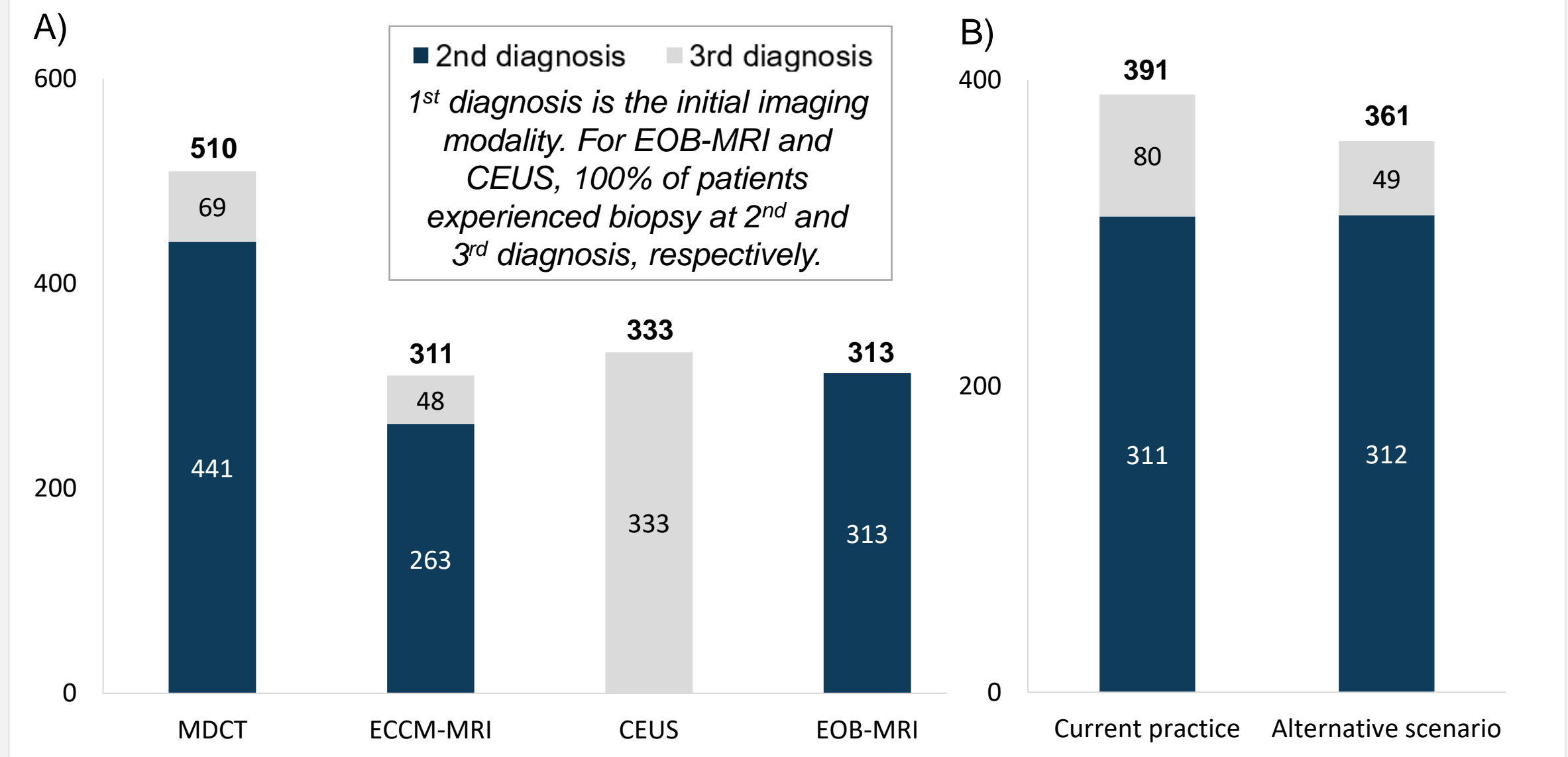
Budget impact

- For HCC, increased use of EOB-MRI in the alternative scenario (Table 1) results in an overall cost saving per patient (Figure 3), due to fewer confirmatory imaging procedures, biopsies, and unnecessary treatment costs
- Compared to total costs of care for HCC, the contrast agent costs are a relatively small proportion (Figure 4)

Figure 3: The cost difference by type between current practice and the alternative scenario (Table 1) (per patient, excluding false-negative patients) for HCC
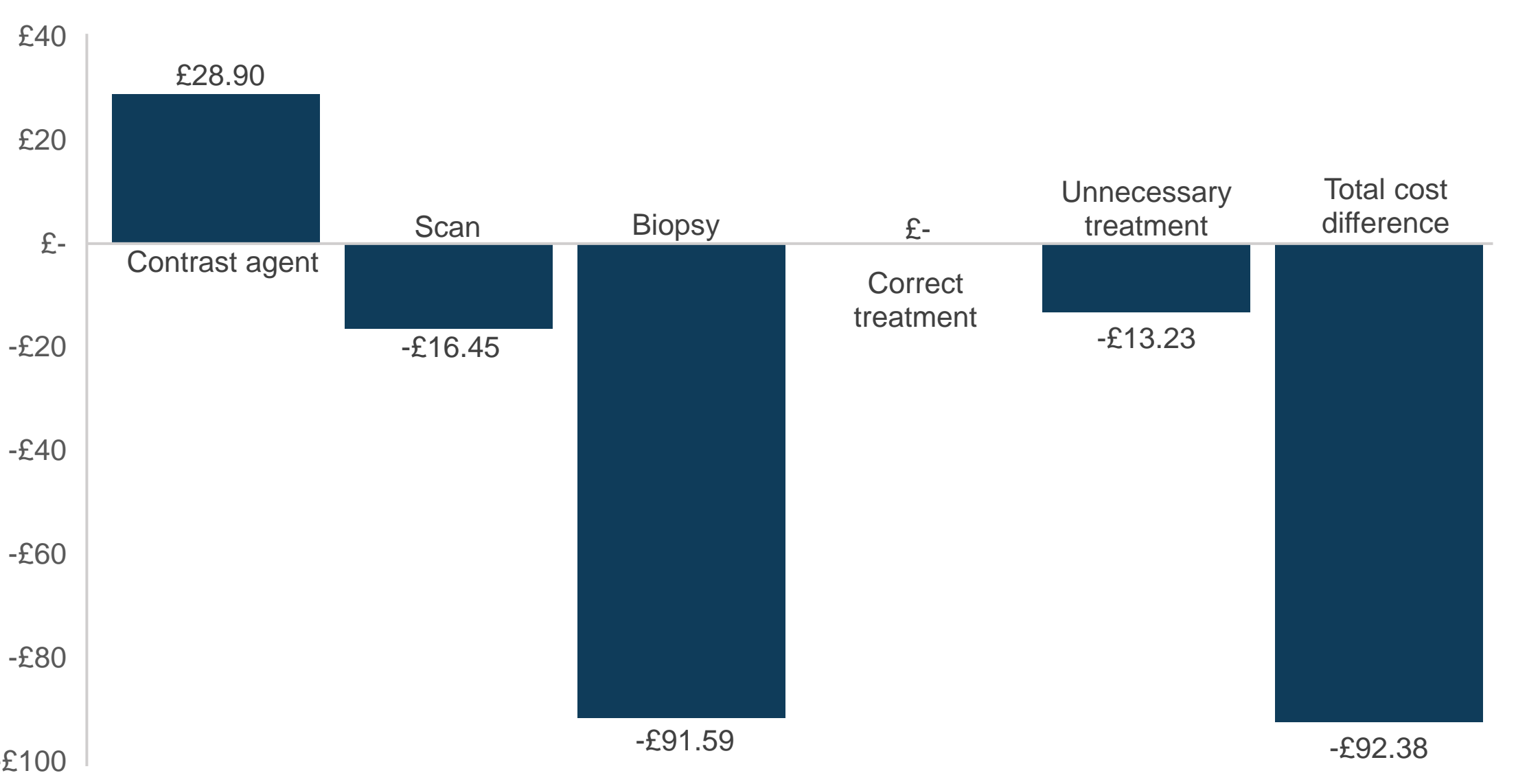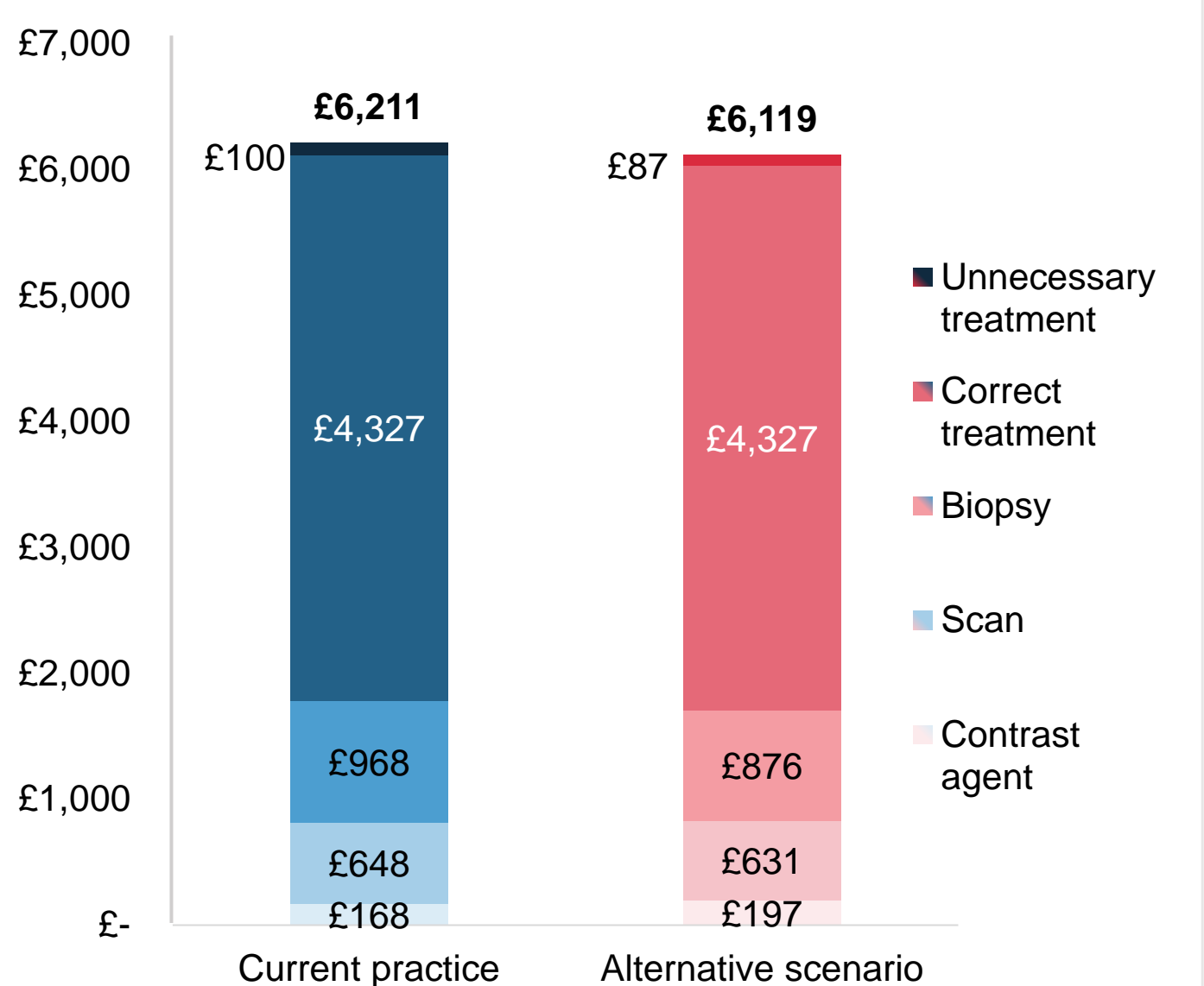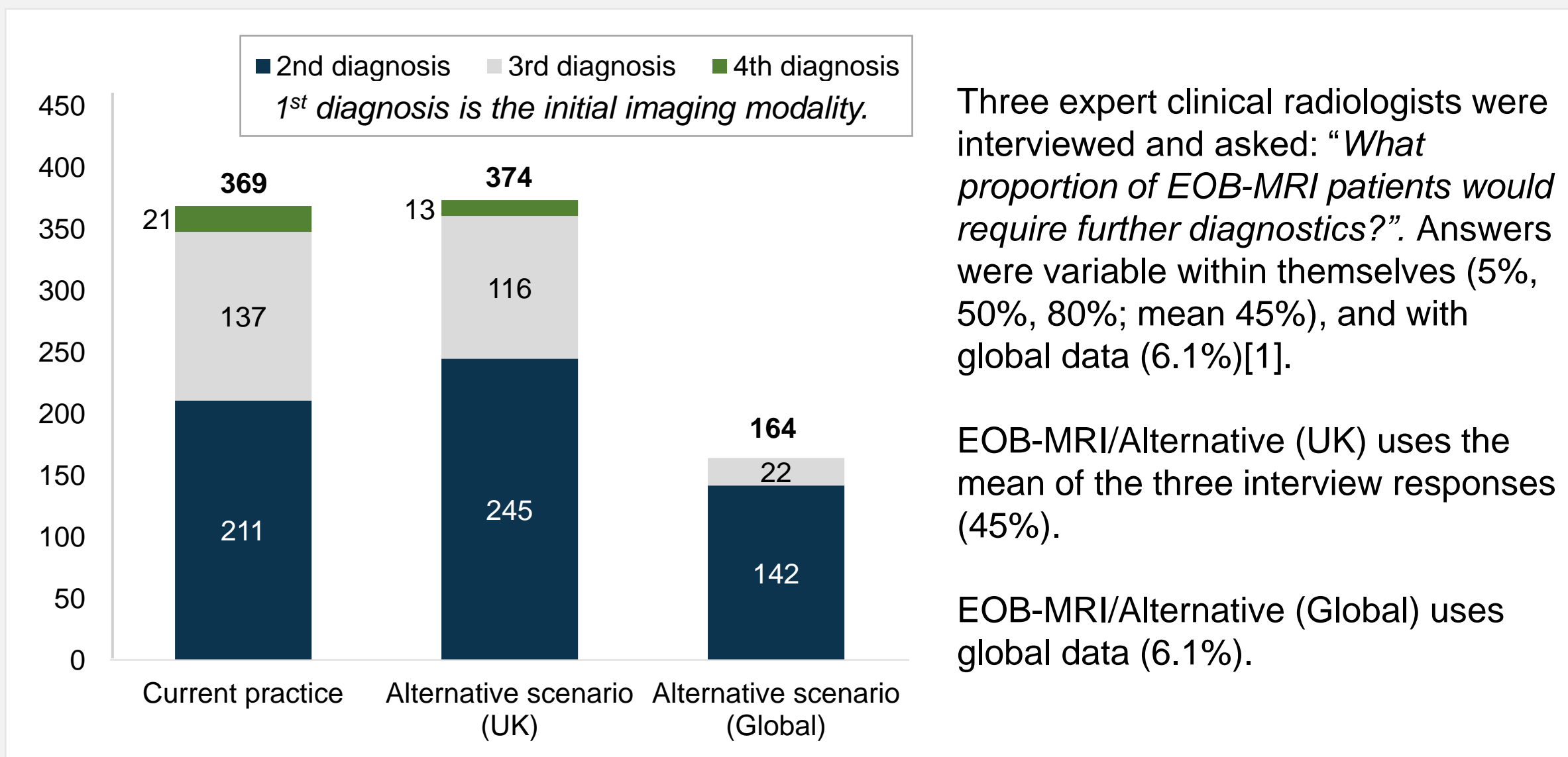

Figure 4: Total costs by scenario (Table 1) for HCC (per patient, excluding false-negative patients)

CRCLM

- For CRCLM, three expert interviews demonstrated differences in practice with regards to use of follow-on modalities after EOB-MRI (range, 5-80%)
- Figure 5 demonstrates the reduction in biopsies by round of diagnosis, if UK practice were consistently in line with what the authors have previously observed in other markets (China, Japan and USA; 6.1%[1])

Figure 5: The total number of CRCLM patients undergoing biopsy by scenario (Table 1); results are based on 1,000 suspected CRCLM patients per scenario

Three expert clinical radiologists were interviewed and asked: "*What proportion of EOB-MRI patients would require further diagnostics?*". Answers were variable within themselves (5%, 50%, 80%; mean 45%), and with global data (6.1%)[1].

EOB-MRI/Alternative (UK) uses the mean of the three interview responses (45%).

EOB-MRI/Alternative (Global) uses global data (6.1%).

- For CRCLM, increased use of EOB-MRI in the alternative UK scenario (Table 1) results in a marginal increase in the overall cost per patient (Figure 6); while increased contrast agent and unnecessary treatment costs are observed, these are partially offset by reductions in scan and biopsy costs (Figure 6)
- Compared to total costs of care for CRCLM, the contrast agent costs are a relatively small proportion (Figure 7)

Figure 6: The cost differences by type between current practice and the alternative scenario (Table 1) (per patient, excluding false-negative patients) for CRCLM
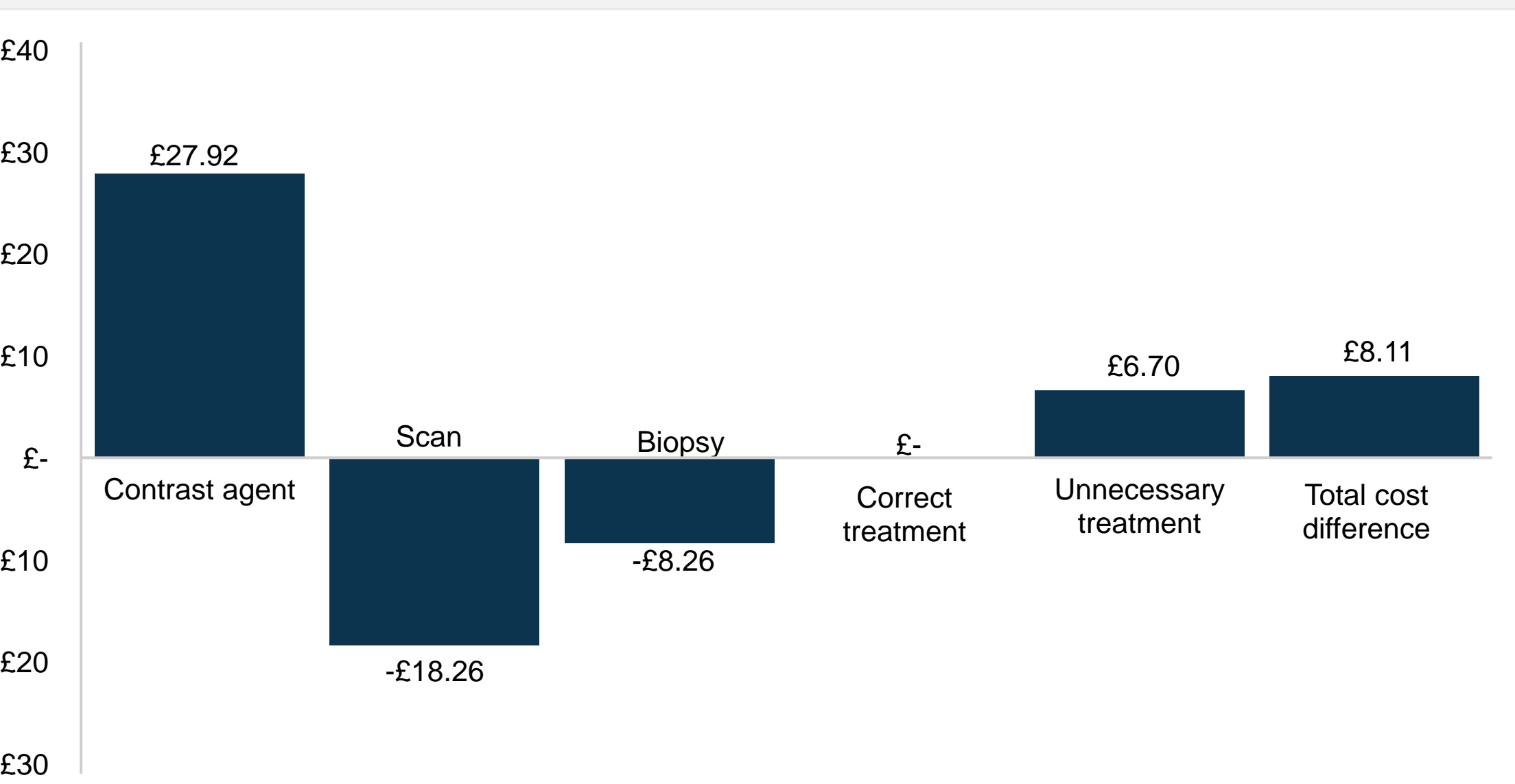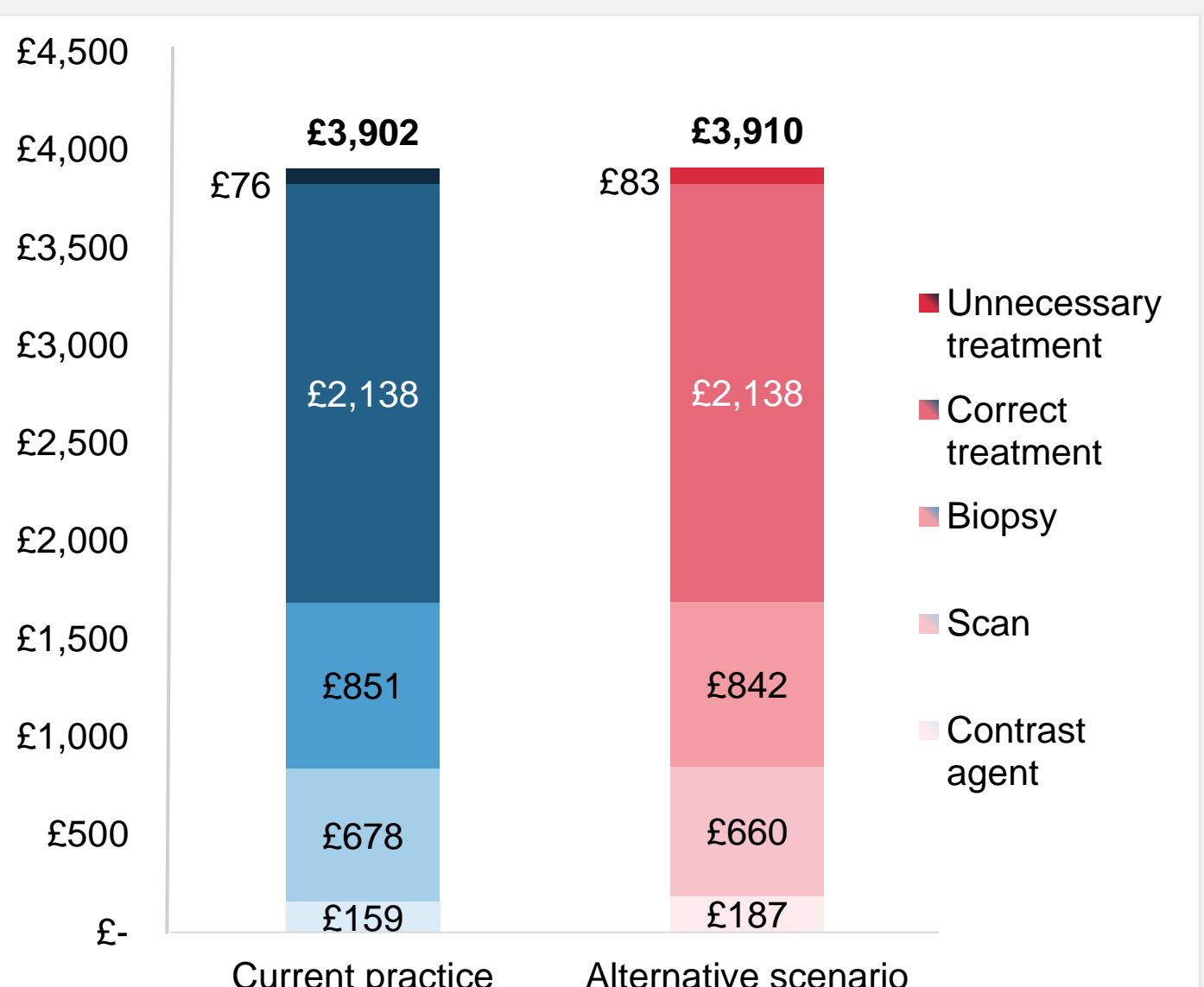

Figure 7: Total costs by scenario (Table 1) for CRCLM (per patient, excluding false-negative patients)

Conclusion

- Compared to the total costs of care for HCC and CRCLM, contrast agent costs account for a relatively small proportion
- Increased use EOB-MRI results in elevated contrast agent costs which are fully (HCC) or mostly (CRCLM) offset by reductions in scan and biopsy costs in the UK setting
- Expert interviews suggest that EOB-MRI in CRCLM is more likely to be followed by additional rounds of diagnostic procedures in the UK, compared to other countries (China, Japan and USA [1]). If UK practice were consistently in line with these countries, and in line with the "Get It Right First Time" recommendations [5], a reduction in the need for biopsy could be achieved

References: [1] Blankenburg, M., Elhamamy, M., Zhang, D., Corbin, A., Jin, G., Harris, J. and Knobloch, G. Evaluation of the health economic impact of initial diagnostic modality selection in patients suspected of having HCC in China and the USA. J Med Econ. 25(1), 1015-1029 (2022). https://pubmed.ncbi.nlm.nih.gov/35930705/ [2] POLI Database, GlobalData Plc 2023, 2023. Available at: www.globaldata.com [3] NHS England, National Schedule of Cost Collection for the NHS, 2022. Available from: https://www.england.nhs.uk/costing-in-the-nhs/national-cost-collection [4] Thomaides-Brears, H.B., Alkhouri, N., Allende, D. et al. Incidence of Complications from Percutaneous Biopsy in Chronic Liver Disease: A Systematic Review and Meta-Analysis. Dig Dis Sci 67, 3366–3394 (2022). https://doi.org/10.1007/s10620-021-07089-w [5] Drugs.com, 2023. Available at: https://www.drugs.com/ converted from USD$ to Pounds sterling£. [5] Halliday, K., et al. Radiology GIRFT programme national specialty report. NHS, 2020