BMUS

HCC US Surveillance

Presented by : Ruth Reeve & Anmol Gangi-Burton

Dr Ruth Reeve

Clinical Specialist Sonographer
Portsmouth Hospitals University NHS Trust
BSc, MSc, PhD

Dr Anmol Gangi-Burton

Consultant GI Radiologist
Nottingham University NHS Trust
MBChB BSc

BMUS

Conflicts

Ruth is the current Development officer for BMUS & a representative in the NHS England Hepatocellular carcinoma: delivering quality ultrasound surveillance guidance

Anmol is on the BMUS professional standards group and a representative on the NHS England Hepatocellular carcinoma: delivering quality ultrasound surveillance guidance

Disclaimer

This presentation is based on research conducted to the best of the presenter's abilities, acknowledging inherent uncertainties and limitations. The findings may be influenced by factors such as data quality, methodology, and interpretation, and do not guarantee real-world accuracy.

The content is intended for informational purposes only and does not necessarily reflect the views of the British Medical Ultrasound Society (BMUS) or its affiliates. The presenter is responsible for ensuring objectivity and disclosing any relevant financial/industry interests. BMUS and its affiliates disclaim liability for any claims arising from this educational activity.

National Standards for Liver Ultrasound Workforce

NHS England

NHS England Working Group published standards for delivering quality US surveillance in 2024

18 statements

BMUS

Statements to consider:

Service Organisation

Statement 3: Imaging services should be organised to **promote adherence** to HCC US surveillance

Statement 7: Providers of HCC US surveillance should engage with healthcare commissioners and cancer alliances to **ensure sufficient US delivery capacity and expertise is available** to support high quality 6-monthly HCC US surveillance for their local population

Statement 8: Surveillance services should have a **nominated lead radiologist and sonographer** responsible for supporting training, service delivery and quality assurance

Statements to consider:

Performance

Statement 10: HCC US should be performed by an **appropriately trained and experienced sonographer or consultant radiologist**

Statement 11: Imaging during HCC US surveillance examinations should **focus** on identifying HCC and the complications of liver disease

Statement 12: Documentation of US surveillance examinations should use a **standardised, structured report**, including LI-RADS US surveillance or equivalent classification

Statement 13: Image capture during US surveillance should include **standardised image and video capture** to enable retrospective review and support interpretation of subsequent imaging examinations

Statements to consider:

Quality Assurance

Statement 15: Hepatocellular carcinoma ultrasound (HCC US) surveillance services should undertake **regular service evaluation** to ensure compliance with these minimum standards for delivering HCC US surveillance

Statement 16: HCC US surveillance services should undertake regular **audit of adherence** with US surveillance

Statement 17: HCC US surveillance services should undertake **regular quality assurance of US surveillance service delivery**

Statement 18: There should be **dedicated radiology events and learning meetings** (REALMs) for the HCC US surveillance service

What does the current evidence say?

What is current practice?

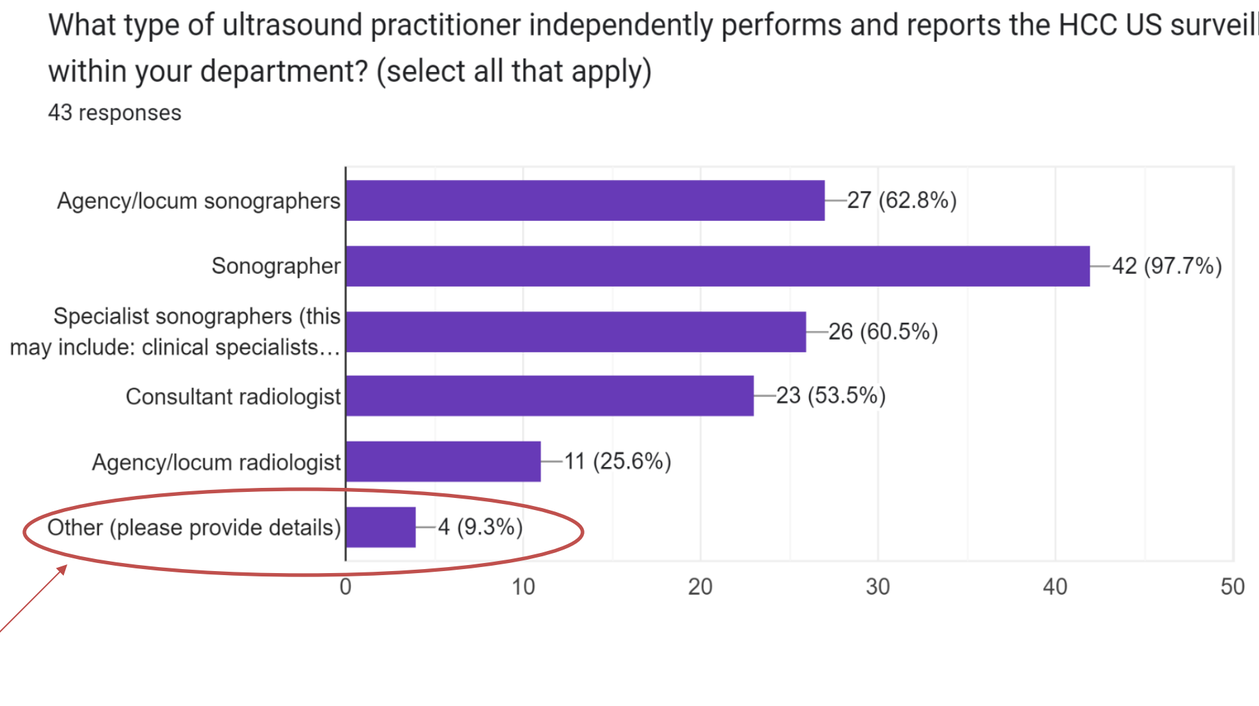
National Survey findings

Responses from 43 NHS Trusts

38 (88%) England
3 (7%) Scotland
2 (5%) Wales

Practice in US departments

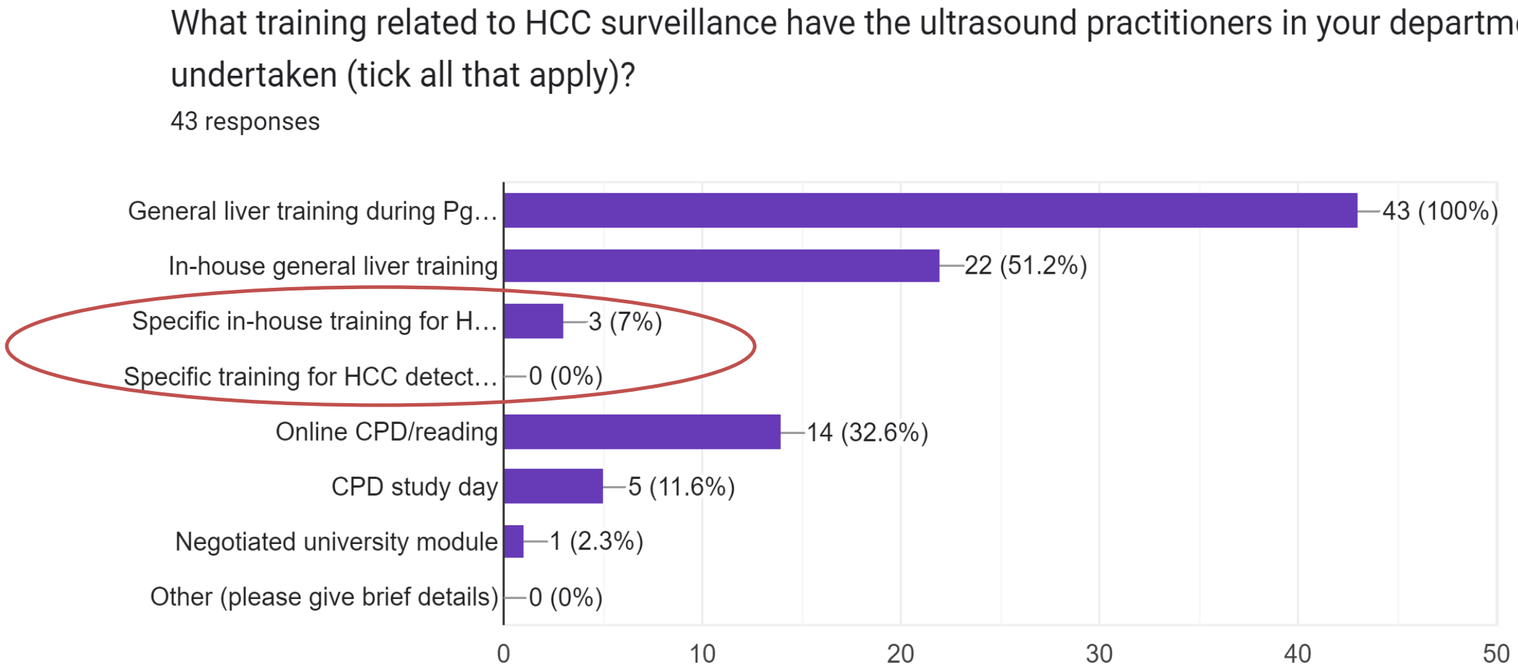
Statement 10: HCC US should be performed by an **appropriately trained and experienced sonographer or consultant radiologist**



Few use trainees to perform and report HCC US

Practice in US departments

Statement 10: HCC US should be performed by an **appropriately trained and experienced sonographer or consultant radiologist**



Most centres rely on general US training and do not provide specific training for ultrasound practitioners prior to undertaking HCC US surveillance examinations

Practice in US departments

Statement 12: **Standardised, structured report**, including LI-RADS US surveillance or equivalent classification

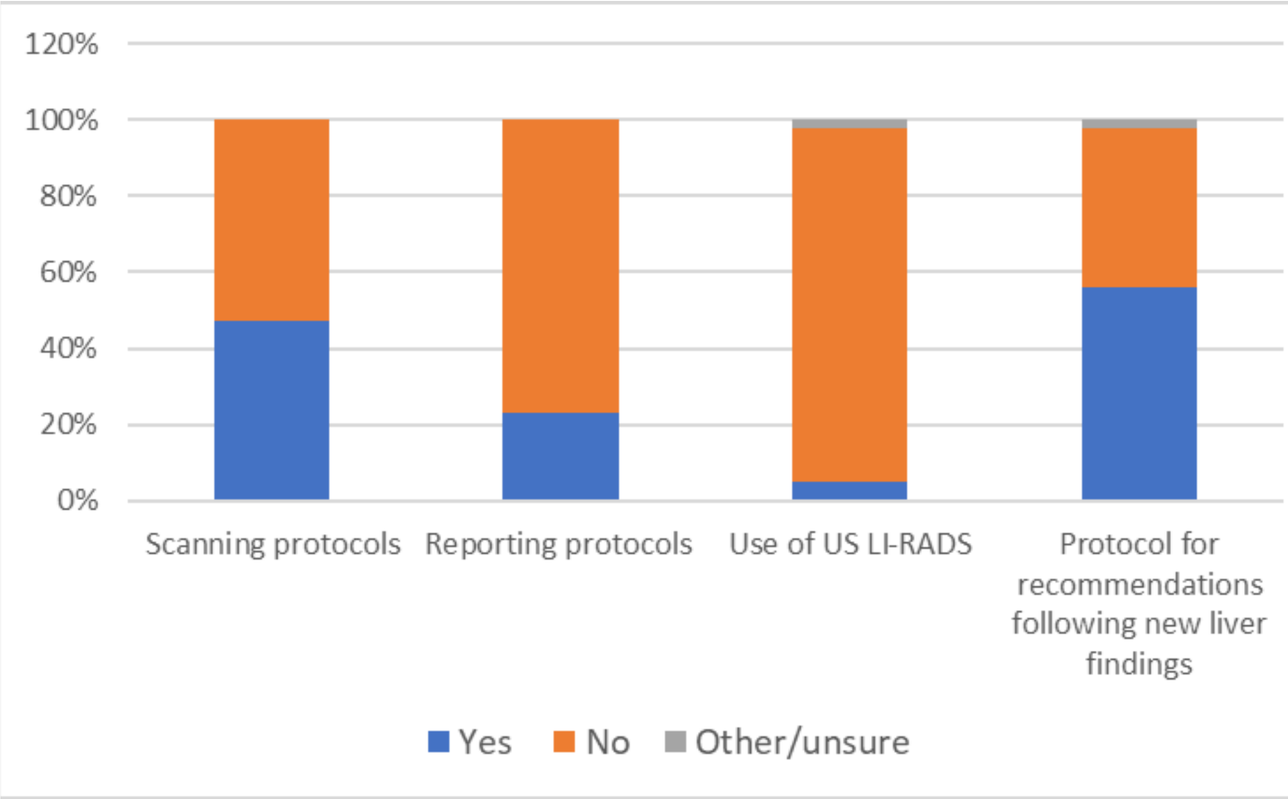
Statement 13: **Standardised image and video capture**

Scanning protocols 53% had none

Reporting protocols 77% had none

US LI-RADS reporting 5% used

Standardised recommendations 42% had none



Practice in US departments

Statement 18: **Dedicated radiology events and learning meetings** (REALMs) for the HCC US surveillance service

Statement 16: HCC US surveillance services should undertake regular **audit of adherence** with US surveillance

Statement 17: HCC US surveillance services should undertake **regular quality assurance of US surveillance service delivery**

MDT & REALM attendance

	yes sonog	no sonog	occasionally	only lead	unsure sonog	all radiologist in HCC	lead HCC radiologist	unsure rad	occassionally rad	no rad
REALM	12%	60%	23%	2%	2%	42%	9%	44%	2%	2%
MDT	0%	79%	12%	7%	2%	37%	21%	33%	7%	2%

Audit

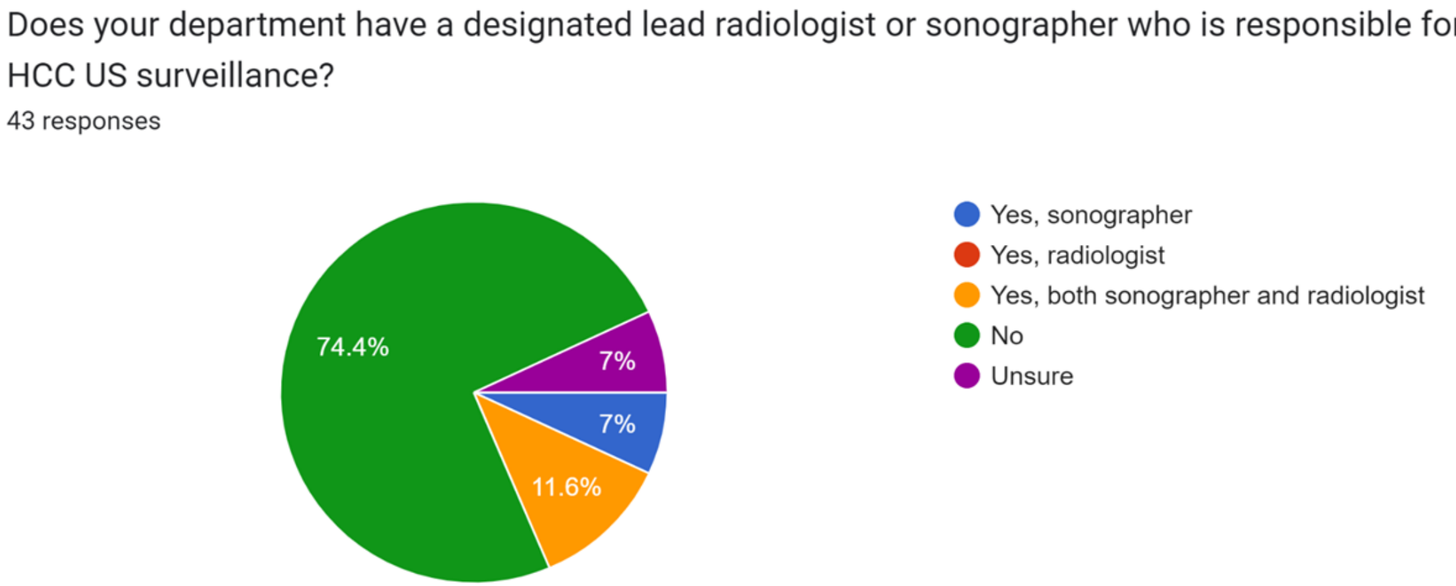
Yes	28%
No	60%
Unsure	12%

Practice in US departments

Statement 8: A **nominated lead radiologist and sonographer** responsible for supporting training, service delivery and quality assurance

Lead sonographer or radiologist

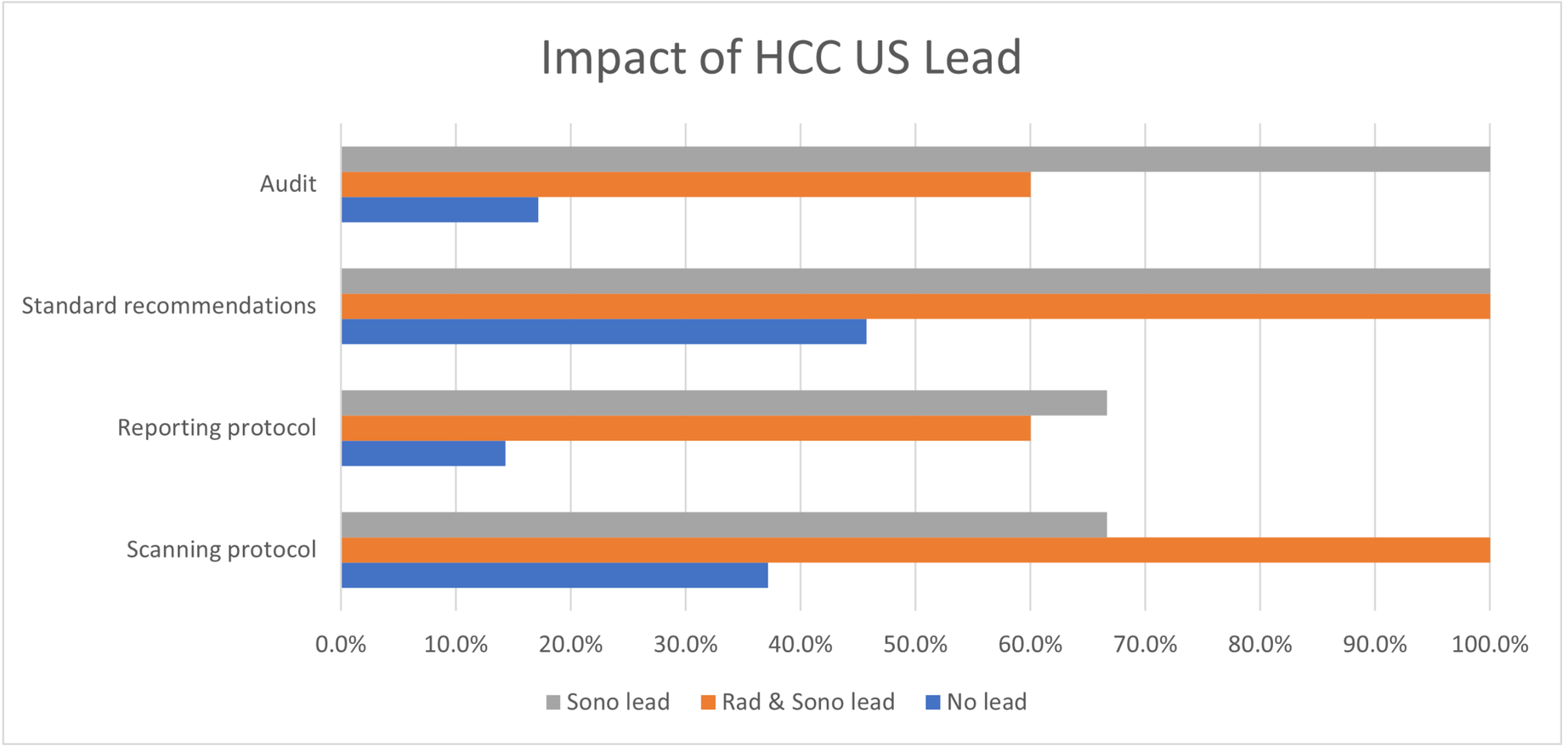
74% had none



Practice in US departments

Centres with a lead US practitioner:

- ^standard protocols (scanning and reporting)
- ^recommendations
- ^audit



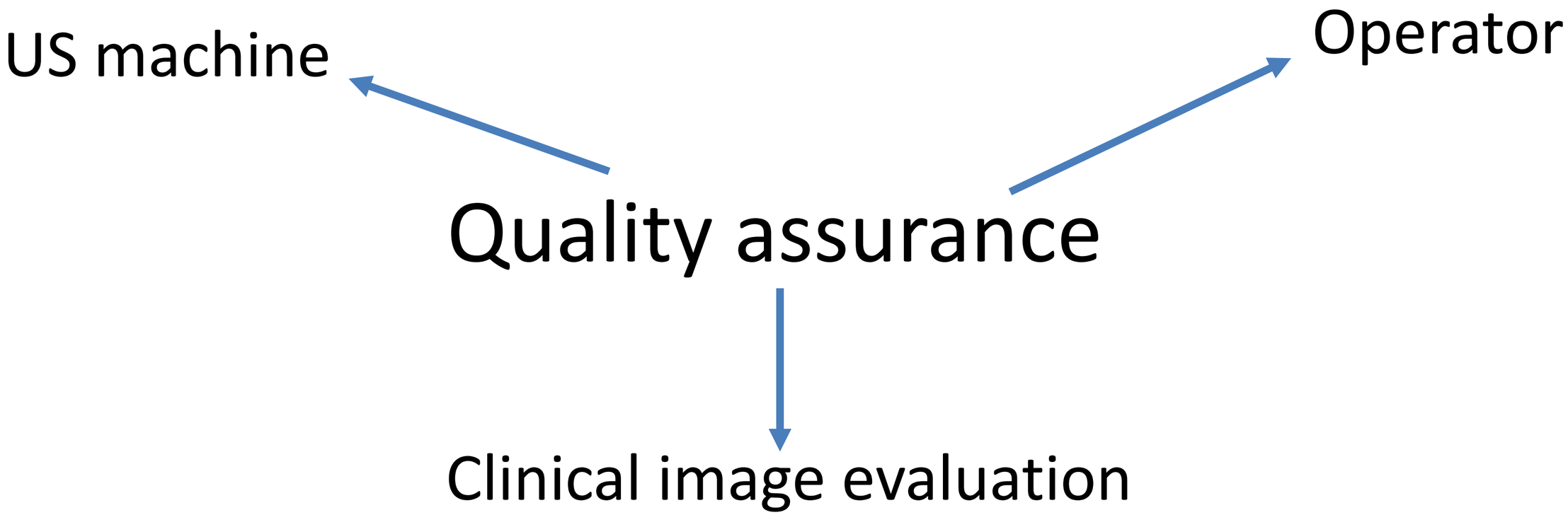
How can departments develop?

- Create & support lead radiologist and sonographer
  - Implement protocols, audit and service evaluation
  - Work with MDT to optimise surveillance & adherence
- Standardise scanning & reporting as NHSE recommendations
- Support ultrasound practitioners to have appropriate training

Performance and quality assurance of HCC surveillance ultrasound: a systematic review

Adapted to the NHS England HCC: delivering quality ultrasound surveillance guidance

Background



Given the role of quality assurance in the diagnostic accuracy of HCC surveillance, there is a need for a systematic review to consolidate existing evidence and identify best practices.

Aims

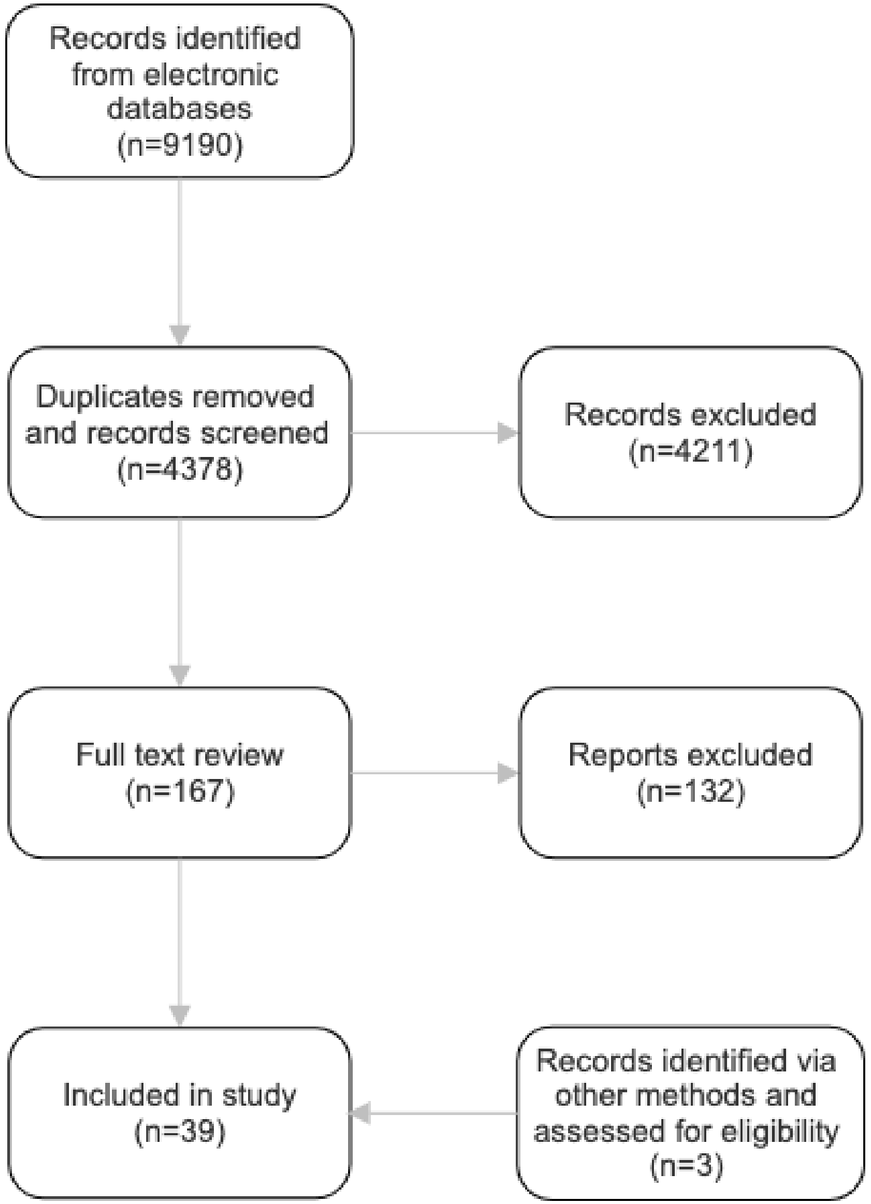
To evaluate the performance and quality assurance of ultrasound HCC surveillance, in particular assessing:

(a) ultrasound training
(b) ultrasound machine assessment
(c) ultrasound image evaluation
(d) ultrasound reporting

Methods

- Registered with PROSPERO (CRD42024585145)
- Databases searched up until 27th July 2024 (PubMed, Embase, Cochrane Central Register of Controlled Trials and EBSCO)
- Search terms relating to HCC ultrasound surveillance, training, quality assurance and reporting

Methods



- Search strategy yielded **9190** potential studies
- **167** for full text review
- **39** papers were included

Results

Statement 10: hepatocellular carcinoma ultrasound (HCC US) surveillance should be performed by an **appropriately trained and experienced** sonographer or consultant radiologist

1. Ultrasound training

Training required to undergo HCC surveillance US:

- No studies reported on training requirements

Minimum number of training ultrasounds to start and maintain HCC surveillance US skills:

- No studies reported on the minimum number

Results

Statement 10: hepatocellular carcinoma ultrasound (HCC US) surveillance should be performed by an **appropriately trained and experienced** sonographer or consultant radiologist

1. Ultrasound training

Quality assurance education:

- On-site education and structured online courses contribute to improved completion rates and better clinical image evaluation performance in ultrasound education (*Choi et al 2018 and Choi et al 2016*).

Korean

Results

Statement 10: hepatocellular carcinoma ultrasound (HCC US) surveillance should be performed by an **appropriately trained and experienced** sonographer or consultant radiologist

2. Quality assurance

US performed by:

- Radiologists or sonographers perform HCC surveillance US in most centres (79%), while in the remaining 21%, only specialists with liver disease expertise conduct them (*Scott et al 2023*). — UK
- Detection rate of liver lesions was similar for radiologists and sonographers [81.3% (26/32) vs 90.6% (29/31)] (*Tangruangkiat et al 2018*). — Thailand
- AI demonstrated significantly higher liver lesion detection rates than radiologists and non-radiologist physicians, while experts consistently outperformed non-experts, both with and without AI assistance (*Tiyarattanachai et al 2023*). — Thailand

Results

Statement 9: US machines used for HCC surveillance should be maintained to established **quality standards** and their technical set up should be **optimised and standardised for HCC detection**

2. Quality assurance

Ultrasound machine:

- 79.3% passed quality assurance tests, with grayscale/dynamic range issues being the most common cause of failure, and no significant difference based on manufacturing year (*Choi et al 2011)*. Korean
- Higher failure rates for phantom and clinical image evaluations in smaller hospitals and private clinics, with radiologists performing better than other professionals, and digital storage formats outperforming analog (*Choi et al 2014)*. Korean
- >50% US machines were 1-3 years old, but around 39% were 6-8 years old or more, with 10.7% being second-hand at purchase (*Choi et al 2018*). Korean

Results

Statement 9: US machines used for HCC surveillance should be maintained to established **quality standards** and their technical set up should be **optimised and standardised for HCC detection**

2. Quality assurance

Ultrasound machine:

- No studies reported on technical set up for HCC detection

Results

Statement 11: Imaging during HCC US surveillance examinations should **focus on identifying HCC** and the complications of liver disease

2. Quality assurance

Focused US:

- Targeted protocol increased detection of nodules and HCC [nodule detection rate 10.0% (23/230) vs 1.3% (3/235), p<0.001; HCC detection rate 1.7% (4/230) vs 0.4% (1/235)] (Tiyarattanachai et al 2018). Thailand
- Targeted protocol reduced US time from 23.1 to 8.1 minutes (p<0.001) (*Harris et al 2017).* Australian
- Both expert and non-expert scanning times were similar when AI was added [non-expert with AI 8.4 ± 3.0 (mean ± SD) and non-expert without AI 8.1 ± 3.0 minutes (p=0.15); expert with AI 7.5 ± 4.1 (mean ± SD) and expert without AI 8.1 ± 3.9 minutes (p=0.09)] (*da Silva et al 2021*). Brazilian

Results

Statement 12: Documentation of US surveillance examinations should use a **standardised, structured report, including LI-RADS US surveillance or equivalent** classification

3. Ultrasound reporting

Reporting practice:

- Location US findings were documented: 43.3% (81/187) in radiology reports, 26.7% (50/187) in medical charts, 19.3% (36/187) in checkup results, and 6.4% (12/187) in checkup results and medical chart (Choi et al 2018). — Korean
- Standardised reporting template was only used in 21% of centres (8/39) but a structured reporting template was desirable by 79% (31/39) centres (Scott et al 2023). — UK
- 48.7% (113/232) have heard of US LI-RADS but do not use it; 9.9% (23/232) routinely use US LI-RADS (Marks et al 2023). — North American

Summary

- Limited evidence on HCC surveillance US training
- Similar performance for sonographers and radiologists, with improved detection using AI
- Limited evidence on US machines, all from Korean studies.
- Grayscale/dynamic range issues being the most common cause of failure, and no significant difference based on manufacturing year
- Targeted US protocol increases detection of nodules and HCC
- Standardised reporting is desirable but not used in most centres, similarly with US LI-RADS with half of centres aware of it but not used routinely in most centres

References

- Choi MH, Jung SE, Choi JI, Jeong WK, Kim HC, Kim Y, Kim Y, Park B. Quality Management of Ultrasound Surveillance for Hepatocellular Carcinoma Under the Korean National Cancer Screening Program. J Ultrasound Med. 2018 Jan;37(1):245-254. doi: 10.1002/jum.14339.
- Choi JI, Jung SE, Jeong WK, Kim HC, Lall C, Kim Y, Choi KS, Suh M, Park B. Effectiveness of on-site education for quality assurance of screening ultrasonography for hepatocellular carcinoma. Med Ultrason. 2016 Sep;18(3):275-80. doi: 10.11152/mu.2013.2066.183.joo.
- Scott RA, Cross TJS, Clarke C, Khan SA, Ryder SD, Franklin J, Aravinthan AD. Outcomes of National Survey of the Practice of Hepatocellular Carcinoma Surveillance. J Hepatocell Carcinoma. 2023 Apr 29;10:725-731. doi:10.2147/JHC.S403702
- Tangruangkiat S, Phonlakrai M, Ritlumlert N, Siripongsakun S, Vidhyarkorn S, Thitisitthikorn W. Ultrasonography detection of liver lesions: A pilot comparison study between radiologists and sonographers. J Med Assoc Thai. 2018; 101(6):S37-S41.
- Tiyarattanachai T, Apiparakoon T, Marukatat S, Sukcharoen S, Yimsawad S, Chaichuen O, Bhumiwat S, Tanpowpong N, Pinjaroen N, Rerknimitr R, Chaiteerakij R. The feasibility to use artificial intelligence to aid detecting focal liver lesions in real-time ultrasound: a preliminary study based on videos. Sci Rep. 2022 May 11;12(1):7749. doi: 10.1038/s41598-022-11506-z.
- Tiyarattanachai T, Apiparakoon T, Chaichuen O, Sukcharoen S, Yimsawad S, Jangsirikul S, Chaikajornwat J, Siriwong N, Burana C, Siritaweechai N, Atipas K, Assawamasbunlue N, Tovichayathamrong P, Obcheuythed P, Somvanapanich P, Geratikornsupuk N, Anukulkarnkusol N, Sarakul P, Tanpowpong N, Pinjaroen N, Kerr SJ, Rerknimitr R, Marukatat S, Chaiteerakij R. Artificial intelligence assists operators in real-time detection of focal liver lesions during ultrasound: A randomized controlled study. Eur J Radiol. 2023 Aug;165:110932. doi: 10.1016/j.ejrad.2023.110932. Epub 2023 Jun 20.

References

- Choi MH, Jung SE, Choi JI, Jeong WK, Kim HC, Kim Y, Kim Y, Park B. Quality Management of Ultrasound Surveillance for Hepatocellular Carcinoma Under the Korean National Cancer Screening Program. J Ultrasound Med. 2018 Jan;37(1):245-254. doi: 10.1002/jum.14339
- Harris N, Gorelik A, Gibson RN. Targeted ultrasound of the liver: Impact on scanning time of a new approach in chronic liver disease. J Med Imaging Radiat Oncol. 2017 Aug;61(4):448-452. doi: 10.1111/1754-9485.12595. Epub 2017 Feb 27.
- da Silva PH, Gomes MM, de Matos CAL, de Souza E Silva IS, Gonzalez AM, Torres US, Salazar GMM, D'Ippolito G. HCC Detection on Surveillance US: Comparing Focused Liver Protocol Using US LI-RADS Technical Guidelines to a General Complete Abdominal US Protocol. J Ultrasound Med. 2021 Nov;40(11):2487-2495. doi: 10.1002/jum.15637. Epub 2021 Jan 19.
- Marks RM, Fung A, Cruite I, Blevins K, Lalani T, Horvat N, Protopapas Z, Chaudhry H, Bijan B, Shiehmorteza M, Nepal P, Tang A. The adoption of LI-RADS: a survey of non-academic radiologists. Abdom Radiol (NY). 2023 Aug;48(8):2514-2524. doi: 10.1007/s00261-023-03951-9. Epub 2023 May 26.
- Choi JI, Jung SE, Kim PN, Cha SH, Jun JK, Lee HY, Park EC. Quality assurance in ultrasound screening for hepatocellular carcinoma using a standardized phantom and standard clinical images: a 3-year national investigation in Korea. J Ultrasound Med. 2014 Jun;33(6):98595. doi: 10.7863/ultra.33.6.985.
- Choi JI, Kim PN, Jeong WK, Kim HC, Yang DM, Cha SH, Chung JJ. Establishing cutoff values for a quality assurance test using an ultrasound phantom in screening ultrasound examinations for hepatocellular carcinoma: an initial report of a nationwide survey in Korea. J Ultrasound Med. 2011 Sep;30(9):1221-9. doi: 10.7863/jum.2011.30.9.1221.