Appendix 2. Summary of included studies with outcomes

Author	Year	Country	Study design	Outcomes	Barriers and facilitators
Viral hepatitis patients					
McMahon et al[1]	2000	USA	Prospective cohort	HCC diagnosed in 32 participants, AFP elevated in 97% of these; mean age at diagnosis 24 years. 83% detected through surveillance were at a resectable stage; 5-year survival rate 42%	n/r
Leykum et al[2]	2007	USA	Retrospective chart review	For all HCPs: 22% of patients were screened prior to HCC diagnosis; all screen-identified HCC was detected at early stages; improved survival for screened patients: Average survival: 19.8 months vs 8.5 months. Decreased risk of HCC death associated with PCP care delivered in a tertiary setting (unadjusted: HR 1.47, 95%CI 1.01, 2.14), but no associations in adjusted analysis	Barriers: Care from a non-hepatology clinic
Sarkar et al[3]	2012	USA	Retrospective cohort	67% screened in first year after HBV diagnosis; 47% in second year, 24% in 10th year. HCC diagnosed in 51 patients. Screened patients more likely to be diagnosed at an early stage of HCC (79% vs 19%) and receive curative treatment (71% vs 30%). Median survival was associated with curative treatment (HR 0.3, 95% CI: 0.1–0.9).	Predictors of surveillance: Attendance at a liver clinic, female, age 40–64 years, cirrhosis, recent HBV diagnosis High ALT negatively associated with surveillance
Sarkar et al[4]	2014	USA	Retrospective cohort	Imaging within 18 months: 56% overall; 73% for PCPs vs 92% for gastroenterologists Imaging + AFP: 49% overall; PCPs 65% vs gastroenterologists 87% AFP only: PCPs 13% vs 5%	n/r
Wu et al[5]	2014	USA	Retrospective cohort	55% received surveillance at least once per 15 months; 35% ≤ every 15 months (mean surveillance interval 3.9 years); 10% received no surveillance. Greater odds of timely HCC surveillance when managed by a gastroenterologist versus PCP: OR 6.87 (95% CI: 4.5, 9.7)	Non-adherence in primary care settings: 26% patient factors, 74% physician failure to order Non-adherence in gastroenterology specialist settings: 88% patient factors, 12% physician failure to order
Allard et al[6]	2017	Australia	Retrospective cohort	Follow-up 4.5 years: 'good adherence' 27%, suboptimal adherence 43%, poor adherence 30%	Half the patients having regular viral load tests had suboptimal/poor adherence suggesting a different barrier for US (ie availability of pathology within the clinic) Surveillance at recommended intervals was more likely in patients receiving antiviral treatment, more recently diagnosed, having regular viral load tests

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Appendix 2. Summary of included studies with outcomes (cont'd)

Author	Year	Country	Study design	Outcomes	Barriers and facilitators
O'Leary et al[7]	2018	Australia	Quasi-experimental	Receipt of 2 US over 12 months: Baseline: 26%; Post-implementation: 88%; Controls: 10%	n/r
DeSilva et al[8]	2022	USA	Quasi-experimental	6 months prior to baseline (ie introduction of the intervention): Surveillance uptake: intervention (PCP) group 27%, GI 22%; PCP: 3% 6 months subsequent to introduction of intervention: intervention (PCP) group 34%, GI 15%; PCP: 2%	n/r
Burman et al[9]	2014	USA	Cross-sectional survey and clinical audit	HCP survey: 96% of HCPs reported regular HCC surveillance in the centre; 43% were not familiar with recommendations Audit: 51% of patients had some form of surveillance in preceding 12 months; of these, 51% had AFP, 13% imaging, 36% AFP + imaging	Barriers: HCP characteristics: older provider age, >25% Asian patients in the practice Facilitators: HCP characteristics: provider of Asian ethnicity, higher HBV/HCC knowledge, positive provider attitude towards surveillance
Gowda et al[10]	2017	USA	Mixed methods	Adherence to surveillance recommendations: 15% of patients had US surveillance at 6- to 12-month intervals No statistical difference on surveillance adherence rates for provider type, however PCP had a slightly lower rate	Barriers: Under-recognition of chronic HBV, infrequent patient visits, lack of continuity of care, inadequate development of patient–PCP trust relationship, patients not following up with US
Davila et al[11]	2010	USA	Retrospective cohort of patients and their providers	Overall: 17% patients had regular surveillance, 38% inconsistent Regular surveillance group: 52% US + AFP; 46% AFP, 2% US 9.8% of cirrhosis + ALD patients screened; 29% of cirrhosis + HBV/HCV; 32% of cirrhosis + ALD + HCV/HBV; 5% of cirrhosis only	All HCPs: Patients receiving surveillance were more likely to be younger, female or Chinese, higher income and education. Patients seen by a gastroenterologist alone or also a PCP were five times more likely to be screened regularly
Patwardhan et al[12]	2011	USA	Retrospective cohort	Overall, 51% received recommended surveillance. Surveillance in context of ≥12-monthly follow-up with gastroenterologist: 67% of patients screened. For primary care only patients: 23% were screened	Facilitators: Being seen ≥ annually by a gastroenterologist
Del Poggio et al[13]	2015	Italy	Quasi-experimental	Pre-intervention: 35% diagnosed through surveillance, post-intervention 55%. HCC diagnosed at early stage (BCLC-A) increased from 48% to 64% in intervention group, and from 38% to 43% in the control. 5-year survival increased in the intervention group: 20% to 40%; in the control group this remained unchanged: 20%	n/r

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Appendix 2. Summary of included studies with outcomes (cont'd)

Author	Year	Country	Study design	Outcomes	Barriers and facilitators
Beste et al[14]	2015	USA	Quasi-experimental	'Adequate' surveillance was 28% for intervention site vs 18% at control sites	n/r
Ahmed Mohammed et al[15]	2017	USA	Retrospective cohort	14% received 100% of biannual surveillance, 16% received 75–99%, 29% received 50–74%, 21% received 25–49% 13% received 1–24%, 7% received no surveillance	For 26 patients not receiving surveillance: 50% were recommended by a specialist but not implemented by PCP or patients did not attend; 26% due to a failure in discharge planning; 15% specialist diagnosed cirrhosis but did not recommend surveillance; 8% diagnosis made by radiologist/pathologist but not recorded in clinical notes
Atiq et al[16]	2017	USA	Retrospective cohort	Over three years 26.3% had ≥3 US, 1.6% had had ≥6 US 70% of HCC detected at an early stage vs 40% with no surveillance 23% of patients eligible for curative treatment vs 0% not receiving surveillance	n/r
Singal et al[17]	2017	USA	Retrospective cohort	Surveillance over 2 years: 2% received consistent surveillance, 33% inconsistent surveillance and 65% no surveillance	Compared with HCV patients, HBV patients were more likely to receive surveillance and patients with ALD cirrhosis and NASH were less likely. Receipt of any surveillance was associated with care from a gastroenterologist/hepatologist
Goldberg et al[18]	2017	USA	Retrospective cohort	Up-to-date with surveillance over median of 4.7 years: 18% for US/MRI/CT	Small association between numbers of US and PCP visits. Number of specialty visits associated with increased odds of US, independent of PCP visits
Singal et al[19]	2019	USA	Randomised trial	Surveillance over 2 years: Mailed US outreach: 18%; mailed US outreach + patient navigation: 23%, usual care: 7%. HCC diagnosed in 1.8% of outreach/navigation, 1.0% of outreach, 2.3% of usual care	Stronger effect of intervention for patients with Child-Pugh class B and those not in receipt of hepatology care
Rodriguez Villalvazo et al[20]	2020	USA	Retrospective cohort	Patients living >60 miles away were less likely to be screened (any imaging) (HR 0.83; 95% CI: 0.79, 0.88) compared with those living 10–30 miles away (HR 1.05; 95% CI: 1.00, 1.11). Patients living in large/small rural towns or isolated areas less likely to receive surveillance	Increased travel time to a VA medical centre was associated with reduced surveillance
Yeo et al[21]	2021	USA	Retrospective cohort	Surveillance across all HCPs: 6–12 months: 8.8%, 12–24 months: 25.3%, >24 months: 40.5%, no testing: 45.4%. Being seen by a PCP negatively associated with surveillance: OR 0.48; 95% CI: 0.46, 0.52	n/r

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Appendix 2. Summary of included studies with outcomes (cont'd)

Author	Year	Country	Study design	Outcomes	Barriers and facilitators
Toyoda et al[22]	2006	Japan	Retrospective cohort	Tertiary-based surveillance: 33% of HCC diagnosed at BCLC 1, 36% at Stage 2; 53% Class A Child-Pugh. PCP surveillance: 13% of HCC diagnosed at BCLC 1, 31% at stage 2; 46% Class A Child-Pugh. No surveillance: 4% of HCC diagnosed at Stage 1, 16% at Stage 2; 34% Class A Child-Pugh. Survival 2001–04: Surveillance in tertiary and primary care: 5-year survival 36%, for no surveillance 19%.	n/r
Nguyen et al[23]	2007	USA	Cross-sectional survey	Any surveillance undertaken in high-risk patients: Gastroenterologists: 100%; internal medicine: 88%; family practice: 84.2%	Facilitators: Knowledge that prevalence of CHB is higher in Asian Americans, surveillance reduces mortality, is cost-effective, non-surveillance represents malpractice
Ferrante et al[24]	2008	USA	Cross-sectional survey	Self-report: 25% reported they would order AFP of abdominal imaging for HBV patients with abnormal LFTs	HBV patients, surveillance rates (self-reported) were higher in female PCPs and in group practice (vs individual practice [29%]) HCV patients, doctors in academic settings more likely to screen for HCC (41%)
Khalili et al[25]	2011	USA	Cross-sectional survey	88% self-reported using abdominal imaging and AFP 6- to 12-monthly 66% (of all providers) screened ≥75% of HBV patients for HCC, and 94% self-reported HCC surveillance for HBV patients 27% were unfamiliar with guidelines	Barriers: Lack of imaging resources (59%), unclear guidelines (35%); difficulty accessing specialty care (35%), costs to patients (31%), poor patient adherence (54%), lack of insurance (49%)
El-Serag et al[26]	2013	USA	Cross-sectional survey	71% self-reported surveillance in line with recommendations. HCPs working in gastroenterology/ hepatology specialities were more likely to recommend guideline-concordant HCC surveillance than other groups	Barriers: Limited knowledge of HCC surveillance recommendations, lack of availability HCC treatment services Facilitators: Experience with management of HCV patients
Han et al[27]	2014	USA	Qualitative	n/r	Barriers: Patients too busy with work, language and culture barriers, limited awareness of CHB, CHC and HCC surveillance, cost Facilitators: Follow-up of surveillance closer to the community (ie distance), ongoing care provided by the PCP, community support of the PCP, patient navigators of the same ethnicity

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Appendix 2. Summary of included studies with outcomes (cont'd)

Author	Year	Country	Study design	Outcomes	Barriers and facilitators
McGowan et al[28]	2015	USA	Cross-sectional survey	PCPs caring for patients with cirrhosis, 45% recommended surveillance	Barriers: Patient factors: poor adherence, financial constraints, lack of insurance Facilitators: Evidence to support surveillance, PCP knowledge of HCC treatment modalities
Dalton-Fitzgerald et al[29]	2015	USA	Cross-sectional survey	Self-reported surveillance: Median annual US surveillance 65%, median biannual surveillance 15%. 86% used US ± AFP US-based surveillance conducted by ~33% biannually and ~67% annually	Barriers: 68% stated not being up-to-date with guidelines; communication difficulties with patients about surveillance (56%), more pressing clinical issues (52%)
Mukhtar et al[30]	2017	USA	Cross-sectional survey	Half of the participants reported surveillance >75% of CHB patients; AFP and US the most frequent used	Barrier: Practicing within a safety net system Facilitator: PCPs with >25% of patients speaking English as a second language (OR 4.26; 95% CI: 1.76, 10.30)
Fitzgerald et al[31]	2018	USA	Cross-sectional survey	92% responded surveillance should be carried out using US; and 64% reported this should occur every 6–12 months For HBV patients, 68% recommended surveillance; 78% responded that HBV patients from China and Africa should be screened	Barriers: Provider: lack of clear guidelines (49%), competing healthcare priorities (45%), time constraints (35%), lack of referral options (32%) Patient barriers: lack of awareness of HCC risk (85%), cost/lack of insurance (70%)
Simmons et al[32]	2019	USA	Cross-sectional survey	67% conducted surveillance, 33% referred to specialist care for this Of those ordering surveillance: >90% US ± AFP. CT/MRI more commonly used for patients with NASH/obesity or decompensated cirrhosis. 36.8% reported not performing surveillance in healthy patients aged >80 years with compensated cirrhosis. 62% screened HCV patients without cirrhosis	Barriers: PCPs not being up to date with recommendations (42%), not considered role of PCP (29%), limited clinical time (14%), other clinical priorities (12%), communication difficulties (10%)

AFP, α-fetoprotein; ALD, alcoholic liver disease; ALT, alanine transaminase; BCLC, Barcelona Clinic level cancer; CHB, chronic hepatitis B; CHC, chronic hepatitis C; CI, confidence interval; CT, computed tomography; GI, gastroenterologist; HBV, hepatitis B virus; HCC, hepatocellular carcinoma; HCP, healthcare provider; HCV, hepatitis C virus; HR, hazard ratio; LFT, liver function test; MRI, magnetic resonance imaging; NASH, non-alcoholic steatohepatitis; n/r, not reported; OR, odds ratio; PCP, primary care provider; US, ultrasound; VA, Veterans Affairs.

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