Supplementary Material:

IA HEPCATT Intervention

IB Standard Letter for Practices

II – Supplementary Results

III Economic Methods

IV: HepCATT Study Algorithm (Read Codes)

/

IA HEPCATT Intervention

- Practice HCV audit tool and patient flag: we designed a new algorithm for the Audit+ Software (Informatica Systems Ltd) which once installed in practices would identify patients with high-risk HCV markers (see supplement material for a full list of risk markers and associated Read codes). The HCV audit tool was piloted and optimised in three general practices before it was rolled out. The audit was designed to identify registered patients who were i) aged 18-75 years and ii) had risk markers of HCV infection or were previously diagnosed with HCV but had not been referred in the last 12 months. The audit tool automatically excluded any patients tested less than one year ago who were HCV antibody negative, patients referred to hepatology, patients receiving low doses of buprenorphine and methadone via tablets and patches that are likely to be prescribed for pain management, and patients at end of life and/or receiving palliative treatment. We recommended the following stages.
    - Screen patient list: the audit was run and updated every 24 hours from the GP system during the 1-year intervention period. After the first run the practice was asked to screen the list of patients identified at the beginning of the intervention to exclude on the system any patient identified by the audit where they felt that an invitation for HCV testing or discussion of treatment was not appropriate.

Contact eligible patients and offer HCV testing: (1) opportunistically: patient records identified by the audit were automatically flagged creating on-screen pop-ups to encourage HCV testing if the patient attends the practice; (2) Letter or email: practice administrators were requested to send out a letter or email generated automatically by the software (see below), to each patient identified to consider having a free HCV test and follow-up patients by telephone, e-mail or text to book an appointment.

-
- Educational training: Practices were encouraged to undertake free online HCV educational resources (such as RCGP e-learning module: http://elearning.rcgp.org.uk/), in addition the Trial Coordinator gave a one-hour educational presentation on HCV and trial procedures and instructions on use of the Audit+ software (Informatica Systems Ltd).
- Increasing patient awareness: posters and leaflets from HCV Trust [http://www.hepctrust.org.uk/resources/leaflets-and-print-publications] were provided for the practices to display in practice waiting rooms and consultation rooms highlighting the risk factors for HCV infection and treatment options.
- Clinical history: practices were asked to add an additional question “have you ever injected recreational drugs?” to the New Patient Registration.

/

IB Standard Letter for Practices

Dear «FullName»,

We are writing to tell you that your GP surgery is working on a new project with a research team from the University of Bristol. **The aim of the project is to encourage more people in the South West of England to get a free test for Hepatitis C.** The Hepatitis C virus can affect the liver and may need treatment. It is very important that the Hepatitis C virus is found and treated early, so that people can live a longer and healthier life. This GP surgery and the research team hope to test people for Hepatitis C, so that we can offer advice and free treatment to people who test positive for Hepatitis C.

We would like to offer you the opportunity to have a free, simple test for Hepatitis C organised by your GP surgery. Receiving this letter does **not** mean that the GP thinks you are ill. Many other people from the GP surgery have also received this letter and have been offered the test. **We hope as many people as possible will take this opportunity for an important free Hepatitis C test.**

If you agree to have a Hepatitis C test, this will **involve a 10 minute visit to your GP surgery.** A member of staff from the surgery will discuss hepatitis with you and then organise the test. The test will involve a simple blood test (either a standard blood test or a finger prick test).

If you would like to talk about the project further or ask any questions, please contact the GP surgery. A member of the surgery team may contact you to see if you would like to book an appointment to take part in the project, or you can call or attend the GP surgery. You can leave this project whenever you want without giving a reason and this will not affect your medical care.

Yours sincerely,

«PreferredGP»

/

II – Supplementary Results

Table S1A: Control practice participants identified as high risk, and numbers of these undergoing antibody tests in the 6-month pre-study period and the 12-month study period.

Practice code [study period start date]	Identified as high risk / number on list (%)	History of injecting drug use (%)	Six-month pre-study period	Twelve-month study period
			Antibody test (%)	Antibody test (%)
BRISTOL				
AA [Apr 2016]	901/17158 (5.25)	277 (1.61)	23 (2.55)	86 (9.54)
AB [May 2016]	311/10092 (3.08)	54 (0.54)	1 (0.32)	33 (10.61)
AC [Jun 2016]	539/10267 (5.25)	54 (0.53)	29 (5.38)	43 (7.98)
AD [Jun 2016]	337/6752 (4.99)	191 (2.83)	3 (0.89)	33 (9.79)
AE [Jul 2016]	510/7703 (6.62)	287 (3.73)	9 (1.76)	27 (5.29)
AF [Aug 2016]	474/11318 (4.19)	141 (1.25)	13 (2.74)	71 (14.98)
AG [Aug 2016]	1159/8389 (13.82)	550 (6.56)	76 (6.56)	90 (7.77)
AH [Oct 2016]	518/10651 (4.86)	211 (1.98)	12 (2.32)	61 (11.78)
AI [Nov 2016]	286/6780 (4.22)	82 (1.21)	11 (3.85)	33 (11.54)
AJ [Dec 2016]	491/13380 (3.67)	163 (1.22)	23 (4.68)	89 (18.13)
AK [Dec 2016]	503/11266 (4.46)	202 (1.79)	19 (3.78)	61 (12.13)
AL [Dec 2016]	561/11157 (5.03)	224 (2.01)	27 (4.81)	87 (15.51)
AM [Dec 2016]	10/4475 (0.22)	3 (0.07)	0	4 (40.00)
AN [Dec 2016]	456/14208 (3.21)	101 (0.71)	37 (8.11)	79 (17.32)
SOMERSET				
AO [Apr 2016]	624/14804 (4.22)	108 (0.73)	5 (0.80)	24 (3.85)
AP [Apr 2016]	698/16019 (4.36)	107 (0.67)	3 (0.43)	60 (8.60)
AQ [May 2016]	713/18289 (3.90)	97 (0.53)	14 (1.96)	67 (9.40)
AR [Jul 2016]	1001/10260 (9.76)	253 (2.47)	18 (1.80)	54 (5.39)
GLOS				
AS [Jul 2016]	220/7104 (3.10)	41 (0.58)	3 (1.36)	40 (18.18)
AT [Aug 2016]	689/14477 (4.76)	96 (0.66)	47 (6.82)	101 (14.66)

/

AU [Dec 2016]	375/5123 (7.32)	73 (1.42)	7 (1.87)	20 (5.33)
Overall	**11376/229672 (4.95)**	**3315 (1.44)**	**380 (3.34)**	**1163 (10.22)**

/

Table S1B: Intervention practice participants identified as high risk, and numbers of these undergoing antibody tests in the 6-month pre-study period and the 12-month study period.

Practice code [study period start date]	Identified as high risk/ number on list (%)	History of injecting drug use (%)	Six-month pre-study period	Twelve-month study period
			Antibody test (%)	Antibody test (%)
BRISTOL				
BA [Apr 2016]	462/1085 (4.26)	229 (2.11)	11 (2.38)	56 (12.12)
BB [May 2016]	490/4660 (10.52)	85 (1.82)	40 (8.16)	136 (27.76)
BC [May 2016]	724/9447 (7.66)	152 (1.61)	69 (9.53)	159 (21.96)
BD [Jul 2016]	812/8611 (9.43)	169 (1.96)	56 (6.90)	119 (14.66)
BE [Jul 2016]	1442/19264 (7.49)	405 (2.10)	47 (3.26)	247 (17.13)
BF [Aug 2016]	454/7643 (5.94)	128 (1.67)	44 (9.69)	122 (26.87)
BG [Aug 2016]	253/9580 (2.64)	84 (0.88)	11 (4.35)	72 (28.46)
BH [Sep 2016]	189/8007 (2.36)	62 (0.77)	2 (1.06)	19 (10.05)
BI [Nov 2016]	509/10410 (4.89)	138 (1.33)	23 (4.52)	83 (16.31)
BJ [Dec 2016]	462/9671 (4.78)	157 (1.62)	27 (5.84)	90 (19.48)
BK [Jan 2016]	339/7656 (4.43)	97 (1.27)	16 (4.72)	63 (18.58)
BL [Mar 2017]	1112/15621 (7.12)	168 (1.08)	42 (3.78)	122 (10.97)
BM [Mar 2017]	651/16113 (4.04)	162 (1.01)	74 (11.37)	168 (25.81)
SOMERSET				
BN [Apr 2016]	1017/11578 (8.78)	241 (2.08)	29 (2.85)	123 (12.09)
BO [Apr 2016]	1006/13695 (7.35)	139 (1.01)	32 (3.18)	149 (14.81)
BP [Jun 2016]	504/7325 (6.88)	67 (0.91)	29 (5.75)	56 (11.11)
BQ [Aug 2016]	1318/22149 (5.95)	158 (0.71)	16 (1.21)	102 (7.74)
GLOS				
BR [Apr 2016]	313/12145 (2.58)	107 (0.88)	3 (0.96)	63 (20.13)
BS [Aug 2016]	316/13376 (2.36)	91 (0.68)	10 (3.16)	52 (16.46)
BT [Dec 2016]	111/8709 (1.27)	16 (0.18)	10 (9.01)	40 (36.04)
BU [Dec 2016)	613/13469 (4.55)	75 (0.56)	17 (2.77)	30 (4.89)
Overall	**13097/239974 (5.46)**	**2930 (1.22)**	**608 (4.64)**	**2071 (15.81)**

/

Table S2: Practice staff time spent inviting patients for screening

Task	**Mean hours (Min, Max)**	**N practices reporting**	**Staff involved**	**Estimated cost**
Installation of software*	2.9 (1, 15)	18/22	Admin (7) Practice Manager (6) IT (4) GP (1) Multiple (2)	£115
Screening patient list	5.5 (1, 30)	17/22	GP (10) GP & other (6) Nurse (1) Admin (3)	£430
Preparing and mailing letters	3.8 (2, 13)	17/22	Admin (16) GP (1) Other (3)	£102
Follow up phone calls	2.3 (0, 5)	11/21	Admin (8) HCA (1) Multiple (2)	£61

*272 practice staff received training 158 (58%) GPs and 44 (16%) nurses with a median 12 (6 to 43) staff trained per practice.

/

III Economic Methods

Economic Analysis

We estimated the short-term cost-effectiveness of the case finding intervention from the NHS perspective. We used a proforma to record the number of practices who received the HCV training, including the number of practice staff trained and job titles. The training session took approximately 1 hour and was delivered by a member of the research team who visited each practice. Staff unable to attend the training session were sent the training session slides for review. Because of this, we estimated that practice staff participated in, on average, 30 minutes of training. We further assumed that trainers took on average 2 hours per training session (30 minute journey each way) when estimating trainer time. Travel expenses for each practice were recorded by the trainer. These upfront training costs are a one-off expense which would not recur if HCV case finding is extended beyond the first year.

For the trial, Audit+ software and ongoing support were contracted with Informatica Systems Limited at an agreed cost per practice. Although Audit+ has much wider functionality, it is probable that, during the study period, practices used it predominantly for HCV case finding. Audit+ is now routinely available to GP practices via the essential part of GP Systems of Choice contractual framework; most of the costs of this are paid centrally by the Government rather than by the CCG or practice. As Audit+ has much wider functionality, the proportion of the cost that can be fairly attributed to HCV case finding will depend on the unknown extent to which GPs use the other functions. In our primary analysis we estimated cost-effectiveness assuming an annual license and support cost of £500 and that Audit+ is solely used for HCV case finding.

Practice staff were provided with a proforma to record the time taken to install the software, extract and screen the lists of high risk patients each time the Audit+ search was run. The proforma also asked staff to record the number of letters sent to patients inviting them to book an appointment. At the end of the intervention period, in both intervention and control sites we extracted information from the GP electronic patient record on HCV-related consultations received by patients identified as high risk by Audit+ during the study period. These were defined based on Read codes (Table S3). Data on laboratory tests (antibody testing and PCR) and referrals to hepatology for viral load testing were extracted from PHE electronic records. We considered PHE records to be the reference standard for laboratory testing. GP records and PHE records showed good agreement for HCV antibody tests, but poorer agreement for PCT tests and referrals to Hepatology. In a sensitivity analysis we estimated costs of laboratory testing and referrals based on GP instead of PHE records to test the robustness of our findings.

We used national unit costs to value staff time spent identifying and inviting patients to screening, taking blood samples, HCV antibody and PCR testing and HCV-related consultations and referrals (Table 2). We compared costs between intervention and control practices using mixed effects linear regression, clustered by practice, adjusting for whether an individual's practice was in Bristol or not, whether that practice had at baseline a high HCV testing rate or not, and length of follow up. We calculated the incremental cost per patient referred for viral load testing in intervention versus control practices. Uncertainty was explored using a cost-effectiveness acceptability curve, which estimate the probability that the intervention is cost-effective at various willingness-to-pay

/

thresholds [1]. We used a two-stage nonparametric bootstrap resampling procedure for clustered data to estimate the cost-effectiveness acceptability curve[2].

In a further sensitivity analysis we assumed that all upfront costs (i.e. training & software installation costs) are £0 and that Audit+ is a core element of the GP electronic health record and its functions are widely used by GPs such that the software license and maintenance cost per patient identified for HCV screening is effectively £0.

/

Table S3: Read codes used to identify HCV-related consultations and tests[1]

Description	Code
Examinations/Signs	
Hepatitis C status	2J1..
Hepatitis C non immune	2J12
Hepatitis C resolved	2126700
Hepatitis C immune	2J11
Diagnostic codes	
Viral Hepatitis C with coma	A7040
Viral hepatitis C without mention of hepatic coma	A7050
Chronic viral hepatitis C	A7072
Hepatitis C	A70z0
Hepatitis C genotype 1	A70A
Hepatitis C carrier	ZV02C
Congenital viral Hepatitis	Q409.
Viral hepatitis carrier	ZV026
Contact with and exposure to viral hepatitis	ZV01B
[V]Hepatitis C carrier	ZV02C00
Laboratory procedures	
Hepatitis C antibody test	43X2.
Hepatitis C antibody test positive	43X3.
Hepatitis C antibody level	43X6.
Hepatitis C IgG level	43JK
Hepatitis C antibody test negative	43X4
Hepatitis C PCR	43h3.
Hepatitis C nucleic acid detection	43j5.
HepC nucleic acid detection assay	43j50
Hepatitis C virus RNA assay	43q..
Hepatitis C viral load	4J3B.
HepC PCR negative	4JQC.
Hepatitis C PCR positive	4JQD
Hepatitis C virus genotype	4JQ3
Hepatitis C non- immune	43B7.
Hepatitis C recombinant immunoblot assay	43dD.
Hepatitis C antigen level	43k1.
HepC antigen negative	4JQE.
Hepatitis C antigen positive	4JQF
Preventative procedures	
Hepatitis C contact	65PM.
Viral hepatitis carrier	65Q7.
Hepatitis C screening counselling	677Q.
HepC screening	6829.
Operations and procedures	
RSV treatment and Hepatitis C treatment drugs b1	7Q053
Other therapeutic procedures	
Referred to hepatology service	8Hk5
Administration procedures	
Hepatitis C screening positive-enhanced services	9kV..
HepC screening neg- enhanced services admin	9kT..
Chronic hepatitis annual review- enhanced services admin	9kR..
HepC screening offered	9Op1.
On hepatitis C treatment plan	9NgR
Hepatology	9b9V
Local codes	
Hepatitis C PCR positive	EMISNQHE29
Hepatitis C negative	EMISNQHE30
Referred for hepatology	EMISNQRE49

1 HCV-related consultations were defined as any event where an HCV-related examination/sign or diagnosis code was recorded in the GP electronic record;

/

We estimated the cost-effectiveness of the HepCATT case finding intervention from the NHS perspective. More detailed methods on economic evaluation are given in supplementary material.

HCV Case-finding

We used a proforma to record the number of practices who received the HCV training, including the number of practice staff trained and job titles and allocated upfront training costs as a one-off expense. Two practices did not respond to the survey and a further six partially completed the survey. For the trial, Audit+ software and ongoing support were contracted with Informatica Systems Limited at an agreed cost per practice used predominantly for HCV case finding. In our primary analysis we estimated cost-effectiveness assuming an annual license and support cost of £500 and that Audit+ is solely used for HCV case finding. In sensitivity testing we removed all upfront costs and Audit+ installation, training and maintenance costs (as Audit+ is now routinely available to GP practices via the essential part of GP Systems of Choice contractual framework paid centrally by the Government – with much wider functionality than just HCV case finding).

Practice staff also used a proforma to record the time taken to install the software, extract and screen the lists of high-risk patients each time the Audit+ search was run, and the number of letters (emails or phone calls) inviting patients to book an appointment. At the end of the intervention period, in both intervention and control sites we extracted information from the GP electronic patient record on HCV-related consultations received by patients identified as high risk by Audit+ during the study period. These were defined based on Read codes (Table S1).

We used national unit costs to value staff time spent identifying and inviting patients to screening, taking blood samples, HCV antibody and PCR testing and HCV-related consultations and referrals. We compared costs between intervention and control practices using mixed effects linear regression, clustered by practice, adjusting for sampling stratification, and length of follow up. We estimated the cost of HCV case-finding per high risk patient identified through the HCV algorithm and calculated the incremental cost per patient assessed at secondary care in intervention versus control practices. Uncertainty was explored using a cost-effectiveness acceptability curve, which estimate the probability that the intervention is cost-effective at various willingness-to-pay thresholds [1]. We used a two-stage nonparametric bootstrap resampling procedure for clustered data to estimate the cost-effectiveness acceptability curve[2].

Cost-effectiveness Model

Model analysis

A Markov model was developed to capture the increased rate of testing, and the higher linkage to care observed in the intervention arm, versus the control arm. The control arm (no intervention) was the only model comparator. The analysis was performed from an NHS perspective, and results are

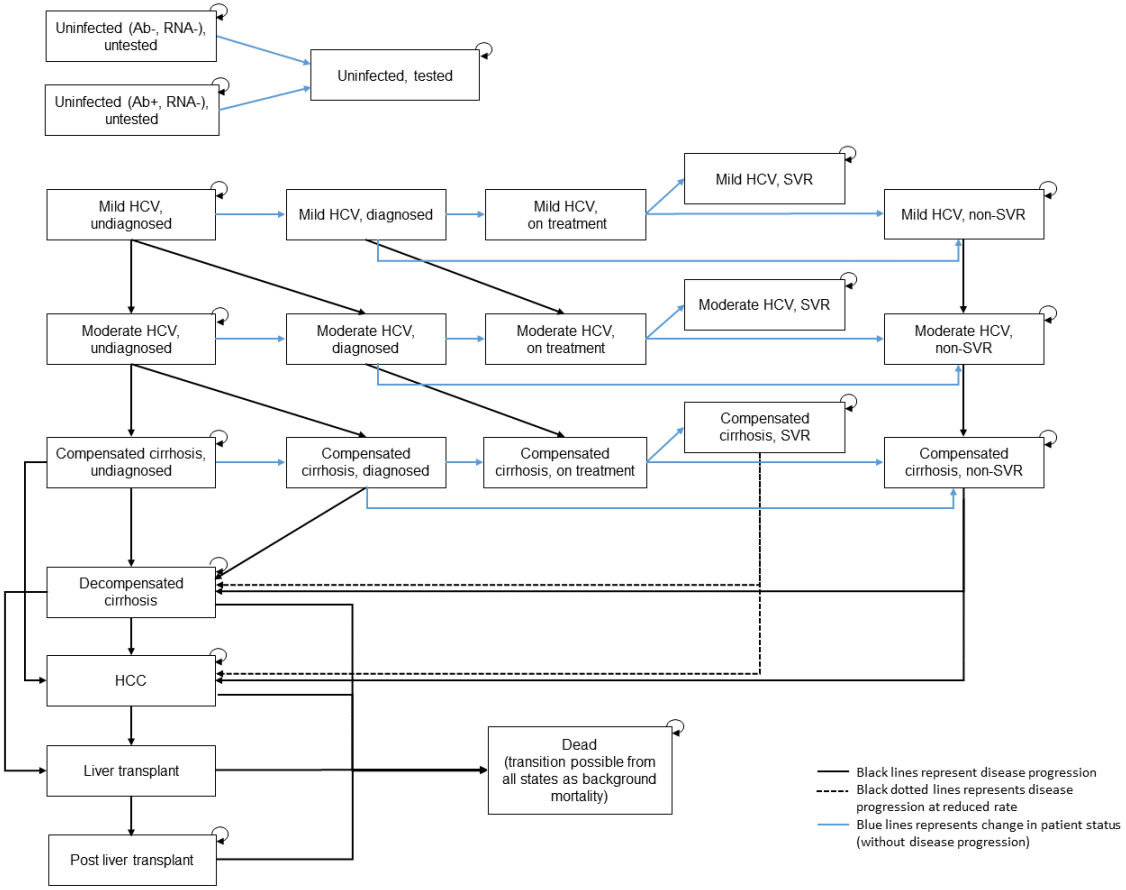
/

presented in 2017 pounds (£, GBP). Outcomes are reported as quality adjusted life years (QALYs). Both costs and QALYs were discounted at 3.5%, as per NICE guidelines[3]. The model results are presented as incremental cost-effectiveness ratios (ICER), which were calculated as the incremental costs divided by the incremental QALYs, to give a cost per QALY gained. Individuals moved between health states during a six-month cycle length, and the model used a lifetime time horizon. Since the Markov model considers a static population, the intervention was assumed to occur for one year only in the base case analysis. To consider the impact of the intervention upon new individuals joining a particular primary care centre, an analysis excluding training costs was performed. In the absence of data on the mean age of individuals identified during the intervention, we assumed a starting age in the model of 45. This corresponds to the age group (40-49 years old) with most prevalent number of chronic HCV infections amongst current- and ex-PWID in England, as estimated by Harris et al[4].

Model structure

The Markov model captures the natural history of HCV using eight main clinical health states, and is similar to those used in previous economic evaluations[5 6]. For early health states, disease status is classified according to the modified HAI (Ishak) score for mild HCV (F0-F2), moderate HCV (F3-F5) and compensated cirrhosis (F6, CC). For individuals with mild HCV, moderate HCV or compensated cirrhosis, health states are mirrored to capture the following diagnosis statuses; 'undiagnosed', 'diagnosed', 'on-treatment', 'SVR', or 'non-SVR'. The model structure schematic is presented in Figure S1. It was assumed that for individuals progressing beyond compensated cirrhosis (to decompensated cirrhosis [DC] or HCC health states) that their HCV infection status would become known due to the severity of their disease. In addition to HCV related mortality associated with decompensated cirrhosis, HCC and liver transplant health states, the model also captures the risk of non-HCV related mortality, for all individuals in the model (i.e. regardless of their current health state). This background risk of non-HCV related mortality was derived from UK life tables[7]. There is no information of injecting status of those identified and attending for HCV testing, therefore we did not model disease transmission. Since the model did not capture disease transmission, it is likely that the estimated ICER will be conservative, as it does not consider the prevention benefit associated with reduced onward transmission as a result of testing and treatment. However, scenarios were performed to consider the impact of lower utility values associated with people who inject drugs (PWIDs) and a threshold analysis presented below considering reinfection.

Figure S1: Economic model structure



/

Intervention effects and linkage to care

The intervention probabilities are presented in **Table S4**, utilising the intervention rate shown in the main paper (Table 3). The background rate of testing was calculated using the mixed-effects Poisson regression model for antibody testing in intervention and control practices. Since there was only weak evidence for a higher proportion of HCV antibody positive tests in the intervention practices compared to the control practices (6.2% versus 4.4%, Table 3), this difference was not included in the base case economic analysis. A scenario analysis was performed to consider a higher antibody yield in the intervention arm presented below. The model captured this difference by adjusting the probability of testing for infected and uninfected individuals within the intervention arm to achieve a higher antibody yield as suggested by the intervention (risk ratio of 1.42). Of those testing HCV antibody positive, it was assumed that reflex PCR testing (PCR test on the same blood sample used for the HCV antibody test) was performed. Of all PCR tests performed, 56 were positive and 83 were negative, with 41 either having missing results or insufficient sample to confirm. The proportion of RNA positive PCR tests was derived from those tests, with a confirmation of conclusive test results being achieved in 40.3% of samples (56/139). Due to the high proportion of inconclusive PCR test results, a scenario was performed shown below in which the proportion of RNA positive tests was derived from PHE sentinel surveillance statistics (72.3%)[8].

A viral load test in secondary care for those testing RNA positive in primary care was considered as successful referral (and engagement) with secondary care. The adjusted rate ratio for viral load tests between the arms was 5.78 (95% CI: 1.55, 21.61) as displayed in Table 3. However, for the parameterisation of the economic model, the proportion receiving a viral load test subsequent to a positive RNA test was required. Of all those testing RNA positive, 47% in the intervention arm (20/43) and 23% in the control arm (3/13) were successfully referred and engaging in secondary care (as indicated by a viral load test in secondary care). In the base case analysis, the unadjusted proportions for the intervention and control arms were used for this parameter. A more conservative scenario was also performed in which the linkage to care for each arm was equal, using a weighted average of the overall linkage to care (shown in main results above).

The probability of achieving SVR was derived from a real world study performed in the UK[9]. For individuals that did not achieve SVR with their first treatment, it was assumed that they would be retreated once, and the SVR rates associated with retreatment were derived from a clinical study amongst individuals that had not responded to prior DAA containing therapy[10]. The economic model analysis was pan-genotypic and did not capture outcomes by genotype.

Table S4 shows the economic model inputs for the Markov model, based on the intervention results reported in the main text (Table 3).

/

Table S4 : Intervention probabilities and intervention effects

Base case probabilities	Mean	Distribution	Source
Testing rate and intervention effect			
Annual probability of testing (control)	9.7%	Multivariate normal distribution†	HepCATT
Antibody testing rate ratio (intervention)	1.59	Multivariate normal distribution†(95% CI 1.21, 2.08)	HepCATT
Antibody prevalence			
Antibody prevalence (combined)	4.39%	Beta (α=180, β=3,054)	HepCATT
Antibody yield treatment effect rate ratio – Scenario^	1.42	N/A	HepCATT
Linkage to care			
Proportion of reflex PCR tests	100%	N/A	Assumption
Proportion of RNA+ (of Ab+)	40.3%	Beta (α=56, β=83)	HepCATT
Proportion of RNA+ (of Ab+) – Scenario	72.3%	N/A	Simmons 2018
Probability of referral and attendance (control)	23.1%	Beta (α=3, β=10)	HepCATT
Probability of referral and attendance (intervention)	46.5%	Beta (α=20, β=23)	HepCATT
Probability of referral and attendance (combined) – Scenario	41.1%	Beta (α=23, β=33)	HepCATT
Probability of treatment (post referral)˝	90%	Uniform (0.8, 1)	Assumption
Initial proportion mild	55.9%	Dirichlet (55.9,33.9,10.2)*	Ward 2016[11]
Initial proportion moderate	33.9%	Dirichlet (55.9,33.9,10.2)*	Ward 2016
Initial proportion cirrhotic	10.2%	Dirichlet (55.9,33.9,10.2)*	Ward 2016
Treatment outcomes			
Mild / moderate HCV	92.8%	Beta (α=376, β=29)	UK National Cohort
Compensated cirrhosis	90.8%	Beta (α=736, β=75)	UK National Cohort
Mild / moderate HCV (retreatment)	93.9%	Beta (α=77, β=5)	Bourlière 2017[10]
Compensated cirrhosis (retreatment)	85.5%	Beta (α=59, β=10)	Bourlière 2017

^ Treatment effect in base case analysis bounded by 1 due to model structure

˝ Of individuals that received a viral load test in secondary care, 90% would go on to receive DAA treatment.

* Assumed sample size of 100 for probabilistic distribution

† Multivariate normal distribution of Cholesky decomposition, derived from the mixed-effects Poisson regression model (presented in Table 3 of the manuscript). Antibody testing rate ratio covariate included for intervention arm.

/

Costs

Table S5 shows care pathway costs used in the economic model. The mean training costs associated with the intervention were £1.22 per individual on the screening list (practice level cost ranging from £0.39 to £3.89). The mean cost of screening the list and sending invitations (per individual) was £2.06 (practice level cost ranging from £0.56 to £9.13). The cost of an antibody test was £8.12 per test (Public Health England), with HCV phlebotomy appointment cost of £14.10 (derived from private healthcare costs). The cost of a PCR test, assumed to be performed as a reflex test, was £90.64. The cost of DAA treatments in the UK is confidential, although it is believed to be significantly lower that UK list prices (approximately £35,000), with evidence that costs are below £10,000[12]. In this analysis, we assumed DAA costs of £10,000, with £15,000 assumed for retreatment. These costs were only incurred upon achievement of SVR, based on current NHS policy. We also performed a scenario in which DAA treatment cost was reduced to £5,000 (shown in the main results above). We also show the ICER across a range of DAA costs, up to £35,000 (Figure S2B). Health state costs were derived from a previous HTA performed in the UK[13]. The health state costs associated with SVR (for mild, moderate and compensated cirrhosis health states) were derived from Grishchenko 2009[14] (**Table S5**). Health state costs were inflated to 2017 costs using the Hospital and Community Health Services Pay and Prices inflation index.

/

Table S5: Base case economic model costs

Costs (per year, except where noted)	Cost	Distribution	Source
Intervention and care pathway costs			
Cost of training per individual (intervention)	£1.22	Gamma (k=1.7746, θ=1.4546)	HepCATT (Table 4)
Cost of screening per individual (intervention)	£2.06	Gamma (k=0.8879, θ=0.431)	HepCATT (Table 4)
Cost HCV appointment	£14.10	Varied by staff cost variation[#]	Based on private practice (se bridge street medical centre)
HCV antibody test	£8.12	Varied by test cost variation^	Public Health England
Cost of PCR test	£90.64	Varied by test cost variation^	Public Health England
Outpatient evaluation	£238	Uniform(£190.40, £285.60)	NHS reference costs 2016/17
Further outpatient evaluation	£262	Uniform(£209.60, £314.40)	NHS reference costs 2016/17
DAA treatment (first treatment)	£10,000	N/A	Hurley 2018[12]
DAA treatment (re-treatment)	£15,000	N/A	Assumption
DAA treatment monitoring	£1,310	Uniform(£1048, 1572)	NHS reference costs 2016/17
Health state costs			
Mild HCV	£195	Gamma (k=25.6995, θ=5.3698) × PPI$^{\pm}$	Shepherd 2007[13]
Moderate HCV	£1,014	Gamma (k=88.8502, θ=8.0698) × PPI$^{\pm}$	Shepherd 2007
Compensated cirrhosis	£1,610	Gamma (k=24.2342, θ=46.9584) × PPI$^{\pm}$	Shepherd 2007
Decompensated cirrhosis	£12,901	Gamma (k=36.0249, θ=253.1582) × PPI$^{\pm}$	Shepherd 2007

/

Hepatocellular carcinoma	£11,496	Gamma (k=18.1081, θ=448.8045) × PPI[±]	Shepherd 2007
Liver transplant (per transplant)	£38,661	Gamma (k=89.7536, θ=304.5004) × PPI[±]	Shepherd 2007
Cost of care in year of liver transplant	£13,379	Gamma (k=13.7788, θ=686.4168) × PPI[±]	Shepherd 2007
Cost of care post liver transplant	£1,959	Gamma (k=15.2189, θ=91.0053) × PPI[±]	Shepherd 2007
Mild SVR	£286	Gamma (k=25, θ=8.08) × PPI[±]	Grishchenko 2009 [14]
Moderate SVR	£349	Gamma (k=25, θ=9.88) × PPI[±]	Grishchenko 2009
Compensated cirrhosis SVR	£618	Gamma (k=25, θ=17.48) × PPI[±]	Grishchenko 2009

[^] Cost of test calculated by using a multiplier for tests costs, following a uniform distribution from 0.8 to 1.2.

[#] Cost of staff calculated by using a multiplier for staff costs, following a uniform distribution from 0.8 to 1.2.

[±] Costs inflated to 2016/17 costs using Hospital and Community Health Services Pay and Prices Inflation Index to 2016/17 (2002/03 = 1.41, 2006/07 = 1.21)

/

Utilities

Utilities for mild, moderate and cirrhotic health states were derived from the UK mild HCV trial (**Table S6**)[15]. Utilities associated with SVR health states were derived from the same source, with an assumption on the utility increment associated made for the cirrhosis SVR health state (similar assumptions have been made in previous economic evaluations). For later disease stages, utilities were derived from a UK study in individuals receiving liver transplants.[16] These utilities have been used in a previous health technology assessment[13] and have been used in many economic evaluations of HCV. Utilities were also adjusted to decline with age, in line with UK utility values amonst the general population.

A scenario was performed shown in the main results in which the utility values were decreased by 18% (i.e. using a 0.82 multiplier) to reflect the lower utility associated amongst PWID without chronic HCV (utility of 0.76), compared to equivalent, age matched, general population norms (utility of 0.93), to estimate the difference utility values between the two groups).[17] Similar analyses of lower utilities amongst PWID have been performed previously.[18]

Table S6: Health state utilities

Health state	Value	Distribution	Source
Mild HCV	0.77	Beta (α=521.2375, β=155.6943)	Wright 2006[15]
Moderate HCV	0.66	Beta (α=168.2461, β=86.6723)	Wright 2006
Compensated cirrhosis	0.55	Beta (α=47.1021, β=38.5381)	Wright 2006
Decompensated cirrhosis	0.45	Beta (α=123.75, β=151.25)	Ratcliffe 2002[16]
HCC	0.45	Beta (α=123.75, β=151.25)	Ratcliffe 2002
Liver transplant (first year)	0.45	Beta (α=123.75, β=151.25)	Ratcliffe 2002
Liver transplant (after first year)	0.67	Beta (α=32, β=16)	Ratcliffe 2002
Mild SVR	0.82	Beta (α=65.8678, β=14.4588)	Wright 2006
Moderate SVR	0.72	Beta (α=58.0608, β=22.5792)	Wright 2006
Compensated cirrhosis SVR	0.61	Beta (α=58.0476, β=37.1124)	Hartwell 2011[19]

HCC: Hepatocellular carcinoma

Transition probabilities

The transition probabilities used in the base case are presented in **Table S7**. These transition probabilities were similar to those used in a previous HTA in HCV[13], with additional transitions introduced for those achieving SVR with compensated cirrhosis, who remain at risk of developing decompensated cirrhosis and HCC (at a reduced probability).

A scenario analysis was performed, shown below, to consider the uncertainty in disease progression, based on transition probabilities estimated from a back-calculation model performed in England, for

transition probabilities from mild HCV, moderate HCV and compensated cirrhosis health states (**Table S8**). The methodological details of the back-calculation model have been described elsewhere, but the model uses hospital episode statistics (HES) and office of national statistics data (ONS) to estimate historical HCV burden in England, and to then project these estimates forward[20]. The transition probabilities from this method are generated through a Bayesian model fitting process, and transition probabilities are differ by age.

/

Table S7: Transition probabilities used in the economic model

Transition probability	**Value**	**Distribution**	**Source**
Mild HCV to moderate HCV	0.025	Beta (α=38.086, β=1485.4)	Shepherd 2007[13]
Moderate HCV to CC	0.037	Beta (α=26.905, β=700.3)	Shepherd 2007
CC to DC	0.039	Beta (α=14.617, β=360.2)	Shepherd 2007
CC to HCC	0.014	Beta (α=1.9326, β=136.1)	Shepherd 2007
CC SVR to DC (relative risk vs. non-SVR)	0.07	Lognormal (95% CI 0.03, 0.2)	Van der Meer 2012[21]
CC SVR to HCC (relative risk vs. non-SVR)	0.23	Lognormal (95% CI 0.16, 0.35)	Morgan 2013[22]
DC to HCC	0.014	Beta (α=1.9326, β=136.1074)	Shepherd 2007
DC to liver transplant (LT)	0.03	Beta (α=6.5256, β=210.9945)	Shepherd 2007
DC to death	0.13	Beta (α=147.03, β=983.97)	Shepherd 2007
HCC to LT	0.03	Beta (α=6.5256, β=210.9945)	Shepherd 2007
HCC to death	0.43	Beta (α=117.1033, β=155.23)	Shepherd 2007
Post LT (0-12 months) to death	0.21	Beta (α=16.2762, β=61.2294)	Shepherd 2007
Post LT (>12 months) to death	0.057	Beta (α=22.9017, β=378.8825)	Shepherd 2007

CC: Compensated cirrhosis, DC: Decompensated cirrhosis, HCC: Hepatocellular carcinoma, LT: Liver transplant

/

Table S8: Transition probabilities derived from the posterior estimates of a back-calculation model for England (used in scenario analysis)

Health state	Age	Value
Mild HCV to moderate HCV	30-39	0.025
	40-49	0.042
	50-59	0.129
	60-69	0.110
	70+	0.130
Moderate HCV to compensated cirrhosis	30-39	0.062
	40-49	0.068
	50-59	0.089
	60-69	0.062
	70+	0.081
Compensated cirrhosis to DC	30-39	0.133
	40-49	0.106
	50-59	0.088
	60-69	0.082
	70+	0.082
Compensated cirrhosis to HCC	30-39	0.004
	40-49	0.007
	50-59	0.017
	60-69	0.039
	70+	0.044

DC: Decompensated cirrhosis, HCC: Hepatocellular carcinoma

Source: Harris et al 2019 [4]

Sensitivity analyses

We undertook deterministic one-way sensitivity analyses by varying one parameter and observing the influence upon the ICER. First, we assumed that linkage to care for each arm was equal based on a weighted average of the overall linkage to care. Second, we halved estimated HCV treatment cost to £5,000 per course of DAA treatment (£10,000 for retreatment). Third, as there was no information on injecting status of those identified we did not model disease transmission in the baseline model, but we did consider the impact of lower utility values associated with people who inject drugs (PWID) and a threshold analysis considering reinfection[17]. Fourth, we considered the possibility of differential yield in testing based on study data. Fifth, an additional scenario assumed the proportion of RNA positive tests was derived from PHE sentinel surveillance data (72.3)[8]. Sixth, we considered alternative progression rates based on a recent back-calculation model performed in England[4]. The first three scenarios are shown in the main results Table 5, the last three are shown below in Table S9.

The main results show our threshold analysis of the intervention effect on the rate ratio of antibody testing, assuming that linkage to care was equal for control and intervention practices. In this scenario the intervention remains cost-effective as long as the intervention effect of increases HCV antibody testing by at least 53% and the annual reinfection rate was equal to or less than 9.1% per year.

We also performed a one-way sensitivity analysis across a range of DAA treatment costs, due to the uncertainty in this parameter (Figure S2A). Probabilistic sensitivity analysis (PSA) was performed by sampling all probabilistic parameters simultaneously in the model, across 10,000 simulations. We performed an analysis of covariance (ANCOVA) to consider the percentage of change in incremental costs and incremental QALYs explained by the uncertainty in each parameter (or group of parameters). We performed threshold analyses to consider the parameter values at which the decision upon which the cost-effectiveness decision changes, at a £20,000 willingness to pay threshold. We considered the minimum increase in antibody testing required, and the maximum reinfection rate below which, the intervention would remain cost-effective.

The main source of variation in the probabilistic model costs is due to the cost of screening per patient, accounting for 48% of the uncertainty in the estimated costs and the main source of uncertainty in the estimated QALYs is due to probability of referral and attendance (54%) and utility increment associated with achieving SVR (24%) (see Figure S2B).

Figure S2A: Incremental cost-effectiveness ratio across various DAA treatment costs

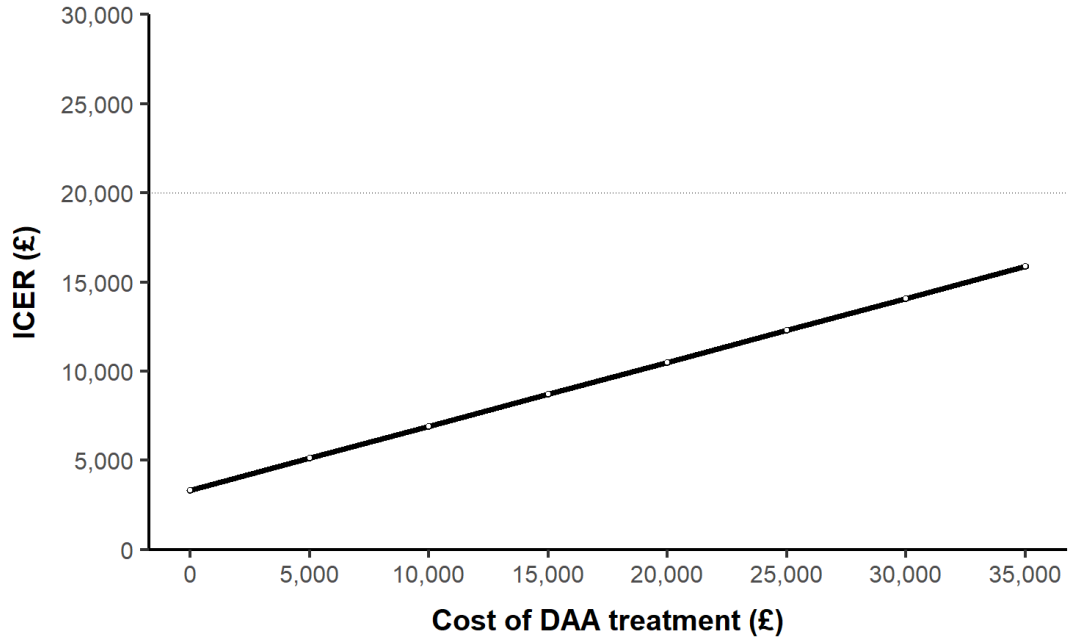


Figure S2B: Analysis of covariance (ANCOVA) for probabilistic sensitivity analysis

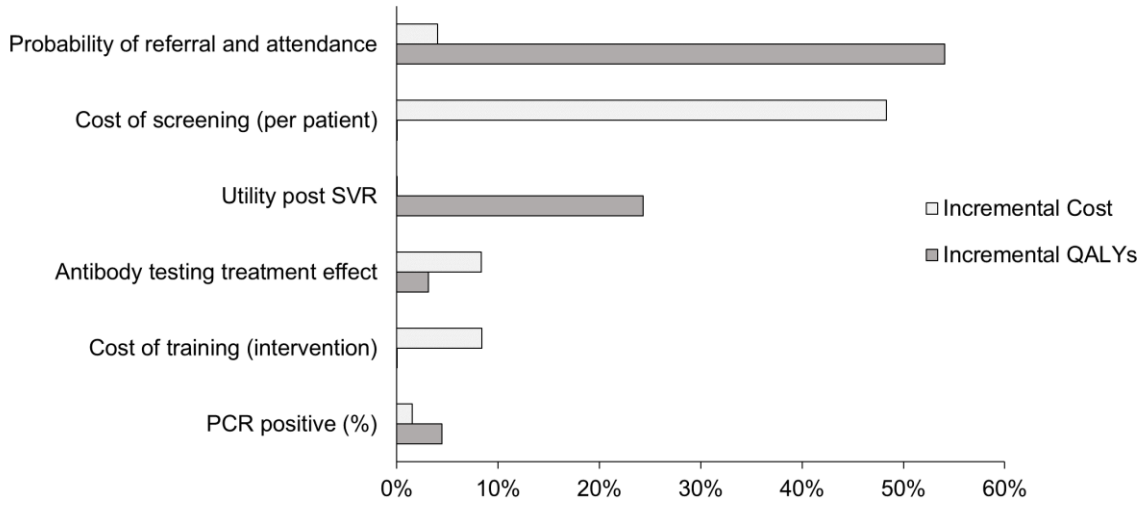


Table S9: Additional scenario analysis results per individual identified as high risk by HepCATT intervention

Testing option	**Total costs**	**Total QALYs**	**Incr. costs**	**Incr. QALYs**	**ICER**
Base case results					
Control arm	£417	16.2207			
Intervention arm	£424	16.2218	£7.45	0.00108	£6,916
Scenario: Treatment effect for higher yield of antibody positives in intervention arm					
Control arm	£417	16.2207			
Intervention arm	£429	16.2223	£12.14	0.00159	£7,635
Scenario: PCR results from PHE RNA positive statistics (rather than with trial)					
Control arm	£732	16.1298			
Intervention arm	£742	16.1318	£10.43	0.00193	£5,396
Scenario: Transition probabilities derived from back-calculation model					
Control arm	£655	16.1843			
Intervention arm	£658	16.1862	£2.13	0.00196	£1,089

IV: HepCATT Study Algorithm (Read Codes)

Name	IDU
Description	History of Intravenous Drug use
Selection	Latest
Referenced by sections	
Referenced by measures	Call01, Off01, Tst01, Ref01, Refe01

Read V2 Terms	CTV3 Terms
13c0: Injecting drug user 13c1: Intravenous drug user 13c7: Current drug user 13cJ: Previously injecting drug user 146C: Failed heroin detoxification 1T0%: H/O heroin misuse 1TE: Uses heroin on top of substitution therapy 1TF: Does not use heroin on top of substitution therapy E240: Opioid type drug dependence Eu112: [X]Mental and behav dis due to use opioids: dependence syndr SL501: Heroin poisoning T800: Accidental poisoning by heroin TJ50: Adverse reaction to heroin, diamorphine U1A5: [X]Accident poisoning/exposure to narcotic drug U205: [X]Intent self poison/exposure to narcotic drug 13c4: Intranasal drug user 1V3C: Shares needles 1V65: Heroin misuse 1V3M: Does not use needle and syringe exchange scheme 1V32: Neck injector 1V3B: Shares syringes 1V33: Groin injector 1V3G: Does not clean needles 1V35: Shares drug equipment 1V38: Sharing of drug injecting equipment HMPNQDR1: "HMPNQDR1" ZV115: [V]Personal history of drug abuse by injection EMISNQCU1: "EMISNQCU1" EMISNQPR6: "EMISNQPR6" EMISNQND10: "EMISNQND10"	

EMISNQHO4: "EMISNQHO4" EMISNQMI10: "EMISNQMI10" 13c5: Substance misuse increased 13c6: Substance misuse decreased 13c8: Reduced drugs misuse 13c9: Subcutaneous drug user 13cC: Continuous use of drugs 13cD: Episodic use of drugs 13cF: Preoccupied with substance misuse 13cF: Preoccupied with substance misuse 13cH: Persistent substance misuse 13cM: Substance misuse 13cN: Has never shared drug injection equipment 146F: H/O: drug abuse E248: Combined opioid with other drug dependence 8FB: Drug rehabilitation 8FB0: Drug detoxification programme completed 1283: FH: Drug dependency 1463: H/O: drug dependency 1J11: Suspected abuse hard drugs 1V0: Misuses drugs 1V3%: Drug injection behaviour 1V65: Heroin misuse 1P31: Compulsive drug taking	

Name	OPIATE_RX	
Description	Methadone or buprenorphine prescriptions (excluding patches and tablets)	
Selection	Latest	
Referenced by sections		
Referenced by measures	Call02, Off02, Tst02, Ref02, Refe02	
Read V2 Terms		CTV3 Terms
djc%: METHADONE HCL [ANALGESIC] dj32: TEMGESIC 300micrograms/1mL injection dj33: TEMGESIC 600microgram/2mL injection dj3y: BUPRENORPHINE 300microgram/1mL injection dj3z: BUPRENORPHINE 600micrograms/2mL injection dj3D: BUPRENORPHINE+NALOXONE 2mg/0.5mg sublingual tablets dj3E: SUBOXONE 2mg/0.5mg sublingual tablets dj3F: BUPRENORPHINE+NALOXONE 8mg/2mg		

sublingual tablets dj3G: SUBOXONE 8mg/2mg sublingual tablets djcA: METHADONE DILUENT liquid cg51: METHADONE 2mg/5mL linctus	

Name	OPIATE_MISUSE	
Description	Opiate misuse	
Selection	Latest	
Referenced by sections		
Referenced by measures	Call02, Off02, Tst02, Ref02, Refe02	
Read V2 Terms		CTV3 Terms
13cG0: Opioid tolerant 13cG1: Opioid naive 4I71: Oral fluid opiate level 1T1%: H/O methadone misuse 44u1: Serum methadone level 44uK: Plasma methadone level 46QB: Urine methadone 46Qf: Urine methadone metabolite level 4I75: Oral fluid methadone level 8B23: Drug addiction therapy 8B2N: Drug addiction detoxification therapy - methadone 8B2P: Drug addiction maintenance therapy - methadone 8BE0: Reinduction to methadone maintenance therapy SL502: Methadone poisoning T801: Accidental poisoning by methadone TJ51: Adverse reaction to methadone U6050: [X]Opioids + relat analgesics caus advers eff in therap use R10B4: [D]Finding of opiate drug in blood 679j0: Education about taking methadone		

Name	BLOOD_1991	
Description	Blood transfusion prior to 1991	
Selection	Latest before 1 Jan 1991	
Referenced by sections		
Referenced by measures	Call03, Off03, Tst03, Ref03, Refe03	
Read V2 Terms		CTV3 Terms
14S1: H/O: blood transfusion 435: Transfusion centre ref. no.		

7K1Q2: Transfusion of stem cells 7L13: Exchange blood transfusion 7L13y: Other specified exchange blood transfusion 7L13z: Exchange blood transfusion NOS 7L14-7L143: Other blood transfusion ... Intravenous blood transfusion NEC 7L14y: Other specified other blood transfusion 7L14z: Other blood transfusion NOS 7L15%: Other intravenous transfusion !7L156: (Excluding) Plasmapharesis 88: Cardiovascular procedures 9bC1: Blood transfusion (specialty) SP33: Infection after injection/infusion/transfusion/vaccination SP332: Infection after transfusion SP33z: Infection after injection/infusion/transfusion/vacc NOS SP38: Other transfusion reaction SP380: Septic shock due to transfusion SP38z: Transfusion reaction NOS TA30: Excess blood or other fluid during transfusion or infusion TA41: Mechanical failure of apparatus during infusion/transfusion TA411: Mechanical failure of apparatus during transfusion TA41z: Mechanical failure of apparatus - infusion/transfusion NOS TB1y0: Blood transfusion with complication, without blame ZV582: [V]Blood transfusion, without reported diagnosis ZVu3M: [X]Blood transfusion, without reported diagnosis G8y00: Extravasation following blood transfusion TJ47z: Adverse reaction to blood or blood products NOS ZVu3V: [X]Blood transfusion	

Name	PRODUCT_1986
Description	Blood products before 1986
Selection	Latest before 1 Jan 1986
Referenced by sections	
Referenced by measures	Call04, Off04, Tst04, Ref04, Refe04

Read V2 Terms	CTV3 Terms
7L141: Intravenous blood transfusion of packed cells 7L142: Intravenous blood transfusion of platelets 7L154: Transfusion of platelets NEC 7L150: Transfusion of coagulation factor 7L151: Transfusion of plasma 7L158: Transfusion of plasma NEC 7L152: Transfusion of serum NEC TJ470: Adverse reaction to blood plasma TJ471: Adverse reaction to human fibrinogen TJ472: Adverse reaction to packed red cells	

Name	TRANSP_1992
Description	Transplant before 1992
Selection	Latest
Referenced by sections	
Referenced by measures	Call05, Off05, Tst05, Ref05, Refe05

Read V2 Terms	CTV3 Terms
8HBB: Transplant follow-up 7B015: Transplant nephrectomy 9b8K: Transplantation surgery 7450: Transplantation of lung 7800: Transplantation of liver 764C: Transplantation of ileum 7B00: Transplantation of kidney 78420: Transplantation of spleen 7830: Transplantation of pancreas 7901: Other transplantation of heart 9b8B2: Cardiothoracic transplantation SP080: Transplanted organ failure SP081: Transplanted organ rejection SP083-SP086: Kidney transplant failure and rejection ... Liver transplant failure and rejection SP089: Complication of transplanted lung SP08C-SP08H: Accelerated rejection of renal transplant ... Acute rejection of renal transplant SP08Z: Thrombosis of artery of transplanted kidney ZV420: [V]Kidney transplanted ZV421: [V]Heart transplanted ZV426: [V]Lung transplanted ZV427: [V]Liver transplanted 7B063: Exploration of renal transplant 7900: Transplantation of heart and lung	

HNG0111: "HNG0111" 78052: Exploration of liver 8HkP: Referral to surgical transplant service	

Name	HIV	
Description	Infection with HIV	
Selection	Latest	
Referenced by sections		
Referenced by measures	Call06, Off06, Tst06, Ref06, Refe06	
Read V2 Terms		CTV3 Terms
43C3: HTLV-3 antibody positive 4J34: HIV viral load A789: Human immunodef virus resulting in other disease A788: Acquired immune deficiency syndrome 66j: Human immunodeficiency virus monitoring Eu024: [X]Dementia in human immunodef virus [HIV] disease 4J3F: Human immunodeficiency virus viral load by log rank L179: HIV disease complicating pregnancy childbirth puerperium R109: [D]Laboratory evidence of human immunodeficiency virus [HIV] 43h9: HIV proviral deoxyribonucleic acid polymerase chain reaction ZV01A: [V]Asymptomatic human immunodeficency virus infection status 9kl: HIV pos gen health check serv declind - enhanc service admin EGTON41: "EGTON41" EMISNQHO13: "EMISNQHO13" AyuC: [X]Human immunodeficiency virus disease HNG0143: "HNG0143" HNG0607: "HNG0607" 43j7: HIV 1 nucleic acid detection A788: Acquired immune deficiency syndrome 66j%: Human immunodeficiency virus monitoring A789: Human immunodef virus resulting in other disease		

Name	HEP_B
Description	Infection with Hepatitis B
Selection	Latest

Referenced by sections	
Referenced by measures	Call07, Off07, Tst07, Ref07, Refe07

Read V2 Terms	CTV3 Terms
141E: History of hepatitis B 4J3D: Hepatitis B viral load ZV02B: [V]Hepatitis B carrier 43B4: Hepatitis B surface antig +ve 7Q052: Hepatitis B treatment drugs Band 1 9kZ: Hepatitis B screening positive - enhanced services admin A703: Viral (serum) hepatitis B Q4091: Congenital hepatitis B infection A7071: Chronic viral hepatitis B without delta-agent EMISNQHO3: "EMISNQHO3" A7070: Chronic viral hepatitis B with delta-agent A7051: Acute delta-(super)infection of hepatitis B carrier	

Name	HCV_MA
Description	Born to mother with HCV
Selection	Latest
Referenced by sections	
Referenced by measures	Call08, Off08, Tst08, Ref08, Refe08

Read V2 Terms	CTV3 Terms
4JQD: Hepatitis C viral ribonucleic acid PCR positive 4JQF: Hepatitis C antigen positive 9NgR: On hepatitis C treatment plan 9kV: Hepatitis C screening positive - enhanced services admin A70z0: Hepatitis C EMISNQHE6: "EMISNQHE6" ZV02C: [V]Hepatitis C carrier A7072: Chronic viral hepatitis C EMISNQHE11: "EMISNQHE11" EMISNQHE29: "EMISNQHE29" A70A: Hepatitis C genotype 1 A70G: Acute hepatitis C	

Name	CHILD_CARE
Description	Child in care
Selection	Latest
Referenced by sections	
Referenced by measures	Call09, Off09, Tst09, Ref09, Refe09

Read V2 Terms	CTV3 Terms
13IB0: Child in foster care 6A50: Child in care statutory review meeting 13Ii: Subject to care order under Children Act 1989 9Ngz9: In transition from children's to adult care service 13Ij: Subject to interim care order under Children Act 1989	

Name	PRISON
Description	Prison
Selection	Latest
Referenced by sections	
Referenced by measures	Call10, Off10, Tst10, Ref10, Refe10

Read V2 Terms	CTV3 Terms
13HQ: In prison 13H9: Imprisonment record ZV625: [V]Legal problems	

Name	ALTERED_ALT
Description	Altered ALT levels
Selection	Latest
Referenced by sections	
Referenced by measures	Call11, Off11, Tst11, Ref11, Refe11

Read V2 Terms	CTV3 Terms
44G2: Liver enzymes abnormal 44G31: ALT/SGPT level abnormal	

Name	HCV
Description	Hepatitis C
Selection	Latest
Referenced by sections	
Referenced by measures	Call12, Off12, Tst12, Ref12, Refe12

Read V2 Terms	CTV3 Terms
9kV: Hepatitis C screening positive - enhanced services admin 7Q053: RSV treatment and Hepatitis C treatment drugs Band 1 A7040: Viral hepatitis C with coma A7050: Viral hepatitis C without mention of hepatic coma A7072: Chronic viral hepatitis C A70z0: Hepatitis C	

ZV02C: [V]Hepatitis C carrier Q409: Congenital viral hepatitis ZV026: [V]Viral hepatitis carrier 14i: H/O hepatitis C antiviral drug therapy EMISNQHE29: "EMISNQHE29"	

Name	HC_TEST
Description	Hepatitis C testing
Selection	Latest
Referenced by sections	HC_TEST, HC_TEST, HC_TEST
Referenced by measures	Call12, Off12, Ref12, Refe12

Read V2 Terms	CTV3 Terms
2J1: Hepatitis C status 2J12: Hepatitis C non immune 43B7: Hepatitis C non-immune 43dD: Hepatitis C recombinant immunoblot assay 43h3: Hepatitis C PCR 43j5: Hepatitis C nucleic acid detection 43k1: Hepatitis C antigen level 43q: Hepatitis C virus RNA assay 43X2: Hepatitis C antibody test 43X3: Hepatitis C antibody test positive 43X6: Hepatitis C antibody level 4J3B: Hepatitis C viral load 65PM: Hepatitis C contact 65Q7: Viral hepatitis carrier 677Q: Hepatitis C screening counselling 6829: Hepatitis C screening 4JQC: Hepatitis C viral ribonucleic acid PCR negative 4JQE: Hepatitis C antigen negative 8I3v: Hepatitis C screening declined 677Q: Hepatitis C screening counselling 43j50: Hepatitis C nucleic acid detection assay 9kT: Hepatitis C screening negative - enhanced services admin 9kR: Chronic hepatitis annual review - enhanced services admin EMISNQHE30: "EMISNQHE30" ZV01B: [V]Contact with and exposure to viral hepatitis	

Name	HC_TEST_E
Description	Hepatitis C testing earliest
Selection	Earliest

Referenced by sections	
Referenced by measures	Tst12

Read V2 Terms	CTV3 Terms
2J1: Hepatitis C status 2J12: Hepatitis C non immune 43B7: Hepatitis C non-immune 43dD: Hepatitis C recombinant immunoblot assay 43h3: Hepatitis C PCR 43j5: Hepatitis C nucleic acid detection 43k1: Hepatitis C antigen level 43q: Hepatitis C virus RNA assay 43X2: Hepatitis C antibody test 43X3: Hepatitis C antibody test positive 43X6: Hepatitis C antibody level 4J3B: Hepatitis C viral load 65PM: Hepatitis C contact 65Q7: Viral hepatitis carrier 677Q: Hepatitis C screening counselling 6829: Hepatitis C screening 4JQC: Hepatitis C viral ribonucleic acid PCR negative 4JQE: Hepatitis C antigen negative 8I3v: Hepatitis C screening declined 677Q: Hepatitis C screening counselling 43j50: Hepatitis C nucleic acid detection assay 9kT: Hepatitis C screening negative - enhanced services admin 9kR: Chronic hepatitis annual review - enhanced services admin EMISNQHE30: "EMISNQHE30" ZV01B: [V]Contact with and exposure to viral hepatitis	

Name	REF
Description	Referred to Secondary Care Services
Selection	Latest
Referenced by sections	REF, REF, REF
Referenced by measures	

Read V2 Terms	CTV3 Terms
8Hk5: Referred to hepatology service EMISNQRE49: "EMISNQRE49"	

Name	X_TEST
Description	Patients to exclude from testing

Selection	Latest	
Referenced by sections		
Referenced by measures		
Read V2 Terms		CTV3 Terms
2J11: Hepatitis C immune		

Name	OFFER	
Description	Hep C screening offered	
Selection	Latest	
Referenced by sections	OFFER, OFFER	
Referenced by measures		
Read V2 Terms		CTV3 Terms
9Op1: Hepatitis C screening offered 6829: Hepatitis C screening		

Name	EOL	
Description	Palliative care	
Selection	Latest	
Referenced by sections	EOL, EOL, EOL, EOL, EOL	
Referenced by measures		
Read V2 Terms		CTV3 Terms
1Z01: Terminal illness - late stage 2JE: Last days of life 8BA2: Terminal care 8BAP: Specialist palliative care 8BAS: Specialist palliative care treatment - daycare 8BAT: Specialist palliative care treatment - outpatient 8BAe: Anticipatory palliative care 8BJ1: Palliative treatment 8CM1%: On gold standards palliative care framework !8CM15: (Excluding) GSF prognostic indicator stage A (blue) - yr plus prognosis 8CM4: Liverpool care pathway for the dying 8CME: Has end of life advance care plan 8H6A: Refer to terminal care consult 8H7L: Refer for terminal care 8H7g: Referral to palliative care service 8HH7: Referred to community specialist palliative care team 8IEE: Referral to community palliative care team declined		

9EB5: DS 1500 Disability living allowance completed 9Ng7: On end of life care register ZV57C: [V]Palliative care 8CMQ: On Liverpool care pathway for the dying 9NgD: Under care of palliative care service 9G8: Ambulance service notified of patient on EoL care register 9c0P: Current palliative oncology treatment 9c0N: Current supportive care for terminal illness 8CMW3: End of life care pathway 9K9: Palliative care handover form completed 9367: Patient held palliative care record 9c0L0: Planned palliative oncology treatment 9c0M: Planned supportive care for terminal illness 9NNd: Under care of palliative care specialist nurse 8CMb: Integrated care priorities for end of life 8CMg: End of life advance care plan 8B2a: Prescription of palliative care anticipatory medication 9NNf0: Under care of palliative care physician 38QH: Palliative Care Outcomes Collaboration Assessment Toolkit 38QK: Palliative Care Problem Severity Score	

Name	RIP	
Description	Death	
Selection	Latest	
Referenced by sections		
Referenced by measures		
Read V2 Terms		CTV3 Terms
22J%: O/E - dead 9134: Registration ghost - deceased 94%: Death administration !942: (Excluding) Medical cert. of still-birth !94Z%: (Excluding) Death administration NOS 9234: FP22-death		

Name	ALT	
Description	ALT levels	
Selection	Latest	
Referenced by sections		
Referenced by measures		
Read V2 Terms		CTV3 Terms

44G3%: ALT/SGPT serum level	

Name	XINVITE	
Description	Exclude patient from invite column	
Selection	Latest	
Referenced by sections	XINVITE	
Referenced by measures		
Read V2 Terms		CTV3 Terms
682A: Hepatitis C screening not offered		

References

1. Sculpher M. Evaluating the cost-effectiveness of interventions designed to increase the utilization of evidence-based guidelines. *Family practice* 2000;17 Suppl 1:S26-31.
2. Ng ES, Diaz-Ordaz K, Grieve R, et al. Multilevel models for cost-effectiveness analyses that use cluster randomised trial data: An approach to model choice. *Stat Methods Med Res* 2016;25(5):2036-52. doi: 10.1177/0962280213511719 [published Online First: 2013/12/19]
3. (NICE) NIoHaCE. Guide to the methods of technology appraisal PMGP. NICE, 2013.
4. Harris RJ, Harris HE, Mandal S, et al. Monitoring the hepatitis C epidemic in England and evaluating intervention scale-up using routinely collected data. *J Viral Hepat* 2019 doi: 10.1111/jvh.13063 [published Online First: 2019/01/22]
5. Miners AH, Martin NK, Ghosh A, et al. Assessing the cost-effectiveness of finding cases of hepatitis C infection in UK migrant populations and the value of further research. *Journal of Viral Hepatitis* 2014;21(9):616-23. doi: 10.1111/jvh.12190
6. Martin NK, Vickerman P, Miners A, et al. The cost-effectiveness of HCV antiviral treatment for injecting drug user populations. *Hepatology* 2012;55(1):49-57. doi: 10.1002/hep.24656 [doi]
7. Office for National Statistics. National Life Tables: 2015-2017. 2018
8. Simmons R, Ireland G, Irving W, et al. Establishing the cascade of care for hepatitis C in England-benchmarking to monitor impact of direct acting antivirals. *J Viral Hepat* 2018;25(5):482-90. doi: 10.1111/jvh.12844 [published Online First: 2017/12/15]
9. Irving WL, McLauchlan J, Foster G. Real world outcomes of DAA therapy for chronic hepatitis C virus infection in the HCV Research UK National cohort. *J Hepatol* 2017;66(1):S504. doi: 10.1016/S0168-8278(17)31408-3
10. Bourlière M, Gordon C, Flamm S, et al. Sofosbuvir, Velpatasvir, and Voxilaprevir for Previously Treated HCV Infection. *N Engl J Med* 2017;376(22):2134-46. doi: 10.1056/NEJMoa1613512
11. Ward T, Gordon J, Bennett H, et al. Tackling the burden of the hepatitis C virus in the UK: characterizing and assessing the clinical and economic consequences. *Public Health* 2016;141:42-51. doi: 10.1016/j.puhe.2016.08.002 [published Online First: 2016/12/10]
12. Hurley R. Slashed cost of hepatitis C drugs spurs drive to eliminate the disease. *BMJ* 2018;361
13. Shepherd J, Jones J, Hartwell D, et al. Interferon alpha (pegylated and non-pegylated) and ribavirin for the treatment of mild chronic hepatitis C: a systematic review and economic evaluation. *Health TechnolAssess* 2007;11(11):1-205, iii. doi: 04/49/01 [pii]

14. Grishchenko M, Grieve R, Sweeting M, et al. Cost-effectiveness of pegylated interferon and ribavirin for patients with chronic hepatitis C treated in routine clinical practice. *Int J Technol Assess Health Care* 2009;25(2):171-80.
15. Wright M, Grieve R, Roberts J, et al. Health benefits of antiviral therapy for mild chronic hepatitis C: randomised controlled trial and economic evaluation. *Health Technol Assess* 2006;10(21):1-113, iii. doi: 95-24-03 [pii]
16. Ratcliffe J, Longworth L, Young T, et al. Assessing health-related quality of life pre- and post-liver transplantation: a prospective multicenter study. *Liver Transpl* 2002;8(3):263-70.
17. McDonald SA, Hutchinson SJ, Palmateer NE, et al. Decrease in health-related quality of life associated with awareness of hepatitis C virus infection among people who inject drugs in Scotland. *JHepatol* 2013;58(3):460-66. doi: S0168-8278(12)00836-7 [pii];10.1016/j.jhep.2012.11.004 [doi]
18. Martin NK, Hickman M, Miners A, et al. Cost-effectiveness of HCV case-finding for people who inject drugs via dried blood spot testing in specialist addiction services and prisons. *BMJ open* 2013;3(8) doi: 10.1136/bmjopen-2013-003153
19. Hartwell D, Jones J, Baxter L, et al. Peginterferon alfa and ribavirin for chronic hepatitis C in patients eligible for shortened treatment, retreatment, or in HCV/HIV co-infection: a systematic review and economic evaluation. *Health Technol Assess* 2011;15:1-210.
20. Sweeting MJ, D. DA, Brant LJ, et al. The burden of hepatitis C in England. *JViral Hepat* 2007;14(8):570-76. doi: JVH851 [pii];10.1111/j.1365-2893.2007.00851.x [doi]
21. Van der Meer AJ, Veldt BJ, Feld JJ, et al. Association between sustained virological response and all-cause mortality among patients with chronic hepatitis c and advanced hepatic fibrosis. *JAMA* 2012;308(24):2584-93. doi: 10.1001/jama.2012.144878
22. Morgan RL, Baack B, Smith BD, et al. Eradication of hepatitis c virus infection and the development of hepatocellular carcinoma: A meta-analysis of observational studies. *Ann Intern Med* 2013;158(5):329-37. doi: 10.7326/0003-4819-158-5-201303050-00005