Anti-Hepatitis C (HCV) test positivity and new HCV diagnoses among women tested in antenatal services in England between 2015-2019

Objective

To determine associations with hepatitis C virus (HCV) positivity, new HCV diagnoses and subsequent linkage to HCV treatment services among pregnant women in England.

Method

A retrospective cohort using .routine laboratory tests for HCV-specific antibody (anti-HCV) and HCV-RNA undertaken during antenatal attendances England. All women receiving at least one anti-HCV test during an antenatal clinic attendance between 2015-2019 were included. Multivariable logistic regression was used to investigate sociodemographic associations with anti-HCV test positivity among pregnant women who did (PWIDs) and did not (non-PWIDs) inject drugs, as well as to identify sociodemographic factors associated with being newly diagnosed during pregnancy. Linkage to antiviral treatment services and treatment outcomes were determined for those women who tested HCV-RNA positive.

Results

32,088 women (median age 32 years, 19,664 (61%) UK-born, 337 (1.1%) PWID) received an anti-HCV test among whom 814 (2.5%) had a positive anti-HCV test (95% confidence interval [2.4-2.7%]). Anti-HCV test positivity was 2.1% [2.0-2.3%] among non-PWIDs and 40% [35-46%] among PWIDs. In multivariable analyses among non-PWIDs, anti-HCV test positivity was associated with older age, living in more deprived areas, and varied by ethnicity and country of birth. Among PWIDs, anti-HCV test positivity was associated with older age only. Three hundred and twenty (39%) of the women testing anti-HCV positive were new diagnoses; those who were newly diagnosed were younger and lived in less deprived than those with a prior diagnosis whereas PWIDs were less likely to be newly diagnosed. HCV-RNA positivity was 52% (n=330/640, 95%CI[47.6-55.5%]) among those with an HCV-RNA test within 30 days, and 75% (n=220/293, 95%CI[69.7-79.9%]) of those eligible for treatment had engaged in HCV treatment services after antenatal testing.

Conclusions

Antenatal testing for HCV provides an opportunity for new case findings and engagement with treatment services where needed. Therefore, universal opt-out testing for HCV antenatally should be reconsidered.

Keywords: Hepatitis C virus, antenatal testing, linkage to treatment

Introduction

In 2016, the World Health Organization (WHO) released a strategy that aimed to eliminate viral hepatitis as a public health threat by the year 2030, as well as reduce the incidence of, and death from, chronic hepatitis (World Health Organization, 2016). It is estimated that internationally 95% of deaths from viral hepatitis are attributable to hepatitis B (HBV) and C (HCV) viruses (World Health Organization, 2016). England has committed to the WHO strategy to eliminate viral hepatitis as a public health threat (The UK Health Security Agency, 2022a). In 2020, it was estimated that there were 81,000 people living with chronic HCV infection in England (The UK Health Security Agency, 2022a), the majority of whom either had no history of injecting (n=8,700) or a previous injecting risk only (n=50,200) meaning that they were unlikely to be identified through routine testing in drug and alcohol services. Furthermore, only 30% of people who inject drugs (PWID) sampled in a cross-sectional survey in the UK were aware of their current chronic HCV infection (The UK Health Security Agency, 2022b).

HCV has a long progression time, remaining asymptomatic and often undetected for decades before liver cirrhosis may develop (Sweeting et al., 2006). People with HCV in England tend to have a late presentation, with an estimated around half of those with liver cirrhosis being diagnosed in the previous two years (The UK Health Security Agency, 2022a), and 17% of those with HCV-associated end-stage liver disease (ESLD) presenting with this prior to HCV diagnosis (Ireland et al., 2020). Therefore, to prevent future disease burden and transmission of HCV it is important to diagnose promptly with early linkage to care and treatment. New approaches to increase testing coverage outside traditional testing services, such as opt-out screening in accident and emergency departments or antenatal services, are needed to improve treatment coverage and reduce HCV morbidity and mortality (Evans et al., 2018; Selvapatt et al., 2015).

Antenatal screening in the UK routinely offers syphilis, HIV and HBV testing (Public Health England, 2020). These are usually done by 10 weeks gestation at an appointment with a midwife in the community or at a hospital (https://www.nhs.uk/pregnancy/your-pregnancy-care/screening-for-hepatitis-b-hiv-and-syphilis/). Acceptance of antenatal HBV screening in 2019/20 was 99.8% (657,375 women screened) with a test positivity rate of 3.77 per 1,000 women tested and a new diagnosis rate of 0.86 per 1,000 women tested (Public Health England, 2021). In contrast, routine universal HCV testing is not currently recommended as part of antenatal screening, due to a low risk of infant acquisition following childbirth, lack of trial evidence on the efficacy of treatment for HCV in pregnancy, and uncertainty about the prevalence of HCV infection among pregnant women (Solutions for Public Health, 2018). However, national guidance recommends opportunistic risk-based HCV testing within antenatal services for women with risk factors for HCV, such as injecting drug use or being from a country with a high HCV prevalence (National Institute for Health and Care Excellence, 2012). These recommendations are supported by findings from a cross-sectional survey of maternity service providers in England, where the majority of service providers (87%) offered HCV testing to pregnant women with risk factors, which was mostly done via a routine risk assessment; most common risk factors considered were a history of injecting drugs, or a previous diagnosis of hepatitis B or HIV (Vusirikala et al., 2022). Half of those surveyed indicated that where official local guidance for discussing blood-borne virus testing was in place, this guidance did not include guidance on HCV (Vusirikala et al., 2022).

Previous research in London found that when adopting a universal HCV testing service, most (73%) of those newly diagnosed would not have been identified through risk-based screening (Ward et al., 2000). More recent research has found a higher prevalence of HCV among women tested antenatally who were born in Eastern Europe, who may not have met routine risk assessment criteria (Cortina-Borja, Williams, Peckham, Bailey, & Thorne, 2016),

depending on how the national guidance for testing of people born in countries of intermediate or high prevalence had been implemented at a local level (National Institute for Health and Care Excellence, 2012). In one antenatal clinic in London that has adopted opt-out anti-HCV testing, the test positivity was similar to that of antenatal HBV testing (3.85 per 1,000 women tested) (Selvapatt et al., 2015).

An international systematic review for HCV case-finding and linkage to care found mixed evidence for the cost-effectiveness of antenatal screening which depended upon the prevalence in the population and successful linkage to HIV services (Public Health England, 2019). Antenatal screening for HCV has been demonstrated to be cost-effective in certain areas of the UK, such as London (Selvapatt et al., 2015), although screening was also modelled to be cost-effective in areas of lower HCV prevalence, which may apply to the UK more widely. Given the new era of HCV treatment, where direct-acting antivirals (DAAs) offer a highly effective and tolerable treatment compared to previous interferon treatments (Dore & Feld, 2015; Martin et al., 2013), antiviral treatment for those who are HCV-RNA positive at antenatal screening may not only improve the health of pregnant women, their partners, and their children, but also prevent onwards transmission (Orkin, Jeffery-Smith, Foster, & Tong, 2016). However, treatment for HCV is not currently recommended whilst pregnant and breastfeeding given the lack of large scale studies on safety in pregnancy (Chappell et al., 2020), although longitudinal trials are ongoing (Gupta, Hiebert, Armstrong, Wester, & Ward, 2022). This may act as a barrier to treatment and increase the number of women who do not return for HCV care, particularly women from under-served and marginalised groups like PWIDs (Krans et al., 2016).

Using data from the sentinel surveillance of blood borne virus testing (SSBBV) conducted between 2015 and 2019, we investigated HCV testing in antenatal services, and the subsequent linkage into HCV treatment services for those found to be HCV positive. In this

article, we investigate sociodemographic factors associated with hepatitis C-specific antibody (anti-HCV) test positivity among women tested as part of antenatal care and factors associated with a new HCV diagnosis among those testing positive. Using data collected through the HCV treatment database we identified those who were referred for treatment, and their corresponding treatment outcome.

Methods

The SSBBV in England was established in 2002 (Public Health England, 2020) and captures testing conducted at any one of 23 sentinel laboratories across England. Participating laboratories are estimated to cover approximately 40% of the English population and are broadly representative of most laboratories providing HCV testing. Data collection methods for SSBBV have been described previously (Brant et al., 2007). Demographic and testing data were extracted for females aged 12-49 years tested antenatally for anti-HCV, indicative of current or cleared HCV, from 2015-2019. The test request location and clinical details accompanying the test request were used to distinguish women assumed to be tested for HCV as part of routine antenatal screening from those tested in other settings and for other reasons. For those with multiple tests in the study period, the first antenatal anti-HCV test was used in analyses. Where possible, the date of first HCV infection diagnosis in SSBBV was updated by the routine laboratory reports of HCV. The routine laboratory reports of HCV were linked to SSBBV using full name, NHS (National Health Service) number (a unique identifier used when accessing healthcare across England) and date of birth. Injecting drug use was determined by the reporting of injecting drug use through SSBBV or from information on a previous test for blood borne viruses in a drug service.

Deprivation of residence was ascertained using the participant's postcode with indices of deprivation grouped at a small local level (Lower-layer Super Output Areas) into deciles (Ministry of Housing Communities & Local Govenment, 2019). Deprivation decile of residence was then used as a continuous variable where higher deprivation decile indicated lower deprivation.

Among those who were anti-HCV positive, participants who had a positive test in SSBBV or from laboratory reports prior to the antenatal test date were considered to be previously diagnosed, with all remaining participants who tested anti-HCV positive considered to be newly diagnosed with HCV.

HCV-RNA testing data from SSBBV were used to identify those with treatment needs among those testing anti-HCV positive (antiviral treatment for HCV is provided to those who are HCV-RNA positive). Linkage to treatment services was determined for all of those with a positive HCV-RNA test within (+/-) 30 days of their anti-HCV positive antenatal test date. Whether treatment had resulted in a sustained virological response (SVR; treatment completion and clearance of HCV) was determined from clinical reporting of treatment outcomes.. To do this, data from SSBBV was linked to the HCV treatment database (2015-2021) by a combination of NHS number, soundex (a coded version of a person's surname), date of birth and gender. Where SVR was not recorded, a negative HCV-RNA test between 12 and 52 weeks was used as a proxy for SVR achievement. These analyses were restricted to those who started treatment from 2015-2020 due to reporting delay of SVR for women starting treatment in 2021.

Linkage to live births

Data were linked to the Office of National Statistics registry of live births, a dataset of all women who gave birth in England between 2015-2020, to obtain the mother's country of birth, using a combination of mother's surname, soundex and mother's date of birth.

Public engagement

The findings of the study were presented to a public engagement group to receive feedback and to discuss implications for antenatal care in relation to their own antenatal experiences, as well as potential implications to a change in HCV antenatal testing policy. The group consisted of women who had engaged in antenatal care in the past three years recruited from antenatal services and personal networks.

Ethics

Laboratory diagnosis data are collated and processed by X as part of surveillance of HCV infection and disease. These data collections are covered by Health Service (Control of Patient Information) Regulations 2002 (regulation 3) which makes provisions for the recognition, control and prevention of communicable diseases and other risks to public health. Caldicott approval, an approval process that ensures national guidance of anonymity of healthcare data is upheld, was obtained for the linkage between laboratory reports and the live births dataset.

Statistical Analysis

Statistical analysis was carried out in STATA (version 17). Univariable and multivariable logistic regression analyses were used to investigate sociodemographic factors associated with (i) anti-HCV test positivity among women tested antenatally and (ii) being newly diagnosed among those with a positive anti-HCV test. Due to difference in sociodemographic risk factors for HCV between people who do not inject drugs (non-PWIDs) and PWIDs,

regression analyses for the first outcome were stratified by PWID status. Factors where global p-values were <0.1 in univariable analyses were included in the multivariable model.

A Kaplan-Meier curve was produced to display the cumulative time to treatment initiation for those who were HCV-RNA positive, stratified by antenatal or prior diagnosis, using R (version 4.1.0). For women who were HCV-RNA positive but not linked to treatment services, follow-up was right-censored on the end date of 31st December 2021. Chi-squared tests were used to compare linkage to treatment, treatment initiation and SVR achievement between women newly diagnosed antenatally and women previously diagnosed.

Results

Between 2015-2019, 32,088 females aged 12-49 years received an anti-HCV test within an antenatal service. The median age of women tested was 32 years (range 13-49 years), 61% (n=19,664) were born in the UK and 337 (xx.x%) were PWIDs. Anti-HCV test positivity was 2.5% (n=814, 95% confidence interval (95%CI) 2.4-2.7%). Test positivity steadily decreased over the five years from 3.1% in 2015 to 1.8% in 2019.

Table 1 displays the results of analyses of sociodemographic factors associated with anti-HCV test positivity among non-PWIDs and PWIDs. Among non-PWIDs, anti-HCV test positivity was 2.1% (n=678/31,751, 95%CI 2.0-2.3%). In the multivariable logistic regression among non-PWIDs increases in age were associated with increased odds of anti-HCV test positivity. Anti-HCV positivity varied by ethnicity whereby being of Asian Bangladeshi, Black or Chinese ethnicity was associated with reduced odds of anti-HCV positivity compared to White British and Irish ethnicity and being of Asian Pakistani ethnicity was associated with increased odds of anti-HCV positivity. Anti-HCV positivity also varied by region of birth where a country of birth in Asia, or Western and Eastern

Europe was associated with increased odds of anti-HCV positivity compared to birth in the UK, and an African country of birth was associated with reduced odds of anti-HCV positivity. Additionally, a higher deprivation of residence decile, which indicates residing in a less deprived area, was associated with reduced odds of anti-HCV positivity.

Among PWIDs, anti-HCV test positivity was 40% (n=136/337, 95%CI 35-46%). Older age was the only factor significantly associated with an increased odds of anti-HCV test positivity in univariable analyses (Table 1).

New diagnoses

Among those who tested anti-HCV positive, 39% (n=320, 95%CI 36.0-42.8%) had no previous diagnosis in SSBBV or through routine laboratory reports of hepatitis C and were considered to be newly diagnosed. Table 2 displays the associations of sociodemographic factors with a new HCV diagnosis among those testing positive. Due to substantial collinearity between ethnicity and region of birth, only region of birth was entered into the multivariable model. In multivariable logistic regression analyses, being older and being a PWID were associated with reduced odds of the antenatal positive test being a new diagnosis. Being born in Eastern Europe compared to being born in the UK and residing in a less deprived area were associated with increased odds of being a new diagnosis.

HCV-RNA positivity

Among those that tested anti-HCV positive, 79% (n=640/814) of women had had an RNA test within 30 days (71% (n=581/814) within 7 days). There was no significant difference in age (p=0.225), being a PWID (p=0.635), being newly diagnosed with HCV antenatally (p=0.674) and country of birth (p=0.836) between women who received an RNA test within 30 days and those who did not, although women who received a test within 30 days were more likely to be of White ethnicity than those who were not tested within 30 days (64% vs.

53%, p<0.05). Among women receiving a test within 30 days, 52% (n=330/640, 95%CI 47.6-55.5%) tested HCV-RNA positive. The median age of women testing HCV-RNA positive was 33 years (range 18-49), 63% (n=209/330) were White British and nearly one fifth (18%, n=61/330) were PWID. Overall, 45% (n=148/330) of those who were HCV-RNA positive were newly diagnosed, but among PWIDs, this was only 18% (n=11/61).

Linkage to HCV treatment services

Thirty-six women had already been linked to treatment services prior to testing HCV-RNA positive in their antenatal clinic. Three of these women had received treatment prior to this test, two of whom tested in an antenatal setting within five months of first starting HCV treatment and one who was lost to follow-up from HCV treatment services.

There were 293 women eligible for postnatal HCV treatment as 37 women experienced spontaneous clearance of HCV-RNA after antenatal testing (i.e. they tested HCV-RNA negative without treatment), and thus treatment was not required. Of those with a positive HCV-RNA test, 75% (n=220/293, 95%CI 69.7-79.9%) were linked to treatment services after antenatal testing and 71% (n=207/293, 95%CI 65.1-75.8%) had started HCV treatment. Linkage to treatment services was similar (p=0.662) for those who were previously diagnosed (76%, n=121/159) and for those newly diagnosed (74%, n=99/159), with treatment initiation also being similar between the two groups (72%, n=114/159 and69%, n=93/134, respectively, p=0.667). The median duration between antenatal anti-HCV testing and treatment was 2.3 years overall, with no significant difference between those newly diagnosed or previously diagnosed (2.2 vs 2.3 years, p=0.52, log-rank test, Figure 1).

Of those that were treated and who received treatment from 2015-2020, the rate of SVR was 74% overall (n=144/194, 95%CI 67.5-80.2%), and in those with (78% n=69/88) and without (71%, n= 75/106) a new diagnosis (p=0.225).

Discussion

This study aimed to investigate HCV antenatal testing in England which is currently not recommended as a universal programme. We found a relatively high test positivity in comparison to HBV antenatal screening (2.5% vs. 0.4%) (Public Health England, 2021), which is not unexpected since risk-based testing was being conducted in the majority of antenatal services. Similarly, the test positivity rate observed in this study was higher compared to an antenatal service offering opt-out HCV testing in London (2.5% vs. 0.4%) (Selvapatt et al., 2015). Over half of those who tested anti-HCV positive also tested HCV-RNA positive, highlighting a need for linkage to care for treatment and partner notification/testing of other children. Given late diagnosis of people with HCV (Ireland et al., 2020; Sweeting et al., 2006; The UK Health Security Agency, 2022a), a large proportion of these women could have been diagnosed earlier, at the time of pregnancy, if opt-out antenatal testing for HCV was in place. Additionally, women born in certain regions that are at increased risk of HCV should have met the inclusion criteria for risk-based screening based on current guidelines (National Institute for Health and Care Excellence, 2012). Therefore, if risk-based screening is to continue in certain regions of England, it is possible that training on at-risk populations may be needed.

PWID had a high rate of anti-HCV test positivity (40%) but many of these women had previously received a diagnosis of HCV, and thus this was associated with reduced odds of being newly diagnosed in antenatal settings. However, several women testing HCV-RNA positive were PWID who had been diagnosed previously. Therefore, testing PWIDs for HCV-RNA in antenatal clinics provides an opportunity to support women to re-engage with HCV treatment and care services. Despite the challenges in achieving this (Krans et al.,

2016), our study found that two-thirds of women were linked to postnatal HCV treatment, a higher rate than that found in other settings such as emergency departments (Parry et al., 2018).

Anti-HCV positivity also varied by ethnicity and country of birth. Similar to previous research in England, being from Eastern Europe was associated with anti-HCV positivity and being newly diagnosed among non-PWID women (Cortina-Borja et al., 2016). Antenatal testing for HCV among women who were born outside the UK can provide an opportunity to diagnose women earlier and to engage in healthcare and treatment, as well as providing an opportunity to reengage in treatment services for those previously diagnosed. Women who had an Asian ethnicity as well as women born in Asia also had increased odds of anti-HCV positivity. It is recommended that these women are screened for HCV antenatally (National Institute for Health and Care Excellence, 2012), but it is unclear how well this guidance is implemented (Vusirikala et al., 2022). Given the complexities of targeting people based on ethnicity and migration status, such as missed (or fewer) opportunities for testing or being perceived as discriminatory or stigmatising, even if antenatal screening is not adopted across England, opt-out testing in more diverse regions could be more appropriate as an alternative to risk-based testing. Additionally, for services that do not adopt opt-out testing, training for midwifes may be needed to ensure that populations which may benefit from HCV antenatal testing in addition to PWID are provided with appropriate care.

Residing in a more deprived area was associated with an increased likelihood of anti-HCV positivity and a reduced likelihood of a new HCV diagnosis. Utilising HCV antenatal testing in more deprived regions only may result in more anti-HCV test positivity but may fail to diagnose some people with HCV residing in less deprived regions. Therefore, providing opt-out testing regardless of the local level of deprivation would provide an opportunity to support women to access care and treatment services in deprived areas, regardless of their

HCV status, and increase the number of women in areas of less deprivation who are aware of their HCV status.

Linkage to HCV treatment services was sub-optimal among women testing in antenatal settings, however this may be partially explained by the fact that treatment is not recommended whilst pregnant and breastfeeding (Chappell et al., 2020). This may also contribute to the long period of time between antenatal testing and treatment start. Therefore, ongoing work is needed to ensure women who receive a positive HCV-RNA test in antenatal services are supported to remain in care throughout pregnancy and childbirth, and to have the opportunity for treatment as soon as possible. Whether midwives could play a greater role in terms of ensuring initial engagement with treatment services, regardless of when treatment can be initiated, and helping women to remain engaged with treatment services should be considered. Improving linkage to treatment should be a priority for service providers if HCV antenatal testing is to be cost-effective (Public Health England, 2019). The proportion of those achieving an SVR was similar to that previously reported for England (The UK Health Security Agency, 2022a), which demonstrates a high likelihood of treatment success when women who are diagnosed with HCV antenatally start treatment.

We have identified several limitations. The period of 2015-2019 was chosen as 2015 is the baseline year for benchmarking WHO elimination progress and 2020 was excluded to minimize the potential effect of the COVID-19 pandemic and social distancing restrictions on the provision of antenatal testing (Mitchell et al., 2022). However, a limitation of this analysis is that data were linked to the treatment database including during the pandemic (2015-2021). This was reasonable given the median duration between diagnosis and treatment, however, the linkage to care estimate may have been affected by disruption to healthcare services caused by the COVID-19 pandemic. Additionally, the categorisation of a person with a positive HCV test as a new diagnosis and identifying the proportion linked to treatment

services were both partly reliant on linkage between databases and therefore true matches may have been missed if data on identifiers or test results were missing or incomplete. The majority of PWID were White British, and therefore our ability to identify risk factors relating to ethnicity and country of birth were limited. Furthermore, as SSBBV is a database of approximately 40% of HCV testing in England, testing conducted outside of these centres and timeframe would not be included in analyses. Despite these limitations, this is a comprehensive analysis of HCV antenatal testing using available surveillance data in England, with important implications for policy.

In conclusion, given the new era of DAA treatment for HCV, antenatal testing provides a great opportunity for new case finding and linkage to treatment for women newly and previously diagnosed, as they are engaged in a managed care pathway with follow-up post-partum. We found that while well-known risk factors for HCV, such as injection drug use, were associated with anti-HCV positivity, a risk-based testing approach may miss women with less-frequently considered characteristics indicative of a high risk of HCV infection, such as an endemic region of birth and ethnicity, which are also challenging to assess. Given that around two-thirds of the population that are undiagnosed with HCV in England are not current drug users, antenatal testing may provide an additional method for case finding among a group that is not routinely offered testing (The UK Health Security Agency, 2022a). Additionally, if England is to achieve the WHO targets of reducing morbidity and mortality from HCV, new strategies for case finding and linkage to treatment, like opt-out antenatal testing, should be considered as this will provide not only an opportunity to treat the women tested antenatally, but also their partners and other children who may also require treatment. Modelling studies may help to understand the most effective and cost-effective combination of risk-based and universal screening options to achieve and sustain targets to eliminate HCV as a public health threat.

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Table 1. Univariable and multivariable logistic regression analyses for factors associated with anti-HCV positivity among women tested in antenatal settings.

	People who do not inject drugs (N=31,751)						People who inject drugs (N=337)			
	Anti-HCV negative N=31,073 *Mean (SD)*	Anti-HCV positive N=678 Row % *Mean (SD)*	OR (95% CI)	p-value	aOR (95% CI)	p-value	Anti-HCV negative N=201 *Mean (SD)*	Anti-HCV positive N=136 Row % *Mean (SD)*	OR (95% CI)	p-value
Age	*32 (6.4)*	*33.6 (5.9)*	*1.04 (1.03, 1.05)*	*<0.0001*	*1.05 (1.04, 1.06)*	*<0.0001*	*32.8 (5.5)*	*34.4 (5.4)*	*1.06 (1.01, 1.10)*	*0.008*
Ethnicity				*<0.0001*		*<0.0001*				0.907
White British/Irish	19,372	378 (1.9%)	ref.		ref.		178	125 (41%)	ref.	
White Other	3,662	144 (3.8%)	2.02 (1.66, 2.45)		1.13 (0.89, 1.44)		9	5 (36%)	0.79 (0.26, 2.42)	
Asian Indian	830	16 (1.9%)	0.99 (0.60, 1.64)		0.85 (0.50, 1.44)		1	0 (0%)	-	
Asian Pakistani	1,549	67 (4.1%)	2.22 (1.70, 2.89)		1.62 (1.19, 2.20)		3	0 (0%)	-	
Asian Bangladeshi	465	5 (1.1%)	0.55 (0.53, 1.34)		0.37 (0.15, 0.92)		2	0 (0%)	-	
Asian Other	1,028	24 (2.3%)	1.20 (0.79, 2.89)		0.89 (0.56, 1.39)		2	0 (0%)	-	
Black Caribbean /African/Other	1,482	6 (0.4%)	0.21 (0.09, 0.47)		0.20 (0.09, 0.45)		1	1 (50%)	1.42 (0.09, 22.98)	
Chinese	507	4 (0.8%)	0.40 (0.15, 1.09)		0.30 (0.11, 0.83)		0	0	-	
Other/unknown	2,178	34 (1.5%)	0.80 (0.56, 1.14)		0.62 (0.42, 0.99)		5	5 (50%)	1.42 (0.40, 5.02)	
Region of birth				*<0.0001*		*<0.0001*				0.956
UK	19,062	323 (1.7%)	ref.		ref.		170	111 (40%)	ref.	
Western and Southern Europe	1,494	63 (4.0%)	2.49 (1.89, 3.28)		2.35 (1.75, 3.16)		7	7 (50%)	1.53 (0.52, 4.49)	
Eastern Europe	2,081	109 (5.0%)	3.09 (2.48, 3.86)		2.80 (2.15, 3.64)		4	2 (33%)	0.77 (0.13, 4.25)	
Africa	2,546	25 (1.0%)	0.58 (0.38, 0.87)		0.63 (0.41, 0.97)		3	3 (50%)	1.53 (0.30, 7.72)	
Asia	3,497	100 (2.8%)	1.69 (1.34, 2.11)		1.58 (1.19, 2.10)		7	3 (30%)	0.66 (0.17, 2.59)	
Central and Southern America	402	8 (2.0%)	1.17 (0.58, 2.38)		0.99 (0.49, 2.04)		2	2 (50%)	1.53 (0.21, 11.03)	
North America	232	2 (0.9%)	0.51 (0.13, 2.06)		0.49 (0.12, 1.98)		2	1 (33%)	0.77 (0.07, 8.55)	
Oceania	160	1 (0.6%)	0.36 (0.05, 2.64)		0.34 (0.05, 2.45)		1	1 (50%)	1.53 (0.09, 24.74)	
Unknown	1,599	47 (2.9%)	1.73 (1.27, 2.37)		1.23 (0.85, 1.78)		5	6 (55%)	1.84 (0.55, 6.17)	
Deprivation Decile	*4.6 (2.9)*	*3.8 (2.7)*	*0.90 (0.87, 0.93)*	*<0.0001*	*0.88 (0.86, 0.91)*	*<0.0001*	*3.3 (2.6)*	*3.1 (2.6)*	*0.98 (0.90, 1.06)*	*0.562*

Table 2. Univariable and multivariable logistic regression analyses for a new diagnosis among women tested anti-HCV positive in antenatal settings.

	Previously diagnosed N=494 *Mean (SD)*	Newly diagnosed (N=320), Row % *Mean (SD)*	OR (95% CI)	p-value	aOR (95% CI)	p-value
Age	*34.2 (5.7)*	*32.9 (6.0)*	*0.96 (0.94, 0.99)*	*0.0023*	*0.96 (0.94, 0.99)*	*0.0064*
Ethnicity				*0.0049*		
White British/Irish	329	174 (35%)	ref.		-	
White Other	67	82 (55%)	2.31 (1.60, 3.35)		-	
Asian Indian	9	7 (44%)	1.47 (0.54, 4.02)		-	
Asian Pakistani	44	23 (34%)	0.99 (0.58, 1.69)		-	
Asian Bangladeshi	2	3 (60%)	2.84 (0.47, 17.13)		-	
Asian Other	15	9 (38%)	1.13 (0.49, 2.65)		-	
Black Caribbean/African/Other	4	3 (43%)	1.42 (0.31, 6.41)		-	
Chinese	2	2 (50%)	1.89 (0.26, 13.54)		-	
Other/unknown	22	17 (44%)	1.46 (0.76, 2.82)		-	
Region of birth				*0.0047*		*0.0199*
UK	288	146 (34%)	ref.		ref.	
Western and Southern Europe	37	33 (47%)	1.76 (1.06, 2.93)		1.40 (0.82, 2.39)	
Eastern Europe	49	62 (56%)	2.50 (1.63, 3.81)		1.84 (1.18, 2.87)	
Africa	16	12 (43%)	1.48 (0.68, 3.21)		1.41 (0.64, 3.14)	
Asia	66	37 (36%)	1.11 (0.71, 1.73)		0.92 (0.58, 1.47)	
Central and Southern America	6	4 (40%)	1.32 (0.37, 4.73)		1.29 (0.34, 4.87)	
North America	1	2 (67%)	3.95 (0.35, 43.87)		5.65 (0.42, 76.81)	
Oceania	1	1 (50%)	1.97 (0.12, 31.76)		4.15 (0.22, 78.05)	
Unknown	30	23 (43%)	1.51 (0.85, 2.70)		1.37 (0.68, 2.75)	
Person who injects drugs				*<0.0001*		*<0.0001*
No	378	300 (44%)	ref.		ref.	
Yes	116	20 (15%)	0.22 (0.13, 0.36)		0.23 (0.14, 0.40)	
Deprivation Decile	*3.4 (2.5)*	*4.1 (2.9)*	*1.11 (1.05, 1.16)*	*0.0002*	*1.10 (1.04, 1.16)*	*0.0009*

Figure 1. Kaplan-Meier curve showing the cumulative time to treatment initiation after a positive HCV-RNA test, stratified by whether the HCV diagnosis was a new or pre-existing diagnosis.

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