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Uptake of hepatitis C specialist services and treatment following diagnosis by dried blood spot in Scotland

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ABSTRACT

Background: Dried blood spot (DBS) testing for hepatitis C (HCV) was introduced to Scotland in 2009. This minimally invasive specimen provides an alternative to venipuncture and can overcome barriers to testing in people who inject drugs (PWID).
Objectives: The objective of this study was to determine rates and predictors of: exposure to HCV, attendance at specialist clinics and anti-viral treatment initiation among the DBS tested population in Scotland.
Study design: DBS testing records were deterministically linked to the Scottish HCV Clinical database prior to logistic regression analysis.
Results: In the first two years of usage in Scotland, 1322 individuals were tested by DBS of which 476 were found to have an active HCV infection. Linkage analysis showed that 32% had attended a specialist clinic within 12 months of their specimen collection date and 18% had begun anti-viral therapy within 18 months of their specimen collection date. A significantly reduced likelihood of attendance at a specialist clinic was evident amongst younger individuals (<35 years), those of unknown ethnic origin and those not reporting injecting drug use as a risk factor.
Conclusion: We conclude that DBS testing in non-clinical settings has the potential to increase diagnosis and, with sufficient support, treatment of HCV infection among PWID.

1. Background

In Scotland, 0.8% of the population aged 15–59 years had been diagnosed with hepatitis C virus (HCV) antibodies by the end of 2012 [1]. The majority of these infections occur in individuals with a history of injecting drug use [2] and recent estimates suggest that around half of people infected with HCV remain undiagnosed [1]. To tackle the epidemic of HCV in Scotland, the Hepatitis C Action Plan for Scotland was launched in September 2006 [3]. In its initial Phase (September 2006–March 2008) the Action Plan identified poor venous access amongst people who inject drugs (PWID), along with a shortage of trained phlebotomists, and the long interval between testing and return of results, as barriers to testing and diagnosis of HCV in this population [4]. Dried blood spots (DBS), drops of whole blood from a finger prick dried onto filter paper, provide an alternative to whole blood specimens collected by venipuncture and can overcome the majority of barriers to HCV testing outlined above [5–8]. As a result of the Action Plan, DBS testing for HCV diagnosis was introduced in Scotland in May 2009. Now that DBS testing is well established in Scotland, the outcomes of DBS testing are quantifiable to give a better understanding of the utility of the DBS approach.

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Table 1
Characteristics of all persons tested by DBS for HCV from May 2009 to end of December 2010, along with characteristics of those who were found to be antibody positive. Results of the univariate and multivariate logistic regression modelling examining the association with the outcome 'HCV antibody positive' are also shown.

Variable	Characteristics	All tested (n = 1322) (%)	Antibody positive (n = 728) (%)	Odds ratio unadjusted (95% CI) p-value	Odds ratio adjusted (95% CI) p-value
Sex	Male	924 (69.9)	507 (54.9)	0.97 (0.77–1.23) p = 0.83	0.88 (0.67–1.14) p = 0.32
	Female	398 (30.1)	221 (55.5)	Ref	Ref
Age group[a]	<35 years	599 (45.3)	269 (44.9)	Ref	Ref
	≥35 years	722 (54.7)	459 (63.6)	2.14 (1.72–2.67) $p \leq 0.001$	1.93 (1.51–2.47) $p \leq 0.001$
Ethnicity	White	1094 (82.8)	641 (58.6)	2.29 (1.71–3.08) $p \leq 0.001$	2.00 (1.42–2.83) $p \leq 0.001$
	Unknown/Non-white	228 (17.2)	87 (38.2)	Ref	Ref
Source	Community addiction/harm reduction service	1180 (89.3)	669 (56.7)	1.84 (1.30–2.63) $p \leq 0.001$	1.21 (0.82–1.82) p = 0.33
	Other (GP/Hospital/Prison/Private)	142 (10.7)	59 (41.6)	Ref	Ref
Time since onset of injecting	≤10 years	171 (12.9)	80 (46.8)	Ref	Ref
	>10 years	330 (25.0)	264 (80.0)	4.55 (3.05–6.84) $p \leq 0.001$	3.58 (2.36–5.45) $p \leq 0.001$
	Not known (PWID)	630 (47.7)	342 (54.3)	1.35 (0.96–1.90) p = 0.082	1.46 (1.01–2.10) p = 0.046
	Non-PWID	191 (14.4)	42 (22.0)	0.32 (0.20–0.50) $p \leq 0.001$	0.28 (0.17–0.39) $p \leq 0.001$

[a] Age was not available for one individual making a total of 1321 for this analysis.

2. Objectives

The objective of this study was to determine the proportion of those tested by DBS in Scotland who had been exposed to HCV; of those diagnosed as being currently infected with HCV the proportion attending a specialist clinic and, of those, the proportion who were initiated on anti-viral treatment. Epidemiological information collected alongside the DBS specimens is also analysed to identify predictors of exposure, attendance and treatment initiation amongst this population.

3. Study design

3.1. Data sources and linkage

The Scottish Hepatitis C Clinical Database, held at Health Protection Scotland (HPS), contains clinical follow-up data for HCV-infected patients attending 17 specialist clinics across Scotland. These data include attendance dates, treatment episodes, demographic, clinical, virological, and patient identifiers (date of birth, sex, surname Soundex (a consonant-only phonetic encoding), and forename initial). Data were restricted to individuals on the database on 31 December 2012 and at this date the database contained records for 14,298 individuals with sufficient identifiers for linkage.

HPS also maintains records on all DBS testing in Scotland since May 2009. The DBS database contains information on dates and result(s) of HCV antibody and reverse transcriptase polymerase chain reaction (RT-PCR) testing, source, ethnicity, risk activitie(s), length of injecting career and limited identifying information (i.e., date of birth, sex, surname Soundex and forename initial). On 31 December 2010 this database comprised records for 1448 specimens relating to 1322 individuals.

Records from the DBS database (up to 31 December 2010) were deterministically linked to individuals on the HCV Clinical database (to 31 December 2012); a complete match on surname Soundex, gender, DOB, and first initial was required for a successful link.

3.2. Data analysis

Three main outcomes were analysed: (a) anti-HCV positivity amongst all individuals tested by DBS for HCV since the inception of the DBS testing programme in Scotland (May 2009) to 31 December 2010, (b) first clinic attendance amongst all chronically HCV-infected persons recorded as being tested by DBS for HCV infection between May 2009 and 31 December 2010 and (c) initiation on antiviral therapy amongst the chronically HCV-infected patients attending a specialist clinic. Univariate and multivariate logistic regression modelling was used to examine the association between the covariates sex, age at diagnosis (grouped into <35 years, ≥35 years), ethnicity (White, Unknown/Non-white), Source of DBS (Community Addiction Team/Harm Reduction, Other) and time since onset of injecting (≤10 years, >10 years, Not known (PWID), Non-PWID) and the outcomes: 'HCV antibody positive' (Table 1), 'first clinic attendance within 12 months of diagnosis by DBS' (Table 2) and 'initiation on antiviral therapy within 18 months of DBS specimen collection' (Table 3). For the latter analysis the variable 'Risk Factor' (Current PWID, Past PWID, Non-PWID/Unknown) was also included. For the Risk Factor variable data collected on length of injecting career (including age of first and last injection) was used, where available, to categorise individuals as past PWID and present PWID, with any individual giving a date of last injecting drug use as five or more years prior to the DBS specimen collection date classified as a past PWID.

All analysis was carried out in R 3.0.1 [9]. Exact p-values are provided except where $p < 0.001$.

4. Results

In 2009/10 DBS specimens were collected from 1322 individuals in Scotland for HCV screening. Of these individuals 55% (n = 728) were seropositive for antibody to HCV, and approximately two-thirds (65.4% (n = 476)) had an active HCV infection (Fig. 1). Table 1 presents characteristics of the overall study sample, according to HCV antibody prevalence. The majority (70%) were males, although HCV antibody prevalence in both sexes was equal at 55%. The average age of all DBS tested individuals was 36, with 45% of individuals falling into the <35 years age category and 55% into the ≥35 years category. Antibody prevalence was significantly higher in the older age category compared to the younger; 64% (95% CI: 60–67%) and 45% (95% CI: 41–49%) respectively. White was the main ethnicity (82.8%), the remainder being of unknown (16.5%) or non-white (0.7%) ethnicity. Most individuals (89.3%) were tested in a community addiction team or harm reduction setting as opposed to other settings (hospital (3.8%), GP (1.7%), prison (0.6%) or private (4.6%)).