



# **Immunization Coverage in Infants at Risk of Perinatal Transmission of Hepatitis B**

**A London Study 2006**

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of the Infectious Disease Working Group  
of the London Antenatal and Newborn Screening Steering Group (LANSSG)

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**15<sup>th</sup> of May 2008**

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**Glossary**

AISS	Antenatal Infection Screening Surveillance
DH	Department of Health
Cfi	Centre for Infections (ex CDSC)
CHSS	Child Health Surveillance System
COVER	Cover of Vaccination Evaluated Rapidly
HBsAg	Hepatitis B surface antigen
HBeAg	Hepatitis B e antigen
HBIG	Hepatitis B immunoglobulin
HPA	Health Protection Agency
HPU	Health Protection Unit
IDWG	Infections Disease Working Group
LANSSG	London Antenatal and Newborn Screening Steering Group
LaRS	Local and Regional Services Division
NHS	National Health System
PCT	Primary Care Trust
SHA	Strategic Health Authority

## **Foreword**

Hepatitis B is a major public health issue with an estimated 2 billion people who have been infected worldwide and an estimated 350 million chronic carriers. Prevalence is higher in Asia and parts of Africa and transmission from mother to child is a high risk with a consequent risk of long term liver damage and even cancer. There are an estimated 1200 infants born in London each year to mothers carrying hepatitis B, who need to be protected with vaccine. In 2005 the World Health Assembly (WHA) and the UNICEF Executive Board endorsed WHO's Global Immunization Vision and Strategy (GIVS) and member states were urged to meet immunization targets.

In London efforts are being made to ensure newly born babies who should receive hepatitis B vaccine do so. This survey was conducted across London to audit the degree to which such at risk infants do receive protection. It represents collaborative work between the HPA local units and the NHS in London. The results are a valuable start to monitoring in this area however they give cause for concern that not all babies do receive complete vaccination. Additional findings indicate that the uptake of screening and vaccination of sexual and household contacts is poor.

There is no room for complacency and more needs to be done in London to ensure women with hepatitis B are diagnosed in pregnancy and their infants fully vaccinated. . We are aware that some improvements have been made since 2006 and many PCTs with higher prevalence have taken steps to ensure change is implemented. The report makes clear the issues that need to be addressed and we believe that the recommendations are pertinent and achievable.

We hope that readers will find the report interesting and useful and that it will assist local review of practice and procedure in this area. We also hope that the report will inspire further joint work locally, in a partnership between the HPA and the NHS, to implement the recommendations.

Dr Helen Maguire- Consultant HPA London Epidemiologist and Dr Roger Gross- HPA London Regional Director

Signatures

## **Acknowledgements**

We wish to thank all of our colleagues in the NHS as well as those at the Health Protection Units who co-ordinated the data collection for their sectors :

Our thanks go as well to all involved Immunisation Leads, Midwives, Heads of Midwifery as well as the Virologists in the Trusts for their help in this demanding and ambitious audit.

In the HPA London region epidemiology unit our thanks go to staff who helped in the data collection, helped in the design of the questionnaire and usefully met the Antenatal Screening Coordinators to promote the launch of the study.

## **Executive Summary**

Since 1998, the UK policy and antenatal screening programme has included universal HBsAg testing of antenatal women in order to ensure that mothers at risk receive appropriate treatment; their babies receive a full course of vaccination to prevent perinatal or early childhood infection; and their family contacts are screened and vaccinated. The proportion of mothers being tested for hepatitis B infection through antenatal screening is high [98% in 2007] in London overall but there is local evidence through audits at PCT or acute Trust level that the uptake of vaccination in babies at risk is not good.

This study begun in 2006 aimed to measure the hepatitis B vaccination uptake in London babies born in the last quarter of 2004 to HBsAg positive mothers and to identify factors associated with incomplete immunisation. A secondary aim was to examine the uptake of post vaccination testing as well as the uptake of screening and vaccination in family contacts (i.e. partner of the mother and siblings).

A total 249 babies were identified for the study, an estimated three quarters of the number expected at risk according to antenatal surveillance of HB infection in London. Numbers identified often did not correspond with data reported by the PCTs to the COVER scheme.

Less than half of the babies (49%) reportedly received all four recommended vaccinations. The outcome was better in South East London sector; for mothers who had received written information on hepatitis B infection and vaccination; who had their GP details recorded at the maternity unit and who had a good command of English. The outcome was not influenced by mother's characteristics (e.g. their age, occupation, place of birth or ethnicity). A third of the babies reportedly had a post vaccination blood test.

The screening and vaccination status of sexual partners was known for 12% of the mothers. Whether there were other children at risk or not was known for 40% of the mothers. When there were known to be older siblings 40% of the first children were reportedly vaccinated.

This study highlights the importance of adequate education and information to the mother and of early communication with community services to arrange follow up of those at risk. It identifies a gap between maternity and community services and the limits of the COVER system to monitor the HB vaccination programme in London.

Recommendations include:

- Provision of written as well as verbal information, in appropriate languages, for women who test HBsAg positive during antenatal care.
- Clear arrangements should be in place for specialist referral of women who test HBsAg positive
- Ensuring that all women who book for antenatal care have a GP and that GP details are recorded in maternity notes.
- Complete reporting of HBIg administration to the HPA immunisation division.
- PCTs should ensure that robust reporting pathways for maternity, PCT child health departments and community immunisation services are in place.
- Integration of neonatal hepatitis B vaccination into current and future child health electronic data collection systems.

An enhanced antenatal hepatitis B surveillance system is being piloted by HPA London in collaboration with the NHS London antenatal coordinator group from January to June this year. If successful the enhanced surveillance system should:

- Provide each HPU with a comprehensive and consistent system for receiving reports on all antenatal chronic hepatitis B infections
- Facilitate further follow up of cases by the local HPUs with NHS services
- Provide sufficient information for HPUs and HPA London region to undertake periodic outcome audit
- Provide ongoing information on the burden of chronic hepatitis B infection in pregnant women by PCT
- Assist HPUs in making recommendations to local NHS partners relating to service development

## **1. Background and context**

### **1.1. Vertical transmission of Hepatitis B virus**

If antenatal infections that are transmissible to unborn infants are detected before or during pregnancy, interventions are possible to reduce the risk of mother to child transmission. Hepatitis B immunization can prevent the development of chronic hepatitis B infection in 90-95% of babies born to infected mothers (hepatitis B surface antigen -HBsAg- positive). Vaccination should prevent the associated risk of cirrhosis and primary liver cancer later in life [1-5] and ongoing transmission associated with chronic infection.

### **1.2. Antenatal Screening and audit of the Baby Immunisation**

A universal antenatal screening programme was officially recommended in 1998 in the UK (Health Services Circular HSC 1998/127)[6] to ensure all women are offered and recommended antenatal screening for hepatitis B and to ensure appropriate follow up and interventions.

This circular required the implementation of 100% antenatal screening for hepatitis B across E&W by April 2000 and established a national target for immunization. Recommendations included that

- infectivity markers are sought in any blood samples that test positive for HB surface antigen positive, for HB e antigen and anti-HBe antibody
- referral to a hepatologist for clinical management and assessment
- offer of screening for family contacts
- Hepatitis B immunoglobulin (HBIG) for the infant at birth when the mother was found to be HBeAg or had acute HB during pregnancy as well as a complete course of immunization following an accelerated schedule
  - initial dose at birth, further doses at one and two months
  - a booster fourth dose and a post-vaccination testing for HBsAg at 12 months

### **1.3. Audit**

The health circular 1998/127 highlighted the necessity for this programme to be monitored and audited.

Retrospective studies of geographic differences in the practices of immunization and of vaccine uptake have already been conducted in the UK and in London [7-11]. All suggest that immunization is not always complete and that the proportion of infants receiving vaccination with each relevant dose decreases over time from birth, with rates of coverage reported for the fourth vaccine at 12 months ranging from 13% to 89%.

#### **1.4. Baseline data on HBsAg positive pregnant women**

In London, the prevalence of hepatitis B amongst the general population as well as amongst pregnant women is higher than elsewhere in the UK and may be increasing [Appendix 1]. This was the rationale for establishing and implementing London wide Antenatal Infection Screening Surveillance (AISS) in 2000 [12]. This surveillance system offers a potential base from which an evaluation of childhood immunization can be conducted. Aggregated data are gathered 6-monthly (3 monthly since 2005) in the 29 National Health Service (NHS) Trusts [Appendices 2 and 3], including number of pregnant women "booked" (registered for a prenatal consultation), tests carried out and positive results for HIV, hepatitis B, syphilis and immunity for rubella [13;14].

#### **1.5. Surveillance and contact tracing by the local HPA HPUs**

A national HPA survey was conducted in 2004. The objective was to establish what surveillance and contact tracing of chronic hepatitis B is currently conducted in local Health Protection Units (HPU) with particular attention paid to follow up of pregnant women. Results showed a lack of consensus on responsibility for follow up of babies requiring vaccination as well as discrepancies in local data management<sup>1</sup>, with both electronic database and paper systems in operation[15].

The Local and Regional Services Division (LaRS) of the HPA Business Plan for 2004-05 and priorities of the HPA Corporate Plan for 2004-2009 include better determination of baseline prevalence of hepatitis B & C. To facilitate this standards were developed for hepatitis B surveillance [15-17].

#### **1.6. Monitoring of vaccination uptake by the PCTs**

At the end of 2004, the childhood immunization data collected through the HPA COVER<sup>2</sup> (Cover of Vaccination Evaluated Rapidly) system was extended to include hepatitis B immunization in babies at risk by 12 and 24 months [18]. Initially, PCTs were required to submit the numerator for the number of children vaccinated; the proportion of children receiving their third dose of vaccine before their first birthday and their fourth dose before their second birthday; and since April 2006, to supply a valid numerator and denominator.

The London Antenatal and newborn Screening Steering Group (LANSSG) requested in 2004 that its Infectious Disease Working Group (IDWG) advise on implementation of standards as well as monitoring and quality assurance for testing and interventions. It was agreed that should be an audit of the follow-up of babies born to HBsAg positive mothers and the uptake of their vaccination. It was also agreed that the audit would examine the management of the mothers and their family contacts.

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<sup>1</sup> The London's Health service included at the time of the audit five Strategic Health Authorities (SHA), four HPUs and 31 Primary Care Trusts (PCT) [Appendices 2; 3], with immunization coordinators based in HPUs or PCTs.

<sup>2</sup> COVER collates quarterly coverage data for children in the UK who reached their first, second, or fifth birthday for DTP vaccine, haemophilus influenzae type b (Hib vaccine), polio vaccine, MenC and MMR vaccine. London data are collected by PCT (20/31 for the update COVER quarterly report in July 2005). They include the denominator of 12-months-old babies, the number who have had the 3rd HBV vaccine given to them, the denominator of 24-months-old babies and the number of 4th vaccine given to them.

The IDWG was requested by the LANSSG to carry out this audit. This was done by the HPA with a lead from its Regional Epidemiology Unit working with the Local HPA units, the NHS in London, the Regional Antenatal Screening Co-ordinator (ASC), and in turn with midwives and ASCs across the city.

## **2. Aim and objectives of the audit**

The aim of this audit was to describe a sample of the population of pregnant women screened HBsAg positive in London and to measure the vaccination coverage of their infants at risk of vertical transmission of hepatitis B.

This audit aimed to inform public health policy and practice in London and to improve the health protection of these and other such infants in the future.

The primary objectives were:

- 1) To estimate the denominator of infants at risk born in all London's acute Trusts in the fourth quarter of 2004 (1<sup>st</sup> October-31<sup>st</sup> December 2004)
- 2) To compare it with the baseline of aggregated data received through and by London AISS, COVER and CFI
- 3) To describe the characteristics of mothers
- 4) To measure the vaccine uptake amongst infants after 15 months of age with birth vaccine, +/- HBIG when required ; Number of HB vaccinations received ; Post vaccination serological testing and its outcome
- 5) To identify factors associated with incomplete immunization of the infants

A secondary objective was to describe screening and vaccination coverage of the mother's sexual partner and of siblings

### **3. Methods**

#### **3.1. Design and audit population**

The design was a retrospective cohort study. The study population included mothers and babies, as outlined below:

- Every HBsAg positive pregnant woman, London resident, who delivered a live baby between 1st October and 31st December 2004 in one of the London's NHS Trusts and their babies.

Evaluation of their immunization coverage was conducted through a retrospective look back after 15 months of age.

#### **3.2. Identification of the audit population**

Women meeting the case definition were identified at each NHS Trust, by the ASC/midwives and microbiologists. The microbiologists were asked to provide the ASC with a list of all women aged 15-50 diagnosed HBsAg positive during 2004 and specify if the woman was pregnant. From this list, the ASC cross checked with the names in delivery records.

The audit population identified was aligned with other sources to cross check completeness. Complementary sources of information used are detailed below.

##### **3.2.1. Baseline from the London's Antenatal Infection Screening Surveillance (AISS)**

Aggregated information from the London AISS provided an estimate of the number of women who antenatally screened HBsAg positive during the second half of 2004 (six monthly reports at this time) at each London Acute Trust. These routine reports of numbers of women booked, tested, and found HB positive [Appendices 3 and 4], provided a baseline and an estimate of the expected numbers to be identified for the audit. Numbers are small at individual Trust level and they do fluctuate from year to year and quarter to quarter

##### **3.2.2. Baseline from the COVER data**

We compared aggregated COVER data with audit numbers. We used the 24 months denominator reported by the PCTs in Jan-March 2007. In Our cohort of babies born in Oct-Dec 2004 should have had their complete immunisation course of four doses reported through COVER by this time.

### **3.2.3.HPA Centre for Infection (CfI) Immunization department for infants eligible for HBiG**

The list of babies who received HBiG, and the list of women who were HBeAg+ according to the audit were cross checked with the lists held at the HPA CfI Immunization department.

## **3.3. Data collection**

### **3.3.1.At the maternity units: for the mother and the newborn baby**

From March to July 2006 across all Trusts, ASC/midwives completed a proforma for these women and their newborns [Appendix 5a] and returned it to the HPA London Regional Epidemiology Unit.

The proforma was based on the "Minimum dataset" proposed for surveillance of acute hepatitis B and included characteristics and factors potentially associated with incomplete immunization.

Data collected included:

- Mother's demographics and characteristics: NHS number, hospital number, NHS Trust of delivery, name, date of birth, post code of residence, country of birth, year of arrival in the UK if born abroad, occupation, ethnic group, level of proficiency in English, whether there had been booking or not in this Trust before delivery, name and details of the general practitioner, name of the paediatrician, whether any written information on hepatitis B infection has been given (i.e. leaflet) and the date when it was given
- Mother's social problems during the past year: homeless, injecting drug, imprisoned
- Maternal hepatitis B infection status: date of most recent positive HBsAg result, whether there has been or not acute hepatitis B during the pregnancy, hepatitis B markers (HBsAg, HBeAg and anti-HBe)
- Baby: name, sex, date of birth, hospital number, NHS number
- Interventions at birth: birth HB vaccine, date of vaccine, birth HBiG required: Y/N, whether HBiG was given, date of HBiG
- An additional question asked whether the mother was immune to rubella and if she had received MMR vaccination

Sector of residence was derived from the maternal post-code.

### **3.3.2.In the community: follow up the baby**

The designated leads at each of the four HPUs (North East and Central; North West; South East and South West) coordinated the completion of the follow-up questionnaires.

When needed, HPUs were asked to liaise with colleagues in the Primary Care Trusts (PCT), to collect the information. The Child Health System was used by PCTs to provide the information.

Some PCTs had no system for collecting or collating this data. The local HPU leads linked directly with services delivering vaccination to collect data for the audit. This was achieved by contacting the maternity units directly for details of the first vaccination then either by contacting GPs, health visitors or designated paediatric clinics for subsequent vaccinations. In some cases mechanisms for recording and reporting this information was unclear.

In certain London sectors, the PCTs provided information on vaccination directly to the regional epidemiology unit on an MS Excel format (i.e LS&L in South East)

At the date of the look back in summer 2006, every baby was at least 18 months of age. All data regarding hepatitis B vaccination they received during their first year of life should therefore have been available.

The proforma [Appendix 5b] included:

- Number of HB vaccinations received
- Whether the post HB vaccination serological testing was performed and its result
- Source of information used for the number of HB vaccinations received
- Whether a BCG vaccination had been given to the baby at birth or since
- Whether HB screening and vaccination had been done for the sexual partner of the mother and any sibling in the household

### **3.4. Communication**

Partners and colleagues in the Trusts and HPUs were invited to contribute to the audit both by HPA London and the London region antenatal screening coordinator. A letter was sent with specific information regarding roles for different participants.

### **3.5. Data management and data analysis**

The MS Access database was developed and data analysis was performed with Stata version 8.2. Map info professional v8.0 was used for mapping cases. Post codes were used to allocate each patient to a borough and PCT. PCT sectors were grouped and are presented by HPU sector (range of four to seven PCTs per HPU sector).

#### **3.5.1. Completeness of the cohort**

We give a description of the numbers of women expected and numbers identified by the maternity units, AISS and COVER. Figures are presented by acute Trust and by PCT.

### **3.5.2.Descriptive and analytical epidemiology**

The main outcome measure was the proportion of babies who received a complete vaccination course (four doses). Secondary outcomes were the proportion completing of post-vaccination serological testing and outcome reporting, and the proportion of family contacts screened and vaccinated per HPU (five at the time of the audit).

Results are mostly presented by HPU of the Trusts of delivery, and if not, by PCT of residence of the mother.

The descriptive analysis included a description of the characteristics of the mothers, the immunization of their babies and the screening and vaccination of the sexual partner and siblings, with distributions and means, or median when appropriate.

The risk of incomplete uptake associated with all factors (related to the mother, infant and locations) was measured by univariate analysis. Odds ratios, 95% confidence intervals and p values were calculated.

We included in the multivariate analysis (using a logistic regression) all factors associated with an incomplete vaccination uptake with a p values less than 0.2.

## **4. Confidentiality and data security**

Names, dates of birth, NHS numbers and addresses were collected to ensure the correct matching of the mother's and baby's follow up questionnaire. GPs details were collected to help the HPUs to find out the follow up data for the baby, liaising with the PCTs or when needed with the GP. Information for this audit (potential risk factors and vaccination received) was only collected via the maternity unit and the HPU. The mothers included were not contacted.

A table with identifiers was recorded on the MS Access data base password protected and stored on the secure password protected server at HPA London office. MS Excel password protected tables were exported. In each HPU, the identified person responsible for the audit received this file for his/her HPU, completed it, filled in missing fields and returned it via the HPA secure document gateway. Alternatively, the identified person could complete paper questionnaires and return them to the audit coordinator in the HPA London region in double envelopes marked confidential.

To ensure confidentiality at HPA London, the paper forms were secured according to the HPA procedures, in a locked drawer and placed under the responsibility of the audit coordinator. A unique reference number was given to the records and an anonymised data set used for analysis.

## 5. Results

The 29 London maternity units participating (seven in North West HPU, four in South West and six in each of North East, North Central and South East) initially identified 269 pregnant women for inclusion.

Of these, 20 were excluded (four had a still birth, one delivered in September 2004, five had an out of London address, three were identified by the name of the baby only but no other data could be reported, four were duplicate reports, three were not HBsAg+ but were initially included because their baby received vaccination at birth due to family circumstances (e.g. partner of the mother HBsAg+, child in fostering, mother declining the HB antenatal test).

The maternity units reported a median number of eight women (range 2-24).

The characteristics of the 249 mothers and their babies are presented in this report.

### 5.1. Completeness of the audit data

#### KEY POINTS

- 249 London mothers HBsAg+ were identified by the maternity units for this audit
- Representing about  $\frac{3}{4}$  of the expected women based on AISS data
- 3 acute Trusts had no baseline AISS data on HBsAg+ pregnant women. (Impossible to align the numbers at risk)
- 9 PCTs had no denominators reported to COVER. (Impossible to align numbers at risk)
- Denominators of babies reported by the PCTs through COVER did not all correspond with the numbers of patients identified in the study

To verify that the maternity units had identified all eligible mothers and babies for the audit, we conducted the following alignments:

#### 5.1.1. Alignment with the Antenatal Infection Screening Surveillance data

According to AISS estimates, around 350 HBsAg positive women should have delivered during the 4th quarter of 2004. AISS data are aggregate estimates of women testing positive in the period and they are likely to include women who screen positive but do not go on to deliver at the testing hospital. Additionally there are issues with duplication of results and variations in the quality of the data collection by each Trust, as well as fluctuations from year to year and quarter to quarter. For the Trusts where alignment was possible, 220/302 mothers (73%) of those at risk were identified for this audit. This varied across London acute Trusts (Table 1; figure 1).

**Table 1. Number of mothers expected according to the numbers of antenatal HBsAg+ tests reported by the London Trusts in 2004 through AISS**

Sector	NHS acute Trust	Total 2004 AISS number	Average for 1 quarter (based on 4 quarterly reports (a))	Number identified for the audit (b)	% of those expected through AISS who were identified (b/a)
NC	Barnet	23	6	2	33.3
NC	Chase Farm §	Missing	Missing	-5	
NC	Homerton §	Missing	Missing	-5	
NC	North Middlesex	95	24	18	75.0
NC	Royal Free	25	6	4	66.7
NC	University College	27	7	10	142.9
NC	Whittington	24	6	3	50.0
NE	BHRØ	115	29	5	17.2
NE	Newham §	Missing	Missing	19	
NE	Royal London	75	19	11	57.9
NE	Whipps Cross	41	10	11	110.0
NW	Chelsea & Westminster	21	5	4	80.0
NW	Ealing	36	9	8	88.9
NW	Hillingdon	22	6	6	100.0
NW	Northwick Park and Central Middlesex	43	11	20	181.8
NW	Queen Charlotte's	28	7	8	114.3
NW	St. Mary's	41	10	9	90.0
NW	West Middlesex	23	6	3	50.0
SE	Farnborough	12	3	2	66.7
SE	Guy's & St. Thomas'	136	34	18	52.9
SE	King's College	112	28	24	85.7
SE	Lewisham	64	16	10	62.5
SE	Queen Elizabeth	89	22	19	86.4
SE	Queen Mary's Sidcup	7	2	2	100.0
SW	Kingston	13	4	2	50.0
SW	Mayday	82	20	14	70.0
SW	St. George's	28	7	5	71.4
SW	St. Helier	19	5	2	40.0
	Total for responding trusts	1201	302	220 p	73%p

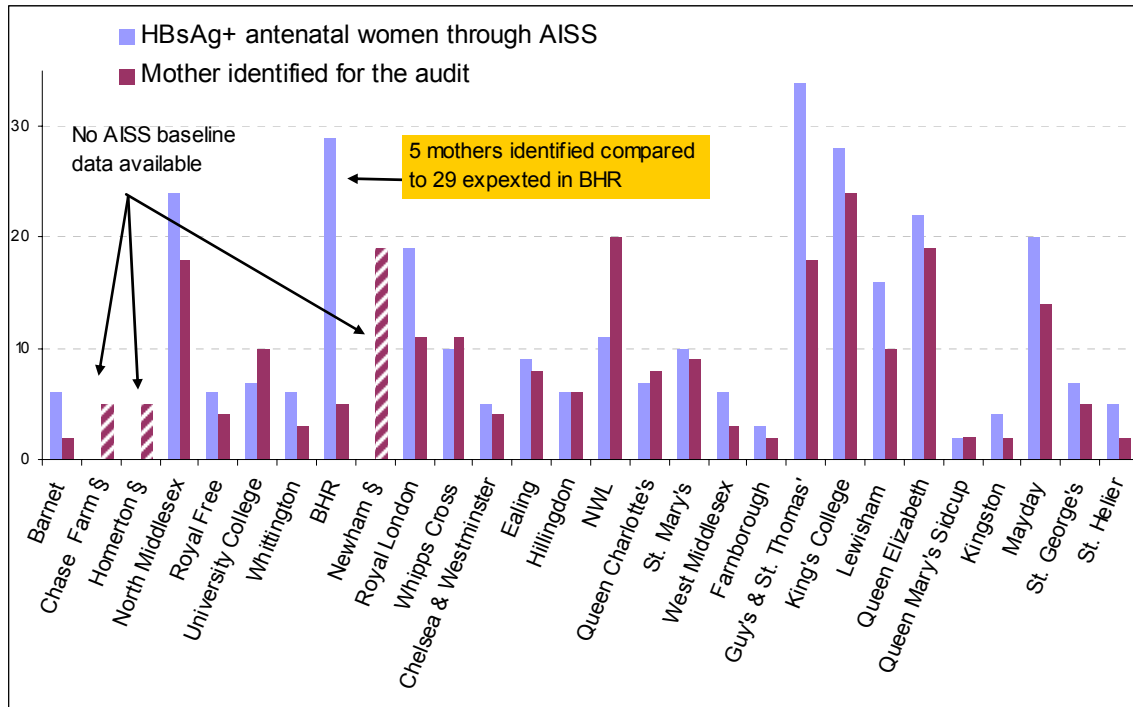
§ AISS data were not provided by the Trusts. Ø BHR Barking Havering and Redbridge (include King Georges + Harold Wood hospitals).

p the percentage is calculated only for Trusts who had baseline AISS data:  $249 - 20 = 220$  (20 mothers in Chase Farm, Homerton and Newham);  $220/302 = 73\%$

In Chase Farm, Newham and Homerton, there were baseline AISS data available. In Guys and in BHR, numbers of mothers identified by the acute trusts were fewer than expected on the basis of AISS reports.

AISS aggregate data was collected every 6 months until 2005 so the quarter reported is an estimate based on the average for 2004

**Figure 1. Numbers of mothers expected to be eligible for audit based on AISS and number identified for the Audit**



**5.1.2. Alignment with Cfl data for babies at high risk**

Survey data provided information on 28/249 babies (12%) reportedly born to a HBeAg+ mothers (i.e. high risk of HB transmission and eligible for HBIG at birth) as well as six babies born to mothers who suffered acute hepatitis B during pregnancy. The HPA Cfl immunization department provides Hepatitis B Immunoglobulin (HBIG) for these babies and confirmed that 20 of them (62%) had received HBIG (Table 2).

In parallel, Cfl reported that seven babies who were not identified in our audit as at high risk who received HBIG.

**Table 2. Number of babies reported in each London sector by the acute Trusts and the HPA Cfl immunisation department**

Sector of the NHS Trusts	NE	NC	NW	SE	SW	Total
N total	51	42	58	75	23	249
Including mother with acute HB (a)	2	1	0	2	1	6
Including mother HBeAg+ (b)	7	7	1	9	4	28
Total babies known to have HBIG required (a+b)	8	9	1	10	4	32
Including babies who received HBIG	5	6	1	6	2	20
Other babies known who received HBIG	3	3	1	0	0	7

### 5.1.3. Alignment with COVER data

The post code of residence of the mother at the time of the antenatal care, as recorded on the maternity unit notes was available for 246/249 mothers (99%).

For each PCT, we aligned the number of babies identified by the maternity units for the audit (at risk babies born in Oct - Dec 2004 by recorded postcode of mother, and the Jan - March 2007 COVER data (Time at which the “audit babies” had reached 24 months and were reportable as denominator to COVER) (Table 3).

**Table 3. COVER 24 months denominator and mothers identified in the audit by PCT of residence. Percentage “reported” through COVER**

London Sector of Residence	PCT of Residence	Cover 24 months denominator (a)	Audit Mothers living in this PCT (b)	% reported by Cover a/b
NC	BARNET	4	7	57
	CAMDEN #	<i>Missing</i>	7	
	ENFIELD	0	13	0
	HARINGEY	<i>Missing</i>	9	
	ISLINGTON #	<i>Missing</i>	8	
NE	BARKING AND DAGENHAM ##	<i>Missing</i>	5	
	CITY AND HACKNEY * #	<i>Missing</i>	6	
	HAVERING	<i>Missing</i>	1	
	NEWHAM * #	<i>Missing</i>	18	
	REDBRIDGE #	3	2	150
	TOWER HAMLETS * #	6	9	67
	WALTHAM FOREST #	6	10	60
NW	BRENT	11	12	92
	EALING #	10	13	76.9
	HAMMERSMITH AND FULHAM	0	2	0
	HARROW	3	7	42.9
	HILLINGDON	5	5	100
	HOUNSLOW	0	5	0
	KENSINGTON AND CHELSEA	21	5	420
	WESTMINSTER	6	2	300
SE	BEXLEY	4	1	400
	BROMLEY	<i>Missing</i>	3	
	GREENWICH #	<i>Missing</i>	18	
	LAMBETH	15	15	100
	LEWISHAM	15	12	125
	SOUTHWARK	33	25	132
SW	CROYDON	9	13	69.2
	KINGSTON	0	2	0
	RICHMOND AND TWICKENHAM	1	0	
	SUTTON AND MERTON	11	3	366.7
	WANDSWORTH	18	8	225
Place of Residence	Missing		3	
	Total	181	249	na

N/A: Not available. # Data for these PCT's may be incomplete due to ongoing problems with the implementation of new child health systems and therefore should be treated with caution. ## Data submitted after the publication had taken place and therefore has not been included in the regional analysis. Ref: Percentage of children immunised by their 1st birthday, by Government Office Region, Strategic Health Authority and PCO Q06-1 Jan to march 2007. [http://www.hpa.org.uk/infections/topics\\_az/cover/Q06-4\\_Jan-Mar.xls](http://www.hpa.org.uk/infections/topics_az/cover/Q06-4_Jan-Mar.xls).

Note: \* caveats for some PCTs say “The HepB figures appear to be incorrect; this is probably due to the fact that the field recording HepB status of the mother was not populated when Homerton Hospital migrated on to their new EPR. The problem was rectified soon after go live and the data was recorded from that date onwards. Unfortunately the historic data could be not added later”.

## 5.2. Characteristics of the mothers diagnosed with acute hepatitis B

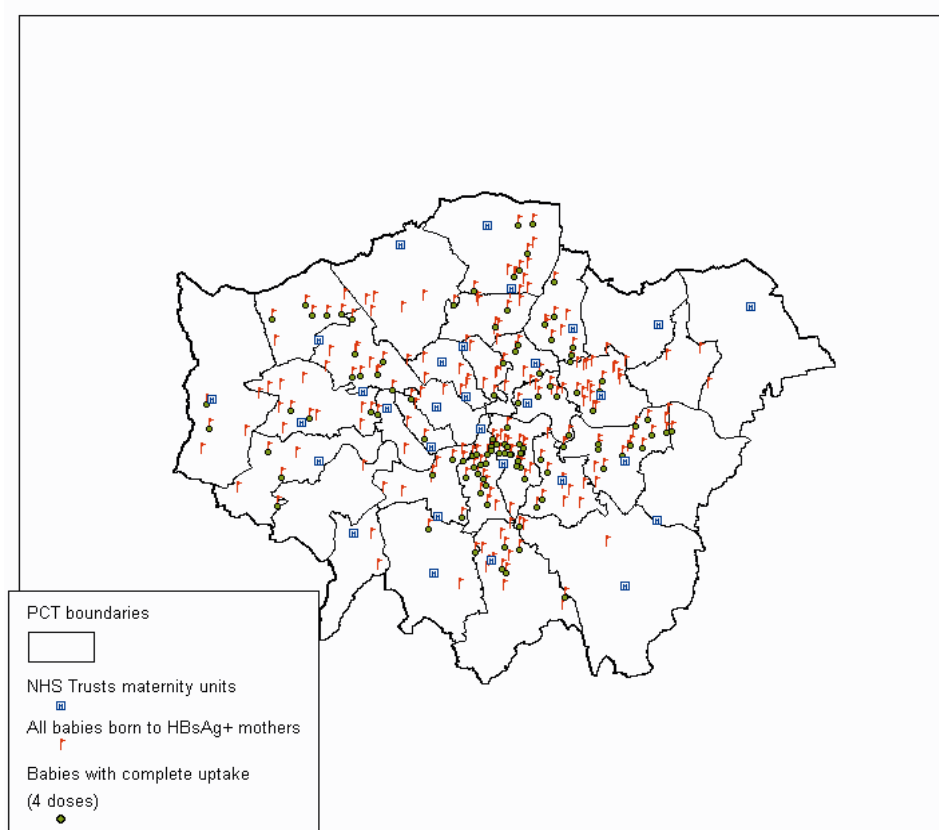
### KEY POINTS

- One third of the mothers had a basic or less than basic level in English
- 7% were born in the UK
- More than half of the mothers were born in Africa
- 97% booked for antenatal care at the acute Trusts where they delivered their baby
- Less than half were reportedly referred to the hepatologist
- 12% were at high risk (HBeAg+); (there was a lot of missing data on the maternal HB markers)

### 5.2.1. Characteristics of mothers

The greatest proportion (30%) of hepatitis B positive mothers reported in the survey were resident in South East London at the time of antenatal testing (Figure 2). Overall, there was not much evidence of geographical mobility. Very few mothers (4%) were not booked in the hospital where they ultimately delivered however 9% were reportedly lost to follow up by the HPU at the time of the study (of the 23 lost to follow up, where comments were available on the questionnaire, 7 were known to have moved; 4 were “not registered with the GP provided during antenatal care; 4 had changed surgery before the 4<sup>th</sup> vaccination). Two GPs did not want to disclose the vaccination information to the HPU hepatitis lead, (one in SE and one NE London).

**Fig 2. London acute Trusts, HBsAg positive mothers by place of residence, and whether the vaccination uptake was complete or not**



Median age of the mothers at delivery was 29 years [16-47]. Where information was reported by the maternity units (73%), more than half, (96/181, 53% - 95% CI 45-60) were born in Africa, mostly in Ghana (31), Nigeria (20), Somalia (17) and Sierra Leone (6). Mothers born in Eastern Europe (22, 12%) were mostly from Albania (5), Kosovo (4) and Romania (3). Other well-represented countries were Bangladesh (6), Turkey (5) and Afghanistan (5).

More than a third of the mothers (35%) had a basic or less than basic command of English. (Table 4)

The large majority (209/217, 96% - 95%CI 93-98), received antenatal care in the same Trust where they delivered. At least 7/209 booked for antenatal care after 30 weeks of pregnancy (this was not systematically asked in the questionnaire so may be an underestimation).

There were very few women with social problem reported (table 4) . Place of birth and command of English are detailed in Figure 3.

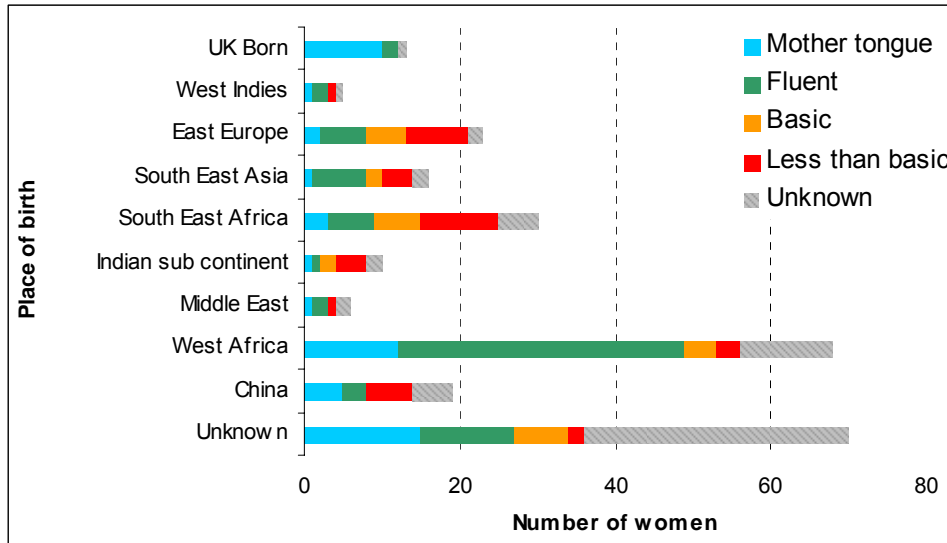
**Table 4. Characteristics of mothers (% rounded to nearest 1)**

<b>A Age group at delivery</b>	<b>Number</b>	<b>%</b>
15 - 19	17	7
20 - 24	38	16
25 - 29	71	30
30 - 34	61	26
35 - 39	37	16
40 - 49	9	4
<b>Total</b>	<b>233</b>	<b>99</b>
Missing data	16	
<b>B booked before delivery</b>	<b>Number</b>	<b>%</b>
Yes	202	93
No	7	3
Booked late <sup>3</sup>	8	4
<b>Total</b>	<b>217</b>	<b>100</b>
Missing data	32	
<b>D London Sector of residence</b>	<b>Number</b>	<b>%</b>
NC	44	18
NE	51	21
NW	51	21
SE	74	30
SW	26	11
<b>Total</b>	<b>246</b>	<b>101</b>
Missing data	3	
<b>E GP Details recorded in maternity notes</b>	<b>Number</b>	<b>%</b>
Yes	235	94
No	14	6
<b>Total</b>	<b>249</b>	<b>100</b>
Missing data	0	
<b>G Ethnicity</b>	<b>Number</b>	<b>%</b>
Black - African	131	61
Black - Caribbean	7	3
Black-other	4	2
Indian/Bangladeshi/Pakistani	22	10
White	20	9
Chinese	22	10
Other Asian	10	5
Unknown		0
<b>Total</b>	<b>216</b>	<b>100</b>
Missing data	33	

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<sup>3</sup> This was not asked in the questionnaire but for eight mothers the notes and comments said the booking for antenatal care was after 30 weeks of pregnancy

Figure 3. Place of birth and command of English



Few mothers (18/246, 7% - 95%CI 4-11) were resident in a health sector (i.e. HPU) different to the HPU of their Trust of delivery (i.e. 5/26 who delivered in South West, 4/74 in South East, 1/51 in North West, 5/51 in North East and 6/44 in North Central) (Table 5).

Table 5. PCT of residence and sector of delivery

Sector of residence	London sector of delivery						
	PCT of residence	NC	NE	NW	SE	SW	TOTAL
<b>North Central London</b>	BARNET	4	0	3	0	0	7
	CAMDEN #	6	0	1	0	0	7
	ENFIELD	12	0	1	0	0	13
	HARINGEY	9	0	0	0	0	9
	ISLINGTON #	7	1	0	0	0	8
<b>North East London</b>	BARKING AND DAGENHAM ##	1	4	0	0	0	5
	CITY AND HACKNEY * #	2	3	0	1	0	6
	HAVERING	0?	1	0	0	0	1
	NEWHAM * #	0	18	0	0	0	18
	REDBRIDGE #	0	2	0	0	0	2
	TOWER HAMLETS * #	0	9	0	0	0	9
	WALTHAM FOREST #	0	9	0	1	0	10
	<b>North West London</b>	BRENT	0	0	12	0	0
EALING #	0	0	13	0	0	13	
HAMMERSMITH AND FULHAM	0	0	2	0	0	2	
HARROW	0	0	7	0	0	7	
HILLINGDON	0	0	5	0	0	5	
HOUNSLOW	0	0	5	0	0	5	
KENSINGTON AND CHELSEA	0	0	4	1	0	5	
WESTMINSTER	0	0	2	0	0	2	
<b>South East London</b>	BEXLEY	0	0	0	1	0	1
	BROMLEY	0	0	0	3	0	3
	GREENWICH #	0	1	0	17	0	18
	LAMBETH	0	0	0	14	1	15
	LEWISHAM	0	1	0	11	0	12
	SOUTHWARK	0	0	0	24	1	25
<b>South West London</b>	CROYDON	0	0	0	0	13	13
	KINGSTON	0	0	1	0	1	2
	SUTTON AND MERTON	0	0	0	0	3	3
	WANDSWORTH	0	0	2	2	4	8
	<b>Total</b>		41	49	58	75	23

Shaded in blue: those who were not resident in the HPU sector of delivery

### 5.2.2. Maternal Rubella status

Rubella immunity for the mother and uptake of MMR vaccination if susceptible was explored (Table 6). Information on the Rubella immunization was available for 202/249 mothers (80%); 11/202 (5%) were reportedly non immune. Of these, four reportedly received MMR.

**Table 6. Mothers rubella immunity by HPU**

Number of mothers		HPU					Total
		NE	NC	NW	SE	SW	
Rubella immunity (% in col)	Yes (%)	29(96.7)	33(91.7)	41(93.2)	68(94.4)	20(100)	191
	No (%)	1(3.3)	3(8.3)	3(6.8)	4 (5.6)	0	11
Unknown		21	6	14	3	3	47
Total known		30	36	44	72	20	202

### 5.2.3. Written information given and referral to Hepatologist

Where information was reported, most women had received written information at the maternity unit to support counselling. This usually includes information on the infection and the vaccination schedule. Less than half of the patients overall and a third of those HBeAg positive were reportedly referred to the hepatologist.

**Table 8. Written information given and referral to Hepatologist**

<b>F Mother referred to Hepatologist</b>	<b>Number</b>	<b>Percent (%)</b>
Yes	60	46
No	70	54
<b>Total</b>	130	100
Missing	119	
<b>G Info given</b>	<b>Number</b>	<b>Percent (%)</b>
Yes	124	95
No	6	5
<b>Total</b>	130	100
Missing	119	

### 5.2.4. Women of high infectivity

The antenatal test was HBeAg positive for 28/211 mothers (13% - 95%CI 9-19). Mothers had an acute hepatitis B reported for 6/180 (3% - 95%CI 1-7). A lot of data were missing (Table 7).

**Table 7. Maternal HB infection and HB markers of high infectivity**

<b>B Acute Hepatitis B during pregnancy</b>	<b>Number</b>	<b>Percent (%) where information provided</b>
Yes	6	3
No	174	86
Unknown	23	11
<b>Total</b>	203	100
Missing	46	
<b>D Anti-HBe</b>	<b>Number</b>	<b>Percent (%)</b>

Positive	170	84
Negative	32	16
<b>Total</b>	<b>202</b>	<b>100</b>
Missing	47	
<b>E HBeAg</b>	<b>Number</b>	<b>Percent (%)</b>
Positive	28	13
Negative	183	87
<b>Total</b>	<b>211</b>	<b>100</b>
Missing	38	

### 5.3. Birth immunisation

#### KEY POINTS

- 97% of babies receive HB immunisation at birth
- Not all eligible babies reportedly receive HBIG

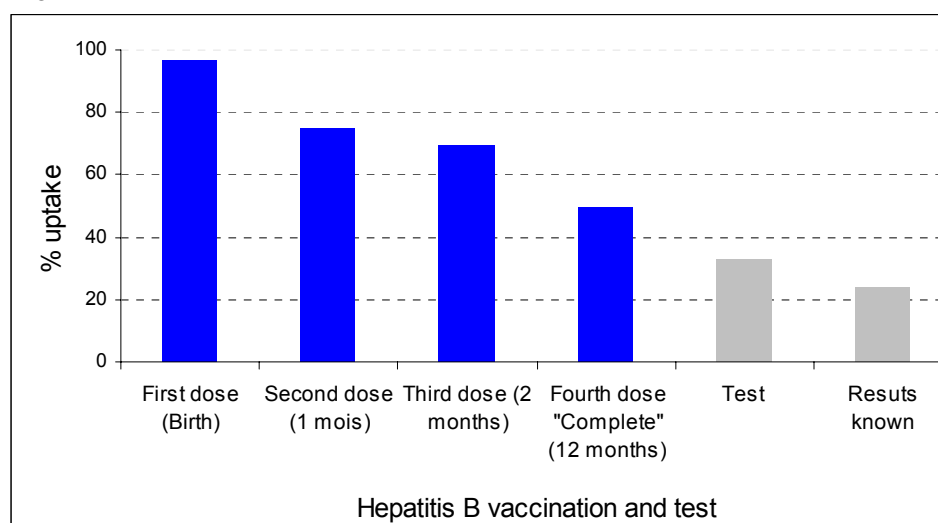
#### 5.3.1. Hepatitis B vaccination at birth

Almost all babies (241/249, 97%) reportedly received HB vaccination at birth and 20/28 of those known to be born to an HBeAg+ mother received HBIG. Where dates are known, first vaccination was done on the day of birth for 178/219 babies (81%) and on the second day for 39 (18%); of 29 receiving HBIG, 26/28 (93%), had this on the day of birth.

### 5.4. Vaccination uptake of the babies after 15 months of age

- Half (49%) had a complete uptake of 4 doses
- Two thirds (69%) received 3 vaccinations
- Complete vaccination uptake ranges from 75% in SE to 38% in NC
- 33% of the babies are reportedly tested
- Babies with incomplete uptake of immunisation are not tested

Overall 97% of the babies received the birth vaccination but the uptake decreased over the time, to three quarters (75%) who received two vaccines, 2 thirds (69%) who received three vaccinations and half (49%) who received all four recommended doses (figure 4). A third (33%) were reportedly tested and a result of test was known for a quarter (24%).

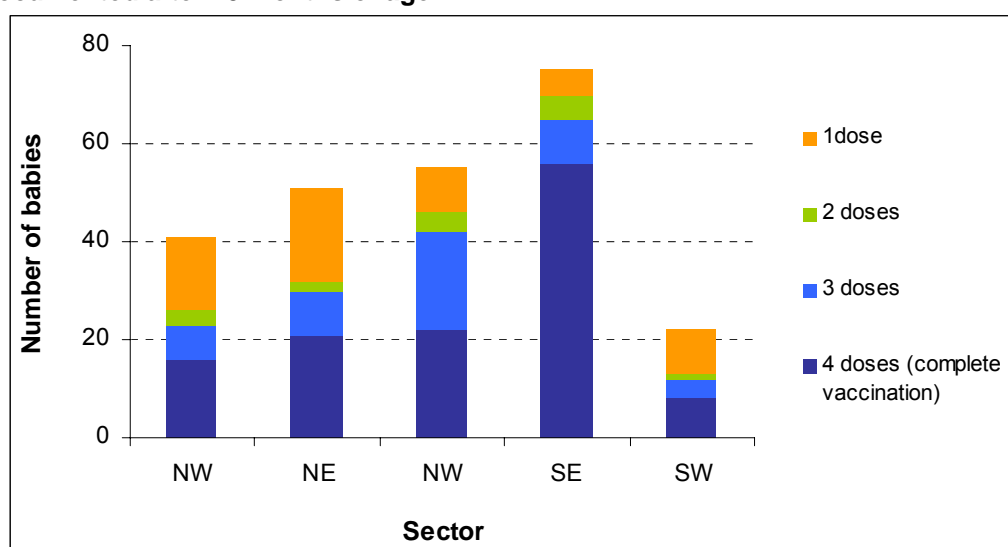
**Figure 4. Uptake for each HB vaccination dose, post vaccination test and results of the tests known.**

Uptake of both vaccination and test varied across the sectors (Table 8).

**Table 8. Number of vaccinations received by 15 months, post vaccination tests and results by HPU**

Number of Babies		London HPU					
		NC	NE	NW	SE	SW	Total
N		42	51	58	75	23	249
Number of doses received by 15 months (% in columns)	Unknown	1	0	3	0	1	5
	1	15	19	9	5	9	57
	2	3	2	4	5	1	15
	3	7	9	20	9	4	49
	4	16 (38%)	21 (41%)	22 (38%)	56 (75%)	8 (35%)	123 (49%)
Post vaccination test done (% in col)	Unknown	24	18	15	3	9	69
	Yes	10 (23%)	15 (29%)	11 (19%)	42 (56%)	4 (17%)	82 (33%)
	No	8	18	32	30	10	98

All tested babies but two, had received the complete course of 4 vaccinations (the remaining 2 babies received 3 vaccinations). None were found HBsAG positive. One baby was anti-HBc positive.

**Figure 5. Number of babies by London sector and according to number of HB vaccinations documented after 15 months of age**

In South East London PCT's provided their information directly. The sources of information used by the HPU's were mainly the GPs (88), HPU records (51 babies), PCT records (59), Child health system (18), Health visitors (for 7 babies), and paediatricians for 19 babies).

Uptake of vaccination per Trust of delivery and per PCT of residence are presented below (Tables 9 and 10).

**Table 9: Uptake of vaccination by Trust of delivery**

HPU	Trust of Birth	Living babies	Number of Vaccinations				Total known	Unknown	% complete (4 vaccinations)
			1	2	3	4			
NC	Barnet	2	1	0	1	0	2	0	0
	North Middlesex	18	10	1	1	6	18	0	33
	Chase Farm	5	0	0	1	4	5	0	80
	University College L	10	2	1	0	6	9	1	60
	Royal Free	4	1	0	3	0	4	0	0
	Whittington	3	1	1	1	0	3	0	0
NE	Harold Wood	2	1	0	1	0	2	0	0
	St. George's	5	1	0	1	3	5	0	60
	Homerton	5	1	0	0	4	5	0	80
	King George	3	3	0	0	0	3	0	0
	Newham	19	8	1	5	5	19	0	26
	Royal London	11	4	1	1	5	11	0	45
	Whipps Cross	11	2	0	2	7	11	0	64
NW	North West London Hospital	21	2	1	7	10	20	1	48
	Ealing	8	0	0	6	2	8	0	25
	Queen Charlotte's & Chelsea Hospital	8	1	2	2	3	8	0	38
	West Middlesex	3	2	0	0	1	3	0	33
	Hillingdon	6	1	1	1	3	6	0	50
	St. Mary's	9	0	0	3	3	6	3	33
	Chelsea & Westminster	4	2	0	1	1	4	0	25
SE	Princess Royal	2	0	1	0	1	2	0	50
	University Farnborough	19	2	3	2	12	19	0	63

SW	Guy's & St. Thomas'	18	1	1	0	16	18	0	89
	King's College	24	2	0	2	20	24	0	83
	Lewisham	10	0	0	5	5	10	0	50
	Mayday	14	6	0	2	5	13	1	36
	Kingston	2	0	1	1	0	2	0	0
	Queen Mary's	2	0	0	0	2	2	0	100
	St. George's	5	1	0	1	3	5	0	60
	St. Helier and Epsom	2	2	0	0	0	2	0	0
	<b>TOTAL</b>	<b>255</b>	<b>57</b>	<b>15</b>	<b>50</b>	<b>127</b>	<b>249</b>	<b>6</b>	

**Table 10: Number of babies receiving doses 1-4 of vaccine by PCT of residence of mother (n = 249)**

PCT of residence	Number of vaccine doses received					
	1	2	3	4	Unknown	TOTAL
Missing postcode	1	0	0	2	0	3
Barking and Dagenham	3	0	2	0	0	5
Barnet	4	0	1	1	1	7
Bexley	0	0	0	1	0	1
Brent Teaching	0	0	4	7	1	12
Bromley	0	1	1	1	0	3
Camden	1	1	2	2	1	7
City and Hackney teaching	1	0	0	5	0	6
Croydon	5	0	2	5	1	13
Ealing	0	1	8	4	0	13
Enfield	5	1	1	6	0	13
Greenwich Teaching	3	1	2	12	0	18
Hammersmith and Fulham	0	1	1	0	0	2
Haringey Teaching	4	1	1	3	0	9
Harrow	1	0	2	4	0	7
Havering	1	0	0	0	0	1
Hillingdon	1	1	1	2	0	5
Hounslow	2	0	0	3	0	5
Islington	2	1	1	3	1	8
Kensington and Chelsea	1	0	2	2	0	5
Kingston	1	0	1	0	0	2
Lambeth	2	0	0	13	0	15
Lewisham	1	2	4	5	0	12
Newham	7	1	5	5	0	18
Redbridge	2	0	0	0	0	2
Southwark	2	1	2	20	0	25
Sutton and Merton	1	0	0	2	0	3
Tower Hamlets	2	1	1	5	0	9
Waltham Forrest	1	0	2	7	0	10
Wandsworth	3	1	1	3	0	8
Westminster	0	0	2	0	0	2
<b>TOTAL</b>	<b>57</b>	<b>15</b>	<b>49</b>	<b>123</b>	<b>5</b>	<b>249</b>

Numbers were too small to further explore differences at a smaller geographical level than the HPU, but when considering those four PCTs who had more than 15 resident mothers diagnosed with the HB carriage, there were important differences with regards to the proportion of babies who reportedly received a complete course of vaccination (20/25 residents in Southwark PCT, 12/18 in Greenwich PCT, 13/15 in Lambeth PCT, and 5/18 in Newham PCT).

### 5.5. Factors associated with incomplete vaccination of infants

- None of the mothers who did not receive a HB information leaflet completed the full vaccination for the baby
- Maternal difficulties with English were associated with a higher risk of incomplete HB vaccination
- Overall, the SE London sector is doing better than others to ensure complete vaccination
- Independently, women with no GP recorded at the maternity unit, women who did not receive antenatal care prior to delivery and women who live in outside the sector where they receive their maternity care are at higher risk of incomplete vaccination.
- There might be an association between women who deliver in a Trust outside their borough of residence and an increased risk of incomplete vaccination however the numbers were too small to analyse this at borough level

London sector of residence of the mother was the main factor associated with the complete vaccination, SE doing better than all others (Table 11).

Those who had no GP details recorded at the maternity unit, who delivered in an other HPU sector than their sector of residence and those who were not booked for antenatal care at the trust where they delivered their baby were at higher risk of incomplete vaccination for their baby.

In addition, not having received a written information on hepatitis B to support the counselling, and not being fluent or having English as a mother tongue were also risk factors for incomplete vaccination of the baby. Babies born to mothers who tested HBeAg positive (potential high infectivity) were more likely to complete the vaccination schedule.

There was no overall statistically significant association between incomplete vaccination and the maternal country of birth ( $p=0.24$ ). There was no association with age-group or ethnicity. No association was found with year of arrival in the UK, nor with occupation, or time at which the HB test was done in pregnancy but numbers where information was available were small (respectively 39, 154 and 144/249).

**Table 11. Univariate analysis of factors associated with receipt of four doses of vaccine after 15 months of age**

Factor	Level	Number of babies N (a)	Incomplete vaccination (b)	(% row) b/a	Odd ratios (95% confidence interval)	p ( $\chi^2$ test)
Sector of Trust of delivery	South East HPU	75	19	25.3	ref	<b>&lt;0.0001</b>
	South West HPU	23	15	65.2	5.55 (2.03-15.08)	
	North East HPU	51	30	58.8	4.21 (1.96-9.03)	
	North West HPU	58	36	62.1	4.82 (2.29-10.14)	
	North Central HPU	42	26	61.9	4.79 (2.13-10.78)	
	<b>Total*</b>	249	126	50.6		
Is resident in the sector (HPU) where the baby was delivered	Yes	228	112	49.1	ref	<b>0.059</b>
	no	18	13	72.2	2.69 (0.86-9.93)	
	<b>Total</b>	246	121	49.2		
Mother given written info on hepatitis B	No	6	6	100.0	ref	<b>0.007</b>
	Yes	124	54	43.5	0 (0-0.51)	
	<b>Total</b>	130	60	46.2		
Details of the GP available	Yes	235	114	48.5	ref	<b>0.02</b>
	No	14	12	85.7	6.37 (1.39-29/08)	
	<b>Total</b>	249	126	50.6		
Booked before delivery	Yes	202	96	47.5	ref	<b>0.04</b>
	Yes after 30 weeks	7	5	71.4	2.76 (0.52-14.56)	
	No	8	7	87.5	7.73 (0.93-63.97)	
	<b>Total</b>	217	108	49.8		
Command of English	Mother tongue	49	19	38.8	ref	<b>0.17</b>
	Fluent	72	34	47.2	1.41(0.68-2.95)	
	Basic	26	15	57.7	2.15 (0.82-5.66)	
	Less than basic	38	23	60.5	2.42 (1.02-5.77)	
	<b>Total</b>	185	91	48.9		
Mother anti-HBe	Positive	32	10	31.3	ref	<b>0.04</b>
	Negative	170	87	51.2	2.31 (0.97 – 5.78)	
	<b>Total</b>	202	97	48.0		
Mother HBeAg	Positive	28	9	32.1	ref	<b>0.05</b>
	Negative	183	95	51.9	0.44 (0.17- 1.09)	
	<b>Total</b>	211	104	49.3		
Mother referred to Hepatologist	No	70	38	54.3	ref	<b>0.15</b>
	Yes	60	25	41.7	0.60 (0.28-1.27)	
	<b>Total</b>	130	63	48.5		

There was an interaction with effect modification observed between command of English and HPU. As detailed below (Table 12), overall, women with basic or less than basic command of English were much more likely to have an incomplete vaccination for their babies (59% versus 44%). In those with no difficulties with English, SE sector performed much better than others (only 20% of babies failing to have the full course of vaccine). On the other hand, for women with difficulties in English, none of the sectors really seemed to deliver high levels of coverage.

**Table 12. Proportion with incomplete uptake of HB vaccination (<4 vaccinations) according to HPU of residence and by command of English compared to overall incomplete uptake in that sector.**

	Incomplete (< than 4 vaccinations)		
HPU	Mother tongue or fluent	Basic or less	Over all incomplete uptake (%)

South West	60%	100%	68%
South East	<b>20%</b>	<b>54%</b>	27%
North West	55%	57%	57%
North East	67%	50%	59%
North Central	73%	62%	68%
Total	44%	59%	49%

### 5.6. Screening and vaccination coverage for sexual partner and other children

- Poor information on other children and partners
- No information on partners
- GPs not aware

**Table 13. Sexual partners and older children identified, tested and vaccinated against hepatitis B, by HPU**

Information about Other Family Members		London HPU					Total
		NE	NC	NW	SE	SW	
Mothers N=		51	42	58	75	23	249
Sexual partners identified N=		33	19	43	75	17	187
Sexual partners tested	Yes	5	0	5	7	0	17
	No	4	0	2	6	0	12
	Unknown	24	19	36	62	17	158
Sexual partners vaccinated	Yes	1	0	7	4	0	12
	No	3	0	8	8	0	19
	Unknown	6	12	27	63	15	123
Are there other children?	Yes	25	6	21	19	0	71
	No	11	2	8	9	0	30
	Unknown	6	9	14	46	17	92
Older children tested	Yes	5	1	0	2	0	8
	No	2	2	0	3	0	7
	Unknown	8	3	12	10	0	33
Older children vaccinated	Yes	19	5	11	13	0	48
	No	4	2	18	8	0	32
	Unknown	15	5	3	6	0	29

## **6. Discussion**

### **4.1 Completeness of the cohort**

A high number of babies at risk in London were identified. The cohort of 249 identified in this study was around three quarters of the number expected, based on aggregated numbers of HBsAg positive pregnant women reported to the AISS. All Trusts participated however some did not have the technical capacity to identify relevant eligible women e.g. -BHR Trust identified three women eligible for the 4th quarter of 2004, compared to a total of 116 HBsAg positive pregnant women reported for the whole 2004 year to AISS. This was surprising and may reflect difficulties in retrospectively flagging patients or linking maternity and laboratory records. In some Trusts AISS data may overestimate the real burden of antenatal HBsAg women. It is possible there are duplicate laboratory reports, or repeated tests. In addition, AISS data may include women tested but who did not deliver a live baby, or women who delivered elsewhere.

Overall though, there are probably women missing in this audit. This sort of discrepancy between expected at risk and the number identified was also noted in a specific audit done in Mayday Hospital in 2006 of babies born in 2004, where the PCT had records for only 46/79 of the babies expected through the AISS data [19]. These findings highlight the need for disaggregate surveillance and monitoring of women infected and babies at risk.

It is also possible that the estimate of vaccine completion is artificially inflated as a consequence of incomplete data, and those not identified could be at greater risk of sub-optimal follow-up (i.e. woman that the acute Trusts can not identify retrospectively for this audit are unlikely to have been referred to anybody; hepatologists, GPs, PCT or HPU leads, or paediatricians).

### **4.2 Characteristics of the mothers**

More than half of the mothers were born in Africa. This differs somewhat from findings in previous London studies of HB infected women where the majority were born in Asia [20-22]. This could be due to implementation of universal HB antenatal screening and identification of some women now who previously may not have been targeted for antenatal testing or to a change in London antenatal population patterns. Where information was available, 2/134 women had problems such as drug use, prison or homelessness reported in the past year. Social problems did seem quite rare in this study although we did not systematically study this or collect relevant information.

There was not much evidence of geographical mobility across HPU sectors, however some HPUs reported that cross borough mobility presents problems for follow up of babies within HPU sectors. Very few mothers (4%) were not booked in the hospital where they delivered and 9% were reportedly lost to follow up by the HPUs at the time of the study.

### **4.3 Vaccination uptake overall and factors associated with incomplete uptake**

A large majority of babies (97%) received their first HB vaccination at birth. However continuity was not always maintained and only half (49%) received the complete course of four vaccinations. This compares with findings of local studies carried out with smaller numbers in London and elsewhere and summarised below:

Time of birth	Place	Number of babies	Complete uptake (4 doses)	Authors. Date published/reported
Set 03-sept 04	Mayday hospital	32	48%	Crook P. June 06
2004	Croydon PCT	33	55%	Crook P. June 06
2004 and 2005	Kingston	23	13%	Jones C. September 06
2004 and 2005	Sutton and Merton PCT	109	66%	Mandal S. Jan 07
Apr 00-Apr 04	Kent HPU	66	45%	Forde I.
	Lambeth, Southwark and Lewisham. SE London HPU			Crook P. July 02
				Wallis DE, Boxall EH BMJ 1999
	Essex Health Authority	29	93%	Bracebridge S, Irwin D, Millership Commun Dis Public Health. 2004 Jun
2001 and 2002	Ealing Hammersmith and Hounslow	144	40%	Van der VanWijgerden
	Brent & Harrow	132	89%	Anderson S & Roper C

Incomplete vaccination was mainly associated with the London health sector of delivery, with South East London doing better than others. It seems that inconsistency in the local arrangements have impacted on the provision of vaccination and on reporting as described elsewhere or locally [23-25].

HPUs report that systems for vaccination and reporting vary considerably between boroughs within their sectors. Many hospitals with higher prevalence of antenatal hepatitis B infection have a hospital based clinic for babies delivered in their maternity unit to ensure the follow up vaccinations. Others have community clinics, and some refer on to GPs. Systems for reporting differ and are complicated if the hospital or community clinics provide vaccination for babies that are not residents of the hospital borough.

In South East London, there seems to be better continuity of care probably resulting from a more integrated approach. A cluster of PCTs (Lambeth, Southwark and Lewisham) have merged their service and jointly fund a dedicated person to liaise with the antenatal screening coordinators, the GPs, and the paediatricians to follow up mothers and their babies.

Although the final responsibility sits with child health departments in PCTs to ensure that neonatal hepatitis B vaccination is completed, the HPUs should be able to monitor vaccination uptake and the protection of family contacts, the current diversity of arrangements makes this difficult.

Our audit did not aim to describe the specific processes in place locally however it appears that some systems work better than others [11;19;10].

None of those not receiving written information on hepatitis B got a complete vaccination for the child. This suggests the importance of appropriate counselling at the maternity unit. Earlier audits in SW, reached the same conclusion [8;11]. Counselling supported by written information, as well as translation services are necessary [26]. Less than half of the women were reportedly referred to the hepatologist or gastroenterologist. It is likely that a hepatologist would reinforce the importance of immunization of the baby, and contribute to an integrated approach for family contacts as well as undertaking a clinical assessment of the infected woman.

The lack of availability of a record of GP details in the notes at the maternity unit was associated with poor outcome and may suggest a lack of GP or poor communication skills. This is a very important issue and in the absence of a GP it is extremely difficult to achieve successful outcome of vaccination. Anecdotal reports suggest that new entrants or asylum seekers are less likely to be registered with a GP. This could be factor associated with incomplete vaccination in this group but was not specifically examined in this audit

Maternal factors such as, ethnicity and country of birth were not significantly associated with outcome. This suggests that the local organization of follow up services is the main determinant of a complete immunisation.

#### **4.4. Blood test for the baby and follow up for the family contacts**

The uptake of the blood test at 15 months was poor (33%) almost all of the babies tested had received four vaccinations. Very poor information is available on the follow up of the family contacts (screening and vaccination of the siblings of the infant and sexual partners of the mother). This might imply discontinuity of care between the maternity unit and follow-up in the community for the whole family. [It is a real concern with reports of up to 11% of contacts chronically infected in other studies; examples of successful integrated approach are reported in Amsterdam [27;28].

Not all the HPUs were able to obtain information on the follow up of family contacts. The absence of this information is an issue and it needs to be further explored in local audits. This audit did not explore maternity protocols for specialist referral of women diagnosed antenatally. Some hepatology centres have anecdotally reported potential capacity problems if all women who screen positive are referred.

#### **4.5 Alignment with COVER data**

Available COVER data did not correspond with the number of babies at risk identified in the audit. Improvements in reporting pathways are needed to ensure COVER data accurately reflects the true caseload.

The LANGSS highlighted as essential the need for PCT commitment and SHA endorsement, both to implement and audit targets. Improvement of data quality and work toward individual-level data was strongly encouraged as well as the necessity to align data from different sources and create links between organisations collecting similar data.

#### **4.6 Missing data**

Data completeness was an issue with the possibility that some vaccinations were given but not centrally documented. At the maternity unit level, there was a general issue of missing information on the questionnaire. The characteristics of the mothers may have been truly missing from the notes altogether or just not reported to the study. Have they been truly missing, that is likely to be detrimental to the mothers and their babies (e.g. level in English and need for translation services in the next consultation, reference to the hepatologist, high infectivity markers and need for HBIg at birth).

## 7. Conclusions

What was already known?

- There are a large number of babies at risk of HB vertical transmission in London
- HB vaccination uptake at birth is good
- COVER data often misrepresent the true local caseload of babies at risk

What this audit adds?

- Overall in London not even half of the babies at risk reportedly received a complete course of hepatitis B immunisation
- The health sector of residence (i.e. HPU and PCT) is associated with uptake of vaccination, more than any maternal factor
- Maternal characteristics (e.g. ethnicity) are not associated with outcome
- A third of the infected mothers have a basic or less than basic level English and outcome was poorer in those women
- The outcome was poorer for women who did not have GP details recorded in maternity notes
- The outcome for babies of women who did not receive written information was poorer
- Not much evidence of geographical mobility across health protection sectors with 7% resident in a health sector (i.e. HPU) different to the HPU of delivery ; and 9% reportedly lost to follow up by the HPU at the time of the study
- Screening and immunisation of family contacts is reported in one in ten families
- The numbers identified for the audit fell short of the numbers anticipated based on AISS and this may reflect the fact that AISS is an aggregate return for women testing positive including duplicates and mothers not progressing to term, or at some Trusts, over reporting to AISS or, inability of maternity units and laboratories to complete the retrospective information required in this audit. Local audits only, and the institution of disaggregate surveillance can resolve this problem
- Recording and reporting of HBIG administration for babies at greatest risk of perinatal infection is sub-optimal at 62%

## 8. Recommendations

### Maternity units:

It is important that the implications for the unborn child and household contacts are understood by HB positive mothers, this is critical to ensure completion of vaccination. In view of the high proportion of mothers for whom English is not the first language, appropriate translation services are necessary. Written information also should be given to support and reinforce the counselling. There could be a "translator needed" note in the maternity records for the next antenatal consultation.

Arrangements should be in place to ensure timely clinical assessment of women who test HBsAg positive. This should be done in collaboration with hepatology services linked to the testing hospital

It is important to ensure that the mother has a GP and GP details are available for further information sharing.

The laboratories should make sure that infectivity markers are sought in any blood samples HB surface antigen positive, for HB e antigen and anti-HBe antibody: Women at high infectivity should be flagged within the maternity unit and their results recorded clearly on the maternity notes.

The HBIg administration form should be completed and returned to the HPA Immunisation Division when the HBIg is administered. If the HBIg is not given to the named patient for any reason this should be reported to the HPA.

#### **PCTs and HPUs:**

PCT child health departments should have a named lead who is responsible for follow up of babies at risk.

PCTs need to ensure that robust arrangements are in place to ensure the following:

1. Information on babies born to hepatitis B positive mothers (including borough of residence) moves from maternity units to the child health department
2. A clear pathway exists for follow up vaccination of babies e.g. hospital clinic, community clinic, GP follow up
3. A clear reporting pathway exists for vaccinations 2,3,4 and blood test results by follow up services to child health department
4. Integration of neonatal hepatitis B vaccination into current and future child health electronic data collection systems
5. Clear pathways for reporting of information on delivery and vaccination of babies between PCTs

In sectors where cross borough mobility is believed to be a problem, HPUs should work with local NHS services to quantify the extent of the problem and if appropriate recommend adoption of the SEL integrated model where the follow up service has been merged across three PCTs.

Robust arrangements need to be in place within the NHS to ensure contacts of and family members of diagnosed hepatitis B infected individuals are assessed and vaccinated if necessary.

## **9. Next steps**

### **Individual level data surveillance by the HPA**

To strengthen the communication between the maternity units, the HPUs and care providers, a pilot of enhanced reporting and surveillance started in London in 2008. This will

- Facilitate alignment and consistency across schemes collecting similar data (AISS, COVER, Cfl)
- Facilitate follow up by the local HPU with NHS services (i.e. the GP) in order to promote high quality management of the cases with regard to clinical referral (i.e. referral to hepatology services for the woman, vaccination of the baby and screening of contacts as required)
- Enable future audits of outcome and management of hepatitis B cases identified antenatally and their contacts. Indicators to monitor are the completion of vaccination of babies born to

HBsAg-positive women; the proportion of women referred to hepatologist; post vaccination test done; and result of post vaccination test)

Individual-level and residence based data will be collected (rather than aggregated data), as recommended. It is essential to have PCT commitment and Strategic Health Authority (SHA) endorsement, both to implement and audit these recommendations. These recommendations should be considered by LANSSG and once endorsed they should be widely discussed and promoted across the HPA and NHS in London.

We believe this scheme will improve the ability of the HPU and HPA to identify London pregnant women at risk in order to improve action taken for them, their babies and household contacts.

### **Increasing uptake of infant hepatitis B vaccine via notification of PCT child health departments**

To increase the uptake of infant hepatitis B vaccination it would be useful to notify PCT child health departments of the need for these vaccinations. The child health department could then flag this need on their computerised child health surveillance system (that lists all local children and their immunisation needs) so that health visitors and community immunisers are made aware that hep B vaccine is needed for this child. To achieve this the NHS (discharging midwife / maternity unit) would need to put in place a system to inform the PCT child health department. This could be achieved either by including with the baby's birth notification (a statutory return made by the midwives to the child health department within 24 hours of birth) a standard letter notifying them of the child's need for hepatitis B vaccine OR the midwives could send a copy of the baby's discharge summary (that is sent routinely to the GP and health visitor anyway) to the child health department highlighting the need for hepatitis B vaccinations. Using this information child health departments could then complete the hepatitis B field that exists on the computerised child health surveillance system to show that this child needs a hepatitis B vaccination. With some minor changes to the IT system it may even be possible to generate standard appointment letters to send to mothers requesting their infant attend for hepatitis B vaccination like any other primary vaccination.

By notifying the local PCT child health department in this way PCTs and health visitors could be made aware of infants at risk enabling them to follow up of vaccinations given by local services.

### **Complementary qualitative approach**

A more qualitative approach could be recommended to explore other possible reasons for poor uptake of vaccination. Only one mother in this study reportedly declined all vaccinations. This could be an underestimate, as the reason for non vaccination were not explored in this audit. It could suggest that incomplete vaccination resulted from a lack of awareness than refusal [29]. Qualitative research and risk communication studies could further explore issues about the nature of the information given to the mothers and their understanding (e.g. re the possible consequences of infection for the unborn baby, re the pathway for them and for their baby -where, when and who will do the vaccinations?). Interviews with some mothers could usefully enhancing our understanding of the problems of accessing information when English is not the first language spoken.

## 10. Appendices

### Appendix 1 London Antenatal Infection Surveillance Scheme (AISS) 2000-2004 : Uptake of testing and hepatitis B prevalence.

*Number of Trusts participating (Half yearly reports received through the London AISS), bookings, tested for HBsAg, rate of testing by half year in London from January 2000 to December 2004 (data up to December 2005)*

Year	Half year	Count of Trusts Participating*	Women Booked	Women tested for HBsAg	Rate of testing for HBsAg %
2000	1	26	52367	47962	91.6
2000	2	28	53767	51278	95.4
2001	1	28	54827	53944	98.4
2001	2	28	52663	50056	95.0
2002	1	29	56356	53203	94.4
2002	2	29	59244	56119	94.7
2003	1	28	58917	55838	94.8
2003	2	28	56530	54785	96.9
2004	1	26	55523	53952	97.2
2004	2	25	52779	50766	96.2

\*Some reports may have been received but have not been counted in this table as booking number, number tested, or both numbers were missing.

*Women tested for HBsAg, screened positive and prevalence per 1000 women tested , by half year in London from January 2000 to December 2004*

Year	Half year	Women tested for HBsAg*	HBsAg positive	Prevalence/1000 women tested
2000	1	45615	419	9.2
2000	2	47149	459	9.7
2001	1	51858	442	8.5
2001	2	50071	461	9.2
2002	1	50696	434	8.6
2002	2	51928	535	10.3
2003	1	57932	596	10.3
2003	2	57100	535	9.4
2004	1	57442	627	10.9
2004	2	54137	630	11.6

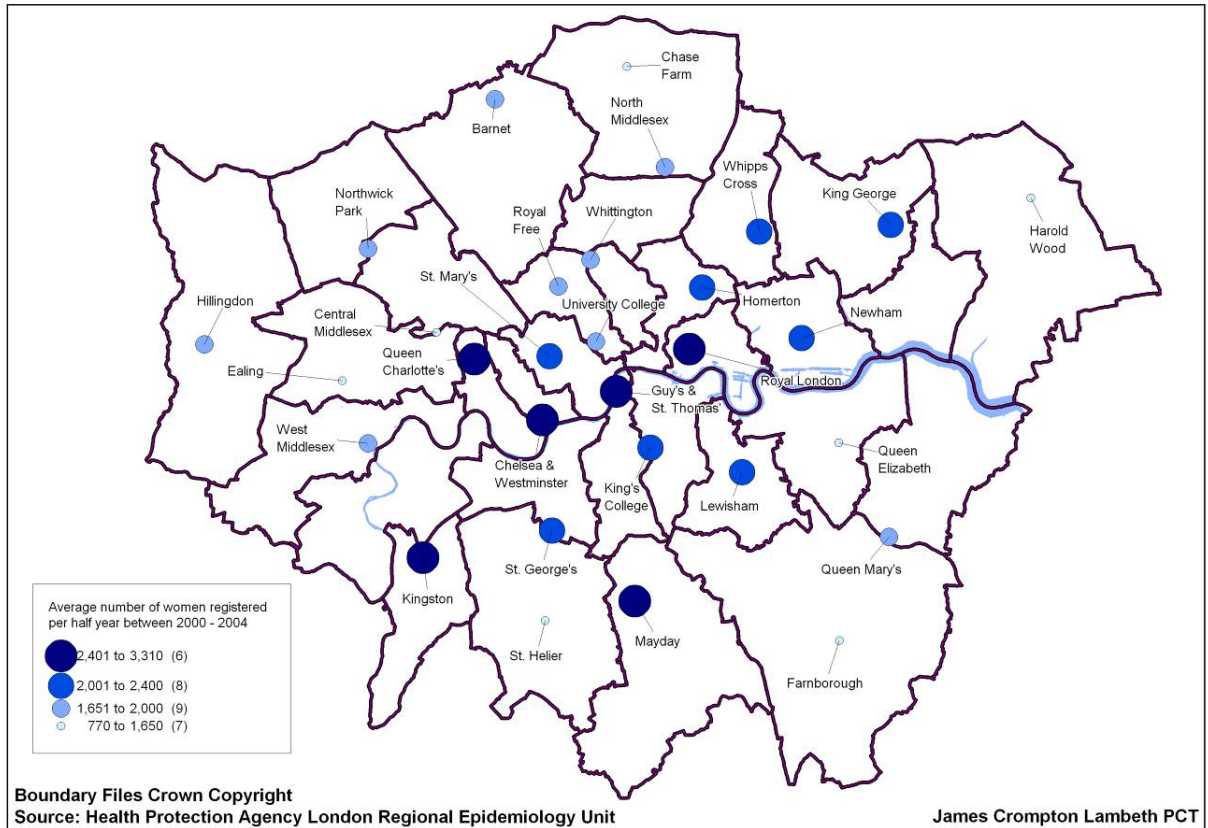
\* The figure of women tested are different of those shown in the first table. In the first table, Trusts are considered only if they provide both numbers of booked and tested women (both needed to calculate the uptake of screening). In this second table, Trusts are considered when both number of tested women and women found positive are provided (both needed to calculate the prevalence of hepatitis B infection).

**Appendix 2 List of NHS Trusts, Primary Care Trusts, Health Protection Units and Strategic Health Authorities in London in 2005**

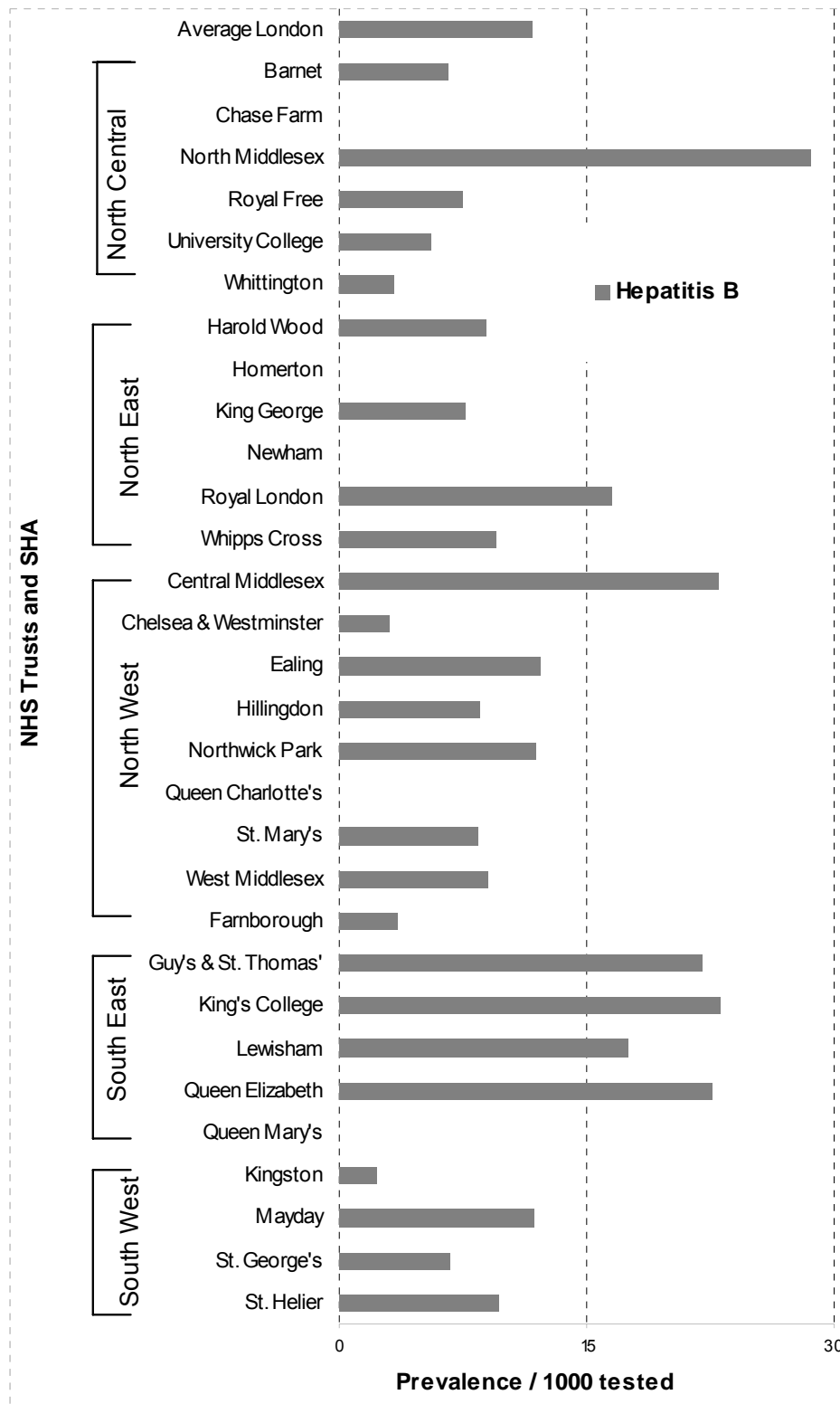
Strategic Health Authority (SHA)	Health protection Unit (HPU)	Primary Care Trust (PCT)	NHS Trusts
North Central	NEC	Barnet	Barnet
North Central	NEC	Haringey	North Middlesex
North Central	NEC	Enfield	Chase Farm
North Central	NEC	Camden	University College L
North Central	NEC	Camden	Royal Free
North Central	NEC	Camden	Whittington
North East	NEC	Havering	Harold Wood*
North East	NEC	Havering	St. George's
North East	NEC	City and Hackney	Homerton
North East	NEC	Barking and Dagenham	Barking
North East	NEC	Redbridge	King George*
North East	NEC	Newham	Newham
North East	NEC	Tower Hamlets	Royal London
North East	NEC	Waltham Forest	Whipps Cross
North West	NW	Brent	North West London Hospital
North West	NW	Harrow	North West London Hospital
North West	NW	Ealing	Ealing
North West	NW	Hammersmith & Fulham	Hammersmith
North West	NW	Hammersmith & Fulham	Queen Charlotte's & Chelsea Hospital
North West	NW	Hounslow	West Middlesex
North West	NW	Hillingdon	Hillingdon
North West	NW	Westminster	St. Mary's
North West	NW	Kensington and Chelsea	Chelsea & Westminster
North West	NW	Kensington and Chelsea	Royal Brompton and Harefield
South East	SE	Bexley	Bexley
South East	SE	Bromley	Bromley
South East	SE	Bromley	Princess Royal University Farnborough
South East	SE	Greenwich	Queen Elizabeth
South East	SE	Lambeth	Guy's & St. Thomas'
South East	SE	Southwark	King's College
South East	SE	Lewisham	Lewisham
South West	SW	Croydon	Mayday
South West	SW	Kingston and Richmond	Kingston
South West	SW	Wandsworth	Queen Mary's
South West	SW	Merton, Sutton	St. George's
South West	SW	Merton, Sutton	St. Helier and Epsom

\* are BHR since 2005

**Appendix 3 Map of the 30 NHS Trusts participating to the London Antenatal Infection Screening Surveillance (AISS), London 2000-2004.**



**Appendix 4 Pregnant women tested for hepatitis B and found positive; prevalence of infection by Trust, through the London AISS, 2nd half of 2004 .**



**Appendix 5a Questionnaire for mothers and babies at birth**


<b>Audit of immunization coverage in infants at risk of perinatal transmission of hepatitis B</b>	
<b>Babies born between 1st October and 31 December 2004 to a London resident HBsAg mother</b>	<i>For office use only</i> Unique study number <input type="text"/> Date received <input type="text"/> dd /mm /yy
The HBsAG positive mother	
<b>Mother's details</b>	
NHS Number	<input type="text"/>
Hospital number	<input type="text"/>
NHS Trust	<input type="text"/>
Booked before delivery?	Yes No Unknown
Surname	<input type="text"/>
Alternative surname?	<input type="text"/>
Forename	<input type="text"/>
Mother's date of birth	<input type="text"/> dd /mm /yy
Address	<input type="text"/>
Post code	<input type="text"/>
Ethnicity	Black-African <input type="checkbox"/> Bl.-Caribbean <input type="checkbox"/> Black-Other <sup>a</sup> <input type="checkbox"/> Indian/Bangladeshi/Pakistani <input type="checkbox"/> White <input type="checkbox"/> Chinese <input type="checkbox"/> Other asian <input type="checkbox"/> Unknown <input type="checkbox"/> Other specify <input type="text"/>
Country of birth	<input type="text"/>
Year of arrival in the UK	<input type="text"/> year
Competency in English	Mother tongue or equivalent <input type="checkbox"/> Fluent <input type="checkbox"/> Basic <input type="checkbox"/> Less than Basic <input type="checkbox"/> Information not available <input type="checkbox"/> <small>Please see overleaf for guidance about how to interpret these categories</small>
Occupation	<input type="text"/>
Injecting drug during past year*	Yes No Unknown
Homeless during past year**?	Yes No Unknown
Imprisoned during past year*	Yes No Unknown
<small>* Give details in comments (see below)</small>	
<b>Maternal hepatitis B infection</b>	
Date of most recent HBsAg+ test	<input type="text"/> dd /mm /yy
Acute hepatitis during pregnancy?	Yes No Unknown <small>Details</small>
HBsAg	Pos / Neg / Unknown
Anti-Hbe	Pos / Neg / Unknown
HBeAg	Pos / Neg / Unknown
Mother referred to a hepatologist	Yes No Unknown
Written information given re Hep B infection, specifying date of required vaccinations	Yes No Unknown
If yes, date	<input type="text"/> dd /mm /yy
<b>Additional question: rubella immunization for the mother</b>	
Is the mother immune?	Yes No Unknown
MMR vaccination given?	Yes No Unknown
<b>GP's details</b>	
Name	<input type="text"/>
Tel	<input type="text"/>
Address	<input type="text"/>
Post code	<input type="text"/>
email	<input type="text"/>

.../...

.../...

Baby's details			
Baby's NHS Number	<input type="text"/>	Hospital number	<input type="text"/>
Baby's surname	<input type="text"/>	Baby's forename	<input type="text"/>
Sex	<input type="radio"/> M <input type="radio"/> F <input type="radio"/> Unknown	Baby's date of birth	<input type="text" value="dd/mm/yy"/>
Consultant paediatrician		<input type="text"/>	
Interventions at birth			
HB vaccination at birth?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown	Date of vaccination	<input type="text" value="dd/mm/yy"/>
HBIg required?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unknown	Date of HBIg given	<input type="text" value="dd/mm/yy"/>
Comments	<input type="text"/>		
Form completed by	<input type="text"/>	Date	<input type="text" value="dd/mm/yy"/>
Position	<input type="text"/>	Email	<input type="text"/>
		Tel	<input type="text"/>
<p><b>Categories for competency in English question</b>  <b>Mother tongue or equivalent</b>                      English is the woman's first language or else she is FULLY multilingual.</p> <p><b>Fluent</b>                      While not at mother tongue level, the woman's competence in English is sufficient to allow her to cope with almost anything she may encounter in the healthcare system: appointments, literature, etc. Occasionally, a term or expression may be unfamiliar to her however or else she may struggle when the speaker has an unfamiliar regional accent.</p> <p><b>Basic</b>                      Speak and understands English to a limited degree. Her understanding will probably exceed her ability to speak however and she will struggle with complex information and terminology. She will probably be interviewed directly for instance, but ideally in the presence of someone fluent in her mother tongue (or another language she is fluent in).</p> <p><b>Less than Basic</b>                      This woman may be able to speak a few sentences, but even if this is the case, she will be unable to cope with appointments and literature without assistance from someone who speaks her mother tongue (or another language she is fluent in).</p> <p><b>Not known</b>                      This information was not reported.</p>			
<p><b>Health Protection Agency</b> London Region                      7th Floor Holborn Gate, 330 High Holborn, London WC1V 7PP Ph: 020 7759 2814 or 2804                      Contacts Isabelle.Giraudon@hpa.org.uk</p>			
<p><b>Please note: we hope that Antenatal Screening Coordinators at each Trust can ensure that a form is completed for each baby born between 1st October and 31 December 2004 to a London resident HBsAg +ve mother and return it by post at the address above</b></p>			

**Appendix 5b Questionnaire for babies by 15 months**

Audit of immunization coverage in infants at risk of perinatal transmission of hepatitis B									
Babies born between 1st October-31st December 2004 to a London resident HBsAg+ve mother				For office use only					
Baby at 15 months				Unique study number					
				Date received	day / month / year				
Baby's details									
NHS Number			Hospital number						
Surname			Forename						
Sex	M	F	Unknown	Date of birth	day / month / 2004				
Vaccination and testing									
Number of HBV vaccinations received by 15 months	0	1	2	3	4	Unknown			
Source of information for the vaccination received <i>(Several answers are possible for sources)</i>	HPU records		GP		C. Health System				
	PCT records		Paediatrician		Health visitors				
	Other:specify								
Post-vaccination testing done?	Yes	No	Unknown						
If baby tested									
HBsAg	Pos / Neg / Unknown		Other HBV markers						
Anti HBC	Pos / Neg / Unknown		If other markers, specify (E.g. anti HBs; HBsAg)						
Hepatitis B screening for family members									
Sexual partner screened	Yes	No	Unknown		Vaccinated*	Yes	No	Unknown	
Are there older children?	Yes	No	Unknown		<i>If yes, complete below for each of the children</i>				
Child 1 screened	Yes	No	Unknown		Vaccinated*	Yes	No	Unknown	
Child 2 screened	Yes	No	Unknown		Vaccinated*	Yes	No	Unknown	
Child 3 screened	Yes	No	Unknown		Vaccinated*	Yes	No	Unknown	
Child 4 screened	Yes	No	Unknown		Vaccinated*	Yes	No	Unknown	
Child 5 screened	Yes	No	Unknown		Vaccinated*	Yes	No	Unknown	
* Vaccinated means 3 courses of vaccine given									
Additional question BCG									
BCG vaccine at birth?	Yes	No	Unknown		BCG given since then	Yes	No	Unknown	
Comments									
Form completed by			Position			Date	day / month / year		
Health Protection Agency London Region 7th Floor Holborn Gate, 330 High Holborn, London WC1V 7PP Ph: 020 7759 2814 Contacts Isabelle Giraudon Isabelle.Giraudon@hpa.org.uk									

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