

Supplementary Appendices

Supplementary Material A. Tables and Figures

Appendix Table 1: Focuses of each universal health review

Health review	Age window	Focuses
Antenatal review	28 weeks pregnancy	Breastfeeding, safer sleep, smoke free pregnancy, immunisation status, maternal and partner mental health
New birth review	10-14 days after birth	Breastfeeding support, safer sleep, transition to parenthood, parent-child interaction, smoke free home
6-8-week review	6-8 weeks old	Breastfeeding support, family mental health, immunisation status, safer sleep, communication and interaction
One-year review	9-12 months old	Immunisation status, nutrition, safer sleep, oral health, accident prevention, physical activity, speech, language, communication
2-2 ¹ / ₂ -year review	2-2 ¹ / ₂ years old	Immunisation status, physical activity, nutrition, oral health, accident prevention, school readiness, speech, language, communication

Appendix Table 2: Coding of date-derived mandated health visiting contacts in the community service dataset

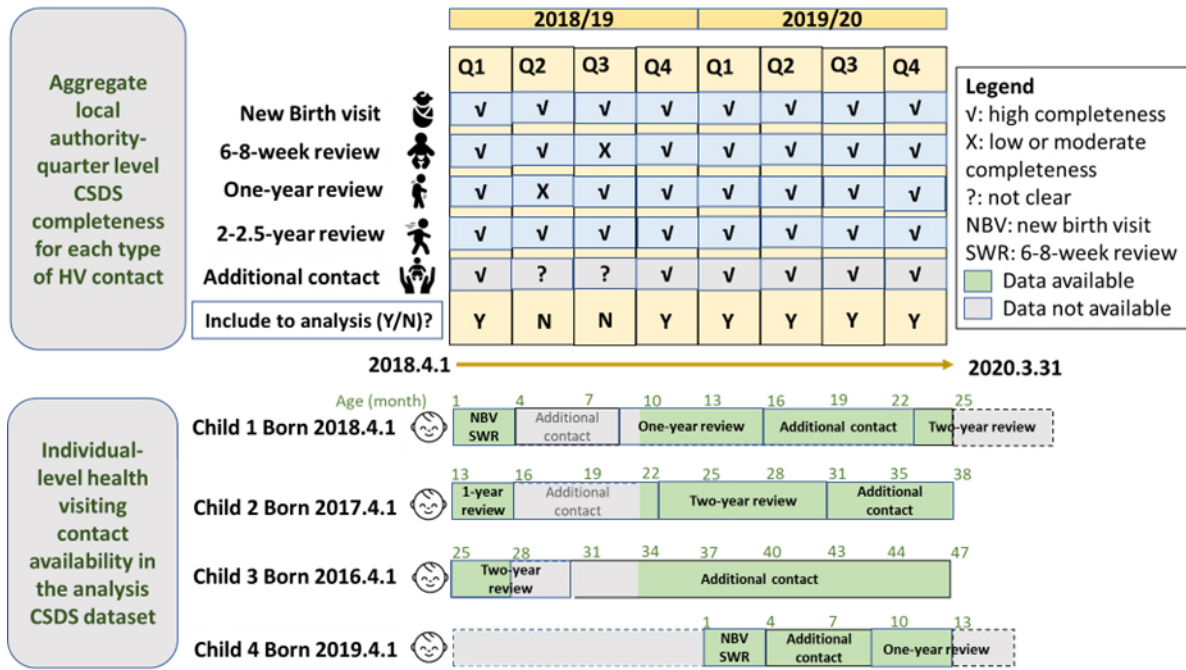
Variable name	Relevant time period	Mandated contact
ContactBetween8_14Days_Flag	8–14 days	New birth visit
ContactBetween15_30Days_Flag	2–4 weeks	New birth visit
ContactBetween42_56Days_Flag	6–8 weeks	6-8-week review
ContactBetween42_63Days_Flag	6–9 weeks	6-8-week review
ContactBetween270_366Days_Flag	9–12 months	One-year review
ContactBetween270_457Days_Flag	9–15 months	One-year review
ContactBetween691_914Days_Flag	23–30months	2-2 ¹ / ₂ -year review

Appendix Table 3: Local-authority-quarters included in the analysis CSDS dataset

Number of quarters a local authority contributed				Number of local authorities contributing to each quarter			
Number of quarters	Number of LAs	Percent (%)	Cum percent (%)	Fiscal Quarter	Number of LAs	Percent (%)	Cum percent (%)
1	15	26.3	26.3	2018/19 Q1	15	9.2	9.1
2	16	28.1	54.4	2018/19 Q2	16	9.8	18.9
3	11	19.3	73.7	2018/19 Q3	22	13.4	32.3
4	4	7.0	80.7	2018/19 Q4	22	13.4	45.7
5	3	5.3	86.0	2019/20 Q1	24	14.6	60.4
6	5	8.8	94.7	2019/20 Q2	22	13.4	73.8
7	1	1.8	96.5	2019/20 Q3	23	14.0	87.8
8	2	3.5	100	2019/20 Q4	20	12.2	100
Total	57	100		Total	164	100	

Note: There are a total of 149 local authorities in the analysis as City of London is combined with Hackney and Isles of Scilly is combined with Cornwall. LA: local authority. Cum percent: cumulative percentage.

Appendix Figure 1: Illustration of the selection of the analysis CSDS dataset in an imaginary local authority

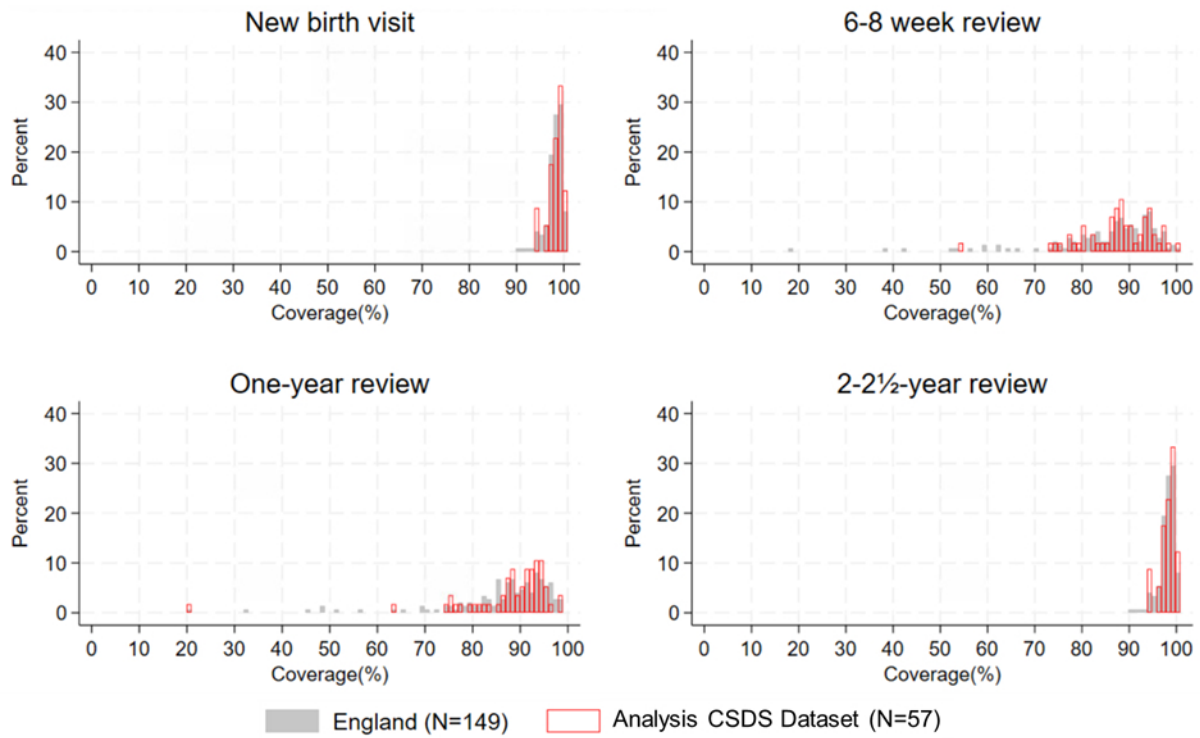


Appendix Table 4: Characteristics of the study sample in the analysis CSDS dataset and Health Visiting metrics

Characteristic	Analysis CSDS dataset	Health visiting metrics
Number of local authorities-quarters (local authorities)	164 (57)	1,192 (149)
Average number of quarters per local authority (range)	2.9 (1, 8)	8 (8, 8)
Number of local authorities by main provider (%)		
HS	43 (75.4%)	–
Council	6 (10.5%)	–
Others (e.g., private company)	8 (14.0%)	–
Number of contacts (%)	1,779,155	4,172,835
New birth visits	167,425 (9.4%)	1,135,310 (27.2%)
6-8-week-review	157,130 (8.8%)	1,006,025 (24.1%)
One-year review	169,495 (9.4%)	1,041,825 (25.0%)
2-2½-year review	165,680 (9.3%)	989,680 (23.7%)
Additional contacts	1,119,420 (62.9%)	–

Note: There are a total of 149 local authorities in the analysis as City of London is combined with Hackney and Isles of Scilly is combined with Cornwall.

Appendix Figure 2: Distribution of coverage of mandated contacts at the local authority level, comparing analysis CSDS dataset and the whole dataset of England, April 2018-March 2020



Supplementary Material B. Data cleaning and management process

We checked the overall level of missing values for variables in Community Services Dataset (CSDS) that are relevant to health visiting delivery (Supplementary Material B, Appendix Table 1). Locations were only applicable for face-to-face contacts. We include variables that are conceptually relevant and have an acceptable level of missing values (<20%): medium, location, whether delivered in a group setting, organisation identifier, and clinical duration. Some important variables were excluded due to a high level of missing data, for example, staff type and occupation type.

We then cleaned and re-categorised the variables we included. For categorical variables, we checked errors. We speculate the true value where possible. For example, the location variable was coded with organisation codes in some contacts, and we replaced the location variable with the corresponding location categories for these contacts. Where such speculation cannot be made, we set the errors to missing.

Categorical variables were then re-categorised into broader groups (Supplementary Material B, Appendix Table 2). Provider organisations were grouped into three types: NHS providers, council providers, and other providers (including

private organisations). Provider type was obtained by searching organisation identifier in CSDS on NHS Digital Organisation/Practitioner Search platform. The type of provider recorded for more than 80% of the Health Visiting contacts in a local authority was considered the main provider in this local authority. The medium of contact was grouped into face-to-face, phone calls, and others. We only looked at the location of face-to-face contacts. Contact locations were grouped into home, health and social care settings, children's centres, and others.

For the duration of contacts, we checked extreme values. Duration of zero minute was set to missing and durations that are longer than eight hours were set to eight hours. Health visiting contacts are assigned into one of the following duration groups: 1-29 min, 30-44 min, 45-59 min, ≥ 60 min.

We further assessed the missingness of these variables at the local authority level. If a local authority had more than a quarter of data missing in a certain variable across all quarters within the dataset, we set the entire variable missing for this local authority as the quality of data is not reliable for this variable this local authority. This means that we may have lost some information on certain variables for some local authorities.



Appendix Table 1: Missingness in variables relevant to Health Visiting service delivery in the analysis CSDS dataset

Variable	% contacts have missing values prior to cleaning	Comments
Medium (face-to-face, telephone, email, etc.)	7.1%	Include
Locations for face-to-face contacts (home, health centre, child centre, others)	12.8%	Include
Group therapy (yes/no)	5.8%	Include
Organisation identifier	0%	Include
Clinical duration (minutes)	9.4%	Include
Initial/follow-up contact	11.8%	Exclude: 1) most of the initial contacts are new birth visits and other mandated and additional contacts are follow-up contacts. 2) The analysis CSDS dataset is not longitudinal, so the initial contacts of the included follow-up contacts may not appear the analysis dataset.
Distance from home to contact location		Exclude: due to high levels of missing data
Home visit contacts	82.0%	
In health care and social settings	68.3%	
In children's centres	89.7%	
Days referral to care contact	0%	Exclude: although no missing values, it is not clear what this variable means.
Registration body (General medical council, General dental council, Health and care professions council, Nursing and midwifery council, etc.)	77.4%	Exclude: due to high levels of missing data
Mandated contacts	74.8%	Exclude: due to high levels of missing data
Additional contacts	78.9%	Exclude: due to high levels of missing data
Staff type (Each type of therapist, Health care worker or assistant, General medical practitioner, Community midwife, Health visitor, Staff nurse, Other nurses)	79.2%	Exclude: due to high levels of missing data
New birth visit	73.8%	Exclude: due to high levels of missing data
6-8 week review	74.4%	Exclude: due to high levels of missing data
One year review	78.6%	Exclude: due to high levels of missing data
Two-year review	81.5%	Exclude: due to high levels of missing data
Additional contact	80.4%	Exclude: due to high levels of missing data
Occupation type (Admin staff, Health care assistants & support staff, Nursing & midwifery & health visiting staff, Nursing & midwifery & health visiting learners, etc.)	96.8%	Exclude: due to high levels of missing data
Job role (Medical & dental, students, Specialist nurse, Staff nurse, Community practitioner, etc.)	77.9%	Exclude: due to high levels of missing data
Mandated contacts	75.5%	Exclude: due to high levels of missing data
Additional contacts	79.4%	Exclude: due to high levels of missing data
Service/team type (Health visiting service, School nursing service, etc.))	1.9%	Exclude: this variable was used to identify Health Visiting contacts

Appendix Table 2: Recategorisation of the medium and location of contacts

Categories in raw CSDS		Categories used in analysis	
Code	Category	Code	Category
Medium			
01	Face-to-face communication	1	Face-to-face contact
02	Telephone	2	Phone call
03	Telemedicine	3	Others
04	Talk type for a person unable to speak		
05	Email		
06	Short Message Service (SMS) – Text Messaging		
07	Online Triage		
08	Online Instant Messaging		
98	Other (not listed)		
Location			
A01-A04	A01 patient's home; A02 carer's home; A03 patient's workplace; A04 other patient related location	1	Home
B01-B02	B01 primary care health centre; B02 polyclinic	2	Health and social care settings
C01-C03	C01 general medical practitioner practice; C02 dental practice; C03 ophthalmic medical practitioner premises		
D01-D03	D01 walk in centre; D02 out of hours centre		
E01-E099	E01 out-patient clinic; E02 ward; E03 day hospital; E04 emergency care department or minor injuries department; E99 other departments		
H01	day centre		
J01	resource centre		
F01	hospice		
G01-G04	G01 care home without nursing; G02 care home with nursing; G03 children's home; G04 integrated care home without nursing and care home with nursing		
K01-K02	K01 sure start children's centre; K02 child development centre	3	Children's centre
L01-L99	L01 school; L02 further education college; L03 university; L04 nursery premises; L05 other childcare premises; L06 training establishments; L99 other educational premises	4	Others
M01-M07	M01 prison; M02 probation service premises; M03 police station / police custody suite; M04 young offender institution; M05 immigration removal centre;		
N01-N03	N01 street or other public open space; N02 other publicly accessible area or building; N03 voluntary or charitable agency premises		
X01	other locations not elsewhere classified		

