

## Online Only Supplemental Appendix

### Supplementary Appendix 1: Description of linkage bridging files transferred to UCL Data Safe Haven and to the Office of National Statistics Secure Research Service

As described in Figure 1, NHS Digital transferred two linkage bridging files to UCL Data Safe Haven (DSH). The first file contained the results of the first two linkage stages (See Tables 1 and Tables 2). This file included the link results when steps in Table 1 allow to link an NPD record to one PDS record only.

To remove potential duplicate HES IDs for the same pupil, a second linkage bridging file was created by NHS Digital and sent to UCL DSH. This second file included the link result in which only a modified step 1 of Table 1 was run, allowing an NPD record to link to many PDS records. Steps 2-8 in Table 1 were not run, and steps 1-7 in Table 2 were repeated.

### Supplementary Appendix 2: Timelines of the four cohorts alongside availability of data from Hospital Episode Statistics, National Pupil Dataset data and Personal Demographics Service

Supplementary Figure 1 shows timelines of the four cohorts alongside availability of data from HES (Grey), DfE NPD data (Green) and PDS (Yellow).

#### Cohort 1

This cohort includes young people born between 01/09/1990-31/08/1991 who entered reception class in September 1996. These young people are captured in HES on their first hospitalisation on or after 01/04/1997 (at approximately 7 years of age or more). These children are first recorded in the NPD with their KS1 and KS2 data from 1998 and 2002,

respectively, and annual school census from 2001/2 onwards. This cohort tests linkage with all children (state and non-state educated) who have a KS4 assessment (approximately 99% of adolescents aged 15/16). The other cohorts only capture children attending state schools (around 92% of the population). The cohort also tests linkage with young people receiving higher education up to age 18 years, a group who are likely to move and who have relatively high rates of admission to hospital.

#### Cohort 2

This cohort comprises children born between 01/09/1996-31/08/1997 who entered reception class in September 2002. These children are recorded in the NPD annual school census from 2001/2 and in KS1 data from 2003/4. These children enter secondary school in September 2008 and have KS3 recorded in 2011 and KS4 recorded in 2012/13. Data on hospitalisations is captured in HES on or after 01/04/1997 (at least approximately 1 year of age) until the most recent data extract available. This cohort has annual Pupil Level Annual School Census (PLASC) census data throughout the primary school years, but not all have had a hospital admission.

#### Cohort 3

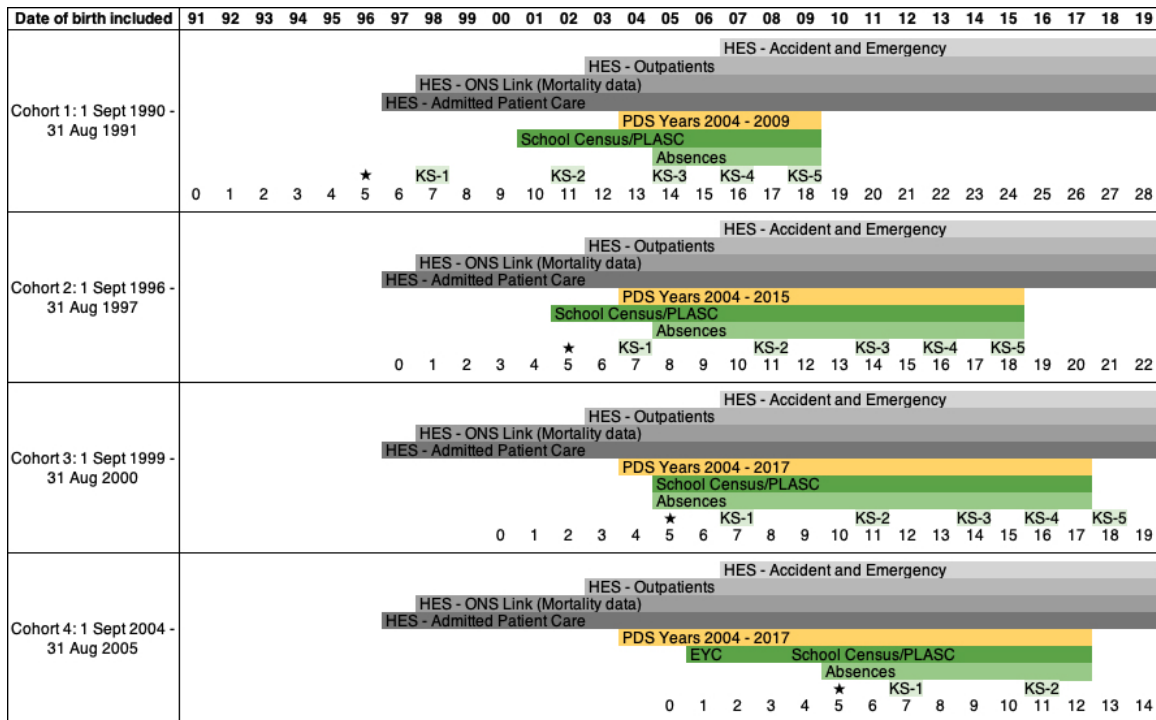
These children are born between 01/09/1999-31/08/2000 and enter NPD in the school census at reception in September 2005. This cohort captures indicators of chronic conditions recorded in the birth record and in infancy, which is the period when the risk of admission to hospital is the highest. These children are recorded in KS1, KS2, KS3 and KS4 data from 2006/07, 2010/11, 2013/14, and 2015/16, respectively.

#### Cohort 4

These children were born between 01/09/2004-31/08/2005 and entered NPD in the school census at reception in September 2010. NPD are requested up until KS2 data which will end in 2015/16. This cohort data in HES and PDS is concurrent, and therefore we expect a higher likelihood of successful linkage.



Supplementary Figure S1: Timelines of the four cohorts alongside availability of data from HES (Grey), DfE NPD data (Green) and PDS (Yellow)



Notes: This figure show the timelines of the four cohorts alongside availability of data from the three sources HES, PDS and NPD for each year on the 1 April. Cohort 1: young people born between 01/09/1990-31/08/1991 who entered reception class in September 1996. DfE NPD extracts include all pupils in Year 6 in 2001/02 as a proxy for those in reception year in 1995/96. Cohort 2: children born between 01/09/1996-31/08/1997 who entered reception class in September 2002. Cohort 3: children are born between 01/09/1999-31/08/2000 and enter NPD in the school census at reception in September 2005. Cohort 4: children are born between 01/09/2004-31/08/2005 and enter NPD in the school census at reception in September 2010. Numbers in last row for each cohort correspond to age of child. Black stars are point of entry to reception. NPD National Pupil Dataset; PDS Personal Demographics Service; HES Hospital Episode Statistics; NHS National Health Service; ONS Office for National Statistics; APC Admitted Patient Care; A&E Accident and Emergency; EYC Early Year Census; EYFSP Early years foundation stage profile; KS Key Stage.



## Supplementary Appendix 3: Description of data resources used in the linkage

Supplementary Table 1: Description of data resources used in the linkage

Data	Population	Years collected	Data captured	Identifiers
<b>NPD</b>	All pupils in England in state schools	School Census/PLASC: 2002 onwards Early Year Census (EYC): 2008-2013 only for 3- and 4-year-olds, and 2014 onwards for all pupils  Absences: 2006 onwards (exclusions, 2002 onwards) Attainment: EYFSP: 2003–2006 for only 10% of pupils, 2007 onwards for all pupils KS1: 1998 onwards KS2: 1996 onwards KS3: 1998-2013 KS4: 2000 onwards KS5: 2001 onwards	Information about all pupils who are currently at school from reception to progression at each key stage. Pupil level data on demographic and personal details, school attended, as well as whether the pupil receives support for special educational needs and/or eligibility for receiving free school meals. Pupil level data on absences and exclusions per term.  Pupil level data on attainment at the EYFSP (ages 3 to 5) and Key Stages 1 to 5 (ages 7 to 18).	First name(s), surname(s), date of birth, sex, residence postcodes history, residence postcodes dates entered each term.
<b>HES</b>	All activity in English hospitals	APC (Inpatients): April 1997 onwards*  HES-ONS link mortality: 1997 onwards Outpatients: 2003 onwards  A&E: 2010 onwards**	Episode level data on all inpatient and day case discharges; information relating to admissions such as admission type, date, reason; clinical information such as diagnosis and procedure codes and demographic data. Deaths records of patients in English hospitals. Information on type of outpatient appointment, the main speciality, treatment speciality, referral source, waiting times, diagnosis and procedures. Records of each A&E attendance, time and method of arrival and departure, time spent in A&E.	First name(s), surname(s), date of birth, sex, residence postcode, NHS number entered for each NHS contact.
<b>PDS</b>	All NHS patients	2004 onwards	Demographic data of users of health and care services in England.	First name(s), surname(s), date of birth, sex, residence postcodes history, residence postcodes dates, address, NHS number entered each time GP registration is updated, or a hospital enters a different address.

Notes: \* APC (Inpatient) data has been collected since 1989 onwards. However, it can be linked only from 1997 due to the introduction of NHS numbers, which is an important element in the linkage of data. \*\* A&E collection was first started in 2007 but the coverage and quality improved from 2010 onwards.

NPD National Pupil Dataset; PDS Personal Demographics Service; HES Hospital Episode Statistics; NHS National Health Service; ONS Office for National Statistics; APC Admitted Patient Care; A&E Accident and Emergency; EYC Early Year Census; EYFSP Early years foundation stage profile; KS Key Stage.

Supplementary Table 2: Example of NPD linkage table

aPMR	Cohort	First name	Surname	Date of birth	Sex	Postcode	Year*
1	1	John	Smith	01/01/1988	1	LS0 0AA	2004
1	1	John	Smith	01/01/1988	1	LS1 1AA	2005
1	1	John	Jones	01/01/1988	1	LS2 2AA	2006

Notes: All records for all pupils in all four cohorts were combined into a single table for linking (multiple rows for each pupil) \* Year refers to academic year (e.g. 2004 means 01/09/2003 – 31/08/2004, and so on for all subsequent years).

Supplementary Table 3: Example of PDS linkage table

NHS Number	First name	Surname	Date of birth	Sex	Postcode	P/A/N Start date	P/A/N End date
123456	John	Smith	01/01/1988	1	LS0 0AA	01/01/2004	NULL
123456	John	Smith	01/01/1988	1	LS1 1AA	01/01/2005	NULL
123456	John	Jones	01/01/1988	1	LS2 2AA	01/01/2006	NULL

Notes: All records from PDS table for person, name and address were combined into a single table for linking (multiple rows for each NHS Number). NULL end dates mean that the record is current.



## Supplementary Appendix 4: Description of linkage between Personal Demographics Service and National Pupil Dataset

Using NPD census extracts, NHS Digital created the linkage table with identifiers for pupils in all four cohorts (Supplementary Table 2). The linkage table contained multiple rows for each pupil indicating different school censuses. For a link to be found in the linkage stage 1, besides considering the 8 steps in Table 1, the academic year from the NPD (column Year in Supplementary Table 2) needed to overlap the date intervals recorded in PDS records corresponding the period when specific demographic information was updated (see paragraph below).

Using PDS, NHS Digital created a table with patients' identifiers (Supplementary Table 3). In this table, multiple rows for each patient's NHS number were available referring to dates when specific patient demographic information was updated (date of birth, sex, address and name). For each NHS Number, when a record is updated, the date is recorded in the P/A/N Start date and the P/A/N End date variables. These two dates define intervals that we used in the linkage algorithm. An interval corresponds to the period between the P/A/N Start date and the P/A/N End date. P refers to a PDS record resulting from a person change (date of birth and sex), A refers to address change, and N refers to name change.

The linking algorithm takes into account all three PDS date types: Person (P), Name (N) and Address (A). The end date is the date P/A/N changes ceases to be applicable. The start date is the date that P/A/N changes start to be applicable. The two agreement dates in PDS, which are the starting and ending date of the academic year, ensure that the recent record is being linked from NPD to PDS.

### Criteria for agreement dates for NPD to PDS linkage

The academic year from the NPD needs to overlap the PDS date intervals for all the relevant types, i.e. Person, Name, and Address. For example, for a link to be found when looking at an NPD record for spring census 2004, the relevant data fields (i.e. a combination of name, date of birth, sex and postcode) must link and the following criterion must hold:

$$(01/09/2003 \leq P \text{ end date}) \text{ and } (P \text{ start date} \leq 31/08/2004)$$

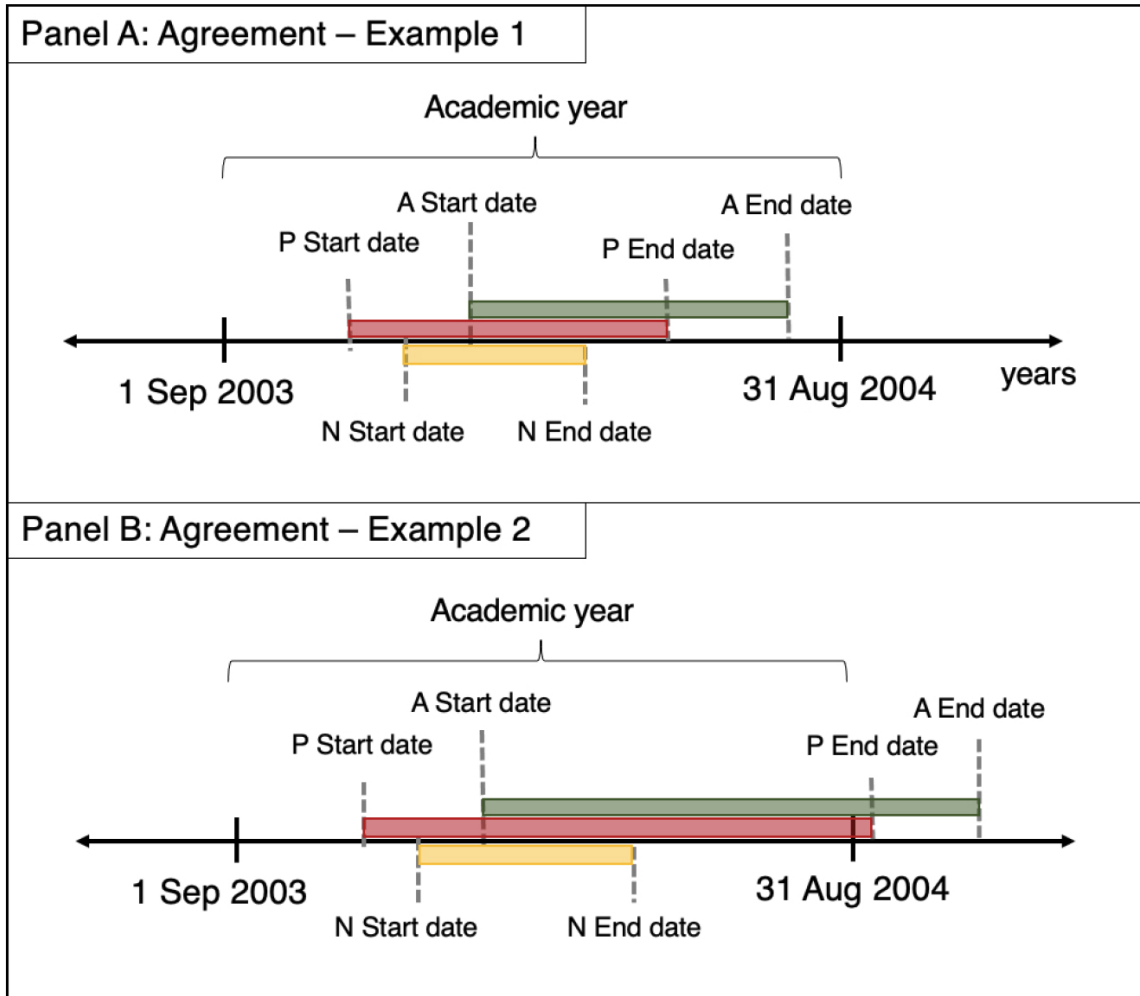
$$\text{and } (01/09/2003 \leq A \text{ end date}) \text{ and } (A \text{ start date} \leq 31/08/2004)$$

$$\text{and } (01/09/2003 \leq N \text{ end date}) \text{ and } (N \text{ start date} \leq 31/08/2004)$$

This criterion means that the academic intervals created by P/A/N Start date and End date must be within the corresponding academic year. In Panels A and B of Supplementary Figure 2 we show examples in which the previous criteria hold.



Supplementary Figure S2: Criteria for agreement dates, example using NPD spring census 2004 and three types of PDS dates



Note: This figure displays P/A/N dates for the academic years 2003/04. In this example, the agreement dates in PDS are 01/09/2003 and 31/08/2004. P = Person, N = Name, A = Address.



## Supplementary Appendix 5: Description of demographic variables in national pupil dataset

### Region 2011 pupil's residence

We derived the region of pupil's residence using the National Statistics Postcode Directory Lower Layer Super Output Area (*LSOA11*) derived from the pupil's postcode (based on 2011 Census). We used the first available *LSOA11* in the spring censuses.

### Ethnic group

We derived this variable as the most common recorded ethnic group in the National Pupil Database. We used *ethnicgroup* variable before 2006 and *ethnicgroupmajor\_spr* from 2006 onwards. We derived six categories to classify ethnic groups (White, Asian, Black, Chinese, Any other ethnic group, and Mixed). The following tables describe the codes assigned to each ethnic category.

### Sex and IDACI deciles

We used the *gender* variable recorded and Income Deprivation Affecting Children Indices (IDACI) deciles derived from the pupil's postcode (*IDACIRank*). We used the first available IDACI decile in the Spring censuses.

### Age at start academic year

We used the age at the start academic year (*AgeAtStartOfAcademicYear*) that was recorded in the first spring census available.

### Persistent absence

Defined as whether a child was absent in 10% or more of academic sessions.

We defined the authorised annual absence rate for all academic years available as the number of sessions missed due to authorised absence during the academic year (*AuthorisedAbsence\_3Term\_ab*) divided by the number of sessions possible for the academic year (*SessionsPossible\_3Term\_ab*). Numerator and denominator are based on all schools' termly sessions except special schools for which annual sessions' data are used.

Special Education Need (SEN); School Action or Early Years Action, School Action Plus or Early Years Action and SEN support (AAP/S); and Statement and Education, health and care plan (S/EHCP)

We derived the SEN, AAP/S and S/EHCP variables using the classification in the following table.



Supplementary Table 4.1: Classification of ethnic group with the *ethnicgroup* variable

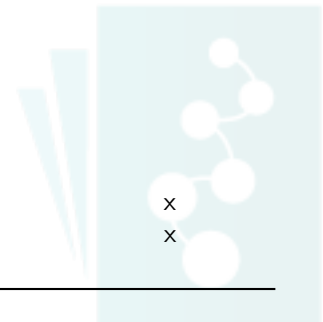
<b>ethnicgroup</b>	<b>Ethnic group</b>	<b>Code</b>
Any Other White Background	White	1
Gypsy / Romany	White	1
Irish	White	1
Traveller Of Irish Heritage	White	1
White British	White	1
Any Other Asian Background	Asian	2
Bangladeshi	Asian	2
Indian	Asian	2
Pakistani	Asian	2
African	Black	3
Any Other Black Background	Black	3
Caribbean	Black	3
Chinese	Chinese	4
Any Other Ethnic Group	Any other ethnic group	5
Any Other Mixed Background	Mixed	6
White and Asian	Mixed	6
White and Black African	Mixed	6
White and Black Caribbean	Mixed	6
Information Not Obtained	Missing	7
Missing	Missing	7
Refused	Missing	7

Supplementary Table 4.2: Classification of ethnic group with the *ethnicgroupmajor* variable

<b>ethnicgroupmajor</b>	<b>Ethnic group</b>	<b>Code</b>
WHIT	White	1
ASIA	Asian	2
BLAC	Black	3
CHIN	Chinese	4
AOEG	Any Other Ethnic Group	5
MIXD	Mixed	6
UNCL	Missing	7

Supplementary Table 4.3: Classification of SEN, AAP/S and S/EHCP variables

<b>Description</b>	<b>Code</b>	<b>SEN: special education need</b>	<b>AAP/S: School action or early years action, school action plus or early years action and SEN support</b>	<b>S/EHCP: statement and education, health and care plan</b>
No Special Educational Need	N			
School Action or Early Years Action (up to 2014/15)	A	x	x	
School Action Plus or Early Years Action Plus (up to 2014/15)	P	x	x	
SEN support (since 2014/15)	K	x	x	
Statement (up to 2017/18)	S	x		x
Education, health and care plan (since 2014/15)	E	x		x





**Supplementary Appendix 6. Performance of linkage stages**

Supplementary Table 5.1: Pupils records by linkage stage (stages 1 and 2) and cohort

Cohort	Linked NPD-PDS-HES (unique aPMR)	Excluded as a fail to link PDS (stage 1)	Excluded as fail to link HES (stage 2)	Total (unique aPMR)
1	571,713	20,244	20,815	612,772
2	542,035	8,868	19,839	570,742
3	512,526	683	14,858	528,067
4	569,851	528	5,711	576,090
Total	2,196,125	30,323	61,223	2,287,671
Row percentages				
1	93.3	3.3	3.4	100.0
2	95.0	1.6	3.5	100.0
3	97.1	0.1	2.8	100.0
4	98.9	0.1	1.0	100.0
Total	96.0	1.3	2.7	100.0

Cohort	Linked NPD-PDS-HES (all pairs)	Excluded as a fail to link PDS (stage 1)	Excluded as fail to link HES (stage 2)	Total (all pairs)
1	572,673	20,244	20,815	613,732
2	543,211	8,868	19,839	571,918
3	514,369	683	14,858	529,910
4	572,570	528	5,711	578,809
Total	2,202,823	30,323	61,223	2,294,369
Row percentages				
1	93.3	3.3	3.4	100.0
2	95.0	1.6	3.5	100.0
3	97.1	0.1	2.8	100.0
4	98.9	0.1	1.0	100.0
Total	96.0	1.3	2.7	100.0

Notes: NPD = national pupil dataset; PDS = personal demographics service; HES = hospital episode statistics.

Supplementary Table 5.2: Pupils records by linkage stage (stages 1 and 2), merging stage and cohort

Cohort	Linked NPD-HES	Excluded as a fail to link PDS (stage 1)	Excluded as fail to link HES (stage 2)	Not merged to UCL-HES (merging stage)	Total (unique aPMR)
1	564,931	20,244	20,815	6,782	612,772
2	535,610	8,868	19,839	6,425	570,742
3	506,215	683	14,858	6,311	528,067
4	567,845	528	5,711	2,006	576,090
Total	2,174,601	30,323	61,223	21,524	2,287,671
Row percentages					
1	92.2	3.3	3.4	1.1	100.0
2	93.8	1.6	3.5	1.1	100.0
3	95.9	0.1	2.8	1.2	100.0
4	98.6	0.1	1.0	0.3	100.0
Total	95.1	1.3	2.7	0.9	100.0

Notes: NPD = national pupil dataset; PDS = personal demographics service; HES = hospital episode statistics.

Supplementary Table 6.1: Linkage national pupil dataset to personal demographics service by linkage step and cohort (all pairs)

Linkage step	Cohort (N)					Cohort (%)				
	90/91	96/97	99/00	04/05	Total	90/91	96/97	99/00	04/05	Total
1	541,397	539,166	509,884	548,099	2,138,546	91.2	95.8	96.4	94.8	94.5
2	14,968	10,304	9,007	12,564	46,843	2.5	1.8	1.7	2.2	2.1
3	3,945	2,226	1,849	2,257	10,277	0.7	0.4	0.4	0.4	0.5
4	173	107	177	503	960	0.0	0.0	0.0	0.1	0.0
5	8,532	4,835	3,887	5,617	22,871	1.4	0.9	0.7	1.0	1.0
6	3,582	1,288	1,016	2,147	8,033	0.6	0.2	0.2	0.4	0.4
7	19,222	4,694	3,096	6,510	33,522	3.2	0.8	0.6	1.1	1.5
8	1,669	430	311	584	2,994	0.3	0.1	0.1	0.1	0.1
Total	593,488	563,050	529,227	578,281	2,264,046	100.0	100.0	100.0	100.0	100.0

Note: The table includes successful linked records.

Supplementary Table 6.2: Linkage national pupil dataset to personal demographics service by academic year of linkage step and cohort (all pairs)

Academic year of linkage step	Cohort (N)					Cohort (%)				
	90/91	96/97	99/00	04/05	Total	90/91	96/97	99/00	04/05	Total
2004	503,135	441,016	179,013	0	1,123,164	84.8	78.3	33.8	0.0	49.6
2005	34,458	40,140	262,752	0	337,351	5.8	7.1	49.7	0.0	14.9
2006	16,444	18,744	23,689	0	58,877	2.8	3.3	4.5	0.0	2.6
2007	12,676	14,434	15,735	0	42,846	2.1	2.6	3.0	0.0	1.9
2008	4,312	11,561	11,246	0	27,119	0.7	2.1	2.1	0.0	1.2
2009	1,572	18,223	7,369	228,484	255,646	0.3	3.2	1.4	39.5	11.3
2010	0	5,047	5,825	292,282	303,154	0.0	0.9	1.1	50.5	13.4
2011	0	3,423	5,579	18,952	27,954	0.0	0.6	1.1	3.3	1.2
2012	0	2,046	6,137	6,688	14,871	0.0	0.4	1.2	1.2	0.7
2013	0	1,725	2,394	9,397	13,516	0.0	0.3	0.5	1.6	0.6
2014	0	1,032	1,828	4,542	7,402	0.0	0.2	0.4	0.8	0.3
2015	0	535	2,582	5,324	8,441	0.0	0.1	0.5	0.9	0.4
2016	0	0	1,475	4,361	5,836	0.0	0.0	0.3	0.8	0.3
2017	0	0	128	879	1,007	0.0	0.0	0.0	0.2	0.0
2018	0	0	68	278	346	0.0	0.0	0.0	0.1	0.0
9999	20,891	5,124	3,407	7,094	36,516	3.5	0.9	0.6	1.2	1.6
Total	593,488	563,050	529,227	578,281	2,264,046	100.0	100.0	100.0	100.0	100.0

Note: The table includes successful linked records.



Supplementary Table 6.3: Linkage national pupil dataset to personal demographics service by linkage step and ethnicity (all pairs)

<b>Linkage step</b>	<b>White</b>	<b>Asian</b>	<b>Black</b>	<b>Chinese</b>	<b>Any other ethnic group</b>	<b>Mixed</b>	<b>Missing</b>	<b>Total</b>
<b>Records (N)</b>								
1	1,783,487	157,904	80,501	6,196	19,298	80,098	11,062	2,138,546
2	28,274	8,204	5,393	216	1,609	2,781	366	46,843
3	6,400	2,006	1,009	113	274	383	92	10,277
4	432	227	172	0	53	57	19	960
5	9,281	7,273	3,664	313	862	1,285	193	22,871
6	5,557	988	753	36	230	376	93	8,033
7	26,620	2,355	2,022	169	418	1,361	577	33,522
8	1,704	430	459	14	134	176	77	2,994
<b>Total</b>	<b>1,861,755</b>	<b>179,387</b>	<b>93,973</b>	<b>7,057</b>	<b>22,878</b>	<b>86,517</b>	<b>12,479</b>	<b>2,264,046</b>
<b>Row percentages</b>								
1	83.4	7.4	3.8	0.3	0.9	3.7	0.5	100.0
2	60.4	17.5	11.5	0.5	3.4	5.9	0.8	100.0
3	62.3	19.5	9.8	1.1	2.7	3.7	0.9	100.0
4	45.0	23.6	17.9	0.0	5.5	5.9	2.0	100.0
5	40.6	31.8	16.0	1.4	3.8	5.6	0.8	100.0
6	69.2	12.3	9.4	0.4	2.9	4.7	1.2	100.0
7	79.4	7.0	6.0	0.5	1.2	4.1	1.7	100.0
8	56.9	14.4	15.3	0.5	4.5	5.9	2.6	100.0
<b>Total</b>	<b>82.2</b>	<b>7.9</b>	<b>4.2</b>	<b>0.3</b>	<b>1.0</b>	<b>3.8</b>	<b>0.6</b>	<b>100.0</b>
<b>Column percentages</b>								
1	95.8	88.0	85.7	87.8	84.4	92.6	88.6	94.5
2	1.5	4.6	5.7	3.1	7.0	3.2	2.9	2.1
3	0.3	1.1	1.1	1.6	1.2	0.4	0.7	0.5
4	0.0	0.1	0.2	0.0	0.2	0.1	0.2	0.0
5	0.5	4.1	3.9	4.4	3.8	1.5	1.5	1.0
6	0.3	0.6	0.8	0.5	1.0	0.4	0.7	0.4
7	1.4	1.3	2.2	2.4	1.8	1.6	4.6	1.5
8	0.1	0.2	0.5	0.2	0.6	0.2	0.6	0.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Note: The table includes successful linked records.



Supplementary Table 6.4: Linkage national pupil dataset to personal demographics service by linkage step and region (all pairs)

Linkage step	London	South East	South West	West Midlands	North West	North East	Yorkshire and The Humber	East Midlands	East of England	Wales	Missing	Total
Records (n)												
1	278,298	315,432	196,505	233,888	297,522	104,861	213,681	175,180	225,551	193	97,435	2,138,546
2	11,609	5,149	2,934	5,004	6,838	1,861	4,449	2,893	3,406	0	2,700	46,843
3	2,673	1,173	740	965	1,435	386	863	609	858	0	575	10,277
4	340	64	35	130	121	28	90	33	62	0	57	960
5	6,599	1,976	901	2,489	3,503	831	2,374	1,205	1,421	0	1,572	22,871
6	1,766	876	531	930	1,336	352	701	439	631	0	471	8,033
7	5,770	4,424	2,726	3,658	5,611	1,367	2,728	2,045	2,970	21	2,202	33,522
8	871	267	151	266	464	78	214	135	273	0	275	2,994
Total	307,926	329,361	204,523	247,330	316,830	109,764	225,100	182,539	235,172	214	105,287	2,264,046
Row percentages												
1	13.0	14.7	9.2	10.9	13.9	4.9	10.0	8.2	10.5	0.0	4.6	100.0
2	24.8	11.0	6.3	10.7	14.6	4.0	9.5	6.2	7.3	0.0	5.8	100.0
3	26.0	11.4	7.2	9.4	14.0	3.8	8.4	5.9	8.3	0.0	5.6	100.0
4	35.4	6.7	3.6	13.5	12.6	2.9	9.4	3.4	6.5	0.0	5.9	100.0
5	28.9	8.6	3.9	10.9	15.3	3.6	10.4	5.3	6.2	0.0	6.9	100.0
6	22.0	10.9	6.6	11.6	16.6	4.4	8.7	5.5	7.9	0.0	5.9	100.0
7	17.2	13.2	8.1	10.9	16.7	4.1	8.1	6.1	8.9	0.1	6.6	100.0
8	29.1	8.9	5.0	8.9	15.5	2.6	7.1	4.5	9.1	0.0	9.2	100.0
Total	13.6	14.5	9.0	10.9	14.0	4.8	9.9	8.1	10.4	0.0	4.7	100.0
Column percentages												
1	90.4	95.8	96.1	94.6	93.9	95.5	94.9	96.0	95.9	90.2	92.5	94.5
2	3.8	1.6	1.4	2.0	2.2	1.7	2.0	1.6	1.4	0.0	2.6	2.1
3	0.9	0.4	0.4	0.4	0.5	0.4	0.4	0.3	0.4	0.0	0.5	0.5
4	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
5	2.1	0.6	0.4	1.0	1.1	0.8	1.1	0.7	0.6	0.0	1.5	1.0
6	0.6	0.3	0.3	0.4	0.4	0.3	0.3	0.2	0.3	0.0	0.4	0.4
7	1.9	1.3	1.3	1.5	1.8	1.2	1.2	1.1	1.3	9.8	2.1	1.5
8	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The table includes successful linked records.

Supplementary Table 7.1: Linkage personal demographics service to hospital episode statistics by linkage step and cohort (all pairs)

Linkage step	Cohort (N)					Cohort (%)				
	90/91	96/97	99/00	04/05	Total	90/91	96/97	99/00	04/05	Total
1	455,015	435,678	412,723	488,064	1,791,480	79.45	80.2	80.24	85.24	81.33
2	112,446	100,895	92,854	80,384	386,579	19.64	18.57	18.05	14.04	17.55
3	2,080	863	727	1,705	5,375	0.36	0.16	0.14	0.3	0.24
4	656	305	269	443	1,673	0.11	0.06	0.05	0.08	0.08
5	179	190	234	515	1,118	0.03	0.03	0.05	0.09	0.05
6	2,181	5,059	7,314	1,266	15,820	0.38	0.93	1.42	0.22	0.72
7	47	97	135	24	303	0.01	0.02	0.03	0	0.01
8	69	124	113	169	475	0.01	0.02	0.02	0.03	0.02
Total	572,673	543,211	514,369	572,570	2,202,823	100	100	100	100	100

Note: The table includes successful linked records.

Supplementary Table 7.2: Linkage personal demographics service to hospital episode statistics by linkage step and ethnicity (all pairs)

Linkage step	White	Asian	Black	Chinese	Any other ethnic group	Mixed	Missing	Total
Records (n)								
1	1,481,539	144,364	68,528	5,055	16,422	66,366	9,206	1,791,480
2	315,316	26,125	20,160	1,323	4,508	16,671	2,476	386,579
3	3,716	689	508	32	128	246	56	5,375
4	1,119	205	194	0	52	89	14	1,673
5	660	195	138	0	47	66	12	1,118
6	11,333	2,083	1,268	114	302	626	94	15,820
7	233	33	18	0	0	19	0	303
8	300	69	59	0	15	32	0	475
Total	1,814,216	173,763	90,873	6,524	21,474	84,115	11,858	2,202,823
Row percentages								
1	82.7	8.1	3.8	0.3	0.9	3.7	0.5	100.0
2	81.6	6.8	5.2	0.3	1.2	4.3	0.6	100.0
3	69.1	12.8	9.5	0.6	2.4	4.6	1.0	100.0
4	66.9	12.3	11.6	0.0	3.1	5.3	0.8	100.0
5	59.0	17.4	12.3	0.0	4.2	5.9	1.1	100.0
6	71.6	13.2	8.0	0.7	1.9	4.0	0.6	100.0
7	76.9	10.9	5.9	0.0	0.0	6.3	0.0	100.0
8	63.2	14.5	12.4	0.0	3.2	6.7	0.0	100.0
Total	82.4	7.9	4.1	0.3	1.0	3.8	0.5	100.0
Column percentages								
1	81.7	83.1	75.4	77.5	76.5	78.9	77.6	81.3
2	17.4	15.0	22.2	20.3	21.0	19.8	20.9	17.5
3	0.2	0.4	0.6	0.5	0.6	0.3	0.5	0.2
4	0.1	0.1	0.2	0.0	0.2	0.1	0.1	0.1
5	0.0	0.1	0.2	0.0	0.2	0.1	0.1	0.1
6	0.6	1.2	1.4	1.7	1.4	0.7	0.8	0.7
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The table includes successful linked records.



Supplementary Table 7.3: Linkage personal demographics service to hospital episode statistics by linkage step and region (all pairs)

Linkage step	London	South East	South West	West Midlands	North West	North East	Yorkshire and The Humber	East Midlands	East of England	Wales	Missing	Total
Records (n)												
1	278,298	315,432	196,505	233,888	297,522	104,861	213,681	175,180	225,551	193	97,435	2,138,546
2	11,609	5,149	2,934	5,004	6,838	1,861	4,449	2,893	3,406	0	2,700	46,843
3	2,673	1,173	740	965	1,435	386	863	609	858	0	575	10,277
4	340	64	35	130	121	28	90	33	62	0	57	960
5	6,599	1,976	901	2,489	3,503	831	2,374	1,205	1,421	0	1,572	22,871
6	1,766	876	531	930	1,336	352	701	439	631	0	471	8,033
7	5,770	4,424	2,726	3,658	5,611	1,367	2,728	2,045	2,970	21	2,202	33,522
8	871	267	151	266	464	78	214	135	273	0	275	2,994
Total	307,926	329,361	204,523	247,330	316,830	109,764	225,100	182,539	235,172	221	105,280	2,264,046
Row percentages												
1	13.0	14.7	9.2	10.9	13.9	4.9	10.0	8.2	10.5	0.0	4.6	100.0
2	24.8	11.0	6.3	10.7	14.6	4.0	9.5	6.2	7.3	0.0	5.8	100.0
3	26.0	11.4	7.2	9.4	14.0	3.8	8.4	5.9	8.3	0.0	5.6	100.0
4	35.4	6.7	3.6	13.5	12.6	2.9	9.4	3.4	6.5	0.0	5.9	100.0
5	28.9	8.6	3.9	10.9	15.3	3.6	10.4	5.3	6.2	0.0	6.9	100.0
6	22.0	10.9	6.6	11.6	16.6	4.4	8.7	5.5	7.9	0.0	5.9	100.0
7	17.2	13.2	8.1	10.9	16.7	4.1	8.1	6.1	8.9	0.1	6.6	100.0
8	29.1	8.9	5.0	8.9	15.5	2.6	7.1	4.5	9.1	0.0	9.2	100.0
Total	13.6	14.5	9.0	10.9	14.0	4.8	9.9	8.1	10.4	0.0	4.7	100.0
Column percentages												
1	90.4	95.8	96.1	94.6	93.9	95.5	94.9	96.0	95.9	87.3	92.5	94.5
2	3.8	1.6	1.4	2.0	2.2	1.7	2.0	1.6	1.4	0.0	2.6	2.1
3	0.9	0.4	0.4	0.4	0.5	0.4	0.4	0.3	0.4	0.0	0.5	0.5
4	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
5	2.1	0.6	0.4	1.0	1.1	0.8	1.1	0.7	0.6	0.0	1.5	1.0
6	0.6	0.3	0.3	0.4	0.4	0.3	0.3	0.2	0.3	0.0	0.4	0.4
7	1.9	1.3	1.3	1.5	1.8	1.2	1.2	1.1	1.3	9.5	2.1	1.5
8	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The table includes successful linked records.



## Supplementary Appendix 7. Linking rates

Supplementary Table 8.1: Linking rate by region 2011 pupil's residence (first recorded) and cohort

	Cohort 1990/91			Cohort 1996/97			Cohort 1999/00			Cohort 2004/05		
	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total
Records (n)												
London	7,708	67,898	75,606	6,205	71,463	77,668	4,214	70,706	74,920	1,552	83,385	84,937
South East	7,985	81,697	89,682	5,942	75,315	81,257	3,848	73,988	77,836	1,324	83,462	84,786
South West	4,212	51,970	56,182	3,014	50,234	53,248	1,344	45,550	46,894	487	49,822	50,309
West Midlands	4,906	62,935	67,841	3,371	59,909	63,280	2,233	54,985	57,218	735	60,099	60,834
North West	6,194	83,206	89,400	3,623	77,676	81,299	2,008	70,358	72,366	953	75,962	76,915
North East	1,563	29,287	30,850	1,019	27,323	28,342	571	24,419	24,990	187	25,898	26,085
Yorkshire and The Humber	3,872	57,455	61,327	2,886	54,467	57,353	1,481	49,579	51,060	652	56,059	56,711
East Midlands	3,533	47,048	50,581	2,757	42,119	44,876	1,756	40,828	42,584	669	45,069	45,738
East of England	5,526	59,620	65,146	4,500	54,325	58,825	3,085	52,101	55,186	1,010	57,331	58,341
Wales	28	38	66	0	45	45	0	64	64	0	69	69
Missing	2,314	23,777	26,091	1,808	22,741	24,549	1,304	23,645	24,949	673	30,692	31,365
Total	47,841	564,931	612,772	35,125	535,617	570,742	21,844	506,223	528,067	8,242	567,848	576,090
Linkage rate (%)												
London	10.2	89.8	100.0	8.0	92.0	100.0	5.6	94.4	100.0	1.8	98.2	100.0
South East	8.9	91.1	100.0	7.3	92.7	100.0	4.9	95.1	100.0	1.6	98.4	100.0
South West	7.5	92.5	100.0	5.7	94.3	100.0	2.9	97.1	100.0	1.0	99.0	100.0
West Midlands	7.2	92.8	100.0	5.3	94.7	100.0	3.9	96.1	100.0	1.2	98.8	100.0
North West	6.9	93.1	100.0	4.5	95.5	100.0	2.8	97.2	100.0	1.2	98.8	100.0
North East	5.1	94.9	100.0	3.6	96.4	100.0	2.3	97.7	100.0	0.7	99.3	100.0
Yorkshire and The Humber	6.3	93.7	100.0	5.0	95.0	100.0	2.9	97.1	100.0	1.2	98.9	100.0
East Midlands	7.0	93.0	100.0	6.1	93.9	100.0	4.1	95.9	100.0	1.5	98.5	100.0
East of England	8.5	91.5	100.0	7.7	92.4	100.0	5.6	94.4	100.0	1.7	98.3	100.0
Wales	42.4	57.6	100.0	0.0	100.0	100.0	0.0	100.0	100.0	0.0	100.0	100.0
Missing	8.9	91.1	100.0	7.4	92.6	100.0	5.2	94.8	100.0	2.2	97.9	100.0
Total	7.8	92.2	100.0	6.2	93.9	100.0	4.1	95.9	100.0	1.4	98.6	100.0

Notes: HES = hospital episode statistics.

Supplementary Table 8.2: Linking rate by ethnic group and cohort

	Cohort 1990/91			Cohort 1996/97			Cohort 1999/00			Cohort 2004/05		
	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total
Records (n)												
White	27,620	487,698	515,318	24,325	452,995	477,320	15,464	414,538	430,002	5,081	437,566	442,647
Asian	2,535	32,946	35,481	2,572	37,555	40,127	2,548	42,910	45,458	1,188	57,524	58,712
Black	1,500	16,967	18,467	1,416	19,154	20,570	1,697	21,416	23,113	679	31,483	32,162
Chinese	276	1,379	1,655	211	1,437	1,648	170	1,527	1,697	88	2,034	2,122
Any other ethnic group	496	3,610	4,106	621	3,935	4,556	689	5,110	5,799	482	8,341	8,823
Mixed	832	13,775	14,607	1,272	19,244	20,516	1,157	20,098	21,255	559	29,699	30,258
Missing	14,582	8,556	23,138	4,715	1,290	6,005	127	616	743	168	1,198	1,366
Total	47,841	564,931	612,772	35,132	535,610	570,742	21,852	506,215	528,067	8,245	567,845	576,090
Linkage rate (%)												
White	5.36	94.64	100.0	5.1	94.9	100.0	3.6	96.4	100.0	1.15	98.85	100.0
Asian	7.14	92.86	100.0	6.41	93.59	100.0	5.61	94.39	100.0	2.02	97.98	100.0
Black	8.12	91.88	100.0	6.88	93.12	100.0	7.34	92.66	100.0	2.11	97.89	100.0
Chinese	16.68	83.32	100.0	12.8	87.2	100.0	10.02	89.98	100.0	4.15	95.85	100.0
Any other ethnic group	12.08	87.92	100.0	13.63	86.37	100.0	11.88	88.12	100.0	5.46	94.54	100.0
Mixed	5.7	94.3	100.0	6.2	93.8	100.0	5.44	94.56	100.0	1.85	98.15	100.0
Missing	63.02	36.98	100.0	78.52	21.48	100.0	17.09	82.91	100.0	12.3	87.7	100.0
Total	7.81	92.19	100.0	6.16	93.84	100.0	4.14	95.86	100.0	1.43	98.57	100.0

Notes: HES = hospital episode statistics.

Supplementary Table 8.3: Linking rate by sex and cohort

	Cohort 1990/91			Cohort 1996/97			Cohort 1999/00			Cohort 2004/05		
	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total
Records (N)												
Male	27,272	285,220	312,492	16,935	274,966	291,901	9,586	260,667	270,253	3,550	291,516	295,066
Female	20,512	279,156	299,668	18,182	260,603	278,785	12,244	245,342	257,586	4,692	276,293	280,985
Missing	57	555	612	15	41	56	22	206	228	0	39	39
Total	47,841	564,931	612,772	35,132	535,610	570,742	21,852	506,215	528,067	8,242	567,848	576,090
Linkage rate (%)												
Male	8.7	91.3	100.0	5.8	94.2	100.0	3.6	96.5	100.0	1.2	98.8	100.0
Female	6.8	93.2	100.0	6.5	93.5	100.0	4.8	95.3	100.0	1.7	98.3	100.0
Missing	9.3	90.7	100.0	26.8	73.2	100.0	9.7	90.4	100.0	0.0	100.0	100.0
Total	7.8	92.2	100.0	6.2	93.8	100.0	4.1	95.9	100.0	1.4	98.6	100.0

Notes: HES = hospital episode statistics.

Supplementary Table 8.4: Linking rate by IDACI deciles and cohort

	Cohort 1990/91			Cohort 1996/97			Cohort 1999/00			Cohort 2004/05		
	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total
Records (N)												
1 (deprived)	7,297	54,289	61,586	4,853	50,469	55,322	2,836	49,585	52,421	885	53,317	54,202
2	5,994	55,564	61,558	4,232	51,065	55,297	2,458	49,348	51,806	831	53,505	54,336
3	5,406	56,104	61,510	3,800	51,603	55,403	2,227	48,998	51,225	826	53,995	54,821
4	4,930	56,541	61,471	3,724	51,655	55,379	2,226	49,025	51,251	736	54,019	54,755
5	4,598	56,538	61,136	3,430	52,267	55,697	2,113	49,321	51,434	794	55,367	56,161
6	4,250	56,842	61,092	3,288	52,386	55,674	2,033	49,838	51,871	809	56,375	57,184
7	3,842	56,777	60,619	2,919	53,228	56,147	1,944	50,336	52,280	819	57,531	58,350
8	3,677	56,026	59,703	2,897	54,166	57,063	2,042	51,136	53,178	860	58,609	59,469
9	3,502	54,751	58,253	2,828	55,644	58,472	1,932	52,691	54,623	838	60,814	61,652
10 (affluent)	3,623	54,132	57,755	2,684	56,199	58,883	1,905	53,689	55,594	795	62,207	63,002
Missing	722	7,367	8,089	477	6,928	7,405	136	2,248	2,384	52	2,106	2,158
Total	47,841	564,931	612,772	35,132	535,610	570,742	21,852	506,215	528,067	8,245	567,845	576,090
Linkage rate (%)												
1 (deprived)	11.9	88.2	100.0	8.8	91.2	100.0	5.4	94.6	100.0	1.6	98.4	100.0
2	9.7	90.3	100.0	7.7	92.4	100.0	4.7	95.3	100.0	1.5	98.5	100.0
3	8.8	91.2	100.0	6.9	93.1	100.0	4.4	95.7	100.0	1.5	98.5	100.0
4	8.0	92.0	100.0	6.7	93.3	100.0	4.3	95.7	100.0	1.3	98.7	100.0
5	7.5	92.5	100.0	6.2	93.8	100.0	4.1	95.9	100.0	1.4	98.6	100.0
6	7.0	93.0	100.0	5.9	94.1	100.0	3.9	96.1	100.0	1.4	98.6	100.0
7	6.3	93.7	100.0	5.2	94.8	100.0	3.7	96.3	100.0	1.4	98.6	100.0
8	6.2	93.8	100.0	5.1	94.9	100.0	3.8	96.2	100.0	1.5	98.6	100.0
9	6.0	94.0	100.0	4.8	95.2	100.0	3.5	96.5	100.0	1.4	98.6	100.0
10 (affluent)	6.3	93.7	100.0	4.6	95.4	100.0	3.4	96.6	100.0	1.3	98.7	100.0
Missing	8.9	91.1	100.0	6.4	93.6	100.0	5.7	94.3	100.0	2.4	97.6	100.0
Total	7.8	92.2	100.0	6.2	93.8	100.0	4.1	95.9	100.0	1.4	98.6	100.0

Notes: HES = hospital episode statistics; IDACI = income deprivation affecting children index.



Supplementary Table 8.5: Linking rate by sex, ethnicity and cohort

	Cohort 1990/91			Cohort 1996/97			Cohort 1999/00			Cohort 2004/05		
	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total	Unlinked to HES	Linked to HES	Total
Records (n)												
Male-White	16,520	246,476	262,996	11,709	232,580	244,289	6,848	213,370	220,218	2,236	224,778	227,014
Male-Asian	1,438	16,594	18,032	1,121	19,386	20,507	1,081	22,153	23,234	495	29,559	30,054
Male-Black	915	8,392	9,307	689	9,784	10,473	686	11,121	11,807	268	16,111	16,379
Male-Chinese	148	686	834	93	726	819	88	764	852	34	1,000	1,034
Male-Any other ethnic	287	1,902	2,189	309	2,036	2,345	323	2,636	2,959	201	4,222	4,423
Male-Mixed	488	6,794	7,282	589	9,789	10,378	510	10,296	10,806	223	15,227	15,450
Female-White	11,100	241,222	252,322	12,616	220,415	233,031	8,610	201,077	209,687	2,844	212,782	215,626
Female-Asian	1,097	16,352	17,449	1,451	18,169	19,620	1,465	20,712	22,177	692	27,959	28,651
Female-Black	585	8,575	9,160	727	9,370	10,097	1,009	10,267	11,276	411	15,366	15,777
Female-Chinese	128	693	821	118	711	829	82	761	843	54	1,034	1,088
Female-Any other ethnic	209	1,708	1,917	312	1,899	2,211	364	2,463	2,827	280	4,116	4,396
Female-Mixed	344	6,981	7,325	683	9,455	10,138	645	9,795	10,440	336	14,469	14,805
Total	33,259	556,375	589,634	30,417	534,320	564,737	21,711	505,415	527,126	8,074	566,623	574,697
Linkage rate (%)												
Male-White	6.3	93.7	100.0	4.8	95.2	100.0	3.1	96.9	100.0	1.0	99.0	100.0
Male-Asian	8.0	92.0	100.0	5.5	94.5	100.0	4.7	95.4	100.0	1.7	98.4	100.0
Male-Black	9.8	90.2	100.0	6.6	93.4	100.0	5.8	94.2	100.0	1.6	98.4	100.0
Male-Chinese	17.8	82.3	100.0	11.4	88.6	100.0	10.3	89.7	100.0	3.3	96.7	100.0
Male-Any other ethnic	13.1	86.9	100.0	13.2	86.8	100.0	10.9	89.1	100.0	4.5	95.5	100.0
Male-Mixed	6.7	93.3	100.0	5.7	94.3	100.0	4.7	95.3	100.0	1.4	98.6	100.0
Female-White	4.4	95.6	100.0	5.4	94.6	100.0	4.1	95.9	100.0	1.3	98.7	100.0
Female-Asian	6.3	93.7	100.0	7.4	92.6	100.0	6.6	93.4	100.0	2.4	97.6	100.0
Female-Black	6.4	93.6	100.0	7.2	92.8	100.0	9.0	91.1	100.0	2.6	97.4	100.0
Female-Chinese	15.6	84.4	100.0	14.2	85.8	100.0	9.7	90.3	100.0	5.0	95.0	100.0
Female-Any other ethnic	10.9	89.1	100.0	14.1	85.9	100.0	12.9	87.1	100.0	6.4	93.6	100.0
Female-Mixed	4.7	95.3	100.0	6.7	93.3	100.0	6.2	93.8	100.0	2.3	97.7	100.0
Total	5.6	94.4	100.0	5.4	94.6	100.0	4.1	95.9	100.0	1.4	98.6	100.0

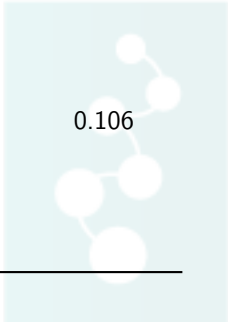
Notes: HES = hospital episode statistics. Cohort totals may differ from previous tables because the table excludes observations with missing Ethnicity.



**Supplementary Appendix 8. Standardized differences and P-values**

Supplementary Table 9.1: Distribution of demographic variables in national pupil dataset by linking status, N = 613,732 pairs (national pupil dataset to hospital episode statistics). Cohort 1990/91

	No link to HES		Linked to HES		Total		P-value	Standardized difference		
	N	(%)	N	(%)	N	(%)				
Region 2011 pupil's residence (first recorded) NPD										
London	7,729	16.1	68,073	12.0	75,802	12.4	<0.001	0.191		
South East	8,000	16.7	81,806	14.5	89,806	14.6				
South West	4,217	8.8	52,018	9.2	56,235	9.2				
West Midlands	4,915	10.3	63,013	11.1	67,928	11.1				
North West	6,200	12.9	83,376	14.7	89,576	14.6				
North East	1,567	3.3	29,318	5.2	30,885	5.0				
Yorkshire and The Humber	3,885	8.1	57,539	10.2	61,424	10.0				
East Midlands	3,535	7.4	47,096	8.3	50,631	8.2				
East of England	5,541	11.6	59,686	10.5	65,227	10.6				
Wales	28	0.1	38	0.0	66	0.0				
Missing	2,317	4.8	23,835	4.2	26,152	4.3				
Total	47,934	100.0	565,798	100.0	613,732	100.0				
Ethnic group (NPD)										
White	27,692	57.8	488,330	86.3	516,022	84.1			<0.001	0.160
Asian	2,541	5.3	33,024	5.8	35,565	5.8				
Black	1,507	3.1	17,047	3.0	18,554	3.0				
Chinese	278	0.6	1,384	0.2	1,662	0.3				
Any other ethnic group	498	1.0	3,627	0.6	4,125	0.7				
Mixed	834	1.7	13,808	2.4	14,642	2.4				
Missing	14,584	30.4	8,578	1.5	23,162	3.8				
Total	47,934	100.0	565,798	100.0	613,732	100.0				
Sex (NPD)										
Male	27,334	57.0	285,716	50.5	313,050	51.0	<0.001	0.131		
Female	20,543	42.9	279,520	49.4	300,063	48.9				
Missing	57	0.1	562	0.1	619	0.1				
Total	47,934	100.0	565,798	100.0	613,732	100.0				
IDACI Deciles (first Census) NPD										
1 (deprived)	7,306	15.2	54,336	9.6	61,642	10.0	<0.001	0.242		
2	6,001	12.5	55,606	9.8	61,607	10.0				
3	5,414	11.3	56,149	9.9	61,563	10.0				
4	4,941	10.3	56,600	10.0	61,541	10.0				
5	4,611	9.6	56,620	10.0	61,231	10.0				
6	4,255	8.9	56,927	10.1	61,182	10.0				
7	3,854	8.0	56,891	10.1	60,745	9.9				
8	3,685	7.7	56,122	9.9	59,807	9.7				
9	3,514	7.3	54,875	9.7	58,389	9.5				
10 (affluent)	3,630	7.6	54,286	9.6	57,916	9.4				
Missing	723	1.5	7,386	1.3	8,109	1.3				
Total	47,934	100.0	565,798	100.0	613,732	100.0				
Age at start academic year (first recorded) NPD										
9 or less	1,083	2.3	7,618	1.3	8,701	1.4	<0.001	0.106		
10	45,766	95.5	551,317	97.4	597,083	97.3				
11 or more	1,028	2.1	6,301	1.1	7,329	1.2				
Missing	57	0.1	562	0.1	619	0.1				
Total	47,934	100.0	565,798	100.0	613,732	100.0				



Supplementary Table 9.1: Continued

	No link to HES		Linked to HES		Total		P-value	Standardized difference
	N	(%)	N	(%)	N	(%)		
Persistent Absence Y10								
No	23695	49.4	416921	73.7	440616	71.8	<0.001	0.277
Yes	3477	7.3	127053	22.5	130530	21.3		
Missing	20,762	43.3	21,824	3.9	42,586	6.9		
Total	47,934	100.0	565,798	100.0	613,732	100.0		
Persistent Absence Y11								
No	21914	45.7	395806	70.0	417720	68.1	<0.001	0.255
Yes	4247	8.9	143616	25.4	147863	24.1		
Missing	21773	45.4	26376	4.7	48149	7.8		
Total	47,934	100.0	565,798	100.0	613,732	100.0		
SEN: Special Education Need								
No	40222	83.9	399408	70.6	439630	71.6	<0.001	0.323
Yes	7655	16.0	165828	29.3	173483	28.3		
Missing	57	0.1	562	0.1	619	0.1		
Total	47,934	100.0	565,798	100.0	613,732	100.0		
AAP/S: School Action or Early Years Action, School Action Plus or Early Years Action and SEN support								
No	41471	86.5	421231	74.4	462702	75.4	<0.001	0.310
Yes	6406	13.4	144005	25.5	150411	24.5		
Missing	57	0.1	562	0.1	619	0.1		
Total	47934	100.0	565,798	100.0	613,732	100.0		
S/EHCP: Statement and Education, health and care plan								
No	46484	97.0	538775	95.2	585259	95.4	<0.001	0.093
Yes	1393	2.9	26461	4.7	27854	4.5		
Missing	57	0.1	562	0.1	619	0.1		
Total	47934	100.0	565,798	100.0	613,732	100.0		

Notes: NPD = national pupil dataset; HES = hospital episode statistics; IDACI = income deprivation affecting children index.



Supplementary Table 9.2: Distribution of demographic variables in national pupil dataset by linking status, N = 571,918 pairs (national pupil dataset to hospital episode statistics). Cohort 1996/97

	No link to HES		Linked to HES		Total		P-value	Standard difference
	n	(%)	n	(%)	n	(%)		
Region 2011 pupil's residence (first recorded) NPD								
London	6,243	17.7	71,652	13.4	77,895	13.6	<0.001	0.247
South East	5,961	16.9	75,452	14.1	81,413	14.2		
South West	3,021	8.6	50,302	9.4	53,323	9.3		
West Midlands	3,392	9.6	60,027	11.2	63,419	11.1		
North West	3,630	10.3	77,805	14.5	81,435	14.2		
North East	1,025	2.9	27,374	5.1	28,399	5.0		
Yorkshire and The Humber	2,908	8.2	54,564	10.2	57,472	10.0		
East Midlands	2,769	7.8	42,187	7.9	44,956	7.9		
East of England	4,525	12.8	54,424	10.1	58,949	10.3		
Wales	0	0.0	45	0.0	45	0.0		
Missing	1,818	5.2	22,794	4.2	24,612	4.3		
Total	35,292	100.0	536,626	100.0	571,918	100.0		
Ethnic group (NPD)								
White	24,452	69.3	453,764	84.6	478,216	83.6	<0.001	0.159
Asian	2,584	7.3	37,654	7.0	40,238	7.0		
Black	1,429	4.0	19,228	3.6	20,657	3.6		
Chinese	213	0.6	1,439	0.3	1,652	0.3		
Any other ethnic group	626	1.8	3,951	0.7	4,577	0.8		
Mixed	1,278	3.6	19,286	3.6	20,564	3.6		
Missing	4,717	13.4	1,297	0.2	6,014	1.1		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
Sex (NPD)								
Male	17,014	48.2	275,479	51.3	292,493	51.1	<0.001	0.062
Female	18,268	51.8	261,094	48.7	279,362	48.8		
Missing	17	0.0	46	0.0	63	0.0		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
IDACI Deciles (first Census) NPD								
1 (deprived)	4,866	13.8	50,540	9.4	55,406	9.7	<0.001	0.218
2	4,247	12.0	51,132	9.5	55,379	9.7		
3	3,811	10.8	51,662	9.6	55,473	9.7		
4	3,738	10.6	51,725	9.6	55,463	9.7		
5	3,444	9.8	52,336	9.8	55,780	9.8		
6	3,310	9.4	52,503	9.8	55,813	9.8		
7	2,936	8.3	53,336	9.9	56,272	9.8		
8	2,914	8.3	54,281	10.1	57,195	10.0		
9	2,851	8.1	55,791	10.4	58,642	10.3		
10 (affluent)	2,701	7.7	56,355	10.5	59,056	10.3		
Missing	481	1.4	6,958	1.3	7,439	1.3		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
Age at start academic year (first recorded) NPD								
4 or less	406	1.2	4,281	0.8	4,687	0.8	<0.001	0.149
5	32,406	91.8	512,223	95.5	544,629	95.2		
6 or more	2,470	7.0	20,069	3.7	22,539	3.9		
Missing	17	0.0	46	0.0	63	0.0		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
Persistent Absence Y5								
No	21,882	62.0	466,085	86.9	487,967	85.3	<0.001	0.174
Yes	1,381	3.9	55,794	10.4	57,175	10.0		
Missing	12,036	34.1	14,740	2.7	26,776	4.7		
Total	35,299	100.0	536,619	100.0	571,918	100.0		

Supplementary Table 9.2: Continued

	No link to HES		Linked to HES		Total		P-value	Standard difference
	n	(%)	n	(%)	n	(%)		
Persistent Absence Y6								
No	21,214	60.1	466,146	86.9	487,360	85.2	<0.001	0.178
Yes	1,184	3.4	51,790	9.7	52,974	9.3		
Missing	12,901	36.5	18,683	3.5	31,584	5.5		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
Persistent Absence Y7								
No	20,027	56.7	439,725	81.9	459,752	80.4	<0.001	0.243
Yes	1,309	3.7	67,155	12.5	68,464	12.0		
Missing	13,963	39.6	29,739	5.5	43,702	7.6		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
Persistent Absence Y8								
No	19,656	55.7	431,203	80.4	450,859	78.8	<0.001	0.260
Yes	1,420	4.0	74,341	13.9	75,761	13.2		
Missing	14,223	40.3	31,075	5.8	45,298	7.9		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
Persistent Absence Y9								
No	19,644	55.7	430,882	80.3	450,526	78.8	<0.001	0.280
Yes	1,270	3.6	73,033	13.6	74,303	13.0		
Missing	14,385	40.8	32,704	6.1	47,089	8.2		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
Persistent Absence Y10								
No	19,880	56.3	440,437	82.1	460,317	80.5	<0.001	0.269
Yes	971	2.8	60,133	11.2	61,104	10.7		
Missing	14,448	40.9	36,049	6.7	50,497	8.8		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
Persistent Absence Y11								
No	17,968	50.9	414,077	77.2	432,045	75.5	<0.001	0.264
Yes	1,053	3.0	62,465	11.6	63,518	11.1		
Missing	16,278	46.1	60,077	11.2	76,355	13.4		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
SEN: Special Education Need								
No	27,164	77.0	306,131	57.0	333,295	58.3	<0.001	0.435
Yes	8,118	23.0	230,442	42.9	238,560	41.7		
Missing	17	0.0	46	0.0	63	0.0		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
AAP/S: School Action or Early Years Action, School Action Plus or Early Years Action and SEN support								
No	27,448	77.8	315,908	58.9	343,356	60.0	<0.001	0.416
Yes	7,834	22.2	220,665	41.1	228,499	40.0		
Missing	17	0.0	46	0.0	63	0.0		
Total	35,299	100.0	536,619	100.0	571,918	100.0		
S/EHCP: Statement and Education, health and care plan								
No	34,810	98.6	512,580	95.5	547,390	95.7	<0.001	0.188
Yes	472	1.3	23,993	4.5	24,465	4.3		
Missing	17	0.0	46	0.0	63	0.0		
Total	35,299	100.0	536,619	100.0	571,918	100.0		

Notes: NPD = national pupil dataset; HES = hospital episode statistics; IDACI = income deprivation affecting children index.

Supplementary Table 9.3: Distribution of demographic variables in national pupil dataset by linking status, N = 529,910 pairs (national pupil dataset to hospital episode statistics). Cohort 1999/00

	No linked to HES		Linked to HES		Total		P-value	Standard difference
	n	(%)	n	(%)	n	(%)		
Region 2011 pupil's residence (first recorded) NPD								
London	4,303	19.4	71,001	14.0	75,304	14.2	<0.001	0.3105
South East	3,881	17.5	74,189	14.6	78,070	14.7		
South West	1,364	6.1	45,672	9.0	47,036	8.9		
West Midlands	2,274	10.3	55,174	10.9	57,448	10.8		
North West	2,036	9.2	70,533	13.9	72,569	13.7		
North East	585	2.6	24,497	4.8	25,082	4.7		
Yorkshire and The Humber	1,502	6.8	49,701	9.8	51,203	9.7		
East Midlands	1,786	8.1	40,944	8.1	42,730	8.1		
East of England	3,119	14.1	52,238	10.3	55,357	10.4		
Wales	0	0.0	64	0.0	64	0.0		
Missing	1,327	6.0	23,720	4.7	25,047	4.7		
Total	22,177	100.0	507,733	100.0	529,910	100.0		
Ethnic group (NPD)								
White	15,692	70.7	415,660	81.9	431,352	81.4	<0.001	0.2809
Asian	2,581	11.6	43,061	8.5	45,642	8.6		
Black	1,735	7.8	21,528	4.2	23,263	4.4		
Chinese	172	0.8	1,530	0.3	1,702	0.3		
Any other ethnic group	700	3.2	5,146	1.0	5,846	1.1		
Mixed	1,178	5.3	20,177	4.0	21,355	4.0		
Missing	127	0.6	623	0.1	750	0.1		
Total	22,185	100.0	507,725	100.0	529,910	100.0		
Sex (NPD)								
Male	9,717	43.8	261,398	51.5	271,115	51.2	<0.001	0.1526
Female	12,445	56.1	246,116	48.5	258,561	48.8		
Missing	23	0.1	211	0.0	234	0.0		
Total	22,185	100.0	507,725	100.0	529,910	100.0		
IDACI Deciles (first Census) NPD								
1 (deprived)	2,863	12.9	49,733	9.8	52,596	9.9	<0.001	0.1417
2	2,487	11.2	49,457	9.7	51,944	9.8		
3	2,257	10.2	49,130	9.7	51,387	9.7		
4	2,263	10.2	49,153	9.7	51,416	9.7		
5	2,139	9.6	49,450	9.7	51,589	9.7		
6	2,056	9.3	49,965	9.8	52,021	9.8		
7	1,980	8.9	50,467	9.9	52,447	9.9		
8	2,077	9.4	51,321	10.1	53,398	10.1		
9	1,972	8.9	52,884	10.4	54,856	10.4		
10 (affluent)	1,953	8.8	53,904	10.6	55,857	10.5		
Missing	138	0.6	2,261	0.4	2,399	0.5		
Total	22,185	100.0	507,725	100.0	529,910	100.0		
Age at start academic year (first recorded) NPD								
4 or less	152	0.7	2,409	0.5	2,561	0.5	<0.001	0.0674
5	21,775	98.2	502,514	99.0	524,289	98.9		
6 or more	249	1.1	2,775	0.5	3,024	0.6		
Missing	9	0.0	27	0.0	36	0.0		
Total	22,185	100.0	507,725	100.0	529,910	100.0		

Supplementary Table 9.3: Continued

	No linked to HES		Linked to HES		Total		P-value	Standard difference
	n	(%)	n	(%)	n	(%)		
Persistent Absence Y2								
No	17,347	78.2	445,430	87.7	462,777	87.3	<0.001	0.1075
Yes	1,440	6.5	53,770	10.6	55,210	10.4		
Missing	3398	15.3	8525	1.7	11923	2.3		
Total	22185	100.0	507725	100.0	529910	100.0		
Persistent Absence Y3								
No	16513	74.4	444782	87.6	461295	87.1	<0.001	0.1307
Yes	1127	5.1	49193	9.7	50320	9.5		
Missing	4,545	20.5	13,750	2.7	18,295	3.5		
Total	22,185	100.0	507,725	100.0	529,910	100.0		
Persistent Absence Y4								
No	15952	71.9	441778	87.0	457730	86.4	<0.001	0.1709
Yes	910	4.1	48320	9.5	49230	9.3		
Missing	5323	24.0	17627	3.5	22950	4.3		
Total	22185	100.0	507725	100.0	529910	100.0		
Persistent Absence Y5								
No	15,562	70.1	441,354	86.9	456,916	86.2	<0.001	0.1645
Yes	859	3.9	46,038	9.1	46,897	8.8		
Missing	5,764	26.0	20,333	4.0	26,097	4.9		
Total	22,185	100.0	507,725	100.0	529,910	100.0		
Persistent Absence Y6								
No	15,505	69.9	445,377	87.7	460,882	87.0	<0.001	0.1885
Yes	599	2.7	39,445	7.8	40,044	7.6		
Missing	6,081	27.4	22,903	4.5	28,984	5.5		
Total	22,185	100.0	507,725	100.0	529,910	100.0		
Persistent Absence Y7								
No	15,034	67.8	436,743	86.0	451,777	85.3	<0.001	0.2105
Yes	512	2.3	38,455	7.6	38,967	7.4		
Missing	6,639	29.9	32,527	6.4	39,166	7.4		
Total	22,185	100.0	507,725	100.0	529,910	100.0		
Persistent Absence Y8								
No	14,782	66.6	426,385	84.0	441,167	83.3	<0.001	0.2316
Yes	639	2.9	47,234	9.3	47,873	9.0		
Missing	6,764	30.5	34,106	6.7	40,870	7.7		
Total	22,185	100.0	507,725	100.0	529,910	100.0		
Persistent Absence Y9								
No	14,917	67.2	432,105	85.1	447,022	84.4	<0.001	0.2515
Yes	436	2.0	40,401	8.0	40,837	7.7		
Missing	6,832	30.8	35,219	6.9	42,051	7.9		
Total	22,185	100.0	507,725	100.0	529,910	100.0		
Persistent Absence Y10								
No	14,799	66.7	424,866	83.7	439,665	83.0	<0.001	0.2715
Yes	488	2.2	45,726	9.0	46,214	8.7		
Missing	6,898	31.1	37,133	7.3	44,031	8.3		
Total	22,185	100.0	507,725	100.0	529,910	100.0		

Supplementary Table 9.3: Continued

	No linked to HES		Linked to HES		Total		P-value	Standard difference
	n	(%)	n	(%)	n	(%)		
<b>Persistent Absence Y11</b>								
No	14,475	65.2	416,671	82.1	431,146	81.4	<0.001	0.2353
Yes	621	2.8	46,459	9.2	47,080	8.9		
Missing	7,089	32.0	44,595	8.8	51,684	9.8		
Total	22,185	100.0	507,725	100.0	529,910	100.0		
<b>SEN: Special Education Need</b>								
No	16,438	74.1	291,701	57.5	308,139	58.1	<0.001	0.3612
Yes	5,739	25.9	215,997	42.5	221,736	41.8		
Missing	0	0.0	35	0.0	35	0.0		
Total	22,177	100.0	507,733	100.0	529,910	100.0		
<b>AAP/S: School Action or Early Years Action, School Action Plus or Early Years Action and SEN support</b>								
No	16,495	74.4	298,569	58.8	315,064	59.5	<0.001	0.3390
Yes	5,682	25.6	209,129	41.2	214,811	40.5		
Missing	0	0.0	35	0.0	35	0.0		
Total	22,177	100.0	507,733	100.0	529,910	100.0		
<b>S/EHCP: Statement and Education, health and care plan</b>								
No	21,980	99.1	484,288	95.4	506,268	95.5	<0.001	0.2324
Yes	197	0.9	23,410	4.6	23,607	4.5		
Missing	0	0.0	35	0.0	35	0.0		
Total	22,177	100.0	507,733	100.0	529,910	100.0		

Notes: NPD = national pupil dataset; HES = hospital episode statistics; IDACI = income deprivation affecting children index.





Supplementary Table 9.4: Distribution of demographic variables in national pupil dataset by linking status, N = 578,809 pairs (national pupil dataset to hospital episode statistics). Cohort 2004/05

	No link to HES		Linked to HES		Total		P-value	Standard difference
	n	(%)	n	(%)	n	(%)		
Region 2011 pupil's residence (first recorded) NPD								
London	1,590	18.8	83,817	14.7	85,407	14.8	0.000	0.237
South East	1,353	16.0	83,748	14.7	85,101	14.7		
South West	504	5.9	49,993	8.8	50,497	8.7		
West Midlands	759	9.0	60,358	10.6	61,117	10.6		
North West	986	11.6	76,373	13.4	77,359	13.4		
North East	197	2.3	26,007	4.6	26,204	4.5		
Yorkshire and The Humber	671	7.9	56,330	9.9	57,001	9.8		
East Midlands	689	8.1	45,255	7.9	45,944	7.9		
East of England	1,040	12.3	57,545	10.1	58,585	10.1		
Wales	0	0.0	69	0.0	69	0.0		
Missing	685	8.1	30,840	5.4	31,525	5.4		
Total	8,474	100.0	570,335	100.0	578,809	100.0		
Ethnic group (NPD)								
White	5,255	62.0	439,397	77.0	444,652	76.8	0.000	0.358
Asian	1,207	14.2	57,790	10.1	58,997	10.2		
Black	696	8.2	31,656	5.6	32,352	5.6		
Chinese	89	1.0	2,038	0.4	2,127	0.4		
Any other ethnic group	486	5.7	8,375	1.5	8,861	1.5		
Mixed	575	6.8	29,871	5.2	30,446	5.3		
Missing	169	2.0	1,205	0.2	1,374	0.2		
Total	8,477	100.0	570,332	100.0	578,809	100.0		
Sex (NPD)								
Male	3,660	43.2	292,784	51.3	296,444	51.2	0.000	0.166
Female	4,814	56.8	277,508	48.7	282,322	48.8		
Missing	0	0.0	43	0.0	43	0.0		
Total	8,474	100.0	570,335	100.0	578,809	100.0		
IDACI Deciles (first Census) NPD								
1 (deprived)	909	10.7	53,590	9.4	54,499	9.4	0.000	0.070
2	855	10.1	53,748	9.4	54,603	9.4		
3	849	10.0	54,246	9.5	55,095	9.5		
4	750	8.8	54,250	9.5	55,000	9.5		
5	812	9.6	55,571	9.7	56,383	9.7		
6	840	9.9	56,601	9.9	57,441	9.9		
7	844	10.0	57,776	10.1	58,620	10.1		
8	885	10.4	58,854	10.3	59,739	10.3		
9	858	10.1	61,048	10.7	61,906	10.7		
10 (affluent)	821	9.7	62,514	11.0	63,335	10.9		
Missing	54	0.6	2,134	0.4	2,188	0.4		
Total	8,477	100.0	570,332	100.0	578,809	100.0		
Age at start academic year (first recorded) NPD								
4 or less	34	0.4	1,078	0.2	1,112	0.2	0.000	0.083
5	8,382	98.9	568,198	99.6	576,580	99.6		
6 or more	61	0.7	1,042	0.2	1,103	0.2		
Missing	0	0.0	14	0.0	14	0.0		
Total	8,477	100.0	570,332	100.0	578,809	100.0		

Supplementary Table 9.4: Continued

	No link to HES		Linked to HES		Total		P-value	Standard difference
	n	(%)	n	(%)	n	(%)		
Persistent Absence Y1								
No	6,560	77.4	499,976	87.7	506,536	87.5	0.000	0.034
Yes	766	9.0	64,769	11.4	65,535	11.3		
Missing	1151	13.6	5587	1.0	6738	1.2		
Total	8477	100.0	570332	100.0	578809	100.0		
Persistent Absence Y2								
No	6,288	74.2	524,842	92.0	531,130	91.8	0.000	0.074
Yes	314	3.7	35,861	6.3	36,175	6.2		
Missing	1875	22.1	9629	1.7	11504	2.0		
Total	8477	100.0	570332	100.0	578809	100.0		
Persistent Absence Y3								
No	5904	69.6	520032	91.2	525936	90.9	0.000	0.079
Yes	277	3.3	34753	6.1	35030	6.1		
Missing	2,296	27.1	15,547	2.7	17,843	3.1		
Total	8,477	100.0	570,332	100.0	578,809	100.0		
Persistent Absence Y4								
No	5804	68.5	529210	92.8	535014	92.4	0.000	0.125
Yes	113	1.3	21646	3.8	21759	3.8		
Missing	2560	30.2	19476	3.4	22036	3.8		
Total	8477	100.0	570332	100.0	578809	100.0		
Persistent Absence Y5								
No	5,666	66.8	521,853	91.5	527,519	91.1	0.000	0.171
Yes	95	1.1	25,261	4.4	25,356	4.4		
Missing	2,716	32.0	23,218	4.1	25,934	4.5		
Total	8,477	100.0	570,332	100.0	578,809	100.0		
Persistent Absence Y6								
No	5,575	65.8	521,192	91.4	526,767	91.0	0.000	0.143
Yes	97	1.1	21,989	3.9	22,086	3.8		
Missing	2,805	33.1	27,151	4.8	29,956	5.2		
Total	8,477	100.0	570,332	100.0	578,809	100.0		
Persistent Absence Y7								
No	5,407	63.8	505,729	88.7	511,136	88.3	0.000	0.188
Yes	99	1.2	27,407	4.8	27,506	4.8		
Missing	2,971	35.0	37,196	6.5	40,167	6.9		
Total	8,477	100.0	570,332	100.0	578,809	100.0		
Persistent Absence Y8								
No	5,341	63.0	494,149	86.6	499,490	86.3	0.000	0.201
Yes	145	1.7	36,519	6.4	36,664	6.3		
Missing	2,991	35.3	39,664	7.0	42,655	7.4		
Total	8,477	100.0	570,332	100.0	578,809	100.0		
SEN: Special Education Need								
No	6,626	78.2	372,191	65.3	378,817	65.4	0.000	0.306
Yes	1,851	21.8	198,127	34.7	199,978	34.5		
Missing	0	0.0	14	0.0	14	0.0		
Total	8,477	100.0	570,332	100.0	578,809	100.0		

Supplementary Table 9.4: Continued

	No link to HES		Linked to HES		Total		P-value	Standard difference
	n	(%)	n	(%)	n	(%)		
AAP/S: School Action or Early Years Action, School Action Plus or Early Years Action and SEN support								
No	6,643	78.4	379,274	66.5	385,917	66.7	0.000	0.284
Yes	1,834	21.6	191,044	33.5	192,878	33.3		
Missing	0	0.0	14	0.0	14	0.0		
Total	8,477	100.0	570,332	100.0	578,809	100.0		
S/EHCP: Statement and Education, health and care plan								
No	8,412	99.2	548,057	96.1	556,469	96.1	0.000	0.218
Yes	65	0.8	22,261	3.9	22,326	3.9		
Missing	0	0.0	14	0.0	14	0.0		
Total	8,477	100.0	570,332	100.0	578,809	100.0		

Notes: NPD = national pupil dataset; HES = hospital episode statistics; IDACI = income deprivation affecting children index.



**Supplementary Appendix 9. Linkage evaluation Logit models**

Supplementary Table 10: Odd Ratios (OR) and adjusted Odd Ratios (aOR) for linkage to HES by cohort

	Cohort 1990/91				Cohort 1996/97			
	(1) Bivariate		(2) Multivariable		(3) Bivariate		(4) Multivariable	
	OR	Conf. Int.	aOR	Conf. Int.	OR	Conf. Int.	aOR	Conf. Int.
<b>Ethnic group</b>								
White	Ref		Ref		Ref		Ref	
Asian	0.74	[0.71,0.77]**	0.69	[0.66,0.72]**	0.79	[0.75,0.82]**	0.69	[0.66,0.73]**
Black	0.64	[0.61,0.68]**	0.62	[0.59,0.66]**	0.73	[0.69,0.77]**	0.67	[0.63,0.71]**
Chinese	0.28	[0.25,0.32]**	0.29	[0.26,0.33]**	0.36	[0.32,0.42]**	0.38	[0.33,0.44]**
Any other ethnic group	0.41	[0.38,0.45]**	0.42	[0.38,0.46]**	0.34	[0.31,0.37]**	0.32	[0.30,0.35]**
Mixed	0.94	[0.87,1.01]	0.92	[0.85,0.98]*	0.81	[0.77,0.86]**	0.80	[0.75,0.85]**
Missing	0.03	[0.03,0.03]**	0.03	[0.03,0.03]**	0.01	[0.01,0.02]**	0.01	[0.01,0.02]**
<b>Sex</b>								
Male	Ref		Ref		Ref		Ref	
Female	1.30	[1.28,1.33]**	1.35	[1.32,1.37]**	0.88	[0.86,0.90]**	0.87	[0.85,0.89]**
Missing	0.94	[0.72,1.24]	22.77	[17.02,30.47]**	0.17	[0.10,0.29]**	10.21	[5.77,18.07]**
<b>Region</b>								
London	Ref		Ref		Ref		Ref	
South East	1.16	[1.12,1.20]**	1.31	[1.26,1.36]**	1.10	[1.06,1.14]**	1.12	[1.08,1.17]**
South West	1.40	[1.35,1.46]**	1.34	[1.28,1.40]**	1.45	[1.39,1.52]**	1.38	[1.31,1.45]**
West Midlands	1.46	[1.40,1.51]**	1.27	[1.22,1.33]**	1.54	[1.48,1.61]**	1.37	[1.30,1.43]**
North West	1.53	[1.47,1.58]**	1.36	[1.30,1.41]**	1.87	[1.79,1.95]**	1.64	[1.57,1.72]**
North East	2.12	[2.01,2.25]**	1.91	[1.80,2.04]**	2.33	[2.18,2.49]**	1.99	[1.85,2.14]**
Yorkshire and The Humber	1.68	[1.62,1.75]**	1.34	[1.28,1.40]**	1.64	[1.56,1.71]**	1.42	[1.35,1.49]**
East Midlands	1.51	[1.45,1.58]**	1.28	[1.23,1.35]**	1.33	[1.27,1.39]**	1.22	[1.16,1.28]**
East of England	1.22	[1.18,1.27]**	1.14	[1.09,1.19]**	1.05	[1.01,1.09]*	1.00	[0.95,1.04]
Wales	0.15	[0.09,0.25]**	0.31	[0.16,0.59]**	0.47	[0.21,1.06]	0.40	[0.17,0.93]*
Missing	1.17	[1.11,1.23]**	1.16	[1.10,1.23]**	1.09	[1.03,1.15]**	1.08	[1.01,1.14]*
<b>IDACI Deciles</b>								
1 (deprived)	0.61	[0.58,0.63]**	0.67	[0.64,0.70]**	0.68	[0.65,0.72]**	0.71	[0.67,0.74]**
2	0.76	[0.72,0.79]**	0.78	[0.74,0.81]**	0.79	[0.76,0.83]**	0.77	[0.73,0.81]**
3	0.85	[0.81,0.88]**	0.86	[0.82,0.90]**	0.89	[0.85,0.94]**	0.87	[0.83,0.92]**
4	0.93	[0.89,0.97]**	0.95	[0.90,0.99]*	0.91	[0.87,0.96]**	0.90	[0.85,0.94]**
5	Ref		Ref		Ref		Ref	
6	1.09	[1.04,1.14]**	1.11	[1.05,1.16]**	1.04	[0.99,1.10]	1.05	[1.00,1.11]
7	1.20	[1.15,1.26]**	1.26	[1.20,1.32]**	1.20	[1.14,1.26]**	1.23	[1.16,1.29]**
8	1.24	[1.19,1.30]**	1.31	[1.25,1.38]**	1.23	[1.17,1.29]**	1.27	[1.20,1.34]**
9	1.27	[1.22,1.33]**	1.31	[1.25,1.38]**	1.29	[1.22,1.36]**	1.37	[1.29,1.44]**
10 (affluent)	1.22	[1.16,1.27]**	1.27	[1.21,1.34]**	1.37	[1.30,1.45]**	1.52	[1.44,1.61]**
Missing	0.83	[0.77,0.90]**	0.95	[0.86,1.04]	0.95	[0.86,1.05]	1.06	[0.95,1.18]
Observations			613,732				571,918	
Pseudo R-squared			0.162				0.093	



Supplementary Table 10: Continued

	Cohort 1999/00				Cohort 2004/05			
	(5) Bivariate		(6) Multivariable		(7) Bivariate		(8) Multivariable	
	OR	Conf. Int.	aOR	Conf. Int.	OR	Conf. Int.	aOR	Conf. Int.
Ethnic group								
White	Ref		Ref		Ref		Ref	
Asian	0.63	[0.60,0.66]**	0.56	[0.54,0.59]**	0.57	[0.54,0.61]**	0.51	[0.47,0.54]**
Black	0.47	[0.44,0.49]**	0.43	[0.40,0.45]**	0.54	[0.50,0.59]**	0.47	[0.43,0.51]**
Chinese	0.34	[0.29,0.39]**	0.35	[0.30,0.41]**	0.27	[0.22,0.34]**	0.27	[0.22,0.34]**
Any other ethnic group	0.28	[0.26,0.30]**	0.26	[0.24,0.28]**	0.21	[0.19,0.23]**	0.18	[0.17,0.20]**
Mixed	0.65	[0.61,0.69]**	0.64	[0.60,0.68]**	0.62	[0.57,0.68]**	0.60	[0.55,0.66]**
Missing	0.19	[0.15,0.22]**	0.21	[0.17,0.25]**	0.09	[0.07,0.10]**	0.09	[0.07,0.10]**
Sex								
Male	Ref		Ref		Ref		Ref	
Female	0.74	[0.72,0.76]**	0.73	[0.71,0.75]**	0.72	[0.69,0.75]**	0.72	[0.69,0.75]**
Missing	0.34	[0.22,0.52]**	0.61	[0.39,0.96]*	0.17	[0.05,0.54]**	1.00	[0.29,3.50]
Region								
London	Ref		Ref		Ref		Ref	
South East	1.16	[1.11,1.21]**	1.00	[0.95,1.04]	1.17	[1.09,1.26]**	0.94	[0.87,1.02]
South West	2.03	[1.91,2.16]**	1.62	[1.51,1.73]**	1.88	[1.70,2.08]**	1.38	[1.24,1.54]**
West Midlands	1.47	[1.40,1.55]**	1.23	[1.16,1.30]**	1.51	[1.38,1.65]**	1.21	[1.11,1.33]**
North West	2.10	[1.99,2.22]**	1.64	[1.55,1.74]**	1.47	[1.36,1.59]**	1.09	[1.00,1.19]*
North East	2.54	[2.33,2.77]**	1.82	[1.67,2.00]**	2.50	[2.16,2.91]**	1.71	[1.47,1.99]**
Yorkshire and The Humber	2.01	[1.89,2.13]**	1.61	[1.51,1.72]**	1.59	[1.45,1.74]**	1.23	[1.12,1.35]**
East Midlands	1.39	[1.31,1.47]**	1.14	[1.08,1.21]**	1.25	[1.14,1.36]**	0.96	[0.87,1.06]
East of England	1.02	[0.97,1.06]	0.86	[0.81,0.90]**	1.05	[0.97,1.14]	0.83	[0.76,0.90]**
Wales	0.42	[0.20,0.89]*	0.37	[0.17,0.80]*	0.42	[0.13,1.33]	0.36	[0.11,1.19]
Missing	1.08	[1.02,1.15]*	0.97	[0.91,1.03]	0.85	[0.78,0.93]**	0.74	[0.68,0.82]**
IDACI Deciles								
1 (deprived)	0.75	[0.71,0.80]**	0.73	[0.68,0.77]**	0.86	[0.78,0.95]**	0.82	[0.75,0.90]**
2	0.86	[0.81,0.91]**	0.82	[0.77,0.87]**	0.92	[0.83,1.01]	0.88	[0.80,0.97]*
3	0.94	[0.89,1.00]	0.89	[0.83,0.94]**	0.93	[0.85,1.03]	0.90	[0.82,1.00]*
4	0.94	[0.88,1.00]*	0.92	[0.86,0.97]**	1.06	[0.96,1.17]	1.03	[0.93,1.14]
5	Ref		Ref		Ref		Ref	
6	1.05	[0.99,1.12]	1.10	[1.03,1.17]**	0.99	[0.89,1.09]	1.03	[0.94,1.14]
7	1.10	[1.04,1.17]**	1.18	[1.11,1.26]**	1.00	[0.91,1.10]	1.11	[1.00,1.22]*
8	1.07	[1.00,1.14]*	1.20	[1.13,1.28]**	0.97	[0.88,1.07]	1.14	[1.03,1.25]*
9	1.16	[1.09,1.23]**	1.36	[1.27,1.45]**	1.04	[0.94,1.15]	1.31	[1.18,1.45]**
10 (affluent)	1.19	[1.12,1.27]**	1.48	[1.39,1.58]**	1.11	[1.01,1.23]*	1.57	[1.42,1.74]**
Missing	0.71	[0.59,0.85]**	0.87	[0.73,1.05]	0.58	[0.44,0.76]**	0.80	[0.59,1.07]
Observations			529,910				578,809	
Pseudo R-squared			0.026				0.027	

