Department for Education

Analysing repeated referrals to children's services in England

Research report

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Contents

List of figures

List of tables

Introduction

This study seeks to ascertain the characteristics and factors underlying the propensity of children who have been referred to Children's Services (CS) to have multiple referrals within a given time period.

Re-referrals can be costly to local authorities, but more importantly, they can be stressful and harmful to the children themselves, as well as to their parents or guardians. Potentially, multiple referrals can be detrimental to children's development, as they may imply prolonged periods of unmet needs and recurrent episodes of abuse, neglect, maltreatment, etc. Furthermore, referred children often live in deprived and poor families (Bilson & Martin, 2016)

Children are referred to Social Services via many routes: Schools, hospitals, police, social workers, GPs, etc. Once a referral has been made, a number of children are immediately stepped down the system as needing "no further action", when case workers deem the children as not meeting the statutory threshold for assessment. When children do meet the threshold, a statutory assessment must be carried out by the Local Authorities to determine the child's needs. Where there are grounds to believe that a child's safety or wellbeing is at risk, a child protection conference (CPC) is called upon. Children are either declared "in need" according to published thresholds or stepped down as needing "no longer in need", when needs do not surpass these thresholds.

For children in need (CiN), a child protection plan (CPP) can be designed to address their needs. This CPP is later reviewed and the child's needs are re-assessed to plan further actions. A child can be stepped down, the CPP can be revised and updated, or in extreme cases, where there are no guarantees of safety, children can be referred to be looked after (CLA).

This analysis focuses on children referred to CS during the financial year 2010-2011. This recruitment period has been chosen to ensure data quality and to maximise the follow-up period.

Research Questions

This report focuses on the following research questions:

1. What are the characteristics of the children referred to Children's Services in England in the financial year 2010-2011?

2. To what extent do the characteristics of the children and the local authorities affect the likelihood a child to be re-referred to children's services?

Data and methods

Children in Need Census database

The data for this analysis have been extracted from the Children in Need census databases of the Children's Services. Data have been exported from SQL as comma separated files (*.csv) to R (R Core Team, 2016) using RStudio (RStudio Team, 2015).

The sample to be followed up is comprised of 498,867 children (recruitment sample) who were referred to the Children's Services during the financial year 2010 (01/04/2010 to 31/03/2011)1. The follow-up period for these children is the financial years 2011-2012, 2012-2013, 2013-2014 and 2015-2016 (01/04/2011 to 31/03/2016). The number of children in this cohort differs from DfE's statistical release (Department for Education, 2011), because the CiN census collection covers all open cases during the financial year, regardless of whether those cases were open before the start of the financial year.

In Figure 1, an example schematic representation of the data structure is presented.

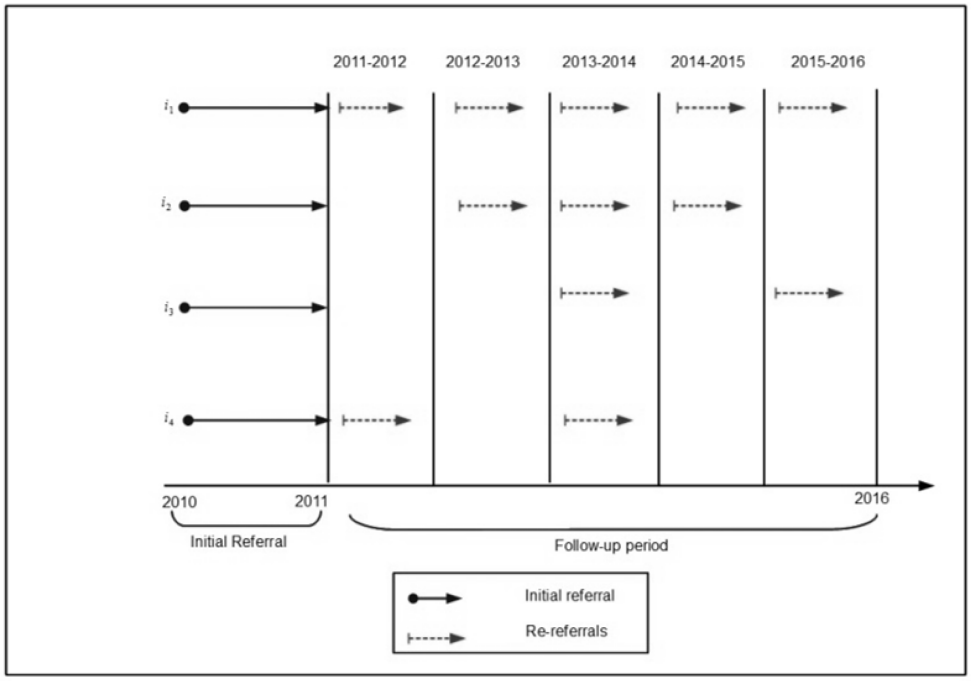

Figure 1: Data structure example

[1] The number of children in this cohort differs from DfE's statistical release (Department for Education, 2011), because the CiN census collection covers all open cases during the financial year, regardless of whether those cases were open before the start of the financial year.

The descriptive statistics presented in this report and the empty multilevel model to follow in later sections, are based on the full dataset of 498,867 children nested within 145 local authorities2. Meanwhile, the multilevel models including variables at the child and local authority levels are estimated on a subsample of 90,209 children nested within 144 local authorities3. The latter also applies to subsequent predicted probability plots and maps.

Additionally, this report uses data from the Children Looked After (CLA) database. The CiN census data has been linked to the CLA database to follow up on the 2010-2011 cohort of children. The CLA administrative dataset contains information on all children who have had episodes of care under the responsibility of the local education authorities. For this report, the focus is on the children referred during 2010-2011, for which descriptive statistics regarding their episodes of cares (if any) are produced.

Selected variables

As mentioned previously the outcome (or dependent) variable is re-referral to the CS system. This is a binary indicator, where 0 indicates no re-referral and 1 indicates re-referral at any time during the follow-up period. The covariates included can be divided into two categories: a) child-level characteristics and b) local authority characteristics. In table 1, a summary of the variables used is presented.

Table 1: Variables used to implement the binary logistic multilevel model for re-referrals to the Children's Services system.

Variable	Level	Description
Gender	Child	Binary variable coded as follows: 0 Male; 1 Female
Age	Child	Continuous variable indicating age at first referral. Unborn are imputed age=-1
No further action	Child	Binary variable indicating whether a child was stepped down as needing "no further action" (NFA) at first referral
Ever disabled	Child	Binary variable indicating whether a child has a declared disability at any point during the follow-up period. This is a proxy for long-term disability
Primary need	Child	Categorical variable indicating the primary need identified by social workers during assessments. This is a hierarchical scale, meaning that being classed in one need can also imply the presence of any other needs classified as lower in the scale, i.e. N1 can include N2 and N3, and so forth. Categories: N1: Abuse or neglect

[2] There are 152 LEAs in England, but the 2010-2011 CiN dataset contained data for 145 LEA
[3] One LEA had to be excluded from the sample due to small numbers.

Variable	Level	Description
		N2: Child's disability N3: Parental disability or illness N4: Family in acute stress N5: Family dysfunction N6: Socially unacceptable behaviour N7: Low income N8: Absent parenting N9: Cases other than children in need (adoption support) N0: Not stated (incomplete records, closed cases, when NFA=1, etc.)
Rate of children in need per social worker	Local authority	Binary variable indicating whether the local authority has an average annual rate (in the follow-up period) of children in need per social worker of more than 10 or not. Coded as follows: 0 for fewer than 10 and 1 for 10 or more.
Rate of referrals per 10,000 children	Local authority	Continuous variable indicating the average annual rate (in the follow-up period) of referrals to the CS system per 10,000 children (under 18) in the general population of the local authority.

Methods

The data will be analysed by implementing a binary logistic multilevel model using the R packages "lme4" (Bates et al., 2015) and "MCMCglmm" (Hadfield, 2010). A multilevel logistic model is a generalised linear model (GLM) that analyses the odds of an event occurring against the event not occurring through a link function (natural logarithm), controlling for the clustering of the observations (for more details, see: Goldstein, 2011; Hox, 2010; Snijders & Bosker, 2011). In this study, children are clustered within local authorities, and hence it needs to be taken into account in the model. The model to be implemented in this study has the following general form:

$$logit\left(p_{ij}\right) = ln\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + (X\beta)_{ij} + (Z\beta)_{0j} + u_{0j} \quad \textbf{Eq. 1}$$

where

$$u_{0j} \sim N(0, \sigma_u^2)$$

In this equation, $\mathrm{p_{ij}}$ corresponds to a binary indicator of whether a child referred in the recruitment period has been re-referred to CS within the follow-up period. β_0 represents the national average when all covariates (x) and $\mathrm{u_{0j}}$ are equal to 0. The term $\mathrm{logit}\left(\mathrm{p_{ij}}\right)$ represents the link function used to transform the binary outcome into a continuous

outcome, thus allowing a linear relationship with the covariates. This link function is the natural logarithm (ln) of the odds ratio (the probability of the event occurring against the probability of the event not occurring); otherwise known as "log-odds". $(X\beta)_{ij}$ is a vector of covariates for child "i" in local authority "j" multiplied by the expected increase in the log-odds of the outcome, when covariate "x" increases in one unit. Meanwhile, $(Z\beta)_{0j}$ is a vector or covariates for local authority "j" multiplied by the expected increase in the log-odds of the outcome, when covariate "z" increases in one unit. Finally, u_{0j} is a random effect that represents the effect of local authorities, which is assumed to be normally-distributed with a mean of 0 and a variance σ_u^2 to be estimated from the model.

Baseline probabilities for specific local authorities can be estimated by adding the national average log-odds and the area-specific average log-odds and then transforming back to the probability. The general formula is as follows:

$$Pr_j = \frac{\exp(\hat{\beta}_0 + \hat{u}_j)}{1 + [\exp(\hat{\beta}_0 + \hat{u}_j)]} \qquad \textbf{Eq. 2}$$

Where Pr_j is the baseline probability for local authority "j"; $\hat{\beta}_0$ corresponds to the posterior estimate (median) of the intercept log-odds (overall average) and $\hat{u}_j$ corresponds to the posterior estimate (median) of the log-odds for local authority "j". The expression "exp" corresponds to the exponential function e^x, i.e. the inverse of the natural logarithm $\ln(x)$.

The exploration stage of this model has been performed using the "lme4" package, using Laplacian approximation. Due to the complexity of the model and the length of the dataset, this model is both hard to converge and long to estimate. After arriving to a set of suitable covariates, the model is estimated under a Bayesian framework using the "MCMCglmm" package, which uses a Markov Chain Monte Carlo (MCMC) algorithm. MCMC estimation has been deemed more precise and reliable in the context of binary logistic multilevel models (Browne & Draper, 2006; Rodriguez & Goldman, 2001), and hence it is preferred.

The statistical significance of each covariates is judged by using the 95% credible intervals (akin to traditional confidence intervals in a frequentist framework), which would overlap markedly with zero should an estimated parameter not differ significantly from it. The overall statistical significance of the model is evaluated by using the Deviance Information Criterion (DIC) (Spiegelhalter et al., 2002), which can be thought of as a generalisation of the Akaike Information Criterion (AIC) (Akaike, 1973) for the Bayesian framework. The DIC statistic helps compare the overall fit of models, taking into account the complexity of them (number of effective parameters). Should a model fit better than another, its DIC statistic would be lower than the other model's DIC statistic.

Descriptive analysis

In this section, some descriptive statistics of the variables of interest are presented. Different aspects of the re-referral phenomenon will be explored, such as rates across the follow-up period, number of years in which children are re-referred, the association of re-referrals with “no further action” and primary need at first referral. Moreover, some descriptive statistics are explored regarding those children in the cohort 2010-2011, who have had episodes of care, i.e. children looked after.

Firstly, the table below displays a summary of the frequency of re-referrals across the period of study (2010-2016).

Table 2: Cumulative frequency of children in cohort 2010-2011 by re-referral status in the follow-up period (2010-2016)

Year	Not re-referred (%)	Re-referred (%)
2010-2011	425,631 (85.3%)	73,236 (14.7%)
2011-2012	346,573 (69.5%)	152,294 (30.5%)
2012-2013	305,920 (61.3%)	192,947 (38.7%)
2013-2014	278,809 (55.9%)	220,058 (44.1%)
2014-2015	262,286 (52.6%)	236,581 (47.4%)
2015-2016	251,290 (50.4%)	247,577 (49.6%)

In table 2, it can be appreciated that nearly 15% of the children referred in 2010-2011 are re-referred within the same year. This proportion doubles by 2011-2012 (31%) and continues to increase across the whole follow-up period, reaching a 50% by 2015-2016. This implies that within 6 years, half the children referred in the financial year 2010-2011 have returned to CS at least once.

Nevertheless, the re-referral rates of Table 2 are deflated because of the number of cases in the sample that become ineligible for referral to CS during the follow-up period. If producing a subset of the sample of only those who are still underage by the end of each CiN census period (March 31st), the re-referral rates have a non-negligible change. This is appreciated in Table 3.

Table 3: Cumulative frequency of children in cohort 2010-2011 by re-referral status in the follow-up period (2010-2016) and underage status by CiN census closure.

Year	Underage by March 31st	Not re-referred (%)	Re-referred (%)
2010-2011	488,152	415,772 (85.2%)	72,380 (14.8%)
2011-2012	469,145	321,579 (68.6%)	147,566 (31.5%)
2012-2013	444,205	263,837 (59.4%)	180,368 (40.6%)
2013-2014	417,097	220,160 (52.8%)	196,937 (47.2%)
2014-2015	390,862	189,657 (48.5%)	201,205 (51.5%)
2015-2016	366,196	166,500 (45.5%)	199,696 (54.5%)

Table 3 shows that when controlling for the age of children (by March 31st, each CiN Census year), re-referral rates increases gradually each year at a steeper rate than in table 2 (not controlling for the age of children). It is appreciated, thus, that re-referral rates surpass the 50% mark by 2014-2015, increasing up to approximately 55% by the end of the follow-up period. This is more clearly observed in figure 2.

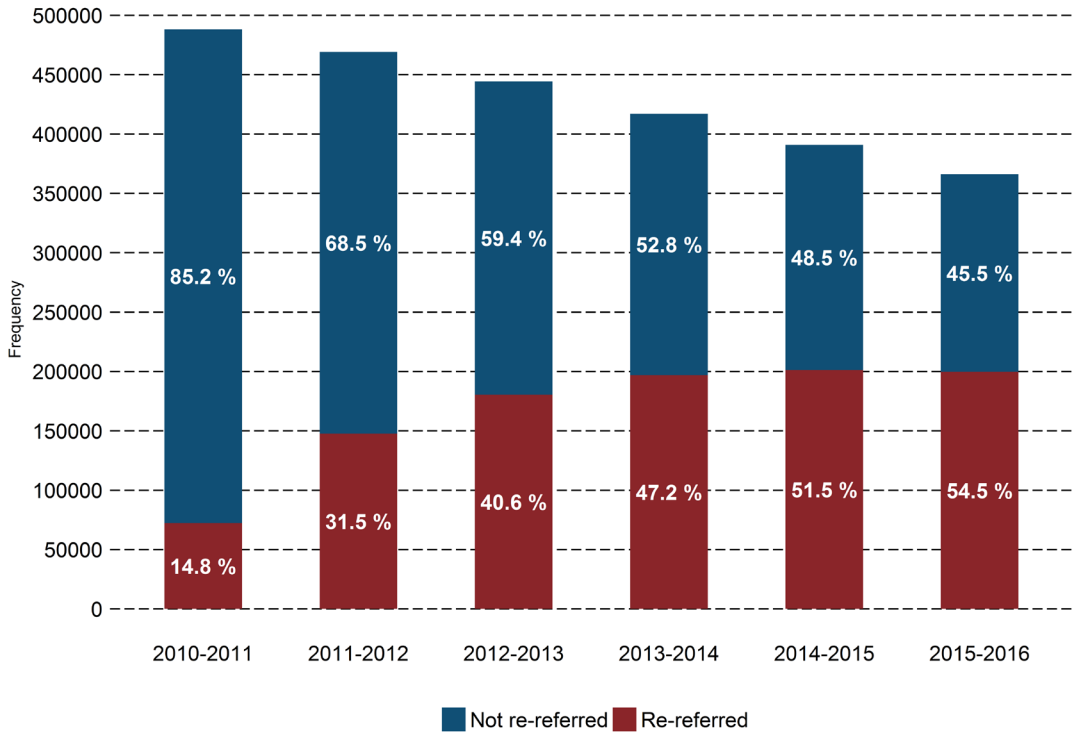

Figure 2: Cumulative frequency of children in cohort 2010-2011 by re-referral status in the follow-up period (2010-2016)

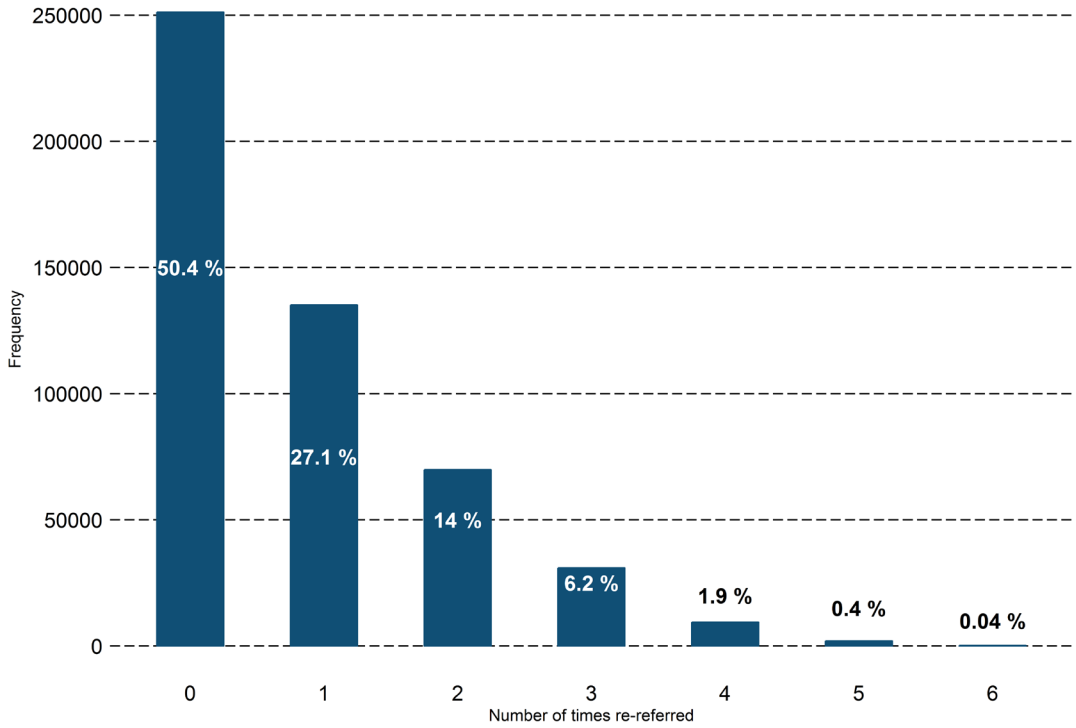

Figure 3: Frequency of number of years in which children in cohort 2010-2011 are re-referred in the follow-up period (2010-2016)

In Figure 3, it can be observed that children can be re-referred more than once during the follow-up period. This figure takes into account only the first re-referral per year, including the recruitment year 2010-2011, in which re-referrals can also occur. It can be seen that 27% of all children are re-referred in only one year of the follow-up period, although in the year in which they are re-referred, there can be more than one re-referral.

Furthermore, figure 3 shows that approximately 23% of all children in the cohort are re-referred in at least two years (not necessarily consecutive) of the follow-up period4. Out of the children who are re-referred, this represents a 45% (more than 110,000 children). Likewise, approximately 9% of all children in the cohort are re-referred in at least 3 out of the 6 years of the follow-up period; this represents a 17% of all re-referred children (more than 40,000 children).

Referrals are not always followed by assessments, as some children are judged to need “no further action” (NFA). In the following table, the relationship between NFA status in the recruitment period and re-referral is explored.

[4] Figure 3 does not control for children who turn 18 after the financial year 2010-2011.

Table 4: Frequency of re-referrals during the follow-up period, by NFA status in the recruitment period

		Not NFA	NFA	Row Total
2010-2011	**Not Re-referred**	**350,858**	**64,914**	**415,772**
	Row percent	84.4%	15.6%	85.2%
	Column percent	87.6%	74.2%	
	Total percent	71.9%	13.3%	
	Re-referred	**49,823**	**22,557**	**72,380**
	Row percent	68.8%	31.2%	14.8%
	Column percent	12.4%	25.8%	
	Total percent	10.2%	4.6%	
	Column Total	**400,681**	**87,471**	**488,152**
		82.1%	17.9%	

		Not NFA	NFA	Row Total
2011-2012	**Not Re-referred**	**271,914**	**49,665**	**321,579**
	Row percent	84.6%	15.4%	68.6%
	Column percent	70.4%	59.7%	
	Total percent	58%	10.6%	
	Re-referred	**114,091**	**33,475**	**147,566**
	Row percent	77.3%	22.7%	31.5%
	Column percent	29.6%	40.3%	
	Total percent	24.3%	7.1%	
	Column Total	**386,005**	**83,140**	**469,145**
		82.3%	17.7%	

		Not NFA	NFA	Row Total
2012-2013	**Not Re-referred**	**222,493**	**41,344**	**263,837**
	Row percent	84.3%	15.7%	59.4%
	Column percent	60.7%	53.2%	
	Total percent	50.1%	9.3%	
	Re-referred	**144,015**	**36,353**	**180,368**
	Row percent	79.9%	20.2%	40.6%
	Column percent	39.3%	46.8%	
	Total percent	32.4%	8.2%	
	Column Total	**366,508**	**77,697**	**444,205**
		82.5%	17.5%	

		Not NFA	NFA	Row Total
2013-2014	**Not Re-referred**	**184,757**	**35,403**	**220,160**
	Row percent	83.9%	16.1%	52.8%
	Column percent	53.6%	49%	
	Total percent	44.3%	8.5%	
	Re-referred	**160,018**	**36,919**	**196,937**
	Row percent	81.3%	18.8%	47.2%
	Column percent	46.4%	51.1%	
	Total percent	38.4%	8.9%	
	Column Total	**344,775**	**72,322**	**417,097**
		82.7%	17.3%	

		Not NFA	NFA	Row Total
2014-2015	**Not Re-referred**	**158,687**	**30,970**	**189,657**
	Row percent	83.7%	16.3%	48.5%
	Column percent	49%	46%	
	Total percent	40.6%	7.9%	
	Re-referred	**164,886**	**36,319**	**201,205**
	Row percent	82%	18.1%	51.5%
	Column percent	51%	54%	
	Total percent	42.2%	9.3%	
	Column Total	**323,573**	**67,289**	**390,862**
		82.8%	17.2%	

		Not NFA	NFA	Row Total
2015-2016	**Not Re-referred**	**139,086**	**27,414**	**166,500**
	Row percent	83.5%	16.5%	45.5%
	Column percent	45.8%	43.8%	
	Total percent	38%	7.5%	
	Re-referred	**164,510**	**35,186**	**199,696**
	Row percent	82.4%	17.6%	54.5%
	Column percent	54.2%	56.2%	
	Total percent	44.9%	9.6%	
	Column Total	**303,596**	**62,600**	**366,196**
		82.9%	17.1%	

On another front, of the total of children being re-referred during 2010-2011, 31% had been declared as NFA. This rate decreases to 23% in 2011-2012 and continues to slowly decrease each year to 18% in 2014-2015. The changes in both rates across the years can be appreciated more clearly in figure 4.

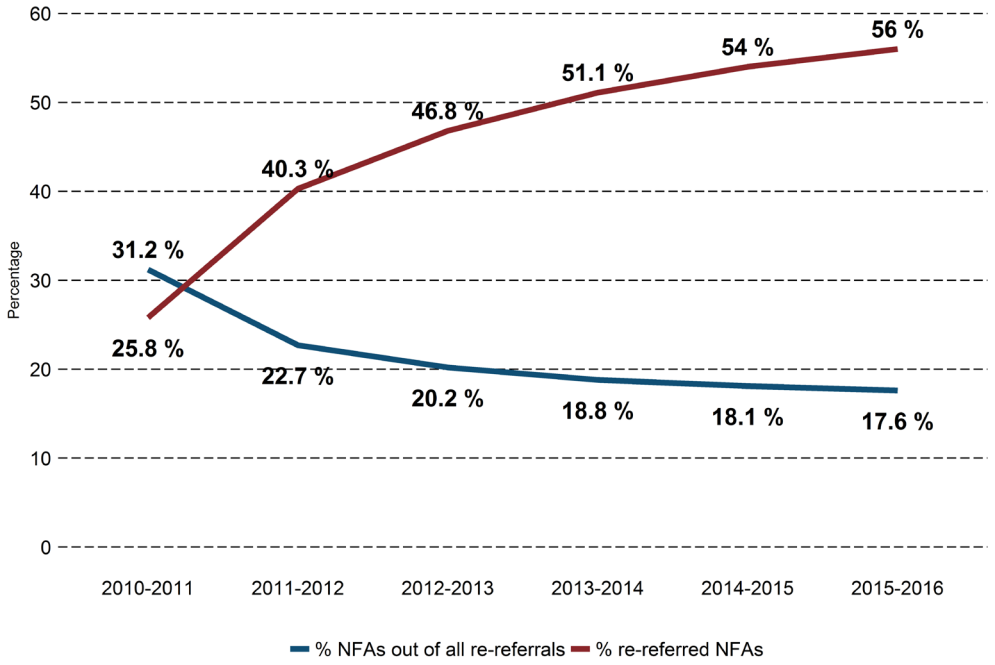

Figure 4: Proportion of NFA children in 2010-2011 being re-referred against proportion of NFAs out of all referrals during the follow-up period.

In figure 4, the red line represents the proportion of children declared as NFA in 2010-2011 who were re-referred (out of the total number of NFA children in 2010-2011). Meanwhile, the blue line represents the proportion of children declared as NFA in 2010-2011 out of the total number of re-referrals each year. Percentages in figure 3 and table 4 consider only those cases that are still underage by March 31st of each CiN Census year.

Table 5: Primary need of children at first referral in 2010-2011

Primary need at first referral	N	%
Not stated	51,047	10.2%
Abuse or neglect	204,121	40.9%
Child's disability	15,932	3.2%
Parental disability or illness	12,685	2.5%
Family in acute distress	52,103	10.4%
Family dysfunction	93,419	18.7%
Socially unacceptable behaviour	11,998	2.4%
Low income	2,454	0.5%
Absent parenting	6,867	1.4%
Other cases	7,281	1.5%
Missing	40,960	8.2%
Total	**498,867**	**100%**

Table 5 displays the frequency of primary needs at first referral of children in the cohort 2010-2011. It can be seen that abuse or neglect is by far the most frequent primary need of children, followed by family dysfunction and family in acute stress. This table also includes "not stated" needs and missing observations, which most likely refer to children stepped down as needing no further action and some other incomplete records.

Table 6: Comparison between primary need of children at first and subsequent referral by year

		Different need	Same need	Total
2010-2011	N	18,115	42,173	60,288
	%	**30%**	**70%**	**100%**
2011-2012	N	36,849	52,808	89,657
	%	**41.1%**	**58.9%**	**100%**
2012-2013	N	31,953	36,565	68,518
	%	**46.6%**	**53.4%**	**100%**
2013-2014	N	29,682	30,772	60,454
	%	**49.1%**	**50.9%**	**100%**
2014-2015	N	23,878	25,006	48,884
	%	**49%**	**51%**	**100%**
2015-2016	N	20,363	20,500	40,863
	%	**49.8%**	**50.2%**	**100%**

On another front, regarding needs of children at subsequent referrals, table 6 compares recorded primary needs at first and subsequent referrals during the follow-up period. It is observed that the closer the re-referral is to the first referral (in 2010-2011), the more likely it is for the primary need for both referrals to be the same (approximately 70% in 2010-2011). Overall, table 6 shows there is a non-negligible proportion of children with primary needs that tend to be quite stable across time, as about half the children in the cohort having the same primary need from their first referral in 2010-2011 up to 2015-2016. Figure 5 illustrates the yearly comparison of table 6.

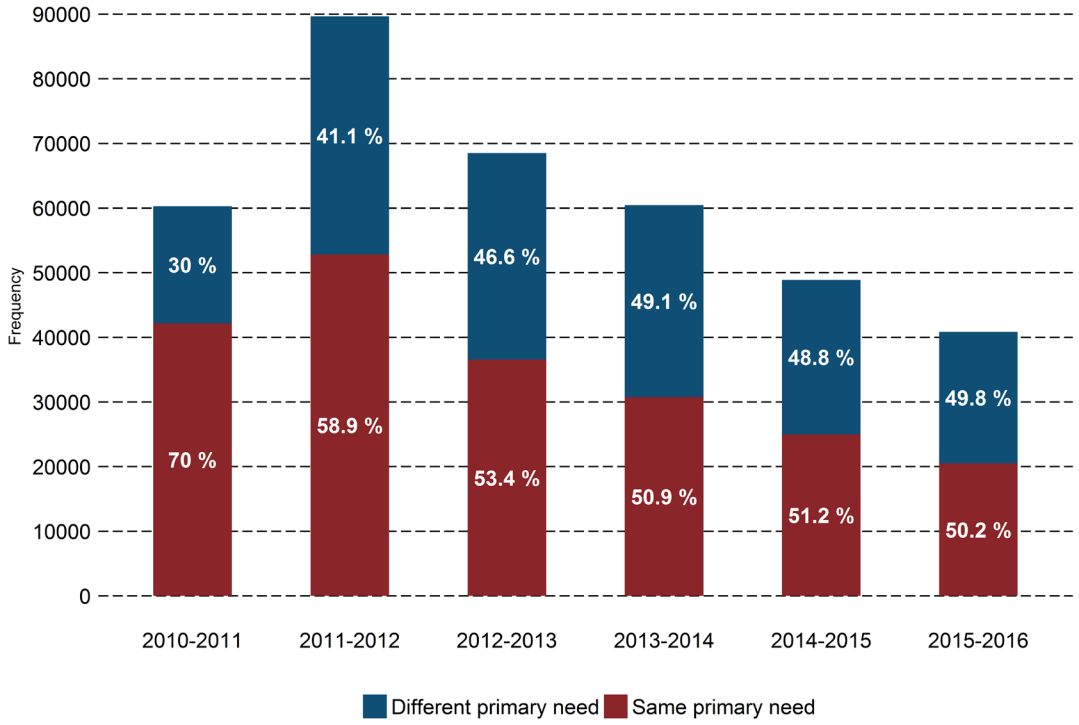

Figure 5: Comparison between primary need of children at first and subsequent referral by year

Children Looked After from cohort 2010-2011

In this subsection, some descriptive statistics from the Children Looked After (CLA) database will be explored. This analysis refers to only those children in need in the cohort 2010-2011 (referred to CS in the financial year 2010-2011), who have started a period of care (looked after) from 01/04/2010 onwards and have been followed up until 2016.

As mentioned before, children referred to Children's Services may become children looked after, when they are assessed to have an increased of risk of harm. Thus, they are put under the guardianship of the local authorities. In the cohort 2010-2011 under study in this report, it was found that 39,545 out of the total of 498,867 children became children looked after at least once in the follow-up period (from 01/04/2010 onwards). This represents 8% of the CiN cohort 2010-2011. Table 7 displays the number of children

looked after from the cohort 2010-2011, according to the legal status of their first episode of care in the follow-up period.

Table 7: Legal status of children looked after from the cohort of children in need 2010-2011

Legal status	Code	N	%
Care orders			
Interim care order	C1	7,868	19.9%
Full care order	C2	339	0.9%
Placement order			
Placement order granted	E1	SUPP	SUPP
Voluntary accommodation			
Single period of accommodation under section 20	V2	23,670	60%
Accommodated under an agreed series of short-term breaks,			
when individual episodes of care are recorded	V3	382	1%
when agreements are recorded (i.e. NOT individual episodes of care)	V4	684	1.7%
Detained on child protection grounds,			
Under police protection and in local authority accommodation	L1	4,779	12.1%
Emergency protection order	L2	911	2.3%
Under child assessment order and in local authority accommodation	L3	SUPP	SUPP
Youth justice legal Statuses			
On remand, or committed for trial or sentence, and accommodated by LA	J1	835	2.1%
Detained in LA accommodation under PACE	J2	SUPP	SUPP
Sentenced to CYPA 1969 supervision order with residence requirement	J3	SUPP	SUPP
Total		**39,468**	**100%**

In Table 7, it is appreciated that the ample majority of children looked after in the cohort of children in need 2010-2011 have been under the legal status of single period of accommodation under section 20 (60%). The second and third most frequent legal statuses of children looked after (in cohort 2010-2011) are, respectively, “interim care order” (20%) and “under police protection and in LA accommodation” (12%). The duration of these periods of care varies across children and this is summarised in Table 8.

Table 8 refers to the average duration of all the periods of care, under which children in the cohort 2010-2011 have been in the follow-up period. It can be appreciated that approximately one in four children looked after (25%) have periods of care lasting up to one week on average. Also, approximately half (51%) the children looked after have periods of care lasting two months or less. On the other end of the distribution, it is observed that 4,000 children looked after (10% out of CLA and 0.8% out of the whole cohort) in this cohort have spent at least one year under care by local authorities.

Table 8: Duration of episodes of care of children looked after in the cohort of children in need 2010-2011

Duration	N	% of cohort	% of CLA
0 (Not CLA)	459,323	92.1%	n/a
2 days or fewer	4,629	0.9%	11.7%
2-7 days	5,531	1.1%	14%
1 week to 1	5,916	1.2%	15%
1-2 months	4,160	0.80%	10.5%
2-4 months	5,152	1.00%	13%
4-6 months	4,003	0.80%	10.1%
6-9 months	3,770	0.80%	9.5%
9-12 months	2,380	0.50%	6%
1 year or more	4,003	0.80%	10.1%
Total	**498,867**	**100%**	n/a
Total CLA	**39,544**	**7.9%**	**100%**

As hinted before, some children have spent more than one period of care and this is summarised in Table 9.

Table 9: Number of episodes of care of children looked after in the cohort of children in need 2010-2011

Number of episodes	N	% of cohort	% of CLA
0 (Not CLA)	459,322	92.1%	n/a
1	34,122	6.8%	86.3%
2	4,099	0.8%	10.4%
3	754	0.2%	1.9%
4 or more	570	0.1%	1.4%
Total cohort	**498,867**	**100%**	n/a
Total CLA	**39,545**	**7.9%**	**100%**

In Table 9, it is observed that the overwhelming majority (86%) of children in the cohort, who have been looked after at some point during the follow-up period, have only spent a single period of care. Those who have spent two periods of care are still worth noting, representing a 10% of the children looked after in the cohort. On the other extreme of the distribution, it is seen that only a 3% of children have undergone 3 or more periods of care.

The following section delves into the likelihood of being re-referred to the CS system and its associated factors at the level of children and local authorities, by implementing a multilevel binary logistic model.

Analysing repeated referrals

Baseline likelihood of re-referral

In this section, an empty multilevel logistic model was implemented to assess the relative weight of the local authority effects. The empty model does not contain any covariates, only the outcome variable controlling for the clustering within local authorities. Since no covariates are included, this model can be deemed as a baseline for subsequent models. Furthermore, this model allows estimating overall baseline odds or probabilities of re-referral for all children and baseline odds or probabilities that are specific to each local education authority for which data are available in this cohort. Results of this model are presented in table 10.

Table 10: Empty multilevel logistic model for the probability of re-referral of children in cohort 2010-2011

Parameter	Posterior mean	Low CI	Upper CI	ESS†	p-MCMC‡
Intercept	-0.134	-0.224	-0.049	5,000	0.001
LEA (variance)	0.282	0.219	0.351	1,230	--
Model fit§	**Estimate**				
VPC§§	0.079				
N(i)	498,867				
N(j)	145				
DIC	677,636.2				

† Effective sample size: In MCMC estimation, it indicates the number of independent samples after accounting for autocorrelation.
‡ p-MCMC is a Bayesian equivalent to classic p-values with akin interpretation.
§ This model has been fitted via MCMC. Number of chains: 1; chain length: 55,000; burn-in: 5,000; thinning: 10. Prior distributions are: inverse gamma (0.001, 0.001) for the random part; and normal (0, 10^8) for the fixed part.
§§ Variance partition coefficient assuming latent normality of higher-level units and a standard logistic distribution variance for lower-level units.

In table 10, the estimates for both the fixed and random parts of the model are in the log-odds scale. The intercept estimate corresponds to an odds ratio of 0.87 [exp(-0.134)], which can be converted to a probability of 0.47. This is the overall probability of being re-referred for children in the cohort 2010.

The variance at the local authority level is 0.282. To assess the relative weight of the local authority variability with respect to the total variability, a common approach is to assume that the variability at the individual level is the variance of the standard logistic distribution ($\pi^2/3 \cong 3.29$) (for more details see: Goldstein et al. 2002; Browne et al. 2005). The variance partition coefficient (VPC) (also known as the intra-class correlation-ICC) is thus:

$$\rho_{model0} = \frac{\sigma_u^2}{\sigma_u^2 + 3.29} = \frac{0.282}{0.282 + 3.29} = 0.079$$

This means that approximately 8% of the total variability in the probability of re-referral is due to the variability between local authorities. This corresponds to the overall variability across local authorities and, although relatively small, is certainly non-negligible. From a different perspective, assuming that the local authority effect is normally-distributed, it is expected that the probability of re-referral across 95% of the local authorities lies between 0.23 and 0.72[5].

In the following graph, it is appreciated that the differences between local authorities at both ends of the distribution are quite large and can potentially make a difference for the probability of children being re-referred.

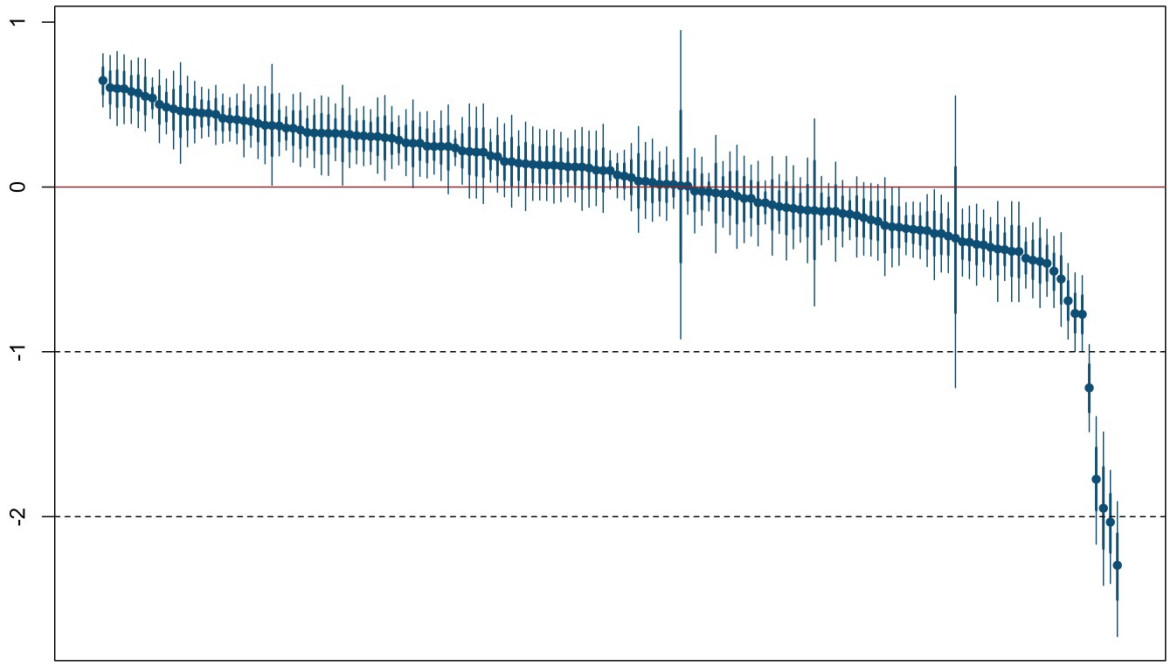

Figure 6: Ranked LA effects estimates with 95% credible intervals for the effects of LEAs on the probability of re-referral of children in cohort 2010-2011.

In Figure 6, the blue dots represent a particular local authority, while the blue segments are their corresponding 95% credible intervals. Meanwhile, the red line at 0 represents the national average. Depending on how much a credible interval overlaps with the national average, it can be interpreted that a particular local authority is not significantly different from the national average. In this figure, it is appreciated that expected variation

[5] This is called “coverage interval”. It assumes that the higher-level effect follows a normal distribution, and hence roughly 95% of the local authorities will fall within 2 standard deviations (square root of the estimated variance) of the overall mean (estimated intercept).

in the log-odds scale is large across local authorities. The local authorities on the right-hand side of the graph are the ones that can be said to be contributing less to the probability of re-referral (negative log-odds). While, on the left-hand side, the local authorities contributing more to the probability of re-referral are found (positive log-odds).

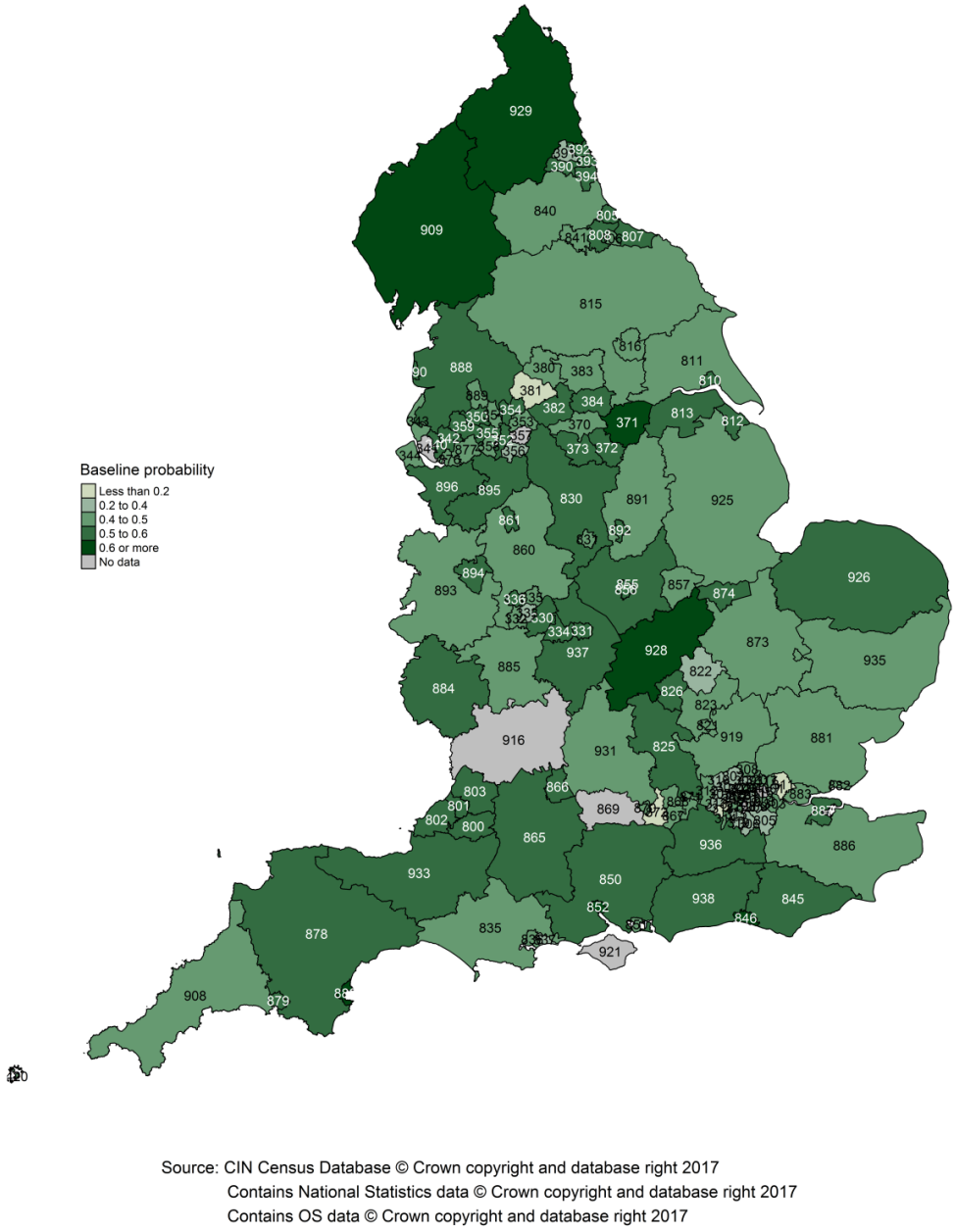

Figure 7: Baseline probabilities of re-referral for children in cohort 2010-2011 in LEAs of England.

Figure 7 illustrates the baseline probabilities of re-referral in each of the 145 local education authorities (LEA) in England, for which information on this cohort is available. These probabilities have been estimated from the empty model, using equation 2 (methods section). As can be seen, darker shades of green indicate a greater baseline probability for children to be re-referred in a particular local authority. This representation of the data differs from figure 6, insofar as Figure 7 depicts the sum of the overall

average (intercept in table 10) and the specific contribution (random effect) of each local authority.

Factors associated with the likelihood of re-referral

The aim of this section is to ascertain the effects that a number of child and LEA characteristics have on the probability of being re-referred. As mentioned before (section 3.1), this model was run on a subsample of 90,209 children nested within 144 local authorities.

Table 11 reports the posterior means of the log-odds of each parameter, as well as their corresponding 95% credible intervals (2.5 and 97.5 percentiles). Odds ratios are obtained by using the exponential function ("exp"). The interpretation of posterior means in the Bayesian framework is somewhat akin to the interpretation of point estimates in a frequentist framework. Parameters in table 4 are all approximately normally-distributed, whose distributions are obtained from at least 1,332 independent samples (ESS). The posterior mean is thus the most likely expected value for any given parameter.

Comparing the intercept from the empty model (table 10) to the one in table 11, it is appreciated that the baseline odds of being re-referred are lower. This is unsurprising, because this model controls for several child and LEA characteristics. This implies that the actual odds of a particular child will depend greatly on their own characteristics and the LEA where they reside.

A child's age is an important factor, as judged by the significance of all three parameters associated with it. Age has been centred around 8 years old (approximately the grand mean of 7.9) and its corresponding squared and cubic terms have been added to control for "floor" and "ceiling" effects. After estimating predicted probabilities, it is appreciated that the older children are, the less likely they are to be re-referred. This is more clearly observed in figures 11, 12 and 13.

On another front, children who had been stepped down as needing no further action in their first referral (starting episode of need) are 1.34 times as likely to be re-referred as children who had not been stepped down as needing no further action. Disabled children are noticeably more likely to be re-referred than non-disabled children, when their primary need is not their disability.

Even though the difference in the likelihood of re-referral of girls and boys seems to be highly significant, this is a small effect. Girls seem to be only slightly more likely than boys to return to the CS system.

Table 11: Multilevel logistic model for the probability of re-referral of children in cohort 2010-2011, controlling for child and LEA characteristics

Parameters	Posterior Mean	Odds ratio	Lower CI	Upper CI	ESS§§	p-MCMC††
Child-level fixed effects†						
Intercept	-0.456	0.634	-0.8	-0.131	4,275	0.009**
Age (linear) ‡	0.02	1.02	0.013	0.027	1,715	<2e-04***
Age (squared) ‡	-0.01	0.99	-0.011	-0.009	1,435	<2e-04***
Age (cubed) ‡	-0.002	0.998	-0.002	-0.002	1,500	<2e-04***
NFA	0.29	1.337	0.232	0.349	1,683	<2e-04***
Disabled	0.766	2.15	0.688	0.852	1,399	<2e-04***
Female	0.08	1.083	0.046	0.11	1,718	<2e-04***
PN1: Abuse or neglect	0.177	1.193	0.11	0.244	1,774	<2e-04***
PN2: Child's disability	-0.727	0.483	-0.851	-0.6	1,574	<2e-04***
PN3: Parental disab./illness	0.348	1.416	0.232	0.461	1,678	<2e-04***
PN4: Family in acute distress	0.333	1.395	0.254	0.412	1,802	<2e-04***
PN5: Family dysfunction	0.509	1.663	0.436	0.581	1,698	<2e-04***
PN6: Socially unacc. Behav.	0.344	1.411	0.225	0.466	1,636	<2e-04***
PN7: Low income	-0.008	0.992	-0.238	0.243	1,489	0.942
PN8: Absent parenting	-0.416	0.66	-0.57	-0.247	1,332	<2e-04***
PN9: Other cases	-0.038	0.963	-0.182	0.109	1,689	0.608
Local authority fixed effects†						
10+ CiN per social worker in LEA	0.214	1.239	-0.107	0.561	4,349	0.218
LEA referral rate per 10,000 §	-0.002	0.998	-0.004	0.000	3,531	0.059
10+ CiN*LEA referral rate	0.004	1.004	0.001	0.006	3,623	0.003**
Random part						
LEA intercept variance	0.152		0.11	0.194	2,635	
Model information‡‡	**Estimate**					
DIC	117,726.5					
MCMC Sample Size	5,000					
N(i)	90,209					
N(j)	144					
VPC	0.044					

† Reference categories: not NFA, not disabled, male, not stated need, fewer than 10 CiN per social worker.

‡ Age is centred around 8 years old (grand mean).

§ LA referral rate per 10,000 is centred around its median of 550.

§§ Effective sample size: In MCMC estimation, it indicates the number of independent samples after accounting for autocorrelation.

†† p-MCMC is a Bayesian equivalent for classic p-values with akin interpretation.

‡‡ This model has been fitted via MCMC. Number of chains: 1; chain length: 55,000; burn-in: 5,000; thinning: 10. Prior distributions are: inverse gamma (0.001, 0.001) for the random part; and normal (0, 10^8) for the fixed part.

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05

Regarding the primary needs recorded at the time of their first referral, table 11 indicates that the likelihood of re-referral is increased for children whose recorded primary need is abuse and neglect, parental disability or illness, family in acute stress, family dysfunction and socially unacceptable behaviour. This is in comparison to children with “no stated need”. It is also observed that when the primary need of a child is disability, they are markedly less likely to be re-referred, as they will probably continue different pathways to care for their needs.

Regarding effects at the level of the local education authorities, it is observed that only the interaction between the number of children in need per social worker and the referral rates per 10,000 children can be safely judged as significant. This implies that the contextual effect of referral rates per local education authority is moderated by the children in need per social worker rate; the lower the number of CiN per social worker, the lower the effect of referral rates on re-referral propensity. This is illustrated more clearly in Figure 11.

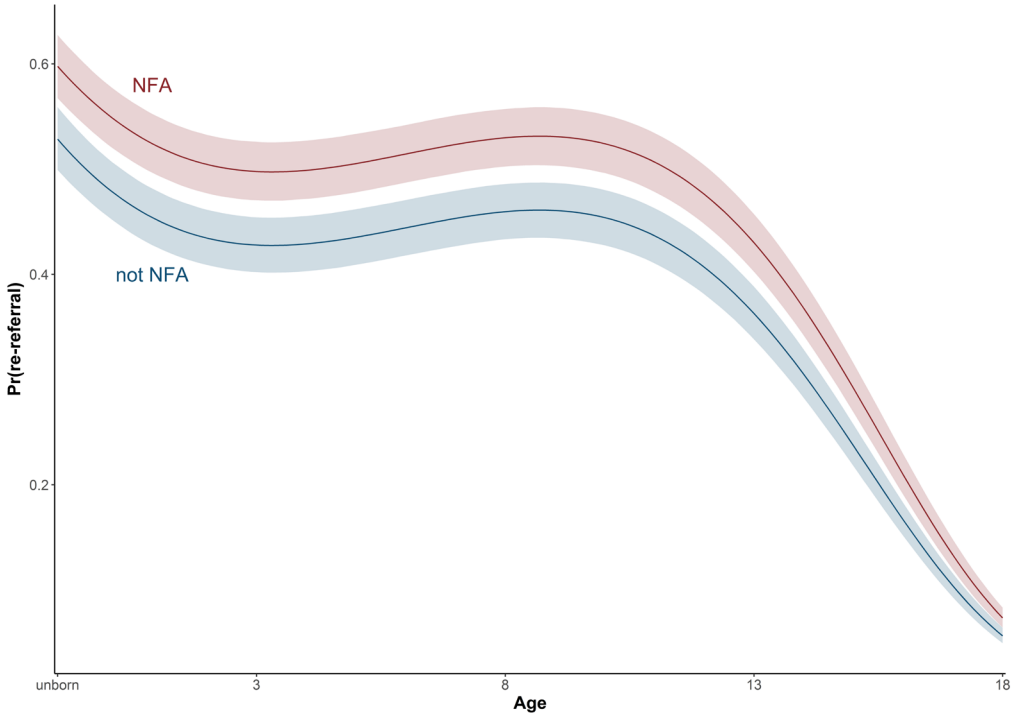

Figure 8: Predicted probabilities of re-referral for children in cohort 2010-2011, according to age and NFA status.

Figure 8 shows that the effect of age on the likelihood of referral is indeed non-linear. The inclusion of the polynomial terms of age (squared and cubed) allows unveiling that at very early ages (including unborn children), re-referral is markedly more likely. The likelihood then declines steadily until about age 3, reaching a plateau up to about age 11. The probability at this interval (3-11 approximately) is around 50%, which implies that at this age there is no discernible pattern. Then, after age 11 the likelihood rapidly decreases as approaching age 18, which in part is due to the fact that older children have

effectively less time to be re-referred. It is also observed in this figure that children who had been stepped down as needing no further action (NFA) in their first episode of need are more prone to re-referral in the follow-up period, while holding all other variables in the model constant. This is observed across the complete age range.

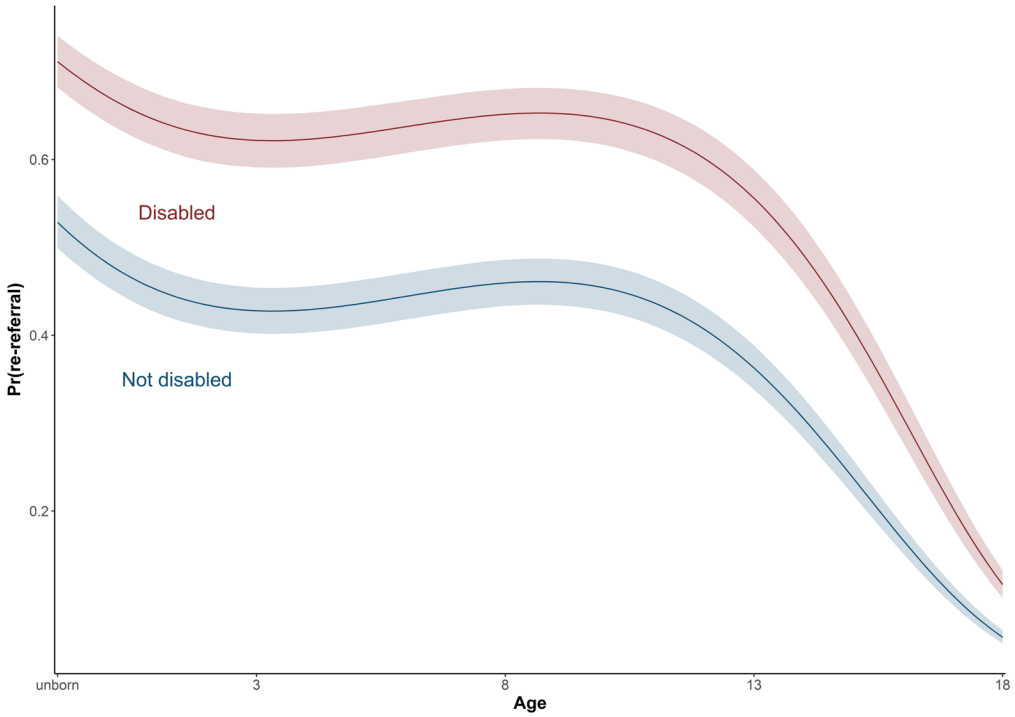

Figure 9: Predicted probabilities of re-referral for children in cohort 2010-2011, according to age and disability status.

In Figure 9, the observed trend across the age range remains as in figure 11, although the difference between the two groups compared is more marked. Disabled children are noticeably more likely to return to the Children's Services system than non-disabled children, while all other variables in the model remain constant. The latter implies, for instance, that primary need at the time of first referral is not considered here, and hence, if the reason for referral of disabled children is their disability, the differences displayed in figure 8 would change considerably. The probability of re-referral for disabled children is above 60% until approximately 13 years old, while their non-disabled peers have less than 50% probability of re-referral between ages 3 and 13.

Figure 10 depicts the median predicted probabilities of boys and girls, showing that girls (top curved line) are slightly more prone than boys (bottom curved line) to return to the Children's Services system. Nevertheless, the credible intervals (2.5 and 97.5 percentiles) of both groups' probabilities considerably overlap, meaning that the uncertainty is too large to distinguish between the two groups of children. In practice, this implies that girls and boys are equally likely to be re-referred in the 6-year follow-up period.

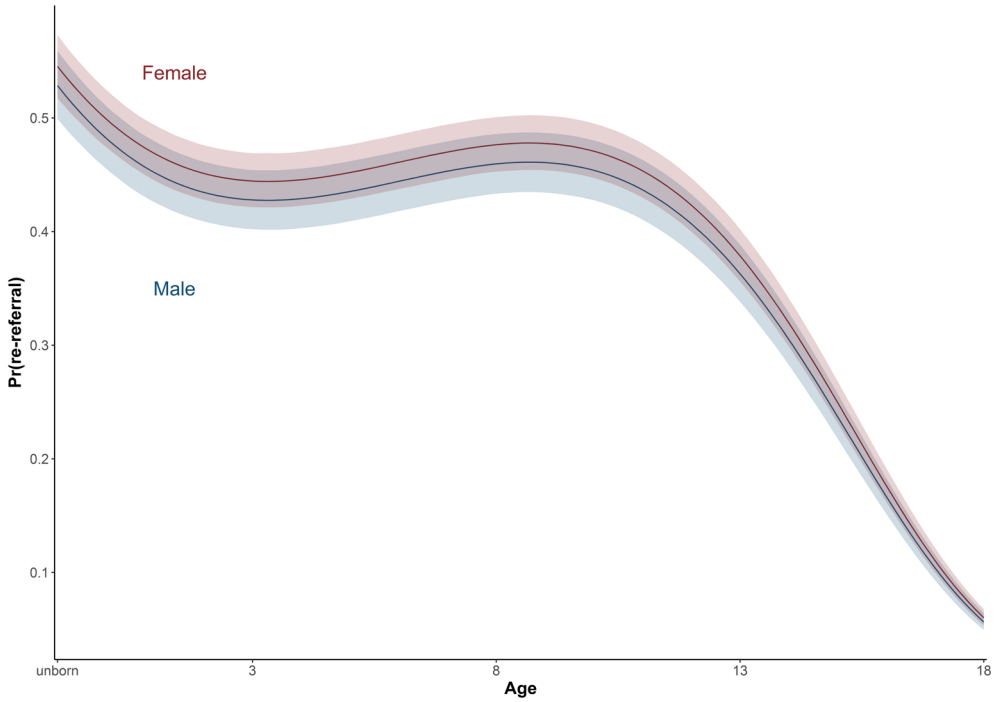

Figure 10: Predicted probabilities of re-referral for children in cohort 2010-2011, according to age and gender.

On another front, regarding the contextual effects of local education authorities, figure 11 illustrates the interaction between the effect of referral rates per 10,000 children and the number of children in need (CiN) per social worker in the local education authority, while holding everything else in the model constant.

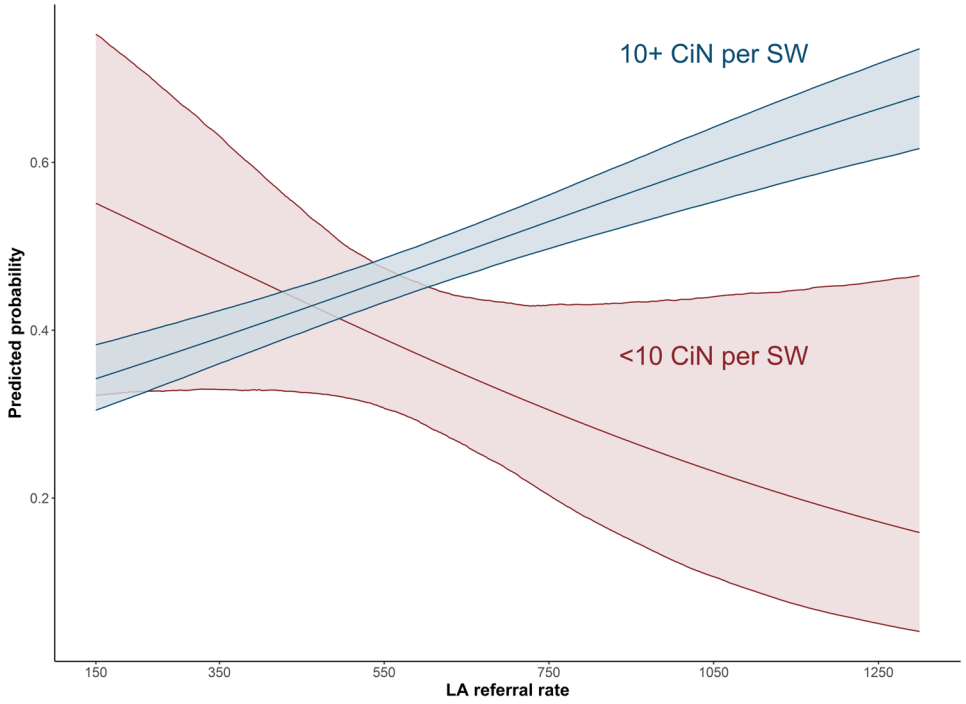

Figure 11: Predicted probabilities of re-referral for children in cohort 2010-2011, according to LEA referral rates and number of CiN per social worker.

As can be seen in Figure 11, the likelihood of children of returning to the CS system increases rapidly for children living in local authorities with more than 10 children in need per social worker, as the referral rates for those local authorities increase. More importantly, this illustrates how re-referral might be related to the capacity of local authorities to handle cases at first referral. Simply put, if local authorities lack capacity to deal with referral cases, as they might be short-staffed, more children would return for a repeated referral, as their needs might have not been assessed or addressed adequately. This does not constitute conclusive evidence and, of course, further insight is required from other sources, such as: for instance, inspection reports.

Figure 12 shows the estimated distributions of probabilities of re-referral for each local authority, for which data are available in this cohort. Comparing this to figure 9, it can be seen that local education authorities are closer together around the national average (red line at zero in the y-axis). Furthermore, the right-most local authorities, i.e. those that are said to contribute the least to re-referral, are nearer the rest of the LEAs.

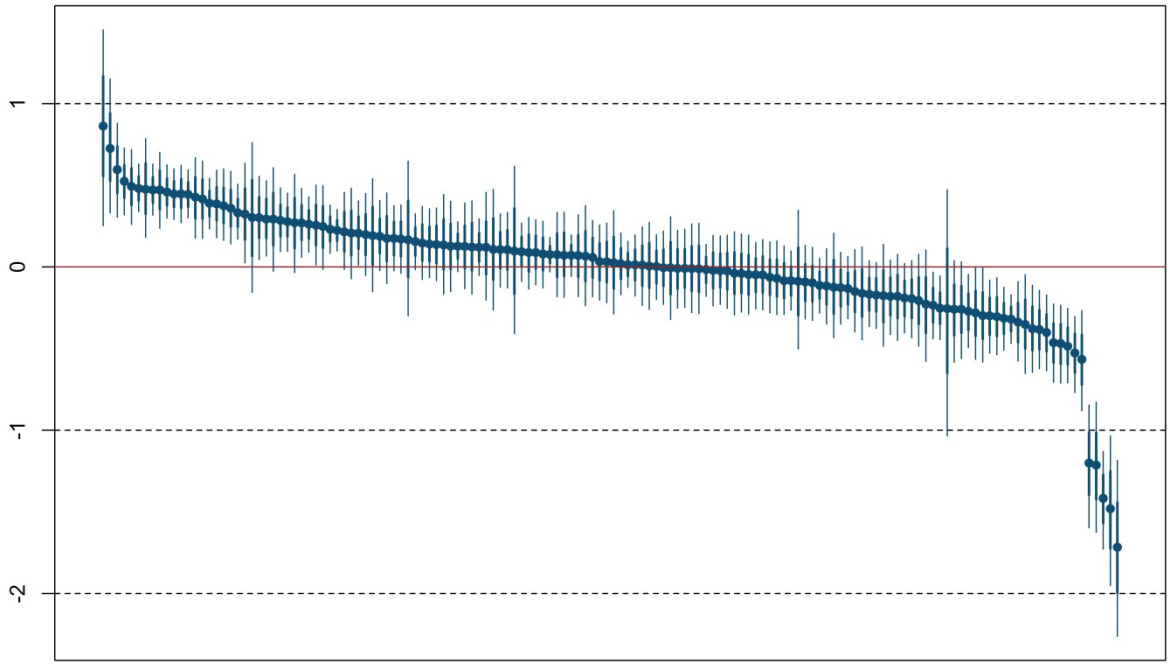

Figure 12: Ranked LA effects estimates with 95% credible intervals for the effects of LEAs on the probability of re-referral of children in cohort 2010-2011, after controlling for child and LEA characteristics.

This reduction in the variability is also reflected in the random part of the model presented in Table 11. The intercept variance (in log-odds units) at the local authority level was reduced from 0.282 in the empty model to 0.152 in the full model. The variance partition coefficient is thus:

$$\rho_{model1} = \frac{\sigma_u^2}{\sigma_u^2 + 3.29} = \frac{0.152}{0.152 + 3.29} = 0.044$$

This means that, after having controlled for compositional (child level characteristics) and contextual (local education authority characteristics) effects, the variation due differences between LEAs is only a 4% of the total variation. In practice, this means that a relevant part of the raw variation across local authorities (variation found in the empty model, i.e. 8% of the total variation) was due to variability in certain characteristics for which local authorities are not necessarily responsible. In other words, if certain groups of children, who are known to be more prone to re-referral, are overrepresented in a particular local authority, any raw measure of re-referral would be obscured by this. One of the strengths of this model is that it allows comparing local authorities, while levelling the field by controlling for known factors associated with re-referral.

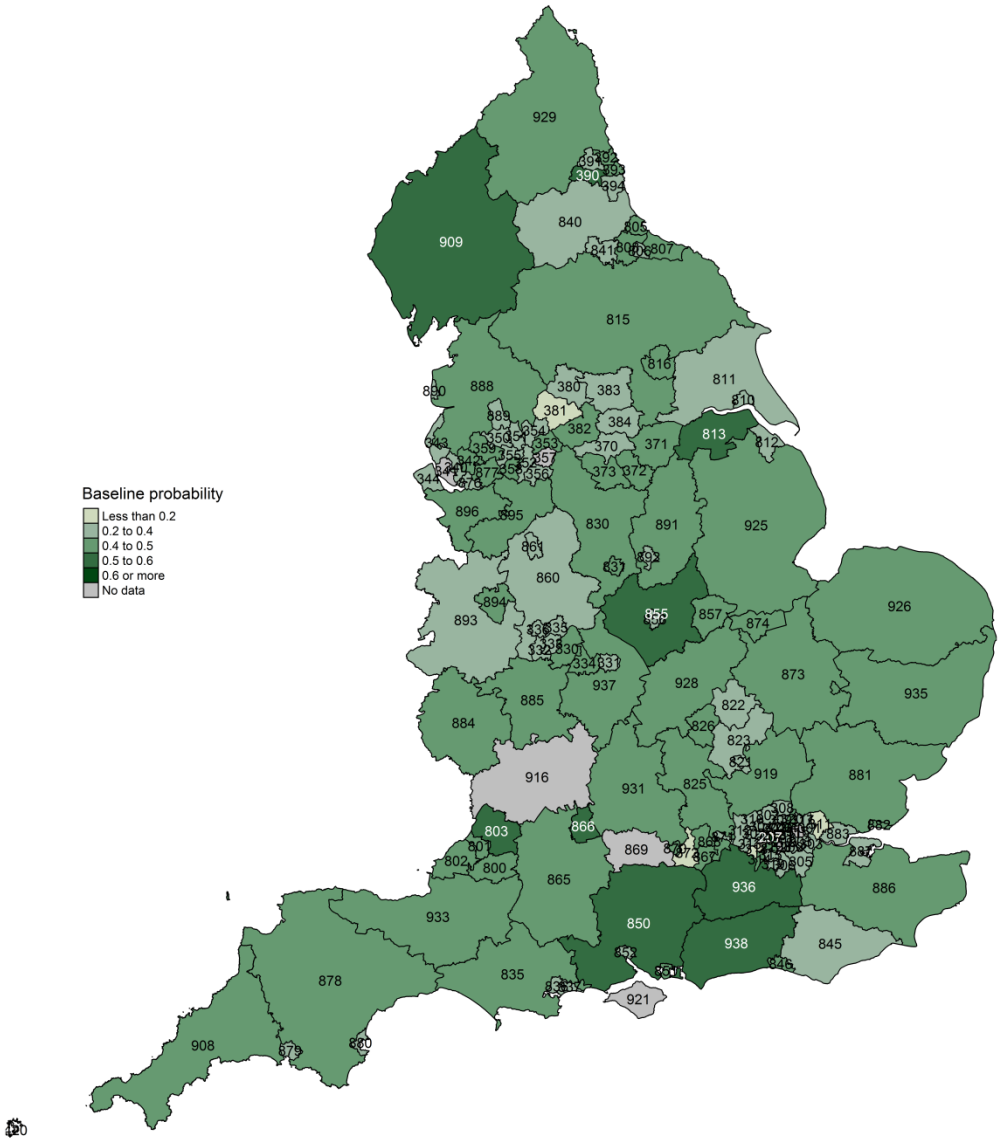

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Figure 13: Baseline probabilities of re-referral for children in cohort 2010-2011 in local education authorities of England, after controlling for child and LEA characteristics.

The map displayed in figure 13 shows the baseline probabilities of referral for children living in the local authorities of England with available data[6]. As mentioned in the methods section, baseline probabilities are estimated by adding the national average probability and the area-specific average probability (equation 2).

When comparing the map in figure 13 to the one in figure 7, it is observed that areas are more uniformly clustered around the baseline probabilities between 0.3 and 0.6, with fewer areas falling into the highest range (between 0.6 and 0.7) and the lowest range (between 0.1 and 0.2). This is line with what is observed in figure 13, where the specific contribution to re-referral of local authorities are clustered more tightly around the national average in comparison with the empty model's estimated LEA-specific contributions.

As mentioned before, controlling for compositional and contextual effects allows levelled comparisons between local authorities. Consequently, this is useful to identify areas where re-referrals are more and less frequent than expected. Since there is no consensus about what an acceptable rate of re-referral is, the overall national average seems to be a suitable standard for comparison. Adjusted rates/probabilities derived from this model could eventually be used to inform area-specific policies, as well as to contribute to better-informed inspections.

[6] For a more detailed map of baseline probabilities of the local authorities in the London area and the North West region, see appendix 1.

Limitations

This study has only followed one cohort of children. Other cohorts might display different patterns of referral and diverse associations between re-referrals and child characteristics, as well as LEA characteristics. These diverse patterns might be due to changes in policy, procedures and even LEA circumstances, or any unforeseen event, such as a spike in referrals following a serious case.

Furthermore, this study only takes into account the first re-referral per financial year per child. There might be cases in which children are re-referred multiple times per year. Analysing the characteristics of these children can be of interest to delve deeper into the reasons of abnormally large numbers of repeated referrals.

On another front, there might be unaccounted sources of confounding. For instance, there could be discretionary differences in the application of threshold criteria across social workers within and between local authorities. These differences may produce an unknown level of variability in no further action decisions, which in turn may impact on re-referral.

This study does not handle missingness from a principled approach, for instance, multiple imputation. Missingness in this longitudinal datasets arises in a number of ways, for instance, LEA records contain implausible dates of birth, as well as implausible dates of referral and closure. This also impacts on the reliability of the recorded ages of children in some cases. However, handling missing data has its own challenges in the multilevel framework. For instance, Gelman et al. (2005) have pointed out that post-estimation procedures are particularly cumbersome in the context of multiply-imputed datasets. This impacts directly on the results presented in this study insofar as area-specific predicted probabilities (a form of post-estimation) are crucial to understand the phenomenon of re-referral.

Nevertheless, the value of this study is not undermined by these limitations, as they invite for further work to tackle these issues, through improved data collection and different analysis strategies. As mentioned before, contrasting these analyses with qualitative data from inspections, for instance, can also provide valuable insight.

Conclusions and further work

In this report, a multilevel binary logistic model was implemented to ascertain the effects that a number of child and local authority characteristics have on the likelihood of children referred to Children's Services in 2010-2011 to be re-referred during a 6-year follow-up period (up to March 31st 2016).

It was found that that after 6 years, over half (55%) the children who were referred to Children's Services returned to the system at least once, controlling for children who became ineligible by turning 18 by the end of each CiN Census period (financial years). This re-referral rate varies widely across local authorities, with a variance that accounts for 8% of the total variance, when no covariates are included. Considering the national average probability, baseline probabilities vary across local authorities between 7% and 63%.

The analysis of a series of individual characteristics determined that an increased likelihood of re-referral is associated with younger children; females; disabled children; children initially stepped down as needing no further action; children referred initially for abuse or neglect, parental disability or illness, family in acute distress, family dysfunction, socially unacceptable behaviour. Meanwhile, at the area level, an increased likelihood of re-referral is found in local authorities with more than 10 children in need per social worker and a referral rate per 10,000 children above average (national median of 550).

Possible avenues for further work include analysing different cohorts; however, this has the caveat that the follow-up period would be shorter. As seen in this report, the proportion of re-referrals increase on yearly basis at an arguably non-negligible rate, which would justify having a reasonably long follow-up period. Moreover, analysing the time between closure of episodes of need and re-referral has been identified as an area of interest, along with analysing more complex trends of repeated episodes of need and care, as well as re-referrals. Regarding child characteristics, it could also be worthwhile analysing how deprivation, ethnicity and other covariates affect re-referral propensity, as well as the time between episodes. Also, should data on siblings be made available in subsequent CiN censuses, the models presented here could be extended to analyse plausible family effects.

The analysis presented in this report could form the basis for further research, but could also have practical implications. Firstly, identifying groups of children with increased risk of re-referral is useful for defining guidelines for closer inspection of such cases at first and subsequent referrals. Secondly, identifying local authorities with more or less than expected likelihood of re-referral facilitates, on the one hand, further investigation of ineffective local authority services and, on the other hand, a closer probe towards determining best practices in successful local authority services.

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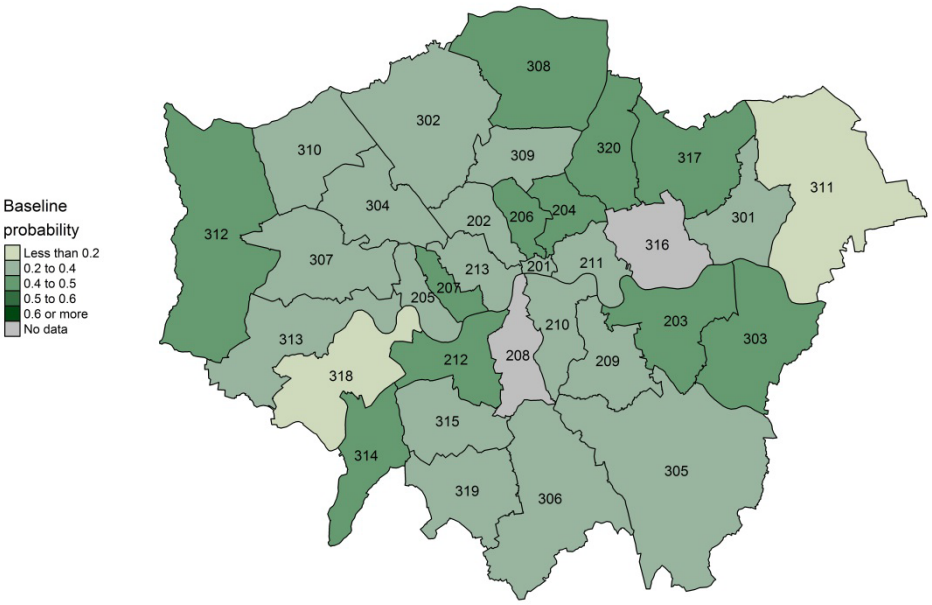
Appendix 1: Maps of baseline probabilities of local authorities in selected regions



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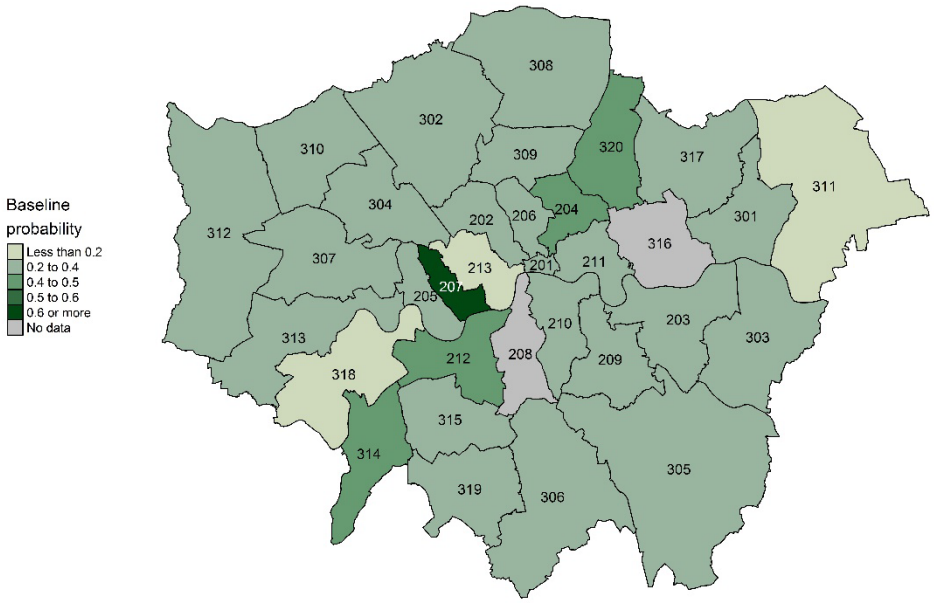
Appendix Figure 1: Baseline probabilities of re-referral for children in cohort 2010-2011 in local education authorities of London, before controlling for child and LEA characteristics.



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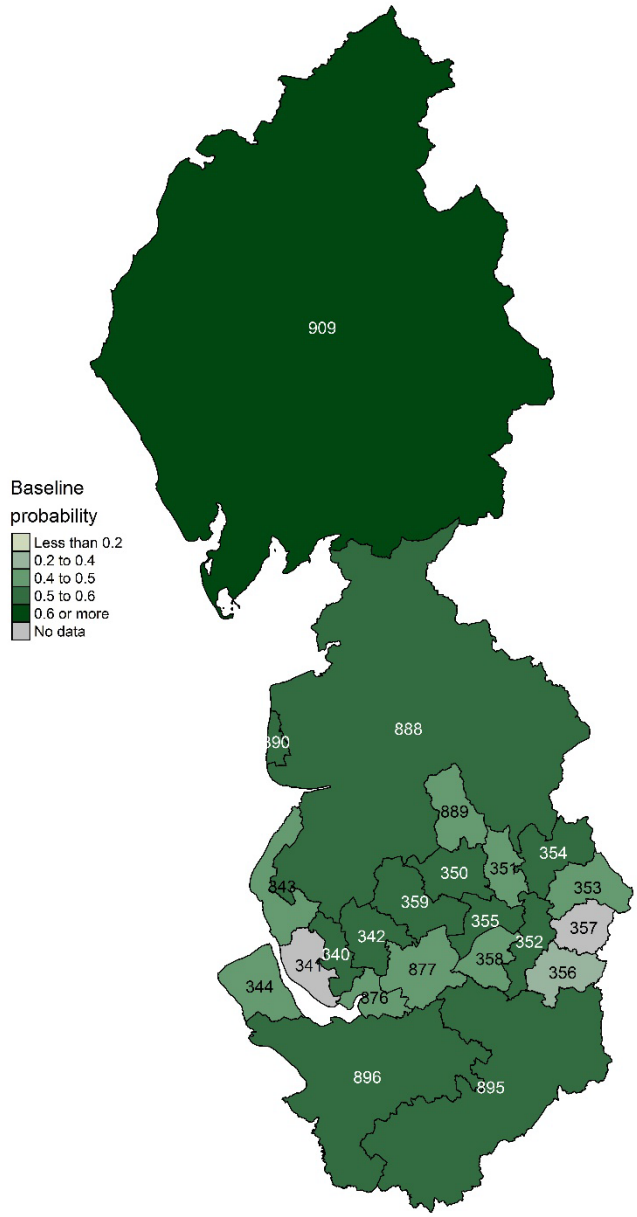
Appendix Figure 2: Baseline probabilities of re-referral for children in cohort 2010-2011 in local education authorities of London, after controlling for child and LEA characteristics.



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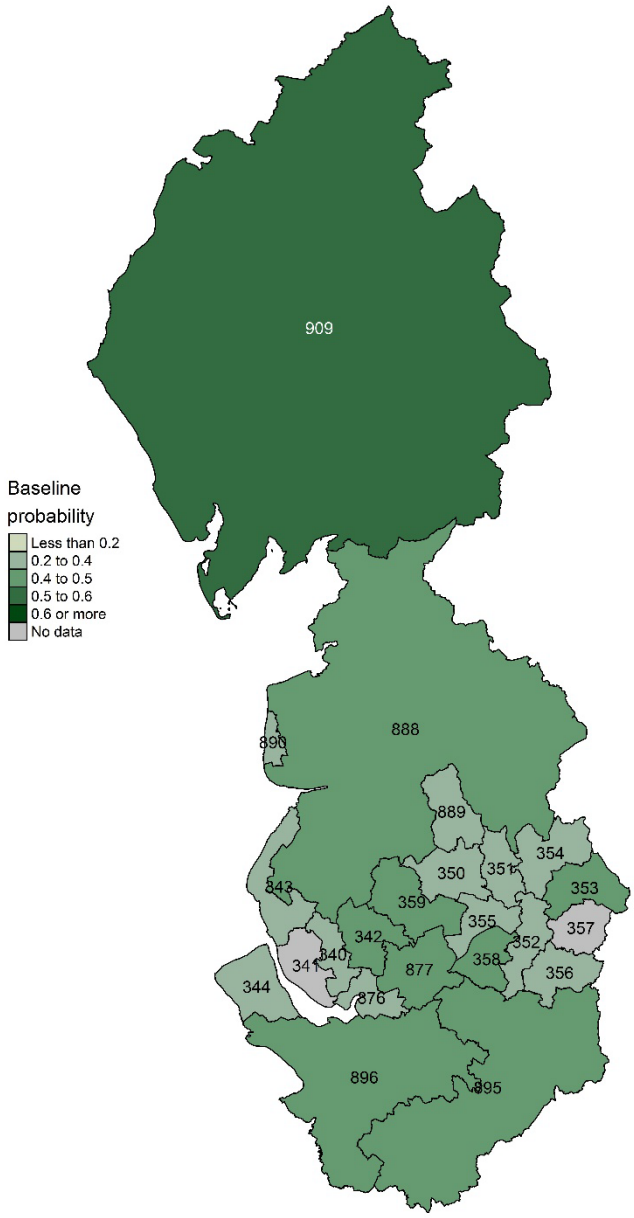
Appendix Figure 3: Baseline probabilities of re-referral for children in cohort 2010-2011 in local education authorities of the North West region, before controlling for child and LEA characteristics.



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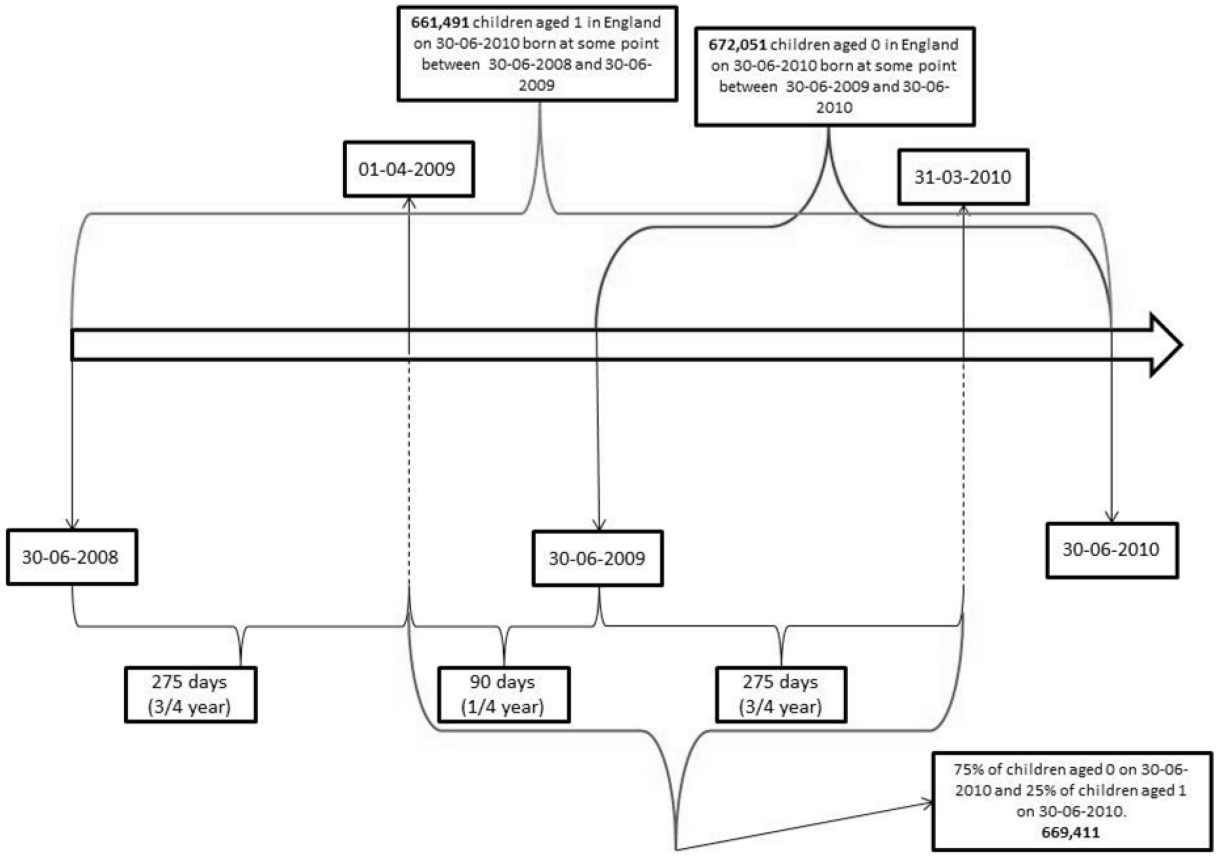
Appendix Figure 4: Baseline probabilities of re-referral for children in cohort 2010-2011 in local education authorities of the North West region, after controlling for child and LEA characteristics.

Appendix 2: Referrals to Children's Services in England before the age of five

To estimate the total population of children in England who were born between 01-04-2009 and 31-03-2010, we consider 75% of children aged 0 and 25% of children aged 1 on 30-06-2010, according to ONS population estimates (ONS, 2015). This estimate considers a uniform distribution of the number of births within a year. Bilson and Martin (2016, page 8) used the same approach, but their estimate differs because they only considered the population of 114 local authorities. The estimated number of children in England born between 01-04-2009 and 31-03-2010 is 669,411.

The following figure illustrates the procedure.



Appendix Figure 5: Timeline comparison between ONS population estimates and CiN census data

The next step is to count the number of children born between 01-04-2009 and 31-03-2010, which were referred to CS before the age of 5. We select those cases from all relevant datasets (2009-2010; 2010-2011; 2011-2012; 2012-2013; 2013-2014 and 2014-2015) and reduce to the number of unique cases.

Given that these children turned 5 during the coverage period of the CIN census 2014-2015, we also need to filter according to age at first referral. It is also important to note

that this count excludes children whose date of first referral is not properly recorded (records show an implausible date). Ignoring missing values in the date of birth field, the total headcount is: 128,571 children. This represents a 19.2% of the estimated total population.

Another approach is to exclude children who have been flagged as disabled at any point during the 5-year follow-up. The reasoning behind this is that these children might be referred only as a result of their disability. Should disabled children be excluded from this headcount, the total is: 127,457 children. This represents a 19% of the estimated total population.

The age of children at the time of the first referral to the system varies, as displayed in the following table.

Appendix Table 1: Distribution of children according to age at first referral to CS

Age	Unborn	0yo	1yo	2yo	3yo	4yo	Total
N	18,339	33,241	21,648	18,673	18,126	17,430	127,457
%	14.4%	26.1%	17%	14.7%	14.2%	13.7%	100%

As can be seen in table 1, the highest percentage of children is referred for the first time to CS before turning one. The group of children referred for the first time before birth and before turning one represent a combined 40% of the total estimated population of children younger than 5 in England. After turning one year old, it is appreciated a slow but steady decline in the percentage, which could imply that concerns over a child's safety might be more pronounced when they are younger.

Dealing with missing dates of birth

As mentioned before, there are missing values in the date of birth field for some children. A remedial strategy for this group is to use the expected date of birth (when properly recorded) as a proxy for actual date of birth. In the previous count, children who were referred to CS record an expected and actual date of birth, for which the latter is considered even if they were referred while unborn. The following count considers children who were referred to CS before birth, whose expected dates of birth fell within the period between 01-04-2009 and 31-03-2010, and whose actual dates of birth are missing. Some of the referrals of unborn children record deaths before the expected date of birth, which we can consider to have never been born. There are 57 of these cases.

Considering these children, the total headcount is: 130,044. This represents a 19.4% of the estimated total population. Should disabled children be excluded from this headcount, the total is: 128,356 children. This represents a 19.2% of the estimated total population.

The distribution of age at first referral for this group of children is as follows:

Appendix Table 2: Distribution of children according to age at first referral to CS (reduced missing)

Age	Unborn	0yo	1yo	2yo	3yo	4yo	Total
N	19,632	33,150	21,521	18,587	18,065	17,401	128,356
%	15.3%	25.8%	16.8%	14.5%	14.1%	13.6%	100%

The percentages in table 2 resemble very closely those in table 1. Nevertheless, it is appreciated an increased number of children being referred before birth and slight reductions in the number of children being referred at subsequent ages in comparison to table 1. This is most likely because some children, who were identified as having been referred for the first time after birth, were actually referred before birth for the first time.

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