

The causal impact of school breakfast clubs on academic attainment

Evaluating the Magic Breakfast intervention

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Motivation

- ▶ Unhealthy or absent breakfasts associated with cognitive, behavioural, and health problems in children
- ▶ 62% of UK school staff witness children arriving hungry at school on a weekly basis (APSE, 2014)
- ▶ Policymakers seek to address this through school breakfast programmes
 - ▶ Oslo breakfasts introduced in the 1930s
 - ▶ U.S. School Breakfast Program in the 1960s
 - ▶ High-profile discussion in recent English election

Research Questions

In the context of expanding provision, we examine:

- ▶ Whether school breakfast programmes have an impact on academic attainment
- ▶ How the effects are mediated
- ▶ For whom the intervention is most effective

Evaluating different models of provision is also a key question, but beyond the scope of our paper

This paper

Our contribution:

- ▶ Provide evidence of effects on attainment from a large-scale RCT in disadvantaged English primary schools
 - ▶ Builds on recent quasi-experimental literature on school nutrition in developed countries
- ▶ Analysis of potential mechanisms and of programme costs

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- ▶ Provide evidence of effects on attainment from a large-scale RCT in disadvantaged English primary schools
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- ▶ Analysis of potential mechanisms and of programme costs

Key results:

- ▶ Breakfast club provision increases academic attainment by around 0.13 standard deviations (~ 2 months' progress)
- ▶ Gains are driven by better behaviour and concentration, and possibly improved health
- ▶ Suggestive evidence of spillovers between groups and peer effects in learning
- ▶ Cost-effective relative to interventions with similar gains - £24 (€27.50) per eligible pupil per year

Outline

1. Existing evidence
2. Intervention and methodology
3. Results
4. Cost
5. Conclusion

Breakfast clubs and human capital

Breakfast clubs could be linked to human capital through several channels:

1. Providing more food and reducing hunger
 - ▶ Brown and Pollitt, 1996
2. Providing better-quality food and improving nutrition
 - ▶ Biological literature has identified key nutrients such as iron and B-vitamins (Pollitt, 1993; Fernstrom, 2000; Chenoweth, 2007)
 - ▶ Economics literature suggests more nutritious food raises attainment (Belot and James, 2011; Anderson et al., 2017)
3. Providing food in a social context that promotes attainment
 - ▶ Interactions with teachers and peers; potentially a calmer start to the day
 - ▶ Links into a large economics literature on the importance of stimulating environments (e.g. Walker et al., 2000, 2005, 2006)

Existing Evidence

Long-standing literature in developing countries: school breakfast improves health, attendance, and (some) academic outcomes

- ▶ Jacoby et al., 1996; Powell et al., 1998

Recent quasi-experimental literature (based on U.S.) focuses mainly on implementation

- ▶ Particular focus on relative effectiveness of before-school and in-class breakfasts (Imberman and Kugler, 2012; Anzman-Frasca et al., 2015; Corcoran et al., 2016)
- ▶ Exceptions: Frisvold (2015) and Dotter (2013) find evidence of academic benefits of universal breakfasts relative to no programme

Experimental evidence from other developed countries does not clearly demonstrate academic benefits

- ▶ Some studies find improvements in health/reductions in hunger, but little effect on attainment (Schanzenbach and Zaki, forthcoming; Ni Mhurchu et al., 2013; Bernstein et al., 2004)

Conceptual framework

Model attainment of pupil i with classroom peers \bar{i} in year t :

$$Y_{it} = f(Y_{i,t-1}, Q_{it}, E_{\bar{i}t}, E_{it}, L_{it})$$

where $Y_{i,t-1}$ is prior attainment; Q_{it} is teacher effectiveness; E_{it} and $E_{\bar{i}t}$ are the efforts of the pupil and her classroom peers; and L_{it} is the pupil's learning time.

The inputs for Y_{it} also depend on the pupil's health (H_{it}), the attendance of her peers ($L_{\bar{i}t}$), and a fixed component of teacher quality \bar{Q}_i .

$$L_{it} = g(L_{\bar{i}t}, H_{it})$$

$$E_{it} = h(E_{\bar{i}t}, E_i, H_{it})$$

$$Q_{it} = q(E_{\bar{i}t}, \bar{Q}_i, L_{\bar{i}t})$$

The Intervention

- ▶ Eligibility: relatively disadvantaged primary schools in England with limited existing breakfast club provision
- ▶ 106 schools randomised within strata
- ▶ Treatment: One year of support from the charity Magic Breakfast to establish a universal, free, before-school breakfast club (academic year 2014/15)
 - ▶ As much food as required, free of cost
 - ▶ £300 (€340) grant to defray capital costs
 - ▶ Support from dedicated school change leader to help with logistics, sustainability, ...
 - ▶ Schools were responsible for meeting other costs (e.g. staffing)
- ▶ Wait-list design: Control schools get two years' support starting 2015/16

Fidelity and Take-up

All treatment schools (that responded to follow-up survey) established breakfast provision

- ▶ But only a third of this was the agreed model of provision
- ▶ 40% of control schools also established new breakfast provision

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Pupil take-up is far from universal:

- ▶ Average take-up is just 20%
- ▶ Three-quarters of schools serve fewer than 50 students
- ▶ In line with the experience of similar jurisdictions (e.g. Wales)

Data and Methodology

- ▶ Evaluation focuses on pupils at Year 2 (age 6/7) and Year 6 (age 10/11)
- ▶ Methodology: OLS/logistic regression, controlling for school and pupil characteristics and baseline measurements [More](#)
- ▶ Main academic outcome measures collected from administrative data (National Pupil Database)
 - ▶ Age 7: Teacher assessments in English and maths
 - ▶ Age 11: English and maths scores on centralised, externally-marked tests
- ▶ Absence and late arrival data and pupil demographics also from NPD
- ▶ Other mechanisms data comes from surveys designed by research team (collected at baseline and follow-up)
 - ▶ Pupil survey: hunger and breakfast consumption
 - ▶ Teacher survey: classroom behaviour and concentration questions
 - ▶ Head teacher survey: data on motivations and implementation
 - ▶ Magic Breakfast: food orders and take-up

Evaluation Sample

- ▶ By design, schools are more disadvantaged than the average English school
 - ▶ 82% of participating schools in bottom 30% of neighbourhoods
- ▶ Well-balanced on observables, but treatment schools are significantly more urban
 - ▶ At 10% level, treatment schools' students have significantly higher hunger and fewer authorised absences at baseline

Balance

Academic Outcomes

Table: Effect of treatment status on academic outcomes

	(1) Age 7	(2) Age 11
Treatment	0.137*** (0.050)	0.114 (0.074)
Observations	4,586	3,907
R^2	0.402	0.433
Control N	2,113	1,857
Treatment N	2,473	2,050
School N	102	98

Notes: *** denotes statistical significance at the 1% level, ** at the 5% level, * at the 10% level. Outcome variables are standardised averages of point scores for reading and maths from teacher assessments (KS1) or test scores (KS2). All models estimated by Ordinary Least Squares. Standard errors clustered at the school level. Regressions control for randomisation strata; prior attainment; demographics (sex, ever FSM, ethnic group, SEN, EAL); pre-intervention school characteristics (Ofsted rating, IMD rank, urban status, number of students).

Potential Mechanisms

Table: Effect of treatment status on potential mechanisms

	(1) Ate B'fast	(2) B'fast at School	(3) Total Absences	(4) Auth. Absences	(5) Unauth. Absences	(6) Late Arrivals	(7) Behaviour Index	(8) Concentration Index
Treatment	0.032** (0.016)	0.146*** (0.036)	-0.884* (0.533)	-1.367*** (0.461)	0.454 (0.347)	-0.147 (0.096)	0.476*** (0.157)	0.654*** (0.158)
Observations	3,373	3,323	8,085	8,085	8,085	8,085	234	234
R ²	N/A	N/A	0.309	0.244	0.240	0.277	0.307	0.336
Pseudo R ²	0.067	0.094	N/A	N/A	N/A	N/A	N/A	N/A
Control N	1,531	1,488	3,755	3,755	3,755	3,755	114	114
Treatment N	1,842	1,835	4,330	4,330	4,330	4,330	120	120
School N	71	70	106	106	106	106	86	86

Notes: *** denotes statistical significance at the 1% level, ** at the 5% level, * at the 10% level. Outcomes for columns (1) and (2) are binary indicators; absence and late arrival variables are measured in half-days over the 2014/15 academic year; and outcomes for columns (7) and (8) are standardised indices derived from teacher survey responses using factor analysis. Standard errors clustered at the school level. Regressions control for randomisation strata; prior absence record (2013/14); demographics (sex, ever FSM, ethnic group, SEN, EAL); pre-intervention school characteristics (Ofsted rating, IMD rank, urban status, number of students). First two columns ("ate breakfast" and "ate breakfast at school") report average marginal effects following logistic regression; other outcomes are OLS coefficients.

Subgroup analysis - Age 7 outcomes

Table: Effect of treatment status on age 7 academic outcomes, by subgroups

	(1) FSM	(2) Not FSM	(3) Low Prior Attainment	(4) Not Low Attainment	(5) No B'fast at BL	(6) B'fast at BL
Treatment	0.103* (0.058)	0.132** (0.060)	0.106 (0.070)	0.117 (0.051)	0.027 (0.131)	0.111* (0.061)
Observations	2,295	2,050	2,460	1,885	255	2,815
R-squared	0.414	0.380	0.244	0.076	0.427	0.407
Control N	1,084	912	1,162	834	99	1,164
Treatment N	1,211	1,138	1,298	1,051	156	1,651
School N	101	102	101	102	73	84
P-val (diff)		0.559		0.858		0.449

Notes: *** denotes statistical significance at the 1% level, ** at the 5% level, * at the 10% level. Models are estimated separately for each subgroup and tested for significant differences in the treatment effect. Standard errors clustered at the school level. Regressions control for randomisation strata; prior attainment (where relevant); demographics (sex, ever FSM, ethnic group, SEN, EAL); and pre-intervention school characteristics (Ofsted rating, IMD rank, urban status, number of students). 'Low prior attainment' is defined as failing to achieve a good level of development at Foundation Stage.

Subgroup analysis - Age 11 outcomes

Table: Effect of treatment status on age 11 academic outcomes, by subgroups

	(1) FSM	(2) Not FSM	(3) Low Prior Attainment	(4) Not Low Attainment	(5) No B'fast at BL	(6) B'fast at BL
Treatment	0.047 (0.080)	0.231** (0.081)	-0.121 (0.134)	0.165** (0.063)	0.009 (0.152)	-0.037 (0.074)
Observations	2,364	1,543	896	3,011	233	2,226
R-squared	0.425	0.455	0.355	0.407	0.483	0.474
Control N	1,158	699	442	1,415	108	934
Treatment N	1,206	844	454	1,596	125	1,292
School N	98	98	96	98	67	78
P-val (diff)	0.004***		0.004***		0.726	

Notes: *** denotes statistical significance at the 1% level, ** at the 5% level, * at the 10% level. Models are estimated separately for each subgroup and tested for significant differences in the treatment effect. Standard errors clustered at the school level. Regressions control for randomisation strata; prior attainment (where relevant); demographics (sex, ever FSM, ethnic group, SEN, EAL); and pre-intervention school characteristics (Ofsted rating, IMD rank, urban status, number of students). 'Low prior attainment' is defined as failing to reach the expected level of development in at least one subject at age 7.

Subgroup analysis - Ate breakfast at school

Table: Effect of treatment status on breakfast at school, by subgroups

	(1) FSM	(2) Not FSM	(3) Low Prior Attainment	(4) Not Low Attainment	(5) No B'fast at BL	(6) B'fast at BL
Treatment	0.180*** (0.039)	0.103** (0.040)	0.166*** (0.043)	0.140*** (0.037)	0.371*** (0.062)	0.138*** (0.035)
Observations	1,808	1,437	1,363	1,882	267	2,951
Pseudo-R ²	0.125	0.087	0.089	0.116	0.324	0.092
Control N	868	584	599	853	118	1,321
Treatment N	940	853	764	1,029	149	1,630
School N	70	69	70	69	60	70
P-val (diff)	0.030**		0.489		0.000***	

Notes: *** denotes statistical significance at the 1% level, ** at the 5% level, * at the 10% level. Models are estimated separately for each subgroup and tested for significant differences in the treatment effect. Standard errors clustered at the school level. Regressions control for randomisation strata; prior attainment (where relevant); demographics (sex, ever FSM, ethnic group, SEN, EAL); and pre-intervention school characteristics (Ofsted rating, IMD rank, urban status, number of students). 'Low prior attainment' is defined as failing to reach the expected level of development in the previous set of assessments.

Cost per Pupil

Table: Annual average cost, per eligible and per treated pupil

Cost type	Average per eligible pupil	Average per treated pupil
Upfront costs	£4.34	£33.30
Ongoing costs	£19.67	£119.46
Total costs	£24.01	£152.76

Notes: The first column reports costs per eligible pupil, i.e. all pupils in the school. The second column uses take-up figures from Magic Breakfast to calculate cost per student taking up the breakfast offer. "Upfront" costs include schools' reported spending on furniture, improvements to the physical environment, catering facilities, resources, staff training, and "other" costs. "Ongoing" costs include the retail cost of food provided by Magic Breakfast during the intervention, additional food purchased by the school, and imputed monetary costs of staff time. Staff time costs are imputed based on average hourly wages for different job titles (4-digit SOC codes) derived from the Annual Survey of Hours and Earnings, which excludes employer-side costs such as National Insurance or pension contributions. Many schools used volunteers or other arrangements to reduce staffing costs. These figures are based on a subsample of 38 treated schools where both cost and take-up data are observed. [Hours](#)

Cost Effectiveness

School breakfast clubs appear to be more cost-effective than some other interventions at raising attainment in England

Table: Per-pupil cost of a one percentage point increase in share of children reaching expected academic level

Study	Intervention	£/1ppt increase	
		Age 7	Age 11
Brown et al. (2012)	universal free school lunches	£110	£50
Belot and James (2011)	higher-quality school lunches	N/A	£16
Brown et al. (2011)	Every Child a Reader	£295	N/A
Crawford et al.	breakfast clubs	£7	£15

Notes: The costs are calculated assuming a linear relationship between cost and attainment within each programme. Roughly 80-90% of English children reach the expected level in a subject. This table draws on the cost-benefit analysis in Brown et al. (2012).

Conclusion

- ▶ Breakfast club provision in disadvantaged schools has a positive impact on pupil attainment (equivalent to about 2 months' progress)
- ▶ Distribution of the academic gains is uneven:
 - ▶ Larger at age 7 than age 11
 - ▶ Larger for less disadvantaged students
- ▶ Multiple mechanisms mediating this, but the most important appears to be behaviour and concentration
- ▶ Limited effect on overall breakfast consumption - suggests that the content/context of school breakfast are important
- ▶ Evidence of spillovers between pupils, with less disadvantaged pupils benefitting most from a less disruptive classroom
- ▶ Cost-effective intervention requiring just £24.01 per eligible pupil per year

Appendix

Methodology

- ▶ Use OLS and logistic regression on standardised outcome variables to estimate effect sizes [More](#)
- ▶ Control for:
 - ▶ Randomisation strata
 - ▶ School characteristics (Ofsted rating, IMD rank, urban status, number of students)
 - ▶ Pupil characteristics (sex, ever FSM, ethnicity, SEN, EAL)
 - ▶ Relevant baseline measure of the outcome
- ▶ Standard errors clustered at school level

[Back](#)

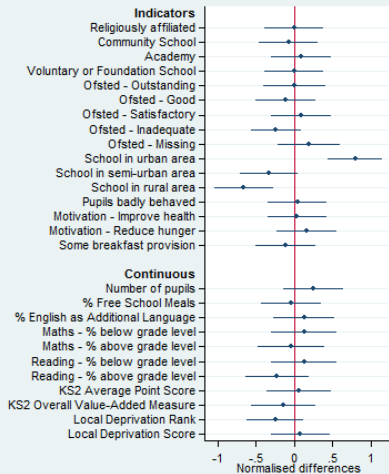
Methodology

- ▶ For *academic outcomes*, use OLS regression on standardised scores
- ▶ For *hunger and breakfast consumption outcomes*, use logistic regression and report average marginal effects
- ▶ For *behaviour and concentration*, construct indices using factor analysis and analyse with OLS
- ▶ For *absence and late arrival outcomes*, use OLS on the number of half-days absent or late
- ▶ Standard errors clustered at school level

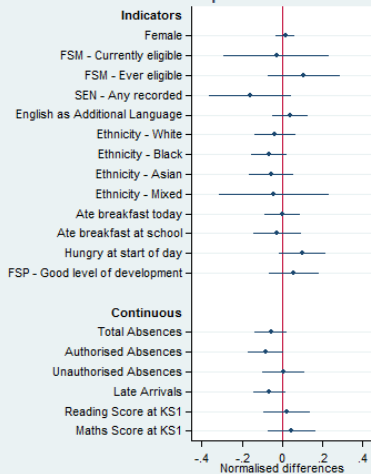
Baseline Balance

Baseline Balance Tests

School characteristics



Pupil characteristics



Baseline Balance - school level

Table: Baseline balance on school-level discrete characteristics

Group:	Intervention		Control		
Variable	n/N (missing)	%	n/N (missing)	%	Difference
Religious	11/53(0)	20.8%	11/53(0)	20.8%	0.0
Community	30/53(0)	56.6%	32/53(0)	60.4%	-3.8
Academy	12/53(0)	22.6%	10/53(0)	18.9%	3.8
Voluntary	11/53(0)	20.8%	11/53(0)	20.8%	0.0
Outstanding	4/53(0)	7.5%	5/53(0)	7.5%	0.0
Good	30/53(0)	56.6%	33/53(0)	62.3%	-5.7
Satisfactory	12/53(0)	22.6%	10/53(0)	18.9%	3.8
Inadequate	0/53(0)	0%	2/53(0)	3.8%	-3.8
No Ofsted	7/53(0)	13.2%	4/53(0)	7.5%	5.7
Urban	40/53(0)	75.5%	19/53(0)	35.8%	39.6***
Semi-urban	10/53(0)	18.9%	18/53(0)	34.0%	-15.1*
Rural	3/53(0)	5.7%	16/53(0)	30.2%	-24.5***
Bad behaviour	17/53(0)	32.1%	16/53(0)	30.2%	1.9
Motive: health	26/53(0)	49.1%	25/53(0)	47.2%	1.9
Motive: hunger	18/53(0)	34.0%	14/53(0)	26.4%	7.5
B'fast provision	22/53(0)	41.5%	25/53(0)	47.2%	-5.7

Baseline Balance - school level

Table: Baseline balance on school-level continuous characteristics

Group:	Intervention		Control		
Variable	n (missing)	Mean	n (missing)	Mean	Difference
number of pupils	53(0)	333.9	53(0)	291.5	42.4
%FSM	53(0)	43.8	53(0)	44.1	-0.3
%EAL	50(3)	35.5	47(6)	31.3	4.1
% above grade, maths	46(7)	34.1	46(7)	32.1	2.0
% below grade, maths	46(7)	17.3	46(7)	17.8	-0.5
% above grade, reading	46(7)	39.6	46(7)	37.5	2.1
% below grade, reading	46(7)	13.8	46(7)	16.2	-2.4
KS1 average points	4(49)	15.4	3(50)	13.6	1.8
KS2 average points	46(7)	27.5	48(5)	27.4	0.1
KS2 value-added	46(7)	100.2	48(5)	100.4	-0.2
IMD rank	53(0)	15.5	53(0)	19.6	-4.1
IMD score	53(0)	42.5	53(0)	41.3	1.2

Baseline Balance - pupil level

Table: Baseline balance on pupil-level discrete characteristics

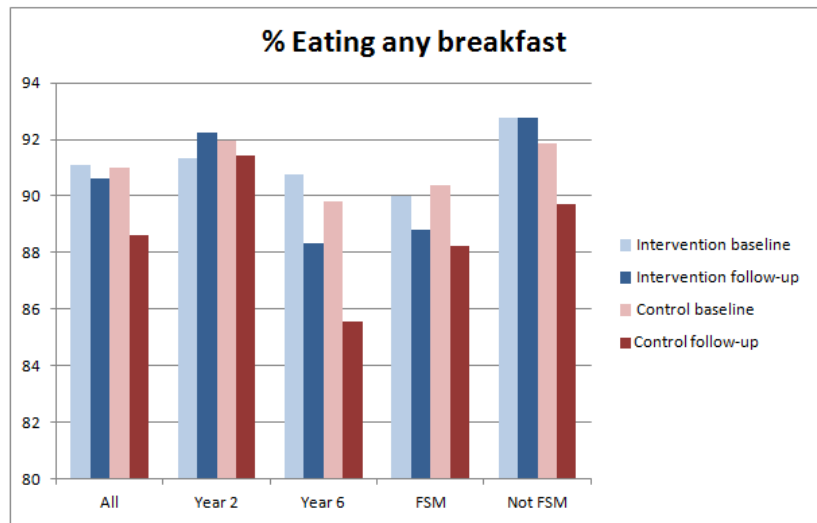
Group:	Intervention		Control		
Variable	n/N (missing)	%	n/N (missing)	%	Difference
Female	2283/4609 (528)	49.5	1969/4038 (405)	48.8	0.8
White	2505/5137 (0)	48.8	2228/4443 (0)	50.1	-1.4
Black	961/5137 (0)	18.7	653/4443 (0)	14.7	4.0
Asian	478/5137 (0)	9.3	640/4443 (0)	14.4	-5.1
Mixed	342/5137 (0)	6.7	252/4443 (0)	5.7	1.0
FSM current	1553/4574 (563)	34	1430/4009 (434)	35.7	-1.7
FSM ever	2478/4574 (563)	54.2	2300/4009 (434)	57.4	-3.2
SEN	983/4574 (563)	21.5	954/4009 (434)	23.8	-2.3
EAL	1786/4568 (569)	39.1	1645/4003 (440)	41.1	-2.0
B'fast today	3211/3526 (1611)	91.1	2326/2556 (1887)	91	0.1
School b'fast	346/3506 (1631)	9.9	269/2536 (1907)	10.6	-0.7
Hungry today	1230/3212 (1925)	38.3	786/2356 (2087)	33.4	4.9*
FSP good	1059/2376 (307)	44.6	838/2012 (253)	41.7	2.9

Baseline Balance - pupil level

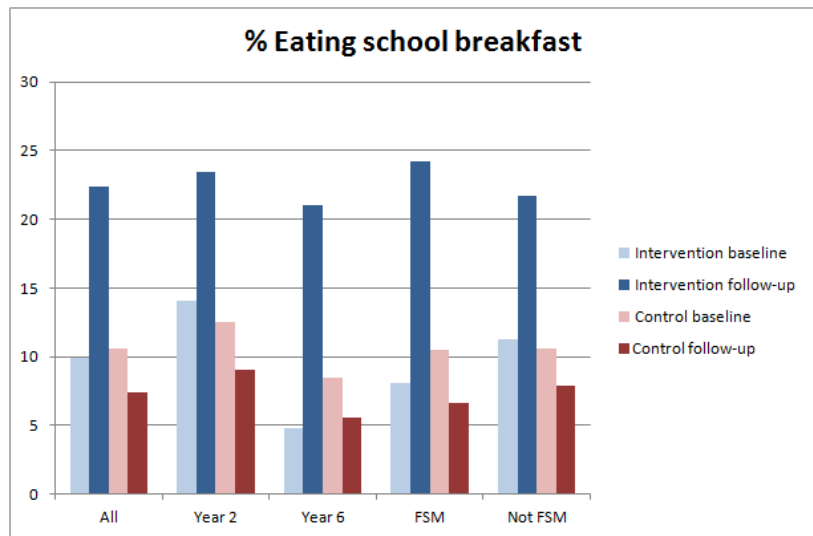
Table: Baseline balance on pupil-level discrete characteristics

Group:	Intervention		Control		
Variable	n (missing)	Mean	n (missing)	Mean	Difference
Absences	4376 (761)	13.05	3792 (651)	13.84	-0.79
Auth. absences	4376 (761)	9.46	3792 (651)	10.31	-0.86*
Unauth. absences	4376 (761)	3.59	3792 (651)	3.53	0.06
Late arrivals	4609 (528)	0.26	4038 (405)	0.37	-0.12
KS1 reading	1914 (540)	14.52	1698 (470)	14.42	0.10
KS1 writing	1914 (540)	13.30	1698 (470)	13.15	0.15
KS1 maths	1913 (541)	14.80	1697 (471)	14.63	0.17

Proportion Eating Breakfast



Proportion Eating School Breakfast



Supervisory hours per pupil

Table: Annual average supervisory hours, per eligible and per treated pupil

Supervisor type	Imputed wage	Number of schools using	Average hours	
			per eligible pupil	per treated pupil
Teaching staff	N/A	35	2.00	15.00
Teachers	£20.92	11	0.31	2.53
Teaching Assistants	£9.15	31	1.69	12.47
Support staff	N/A	20	0.45	4.34
Catering Staff	£7.24	4	0.06	0.52
Caretaking Staff	£10.01	3	0.09	1.19
Pastoral Staff	£13.03	9	0.23	2.07
Office Staff	£10.87	8	0.07	0.56
Other staff/helpers	N/A	13	0.58	3.27
Volunteers	Unknown	10	0.52	2.50
Other	Unknown	4	0.06	0.76
Total	N/A	37	3.03	22.61

Notes: The first column reports supervisory hours per eligible pupil, i.e. all pupils in the school. The second column uses take-up figures from Magic Breakfast to calculate hours per student taking up the breakfast offer. Teaching staff include teachers and teaching assistants; support staff include catering, caretaking, pastoral, and office staff; and 'Other' supervisors include volunteers and unspecified staff. Imputed wages taken from the Annual Survey of Hours and Earnings based on 4-digit SOC codes, but exclude employer-side costs such as NICs or pension contributions. [Back](#)