Supplemental material

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Supplementary Materials

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Supplementary Table S17: Associations between standardised housing conditions and percentage of total missed sessions in years 1 to 11.

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Supplementary Table S19: Associations between housing quality scale and log-transformed percentage of total missed sessions in years 1 to 11.

Supplementary Table S20: Associations between housing quality items and log-transformed percentage of total missed sessions in years 1 to 11.

Supplementary Table S21: Associations between housing condition values and percentage of total missed sessions in years 1 to 11.

Supplementary Table S22: Associations between housing condition values and educational attainment.

Supplementary Table S23: Associations between housing quality scale, housing conditions and percentage of missed sessions across compulsory education using two methods of pooling across years.

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Supplementary Figure S1: Directed acyclic graph. Note: housing quality is measured as a composite index of accommodation type, floor level, garden access, damp, heating, and overcrowding.
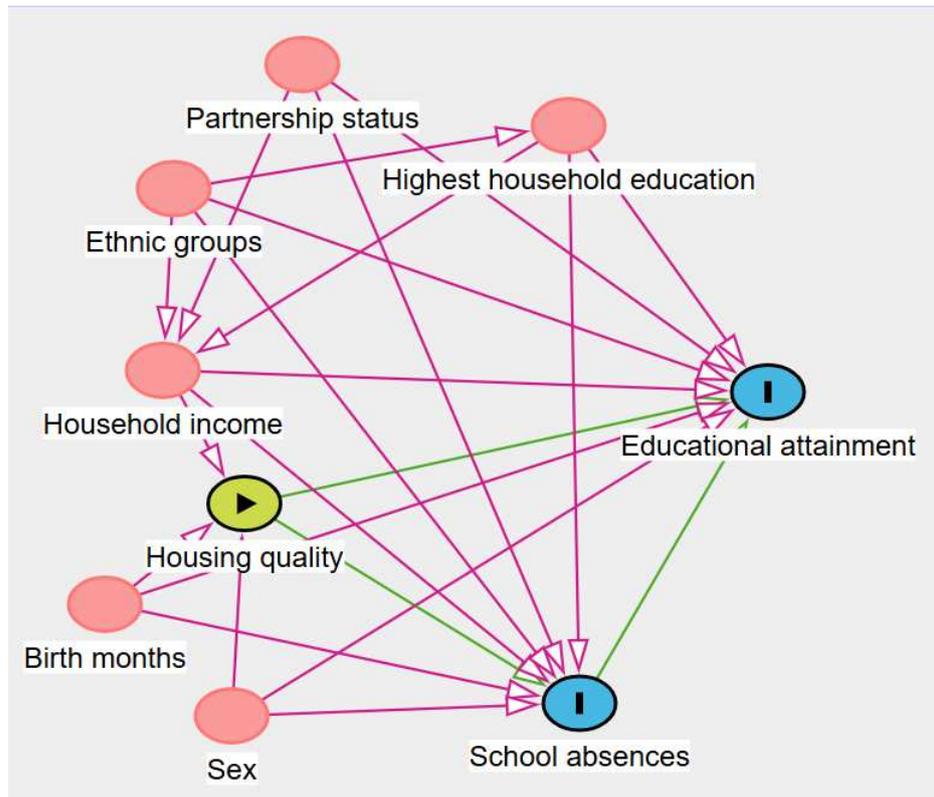
Supplementary Figure S2: Distribution of outcome variables - (A) percentage of missed session (n=7272), and (B) and standardised test scores (n=6741).

(A)

(B)

4

5
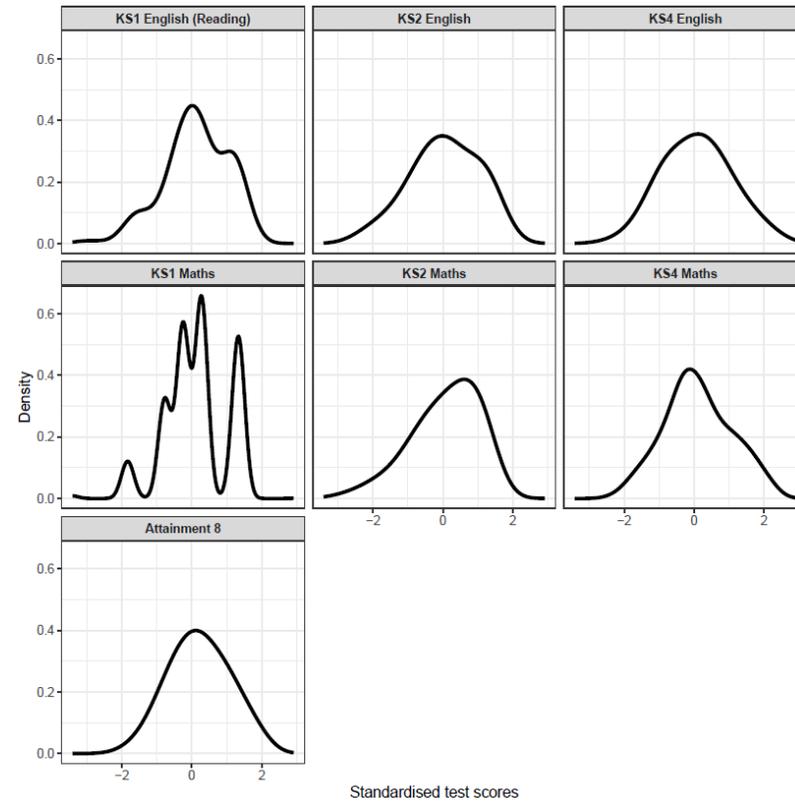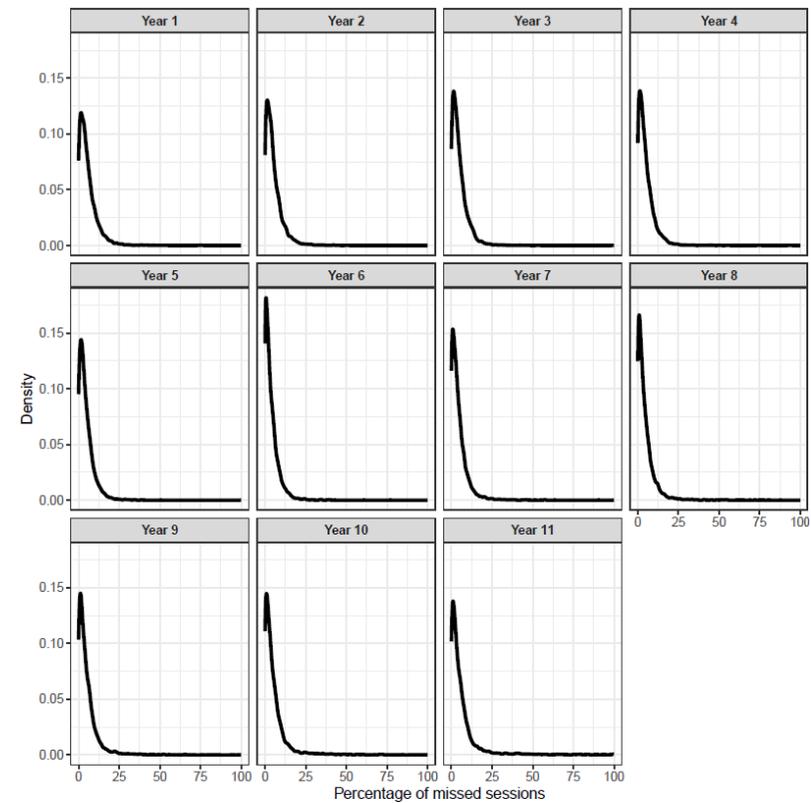
Supplementary Figure S3: Flowchart indicating sample selection in the Millennium Cohort Study

Supplementary Table S1: Frequencies of housing condition features in the two analytical samples of the Millennium Cohort Study.

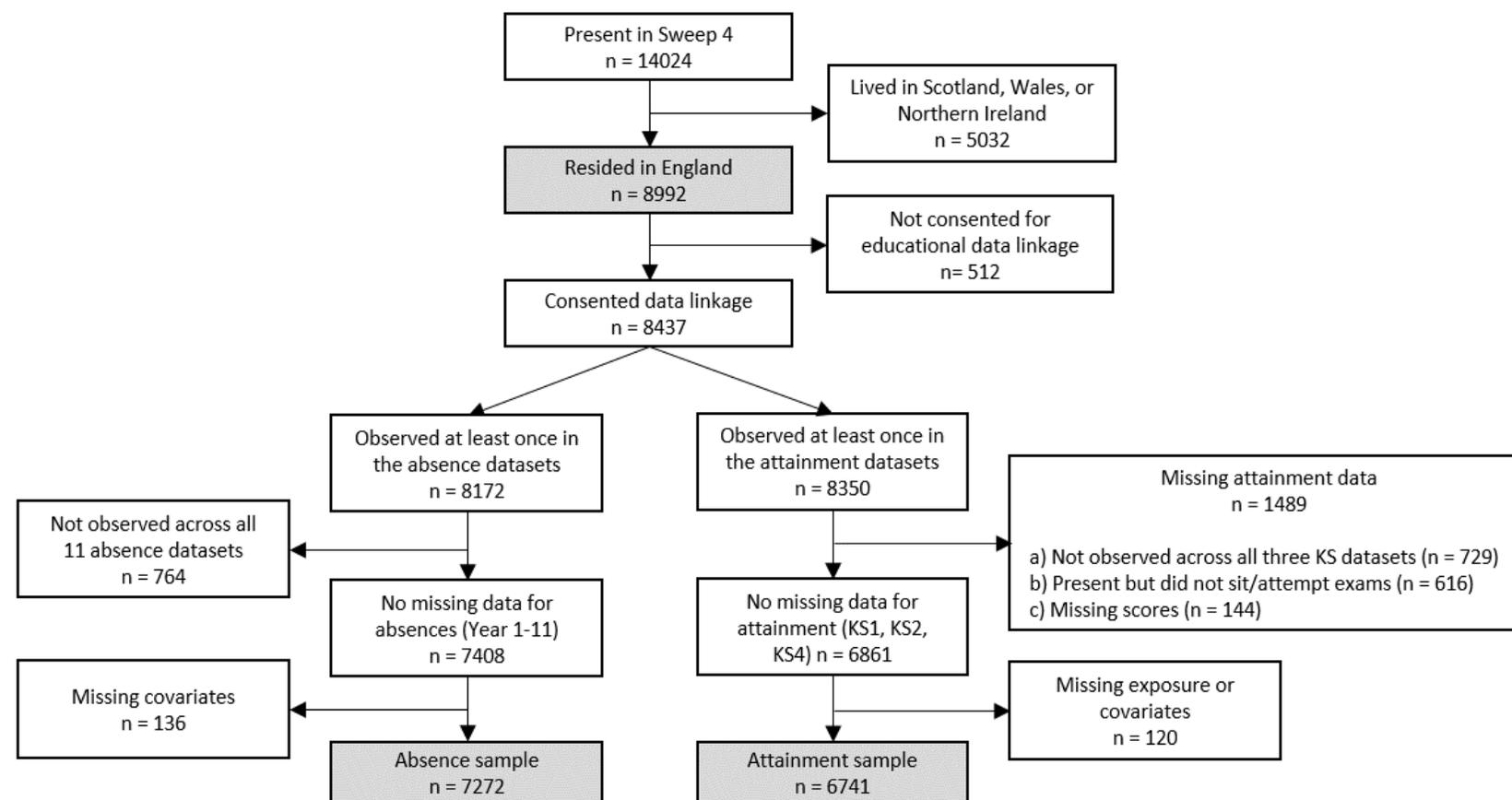|	Absence sample (n=7272)	Attainment sample (n=6741)
Type of accommodation		
0 (high)	6651 (91.4%)	6166 (91.5%)
1	610 (8.4%)	564 (8.3%)
2 (low)	11 (0.2%)	11 (0.2%)
Floor level		
0 (high)	6779 (93.3%)	6285 (93.4%)
1	238 (3.3%)	216 (3.3%)
2 (low)	255 (3.3%)	240 (3.3%)
Garden access		
0 (high)	6538 (89.9%)	6082 (90.4%)
1	129 (2.0%)	122 (2.0%)
2 (low)	605 (8.1%)	537 (7.6%)
Damp and mould		
0 (high)	6126 (84.3%)	5724 (85.1%)
1	956 (12.9%)	856 (12.3%)
2 (low)	190 (2.8%)	161 (2.6%)
Heating		
0 (high)	6974 (95.5%)	6476 (95.8%)
1	NA	NA
2 (low)	298 (4.5%)	265 (4.2%)
Overcrowding		
0 (high)	1075 (15.6%)	1026 (16.1%)
1	5173 (72.2%)	4808 (72.4%)
2 (low)	1024 (12.3%)	907 (11.6%)

Supplementary Figure S4: Correlation coefficients (Kendall's tau) between housing condition in the (A) Absence (n=7272), and in the (B) Attainment (n=6741) samples.

(A)
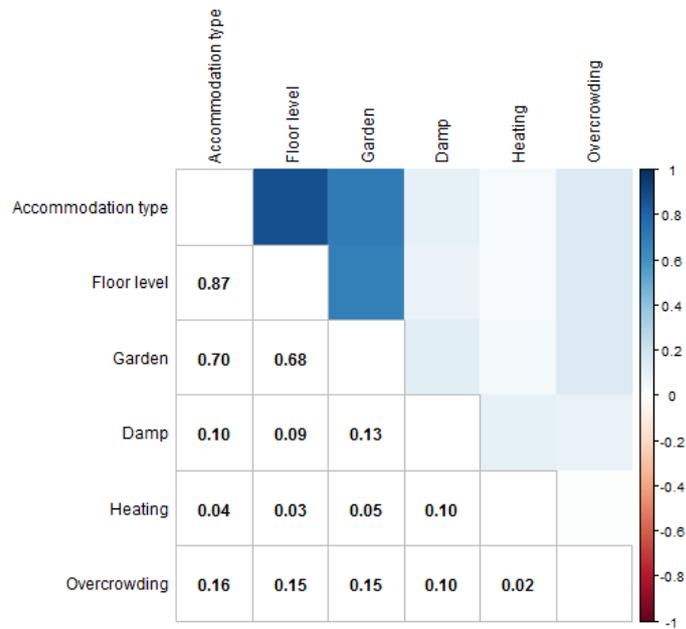
(B)
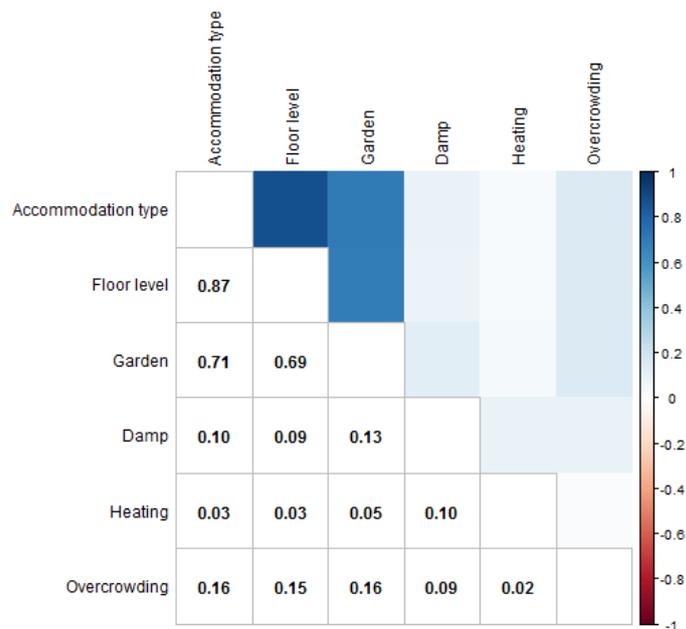
Supplementary Table S2: Number and percentage of total sessions missed across Year 1 to 11 in the Millennium Cohort Study.

Year	Total number of sessions missed		Percentage of sessions missed	
	Average	95% CI	Average	95% CI
Year 1 (2006/2007)	16.98	16.39, 17.57	5.51	5.32, 5.71
Year 2 (2007/2008)	15.47	14.97, 15.98	5.07	4.90, 5.24
Year 3 (2008/2009)	14.66	14.18, 15.13	4.82	4.65, 4.98
Year 4 (2009/2010)	14.87	14.44, 15.31	4.84	4.70, 4.98
Year 5 (2010/2011)	13.97	13.57, 14.37	4.61	4.47, 4.74
Year 6 (2011/2012)	12.64	12.22, 13.07	4.01	3.88, 4.15
Year 7 (2012/2013)	14.17	13.64, 14.70	4.70	4.52, 4.87
Year 8 (2013/2014)	14.04	13.55, 14.54	4.67	4.50, 4.85
Year 9 (2014/2015)	16.61	15.98, 17.24	5.45	5.24, 5.66
Year 10 (2015/2016)	18.10	17.36, 18.83	5.83	5.59, 6.08
Year 11 (2016/2017)	20.86	19.83, 21.89	6.95	6.61, 7.30
Total (Year 1-11)	**172.38**	**167.78, 176.98**	**5.13**	**4.99, 5.27**
By housing quality				
High	163.5	158.8, 168.1	4.86	4.72, 5.00
Low	216.9	204.2, 229.5	6.49	6.11, 6.88

Note: missed sessions were recorded by the Department for Education during the first 5 half terms. The sample size was n=7272.

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Supplementary Table S3: Association between each 1 SD decrease in housing quality and percentage of missed sessions in years 1 to 11 in the Millennium Cohort Study.

	Unadjusted			Adjusted		
	b	95% CI	*p*	b	95% CI	*p*
Authorised absences						
Year 1	0.47	0.35, 0.58	<0.001	0.10	-0.03, 0.23	0.122
Year 2	0.45	0.34, 0.56	<0.001	0.15	0.03, 0.26	0.012
Year 3	0.43	0.31, 0.56	<0.001	0.23	0.09, 0.36	0.001
Year 4	0.25	0.13, 0.37	<0.001	0.07	-0.05, 0.19	0.230
Year 5	0.26	0.15, 0.38	<0.001	0.11	-0.02, 0.24	0.085
Year 6	0.21	0.12, 0.30	<0.001	0.14	0.04, 0.23	0.004
Year 7	0.29	0.16, 0.41	<0.001	0.14	0.01, 0.27	0.029
Year 8	0.22	0.10, 0.35	0.001	0.10	-0.03, 0.24	0.140
Year 9	0.23	0.11, 0.36	<0.001	0.15	0.02, 0.28	0.025
Year 10	0.20	0.05, 0.35	0.008	0.06	-0.10, 0.22	0.450
Year 11	0.27	0.02, 0.52	0.035	0.12	-0.09, 0.32	0.259
Total	0.30	0.21, 0.38	<0.001	0.12	0.04, 0.21	0.005
Unauthorised absences						
Year 1	0.26	0.19, 0.34	<0.001	0.13	0.05, 0.21	0.001
Year 2	0.22	0.15, 0.28	<0.001	0.09	0.02, 0.15	0.012
Year 3	0.22	0.14, 0.30	<0.001	0.08	0.01, 0.15	0.029
Year 4	0.24	0.16, 0.33	<0.001	0.12	0.04, 0.20	0.005
Year 5	0.18	0.12, 0.25	<0.001	0.06	-0.01, 0.13	0.093
Year 6	0.15	0.10, 0.20	<0.001	0.02	-0.03, 0.08	0.435
Year 7	0.20	0.12, 0.28	<0.001	0.06	-0.02, 0.14	0.129
Year 8	0.24	0.14, 0.34	<0.001	0.05	-0.06, 0.17	0.337
Year 9	0.44	0.29, 0.59	<0.001	0.17	0.01, 0.33	0.034
Year 10	0.61	0.41, 0.82	<0.001	0.24	0.02, 0.47	0.032
Year 11	0.79	0.49, 1.09	<0.001	0.28	-0.02, 0.58	0.066
Total	0.32	0.26, 0.39	<0.001	0.12	0.05, 0.19	0.001
Total absences						
Year 1	0.73	0.58, 0.88	<0.001	0.23	0.07, 0.40	0.006
Year 2	0.67	0.54, 0.80	<0.001	0.23	0.09, 0.37	0.001
Year 3	0.65	0.51, 0.79	<0.001	0.31	0.16, 0.46	<0.001
Year 4	0.50	0.36, 0.63	<0.001	0.19	0.05, 0.34	0.009
Year 5	0.45	0.32, 0.58	<0.001	0.17	0.03, 0.32	0.020
Year 6	0.36	0.25, 0.47	<0.001	0.16	0.05, 0.28	0.007
Year 7	0.49	0.32, 0.66	<0.001	0.21	0.03, 0.39	0.023
Year 8	0.46	0.27, 0.65	<0.001	0.16	-0.04, 0.36	0.125
Year 9	0.67	0.45, 0.90	<0.001	0.32	0.09, 0.56	0.008
Year 10	0.82	0.51, 1.12	<0.001	0.30	-0.02, 0.62	0.064
Year 11	1.06	0.62, 1.49	<0.001	0.40	0.00, 0.79	0.050
Total	0.62	0.50, 0.75	<0.001	0.24	0.10, 0.38	0.001

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7272.

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Supplementary Table S4: Associations between *'High* versus *'Low'* housing quality and percentage of missed sessions in years 1 to 11 in the Millennium Cohort Study.

	Unadjusted			Adjusted		
	b	95% CI	*p*	b	95% CI	*p*
Total absences						
Year 1	2.03	1.59, 2.47	<0.001	0.94	0.50, 1.38	<0.001
Year 2	1.80	1.42, 2.18	<0.001	0.84	0.44, 1.24	<0.001
Year 3	1.75	1.34, 2.15	<0.001	0.97	0.57, 1.37	<0.001
Year 4	1.23	0.85, 1.61	<0.001	0.53	0.14, 0.91	0.007
Year 5	1.12	0.73, 1.50	<0.001	0.47	0.07, 0.87	0.022
Year 6	0.94	0.62, 1.26	<0.001	0.46	0.09, 0.83	0.016
Year 7	1.24	0.80, 1.68	<0.001	0.55	0.11, 1.00	0.016
Year 8	1.19	0.67, 1.71	<0.001	0.45	-0.07, 0.97	0.092
Year 9	1.88	1.18, 2.58	<0.001	1.03	0.33, 1.72	0.004
Year 10	2.08	1.27, 2.90	<0.001	0.85	0.03, 1.66	0.042
Year 11	2.66	1.55, 3.78	<0.001	1.04	0.03, 2.06	0.043
Total	1.63	1.22, 2.04	<0.001	0.74	0.34, 1.13	<0.001

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7272.

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Supplementary Table S5: Associations between housing conditions and percentage of total missed sessions in years 1 to 11 in the Millennium Cohort Study.

	Adjusted					
	b	95% CI	*p*	b	95% CI	*p*
	Accommodation type			Floor level		
Year 1	0.54	0.02, 1.06	0.041	0.23	-0.22, 0.68	0.308
Year 2	0.57	0.06, 1.07	0.029	0.33	-0.08, 0.75	0.115
Year 3	0.64	0.10, 1.18	0.020	0.28	-0.13, 0.69	0.180
Year 4	0.67	0.23, 1.11	0.003	0.17	-0.20, 0.54	0.358
Year 5	0.82	0.30, 1.34	0.002	0.34	-0.09, 0.77	0.117
Year 6	0.63	0.14, 1.11	0.012	0.16	-0.16, 0.48	0.325
Year 7	0.33	-0.26, 0.93	0.273	0.23	-0.27, 0.73	0.370
Year 8	0.29	-0.40, 0.98	0.405	0.17	-0.41, 0.75	0.564
Year 9	0.44	-0.44, 1.32	0.328	0.29	-0.37, 0.94	0.394
Year 10	0.44	-0.59, 1.47	0.400	0.45	-0.47, 1.37	0.336
Year 11	0.45	-0.89, 1.79	0.509	0.61	-0.56, 1.78	0.306
Total	**0.53**	**0.03, 1.02**	**0.037**	0.30	-0.13, 0.72	0.170
	Garden access			Damp		
Year 1	0.07	-0.19, 0.33	0.601	0.53	0.17, 0.90	0.004
Year 2	0.16	-0.09, 0.41	0.203	0.32	0.05, 0.59	0.020
Year 3	0.44	0.13, 0.75	0.006	0.52	0.25, 0.79	<0.001
Year 4	0.19	-0.08, 0.46	0.161	0.34	0.04, 0.64	0.025
Year 5	0.15	-0.12, 0.42	0.277	0.12	-0.13, 0.37	0.329
Year 6	0.12	-0.12, 0.36	0.315	0.20	-0.06, 0.47	0.127
Year 7	0.17	-0.17, 0.51	0.321	0.40	0.08, 0.71	0.013
Year 8	0.16	-0.21, 0.54	0.387	0.23	-0.13, 0.58	0.209
Year 9	0.27	-0.22, 0.76	0.277	0.75	0.30, 1.19	0.001
Year 10	0.33	-0.19, 0.86	0.215	0.95	0.39, 1.50	0.001
Year 11	0.55	-0.16, 1.26	0.129	0.87	0.19, 1.54	0.012
Total	0.24	-0.02, 0.5	0.076	**0.47**	**0.24, 0.71**	**<0.001**
	Heating			Overcrowding		
Year 1	0.36	0.07, 0.66	0.015	0.21	-0.05, 0.48	0.109
Year 2	0.31	-0.03, 0.65	0.070	0.24	0.00, 0.49	0.050
Year 3	0.08	-0.22, 0.37	0.618	0.36	0.11, 0.61	0.005
Year 4	0.04	-0.30, 0.38	0.820	0.23	-0.03, 0.49	0.084
Year 5	0.07	-0.22, 0.36	0.629	0.18	-0.04, 0.40	0.115
Year 6	0.04	-0.25, 0.34	0.774	0.27	0.07, 0.48	0.010
Year 7	-0.02	-0.32, 0.28	0.889	0.41	0.11, 0.71	0.007
Year 8	0.00	-0.38, 0.38	0.993	0.31	0.05, 0.58	0.021
Year 9	-0.02	-0.50, 0.45	0.924	0.59	0.22, 0.96	0.002
Year 10	-0.42	-0.89, 0.05	0.078	0.42	-0.14, 0.97	0.142
Year 11	-0.42	-1.11, 0.26	0.226	0.66	0.07, 1.24	0.027
Total	0.00	-0.26, 0.26	0.990	**0.35**	**0.13, 0.58**	**0.002**

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7272.

Supplementary Table S6: Associations between housing conditions and % of missed sessions in years 1 to 11 due to <u>authorised</u> absences in the Millennium Cohort Study.

	Adjusted					
	b	95% CI	*p*	b	95% CI	*p*
	Accommodation type			Floor level		
Year 1	0.17	-0.26, 0.60	0.436	-0.02	-0.35, 0.31	0.913
Year 2	0.36	-0.05, 0.77	0.085	0.20	-0.13, 0.54	0.239
Year 3	0.51	0.06, 0.96	0.025	0.18	-0.17, 0.52	0.313
Year 4	0.35	-0.03, 0.73	0.072	0.08	-0.25, 0.41	0.637
Year 5	0.56	0.06, 1.07	0.029	0.22	-0.17, 0.61	0.274
Year 6	0.61	0.18, 1.03	0.005	0.20	-0.07, 0.47	0.140
Year 7	0.32	-0.14, 0.79	0.171	0.15	-0.20, 0.49	0.398
Year 8	0.26	-0.24, 0.77	0.305	0.11	-0.28, 0.50	0.572
Year 9	0.12	-0.31, 0.55	0.576	0.04	-0.25, 0.33	0.789
Year 10	0.20	-0.31, 0.70	0.445	0.06	-0.33, 0.44	0.777
Year 11	0.01	-0.57, 0.60	0.967	0.01	-0.58, 0.61	0.964
Total	**0.32**	**0.00, 0.63**	**0.048**	0.11	-0.14, 0.37	0.388
	Garden access			Damp and mould		
Year 1	-0.06	-0.27, 0.15	0.565	0.26	-0.01, 0.54	0.060
Year 2	0.06	-0.13, 0.25	0.533	0.28	0.03, 0.52	0.026
Year 3	0.20	-0.04, 0.44	0.094	0.55	0.32, 0.78	<0.001
Year 4	0.00	-0.21, 0.21	0.990	0.28	0.02, 0.55	0.035
Year 5	0.03	-0.19, 0.26	0.767	0.18	-0.04, 0.39	0.117
Year 6	0.11	-0.07, 0.29	0.210	0.18	-0.04, 0.40	0.115
Year 7	0.06	-0.18, 0.31	0.613	0.39	0.13, 0.64	0.004
Year 8	0.04	-0.24, 0.31	0.798	0.23	0.00, 0.45	0.045
Year 9	-0.06	-0.30, 0.18	0.609	0.55	0.26, 0.85	<0.001
Year 10	0.04	-0.22, 0.29	0.774	0.34	0.06, 0.63	0.017
Year 11	0.00	-0.31, 0.30	0.982	0.41	0.00, 0.82	0.053
Total	0.04	-0.12, 0.20	0.634	**0.33**	**0.18, 0.48**	**<0.001**
	Heating			Overcrowding		
Year 1	0.35	0.09, 0.62	0.009	0.12	-0.12, 0.37	0.310
Year 2	0.25	-0.04, 0.55	0.094	0.10	-0.12, 0.33	0.361
Year 3	0.14	-0.11, 0.39	0.264	0.21	0.01, 0.42	0.043
Year 4	-0.03	-0.30, 0.25	0.837	0.03	-0.17, 0.24	0.741
Year 5	0.09	-0.14, 0.33	0.428	0.06	-0.12, 0.25	0.503
Year 6	0.09	-0.18, 0.36	0.517	0.12	-0.06, 0.30	0.194
Year 7	0.01	-0.20, 0.23	0.892	0.21	-0.01, 0.44	0.066
Year 8	0.01	-0.24, 0.26	0.941	0.19	-0.01, 0.40	0.062
Year 9	0.10	-0.25, 0.44	0.577	0.33	0.07, 0.59	0.014
Year 10	-0.11	-0.42, 0.20	0.483	-0.01	-0.35, 0.32	0.934
Year 11	0.00	-0.41, 0.42	0.991	0.30	-0.09, 0.69	0.134
Total	0.08	-0.10, 0.27	0.374	0.15	-0.01, 0.32	0.066

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7272.

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Supplementary Table S7: Associations between housing conditions and % of missed sessions in years 1 to 11 due to <u>unauthorised</u> absences in the Millennium Cohort Study.

	Adjusted					
	b	95% CI	*p*	b	95% CI	*p*
	Accommodation type			Floor level		
Year 1	0.37	0.13, 0.61	0.003	0.25	0.04, 0.46	0.021
Year 2	0.21	-0.02, 0.44	0.077	0.13	-0.05, 0.32	0.160
Year 3	0.13	-0.16, 0.42	0.376	0.10	-0.10, 0.31	0.311
Year 4	0.32	0.06, 0.58	0.015	0.10	-0.06, 0.25	0.217
Year 5	0.26	0.01, 0.51	0.042	0.12	0.00, 0.25	0.055
Year 6	0.02	-0.20, 0.23	0.874	-0.04	-0.15, 0.07	0.487
Year 7	0.01	-0.29, 0.30	0.954	0.08	-0.17, 0.32	0.528
Year 8	0.03	-0.33, 0.39	0.880	0.06	-0.26, 0.38	0.713
Year 9	0.32	-0.31, 0.94	0.323	0.25	-0.22, 0.71	0.299
Year 10	0.24	-0.42, 0.91	0.474	0.39	-0.24, 1.03	0.225
Year 11	0.44	-0.61, 1.49	0.407	0.60	-0.33, 1.53	0.208
Total	0.21	-0.07, 0.49	0.132	0.19	-0.05, 0.42	0.124
	Garden access			Damp and mould		
Year 1	0.13	0.01, 0.25	0.031	0.27	0.07, 0.47	0.008
Year 2	0.10	-0.05, 0.25	0.175	0.04	-0.06, 0.15	0.433
Year 3	0.24	0.01, 0.47	0.045	-0.03	-0.13, 0.07	0.586
Year 4	0.20	0.00, 0.39	0.050	0.06	-0.06, 0.18	0.350
Year 5	0.12	-0.05, 0.28	0.179	-0.05	-0.17, 0.07	0.381
Year 6	0.01	-0.13, 0.14	0.929	0.03	-0.09, 0.15	0.670
Year 7	0.11	-0.05, 0.26	0.179	0.01	-0.15, 0.17	0.894
Year 8	0.13	-0.07, 0.33	0.209	0.00	-0.22, 0.22	0.982
Year 9	0.33	-0.01, 0.68	0.057	0.19	-0.09, 0.48	0.188
Year 10	0.29	-0.08, 0.67	0.124	0.60	0.19, 1.02	0.005
Year 11	0.55	-0.02, 1.13	0.058	0.46	-0.06, 0.99	0.083
Total	**0.20**	**0.03, 0.37**	**0.020**	**0.14**	**0.00, 0.28**	**0.046**
	Heating			Overcrowding		
Year 1	0.01	-0.10, 0.12	0.837	0.09	-0.02, 0.19	0.095
Year 2	0.06	-0.07, 0.19	0.379	0.14	0.04, 0.25	0.008
Year 3	-0.07	-0.16, 0.03	0.178	0.15	-0.01, 0.30	0.064
Year 4	0.07	-0.11, 0.25	0.450	0.19	0.04, 0.35	0.015
Year 5	-0.03	-0.16, 0.11	0.696	0.12	-0.03, 0.26	0.107
Year 6	-0.05	-0.16, 0.06	0.395	0.15	0.03, 0.27	0.012
Year 7	-0.04	-0.19, 0.12	0.659	0.20	0.05, 0.34	0.008
Year 8	-0.01	-0.28, 0.27	0.955	0.12	-0.05, 0.30	0.172
Year 9	-0.12	-0.42, 0.19	0.442	0.26	0.01, 0.51	0.042
Year 10	-0.31	-0.59, -0.03	0.030	0.43	0.05, 0.81	0.025
Year 11	-0.42	-0.80, -0.05	0.026	0.36	-0.05, 0.76	0.085
Total	-0.08	-0.21, 0.05	0.225	**0.20**	**0.07, 0.33**	**0.003**

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7272.

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Supplementary Table S8: Average education attainment by housing quality in the Millennium Cohort Study.

	Higher housing quality		Lower housing quality	
	Mean	95% CI	Mean	95% CI
KS1 - English (Reading)	0.16	0.14, 0.18	-0.11	-0.16, -0.05
KS2 - English	0.08	0.05, 0.10	-0.16	-0.22, -0.11
KS4 - English	0.11	0.09, 0.14	-0.13	-0.19, -0.07
KS1 - Math	0.16	0.13, 0.18	-0.11	-0.17, -0.06
KS2 - Math	0.10	0.07, 0.12	-0.14	-0.20, -0.08
KS4 - Math	0.15	0.12, 0.17	-0.12	-0.18, -0.06
KS4 - Attainment 8	0.26	0.24, 0.28	0.00	-0.05, 0.05

The sample size was n=6741.

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Supplementary Table S9: Associations between *'Higher'* versus *'Lower'* housing quality and educational attainment in the Millennium Cohort Study.

	Unadjusted			Adjusted		
	β	95% CI	*p*	β	95% CI	*p*
Key Stage 1						
English (Reading)	-0.31	-0.37, -0.24	<0.001	-0.07	-0.13, -0.01	0.033
Math	-0.29	-0.36, -0.22	<0.001	-0.08	-0.15, -0.01	0.019
Key Stage 2						
English	-0.28	-0.35, -0.21	<0.001	-0.06	-0.12, 0.01	0.093
Math	-0.30	-0.37, -0.22	<0.001	-0.12	-0.2, -0.04	0.002
Key Stage 4						
English	-0.34	-0.42, -0.27	<0.001	-0.12	-0.19, -0.05	0.001
Math	-0.35	-0.42, -0.27	<0.001	-0.11	-0.18, -0.03	0.004
Attainment 8	-0.35	-0.42, -0.28	<0.001	-0.13	-0.19, -0.07	<0.001

Linear regressions with complex survey weights were conducted. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=6741.

Supplementary Table S10: Associations between housing conditions and educational attainment in the Millennium Cohort Study.

	Adjusted					
	b	95% CI	*p*	b	95% CI	*p*
	Accommodation type			Floor level		
KS1: English (Reading)	-0.03	-0.12, 0.06	0.553	0.01	-0.04, 0.07	0.687
KS1: Math	-0.02	-0.12, 0.07	0.656	0.01	-0.04, 0.07	0.603
KS2: English	0.04	-0.05, 0.12	0.396	0.04	-0.02, 0.09	0.208
KS2: Math	-0.08	-0.17, 0.02	0.123	-0.03	-0.10, 0.03	0.345
KS4: English	-0.01	-0.11, 0.08	0.784	-0.01	-0.08, 0.06	0.823
KS4: Math	-0.06	-0.15, 0.04	0.253	-0.02	-0.09, 0.04	0.480
KS4: Attainment 8	-0.05	-0.14, 0.03	0.223	-0.03	-0.09, 0.04	0.436
	Garden access			Damp		
KS1: English (Reading)	-0.02	-0.06, 0.03	0.439	0.01	-0.04, 0.07	0.587
KS1: Math	-0.02	-0.06, 0.02	0.355	0.01	-0.03, 0.06	0.559
KS2: English	-0.01	-0.06, 0.04	0.737	0.03	-0.03, 0.08	0.347
KS2: Math	-0.04	-0.09, 0.01	0.114	-0.01	-0.06, 0.04	0.725
KS4: English	-0.04	-0.09, 0.01	0.115	-0.01	-0.06, 0.04	0.714
KS4: Math	-0.02	-0.07, 0.03	0.366	-0.02	-0.07, 0.03	0.346
KS4: Attainment 8	-0.03	-0.07, 0.01	0.170	-0.02	-0.07, 0.02	0.326
	Heating			Overcrowding		
KS1: English (Reading)	-0.04	-0.10, 0.01	0.098	-0.12	-0.16, -0.07	<0.001
KS1: Math	-0.06	-0.11, 0.00	0.045	-0.10	-0.14, -0.06	<0.001
KS2: English	-0.06	-0.12, 0.00	0.067	-0.15	-0.19, -0.10	<0.001
KS2: Math	-0.07	-0.13, 0.00	0.048	-0.10	-0.14, -0.05	<0.001
KS4: English	-0.05	-0.10, 0.01	0.104	-0.11	-0.16, -0.06	<0.001
KS4: Math	-0.04	-0.09, 0.01	0.154	-0.09	-0.14, -0.04	<0.001
KS4: Attainment 8	-0.05	-0.10, 0.00	0.066	-0.12	-0.16, -0.07	<0.001

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=6741.

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Supplementary Table S11: Interaction between housing quality, household income/sex and % of missed sessions in years 1 to 11 in the Millennium Cohort Study.

	Household Income			Sex		
	F-value	p	p_{FDR}	F-value	p	p_{FDR}
Total absences						
Year 1	0.679	0.608	0.678	1.060	0.304	0.544
Year 2	1.356	0.250	0.678	0.003	0.957	0.970
Year 3	0.741	0.565	0.678	0.001	0.970	0.970
Year 4	1.055	0.380	0.678	0.725	0.395	0.544
Year 5	3.705	0.006	0.068	2.428	0.121	0.544
Year 6	0.848	0.496	0.678	0.191	0.663	0.810
Year 7	0.553	0.697	0.697	0.798	0.373	0.544
Year 8	1.500	0.203	0.678	1.720	0.191	0.544
Year 9	0.926	0.450	0.678	2.259	0.134	0.544
Year 10	0.666	0.616	0.678	1.330	0.250	0.544
Year 11	0.764	0.550	0.678	1.057	0.305	0.544
Total	0.401	0.808	NA	0.809	0.369	NA

Linear regressions with complex survey weights were conducted separately. Models were controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7272.

Supplementary Table S12: Interaction between housing quality, household income/sex and educational attainment in the Millennium Cohort Study.

	Household Income		Sex	
	F-value	*p*	F-value	*p*
KS1: English (Reading)	1.966	0.101	0.215	0.643
KS1: Math	2.342	0.056	1.838	0.177
KS2: English	0.854	0.493	0.009	0.922
KS2: Math	1.608	0.174	0.943	0.333
KS4: English	1.447	0.220	0.165	0.685
KS4: Math	2.156	0.075	0.670	0.414
KS4: Attainment 8	1.147	0.336	0.235	0.629

Linear regressions with complex survey weights were conducted separately. Models were controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=6741.

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Supplementary Table S13: Association between each 1 SD decrease in housing quality and percentage of missed sessions in years 1 to 11 among non-movers in the Millennium Cohort Study.

	Sample size	Unadjusted			Adjusted		
		b	95% CI	*p*	b	95% CI	*p*
Total absences							
Year 1	6603	0.75	0.59, 0.90	<0.001	0.26	0.09, 0.44	0.003
Year 2	6603	0.66	0.53, 0.79	<0.001	0.23	0.08, 0.37	0.003
Year 3	7272	0.65	0.51, 0.79	<0.001	0.31	0.16, 0.46	<0.001
Year 4	7272	0.50	0.36, 0.63	<0.001	0.19	0.05, 0.34	0.009
Year 5	7272	0.45	0.32, 0.58	<0.001	0.17	0.03, 0.32	0.020
Year 6	7272	0.36	0.25, 0.47	<0.001	0.16	0.05, 0.28	0.007
Year 7	5279	0.43	0.22, 0.65	<0.001	0.16	-0.06, 0.38	0.145
Year 8	5279	0.24	0.09, 0.40	0.002	-0.06	-0.22, 0.11	0.492
Year 9	5279	0.44	0.23, 0.65	<0.001	0.11	-0.11, 0.33	0.335
Year 10	4091	0.68	0.33, 1.02	<0.001	0.26	-0.11, 0.64	0.167
Year 11	4091	0.70	0.26, 1.14	0.002	0.23	-0.22, 0.69	0.311
Total	66313	0.53	0.42, 0.64	<0.001	0.19	0.07, 0.30	0.001

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income.

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Supplementary Table S14: Association between each 1 SD decrease in housing quality and educational attainment among non-movers in the Millennium Cohort Study.

	Sample size	Unadjusted			Adjusted		
		β	95% CI	*p*	β	95% CI	*p*
Key Stage 1							
English (Reading)	6138	-0.14	-0.16, -0.12	<0.001	-0.03	-0.05, 0.00	0.019
Math	6138	-0.12	-0.15, -0.10	<0.001	-0.03	-0.05, 0.00	0.042
Key Stage 2							
English	6741	-0.12	-0.15, -0.09	<0.001	-0.02	-0.05, 0.00	0.060
Math	6741	-0.12	-0.15, -0.09	<0.001	-0.04	-0.07, -0.01	0.004
Key Stage 4							
English	3867	-0.12	-0.17, -0.07	<0.001	-0.03	-0.08, 0.01	0.144
Math	3867	-0.15	-0.19, -0.11	<0.001	-0.04	-0.08, 0.00	0.043
Attainment 8	3867	-0.13	-0.18, -0.09	<0.001	-0.04	-0.08, 0.00	0.043

Linear regressions with complex survey weights were conducted. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income.

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Supplementary Table S15: Association between each 1 SD decrease in housing quality and percentage of total missed sessions in years 1 to 11 after multiple imputation in the Millennium Cohort Study.

	Unadjusted			Adjusted		
	b	95% CI	*p*	b	95% CI	*p*
Total absences						
Year 1	0.73	0.58, 0.87	<0.001	0.23	0.07, 0.40	0.006
Year 2	0.67	0.54, 0.79	<0.001	0.23	0.09, 0.37	0.001
Year 3	0.63	0.50, 0.77	<0.001	0.31	0.16, 0.46	<0.001
Year 4	0.48	0.35, 0.61	<0.001	0.19	0.05, 0.34	0.009
Year 5	0.43	0.31, 0.56	<0.001	0.17	0.03, 0.32	0.020
Year 6	0.35	0.24, 0.45	<0.001	0.16	0.04, 0.28	0.007
Year 7	0.48	0.31, 0.64	<0.001	0.21	0.03, 0.39	0.023
Year 8	0.45	0.27, 0.64	<0.001	0.16	-0.04, 0.36	0.125
Year 9	0.22	0.10, 0.35	<0.001	0.32	0.09, 0.56	0.008
Year 10	0.81	0.51, 1.11	<0.001	0.30	-0.02, 0.62	0.064
Year 11	1.04	0.61, 1.47	<0.001	0.40	0.00, 0.79	0.050

Missing data was imputed using multiple imputations by changed regressions (10 datasets) based on all variables in the models plus auxiliary variables of housing tenure, area deprivation and employment. Linear regressions with complex survey weights were conducted. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7408.

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Supplementary Table S16: Association between each 1 SD decrease in housing quality and school performance after multiple imputation in the Millennium Cohort Study.

	Unadjusted			Adjusted		
	β	95% CI	*p*	β	95% CI	*p*
Key Stage 1						
English (Reading)	-0.14	-0.16, -0.11	<0.001	-0.03	-0.05, 0.00	0.022
Maths	-0.12	-0.15, -0.10	<0.001	-0.03	-0.05, 0.00	0.032
Key Stage 2						
English	-0.12	-0.15, -0.10	<0.001	-0.03	-0.05, 0.00	0.060
Maths	-0.12	-0.15, -0.09	<0.001	-0.04	-0.07, -0.01	0.004
Key Stage 4						
English	-0.13	-0.16, -0.10	<0.001	-0.04	-0.06, -0.01	0.012
Maths	-0.14	-0.17, -0.11	<0.001	-0.04	-0.06, -0.01	0.010
Attainment 8	-0.14	-0.17, -0.11	<0.001	-0.04	-0.07, -0.02	0.001

Missing data was imputed using multiple imputations by changed regressions (10 datasets) based on all variables in the models plus auxiliary variables of housing tenure, area deprivation and employment. Linear regressions with complex survey weights were conducted. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=6861.

Supplementary Table S17: Associations between standardised housing conditions and percentage of total missed sessions in years 1 to 11 in the Millennium Cohort Study.

	**Adjusted**					
	b	95% CI	*p*	b	95% CI	*p*
	\multicolumn{3}{c}{Accommodation type}	\multicolumn{3}{c}{Floor level}	
Year 1	0.16	0.01, 0.30	0.041	0.09	-0.09, 0.28	0.308
Year 2	0.16	0.02, 0.31	0.029	0.13	-0.03, 0.30	0.115
Year 3	0.18	0.03, 0.34	0.020	0.11	-0.05, 0.28	0.180
Year 4	0.19	0.07, 0.32	0.003	0.07	-0.08, 0.22	0.358
Year 5	0.24	0.09, 0.38	0.002	0.14	-0.03, 0.31	0.117
Year 6	0.18	0.04, 0.32	0.012	0.06	-0.06, 0.19	0.325
Year 7	0.10	-0.08, 0.27	0.273	0.09	-0.11, 0.29	0.370
Year 8	0.08	-0.11, 0.28	0.405	0.07	-0.17, 0.30	0.564
Year 9	0.13	-0.13, 0.38	0.328	0.12	-0.15, 0.38	0.394
Year 10	0.13	-0.17, 0.42	0.400	0.18	-0.19, 0.55	0.336
Year 11	0.13	-0.26, 0.52	0.509	0.25	-0.23, 0.72	0.306
Total	**0.15**	**0.01, 0.29**	**0.037**	0.12	-0.05, 0.29	0.170
	\multicolumn{3}{c}{Garden access}	\multicolumn{3}{c}{Damp and mould}	
Year 1	0.04	-0.11, 0.19	0.601	0.24	0.08, 0.40	0.004
Year 2	0.09	-0.05, 0.23	0.203	0.14	0.02, 0.26	0.020
Year 3	0.25	0.07, 0.42	0.006	0.23	0.11, 0.35	<0.001
Year 4	0.11	-0.04, 0.26	0.161	0.15	0.02, 0.29	0.025
Year 5	0.08	-0.07, 0.24	0.277	0.06	-0.06, 0.17	0.329
Year 6	0.07	-0.07, 0.2	0.315	0.09	-0.03, 0.21	0.127
Year 7	0.10	-0.1, 0.29	0.321	0.18	0.04, 0.32	0.013
Year 8	0.09	-0.12, 0.3	0.387	0.10	-0.06, 0.26	0.209
Year 9	0.15	-0.12, 0.43	0.277	0.34	0.14, 0.53	0.001
Year 10	0.19	-0.11, 0.48	0.215	0.43	0.18, 0.67	0.001
Year 11	0.31	-0.09, 0.71	0.129	0.39	0.09, 0.69	0.012
Total	0.13	-0.01, 0.28	0.076	**0.21**	**0.11, 0.32**	**<0.001**
	\multicolumn{3}{c}{Heating}	\multicolumn{3}{c}{Overcrowding}	
Year 1	0.14	0.03, 0.26	0.015	0.11	-0.03, 0.26	0.109
Year 2	0.12	-0.01, 0.26	0.070	0.13	0.00, 0.26	0.050
Year 3	0.03	-0.09, 0.15	0.618	0.19	0.06, 0.33	0.005
Year 4	0.02	-0.12, 0.15	0.820	0.12	-0.02, 0.26	0.084
Year 5	0.03	-0.09, 0.14	0.629	0.10	-0.02, 0.22	0.115
Year 6	0.02	-0.10, 0.13	0.774	0.15	0.04, 0.26	0.010
Year 7	-0.01	-0.13, 0.11	0.889	0.22	0.06, 0.38	0.007
Year 8	0.00	-0.15, 0.15	0.993	0.17	0.03, 0.31	0.021
Year 9	-0.01	-0.20, 0.18	0.924	0.32	0.12, 0.52	0.002
Year 10	-0.17	-0.35, 0.02	0.078	0.22	-0.08, 0.52	0.142
Year 11	-0.17	-0.44, 0.11	0.226	0.35	0.04, 0.67	0.027
Total	0.00	-0.10, 0.10	0.990	**0.19**	**0.07, 0.31**	**0.002**

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7272.

Supplementary Table S18: Associations between standardised housing conditions and educational attainment in the Millennium Cohort Study.

	Adjusted					
	b	95% CI	*p*	b	95% CI	*p*
	Accommodation type			Floor level		
KS1: English (Reading)	-0.01	-0.03, 0.02	0.553	0.00	-0.02, 0.03	0.687
KS1: Math	-0.01	-0.03, 0.02	0.656	0.01	-0.02, 0.03	0.603
KS2: English	0.01	-0.01, 0.04	0.396	0.01	-0.01, 0.04	0.208
KS2: Math	-0.02	-0.05, 0.01	0.123	-0.01	-0.04, 0.01	0.345
KS4: English	0.00	-0.03, 0.02	0.784	0.00	-0.03, 0.03	0.823
KS4: Math	-0.02	-0.04, 0.01	0.253	-0.01	-0.04, 0.02	0.480
KS4: Attainment 8	-0.02	-0.04, 0.01	0.223	-0.01	-0.04, 0.02	0.436
	Garden access			Damp and mould		
KS1: English (Reading)	-0.01	-0.04, 0.02	0.439	0.01	-0.02, 0.03	0.587
KS1: Math	-0.01	-0.04, 0.01	0.355	0.01	-0.01, 0.03	0.559
KS2: English	0.00	-0.03, 0.02	0.737	0.01	-0.01, 0.03	0.347
KS2: Math	-0.02	-0.05, 0.01	0.114	0.00	-0.03, 0.02	0.725
KS4: English	-0.02	-0.05, 0.01	0.115	0.00	-0.03, 0.02	0.714
KS4: Math	-0.01	-0.04, 0.02	0.366	-0.01	-0.03, 0.01	0.346
KS4: Attainment 8	-0.02	-0.04, 0.01	0.17	-0.01	-0.03, 0.01	0.326
	Heating			Overcrowding		
KS1: English (Reading)	-0.02	-0.04, 0.00	0.098	-0.06	-0.09, -0.04	<0.001
KS1: Math	-0.02	-0.04, 0.00	0.045	-0.05	-0.07, -0.03	<0.001
KS2: English	-0.02	-0.05, 0.00	0.067	-0.08	-0.10, -0.05	<0.001
KS2: Math	-0.03	-0.05, 0.00	0.048	-0.05	-0.08, -0.03	<0.001
KS4: English	-0.02	-0.04, 0.00	0.104	-0.06	-0.09, -0.03	<0.001
KS4: Math	-0.01	-0.04, 0.01	0.154	-0.05	-0.08, -0.02	<0.001
KS4: Attainment 8	-0.02	-0.04, 0.00	0.066	-0.06	-0.09, -0.04	<0.001

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=6741.

Supplementary Table S19: Associations between housing quality scale and log-transformed percentage of total missed sessions in years 1 to 11 in the Millennium Cohort Study.

	Unadjusted			Adjusted		
	b	95% CI	*p*	b	95% CI	*p*
Total absences						
Year 1	0.10	0.09, 0.12	<0.001	0.03	0.01, 0.05	0.001
Year 2	0.11	0.09, 0.13	<0.001	0.05	0.03, 0.06	<0.001
Year 3	0.10	0.08, 0.12	<0.001	0.05	0.03, 0.07	<0.001
Year 4	0.07	0.05, 0.09	<0.001	0.03	0.01, 0.04	0.011
Year 5	0.07	0.05, 0.09	<0.001	0.03	0.01, 0.05	0.007
Year 6	0.06	0.04, 0.09	<0.001	0.03	0.01, 0.05	0.001
Year 7	0.07	0.05, 0.10	<0.001	0.03	0.01, 0.06	0.005
Year 8	0.07	0.04, 0.09	<0.001	0.02	0.00, 0.05	0.037
Year 9	0.07	0.05, 0.10	<0.001	0.04	0.01, 0.06	0.010
Year 10	0.10	0.07, 0.12	<0.001	0.03	0.01, 0.06	0.018
Year 11	0.10	0.09, 0.12	<0.001	0.03	0.01, 0.05	0.001
Total	0.09	0.07, 0.10	<0.001	0.03	0.02, 0.05	<0.001

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7272.

Supplementary Table S20: Associations between housing quality items and log-transformed percentage of total missed sessions in years 1 to 11 in the Millennium Cohort Study.

	Adjusted					
	b	95% CI	*p*	b	95% CI	*p*
	Accommodation type			Floor level		
Year 1	0.09	0.03, 0.16	0.007	0.03	-0.02, 0.08	0.202
Year 2	0.15	0.08, 0.21	<0.001	0.08	0.02, 0.13	0.005
Year 3	0.10	0.03, 0.17	0.006	0.03	-0.02, 0.08	0.213
Year 4	0.11	0.05, 0.18	0.001	0.02	-0.03, 0.07	0.458
Year 5	0.15	0.07, 0.23	<0.001	0.07	0.01, 0.14	0.029
Year 6	0.13	0.07, 0.20	<0.001	0.04	-0.01, 0.09	0.096
Year 7	0.09	0.01, 0.17	0.037	0.03	-0.04, 0.10	0.361
Year 8	0.06	-0.02, 0.14	0.146	0.00	-0.07, 0.07	0.918
Year 9	0.10	0.00, 0.20	0.043	0.04	-0.03, 0.12	0.225
Year 10	0.10	0.02, 0.19	0.020	0.05	-0.03, 0.13	0.186
Year 11	0.09	0.03, 0.16	0.007	0.03	-0.02, 0.08	0.202
Total	0.11	0.05, 0.16	<0.001	0.04	0.00, 0.08	0.062
	Garden			Damp		
Year 1	0.02	-0.02, 0.05	0.341	0.05	0.01, 0.10	0.014
Year 2	0.04	0.00, 0.07	0.026	0.04	0.01, 0.08	0.024
Year 3	0.05	0.01, 0.09	0.007	0.08	0.04, 0.11	<0.001
Year 4	0.02	-0.02, 0.06	0.344	0.05	0.00, 0.10	0.041
Year 5	0.02	-0.02, 0.06	0.377	0.01	-0.03, 0.05	0.577
Year 6	0.03	0.00, 0.07	0.077	0.02	-0.02, 0.07	0.304
Year 7	0.03	-0.01, 0.07	0.146	0.05	0.01, 0.09	0.011
Year 8	0.02	-0.02, 0.06	0.414	0.04	-0.01, 0.08	0.102
Year 9	0.01	-0.04, 0.06	0.577	0.08	0.02, 0.13	0.004
Year 10	0.04	-0.01, 0.09	0.098	0.06	0.01, 0.10	0.023
Year 11	0.02	-0.02, 0.05	0.341	0.05	0.01, 0.10	0.014
Total	0.03	0.00, 0.05	0.043	0.05	0.02, 0.08	0.001
	Heating			Overcrowding		
Year 1	0.05	0.01, 0.1	0.015	0.03	0.00, 0.07	0.079
Year 2	0.05	0.00, 0.09	0.052	0.05	0.01, 0.09	0.008
Year 3	0.03	-0.01, 0.07	0.197	0.06	0.02, 0.10	0.003
Year 4	0.01	-0.03, 0.06	0.555	0.02	-0.01, 0.06	0.209
Year 5	0.03	-0.02, 0.08	0.304	0.03	-0.01, 0.07	0.100
Year 6	0.03	-0.02, 0.08	0.284	0.04	0.01, 0.08	0.021
Year 7	0.01	-0.03, 0.06	0.570	0.05	0.01, 0.09	0.010
Year 8	0.03	-0.02, 0.08	0.239	0.05	0.01, 0.08	0.013
Year 9	0.00	-0.06, 0.05	0.943	0.06	0.02, 0.10	0.003
Year 10	-0.03	-0.09, 0.03	0.307	0.05	0.00, 0.09	0.038
Year 11	0.05	0.01, 0.10	0.015	0.03	0.00, 0.07	0.079
Total	0.02	-0.01, 0.06	0.162	0.04	0.02, 0.07	0.001

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7272.

Supplementary Table S21: Associations between housing condition <u>values</u> and percentage of <u>total</u> missed sessions in years 1 to 11 in the Millennium Cohort Study.

	**Adjusted**					
	b	95% CI	p	b	95% CI	p
Accommodation type	\multicolumn{3}{c}{Value 1}		\multicolumn{3}{c}{Value 2}	
	\multicolumn{3}{c}{*(reference value '0')*}		\multicolumn{3}{c}{*(reference value '0')*}	
Year 1	0.52	-0.04, 1.08	0.070	1.56	-1.31, 4.44	0.285
Year 2	0.62	0.09, 1.16	0.021	-0.15	-2.25, 1.96	0.892
Year 3	0.73	0.16, 1.29	0.012	-0.61	-2.90, 1.68	0.601
Year 4	0.74	0.28, 1.21	0.002	-0.28	-1.90, 1.35	0.738
Year 5	0.89	0.35, 1.43	0.001	0.12	-2.27, 2.51	0.922
Year 6	0.64	0.11, 1.16	0.017	0.99	-0.59, 2.57	0.219
Year 7	0.37	-0.26, 1.00	0.242	-0.27	-2.39, 1.85	0.800
Year 8	0.33	-0.42, 1.07	0.391	-0.16	-2.13, 1.81	0.875
Year 9	0.49	-0.45, 1.43	0.302	-0.36	-3.53, 2.81	0.823
Year 10	0.52	-0.59, 1.63	0.358	-0.82	-2.59, 0.95	0.364
Year 11	0.62	-0.82, 2.07	0.397	-2.80	-5.77, 0.17	0.064
Total	**0.59**	**0.06, 1.11**	**0.028**	-0.25	-1.93, 1.43	0.769
Floor level	\multicolumn{3}{c}{Value 1}		\multicolumn{3}{c}{Value 2}	
	\multicolumn{3}{c}{*(reference value '0')*}		\multicolumn{3}{c}{*(reference value '0')*}	
Year 1	0.52	-0.26, 1.30	0.191	0.33	-0.62, 1.28	0.492
Year 2	0.68	-0.18, 1.53	0.120	0.50	-0.36, 1.37	0.251
Year 3	1.12	0.16, 2.08	0.023	0.16	-0.58, 0.90	0.668
Year 4	0.55	-0.17, 1.27	0.135	0.17	-0.67, 1.00	0.694
Year 5	1.40	0.52, 2.27	0.002	0.18	-0.65, 1.00	0.671
Year 6	1.02	0.28, 1.76	0.007	-0.09	-0.72, 0.55	0.786
Year 7	0.26	-0.67, 1.19	0.582	0.44	-0.55, 1.43	0.380
Year 8	0.34	-0.83, 1.51	0.563	0.26	-0.92, 1.44	0.664
Year 9	0.27	-1.24, 1.78	0.725	0.58	-0.62, 1.78	0.343
Year 10	0.11	-1.42, 1.64	0.888	1.06	-0.99, 3.11	0.308
Year 11	0.46	-1.29, 2.21	0.605	1.29	-1.40, 3.97	0.346
Total	0.61	-0.19, 1.42	0.135	0.44	-0.38, 1.27	0.289
Garden access	\multicolumn{3}{c}{Value 1}		\multicolumn{3}{c}{Value 2}	
	\multicolumn{3}{c}{*(reference value '0')*}		\multicolumn{3}{c}{*(reference value '0')*}	
Year 1	1.62	0.60, 2.64	0.002	-0.03	-0.57, 0.51	0.905
Year 2	1.86	0.65, 3.06	0.003	0.13	-0.35, 0.62	0.586
Year 3	1.26	0.36, 2.16	0.006	0.79	0.15, 1.43	0.016
Year 4	0.86	0.08, 1.63	0.031	0.31	-0.24, 0.86	0.265
Year 5	1.29	0.24, 2.33	0.016	0.17	-0.35, 0.70	0.518
Year 6	1.13	0.11, 2.15	0.030	0.13	-0.35, 0.61	0.597
Year 7	0.62	-0.28, 1.53	0.174	0.30	-0.40, 0.99	0.406
Year 8	0.34	-0.60, 1.29	0.472	0.31	-0.44, 1.05	0.415
Year 9	0.57	-1.03, 2.18	0.482	0.51	-0.49, 1.51	0.316
Year 10	-0.04	-1.38, 1.29	0.951	0.71	-0.39, 1.81	0.206
Year 11	0.07	-2.08, 2.22	0.949	1.15	-0.34, 2.64	0.129
Total	**0.87**	**0.05, 1.69**	**0.038**	0.41	-0.13, 0.94	0.135
Damp	\multicolumn{3}{c}{Value 1}		\multicolumn{3}{c}{Value 2}	
	\multicolumn{3}{c}{*(reference value '0')*}		\multicolumn{3}{c}{*(reference value '0')*}	
Year 1	0.14	-0.22, 0.5	0.435	1.88	0.67, 3.08	0.002

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	Value 1			Value 2		
Year 2	0.04	-0.26, 0.34	0.783	1.22	0.31, 2.13	0.009
Year 3	0.20	-0.11, 0.51	0.197	1.69	0.87, 2.52	0.000
Year 4	0.27	-0.05, 0.59	0.102	0.84	-0.06, 1.74	0.068
Year 5	0.10	-0.24, 0.44	0.579	0.30	-0.37, 0.98	0.375
Year 6	0.26	-0.10, 0.63	0.156	0.28	-0.53, 1.09	0.498
Year 7	0.30	-0.13, 0.73	0.167	0.99	0.05, 1.92	0.039
Year 8	0.13	-0.27, 0.53	0.534	0.66	-0.50, 1.81	0.264
Year 9	0.70	0.01, 1.39	0.048	1.60	0.47, 2.72	0.006
Year 10	1.18	0.36, 2.00	0.005	1.41	-0.20, 3.02	0.086
Year 11	0.86	-0.14, 1.87	0.092	1.74	-0.42, 3.91	0.113
Total	**0.38**	**0.03, 0.73**	**0.031**	**1.15**	**0.38, 1.91**	**0.003**
Heating				Value 2		
				(reference value '0')		
Year 1				0.73	0.14, 1.32	0.015
Year 2				0.62	-0.05, 1.30	0.070
Year 3				0.15	-0.44, 0.74	0.618
Year 4				0.08	-0.60, 0.76	0.820
Year 5				0.14	-0.44, 0.72	0.629
Year 6				0.09	-0.51, 0.68	0.774
Year 7				-0.04	-0.65, 0.56	0.889
Year 8				0.00	-0.76, 0.76	0.993
Year 9				-0.05	-1.00, 0.91	0.924
Year 10				-0.84	-1.77, 0.09	0.078
Year 11				-0.85	-2.23, 0.53	0.226
Total				0.00	-0.52, 0.52	0.990
Overcrowding	Value 1			Value 2		
	(reference value '0')			*(reference value '0')*		
Year 1	0.00	-0.29, 0.29	0.998	0.49	-0.08, 1.06	0.092
Year 2	0.13	-0.14, 0.40	0.357	0.52	0.00, 1.04	0.049
Year 3	0.03	-0.26, 0.32	0.849	0.82	0.28, 1.35	0.003
Year 4	-0.10	-0.38, 0.17	0.457	0.55	0.00, 1.09	0.049
Year 5	0.10	-0.17, 0.38	0.462	0.38	-0.09, 0.84	0.111
Year 6	0.16	-0.10, 0.42	0.241	0.58	0.14, 1.02	0.010
Year 7	0.02	-0.31, 0.35	0.918	0.94	0.30, 1.58	0.004
Year 8	0.09	-0.25, 0.43	0.596	0.69	0.13, 1.25	0.016
Year 9	0.17	-0.29, 0.63	0.461	1.30	0.52, 2.08	0.001
Year 10	-0.20	-0.90, 0.49	0.565	1.01	-0.13, 2.14	0.081
Year 11	-0.05	-0.73, 0.63	0.881	1.52	0.25, 2.78	0.019
Total	0.03	-0.24, 0.30	0.824	**0.80**	**0.32, 1.27**	**0.001**

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. Reference values were the positive housing conditions (i.e. value '0'), associations for intermediate (value '1') and negative (value '2') features from the same models are shown. The sample size was n=7272.

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Supplementary Table S22: Associations between housing condition <u>values</u> and educational attainment in the Millennium Cohort Study.

	Adjusted					
	b	95% CI	*p*	b	95% CI	*p*
Accommodation type	Value 1 *(reference value '0')*			Value 2 *(reference value '0')*		
KS1: English (Reading)	0.00	-0.09, 0.08	0.971	-0.57	-1.30, 0.16	0.124
KS1: Math	0.00	-0.09, 0.09	0.938	-0.40	-1.11, 0.31	0.269
KS2: English	0.05	-0.03, 0.14	0.198	-0.26	-1.00, 0.47	0.481
KS2: Math	-0.06	-0.16, 0.03	0.191	-0.44	-1.28, 0.40	0.301
KS4: English	0.00	-0.11, 0.10	0.925	-0.20	-0.71, 0.31	0.439
KS4: Math	-0.04	-0.14, 0.06	0.407	-0.42	-1.11, 0.28	0.236
KS4: Attainment 8	-0.04	-0.13, 0.04	0.317	-0.28	-0.77, 0.22	0.275
Floor level	Value 1 *(reference value '0')*			Value 2 *(reference value '0')*		
KS1: English (Reading)	-0.01	-0.13, 0.12	0.897	0.03	-0.10, 0.16	0.625
KS1: Math	-0.07	-0.21, 0.07	0.334	0.07	-0.04, 0.18	0.235
KS2: English	-0.03	-0.17, 0.11	0.665	0.10	-0.02, 0.23	0.098
KS2: Math	-0.14	-0.27, -0.01	0.034	-0.01	-0.15, 0.13	0.869
KS4: English	-0.14	-0.28, 0.00	0.052	0.04	-0.11, 0.20	0.582
KS4: Math	-0.10	-0.23, 0.02	0.102	-0.01	-0.17, 0.14	0.873
KS4: Attainment 8	-0.13	-0.24, -0.01	0.029	-0.01	-0.16, 0.14	0.947
Garden access	Value 1 *(reference value '0')*			Value 2 *(reference value '0')*		
KS1: English (Reading)	0.00	-0.11, 0.1	0.925	-0.20	-0.71, 0.31	0.439
KS1: Math	-0.15	-0.32, 0.01	0.063	-0.02	-0.11, 0.06	0.578
KS2: English	0.02	-0.16, 0.20	0.817	-0.02	-0.13, 0.08	0.695
KS2: Math	-0.13	-0.29, 0.04	0.127	-0.07	-0.17, 0.03	0.181
KS4: English	-0.08	-0.23, 0.08	0.329	-0.07	-0.17, 0.02	0.146
KS4: Math	-0.09	-0.22, 0.05	0.226	-0.04	-0.14, 0.06	0.454
KS4: Attainment 8	-0.10	-0.22, 0.03	0.128	-0.05	-0.14, 0.04	0.242
Damp	Value 1 *(reference value '0')*			Value 2 *(reference value '0')*		
KS1: English (Reading)	0.05	-0.02, 0.12	0.171	-0.04	-0.20, 0.12	0.622
KS1: Math	0.03	-0.03, 0.10	0.305	-0.02	-0.15, 0.12	0.815
KS2: English	0.02	-0.05, 0.10	0.551	0.05	-0.10, 0.21	0.483
KS2: Math	0.05	-0.02, 0.12	0.167	-0.14	-0.30, 0.02	0.076
KS4: English	0.02	-0.05, 0.10	0.581	-0.09	-0.22, 0.05	0.207
KS4: Math	0.01	-0.05, 0.08	0.746	-0.12	-0.25, 0.00	0.059
KS4: Attainment 8	0.00	-0.06, 0.06	0.996	-0.10	-0.22, 0.02	0.112
Heating				Value 2 *(reference value '0')*		
KS1: English (Reading)				-0.09	-0.19, 0.02	0.098
KS1: Math				-0.11	-0.22, 0.00	0.045
KS2: English				-0.11	-0.23, 0.01	0.067
KS2: Math				-0.13	-0.27, 0.00	0.048
KS4: English				-0.09	-0.21, 0.02	0.104

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	Value 1			Value 2		
KS4: Math				-0.08	-0.18, 0.03	0.154
KS4: Attainment 8				-0.09	-0.19, 0.01	0.066
Overcrowding	*(reference value '0')*			*(reference value '0')*		
KS1: English (Reading)	-0.12	-0.17, -0.06	<0.001	-0.23	-0.32, -0.14	<0.001
KS1: Math	-0.09	-0.14, -0.04	0.001	-0.20	-0.29, -0.11	<0.001
KS2: English	-0.14	-0.20, -0.08	<0.001	-0.29	-0.39, -0.19	<0.001
KS2: Math	-0.10	-0.16, -0.03	0.003	-0.19	-0.29, -0.10	<0.001
KS4: English	-0.11	-0.17, -0.05	<0.001	-0.22	-0.32, -0.11	<0.001
KS4: Math	-0.10	-0.16, -0.04	0.002	-0.18	-0.28, -0.09	<0.001
KS4: Attainment 8	-0.10	-0.16, -0.05	<0.001	-0.24	-0.33, -0.15	<0.001

Linear regressions with complex survey weights were conducted separately. Adjusted models controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. Reference values were the positive housing conditions (i.e. value '0'), associations for intermediate (value '1') and negative (value '2') features from the same models are shown. The sample size was n=6741.

Supplementary Table S23: Associations between housing quality scale, housing conditions and percentage of missed sessions across compulsory education using two methods of pooling across years in the Millennium Cohort Study.

	Pooled linear regression			**Linear mixed-effects regression**		
	b	95% CI	*p*	b	95% CI	*p*
Total absences						
Housing quality score	0.24	0.10, 0.38	0.001	0.15	0.05, 0.24	0.003
Accommodation type	0.53	0.03, 1.02	0.037	0.17	-0.17, 0.50	0.334
Floor level	0.30	-0.13, 0.72	0.170	0.08	-0.16, 0.31	0.533
Garden access	0.24	-0.02, 0.50	0.076	0.12	-0.05, 0.29	0.171
Damp	0.47	0.24, 0.71	<0.001	0.38	0.18, 0.59	<0.001
Heating	0.00	-0.26, 0.26	0.990	0.01	-0.22, 0.24	0.939
Overcrowding	0.35	0.13, 0.58	0.002	0.27	0.08, 0.46	0.006
Authorised absences						
Housing quality score	0.12	0.04, 0.21	0.005	0.07	0.00, 0.14	0.057
Unauthorised absences						
Housing quality score	0.12	0.05, 0.19	0.001	0.08	0.03, 0.13	0.001

Pooled linear regressions and linear mixed-effects regression with complex survey weights were conducted separately for each item and the total scores. Models were controlled for sex, month of birth, ethnic groups, maternal partnership status, highest household education, and household income. The sample size was n=7272, with a total of 79992 observations.

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