Supporting Information. S3 File.

The controlled direct effect of temperament at 2-3 years on cognitive and academic outcomes at 6-7 years

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S3 File. Sensitivity analysis for controlled direct effects

Sensitivity analyses were conducted to assess the effect of an unmeasured confounder, *U* of the association between *X* and *Y*, on the CDEs of the temperament subscale of reactivity on cognitive and academic outcomes. Assuming that *U* is a binary variable and the effect of *U* on *Y* on the additive scale, conditional on exposure, mediator, and covariates (*X*, *M*, *C*) is the same for both exposure levels X=*x* and X=*x**, the bias for the conditional CDE is defined as [1]:

$$Bias\left(CDE_{x,x*}(\mathrm{m})\right) = \delta\gamma \qquad (1)$$

Where δ denotes the difference in prevalence of *U* in the exposed, *x* and counterfactual, *x** group while γ denotes the effect size of *U* on cognitive and academic outcomes.

Table S2 showed that to invalidate the observed CDE (β=-0.37) of reactivity on the PPVT score, the unmeasured confounder *U* would need to have a difference in prevalence of 80% (for example 90% for exposure level *x*, and 10% for counterfactual exposure level *x**) and would be required to decrease the PPVT score by at least 0.6. *U* might have an effect size of 0.6 on the PPVT score. However, it does not appear plausible for a *U* to have a prevalence difference of 0.8 or more that could eliminate the CDE of reactivity on PPVT.

Table S2. The effect of a potential unmeasured binary confounder *U* of parenting practices to outcomes pathway

$P(U=1\|x, m, c)^{(1)}$	$P(U=1\|x^*, m, c^{(2)}$	$\delta=^{(1)-(2)}$	γ	$d=\delta\gamma$
Peabody Picture Vocabulary Test (direct effect of reactivity β=-0.37)				
0.6	0.4	0.2	-0.40	-0.08
0.7	0.3	0.4	-0.40	-0.16
0.8	0.2	0.6	-0.40	-0.24
0.9	0.1	0.8	-0.40	-0.32
0.6	0.4	0.2	-0.60	-0.12
0.7	0.3	0.4	-0.60	-0.24
0.8	0.2	0.6	-0.60	-0.36
0.9	0.1	0.8	-0.60	-0.48
0.6	0.4	0.2	-0.80	-0.16
0.7	0.3	0.4	-0.80	-0.32
0.8	0.2	0.6	-0.80	-0.48
0.9	0.1	0.8	-0.80	-0.64
Matrix Reasoning Test (direct effect of reactivity β =-0.11)				
0.6	0.4	0.2	-0.10	-0.02
0.7	0.3	0.4	-0.10	-0.04
0.8	0.2	0.6	-0.10	-0.06
0.9	0.1	0.8	-0.10	-0.08
0.6	0.4	0.2	-0.20	-0.04
0.7	0.3	0.4	-0.20	-0.08
0.8	0.2	0.6	-0.20	-0.12
0.9	0.1	0.8	-0.20	-0.16
0.6	0.4	0.2	-0.30	-0.06
0.7	0.3	0.4	-0.30	-0.12
0.8	0.2	0.6	-0.30	-0.18
0.9	0.1	0.8	-0.30	-0.24
ARS-Literacy (direct effect of reactivity β =-0.08)				
0.6	0.4	0.2	-0.05	-0.01
0.7	0.3	0.4	-0.05	-0.02
0.8	0.2	0.6	-0.05	-0.03

0.9	0.1	0.8	-0.05	-0.04
0.6	0.4	0.2	-0.10	-0.02
0.7	0.3	0.4	-0.10	-0.04
0.8	0.2	0.6	-0.10	-0.06
0.9	0.1	0.8	-0.10	-0.08
0.6	0.4	0.2	-0.15	-0.03
0.7	0.3	0.4	-0.15	-0.06
0.8	0.2	0.6	-0.15	-0.09
0.9	0.1	0.8	-0.15	-0.12
ARS-Numeracy (direct effect of reactivity β =-0.07)				
0.6	0.4	0.2	-0.05	-0.01
0.7	0.3	0.4	-0.05	-0.02
0.8	0.2	0.6	-0.05	-0.03
0.9	0.1	0.8	-0.05	-0.04
0.6	0.4	0.2	-0.10	-0.02
0.7	0.3	0.4	-0.10	-0.04
0.8	0.2	0.6	-0.10	-0.06
0.9	0.1	0.8	-0.10	-0.08

$P(U = 1|x, m, c)$ = prevalence of the unmeasured confounder for exposure level *x*; $P(U = 1|x^*, m, c)$ = prevalence of the unmeasured confounder for exposure level *x**. δ = difference in the prevalence of the unmeasured confounder between exposure level *x* and *x**; γ= beta coefficient of the direct effect of *U* on *Y*; *d* =magnitude of bias, is the product of δ and γ.

Reference for S3 File

1. VanderWeele TJ. Bias formula for sensitivity analysis for direct and indirect effects. Epidemiology 2010;21(4):540-551.