**Supplementary Information**

*Participants*

The DirecNet study group includes the Nemours Children’s Health System in Jacksonville, Florida, Stanford University, University of Iowa, Washington University in St. Louis and Yale University. Nemours was the clinical coordinating center for the study, and the Stanford Center for Interdisciplinary Brain Sciences Research served as the Imaging and Data Coordinating Center (IDCC), where all imaging and cognitive-behavioral data were analyzed and processed. Participants in the type 1 diabetes group were diagnosed at ≥ 6 months of age and used insulin for at least one month prior to study enrollment. Family reports of a prior history of diabetic ketoacidosis (DKA) and severe hypoglycemia (SH) were made available from medical records. Participants in the non-diabetic control group had a glycated hemoglobin (HbA1c) result <6.0% (42 mmol/mol), fasting glucose <110mg/dL and no history of abnormal blood glucose. Sibling controls of participants with type 1 diabetes (N=6) had negative islet cell autoantibody testing within 1 year of enrollment. Exclusion criteria for both the diabetic and control groups included past medical history of disorders that could impair neurologic development, intellectual disability or significant learning disabilities, psychiatric treatment (except for ADHD, N=5 type 1 diabetes, 4 controls), premature birth (<34 weeks gestation), low birth weight (<2000g) and MRI contraindications.

*fMRI data preprocessing*

The first three volumes of each scan were discarded to allow for stabilization of longitudinal magnetization. Structural and functional images were processed using the Brain Extraction Tool (BET) to remove non-brain tissue (1). Functional data additionally underwent motion correction to the mean image using MCFLIRT (2), spatial smoothing with a Gaussian kernel of 6mm FWHM, and high-pass temporal filtering with a cutoff of 100s. Each subject’s functional image was aligned to their structural image, using FMRIB’s Linear Image Registration Tool (3). A linear registration was used to align each subject’s structural intermediate image to a standard pediatric brain template with an isotropic voxel size of 1 mm that was created from 7.5-13.5 year-old children at the Montreal Neurological Institute (4, 5). The linear transformations were combined to register each subject’s functional data to template space.

Inspection of motion in each group indicated that an average of 18.8 ± 8.0 frames were flagged by FSL’s motion outliers tool (http://fsl.fmrib.ox.ac.uk/fsl/fslwiki/FSLMotionOutliers) in the control group. In the type 1 diabetes group, an average of 19.9 ± 9.4 frames were flagged. The number of flagged frames did not differ between groups, *t* = 0.552, *p* = 0.582. The average absolute motion in the control and type 1 diabetes groups was 0.34 ± 0.20 mm (range = 0.06 to 0.84 mm) and 0.37 ± 0.25 (range = 0.08 to 1.14 mm), respectively. The average relative motion in the control and type 1 diabetes groups was 0.11 ± 0.06 mm (range = 0.03 to 0.37 mm) and 0.11 ± 0.06 (range = 0.04 to 0.37 mm), respectively. Absolute and relative motion estimates were not significantly different between groups, *t* = 0.552, *p* = 0.582.

*Comparison of included versus excluded subjects*

Participants were excluded from fMRI analyses for one or more of the following reasons: excessive motion (28 participants with type 1 diabetes, 7 controls), anatomical abnormality (2 participants with type 1 diabetes), errors in behavioral data recording (5 participants with type 1 diabetes, 6 controls) and not performing the task as instructed (i.e., performed the task at or below chance level; 16 participants with type 1 diabetes, 6 controls). Exploratory analyses were conducted to determine whether included and excluded participants differed with respect to demographic and cognitive metrics. Independent samples and Mann-Whitney t-tests indicated that the groups were slightly, but significantly different in age, *U* = 5316.5, *p* = 0.004. The median (25th, 75th percentile) age in excluded and included participants were 10.9 (9.4, 12.2) and 11.9 (10.4, 13.0) years, respectively. The two groups did not differ with respect to any other metric, including sex, performance on the Wechsler Intelligence Scale for Children (WISC-IV), Behavior Rating Inventory of Executive Function (BRIEF), or the Woodcock-Johnson III Tests of Cognitive Abilities (WJIII), *p*s > 0.192.

*Exploratory correlations with age of onset*

To better understand the meaning of the negative correlation between modulation of activation and age of onset in the type 1 diabetes group, bivariate Spearman correlations were conducted between age of onset and behavioral (task performance) and cognitive measures (WISC-IV, BRIEF and WJ-III scores). Results of these analyses indicated no significant associations, *p*s > 0.307. Thus, future studies are needed to test whether higher modulation in children with an earlier age of onset of type 1 diabetes is indeed compensatory in nature.

**References**

1. Smith, SM. Fast robust automated brain extraction. Hum Brain Mapp 2002; 17: 143-155.

2. Jenkinson, M, P Bannister, M Brady, et al. Improved optimization for the robust and accurate linear registration and motion correction of brain images. Neuroimage 2002; 17: 825-841.

3. Jenkinson, MS Smith. A global optimisation method for robust affine registration of brain images. Med Image Anal 2001; 5: 143-156.

4. Fonov, V, AC Evans, K Botteron, et al. Unbiased average age-appropriate atlases for pediatric studies. Neuroimage 2011; 54: 313-327.

5. Fonov, VS, AC Evans, RC McKinstry, et al. Unbiased nonlinear average age-appropriate brain templates from birth to adulthood. Neuroimage 2009; 47: S102.

6. Mumford, JA, J-B Poline,RA Poldrack. Orthogonalization of regressors in fMRI models. PLoS One 2015; 10: e0126255.