

1 A longitudinal resource for population neuroscience 2 of school-age children and adolescents in China

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42 ^{*}LBCC is an international consortium and has aggregated 123,984 MRI scans, across more than 100 primary
43 studies, from 101,457 human participants between 115 days post-conception to 100 years of age, and built brain
44 charts to identify previously unreported neurodevelopmental milestones. More information are available at
45 <https://github.com/brainchart/lifespan>.

46 ^{**}CCNP is a long-term effort (2013-2032) to build the lifespan brain-mind development cohort in China, and more
47 consortium information are available at <http://deepneuro.bnu.edu.cn/?p=163>.

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50 ABSTRACT

During the past decade, cognitive neuroscience has been calling for population diversity to address the challenge of validity and generalizability, ushering in a new era of population neuroscience. The developing Chinese Color Nest Project (devCCNP, 2013-2022), a ten-year pilot stage of the lifespan CCNP (2013-2032), is an ongoing project focusing on brain-mind development. The project aims to create and share a large-scale, longitudinal and multimodal dataset of typically developing children and adolescents (ages 6.0–17.9 at enrolment) in the Chinese population. The devCCNP houses not only phenotypes measured by demographic, biophysical, psychological and behavioural, cognitive, affective, and ocular-tracking assessments but also neurotypes measured with magnetic resonance imaging (MRI) of brain morphometry, resting-state function, naturalistic viewing function and diffusion structure. This Data Descriptor introduces the first data release of devCCNP including a total of 864 visits from 479 participants. Herein, we provided details of the experimental design, sampling strategies, and technical validation of the devCCNP resource. We demonstrate and discuss the potential of a multicohort longitudinal design to depict normative brain growth curves from the perspective of developmental population neuroscience. The devCCNP resource is shared as part of the “Chinese Data-sharing Warehouse for *In-vivo* Imaging Brain” in the *Chinese Color Nest Project (CCNP) – Lifespan Brain-Mind Development Data Community* (<https://www.scidb.cn/en/c/ccnp>) at the Science Data Bank.

52 **Design Types** • Accelerated longitudinal design • Brain-mind development • Population imaging • Brain chart • Repeated
53 measure

54 **Measurements** • Psychological behaviours • Biophysical and physical measures • Intelligence quotient measure • Neuroimaging
55

56 **Sample Characteristic - Organism** • Homo sapiens

57 **Sample Characteristic - Environment** • School- and community-based sample

58 **Sample Characteristic - Location** • Chongqing and Beijing, China

59 **Duration** • 10 years (2013-2022)

60 Background & Summary

61 To explore the relationship between human behaviour and the brain, especially with respect to individual differences and
62 precision medicine, large-scale neuroimaging data collection is necessary. In 2008, thirty-five laboratories from 10 countries
63 including China, launched the 1000 Functional Connectomes Project (FCP)¹. This global project shared MRI data from 1,414
64 worldwide participants' neuroimaging data through the Network Information Technology Resources Collaboratory (NITRC)
65 in the United States. As a milestone in open science for human brain function, the project demonstrated the association of
66 individual differences in functional connectivity with demographic phenotypes (age and sex)¹. Since then, population-based
67 prospective efforts have been implemented by worldwide brain initiatives, such as Human Connectome Project (HCP)², US
68 BRAIN Initiative (Brain Research through Advancing Innovative Neurotechnologies Initiative, or BRAIN)³, Brain Mapping by
69 Integrated Neurotechnologies for Disease Studies (Brain/MINDS) in Japan⁴, UK (United Kingdom) Biobank⁵, BRAIN Canada⁶,
70 and Adolescent Brain Cognitive Development (ABCD) study⁷. This has introduced big data into cognitive neuroscience with
71 population imaging, namely population neuroscience^{8,9}, to increase population diversity or sample representativeness for
72 improvements in generalizability, a significant challenge faced by current cognitive neuroscience research^{10,11}.

73 The Chinese Color Nest Project (CCNP, 2013-2032)¹² is an early representative effort, likely the first in China, investigating
74 brain growth during the transition period from childhood to adolescence. CCNP has built and accumulated rich and valuable
75 experiences as a pilot study to accelerate the pace of initiating related brain-mind development cohort studies in the China Brain
76 Project^{13,14}. CCNP is devoted to collecting nationwide data on brain structure and function across different stages of human
77 lifespan development (6–85 years old). The long-term goal of this work is to create neurobiologically sound developmental
78 curves for the brain to characterize phenomenological changes associated with the onset of various forms of mental health and
79 learning disorders, as well as to predict the developmental status (i.e., age-expected values) of an individual brain's structure or
80 function. The developmental component of CCNP (devCCNP), also known as "Growing Up in China"¹⁵, has established follow-
81 up cohorts in Chongqing and Beijing, China. With the collection of longitudinal brain images and psychobehavioural samples
82 from school-age children and adolescents (6–18 years) in multiple cohorts, devCCNP has constructed a full set of school-age
83 brain templates, morphological growth curves¹⁶ and functional connectivity gradients¹⁷ for the Chinese Han population as well
84 as related (although preliminary) differences in brain development between Chinese and American school-age children¹⁶. The
85 project has contributed to charting human brain development across the lifespan (0–100 years) in an international teamwork led
86 by the Lifespan Brain Chart Consortium¹⁸.

87 To expand available resources for investigating population diversity¹⁹ while recognizing and addressing the issues of
88 sampling bias, and inclusion barriers within developmental population neuroscience²⁰, we describe and share the brain-mind

89 datasets of devCCNP here. We offer a comprehensive outline of the devCCNP protocol, along with recommendations to ensure
90 that devCCNP can be scaled up to facilitate access to more diverse populations in the future. We provide all the anonymized
91 raw data adhering to Brain Imaging Data Structure (BIDS) standards²¹. In summary, this dataset comprises ample tasks
92 addressing neurodevelopmental milestones of both primary and higher-order cognitive functions. The dataset holds the potential
93 to deepen our understanding of brain development in various dimensions, and augments assessments of cultural diversity
94 among the existing datasets using accelerated longitudinal designs (ALD) (see Table 1 from the cohort profile on CCNP¹² for a
95 nonexhaustive list of normative developmental samples obtained by ALD). In addition, we hope that the devCCNP will provide
96 a resource to explore potential regional differences due to multisite sampling, and their impacts on brain development.

97 Methods

98 Overall Design

99 The pilot stage of devCCNP aimed to establish an ALD cohort. The cohort consisted of 480 participants with typical
100 development, who were evenly divided into age-specific groups. Each age cohort contain 20 boys and 20 girls (Figure. 1a). We
101 conducted data collection in two regions in China with distinct geographic and socioeconomic profiles, the Beibei District
102 of Chongqing (devCCNP-CKG Sample) and the Chaoyang District of Beijing(devCCNP-PEK Sample), to capture a more
103 representative sample of the Chinese population and its diverse characteristics. The devCCNP-CKG Sample was collected
104 from March 2013 to January 2017, and the devCCNP-PEK Sample was collected from September 2017 to December 2022.
105 Participants underwent assessment three times in total, referred to as three "waves" of visits. To account for season effects,
106 there was a 15-month time gap between each wave (Figure. 1b). A repeated protocol was applied, which was adjusted based on
107 the participants' age. The total time for each assessment was approximately 10–12 hours, including preparation time and short
108 breaks. The time duration of each visit is listed in Table 1.

109 Recruitment Strategy

110 The devCCNP project focused on enrolling typically developing school-age Chinese children and adolescents. The CKG
111 Sample was included one primary school and one junior high school in Chongqing. The participants were recruited through
112 face-to-face communications between parents, schools, and CCNP program staff. In the case of the PEK Sample, recruitment
113 took place in Beijing, where community-based recruitment was initially accomplished through various science popularization
114 activities and online advertisements. We provided a series of activities for the families to experience educational neuroscience,
115 including lectures on the brain, neuroimaging, cognitive neuroscience, and facility tours to experience MRI mock scanning, to
116 make them interested and familiar with the entire procedure. Because the project gradually gained a good reputation, word of
117 mouth recruitment became a major source of participants.

118 Retention Strategy

119 To accommodate each participant's after-school schedule, the experimental procedures for one wave were conducted in 2 to
120 4 separate visits as shown in Table 2. A 1-month time window was given for completing all the experimental protocols in
121 one wave, allowing for flexibility in scheduling. During the COVID-19 pandemic, relevant to the PEK Sample only, the time
122 window was extended to three months to ensure that participants were able to complete the study. In addition, we offered
123 modest monetary compensation and a variety of educational toys to the participants. The primary strategies to promote retention
124 are listed below.

125 Personal Development Report

126 After each wave's data collection, every participant was provided with a well-designed personal development report containing
127 feedback on various aspects of physiological characteristics (e.g. height, weight, blood pressure, and heart rate), cognitive
128 ability (e.g. intelligence quotient or IQ), social-emotional development (e.g. social anxiety, depression, stress perception and
129 behavioural problems), personality, and brain development. The brain development report included measurements of global
130 and network morphology (i.e., 7 large-scale brain network organizations²²). Additionally, the report compared 2 or 3 wave
131 performances to highlight development changes over time. Percentiles or norm-referenced scores were given to guide the
132 interpretation of developmental behaviours. Practical advice or recommendations for enhancing the performance were provided
133 only for reference.

134 Brain Science Popularization

135 The enrolled participants and their guardians were regularly invited to attend talks popularizing brain science organized by
136 the program staff. The talks were focused on providing an intuitive understanding of the personal development report and
137 promoting extensive knowledge of brain science. During the progress, we emphasized the scientific significance of establishing
138 longitudinal datasets for Chinese children and adolescents, with the aim of encouraging retention in the project. A featured

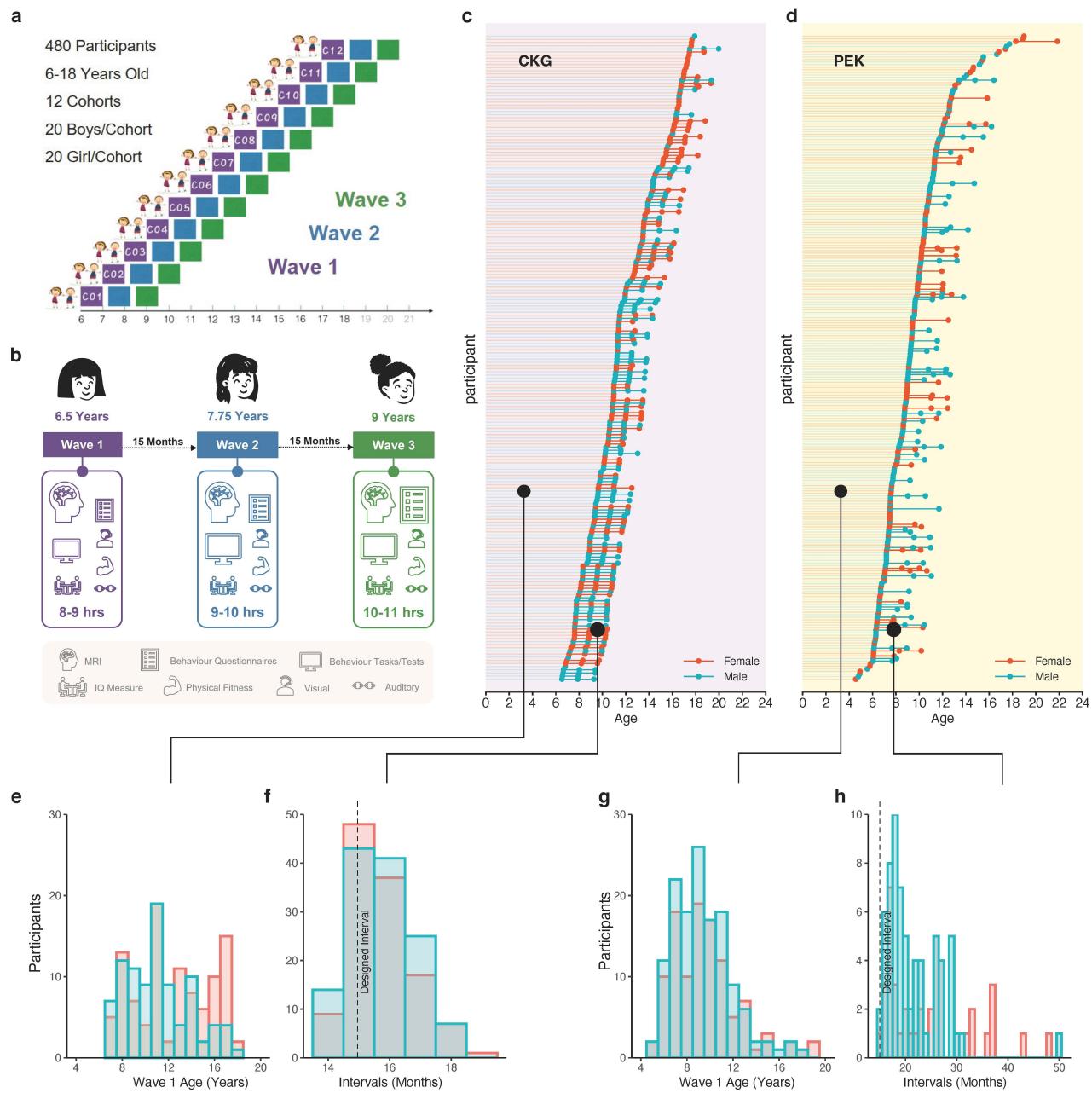


Figure 1. Experimental design and sample composition. (a) The Accelerated Longitudinal Design (ALD) of devCCNP has 3 repeated measuring waves: Wave 1 (baseline, purple), Wave 2 (follow-up 1, blue), and Wave 3 (follow-up 2, green). The age range of participant enrolment was 6–18 years. The 480 participants were divided into 12 age cohorts, with 20 boys and 20 girls in each. The interval between each successive waves was designed to be 15 months. (b) An example of a participant's protocol who enrolled at 6.5 years. Measurement content is justified according to the age of each participant. As shown in Table 1, the number of psychological behaviour measurements (related to questionnaires and computer-mediated tasks/tests) increases with age. (c,d) Age and sex distributions for participants' completion in the CKG and PEK Samples (female, red; male, blue). Dots indicate the specific age of each wave's data collection, while lines indicate the actual intervals between two waves. (e,g) Numbers of participants enrolled (Wave 1) in each age group are calculated according to sex. (f) The actual intervals in the CKG Sample better adhere to the original design; the largest interval is 19 months. (h) In the PEK Sample, intervals have been commonly extended from 16 to 50 months.

139 program *Localization of Frontiers for Young Minds* articles (<https://kids.frontiersin.org/articles>) was launched in July 2019 with
140 weekly neuroscience popularization articles promoted through various social media platforms, such as the *WeChat* Official
141 Accounts Platform. Teenagers volunteered to be part of the translation team and were supervised by the CCNP Science Mentors.
142 This initiative widely popularized background knowledge to school-age students, and improved acceptance of the project
143 among the target population.

144 **Participant Procedure**

145 **Screening & Registration**

146 A prescreening phone interview inquired about each participant's health history, family history of disease, and any potential risk
147 or side effect associated with the MRI procedure. After a detailed introduction, any necessary explanations and an assessment
148 of those who were willing to participate, individuals meeting inclusion criteria without any reason for exclusion were invited to
149 preregistration. Both participants and their guardians were invited to be confirmed on site, and signed the informed consent
150 form before official participation.

151 The inclusion criteria were as follows:

- 152 • Male or female native Chinese speakers aged 6.0–17.9 years at enrolment. Note that some participants under 6 years old
153 were also enrolled as a preexperiment on younger individuals.
- 154 • Must have the capacity to provide assent, guardian must have the capacity to sign informed consent.

155 . The exclusion criteria were as follows:

- 156 • Guardians unable to provide developmental and/or biological family histories (e.g., some instances of adoption).
- 157 • Serious neurological (specific or focal) disorders.
- 158 • History of significant traumatic brain injury.
- 159 • History or family history (first-degree relatives) of neuropsychiatric disorders, such as ASD, ADHD, bipolar disorder, or
160 schizophrenia.
- 161 • Contraindication for MRI scanning, such as metal implants, or pacemakers.

162 **Ethical Approval**

163 This project was approved by the Institutional Review Board of the Institute of Psychology, Chinese Academy of Sciences.
164 Prior to conducting the research, written informed consent was obtained from one of the participants' legal guardians, and
165 written assent was obtained from the participants. Participants who became adults in the longitudinal follow-up provided
166 written consent once becoming 18 years old.

167 **Experimental Design**

168 Detailed assessments are listed in Table 1. Data collection was accomplished by well-trained research assistants.

169 **Demographics & Characteristics**

170 Demographic information (e.g., age, sex and handedness) and characteristics of both participants (e.g., educational level)
171 and their families (e.g., number of children) were collected at the beginning of each wave through self-designed parental
172 questionnaires. The hand preference of the participant was assessed by the Annett Hand Preference Questionnaire (AHPQ)²³ in
173 the CGK Sample and was classified into 5 subgroups: strong right preference (RR), mixed with right tendencies (MR), mixed
174 (M), mixed with left tendencies (ML), and strong left preference (LL). In the PEK Sample, the Chinese version of Edinburgh
175 Handedness Inventory (EHI)²⁴ was applied and participants were classified into 7 subgroups; two additional subgroups
176 compared with the CGK Sample were right preference (R) and left preference (L). Parent-reported Child Behavior Check List
177 (CBCL)^{25,26} was applied with Version: Ages 4–16 (1991 version) in the CGK Sample and Version: Ages 6–18 (2001 version)
178 in PEK Sample. To capture participants' family characteristics to achieve better population classification, a self-designed
179 parent-reported Subjective Social Status questionnaire using a 10-point self-anchoring scale was additionally conducted in
180 the process of PEK sampling. Additionally, in the PEK Sample, Music Training History Questionnaire for Children^{27,28}
181 was completed by parents to collect information about the participants' previous training or acquisition of music-related
182 knowledge/skills.

183 **Biophysical Measures**

184 Objective biophysical measurements include height, weight, head circumference, and biomarkers of cardiovascular health (i.e.,
185 blood pressure and heart rate). The blood pressure assessment was performed immediately after the participant's MRI scan,
186 and the data provided were related to this specific time point. Visual acuity (naked eyesight in general, corrected eyesight as
187 optional if the participant had ametropia) and Pure Tone Audiometry (PTA)²⁹ were specifically measured in the PEK Sample.
188 Even though PTA is a relatively basic and important hearing test, and was conducted in a sound-proof room, we note that the
189 results might be affected by other factors, such as the psychological status of the participant. Therefore, we emphasized that the
190 participant's biophysical characteristics were only related to the physical and emotional state of the moment.

191 **Physical Fitness Measures**

192 Grip strength³⁰, standing broad jump³¹ and 15-metre shuttle run³² were tested to measure the muscle strength and cardiopul-
193 monary endurance of the participants. After watching the procedure demonstrations, the test method and details were explained
194 to the participants, and they were required to warm up sufficiently. The 15-metre shuttle run was conducted at the end, and the
195 number of completed laps was recorded as the result. Rating of Perceived Exertion (RPE)³³ was measured immediately after
196 the shuttle run to evaluate exercise intensity.

197 **Intelligence Quotient Measure**

198 All participants aged 6–17.9 were given the Wechsler Intelligence Scale for Children-IV-Chinese Version (WISC-IV)³⁴ during
199 each wave's assessment. Ten core subtests and 4 supplementary subtests were combined to estimate Full Scale Intelligence
200 Quotient (FSIQ) with 4 indices: Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory
201 Index (WMI) and Processing Speed Index (PSI). Participants aged above 18 years completed the Chinese Version of Wechsler
202 Adult Intelligence Scale (WAIS-IV)³⁵.

203 **Psychological Behaviour Questionnaires**

204 Widely used questionnaires with high reliability and validity, primarily focused on cognition, personality, and issues pertaining to
205 social-emotional functioning (e.g., life events, self-concept, emotions and affects such as stress, anxiety, depression, loneliness,
206 and positive and negative affect) were obtained by one-on-one instruction. All the psychological behaviour questionnaires
207 corresponding to each Sample are detailed in Table 1.

208 **Psychological Behaviour Tasks/Tests**

209 Various experimental paradigms through E-Prime, MATLAB and other platforms were used to assess participants' cognitive
210 performance in different domains (e.g., executive attention, social cognition, decision-making and language). Some culturally
211 specific tasks were also conducted (e.g., Chinese Character Naming Task). Details are listed in Table 1. Before each formal
212 task/test, participants were informed of the overall procedure through an instructional message and allowed to have exercise
213 trials. Brief introductions on these tasks/tests are as follows:

- 214 • **Attention Network Test** The classic Attention Network Test (ANT)³⁶ was applied to assess the three attention networks:
215 alerting, orienting and executive attention. During the experiment, small cartoon images of "fish" were presented on
216 the centre of the computer screen for a very short time. Participants were asked to determine as soon and as correctly
217 as possible whether the head of the centre "fish" pointed the left or right (we use images of cartoon fish to replace
218 the "arrow" in the classic ANT paradigm for high preference in children and adolescents). Response times (RTs) and
219 accuracy were measured for each trial.
- 220 • **Singleton Stroop Task** This task was introduced to assess an individual's bottom-up attention capture and top-down
221 inhibitory control. A fixation point was presented on the screen at the beginning and end of each experimental trial. Five
222 short vertical lines were then presented on the screen, and one of the lines was red while the remaining were black. The
223 next task stimulus, a vertical arrow, randomly appeared at the top or bottom of the screen. Participants were asked to
224 respond to the direction of the arrow as quickly and correctly as possible. RTs and accuracy were measured for each trial.
- 225 • **Task-Switch Paradigm** In this experiment³⁷ participants were asked to make judgements as soon and as correctly as
226 possible between two different types of digit categorization: whether the presented digit was greater or less than 5 and
227 whether the present digit was odd or even. RTs and accuracy were measured for each trial.
- 228 • **Digit N-back Task** This paradigm³⁸ was used with two levels: 1-back and 2-back. Participants were asked to judge as
229 soon and as correctly as possible whether each stimulus in a sequence, which consisted of nine random digits from 1 to
230 9, matched the stimulus that appeared N items ago. To be specific, participants would determine whether the currently
231 presented digit was the same as the one (i.e., 1-back) or second one (i.e., 2-back) presented before. RTs and accuracy
232 were measured for each trial.

- **Prisoner's Dilemma** This task was conducted to assess the influence of networks on the emergence of cooperation^{39,40}. Before the formal experiment, participants were instructed that there were four blocks of games. Two of them are social partner blocks, in which their partners in each round are peer children and would be paid according to the final outcome. In contrast, in two blocks of nonsocial partner blocks, the partner's choice was randomly given by computer. In the experiment, first, a fixation point was presented on the screen. Then, a payoff matrix that lists the payoff when the participant and the partner choose to "cooperate" or "betray" is created. Participants were instructed, "You need to choose "cooperate" or "betray" without knowing your partner's choice. You will then present your partner's choice and therefore respective benefits based on bilateral choices." Finally, participants were asked to assess their emotional response towards the choices. Before participating in the social decision-making study, both prisoner's dilemma and ultimatum game introduced next, the participants were asked to describe themselves in a self-introduction, including their age, upbringing, education, personality, and hobbies. The participants were informed that their self-introduction would be anonymously presented to a group of peers who would participate in the same experiments. Those peers acted as their partners in the experiment. Each of those peer partners independently made a choice after reading the participants' self-introduction and their choices were preprogrammed in the experiment computer and displayed to them in the experiment.
- **Ultimatum Game** This task was designed to explore whether and how social comparisons with third parties affect individual preferences for fair decision-making^{41,42}. Before the formal experiment, participants were told that there are two blocks of games. One of them would be under the "gain" context, which means that players in the game are together to distribute gain. The other would be under the "loss" context, which means that players in the game are together to distribute loss suffering. In the formal experiment, an allocation of gain/loss would be offered, and participants needed to decide to accept or reject the offer and report how satisfied they felt about their final rewards/suffering.
- **Delay Discounting Task** To explore reward evaluation and impulsivity characteristics⁴³, in this task, participants were asked to make a series of choices to receive a certain value of fictitious funds immediately, or to wait for a period of time (i.e., a day, a week, a month, three months, or six months) before receiving a larger amount. For example, choosing between "Get ¥100 tomorrow" and "Get ¥50 today". The reward amount was presented on the screen immediately after each decision was made.
- **Risky Decision Task** This task was designed as an interactive, sequential gambling game to probe the neural correlates of risk taking and risk avoidance during sensation seeking^{44,45}. Participants were instructed to play a roulette game with a certain amount principal at the beginning. After deciding whether to participate in the gamble or not depending on the situation introduced (the odds of winning the jeton), rewards (gain or loss) were presented. Each decision had to be made in 4 seconds. After each trial participants were asked to evaluate and report whether they had made the right choice.
- **Chinese Character Reading Test: Chinese Character Naming Task** This task was introduced to examine children's reading ability and to determine potential developmental issues in the process of reading acquisition⁴⁶. Participants under 12 years old were asked to read a list of 150 Chinese characters (increasing difficulty from front to back) one by one. The score was calculated from the number of characters reading correctly.
- **Lexical Identification** This task used the semantic priming paradigm to examine mental representations of word meanings and their relationships^{47,48}. Critical words consisted of real word targets following a thematic prime (e.g., eat-lunch) or a categorical prime (e.g., apple-banana). Additionally, filler words consisting of nonword targets (e.g., eat-unch) were also added. The words (both the prime and target words) were consecutively presented on the screen and after the presentation of each word, participants were asked to judge whether the word was a real word or not. RTs and accuracy were recorded.
- **Audiovisual Integration of Words** This task examined the integration of visual and auditory word information^{49,50}. In each trial, participants were visually presented with one Chinese character on the screen and presented with a word pronunciation at the same time. The character was either audiovisually congruent (where the character and the pronunciation were matching) or incongruent (where the character and the pronunciation were nonmatching). Participants were instructed to judge whether the auditory word pronunciation matched the visual word form. RTs and accuracy were recorded.
- **Brief Affect Recognition Test** This test was used to evaluate an individual's recognition of facial expressions^{51,52}. Participants were first presented with a 200ms fixation point in the centre of the screen, and then randomly presented with a picture of a model's emotional expression for 200ms. Ten models (six women and four men) were selected from the Ekman database. Participants were asked to judge the expression presented from two options within the limited time (200ms), or they would automatically skip to the next image. Failed to select an expression was marked as wrong. There

284 were 30 sets of facial expressions made up of six different facial emotions (happiness, sadness, fear, disgust, surprise, and
285 anger).

- 286 • **Temporal Bisection Paradigm** To evaluate an individual's characteristics on time perception^{53,54}, participants were
287 required to learn two time intervals to strengthen their memory of long and short time intervals. These time intervals were
288 defined as the presenting a $2\text{cm} \times 2\text{cm}$ black squares was presented. For short duration, the black squares were presented
289 for 400ms, for long duration, the black squares were presented for 1600ms. After the training procedure, participants
290 were instructed to judge the length of the test time intervals (rating intervals as "long" or "short") according to the
291 previously learned time intervals. Black squares were randomly presented 20 times for 400, 600, 800, 1000, 1200, 1400,
292 or 1600ms interval.
- 293 • **Ebbinghaus Illusion** To assess participants' susceptibility to perceptual illusions^{55,56}, participants were instructed to
294 view a screen with a grey background. A probe circle and a reference circle were presented on the left and right sides of
295 the central fixation point. The probe circle was always surrounded by a group of smaller circles. The reference circle,
296 which was fixed in size, was surrounded by larger circles. The perceptual sizes of the probe circle and reference circle
297 were not the same. The task was to adjust the size of the probe circle with up or down arrow key to match that of the
298 reference circle. A chinrest was used to help minimize head movement.
- 299 • **Binocular Rivalry** To evaluate sensory eye dominance^{57,58}, participants were instructed to view two orthogonal sinewave
300 grating disks ($\pm 45^\circ$ from vertical) dichoptically through a pair of shutter Goggles (NVIDIA 3D Vision2 glasses). A
301 chinrest was used to minimize head motion. The gratings were displayed in the centre of the visual field and were
302 surrounded by a checkerboard frame that promoted stable binocular alignment. Participants were required to report
303 whether they perceived one of the two gratings or non-oriented disks by holding down one of the three keys (Left, Right,
304 or Down arrows) on the keyboard. If a key was not pressed within a predetermined period of time, there would be an
305 audible alarm for the participants.
- 306 • **Ocular-tracking Task** This task examines basic visuomotor ability by measuring ocular-tracking performance, as
307 previously described^{59–63}. This task was based on the classic Rashbass step-ramp paradigm⁶⁴ modified to accommodate
308 a random sampling of the polar angles from 2° to 358° in 4° increments around the clock face without replacement using
309 90 trials. Each trial began with a cartoon character (Donald Duck or Daisy, $0.64^\circ H \times 0.64^\circ V$) in the centre of a black
310 background on a computer screen. Participants were asked to fixate on the central character and initiated the trial by
311 pressing a mouse button. After a random delay drawn from a truncated exponential distribution (mean: 700ms; minimum:
312 200ms; maximum: 5,000ms), the character would jump in the range of 3.2° to 4.8° away from the fixation point and
313 immediately move back at a constant speed randomly sampled from $16^\circ/s$ to $24^\circ/s$ towards the centre of the screen and
314 then onwards for a random amount of time from 700 to 1,000ms before disappearing. To minimize the likelihood of
315 an initial catch-up saccade, the character always crossed the centre of the screen at 200ms after its motion onset. Both
316 the character speed and moving direction were randomly sampled to minimize expectation effects. Participants were
317 instructed to keep their eyes on the character without blinking once they initiated the trial and then to use their eyes to
318 track the character's motion as best as they could until it disappeared on the screen.
- 319 • **Dichotic Digit Test** This test was used to assess individuals' binaural integration^{65,66}, attention allocation, and aud-
320 itory/speech working memory ability. A different set of digits (2 or 3 digits) was presented simultaneously to the
321 participant's left and right ears with an output intensity set to 50dB HL. Participants were asked to listen carefully and
322 repeat the digits heard from right ear to left ear during half of the trials, and from left ear to right ear during the other half
323 of the trials. The orders were counterbalanced between participants.
- 324 • **Competing Sentences** This test was introduced to examine auditory selective attention and the ability to inhibit irrelevant
325 utterance interference during speech recognition⁶⁶. Two simple Chinese sentences with the same syntactic structure but
326 different contents (7 words with 4 key words, e.g., "the turtle/swims slower/than/the whale" ("乌龟/比/鲸鱼/游得慢"))
327 were presented simultaneously to the left and right ears. Participants were asked to listen carefully and repeat the content
328 in the attended ear (i.e., the output intensity of the attended ear was 35dB HL while the nonattended side was 50dB HL)
329 at the end of the sentence. The attended ear was left on half of the trial and right on the other half. The orders were
330 counterbalanced between participants.
- 331 • **Mandarin Hearing in Noise Test for Children** This test was used to assess speech recognition ability in a noisy
332 environment⁶⁷. A simple Chinese target sentence (15 sentences of 10 Chinese syllables each, e.g., "He drew a tiger
333 with a brush" ("他用画笔画了一只老虎")) was presented by the frontal speaker, and speech spectrum noise was
334 simultaneously played by the frontal or lateral (90° apart) speaker. The noise intensity was constant at 65dB SPL, and the

335 starting signal-to-noise ratio (SNR) was 0 dB for the front noise speaker and -5 dB for the side noise speaker. Participants
336 were required to listen carefully and repeat the sentence at the end. The SNR threshold at which participants correctly
337 reported 50% of syllables in the sentence was recorded as the speech recognition threshold (SRT).

338 • **Verbal Fluency** The verbal fluency test was used to evaluate strategic search and retrieval processes from the lexicon and
339 semantic memory^{68,69}. Participants in each trial were required to speak nonrepeated words based on one given category
340 within 1 minute. There were two trials for semantic fluency and two for phonemic fluency. Semantic fluency required
341 participants to say as many words as possible belonging to a particular semantic category (fruit, animal). Phonemic
342 fluency required the participants to say as many different words as possible (excluding proper names) beginning with a
343 Mandarin initial consonant (/d/ and /y/) but not repeating the first vowel and tone. The last four behaviour tests were
344 performed in a soundproof room in one session, and normal hearing in both ears (average hearing threshold $\leq 20\text{dB HL}$
345 from 250 to 8000Hz) was required.

346 **MRI Mock Scan**

347 In the preparation stage for MRI scans during PEK sampling, mock scanning was performed to improve participant compliance
348 by alleviating anxiety and psychological distress, and to facilitate the success of scans, especially for participants under 12
349 years old (i.e., primary education stage)⁷⁰. The mock scanner room was built in a child-friendly atmosphere (e.g., child-style
350 decorations, toys or books for different ages, etc) which provided a relaxed buffer zone. A real-size mock scanner built by
351 PST (Psychology Software Tools, Inc.) using a 1:1 model of the GE MR750 3T MRI scanner in use at the PEK site, allowed
352 participants an experience faithful to the actual MRI scanning procedure. Participants were guided to lie still on the bed
353 listening to the recorded MRI scanning sounds and watching the screen through the mirror attached to the model head coil.
354 Three imaging scenarios were performed: resting-state fMRI (rfMRI), morphometric MRI and natural stimulus fMRI (ns-fMRI)
355 which refers to the movie-watching state in this sample. Each scenario lasted at least five and a half minutes. The instructions
356 were consistent with the actual MRI scan, except the movie clip played during the natural stimulus was replaced by additional
357 resources. Head motion data were automatically acquired with the MoTrack Head Motion Tracking System (PST-100722).

358 **Magnetic Resonance Imaging**

359 MRI data of CKG Sample were collected using a 3.0-T Siemens Trio MRI scanner (sequencing order: rfMRI→T1-
360 weighted→rfMRI→T2-tse/tirm) at the Center for Brain Imaging, Southwest University. The PEK Sample were imaged
361 on a 3.0-T GE Discovery MR750 scanner at the Magnetic Resonance Imaging Research Center of the Institute of Psychology,
362 Chinese Academy of Sciences (sequencing order: rfMRI→T1-weighted→rfMRI→T2-weighted→ns-fMRI→DTI). Imaging
363 sequences remained the same across all waves at each site but were different between the two sites and optimized for similar
364 space and time resolutions. Minimal adjustments to sequencing order would occur as necessary. To avoid introducing cognitive
365 content or emotional states into the resting-state condition, the rfMRI scans were always conducted before movie-watching.
366 The detailed acquisition parameters in both samples are presented in Table 3. MRI procedure was performed within one session,
367 small breaks were allowed and instructions were given before starting each sequence. During data collection there were no
368 software or hardware upgrades that would affect the MRI scanning performance.

369 • **Resting-state fMRI** Two rfMRI scans with identical (within each Sample) parameters were acquired and separated
370 by a T1-weighted sequence. Participants were asked to keep their eyes fixated on a light crosshair (CKG Sample) or a
371 cartoon image (PEK Sample) on the dark screen, to stay still, and not to think of anything in particular. Noise-cancelling
372 headphones (OptoACTIVE™ Active Noise Control Optical MRI Communication System, Version 3.0) were provided in
373 the PEK Sample rfMRI scan to foster a more comfortable imaging experience.

374 • **Morphometric MRI** Morphometric imaging consisted of T1-weighted, T2-weighted (PEK Sample only) and T2-tse/tir
375 (CKG Sample only) scans. A T2 scan was performed after two rfMRI scans to evaluate brain lesions and improve
376 cross-registration. For both morphometric scans, participants were asked to keep their eyes closed to rest.

377 • **Natural Stimulus fMRI** This functional MRI condition was implemented in the PEK Sample only and under a movie-
378 watching state. Movie watching mimics real-world experiences related to the context. Movie watching requires the
379 viewer to constantly integrate perceptual and cognitive processing. Movie-watching helps to reduce head motion and
380 increase participant compliance and, therefore, improve the feasibility of brain-behaviour association studies⁷¹. At the
381 beginning of PEK sampling, participants were watching an audiovisual movie clip that was self-produced and consisted
382 of 6 public interest advertisements⁷² (Table 4). From August 2020, the movie clip was replaced by an animated film
383 named “Despicable Me”⁷³ (6m : 06s clip, DVD version exact times 1 : 02 : 09 – 1 : 08 : 15, spanning from the bedtime
384 scene to the getting in a car scene).

385 • **Diffusion Tensor MRI** This sequence was implemented in the PEK Sample only. During the scans participants were
386 free to decide if they wanted to watch another animation clip or rest. Detailed parameters are presented in Table 3.

387 **Summarizing lessons learned**

388 Throughout the implementation of the pilot devCCNP, we faced several challenges and gained valuable insights. We are
389 continuing to improve strategies in dissemination, recruitment, retention, and characterization. Here are some key considerations
390 that may aid similar endeavours, including large-scale sampling projects (e.g. the national longitudinal cohort on child brain
391 development in China).

392 **Recruitment Strategy**

393 Due to the particularity of children and adolescents, studies involving this population typically encounter significant challenges.
394 All projects should be conducted on the premise of not affecting academic progress and ensuring safety. Both school- and
395 community-based recruitment have distinct advantages and, inevitably, inherent drawbacks.

- 396 • **School-based Strategy** Support of flexible schoolwork arrangements matched with the sampling schedule can greatly
397 ensure the quantity and quality of data collection for junior and senior high school participants. With the help and
398 encouragement from coordinators in school, recruitment efforts could be reduced. However, for these same reasons, the
399 participants' motivation could be compromised, as they may not be primarily driven by their interest in the project or
400 may lack a clear understanding of the value and the contribution of participation. Meanwhile selecting recruiting schools
401 may also, to some extent, reduce the sample representativeness of the target population.
- 402 • **Community-based Strategy** Younger participants are undoubtedly easier to recruit in the community, but the number
403 of pubertal-age participants is limited especially for longitudinal studies. Self-enrolled participants recruited at the
404 community level or their guardian typically possess relevant knowledge and understand the value of participating in
405 the project; therefore they are strongly motivated and tend to cooperate better. However, this also biases the sample to
406 families with higher levels of education, or with some uncertain developmental problems. Especially with word of mouth
407 spreading and popularizing, the similarity between participants' families (e.g., social status, economic background)
408 and/or their characteristics would be higher, which might diminish the individual differences between the participants.

409 The drawbacks outlined above can be compensated by combining diverse recruitment strategies and expanding the age range
410 and geographical regions of the recruitment. This approach could enable a greater diversity of physical, psychological and
411 cognitive phenotypes and promote the establishment of a typical developing cohort.

412 **Experimental Design**

413 Charting the typical developmental trajectories of individuals (with respect to physical, psychological and morphological
414 development) through longitudinal design greatly contributes to uncovering the complex relationship between the brain and
415 behaviour. As a long-term project, it is important not only to assess the full range of participants' current state at a single time
416 point of data collection, but also to capture what important life or social events occur during the follow-up period. These events
417 include, but are not limited to, a family event (e.g., death of a family member, divorce of guardians), the birth of siblings,
418 sudden illness, a significant social or public health event, and others. Future projects could employ regular questionnaires
419 or scales (e.g., monthly) to collect related information during follow-up intervals, so that relevant details could be recorded.
420 Alternatively, participants could be asked to retrospectively report the events at each time point of data collection, but this may
421 miss the ability to capture their physiological or psychological experiences at the time of the event.

422 **Practical Experience**

423 The attentiveness and compliance of participants have significant impacts on data quality. The following lists the lessons we
424 have learned in the course of our practice.

- 425 • **Questionnaire and Scale** For large-scale projects involving different economic or cultural areas (e.g., northern and
426 southern China), it is recommended to apply both questionnaires or scales consisting of subjective and objective
427 assessments. For example, it is suggested to apply Subjective Social Status and to inquire about family income to assess
428 participants' family economic status. The combination of objective and subjective questions for the same evaluation
429 purpose can better classify populations living in areas of significant cultural differences. This recommendation also
430 applies to other physical, psychological and cognitive assessments.
- 431 • **Behaviour Tasks/Tests** Most of the behavioural measurements tested with computers require convenient interactions
432 with participants. Tasks requiring participants to press keys quickly is not conducive to young children if the keys are too
433 small or placed too close. For example, pressing "1" or "2" on a keyboard is more likely to cause errors than pressing "A"
434 or "M". Some measurements have higher requirements with respect to participant posture (e.g., ocular-tracking task
435 requires the participant to operate the mouse while keeping the head and upper body still). Therefore, the number of trials
436 and the duration of each trial need to be carefully designed. An overall time of less than 20 minutes for completion is

437 recommended for young participants. At the same time the related hardware equipment should be able to accommodate
438 a broad range of participant characteristics (e.g., head circumference, height, bodily form). For example, common
439 ocular-tracking devices in the laboratory need to be equipped with stable chairs that can be adjusted for a wide range of
440 heights, child-sized desks, or chinrests that can restrain the head. It is recommended to invite children of each age group
441 to evaluate all the experimental protocols at the design stage.

442 • **Magnetic Resonance Imaging** A scanning time for one MRI session of no longer than 45 minutes (one hour maximum)
443 is strongly recommended, especially for junior participants. In particular, mock scan training before formal MRI was
444 shown to effectively improve the success of imaging. In general, training immediately before the formal MRI can
445 be effective although additional mock training episodes before the formal MRI day could also be considered if the
446 participants are particularly scared, are sensitive to sound, or find it difficult to concentrate.

447 • **Personalized Schedule** During each wave's data collection, as shown in Table 2, the order in which the tests are
448 scheduled needs to be thoroughly arranged. To better achieve MRI data collection in this project, in principle, MRI
449 was arranged at the beginning of each wave. For those who had more than 2 visits within one wave, IQ measurements
450 were scheduled on the last visit, as they were usually of greater interest to guardians. Physical fitness tests should not be
451 scheduled within a few hours before MRI scans; measurements concerning visual perception should not be scheduled
452 after the measurement that require staring at digital screen for an extended duration.

453 • **Implementation Progress** Generally, one-on-one instruction from the same implementer across visits (within or even
454 across waves) can be conducive to friendly and cooperative relationships with the participants and can be, especially
455 helpful in relieving the timidity of young children to strangers. Measurements with higher qualification requirements for
456 the implementer (i.e., IQ measure) are recommended to be conducted by limited authorized staff. It is worth mentioning
457 that, unless it is ethically required, we do not recommend that parents be allowed to observe the participant's
458 engagement process, as this may have the potential to impact their child's performance.

459 Data records

460 Dataset Deposition

461 The devCCNP data has been publicly shared in the *Chinese Color Nest Project (CCNP) – Lifespan Brain-Mind Development*
462 *Data Community* (<https://www.scidb.cn/en/c/ccnp>), which is a public platform supported by the National Science Data Bank for
463 sharing CCNP-related data and promoting the cooperation of open neuroscience.

464 devCCNP full release

465 This dataset will be fully available to the research community when acquisition is completed for the pilot stage of CCNP. Before
466 that stage, the full (both MRI and behaviour) data are only available to researchers and collaborators of CCNP. Of note, all of
467 the MRI data have been deposited into the Science Data Bank and are accessible upon requests submitted according to the
468 instructions on the Science Data Bank website (<https://doi.org/10.57760/sciencedb.07478>). A sample of the longitudinal data
469 from a participant is fully accessible at FigShare (<https://doi.org/10.6084/m9.figshare.22323691.v1>) to demonstrate the data
470 structure.

471 devCCNP Lite

472 This release version contains only T1-weighted MRI, rfMRI and diffusion tensor MRI data of devCCNP. No cognitive
473 or behavioural information is included. The devCCNP Lite is immediately accessible upon the requests according to the
474 instructions on the Science Data Bank website (<https://doi.org/10.57760/sciencedb.07860>).

475 Data Structures

476 All data files are organized according to the Brain Imaging Directory Structure (BIDS) standards²¹. An example of the MRI
477 data storage structure is presented in Figure 2. Under the top-level project folder "devCCNP/", CKG and PEK Sample are
478 organized separately. Each participant's folder "sub-CCNP*/" may contain several subfolders depending on how many waves
479 have been completed to date (i.e., if all waves are finished, the folder would include three "/ses-*" subfolders). Imaging data
480 ("nii.gz") and metadata ("json") are organized into modality-specific directories "/anat/", "/func/" and "/dwi/". Note that in the
481 PEK Sample, Diffusion Tension Imaging (DTI) data files are stored under "/dwi/" folders with the datatype name "*_dwi.*". All
482 demographic and behavioural data are structured under the "/beh/" folder ("tsv"). Detailed parameters of each psychological
483 behaviour task/test are provided in the "json" file attached.

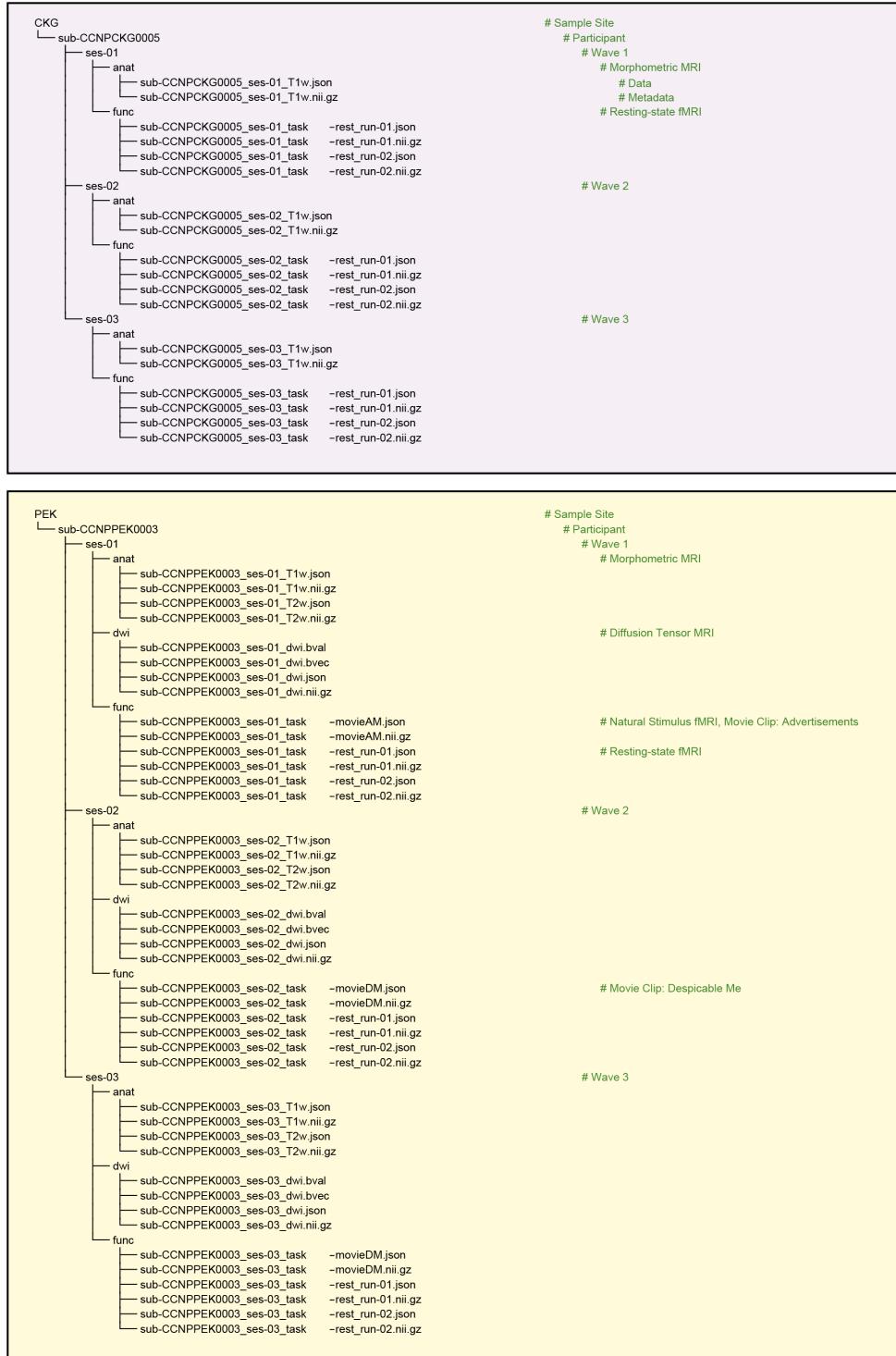


Figure 2. Example of the MRI raw data directory structure. Collected MRI raw data are structured within a hierarchy of folders according to the standard BIDS format. Under the toplevel project folder "devCCNP/", CKG (top) and PEK (bottom) Samples are organized separately. Each participant's folder "sub-CCNP*/" may contain several subfolders depending on how many waves have been completed to date (i.e., if all waves are completed, the folder would include three "/ses-*" subfolders). Imaging data ("*.nii.gz") and metadata ("*.json") are organized into modality-specific directories "/anat/", "/func/" and "/dwi/". Note that in the PEK Sample, Diffusion Tension Imaging (DTI) data files are stored under "/dwi/" folders with datatype name "*_dwi.*".

484 **Partial and Missing Data**

485 Some participants were not able to complete all components of the CCNP protocol due to a variety of situations (e.g., delay
486 or cancel caused by the COVID-19 pandemic). Overall, we logged data collection if any issues occurred that required extra
487 attention during analysis (see details written in the "json" file attached to each data).

488 **Data Licence**

489 The devCCNP sample data licence is CC-BY-NC 4.0. To access data, investigators must complete the application file *Data Use*
490 *Agreement on Chinese Color Nest Project* (DUA-CCNP) located at: <http://deepneuro.bnu.edu.cn/?p=163> and have it reviewed
491 and approved by the Chinese Color Nest Consortium (CCNC). Compliance with all terms specified by the DUA-CCNP is
492 required. Meanwhile, the baseline CKG Sample on brain imaging is available to researchers via the International Data-sharing
493 Neuroimaging Initiative (INDI) through the Consortium for Reliability and Reproducibility (CoRR)⁷⁴. More information
494 about CCNP can be found at: <http://deepneuro.bnu.edu.cn/?p=163> or <https://github.com/zuoxinian/CCNP>. Requests for further
495 information and collaboration are encouraged and considered by the CCNC; please read the Data Use Agreement and contact
496 us via deepneuro@bnu.edu.cn.

497 **Technical Validation**

498 **Sample composition**

499 A total of 479 participants completed baseline visits, 247 (51.6%) completed the second wave data collection, and 138 (28.9%)
500 completed the third wave (i.e., final protocol) as of December 2022. There were 648 (75.0%) measurements completed by
501 participants twelve years old or younger. The number of participants who completed visits in each age cohort are shown in
502 Table 5, and age and sex composition are presented in Figure 1c-d. Demographic and enrolment data for both the CKG Sample
503 (enrolled in 2013-2017) and the PEK (enrolled in 2018-2022) Sample are listed in Table 6. As mentioned above, the overall
504 design has a longitudinal follow-up interval of 15 months, to which the CKG Sample consistently adhered; however, during the
505 PEK sampling, the intervals were prolonged. For instance, inevitable practical situations affected community-based recruitment,
506 primarily the COVID-19 pandemic. Please note that during COVID-19, data collection was suspended from January to August
507 2020. We designed questionnaires to assess participants' learning and daily life status¹². Each participant's sampling age and
508 corresponding intervals are presented in Figure 1e-h. For all of the measurement intervals, 122 (32.1%) were achieved by
509 design.

510 **Quality Assessment**

511 **Phenotypic Data**

512 All of the psychological and behavioural data were made available to users regardless of data quality. We provided all the
513 information on situations that may affect the quality of data within the "json" file. This can guide investigators decisions
514 regarding inclusion of the result data. To verify whether the measured distributions obey a normal distribution, we performed
515 preliminary statistical analysis of several core behaviour measures in the dataset (Figure 3). Distributions of FSIQ and four
516 indices are shown in Figure 3a. We summarize the median, mean and standard deviation for each Sample. As shown in Table
517 7, the Shapiro-Wilk test suggests that the sample data commonly disobey a Gaussian distribution. We believe that this is a
518 common situation that arises when recruiting from the local community (PEK sample), as the program tends to attract parents
519 with high levels of education who place greater emphasis on education. Better education conditions could result in higher IQ.
520 Furthermore, the IQ scores were normalized based on the normative model of Chinese children established in 2008³⁴, which
521 may be out of time. Additionally, there was a significant difference between the FSIQ, WMI, PRI and VCI performance of
522 the two samples as identified by the rank-sum test. Mental health assessed by CBCL scores demonstrated that the majority of
523 participants were in the normal range (Figure 3b) with only 12 participants (1.77%) exhibiting CBCL total problem scores
524 ≥ 70 . We performed preliminary statistical analysis of several core characterization measures and present their accuracy rates
525 in Figure 3c.

526 **Structural MR Imaging**

527 Structural MRI images were first anonymized to remove all facial information from the raw MRI data. We obscured the facial
528 information using the face-masking tool customized with the Chinese paediatric templates¹⁶. The anonymized images were
529 then denoised by spatially adaptive nonlocal means and corrected for intensity normalization in the Connectome Computation
530 System (CCS)⁷⁵. To extract individual brains, we trained a deep learning method using a small set of semiautomatically
531 extracted brains in the CKG Sample, and then applied it to all the devCCNP samples. The preprocessed brain volumes were all
532 in the native space and fed into the FreeSurfer (version 6.0) pipeline to obtain general morphological measurements of different
533 brain morphometry. We visually inspected the quality of the T1-weighted images, and two raters were trained to rate the quality
534 using a 3-class framework⁷⁶, with "0" denoting images that suffered from gross artefacts and were considered unusable, "1"

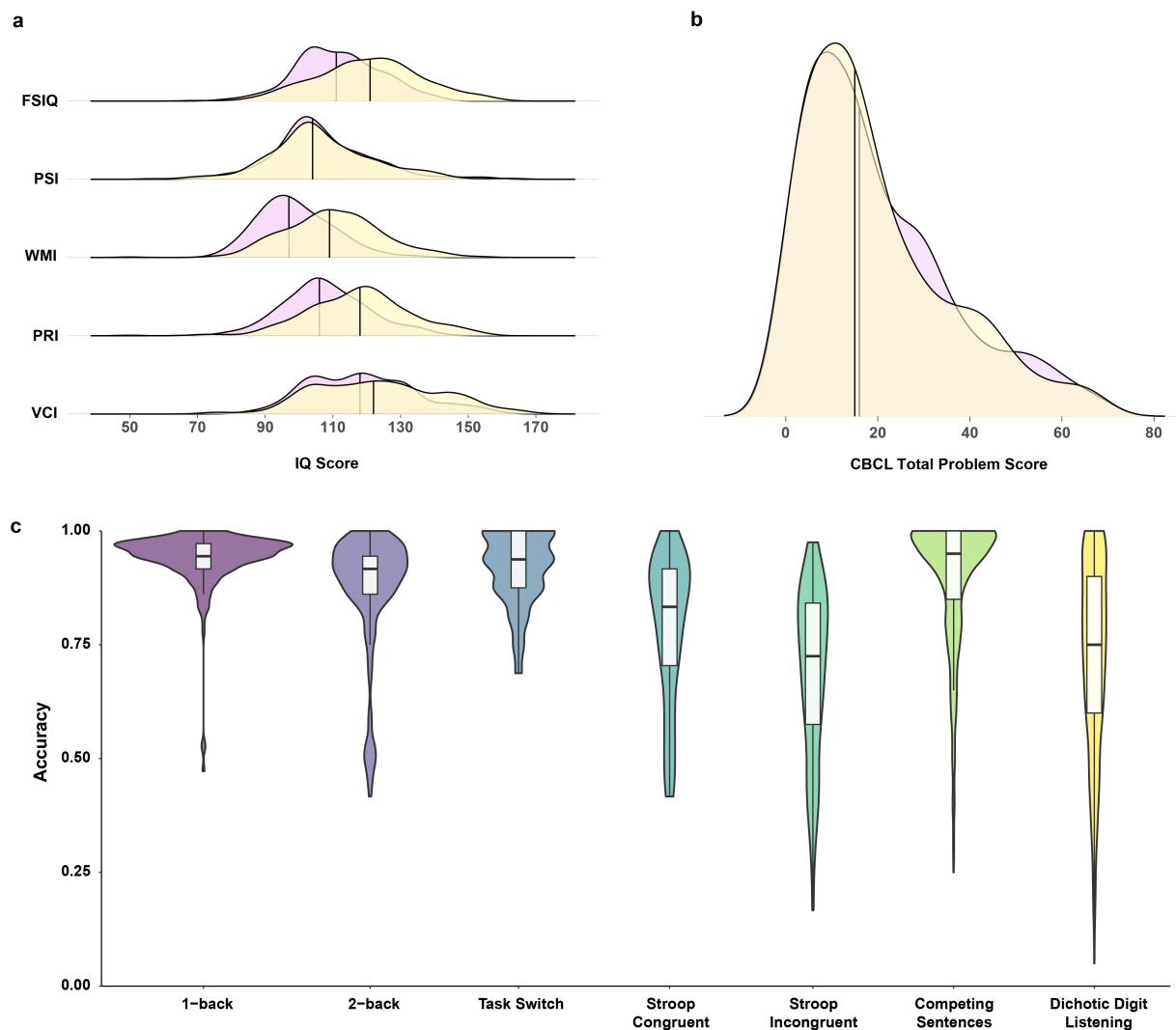


Figure 3. Example of performance on several core characterization measures. (a) Distribution of Full Scale Intelligence Quotient (FSIQ) with four indices: Processing Speed Index (PSI), Working Memory Index (WMI), Perceptual Reasoning Index (PRI), and Verbal Comprehension Index (VCI). Related statistical results are shown in Table 7. (b) Distribution of CBCL total problem scores. Two samples are displayed separately (CKG, light pink; PEK, canary) in (a-b), and vertical lines indicate the medians of samples. (c) Distribution of accuracy rates for seven behaviour measurements. Extremely low values are removed for plotting. Data are represented for measurements of all waves.

535 with some artefacts, but that were still considered usable, and "2" free from visible artefacts. Images with an average score
 536 lower than "1" across the two raters were excluded. A total of 761 (91.9%) images passed the quality control, with 436 (94.8%)
 537 images in the CKG Sample and 325 (88.3%) images in the PEK Sample. The Spearman's rank correlation coefficient of the
 538 two raters was 0.495.

539 **Functional MR Imaging**

540 RfMRI data preprocessing⁷⁵ included the following steps: (1) dropping the first 10s (5 TRs) for the equilibrium of the magnetic
 541 field; (2) correcting head motion; (3) slice timing; (4) despiking for the time series; (5) estimating head motion parameters; (6)
 542 aligning functional images to high resolution T1 images using boundary-based registration; (7) mitigating nuisance effects such
 543 as ICA-AROMA-derived, CSF and white matter signals; (8) removing linear and quadratic trends of the time series; and (9)
 544 projecting volumetric time series to *fsaverage5* cortical surface space. Scans with a mean FD greater than 0.5 were excluded. A
 545 total of 452 (98.3%) scans in the CKG Sample and 328 (92.4%) scans in the PEK Sample had at least one rfMRI passed the
 546 quality control in each session.

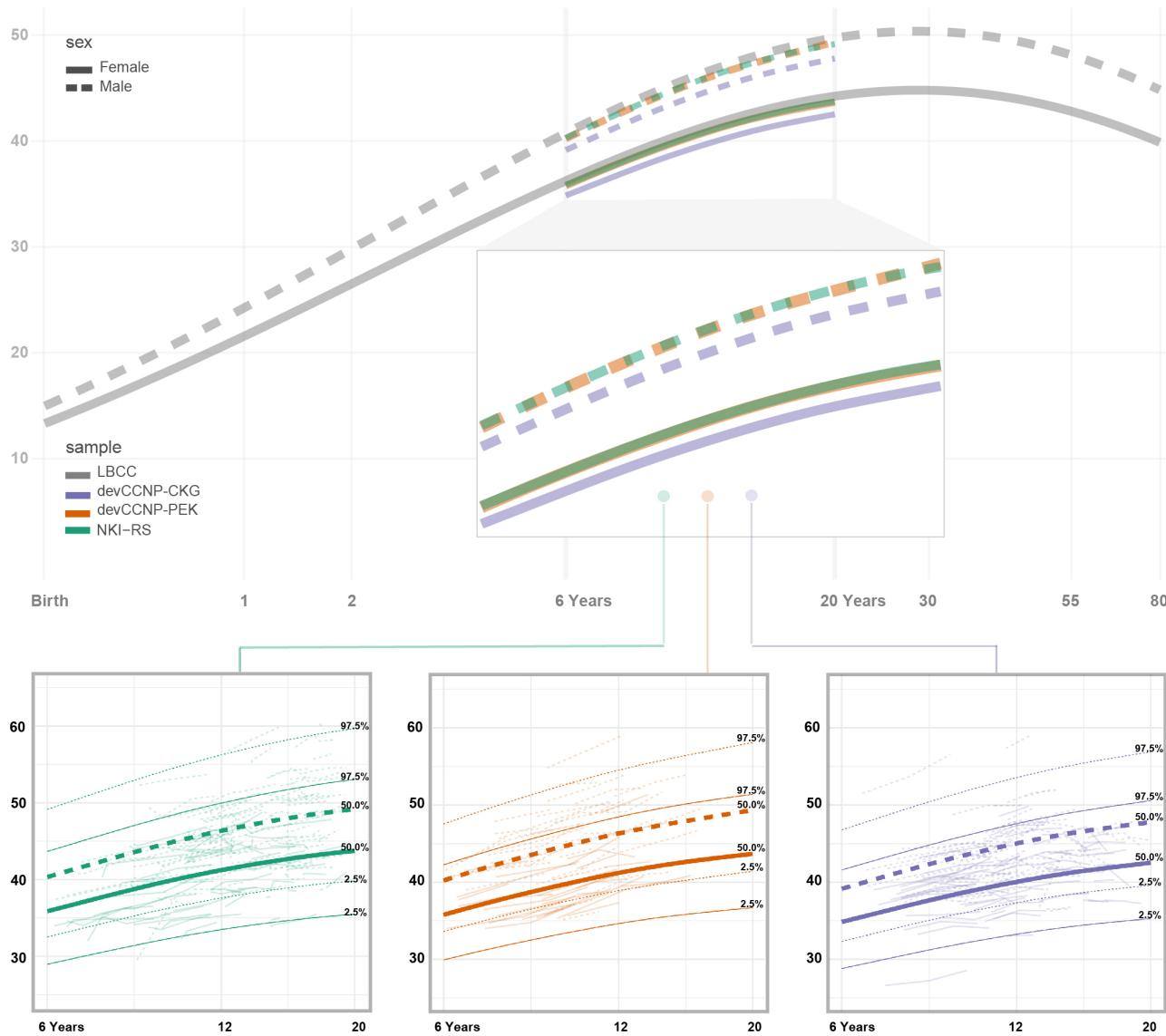


Figure 4. Site/sex-specific brain charts of white matter volume (WMV). The sex-specific lifespan brain charts of WMV (LBCC, light gray) were adjusted by leveraging the school-aged (6–18 years old) samples for three sites (devCCNP-CKG, purple; devCCNP-PEK, orange; NKI-RS, green). The site-specific brain charts are depicted with their percentiles (2.5%, 50%, 97.5%) for males (dashed lines) and females (solid lines). The background polylines characterize individual WMV changes (unit: 10ml or 10,000mm³) extracted from the multicohort accelerated longitudinal samples.

547 Brain Growth Charts

548 Growth charts on height, weight and head circumference are a cornerstone of paediatric health care. A similar tool has
 549 been recently generated for lifespan development of human brain morphology¹⁸ by the Lifespan Brain Chart Consortium
 550 (LBCC) (<https://github.com/brainchart/lifespan>). While promising for characterizing the neurodevelopmental milestones and
 551 neuropsychiatric disorders, these charts need more diverse samples to enhance their utility in practice. Here, we employed the
 552 devCCNP Sample and the NKI-Rockland Sample (NKI-RS) for Longitudinal Discovery of Brain Development Trajectories⁷⁷
 553 to upgrade the LBCC charts. All the preprocessed T1-weighted MRI images from devCCNP and NKI-RS were subjected to the
 554 same manual quality control procedure from the same raters at each site.

555 Specifically, the maximum likelihood method was used to estimate sample-specific or site-specific statistical offsets (random
 556 effects, i.e., mean μ , variance σ , and skewness ν) from the age- and sex-appropriate epoch of the normative brain growth
 557 trajectory modelling through the Generalized Additive Models for Location, Scale and Shape (GAMLSS: see details of the

558 site-specific growth chart modeling in Figure 5 from the LBCC original work¹⁸). Out-of-sample centile scores for each
559 participant from the devCCNP and the NKI-RS site benchmarked against the offset trajectory were estimated. The normative
560 growth trajectories were estimated for not only global neurotypes including total cortical grey matter volume (GMV), total white
561 matter volume (WMV), total subcortical grey matter volume (sGMV), global mean cortical thickness (CT) and total surface
562 area (SA) but also, regional neurotypes, including volumes of the 34 neuroanatomical areas according to the Desikan-Killiany
563 (DK) parcellation⁷⁸.

564 According to the lifespan WMV trajectory from the LBCC seminal work¹⁸ (i.e., rapid growth from mid-gestation to
565 early childhood, peaking in young adulthood at 28.7 years), we presented the growth curves of WMV for devCCNP-CKG,
566 deveCCNP-PEK and NKI-RS (Figure 4). These curves indicated rapid increases in WMV from childhood to adolescence
567 consistent with the LBCC findings. To better illustrate the growth curve differences between populations, we depicted site-
568 and sex-specific (adjusted) growth curves of WMV in Figure 4 (top). WMV is made up of the connections between neurons
569 for cortical communications via neural information flow, and thus, its growth reflects underlying microstructural plasticity
570 during school-age neurodevelopment⁷⁹ (e.g., language performance and training effects during learning⁸⁰). In our analyses,
571 the study-specific variability (e.g., imaging or sample bias) was adjusted by the GAMLSS modelling method. Therefore, the
572 findings we detected are more reproducible and generalizable across devCCNP and NKI-RS samples. Specifically, as shown in
573 Figure 4, boys had larger WMV than girls, whereas the CKG participants (bottom, right) exhibited relatively smaller WMV than
574 the participants from PEK (bottom, middle) and NKI-RS (bottom, left). Brain growth curves are included in the Supplementary
575 Information (GMV, Figure S1; sGMV, Figure S2; TCV, Figure S3; mean CT, Figure S4; TSA, Figure S5).

576 To quantitatively estimate the diversity in brain growth attributable to ethnicity (referring between devCCNP to NKI-RS)
577 and geographics (referring between devCCNP-CKG to devCCNP-PEK), we computed the normalized variance (NV)¹⁶ of
578 regional volume for each DK-parcel with the following equation

$$NV = 2 \times \frac{\delta(V_{devCCNP} - V_{NKI-RS})}{\mu(V_{devCCNP} + V_{NKI-RS})}$$

579 , where V is a vector referring to the parcel volume and δ refers to the standard deviation. In other words, NV indicates the
580 degree of curve shape dispersion between two growth curves across ages (we use 0.1 year as the sample age). δ is normalized
581 by the mean volume of parcels across two samples, denoted as μ . The results are illustrated in Figure 5 (first row). A small NV
582 indicates that two brain growth curves share similar shapes, and vice versa. The sex-specific lifespan brain charts of regional
583 volume (unit: ml) specific to one high NV (Pars Orbitalis; second row) and one low NV (Paracentral Lobule; third row) were
584 depicted to illustrate the differences. As shown in Figure 5 (bottom), we matched the 34 parcellated regions to the 8 large-scale
585 functional networks⁸¹ for an intuitive sense of the growth chart differences at the network level. We present the NV rank for
586 comparisons between NKI-RS and devCCNP as well as between devCCNP-CKG and devCCNP-PEK in Figure 5 (forth row).
587 As done in the LBCC paper¹⁸, we built normative growth charts of a brain parcel by GAMLSS modelling on the total volume
588 of the parcel as the sum of its two homotopic areas in the two hemispheres. The NV and its rank maps were rendered onto
589 both lateral and medial cortical surfaces of the left hemisphere for visualization purposes. Details of NV are listed in Table S1
590 and S2 according to their ranking orders. Individual differences in growth charts of cortical volumes between devCCNP and
591 NKI-RS are much larger than those between CKG and PEK. Such differences are spatially ranked in a consistent order among
592 populations, indicating more diverse growth curves among individuals in high-order associative (frontoparietal or cognitive
593 control, ventral attention, default mode and language) areas than those in primary areas.

594 Usage Notes

595 Part of this dataset has been successfully used in our previous publications. Two review articles (in Chinese¹⁵ and English¹²)
596 were published to summarize the devCCNP protocol for experimental design, sample selection, data collection, and preliminary
597 key findings in stages. With the baseline brain imaging data from devCCNP-CKG, we previously reported that children
598 exhibited similar region-specific asymmetry of the dorsal anterior cingulate cortex (dACC) as adults, and further revealed that
599 dACC functional connectivity with the default, frontoparietal and visual networks showed region-specific asymmetry⁸². Head
600 motion data during mock scanning from devCCNP-PEK were used to demonstrate frequency-specific evidence to support
601 motion potentially as a developmental trait in children and adolescents by the development of a neuroinformatic tool DREAM⁸³.
602 Social anxiety was positively correlated with the GMV in an area of the orbital-frontal cortex, and its functional connectivity
603 with the amygdala⁸⁴. A standardized protocol for charting brain development in school aged children has been developed to
604 generate the corresponding brain templates and model growth charts, revealing differences in brain morphological growth
605 between Chinese and American populations particularly around puberty¹⁶. Meanwhile, by manual tracing, we charted the
606 growth curves of the human amygdala across school ages through longitudinal brain imaging⁸⁵. Using rfMRI data, we revealed
607 age-dependent changes in the macroscale organization of the cortex, and the scheduled maturation of functional connectivity

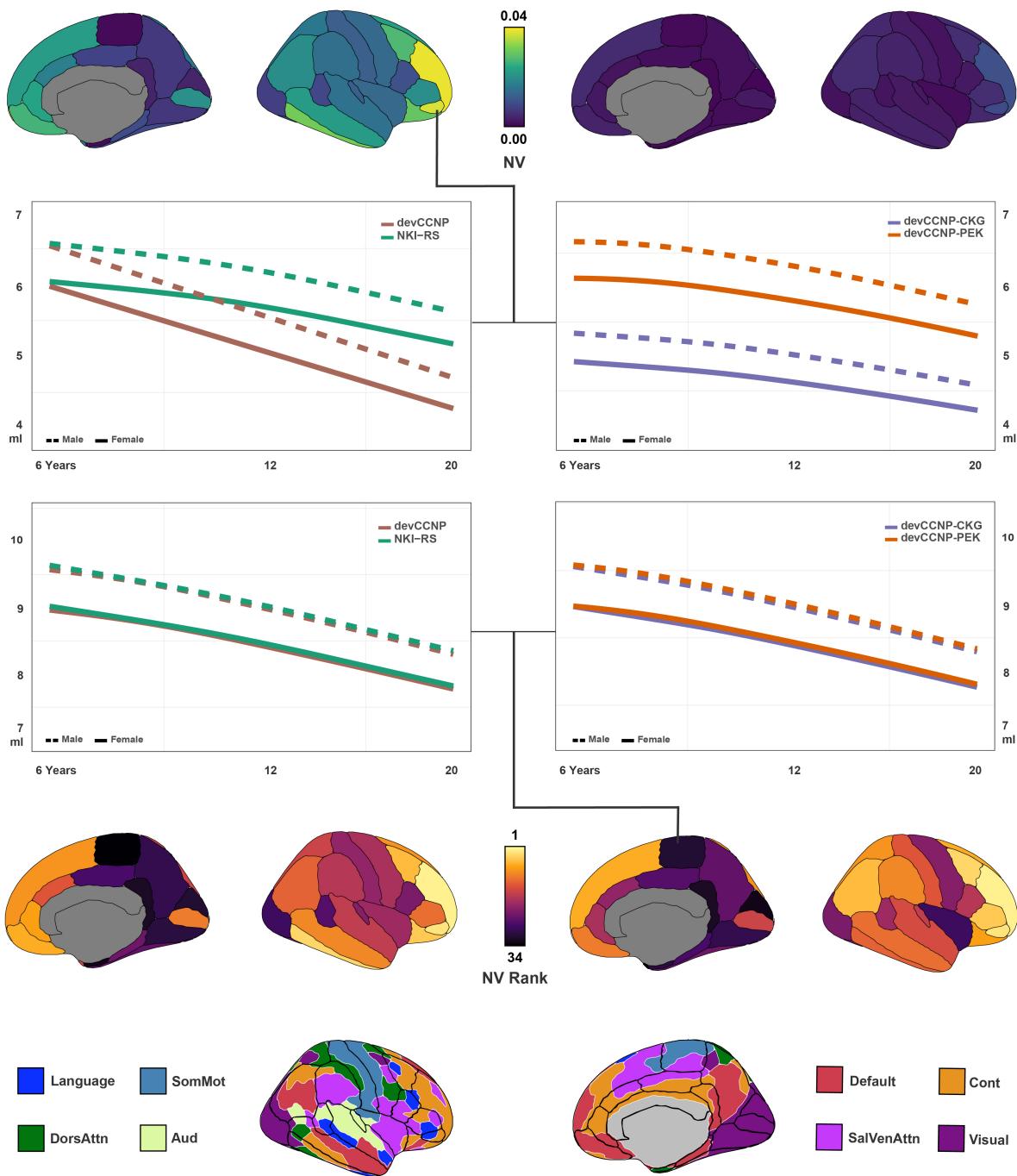


Figure 5. Similarities in brain growth curves between devCCNP and NKI-RS. NV values of the similarity between the United States and China (first row, left) and two samples within devCCNP (first row, right) are presented through 34 gyral-based neuroanatomical regions, referred to as Desikan-Killiany parcellation⁷⁸ (bottom, matched to Kong2022 8 large-scale functional network order⁸¹). Sex-specific lifespan brain charts of regional volume (unit: ml) specific to one high NV (pars orbitalis; second row) and one low NV (paracentral lobule; third row) are depicted. Males are denoted with dashed lines and females are denoted with solid lines. On this basis, the ranks of NV values of these regions are presented (forth row) from highest to lowest. See Table S1 and S2 for detailed values. Note that only the NV values and rank of female participants are shown here, as brain charts are modelled sex-specifically¹⁸. The left hemisphere is plotted here purely for visualization purposes. See Figure S6 for results relating to male participants.

gradient shifts, which are critically important for understanding how cognitive and behavioural capabilities are refined across development, marking puberty-related changes¹⁷.

The baseline imaging data of the CKG Sample has been released as part of the CoRR⁷⁴ and the IPCAS 7 site (http://dx.doi.org/10.15387/fcp_indi.corr.ipcas7), which has been listed as one of the existing, ongoing large-scale developmental dataset⁸⁶. As part of an international consortium recently initiated for the generation of human lifespan brain charts¹⁸, CCNP contributes to the largest worldwide MRI samples ($N > 120,000$) for building normative brain charts for the human lifespan (0 – 100 years). The full set of devCCNP data is increasingly appreciated by collaborative studies on school-aged children and adolescents. All data obtained freely from the INDI-CoRR-IPCAS7 or CCNC, can only be used for scientific research purposes. The users of this dataset should acknowledge the contributions of the original authors, properly cite the dataset based on the instructions on the Science Data Bank website (<https://doi.org/10.57760/sciencedb.07478> and <https://doi.org/10.57760/sciencedb.07860>). We encourage investigators to use this dataset in publication under the requirement of citing this article and contact us for additional data sharing and cooperation.

Code availability

No custom codes or algorithms were used to generate or process the data presented in this manuscript.

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938 Competing interests

939 The authors declare no competing interests.

940 **Tables**

	Age of Implementation	CKG Sample	PEK Sample	Duration (minutes)
Demographics				
Sex, date of birth, race, birth weight, gestational age at birth	All	All, Parental	✓	~3
Handedness ^{23,24}	All	✓	✓	~3
Participant Characteristic				
Education level, academic performance	All	All, Parental	✓	~15
Music Training History Questionnaire for Children ^{27,28}	All	All, Parental	✓	~15
Child Behaviour Checklist, CBCL ^{25,26}	6–18, Parental	✓	✓	~15
Family Characteristics				
Area (urban/rural), number of children	All	All, Parental	✓	~3
Education level, careers and industries of parents	All	All, Parental	✓	~3
Subjective social status (Self-designed)	All	All, Parental	✓	~3
Biophysical Measures				
Height, weight, head circumference, cardiovascular (blood pressure, pulse)	All	✓	✓	~3
Visual acuity, pure tone audiology ²⁹	6–18	✓	✓	~10
Physical Fitness Measures				
Grip strength ³⁰ , standing broad jump ³¹ , 15-meter shuttle run ³²	6–18	✓	✓	~15
Rating of Perceived Exertion, RPE ³³	6–18	✓	✓	~1
Intelligence Quotient Measure				
Wechsler Intelligence Scale for Children-IV-Chinese Version, WISC-IV ³⁴	≥ 6	✓	✓	~100
Chinese Version of Wechsler Adult Intelligence Scale, WAIS-IV ³⁵				
Neuroimaging				
Mock scan ⁷⁰	All	✓	✓	~30
Magnetic resonance imaging, MRI	All	✓	✓	~50
Psychological Behaviour Questionnaires				
Self-reported Pubertal Development Scale (Chinese Version), C-PDS ^{87,88}	≥ 6	✓	✓	
Pittsburgh Sleep Quality Index, PSQI ^{89,90}	≥ 6	✓	✓	
Torrance Test of Creative Thinking, TTCT ^{91,92}	≥ 6	✓	✓	
Williams Creativity Assessment Packet, CAP ^{92,93}	≥ 6	✓	✓	
Video Game Questionnaire (Self-designed)	≥ 6	✓	✓	
Eysenck Personality Questionnaire (Children's Version), EPQ ^{94,95}	≥ 7	✓	✓	
Eysenck Personality Questionnaire (Adult's Version), EPQ ^{94,96}	≥ 7	✓	✓	
Piers-Harris Children's Self-concept Scale, PHCSS ^{95,97}	6–17	✓	✓	
Social Anxiety Scale for Children, SASC ^{98,99}	7–16	✓	✓	
Multidimensional Anxiety Scale for Children, MASC ^{100,101}	8–19	✓	✓	
State-Trait Anxiety Inventory (Form Y), STAI-Form Y ^{102,103}	≥ 6	✓	✓	
Chinese Perceived Stress Scale, CPSS ^{104,105}	≥ 10	✓	✓	
Positive Affect and Negative Affect Scale, PANAS ^{106,107}	≥ 6	✓	✓	
Social Value Orientation, SVO ^{108,109}	≥ 6	✓	✓	~90

Table 1. Complete protocol

Example of 2-visit Schedule		
	Day 1	Day 2
09 AM	Demographics & Characteristics Mock MRI Scan	Intelligence Quotient Measure
10 AM	Biophysical Measures	
11 AM	Magnetic Resonance Imaging	Psychological Behaviour Tasks/Tests Part2
12 PM	Lunch Break	
13 PM	Psychological Behaviour Questionnaires	Psychological Behaviour Tasks/Tests Part4
14 PM		
15 PM		
16 PM	Psychological Behaviour Tasks/Tests Part1	Physical Fitness Measures

Example of 4-visit Schedule		
	Day 1	Day 2
09 AM	Demographics & Characteristics Mock MRI Scan	Psychological Behaviour Questionnaires
10 AM	Biophysical Measures	
11 AM	Magnetic Resonance Imaging	Psychological Behaviour Tasks/Tests Part1
	Day 3	Day 4
09 AM	Psychological Behaviour Tasks/Tests Part2	Intelligence Quotient Measure
10 AM		
11 AM		Physical Fitness Measures

Table 2. Examples of two individual schedule for each wave's data collection

	CKG Sample	PEK Sample	
Scanner Head Coil	Siemens Trio Tim, 3.0T 12-channel	GE Discovery MR750, 3.0T 8-channel	
	r-fMRI	r-fMRI	ns-fMRI
Sequence	EPI	Gradient Echo	Gradient Echo
Time Acquisition (min:sec)	7m:45s	6m	6m:06s
Slices	38	33	33
% FOV Phase	1	1	1
Resolution (mm)	3 × 3 × 3	3.5 × 3.5 × 4.2	3.5 × 3.5 × 4.2
matrix	72 × 72	64 × 64	64 × 64
TR (ms)	2500	2000	2000
TE (ms)	30	30	30
Flip Angle (°)	80	90	90
Notes			
	T1-weighted	T1-weighted	DTI
Sequence	3D MPRAGE	3D SPGR	Spin Echo
Time Acquisition (min:sec)	8m:19s	4m:41s	10m:54s
Slices	176	176	75
% FOV Phase	1	1	1
Resolution (mm)	1 × 1 × 1	1 × 1 × 1	2 × 2 × 2
matrix	256 × 256	256 × 256	112 × 112
TR (ms)	2600	6.7	8724
TE (ms)	3.02	2.9	81.4
Flip Angle (°)	8	12	90
Notes	900ms TI	450ms TI	64 directions, 10 b0 images, b=1000s/mm ²

Table 3. MRI Protocol Parameters

Order	Name	Description
1	Animal Humane Society	Cute cats in an animal welfare facility
2	The World is Where We Live	Side-by-side clips of the human world and the animal world to show the connection between humans and wildlife
3	A Love Story in Milk	A love story between two milk bottles
4	Water ink	Painting with water and black ink
5	50 Years of Flower Power	A story about the Struggle for Human Rights in the last 50 years
6	You can help save the Cerrado	Fingertut demonstrating the wildlife

Table 4. Summary of the advertisements included in the first movie clip used in PEK Sample. (Table 1 in ref⁷²)

Age Group	Sample	≤5	6	7	8	9	10	11	12	13	14	15	16	17	≥18	Enrollments
Wave1	CKG	0	7	21	19	22	27	29	10	20	10	10	20	12	0	207
	PEK	8	37	51	31	47	36	24	16	5	4	4	3	3	3	272
Wave2	CKG	0	0	2	17	18	24	20	30	7	14	9	7	9	6	163
	PEK	0	0	7	12	15	13	17	10	4	4	1	0	0	1	84
Wave3	CKG	0	0	0	0	8	25	15	6	18	7	7	7	2	6	101
	PEK	0	0	0	1	2	10	3	8	4	3	4	2	0	0	37
Total		8	44	81	80	112	135	108	80	58	42	35	39	26	15	864

Table 5. Enrollments of each age cohort in two Samples

	CKG Sample	PEK Sample	Total
Site	Southwest University	Chinese Academy of Sciences	
Location	Beibei District, Chongqing	Chaoyang District, Beijing	
Area	Southwest China	North China	
Sample Environment	School-based	Community-based	
Enrollment	201	272	479
Female	105	121	230
Male	96	151	249
Under 12 Years Old	119	234	359

Table 6. Enrollment profile at two Samples

IQ Measures	Sample	Median	Mean	SD	Shapiro-Wilk Test		Rank-Sum Test	
					W-value	P-value	W-value	P-value
FSIQ	CKG	111	111.54	12.08	0.99	0.01	99068.50	0.00
	PEK	121	120.58	15.49	1.00	0.68		
	devCCNP	115	115.52	14.39	0.99	0.00		
PSI	CKG	104	106.71	14.00	0.96	0.00	71633.00	0.92
	PEK	104	106.79	15.52	0.98	0.00		
	devCCNP	104	106.75	14.67	0.97	0.00		
WMI	CKG	97	98.90	10.85	0.97	0.00	105471.00	0.00
	PEK	109	110.11	14.37	0.99	0.02		
	devCCNP	103	103.77	13.67	0.98	0.00		
PRI	CKG	106	107.85	12.49	0.99	0.01	100167.00	0.00
	PEK	118	117.69	15.30	0.99	0.00		
	devCCNP	112	112.12	14.61	0.99	0.00		
VCI	CKG	118	118.47	15.48	0.98	0.00	82407.50	0.00
	PEK	122	123.34	18.56	0.99	0.01		
	devCCNP	120	120.59	17.05	0.99	0.00		

Table 7. Distribution and statistics of IQ measures

1 A longitudinal resource for population neuroscience 2 of school-age children and adolescents in China: 3 Supplementary Figures & Tables

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43 ^{*}LBCC is an international consortium and has built brain charts to identify previously unreported
44 neurodevelopmental milestones. More information are available at <https://github.com/brainchart/lifespan>.

45 ^{**}CCNP is a long-term effort (2013-2032) to build the lifespan brain-mind development cohort in China, and more
46 consortium information are available at <http://deepneuro.bnu.edu.cn/?p=163>.

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49 **ABSTRACT**

During the past decade, cognitive neuroscience has been calling for population diversity to address the challenge of validity and generalizability, ushering in a new era of population neuroscience. The developing Chinese Color Nest Project (devCCNP, 2013-2022), a ten-year pilot stage of the lifespan CCNP (2013-2032), is an ongoing project focusing on brain-mind development. The project aims to create and share a large-scale, longitudinal and multimodal dataset of typically developing children and adolescents (ages 6.0–17.9 at enrolment) in the Chinese population. The devCCNP houses not only phenotypes measured by demographic, biophysical, psychological and behavioural, cognitive, affective, and ocular-tracking assessments but also neurotypes measured with magnetic resonance imaging (MRI) of brain morphometry, resting-state function, naturalistic viewing function and diffusion structure. This Data Descriptor introduces the first data release of devCCNP including a total of 864 visits from 479 participants. Herein, we provided details of the experimental design, sampling strategies, and technical validation of the devCCNP resource. We demonstrate and discuss the potential of a multicohort longitudinal design to depict normative brain growth curves from the perspective of developmental population neuroscience. The devCCNP resource is shared as part of the “Chinese Data-sharing Warehouse for *In-vivo Imaging Brain*” in the *Chinese Color Nest Project (CCNP) – Lifespan Brain-Mind Development Data Community* (<https://www.scidb.cn/en/c/ccnp>) at the Science Data Bank.

51 **Design Types** • Accelerated longitudinal design • Brain-mind development • Population imaging • Brain chart • Repeated
52 measure

53 **Measurements** • Psychological behaviours • Biophysical and physical measures • Intelligence quotient measure • Neuroimaging
54

55 **Sample Characteristic - Organism** • *Homo sapiens*

56 **Sample Characteristic - Environment** • School- and community-based sample

57 **Sample Characteristic - Location** • Chongqing and Beijing, China

58 **Duration** • 10 years (2013-2022)

59 **Supplementary Materials**

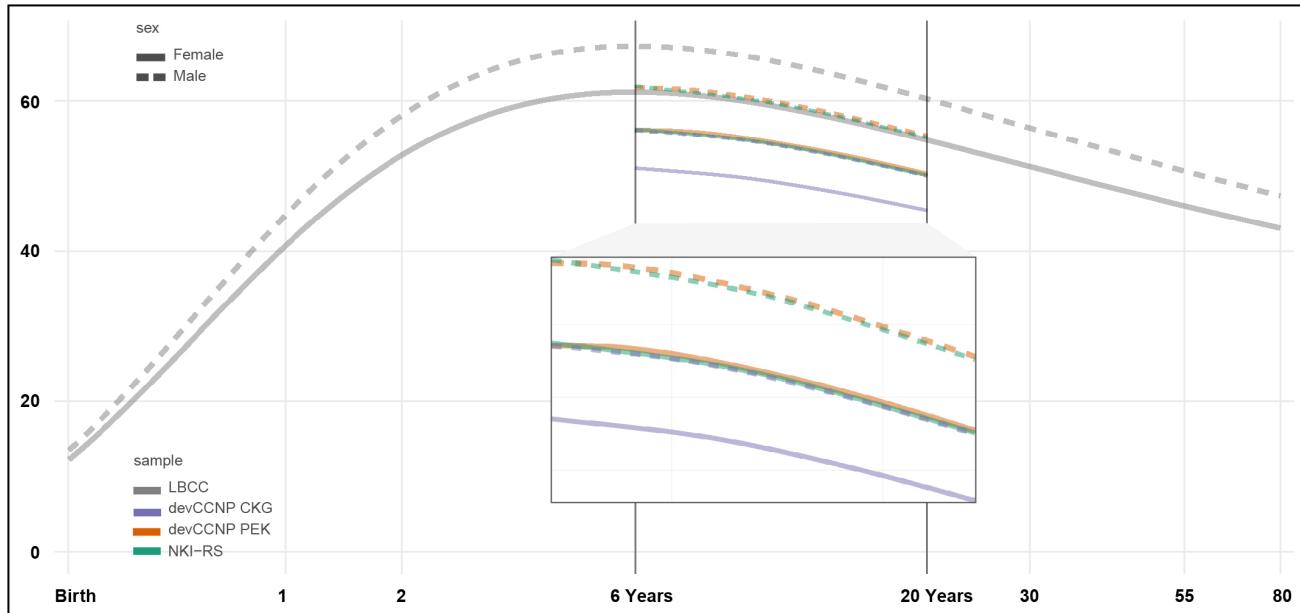


Figure S1. Site/sex-specific brain charts of grey matter volume (GMV). The sex-specific lifespan brain charts of GMV (LBCC, light gray) were adjusted by leveraging the school-aged (6–18 years old) samples for three sites (devCCNP-CKG, purple; devCCNP-PEK, orange; NKI-RS, green), with male (dashed lines) and female (solid lines) respectively. unit: 10ml or 10,000mm³.

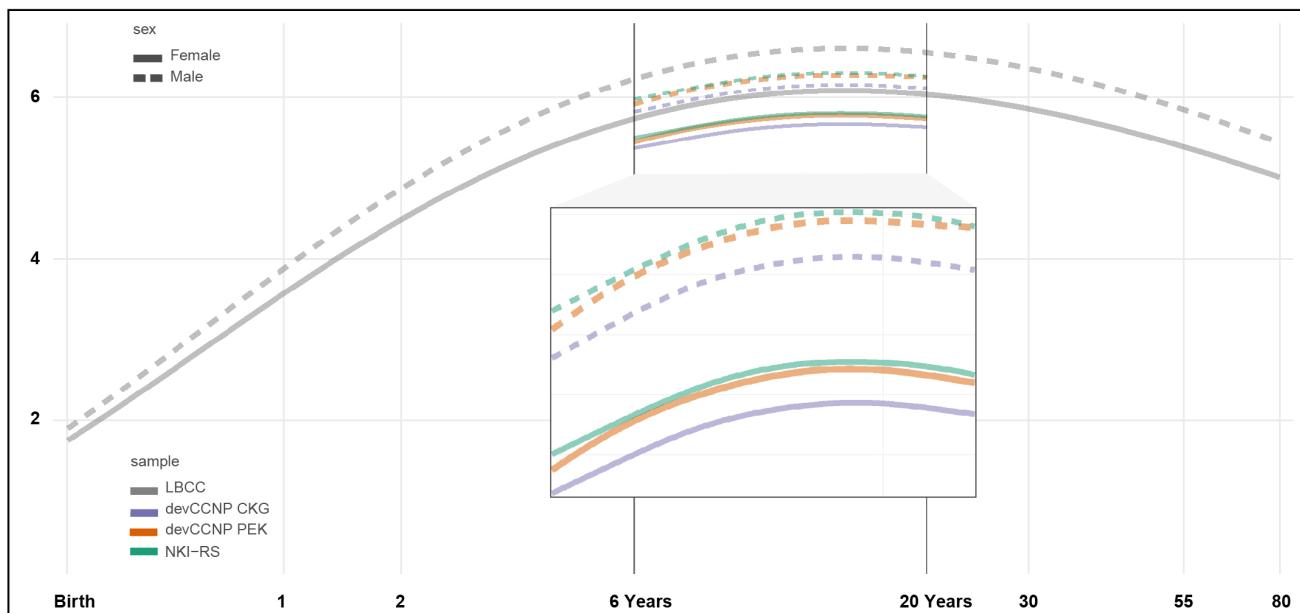


Figure S2. Site/sex-specific brain charts of subcortical grey matter volume (sGMV). The sex-specific lifespan brain charts of sGMV (LBCC, light gray) were adjusted by leveraging the school-aged (6–18 years old) samples for three sites (devCCNP-CKG, purple; devCCNP-PEK, orange; NKI-RS, green), with male (dashed lines) and female (solid lines) respectively. unit: 10ml or 10,000mm³.

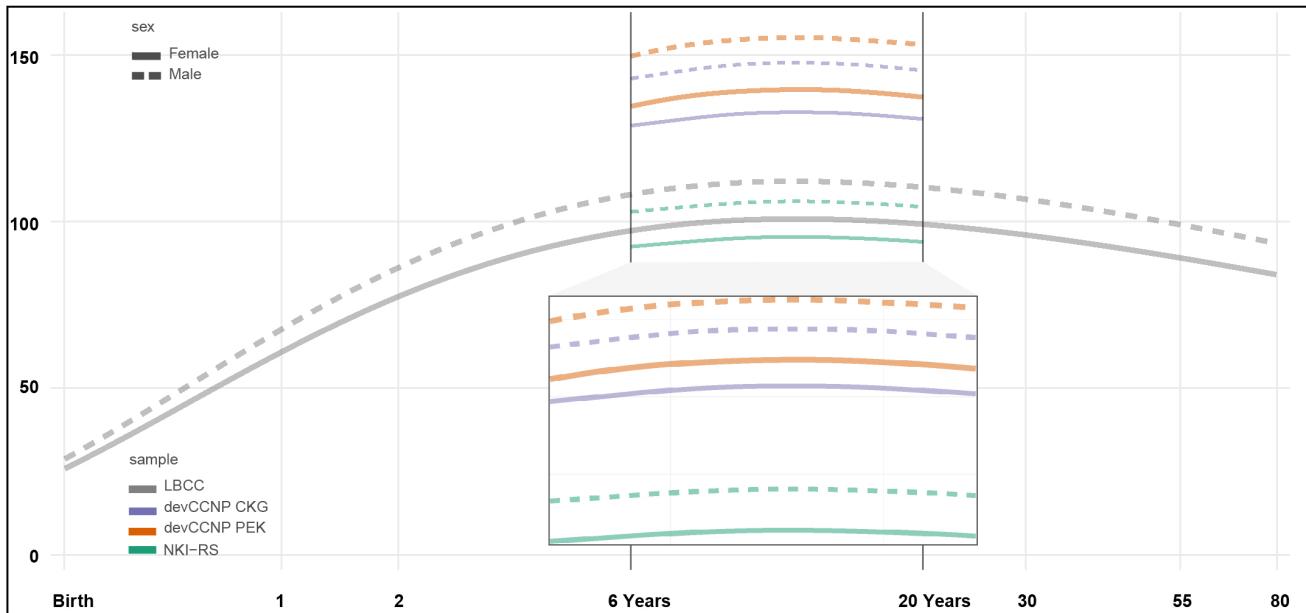


Figure S3. Site/sex-specific brain charts of total cerebrum volume (TCV). The sex-specific lifespan brain charts of TCV (LBCC, light gray) were adjusted by leveraging the school-aged (6–18 years old) samples for three sites (devCCNP-CKG, purple; devCCNP-PEK, orange; NKI-RS, green), with male (dashed lines) and female (solid lines) respectively. unit: 10ml or 10,000mm³.

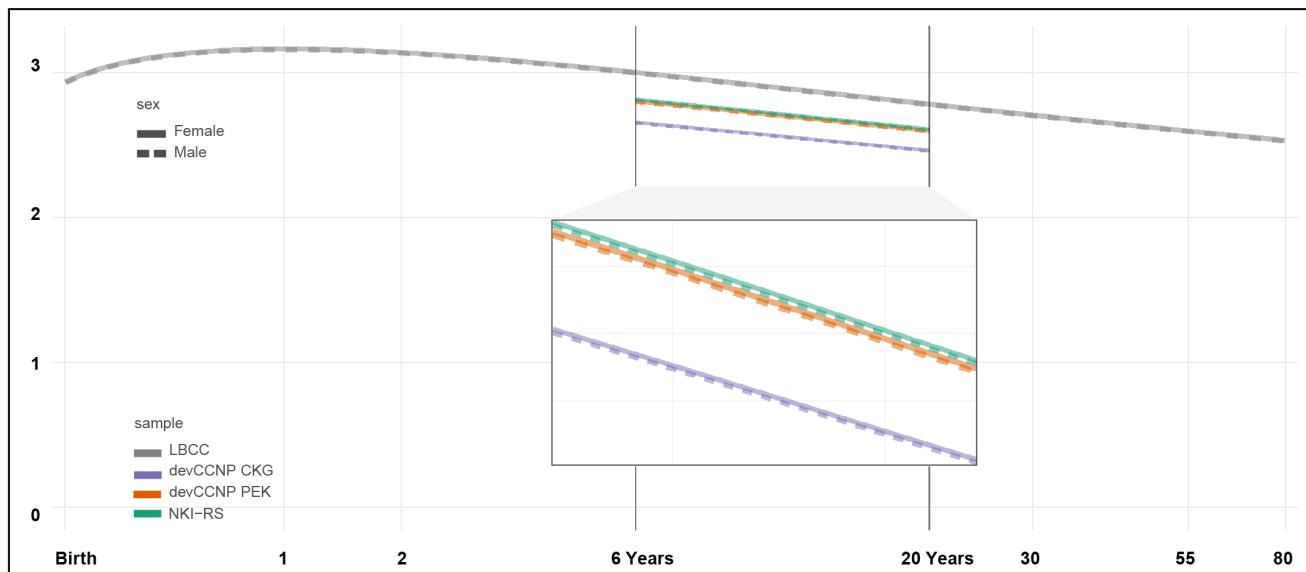


Figure S4. Site/sex-specific brain charts of mean cortical thickness (CT). The sex-specific lifespan brain charts of mean CT (LBCC, light gray) were adjusted by leveraging the school-aged (6–18 years old) samples for three sites (devCCNP-CKG, purple; devCCNP-PEK, orange; NKI-RS, green), with male (dashed lines) and female (solid lines) respectively. unit: mm.

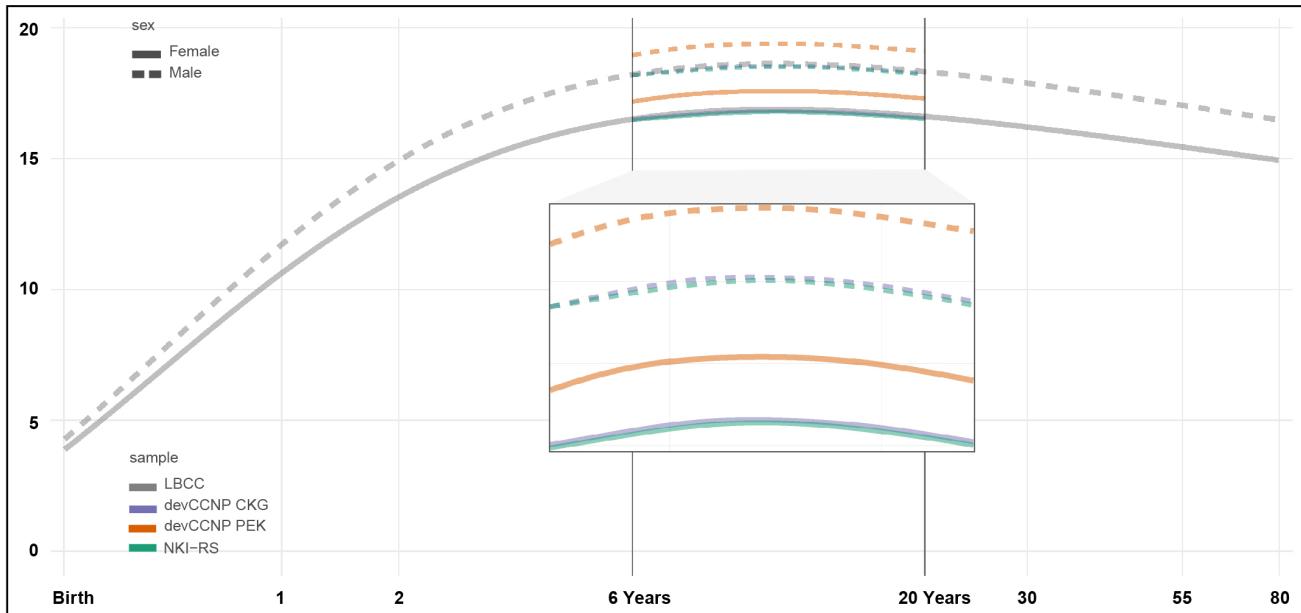


Figure S5. Site/sex-specific brain charts of total surface area (TSA). The sex-specific lifespan brain charts of TSA (LBCC, light gray) were adjusted by leveraging the school-aged (6–18 years old) samples for three sites (devCCNP-CKG, purple; devCCNP-PEK, orange; NKI-RS, green), with male (dashed lines) and female (solid lines) respectively. unit: $10,000\text{mm}^2$.

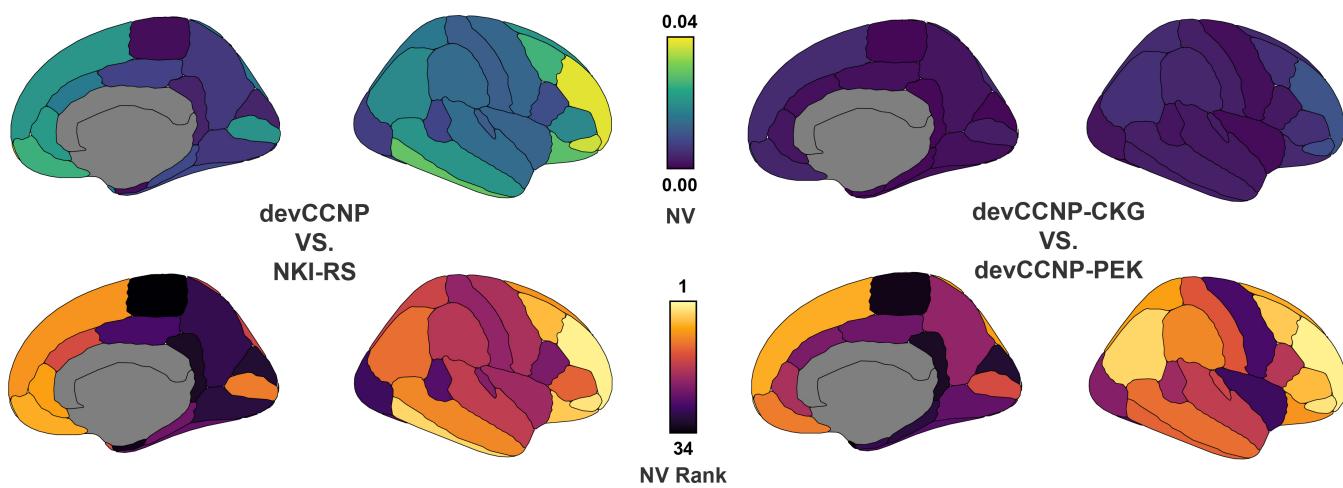


Figure S6. Similarities of brain growth curves between male participants in devCCNP and NKI-RS. NV values of the similarity between the United States and China (top, left) and two Samples within devCCNP (top, right) are presented through 34 gyral-based neuroanatomical regions. NV rank of these parcels are presented respectively bottom) from highest (order 1) to lowest (order 34).

NV Rank	Region	Network	NV
1	Rostral middle frontal gyrus	Default, Language, Cont, SalVenAttn	0.0443
2	Pars orbitalis	Default, Language, Cont	0.0429
3	Inferior temporal gyrus	Default, Language, Cont, SalVenAttn, DorsAttn, Visual	0.0354
4	Lateral orbital frontal cortex	Default, Cont, SalVenAttn	0.0338
5	Caudal middle frontal gyrus	Default, Language, Cont, SalVenAttn, DorsAttn, Visual	0.0310
6	Medial orbital frontal cortex	Default, Cont	0.0299
7	Rostral anterior cingulate cortex	Default, Cont	0.0263
8	Superior frontal gyrus	Default, Language, Cont, SalVenAttn, DorsAttn, SomMot	0.0251
9	Middle temporal gyrus	Default, Language, Cont, SalVenAttn, DorsAttn, Aud, Visual	0.0249
10	Pericalcarine cortex	Visual	0.0230
11	Pars triangularis	Default, Language, Cont, SalVenAttn	0.0224
12	Inferior parietal cortex	Default, Cont, SalVenAttn, DorsAttn, Aud, Visual	0.0223
13	Caudal anterior-cingulate cortex	Cont, SalVenAttn	0.0197
14	Temporal pole	Default	0.0188
15	Superior parietal cortex	Cont, DorsAttn, SomMot, Visual	0.0181
16	Superior temporal gyrus	Default, Language, SalVenAttn, Aud	0.0171
17	Supramarginal gyrus	Cont, SalVenAttn, DorsAttn, SomMot, Aud	0.0167
18	Precentral gyrus	Language, SalVenAttn, DorsAttn, SomMot, Visual	0.0158
19	Postcentral gyrus	SalVenAttn, DorsAttn, SomMot	0.0140
20	Transverse temporal cortex	Aud	0.0137
21	Pars opercularis	Language, Cont, SalVenAttn, DorsAttn	0.0114
22	Parahippocampal gyrus	Default, Cont, DorsAttn, Visual	0.0104
23	Fusiform gyrus	Default, Language, SalVenAttn, DorsAttn, Visual	0.0101
24	Banks superior temporal sulcus	Default, Language, SalVenAttn, Aud	0.0096
25	Posterior-cingulate cortex	Default, Cont, SalVenAttn, SomMot	0.0089
26	Lateral occipital cortex	Visual	0.0084
27	Precuneus cortex	Default, Cont, SalVenAttn, DorsAttn, SomMot, Visual	0.0072
28	Lingual gyrus	Cont, Visual	0.0071
29	Cuneus cortex	Visual	0.0042
30	Isthmus–cingulate cortex	Default, Cont	0.0039
31	Entorhinal cortex	Default, DorsAttn	0.0011
32	Paracentral lobule	SalVenAttn, SomMot, Visual	0.0009

Table S1. NV among devCCNP and NKI-RS. As explained in the manual delineation procedure of Desikan-Killiany parcellation, the region frontal pole was not actually designed as a measure of the frontal pole itself. Other frontal lobe regions were first designated and the remaining portion was called the frontal pole, which was also proven to be unreliable. The region corpus callosum was introduced to better define the regions around it. Therefore, the NV of these two regions is not shown.

NV Rank	Region	Network	NV
1	Rostral middle frontal gyrus	Default, Language, Cont, SalVenAttn	0.0114
2	Pars orbitalis	Default, Language, Cont	0.0101
3	Caudal middle frontal gyrus	Default, Language, Cont, SalVenAttn, DorsAttn, Visual	0.0056
4	Pars triangularis	Default, Language, Cont, SalVenAttn	0.0055
5	Inferior parietal cortex	Default, Cont, SalVenAttn, DorsAttn, Aud, Visual	0.0054
6	Superior frontal gyrus	Default, Language, Cont, SalVenAttn, DorsAttn, SomMot	0.0051
7	Lateral orbital frontal cortex	Default, Cont, SalVenAttn	0.0045
8	Superior parietal cortex	Cont, DorsAttn, SomMot, Visual	0.0045
9	Supramarginal gyrus	Cont, SalVenAttn, DorsAttn, SomMot, Aud	0.0039
10	Medial orbital frontal cortex	Default, Cont	0.0039
11	Middle temporal gyrus	Default, Language, Cont, SalVenAttn, DorsAttn, Aud, Visual	0.0036
12	Inferior temporal gyrus	Default, Language, Cont, SalVenAttn, DorsAttn, Visual	0.0036
13	Postcentral gyrus	SalVenAttn, DorsAttn, SomMot	0.0029
14	Superior temporal gyrus	Default, Language, SalVenAttn, Aud	0.0026
15	Pericalcarine cortex	Visual	0.0026
16	Transverse temporal cortex	Aud	0.0026
17	Pars opercularis	Language, Cont, SalVenAttn, DorsAttn	0.0025
18	Rostral anterior cingulate cortex	Default, Cont	0.0024
19	Banks superior temporal sulcus	Default, Language, SalVenAttn, Aud	0.0020
20	Caudal anterior-cingulate cortex	Cont, SalVenAttn	0.0019
21	Precentral gyrus	Language, SalVenAttn, DorsAttn, SomMot, Visual	0.0018
22	Lateral occipital cortex	Visual	0.0017
23	Fusiform gyrus	Default, Language, SalVenAttn, DorsAttn, Visual	0.0017
24	Precuneus cortex	Default, Cont, SalVenAttn, DorsAttn, SomMot, Visual	0.0015
25	Posterior-cingulate cortex	Default, Cont, SalVenAttn, SomMot	0.0014
26	Parahippocampal gyrus	Default, Cont, DorsAttn, Visual	0.0013
27	Lingual gyrus	Cont, Visual	0.0011
28	Entorhinal cortex	Default, DorsAttn	0.0011
29	Paracentral lobule	SalVenAttn, SomMot, Visual	0.0008
30	Isthmus-cingulate cortex	Default, Cont	0.0006
31	Cuneus cortex	Visual	0.0005
32	Temporal pole	Default	0.0003

Table S2. NV among devCCNP-PEK and devCCNP-CKG