Cohort Profile: Chengdu Positive Child Development (CPCD) Survey

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Key features

• The Chengdu Positive Child Development (CPCD) survey is a Chinese multidisciplinary school-based cohort study investigating any associations between students' sociodemographic, physical, and psychological characteristics, family environment, lifestyle behaviours, academic performance, and their health status.

• We recruited 8,825 students aged 6-16 from five primary and middle schools in Chengdu (the capital city of Sichuan Province) at baseline (between 23 December 2019 and 13 January 2020), and their caregivers and school principals were surveyed for students' behaviours, the caregiver's health status, and information about the schools.

• At the first follow-up of 7,985 students, completed between 16 June and 8 July 2020, COVID-19-related information was collected from both students and their caregivers; further follow-ups are planned.

• By providing an unbiased baseline in the pre-COVID era, the CPCD survey could be an important resource when studying the effect of epidemics on early-stage physical and mental development. Planned follow-up surveys would allow the effects of the epidemic on the life-course of the "COVID-19 generation" children to be examined.

• Researchers interested in collaboration should contact the principal investigator Professor Peng Jia.

Keywords

COVID-19; child development; epidemiology; spatial lifecourse epidemiology; school-based cohort; positive child development

Why was the cohort set up?

Childhood is a critical developmental stage affecting future health, competence, and capacity. According to theories of child development (physical and behavioural development risk process theories), some preventable outcomes include chronic illness, mental illness, obesity, myopia, developmental injury, substance abuse, antisocial behaviour, social alienation,

and school failure.[1,2]

Positive Child Development (PCD) is a positive psychological approach which focuses on the growth, cultivation, and nurturing of developmental assets, abilities, and potentials in children.[3,4] It focuses on each child's unique talents, strengths, interests, and potential. It aims to understand children and engaging them in productive activities rather than correcting or curing them for maladaptive tendencies.[5] It has been highlighted as a potentially supporting better health and social outcomes throughout the life course.[6-9] Many US development programs have shown positive changes in children's and adolescents' behaviours (such as interpersonal skills and quality of peer and adult relationships) and significant improvements in problem behaviours (e.g., drug and alcohol use, school misbehaviour).[10] Other studies have found similar findings where, for example, children with positive development were more satisfied with life and had fewer problem behaviours.[11-14]

There have been some efforts in tracking child development in China. For example, since 1985, the Chinese National Survey on Students Constitution and Health has conducted surveys every five years under a repeated cross-sectional study design (without follow-up data) into the physical health of children and adolescents aged 7-22 years.[15] The China Education Panel Survey, followed up annually since 2013-14, focuses on influences of various factors (e.g., individual, family, school) on the quality of education among middle school students (aged 13-15 years).[16] However, few large-sample and long-term (e.g., cohort) studies have looked at child development in mental health and social adaption. Moreover, most Chinese studies adopted a deficit perspective, focusing on children's problem behaviours and unhealthy psychological states, and seeking their causes. The importance of promoting children's holistic development has been largely overlooked.[17-20]

The Chengdu Positive Child Development (CPCD) survey is an ongoing school- based cohort study in the capital city of Sichuan Province, with support from The Hong Kong Polytechnic University and Sichuan University. Chengdu, a western China mega-city, comprises 12 urban districts, three counties, and five county-level cities. The total area is 14,335 km^2 (about 6.6% built-up areas) with about 16.6 million permanent residents (74.4% urban).

The baseline was established between 23 December 2019 and 13 January 2020. The CPCD is an integral component of the Tin Ka Ping Positive Adolescent Training through Holistic Social Programs Project, a Jockey Club Youth Enhancement Scheme. The original aims of the CPCD are understanding the current state of positive development and psychosocial and behavioural problems in children, and evaluating the effects of the Positive Child Development

programs (such as school courses of health education and promotion) on facilitating positive development and remediating psychological and behavioural problems.

Who is in the cohort?

The CPCD adopted a cluster sampling method to select five primary and middle schools: one downtown, two suburban in the south, and two suburban in the north of Chengdu. A total of 8,968 questionnaires were sent out at the baseline survey, and a total of 8,825 students at Grades 1-9 (aged 6-16) who attended school on the date of the survey have completed the questionnaire, with a response rate of 98.4%.

Prior to participation, written informed consent was given by the students' legal guardians. This included a project overview, survey procedures, potential benefits and risks, and confidentiality agreement. All students provided written informed consent before participating.

How often have they been followed up?

The first follow-up was planned for one year after the baseline survey. However, it was conducted six months ahead of schedule to capture the immediate impact of coronavirus disease 2019 (COVID-19) epidemic, commencing in late January 2020. This followed immediately after the baseline survey of participants who have all experienced the social distancing (e.g., stay-at-home, school closure).

As a result, 7,985 students were followed up for the first time between 16 June and 8 July 2020 (six months after the baseline survey); 840 students had been lost to follow-up. These were mainly middle school students, with 84.4% (709 out of 840) at Grade 9. The follow-up was too close to the high school entrance examination (14-15 July 2020) for them to participate; the remainder were absent on the survey date, but are expected to participate in future follow-ups.

Future follow-ups are planned to be both passive and active. In the passive mode, the students will be linked to the school database of physical examination to obtain data on anthropometric measurements and health outcomes. In the active mode, all students in the baseline survey will be invited to complete the baseline questionnaire every 1-2 years. All of those currently lost to follow-up are planned to be re-included to the cohort.

What has been measured?

Information collected through a self-administered questionnaire from the students and caregivers was linked to the students' physical examination database to obtain anthropometric measurements (**Table 1**). Moreover, school information was collected by interviewing school principals. In addition, COVID-19 related information was collected from both students and their caregivers in the first follow-up.

Anthropometric and sociodemographic characteristics

Anthropometric measurements, conducted by trained health professionals during the annual school physical examination, included height, weight, blood pressure, vital capacity, and naked eye vision. Naked eye vision was measured as the level that one could see on a standard logarithmic visual acuity chart (GB 11533-1989) at 5 m (test distance), without glasses and with one eye open alternately. Vital capacity (the maximum amount of air one can expel from the lungs after a maximum inhalation) was measured instrumentally. Sociodemographic characteristics were collected from both the students' and caregivers' questionnaire. These included age, sex, weekly pocket money, parents' age, education level, and occupation, family living condition and monthly income.

Health status

Health problems (such as how often students had allergic diseases, asthma, headaches, rashes or other skin problems, stomach-ache or stomach cramps, nausea, nervousness, constipation, and obesity) were reported by students' caregivers on a 3-point Likert-type scale.

Depressive symptoms were measured by the Center for Epidemiological Studies-Depression Scale. This is a 20-item tool that asks students to rate how often they have experienced depression-related symptoms or feelings in the past week.[21] Anxiety was measured by the Screen for Child Anxiety Related Disorders, a 41-item measure on a 3-point Likert-type scale.[22] Post-traumatic stress disorders was measured by the Chinese version of the Children's Revised Impact of Event Scale, a 13-item tool measuring the frequency of symptoms for intrusion, avoidance, and hyperarousal.[23]

Psychological characteristics

PCD attributes were measured by the Chinese Positive Youth Development Scale, an 80-item self-report tool with 15 sub-scales. These include bonding, resilience, social competence, recognition of positive behaviours, emotional competence, cognitive competence, behavioural competence, moral competence, self-determination, self-efficacy, clear and positive identity, beliefs in the future, prosocial involvement, prosocial norms, and spirituality.[3, 24]

Satisfaction with life was measured by a Life Satisfaction Scale,[25] the Chinese version of which has shown acceptable psychometric properties in assessing the global judgment of one's quality of life.[26] Materialism was measured by a Chinese Adolescent Materialism Scale.[27] Egocentrism was measured by a Chinese Adolescent Egocentrism Scale.[28] Empathy was measured using an 11-item scale with items such as "I try to understand others' perspectives when making a decision", which was developed specifically for this cohort's data collection. Family dysfunction was measured by a Chinese Family Assessment Instrument with five subscales: mutuality, communication, conflict and harmony, parental concern, and parental control.[29]

Academic performance

Three aspects of academic performance were measured by the instruments developed specifically for this cohort's data collection.

Academic intrinsic value was assessed by two questions: "Do you think doing school work is boring?" and "Do you enjoy doing your school work?".

Academic utility value was assessed by three questions: "How useful do you think what you learned in school is now in your daily life?", "How much of what you learn in school today do you think will be useful to you in your daily life in the future?", and "How much do you think what you learned in school will help you become the person you want to be when you graduate?".

Academic anxiety was assessed by three questions: "How worried are you about falling behind in your studies?", "How nervous are you when the teacher hands out the graded papers?", and "How nervous are you going to be during the exam?".[30] In addition, the students' most recent final exam results at the time of the survey were collected through the student management information systems.

Behavioural factors

Internet addiction was measured by a Young Internet Addiction Test. The test scores response from 1 to 5, with a score of 1 for "rarely" and 5 for "always." Summative scores ranging from 20 to 49 are considered to indicate "average" online users. Scores from 50 to 79 are considered to indicate occasional to frequent problems related to Internet use. Scores from 80 to 100 are considered to indicate significant problems related to Internet use.[31]

Delinquent Behaviours were measured by 12 questions on how many times students had engaged in certain misconducts or showed poor performances over the previous year.[32] Non-suicidal self-injuries were measured by the short version of the Deliberate Self-Harm Inventory.[33] Suicidal behaviours were measured by three questions: "Have you ever seriously considered trying to suicide?", "Have you made any specific plans for how you would suicide?", and "How many times have you actually tried to suicide?".

In addition to the self-report questionnaire, students' behaviours were also assessed by the primary caregiver, using a Child Behaviour Checklist, which listed the students' behaviours over the past six months.[34, 35]

Caregivers' health status

Caregivers' depressive symptoms were measured by the Zung Self-rating Depression Scale which, based on the diagnostic criteria for depression, asked how they have felt in the past week. Caregivers rated each item on a 4-point Likert scale. Individual's standard scores were calculated by adding the 20 scores and multiplying by 1.25. The severity of depression was defined by standard score as no depression (<53), mild depression (53-62), moderate depression (63-72), and severe depression (>72).[36]

Caregivers' anxiety symptoms were measured by the Zung Self-Rating Anxiety Scale (SAS), comprising 20 items and based on the diagnostic criteria for anxiety. Similarly, the standard score was calculated for each caregiver and the severity of anxiety was defined as no anxiety (<50), mild anxiety (50-59), moderate anxiety (60-69), and severe anxiety (>69).[37]

COVID-19 related information

In addition to the questions asked in the baseline survey, more questions were added to the first follow-up survey about the students' and caregivers' behaviours and perceptions which

might have been affected by the COVID-19 lockdown. Behaviours included self-reported time spent on sleeping, in physical activity, and at electronic screens (for both purposes of online classes and entertainment). Perceptions included awareness of COVID-19 and the extent to which it has affected aspects of their lives.[38,39]

What has it found?

At baseline, the students were aged from 6 to 16 (**Table 2)**. There were slightly more boys than girls (51.6% *v.s.* 48.4%) and more primary than middle school students (62.7% *v.s.* 37.3%). More students lived in urban than rural areas (65.0% *v.s.* 35.0%). More than half of the students' parents had at least high school education. On average, boys' parents had a higher educational level than girls' (p=0.02 for fathers and p=0.04 for mothers). Parents of primary school students had a higher educational level than those of middle school students' (p<0.01 for both). On average, boys' families had more monthly income than girls' (9.8K *yuan v.s.* 9.5K *yuan*), but allocated less pocket money weekly (24.8 *yuan v.s.* 25.1 *yuan*). Eyesight of the middle school students was generally worse than of the primary school students.

Characteristics of the students lost to follow-up, but remaining in the cohort are shown in **Table 3**. A summary of the information collected in the baseline and first follow-up survey showed that, in the follow-up survey, favourable declines were observed in the delinquent behaviour score (0.28 to 0.24, p<0.001), anxiety score (17.14 to 15.21, p<0.001), academic anxiety score (3.38 to 3.33, p=0.007), family dysfunction score (1.96 to 1.93, p=0.006), and child behaviour checklist score (24.82 to 19.82, p<0.001).

The academic intrinsic value score, however, decreased (3.75 to 3.71, p=0.009), while the materialism score (1.87 to 1.94, p<0.001) and suicidal behaviour score (0.17 to 0.21, p<0.001) increased, all considered unfavorable (**Table 4**).

Whereas a decline in the use of electronic devices was self-reported, it was, in the caregivers' opinion, reported to have increased.

Awareness of COVID-19 and the extent to which COVID-19 has affected different aspects of life were reported by both students and caregivers (**Table 5**). Most families of the students (96.7%) were not infected by COVID-19. Most of the students considered COVID-19 to be very serious (69.5%) and the infection to be very dangerous (75.8%). Most reported that being infected was "impossible" or "not quite possible (59.2%) and that they were "capable" or "very capable" of preventing the disease (79.4%). Most thought that the COVID-19 lockdown did not

affect their dietary (77.3%), study (66.2%), social (61.3%), and physical activities (60.7%) by reporting “not at all” or “a little bit”.

What are the main strengths and weaknesses?

The CPCD provides a unique opportunity to investigate the associations between students’ sociodemographic, physical, and psychological characteristics (including PCD), family environment, lifestyle behaviours, academic performance, and health status in China.

More importantly, all students experienced the COVID-19 pandemic (prevalent locally during January and April), which has had an unknown impact on children’s short-term and long-term development.[40]

Baseline data were, coincidentally, collected before the outbreak of COVID-19. They provide an important resource for studying the effect of the epidemic on early-stage physical and mental development, by providing an unbiased baseline.

Continuous follow-ups would further enable investigation of the life-course effects of the epidemic on children of the “COVID-19 generation”. The first follow-up will provide a baseline in the post-COVID era. This could be an important reference for evaluating the effects of subsequent interventions and policies on improving children’s health.

As epidemics might become more intensive and frequent in the 21st century,[41] findings from our cohort could inform multiple stakeholders, including policy-makers, clinical practitioners, school administrators, and guardians (including parents) of potential changes in students’ psychological, behavioural, and health statuses, facilitating better policy-making, clinical practice, and intervention at home and at school.[42]

There are also some weaknesses in the CPCD. First, in addition to the intrinsic limitations of the tools used to measure psychological and behavioural characteristics, most responses were self- or caregiver-reported, with limited measurements from students’ physical examination. Second, the Chinese Positive Youth Development Scale was validated for the adolescents, but not for primary school students (this does, however, creates an opportunity to validate the suitability of this tool in measuring positive development quality among primary school students). The time spent on sleeping, physical activity, and viewing electronic screens, as reported by caregivers, might not be accurate. Third, the considerable number of middle-school students lost to follow-up might affect the representativeness of the remaining cohort of middle

school students in Chengdu overall; moreover, the cohort was not randomly sampled and are not city representative.

Can I get hold of the data? Where can I find out more?

To learn more about this cohort and explore potential collaborations, please contact the principal investigator Professor Peng Jia.

Ethics approval

The study protocol was approved by the Medical Ethics Committee of Sichuan University (K2020025).

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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Conflict of Interest

None declared.

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Figure legend

Figure 1. Flowchart of implementation of the Chengdu Positive Child Development (CPCD) survey

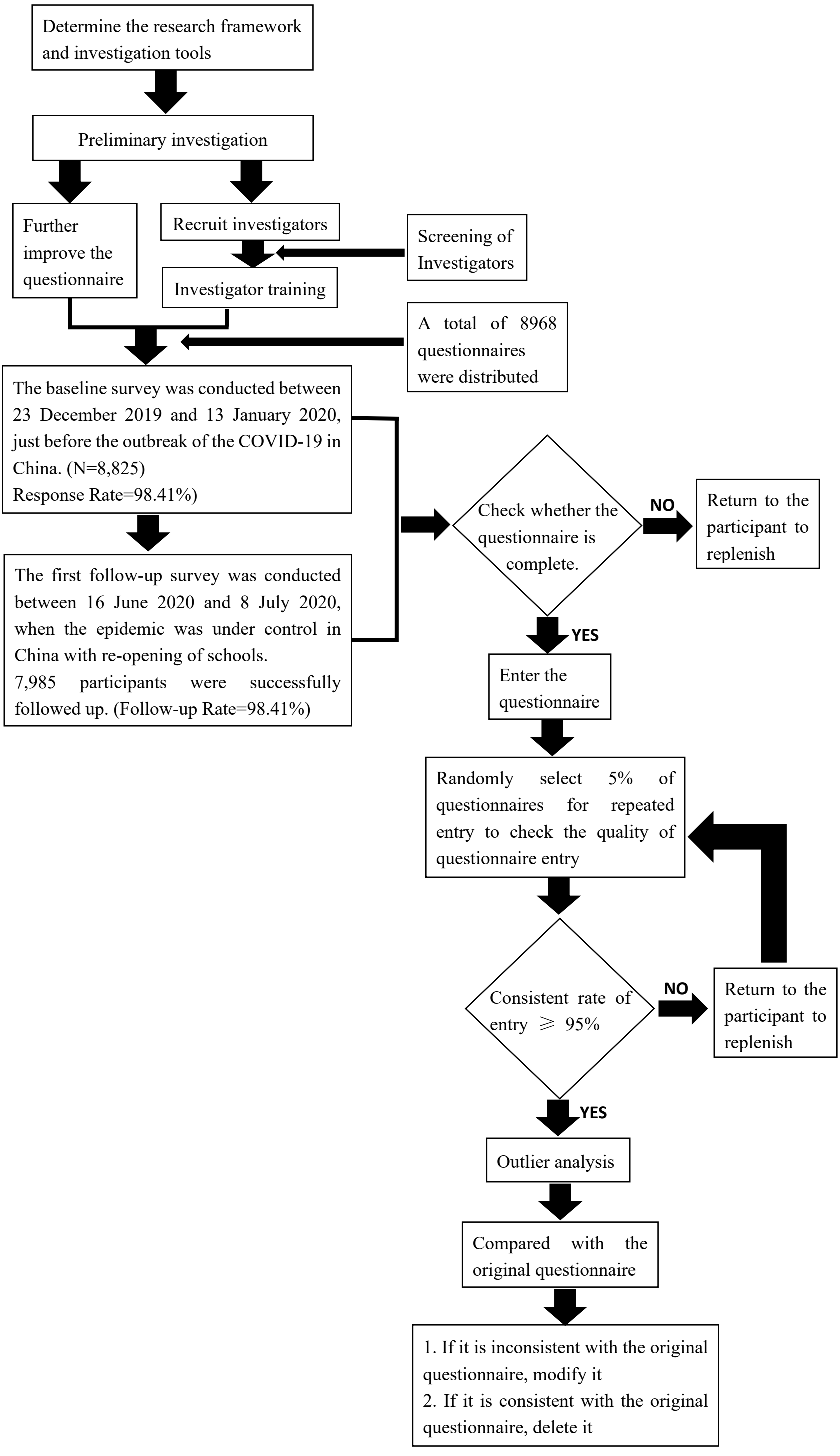
Determine the research framework and investigation tools
Preliminary investigation
Further improve the questionnaire
Recruit investigators
Screening of Investigators
Investigator training
A total of 8968 questionnaires were distributed
The baseline survey was conducted between 23 December 2019 and 13 January 2020, just before the outbreak of the COVID-19 in China. (N=8,825)
Response Rate=98.41%)
The first follow-up survey was conducted between 16 June 2020 and 8 July 2020, when the epidemic was under control in China with re-opening of schools.
7,985 participants were successfully followed up. (Follow-up Rate=98.41%)
Check whether the questionnaire is complete.
NO
Return to the participant to replenish
YES
Enter the questionnaire
Randomly select 5% of questionnaires for repeated entry to check the quality of questionnaire entry
Consistent rate of entry ⩾ 95%
NO
Return to the participant to replenish
YES
Outlier analysis
Compared with the original questionnaire
1. If it is inconsistent with the original questionnaire, modify it
2. If it is consistent with the original questionnaire, delete it

Table 1. Summary of the measurements at the baseline of the Chengdu Survey of Positive Youth Development (SPYD)

Measurements	No. of variables	Variables/Tools
Anthropometric characteristics	8	Height, weight, diastolic blood pressure, systolic blood pressure, vital capacity, pulse rate and naked eye vision
Sociodemographic characteristics	26	Children's age, sex, ethnicity, grade, number of siblings, pocket money received per week; parents' educational level, occupation, monthly income; family conditions
Children's health status		
Caregiver-reported conditions	25	Allergic diseases, asthma, headache, rashes or other skin problems, stomachache or stomach cramps, nausea, emesis, nervousness, constipation, obesity, depression symptoms, anxiety symptoms; Children's Revised Impact of Event Scale (CRIES)
Depression	20	The Center for Epidemiological Studies-Depression Scale (CES-D)
Anxiety	41	Screen for Child Anxiety Related Emotional Disorders
Psychological characteristics		
Positive youth development	80	The Chinese Positive Youth Development Scale
Life Satisfaction	5	Life Satisfaction Scale
Materialism	21	The Chinese Adolescent Materialism Scale
Egocentrism	19	The Chinese Adolescent Egocentrism Scale
Empathy	11	E.g., "I try to understand others' perspectives when making a decision"
Family function	33	Mutuality (mutual support, love, and concern among family members), communication (frequency and nature of interaction among family members), conflict and harmony (conflicting and harmonious behaviors in the family), parental concern (parental support behaviors), and parental control (harshness of parenting behaviors)
Academic performance	12	E.g., "Do you think doing school work is boring?"
Behavioral factors		
Internet addiction	23	
Delinquent Behaviors	12	
Non-suicidal self-injuries	9	Deliberate Self-Harm Inventory (DSHI)
Suicidal behaviors	3	E.g., "Have you ever seriously considered trying to suicide?"
Caregiver-reported behaviors	107	Child Behavior Checklist
Caregivers' health status		
Depression	20	Zung Self-rating Depression Scale
Anxiety	20	Zung Self-Rating Anxiety Scale
COVID-19 related information	23	Self- reported times of drinking sugary drinks per week; self- and caregiver-reported daily time on sleep, physical activity, and electronic use; self-reported and caregiver-reported awareness of the COVID-19 and the extent to which the COVID-19 has affected different aspects of their lives

Table 2. Characteristics of the participants at the baseline of the Chengdu Survey of Positive Youth Development (SPYD)

Characteristics	Percentage (%) or Mean ±SD						
	All (n=8,825)	Boys (n=4,550)	Girls (n=4,275)	*p*-value (sex)	Primary school (n=5,533)	Middle school (n=3,292)	*p*-value (grade)
Age (year)	10.9±2.3	10.9±2.3	10.9±2.3	0.53	9.5±1.6	13.3±1.0	<0.01
Sex							0.01
Boy	51.6	-	-		52.6	49.8	
Girl	48.4	-	-		47.4	50.2	
Grade				0.01			
Primary school	62.7	64.0	61.3		-	-	
Middle school	37.3	36.0	38.7		-	-	
Height (cm)	143.1±14.6	143.7±15.4	142.5±13.8	<0.01	135.2±11.5	156.4±8.5	<0.01
Weight (km)	38.5±13.6	38.9±13.9	37.9±13.2	<0.01	32.0±9.8	49.3±12.1	<0.01
Sight Left (diopter)	4.80±0.34	4.82±0.33	4.78±0.34	<0.01	4.87±0.29	4.69±0.38	<0.01
Sight Right (diopter)	4.79±0.34	4.81±0.33	4.77±0.35	<0.01	4.86±0.29	4.67±0.38	<0.01
Diastolic blood pressure (mmHg)	71.7±16.1	71.5±16.0	72.0±16.3	0.14	69.5±14.5	75.6±17.9	<0.01
Systolic blood pressure (mmHg)	103.2±14.6	103.6±15.0	102.8±14.2	0.02	101.3±13.6	106.4±15.7	<0.01
Vital capacity (L)	2.0±0.8	2.1±0.9	1.9±0.6	<0.01	1.6±0.6	2.6±0.7	<0.01
Residence				0.20			<0.01
Urban	65.0	65.6	64.3		66.5	62.3	
Rural	35.0	34.4	35.7		33.5	37.7	
Caregiver's questionnaire completed by mother	55.9	50.9	61.2	<0.01	58.0	52.6	<0.01
Father's age (year)	39.6±6.2	39.5±6.3	39.8±6.0	<0.05	38.1±5.9	42.1±5.7	<0.01
Mother's age (year)	37.1±5.9	37.0±5.9	37.2±5.8	0.41	35.6±5.5	39.6±5.6	<0.01
Father's highest educational level				0.06			<0.01
Primary school or below	7.3	7.5	7.2		5.7	10.0	
Middle school	41.1	39.5	42.6		38.9	44.6	
High school	25.2	25.2	25.2		26.3	23.3	
Vocational or technical school	9.9	10.4	9.5		11.3	7.8	
Bachelor or above	16.5	17.4	15.5		17.8	14.3	
Mother's highest educational level				0.05			<0.01
Primary school or below	10.8	11.0	10.6		8.0	15.4	
Middle school	39.9	38.4	41.4		37.8	43.4	
High school	23.6	24.1	23.2		25.3	20.9	
Vocational or technical school	10.4	10.5	10.4		11.9	8.1	
Bachelor or above	15.3	16.0	14.4		17.0	12.2	
Father's occupation				0.05			<0.01
Staff of state agencies, enterprises and institutions	23.3	24.4	22.1		24.0	22.1	
Professional technical personnel	6.3	6.7	6.0		6.7	5.8	
Business and service personnel	6.4	6.3	6.6		6.7	6.0	
Laborer	32.2	32.0	32.4		32.2	32.3	
Farmer	10.0	9.5	10.5		8.3	12.6	
Individual business	16.3	15.8	16.8		16.7	15.6	
Other occupations	3.7	3.5	3.8		3.8	3.5	
Unemployed/Retired personnel	1.8	1.8	1.8		1.6	2.1	
Mother's occupation				0.02			<0.01
Staff of state agencies, enterprises and institutions	20.5	21.4	19.6		22.0	18.0	
Professional technical personnel	8.2	8.8	7.5		8.2	8.2	
Business and service personnel	13.8	13.9	13.9		14.4	13.1	
Laborer	9.9	10.3	9.4		9.4	10.7	
Farmer	11.8	11.1	12.5		9.7	15.3	
Individual business	16.5	15.6	17.4		16.4	16.6	
Other occupations	4.0	4.0	4.0		4.3	3.4	
Unemployed/Retired personnel	15.3	14.9	15.7		15.6	14.7	
Number of siblings	1.0±1.4	1.0±1.5	0.9±1.3	0.27	1.0±1.5	0.9±1.2	<0.01
Family monthly income (K *yuan*)	9.7±10.2	9.8±10.0	9.5±10.3	0.18	9.9±10.2	9.4±10.1	0.02
Pocket money per week (*yuan*)	24.9±29.0	24.8±30.6	25.1±27.2	0.66	22.2±30.0	29.0±26.9	<0.01

P-values tested the differences in each variable between sexes (boy and girl) and grades (primary and middle school), and were based on $\chi 2$ tests for categorical variables or t-tests for continuous variables.

Table 3. Characteristics of the participants followed up and lost to follow-up

Characteristics	Percentage (%) or Mean ±SD									
	Followed up (Matched)					Lost to follow-up				
	All (n=7,985)	Boys (n=4,124)	Girls (n=3,861)	Primary sch. (n=5,452)	Middle sch. (n=2,533)	All (n=840)	Boys (n=426)	Girls (n=414)	Primary sch. (n=81)	Middle sch. (n=759)
Age (year)	10.6±2.2	10.6±2.2	10.6±2.2	9.5±1.6	13.0±0.9	13.7±1.8	13.6±2.1	13.8±1.6	8.6±1.9	14.2±0.6
Sex										
Boy	51.6	-	-	52.4	50.0	50.7	-	-	65.4	49.1
Girl	48.4	-	-	47.6	50.0	49.3	-	-	34.6	50.9
Grade										
Primary school	68.3	69.3	67.2	-	-	9.6	12.4	6.8	-	-
Middle school	31.7	30.7	32.8	-	-	90.4	87.6	93.2	-	-
Height (cm)	141.5±13.9	142.0±14.5	141.1±13.3	135.3±11.4	155.0±8.1	158.3±12.2	160.7±13.3	155.8±10.4	133.3±14.6	160.9±8.3
Weight (km)	36.9±12.2	37.4±12.5	36.4±11.7	32.0±9.7	47.5±10.0	53.2±17.1	53.8±17.0	52.5±17.2	31.3±11.8	55.5±15.9
Sight Left (diopter)	4.82±0.32	4.84±0.32	4.80±0.33	4.87±0.29	4.71±0.36	4.64±0.42	4.67±0.42	4.60±0.42	4.89±0.31	4.62±0.42
Sight Right (diopter)	4.81±0.33	4.83±0.32	4.79±0.33	4.86±0.29	4.70±0.36	4.61±0.42	4.65±0.41	4.56±0.43	4.88±0.30	4.57±0.42
Diastolic blood pressure (mmHg)	71.3±15.7	71.2±15.6	71.5±15.8	69.5±14.4	75.2±17.5	75.7±19.2	74.6±18.5	76.8±19.8	64.9±15.7	76.9±19.1
Systolic blood pressure (mmHg)	102.6±14.5	102.9±14.9	102.4±14.0	101.3±13.6	105.5±15.8	108.6±15.0	110.1±14.3	107.2±15.4	98.5±13.5	109.7±14.7
Vital capacity (L)	1.9±0.7	2.0±0.8	1.8±0.6	1.6±0.6	2.5±0.7	2.7±0.8	3.0±0.8	2.4±0.6	1.6±0.7	2.8±0.7
Residence										
Urban	64.2	64.9	63.5	66.4	59.5	72.1	72.5	71.7	74.1	71.9
Rural	35.8	35.1	36.5	33.6	40.5	27.9	27.5	28,3	25.9	28.1
Caregiver's questionnaire completed by mother	55.6	50.7	60.8	57.8	51.0	58.9	53.0	64.8	71.0	57.7
Father's age (year)	39.4±6.2	39.3±6.3	39.6±6.1	38.2±5.9	42.1±5.9	41.7±5.4	41.8±5.6	41.6±5.2	36.9±6.9	42.1±5.0
Mother's age (year)	36.9±5.9	36.8±5.9	36.9±5.9	35.6±5.5	39.6±5.9	39.2±5.1	39.5±5.5	39.0±4.7	34.5±6.4	39.7±4.7
Father's highest educational level										
Primary school or below	7.5	7.5	7.4	5.7	11.2	6.0	6.5	5.4	5.8	6.0
Middle school	41.2	39.8	43.0	39.0	46.4	38.7	37.4	40.1	34.8	39.1
High school	25.2	25.3	25.0	26.3	22.7	25.4	24.2	26.6	27.5	25.2

Vocational or technical school	10.0	10.6	9.3	11.3	7.1	9.9	8.7	11.2	7.3	10.1
Bachelor or above	16.1	16.8	15.3	17.7	12.6	20.0	23.2	16.7	24.6	19.6
Mother's highest educational level										
Primary school or below	11.3	11.5	11.1	8.0	18.1	6.2	6.5	5.9	2.9	6.5
Middle school	39.9	38.3	41.6	37.9	44.2	40.2	40.2	40.2	30.4	41.1
High school	23.4	23.9	22.8	25.3	19.4	26.2	25.9	26.6	29.0	26.0
Vocational or technical school	10.5	10.6	10.4	11.9	7.6	9.8	9.0	10.6	14.5	9.3
Bachelor or above	14.9	15.7	14.1	16.9	10.7	17.6	18.4	16.7	23.2	17.1
Father's occupation										
Staff of state agencies, enterprises and institutions	22.8	23.9	21.7	23.8	20.7	27.2	29.1	25.4	33.4	26.7
Professional technical personnel	6.1	6.4	5.8	6.7	4.9	8.5	9.4	7.6	5.8	8.8
Business and service personnel	6.7	6.5	6.8	6.7	6.5	4.5	4.4	4.7	4.3	4.5
Laborer	33.3	33.2	33.5	32.2	35.6	21.9	20.6	23.2	29.0	21.2
Farmer	9.5	9.0	10.0	8.3	11.9	14.7	14.3	15.0	7.3	15.3
Individual business	16.1	15.6	16.6	16.8	14.6	18.1	17.6	18.5	11.6	18.7
Other occupations	3.8	3.6	3.9	3.8	3.8	2.9	2.4	3.4	7.2	2.5
Unemployed/Retired personnel	1.7	1.8	1.7	1.7	2.0	2.2	2.2	2.2	1.4	2.3
Mother's occupation										
Staff of state agencies, enterprises and institutions	20.7	21.5	19.9	22.1	17.8	18.6	20.8	16.3	17.4	18.7
Professional technical personnel	7.9	8.6	7.2	8.2	7.3	10.8	11.2	10.6	7.3	11.2
Business and service personnel	14.0	14.1	13.9	14.3	13.4	12.5	10.9	14.0	17.4	12.0
Laborer	10.3	10.7	9.8	9.4	12.1	6.2	6.5	5.9	5.8	6.3
Farmer	11.4	10.6	12.2	9.7	14.9	15.8	15.7	15.8	4.3	16.8
Individual business	16.2	15.3	17.1	16.4	15.5	19.7	19.1	20.4	17.4	20.0

Other occupations	4.0	4.1	3.9	4.3	3.6	3.3	2.7	3.9	8.7	2.8
Unemployed/Retired personnel	15.5	15.1	16.0	15.6	15.4	13.1	13.1	13.1	21.7	12.2
Number of siblings	1.0±1.5	1.0±1.5	1.0±1.4	1.0±1.5	1.0±1.2	0.7±1.2	0.8±1.5	0.7±0.9	0.8±0.9	0.7±1.3
Family monthly income (K *yuan*)	9.6±10.1	9.8±10.1	9.4±10.2	9.9±10.2	9.2±9.9	10.0±10.4	9.6±9.4	10.3±11.3	10.1±7.8	9.9±10.6
Pocket money per week (*yuan*)	24.2±29.4	23.5±27.9	24.9±30.8	22.7±30.4	27.0±27.0	36.8±33.1	35.9±37.7	37.7±27.7	32.4±44.0	37.1±32.1

Table 4. The positive youth development attributes and behaviors of the participants in the baseline and first follow-up surveys

Outcome	Mean ±SD		*p*-value
	Baseline (n=8,825)	Followed up (n=7,985)	
Positive youth development score[a]	5.07±0.73	5.06±0.78	0.580
Life satisfaction score[a]	4.39±1.13	4.38±1.20	0.622
Internet addiction score[b]	35.35±15.03	35.07±15.13	0.214
Delinquent behavior score[b]	0.28±0.50	0.24±0.44	<0.001
Materialism score[b]	1.87±0.91	1.94±1.00	<0.001
Egocentrism score[a]	2.86±0.94	2.85±0.96	0.519
Empathy score[a]	4.55±0.89	4.57±0.91	0.088
Non-suicidal self-injury[b]	1.26±3.23	1.28±3.31	0.670
Suicidal behaviour score[b]	0.17±0.49	0.21±0.56	<0.001
Depression[b]	14.50±10.26	14.36±10.61	0.371
Anxiety[b]	17.14±14.86	15.21±15.11	<0.001
Academic values- Intrinsic values score[a]	3.75±0.95	3.71±0.99	0.009
Academic values- Utility values score[a]	4.29±0.72	4.29±0.75	0.758
Academic anxiety score[b]	3.38±1.13	3.33±1.15	0.007
Family function score[b]	1.96±0.72	1.93±0.73	0.006
Child Behavior Checklist score[b]	24.82±20.64	19.82±20.26	<0.001
Physical activity (hours)	1.65±1.59	1.77±1.88	<0.001
Sleep (hours)	8.59±1.86	8.72±1.97	<0.001
Child self-reported electronic devices	2.13±2.35	1.86±2.34	<0.001
Caregiver reported child electronic devices (hours)	1.69±2.16	2.21±2.22	<0.001

***a:the higher, the better; b:the lower, the better.**

Table 5. The COVID-19 related information among the participants in the first follow-up survey

Question	Percentage (%) or Mean ±SD			
	Options			
Children's Revised Impact of Event Scale score	14.1±14.0			
Have you or your family member been infected by COVID-19?	Yes		No	
	3.3		96.7	
How serious do you think the COVID-19 epidemic is?	Not serious	A little serious	Quite serious	Very serious
	3.2	5.8	21.5	69.5
How dangerous do you think the COVID-19 infection is?	Not dangerous	A little dangerous	Quite dangerous	Very dangerous
	1.5	4.5	18.2	75.8
How possible do you think you might be infected by COVID-19?	Impossible	Not quite possible	Possible	Very possible
	22.7	36.5	29.7	11.1
How capable do you think you are at preventing COVID-19?	Incapable	Not quite capable	Capable	Very capable
	6.0	14.6	42.5	36.9
	Not at all	A little bit	Relatively	Very
Have your dietary activities been significantly affected during the COVID-19 outbreak?	40.8	36.5	14.8	7.9
Have your study modes been greatly affected during the COVID-19 outbreak?	31.6	34.6	21.3	12.5
Have your social activities been greatly affected during the COVID-19 outbreak?	31.7	29.6	20.8	17.8
Have your entertainment activities been greatly affected during the COVID-19 outbreak?	31.2	29.5	22.0	17.3