

The Construction and Prospects of the Chongqing Twin Children Database

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Twins could play a crucial role in our understanding of genetic contributions to numerous etiologically complex disorders. In China, although adult twins are relatively rare, twins will become increasingly available due to increasing twin birth rates. Thus, child twin data will be a valuable resource to contribute to the field of child and adolescent psychopathology. The first twin database of children aged from 6 to 16 was established in Chongqing, R.P., China. In this article, we will discuss our experiences in establishing the twin database, completed in three steps — the first step being to search and identify twins, the second being to keep contact with the twins and the final being to seek cooperation with the twin families, and its future prospects. Our twin database has proven to be an efficient method for the investigation and data collection of twin children in China. The results of our present study suggest that the inclusion of twin information in the residence registration of the public security bureaus in the future may ensure a smooth run of research based on the demographic resources. We propose that school networks may be adopted as the preferred method of collection of twin records for future studies.

Keywords: twin database, children, mental health, environment, heredity

Background to the Establishment of the Twin Children Database

In this era of rapid social and technological advancements leading to life complexity, a majority of diseases seriously endangering children's physiological functions have been effectively controlled in most parts of the world. However, the growing incidence of psychological problems has aroused widespread concern in international communities.

The incidence of mental health problems of children in developed countries lies within the range of 10% to 20%, and in developing countries may be even higher (Hackett & Hackett, 1999). It is noteworthy that since

the proportion of children under the age of 16 in the total population of developing countries is higher than that of developed countries, the total number of affected children is much higher. Currently, the incidence of child mental health problems is approximately 15% in China (Junmian, 2000; Xueyong, 2002), meaning that 50 million children and teenagers may need mental health services.

The key to the solution of these mental health issues lies in the studies of the effects of heredity and environment on the psychological development and mental health of children. Thus, we aim to set up a twin database to aid researchers in their work on mental health problems in Chongqing, China.

The period of 6 to 16 years of age is a critical stage for individual psychological development, during which children will witness a dramatic development in their memory, thinking, self-concept, and interpersonal skills. However, children at this period were also at high risk of suffering from mental disorders. Therefore, our children twin database investigation mainly focused on children aged 6 to 16 years old.

Twin Method, Twin Databases SQ and Chongqing Children Twins Project

It is well known that most twins share a high degree of similarity in their genetic makeup. Monozygotic twins (MZ) develop from the same fertilized ovum and have complete inheritance foundation, while dizygotic twins (DZ) develop from different ova and share only half of the genetic makeup. By comparing monozygotic twins and dizygotic twins, we can examine the interplay between heredity and environment. Thus, twin data is

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an ideal model for the study of the effects of hereditary and environmental factors on human characteristics.

The influences of heredity and environment on the human body, mental health, temperament and personality have always been a focus of intensive debate. Twin analysis provides an important method to analyze and study this issue. Current available twin databases are almost exclusively based in western countries, such as the Norwegian Twin Registry (Bergem, 2002), the Danish Twin Registry (Skytthe et al., 2002), the Swedish Twin Registry (Pedersen et al., 2002), the Netherlands Twin Registry (Boomsma et al., 2002), Minnesota (Iacono & McGue, 2002) and Wisconsin (Van Hulle et al., 2002) Twin Registry, Virginia and North Carolina Twin Registries and Mid-Atlantic Twin Registry, Sri Lankan Twin Registry (Sumathipala et al., 2002). Several attempts have also been made in China to establish twin databases; for example, in 2002, Huiying Yang established a database of 8583 pairs of twins (Yang, 2002). In order to investigate eye diseases, another twin database including 9000 pairs of twins was established in Guangzhou (He et al., 2006). However, twin databases in China are still lacking.

Therefore, we sought to establish a twin database for children aged between 6 and 16 years old, with a special emphasis on mental development (including cognitive functions and personality traits) and mental health in the Chongqing municipality. Based on this twin database registry, we aim to perform a comprehensive, long-term longitudinal study on the effects of heredity and environment on the human body, temperament and personality traits.

City Profile of Chongqing

Chongqing is the largest and most populated city in the world, with an estimated population of 32 million people. The city is located in the center of Western China and covers an area of 82,403 square kilometers. It is also the economic, educational and political center of Western China.

The geographical features of Chongqing are characterized by its rivers and hills, an extensive chain of rolling mountains and its crisscrossing river network. The geographical environments, together with the social and economical displacements have contributed to the unique child psychological characteristics in Chongqing.

According to statistics, the number of permanent residents in Chongqing municipality is 27,709,800, of which 6- to 16-year-old children account for 21.2% and the twin birth rate is 1.8%. Note that resident population herein refers to those who have resided in the townships, towns, or street communities for more than 6 months or those who have resided in them for less than 6 months but have been away from the place of their permanent household registration for more than 6 months and their new household registration has not yet been settled. This rich demographic resource can

provide a great convenience for scientific researches.

Initial Construction of the Twin Database in the Chongqing Municipality

The initial construction of the twin database for children aged 6 to 16 years in the Chongqing municipality includes three steps:

1. to search and identify twins (as there is no current twin registration system or ready-made twin information in population databases of Chongqing)
2. to maintain contact with the twins
3. to seek cooperation with the twin families.

In the initial stage, we aimed to find the most efficient way to recruit twins with good reliability at a low cost in order to facilitate the further expansion of the twin database and the relevant in-depth studies and also to offer suggestions for the establishment of self-contained twin children databases.

Searching and Identifying Twin Resources

The following three methods were employed to search twins aged between 6 and 16:

1. Residence registration management in the public security bureaus: The records (including date of birth, sex, home address, and so on) of children aged between 6 and 16 in Chongqing municipality were obtained through the residence registration management system of the public security bureaus. Candidate twins or multiples were determined by their identical or similar date of birth, home address and surnames (the twins subjectively designated by this method may return some false positives and sometimes it is difficult to keep contact with those twins whose home address registered at birth was changed. Therefore, only records from the Yuzhong District were collected).
2. Education commission and school networks: Considering the fact that the subjects in this study are children aged between 6 and 16 and are at school age, we set up to enroll twins from primary and middle schools. Institutional approval from local education commissions was obtained. We collected twin records from school archives of seven main urban districts in Chongqing municipality — Yuzhong District, Shapingba District, Jiangbei District, Nan'an District, Dadukou District, Jiulongpo District and Beipei District.
3. Twin reunions held by public media: Our research team initiated cooperation with newspapers and magazines, covering nine main urban districts in Chongqing municipality — Yuzhong District, Shapingba District, Dadukou District, Nan'an District, Jiangbei District, Jiulongpo District, Beipei District, Yubei District and Ba'nán District — to hold twin reunions and attract the active participation of twin families. Based on this method, twin

clubs were established and twin records of those aged between 6 and 16 were collected.

Comparison of time and cost spent on the twin record collection and the contact with twins and contact success rates between different methods

The following comparisons were drawn after obtaining the twin records in order to seek an efficient and economic way for inviting the participation of twins in the investigation.

Comparison of Time and Cost Spent on the Twin Record Collection

Twin records were collected by residence registration in the public security bureaus, school archives and twin reunions held by public media.

Based on the results summarized, records obtained by residence registration in the public security bureaus saved the most time and cost (average record collection cost: 0.14 yuan/pair; Average record collection time 0.02 day/pair). However, because records of actual twin births were unavailable and the twins were subjectively assumed on the basis of identical date of birth, identical home address and identical surname, the interpretation of these data may suffer relative poor reliability. Therefore, in the subsequent contact work, this method was discarded. The result also suggests that the inclusion of twin information in the residence registration of the public security bureaus in the future may become a useful avenue for use in research based on the demographic resources.

For school archive searches the average record collection cost was 0.40 yuan/pair and the average record collection time was 0.04 day/pair. The data obtained from twin reunions held by public media had an average record collection cost of 15.38 yuan/pair and an average record collection time of 0.26 day/pair. This suggests that school networks may be adopted as the chief twin record collection method in future research.

Comparison of Time and Cost Spent on the Contact With Twins and Contact Success Rates Between Different Methods

During this phase, 100 pairs of twins were randomly contacted by mail, with the cost of record collection being 210 yuan and that of the contact being 250 yuan. Four pairs of twins voluntarily participated in the present study, with the successful recruitment rate of 4%. Therefore, the average cost for a successful recruitment of a pair of twins was 62.5 yuan and the average contact time was 18.75 days.

According to the information obtained by the education commission and school networks, 101 pairs of twins were randomly selected. After obtaining the consents from schools, 101 pairs of twins were contacted and the total contact cost was 760 yuan. Forty-three of the pairs contacted voluntarily participated in the present study, making the successful contact rate 42.6%. The average contact cost was 17.67 yuan and the average contact time was 2.40 days.

Based on the information collected through the twin reunions held by public media, parents of 48 pairs of twins were randomly approached by telephone. The

total contact cost was 145.6 yuan. Of these twins, 14 pairs voluntarily participated in the present study and the successful contact rate was 29.2%. The average cost for a successful recruitment was 10.40 yuan and the average contact time was less than 1 day.

The above results demonstrated that the school networks were highest ranking in the contact success rate, followed by the twin reunions held by public media and then followed by the residence registration in the public security bureaus. Therefore, school networks may be adopted as the chief contact means in the subsequent studies.

Comparison of Different Contact Pathways in the Education Commission/School Network Method

During the collection of twin information through the education commission/school networks, two pathways were used to win the trust and the active participation of the twins and their parents. Data was collected from different sites and the two ways were compared:

1. School pathway: the class advisor explained the purpose of our investigation to the parents of twins. The parents would then decide whether to participate or not. The data was collected at school.
2. Hospital pathway: parents were invited to the outpatient department of Mental Health Center of the First Affiliated Hospital of Chongqing Medical University and their information was collected in the examination room.

Comparison of different contact pathways in the education commission/school network method showed that the recruitment of twins by the school pathway was more successful (contact success rate: 60%) than the hospital pathway (contact success rate: 25.5%). However, the average cost and time of the school pathway were slightly higher (average time spent on the contact and information collection: 2.73 day/pair; average cost spent on the contact and information collection: 20 yuan/pair) than the hospital pathway (average time spent: 1.62 day/pair; average cost spent: 12.3 yuan/pair). The higher enrollment rate through the school pathway may be attributed to the high prestige of teachers whereas the hospital pathway would save more time and cost. Taken together, these results suggest that in the following studies participation was better when twins were collected from school. We may adopt the method in which we first inform the school and then invite the parents and their twins to the hospital to take relevant tests and to collect their information.

Initial Resources Collected in the Twin Database and Study Plan

Initial Resources Collected in the Twin Database

Owing to the insufficient information obtained from the residence registration of the public security bureaus, the information included was mostly collected from

Table 1

Numbers of Twins and Other Multiples in the Chongqing Twin Children Database During the Initial Stage

District	Resident population in 2005 (10 thousands)	Number of twins aged between 6 and 16 (pair)	Number of triplets or multiples (group)	Number of twins, triplets and multiples (person)
Yuzhong District	69.78	172	3	353
Shapingba District	86.24	137	1	277
Dadukou District	26.23	83	1	169
Nan'an District	66.76	94	0	188
Jiangbei District	65.07	125	1	253
Jiulongpo District	94.65	116		232
Beipei District	67.35	144	1	291
Other		28	0	56
Total	356.85	899	7	1819

education commission/school network (763 pairs) and the media (78 pairs) methods. Other recruitment methods such as acquaintance and encounter (58 pairs) also contributed to a small percentage of our twin registration. The records of 1819 children (899 pairs are twins; seven are triplets or multiples) twins aged between 6 and 16 (including names, sex, age, school, home address, parent data and contact information which was only available to the researchers involved) were obtained.

Study Plan

1. Enrolled subjects: school twins aged 6 to 16 in Chongqing municipality, their relatives (parents or guardians) and teachers. Those with serious physical diseases or mental illnesses were excluded from the present study.
2. Cooperation obtained: Written informed consents were obtained. Only these twins with parental consent were investigated in our present study.
3. Data collection: Psychological development (including cognitive functions and personality traits), mental health status, genetic information and neurobiology information (cognitive electrophysiology such as ERP, fMRI) of twin children was investigated to establish the phenotype information database and the DNA genetic resource database of twins.

Initial goals: We aim to characterize the psychological development and mental health of children in the Chongqing municipality. In addition, our study may contribute to the elucidation of the genetic origins of the psychological development and mental health of children and provides essential information to analyze the interaction of genetic and environmental factors as well as the causes of the development of mental disorders.

Prospects

In an attempt to offer precious twin resources for mental health research, we aim to further expand the twin database for children aged between 6 and 16 in the Chongqing municipality and western China.

Although tremendous efforts have been made in the study of the brain functions of child twins both at home and abroad, they have mainly focused on some sporadic traits or diseases. Systemic and comprehensive information collection and analysis for the psychological development, mental health and mental illness of children twins have not yet been addressed thus far. Currently, the development of molecular genetics, neurophysiology, neuropsychology, imaging techniques and their interactions together with the ever-increasing development of statistical theories and methods and their relevant software have actually made it possible to build a comprehensive and systemic twin phenotype database and DNA genetic resource database on the basis of the characteristics of psychological development, mental health and neurobiology of twin children. Studies examining the effects and the interaction of genetic and environmental factors upon mental health by using twin databases are emerging as an overwhelming trend in the future of twin studies.

From now on, we should take full advantage of relatively sophisticated research techniques and methods to establish twin registration systems aimed at children, and probe into the influences of genetic, developmental and environmental on the children's mental development by using modern twin research methods. This may contribute to the interpretation of the interaction between genetic and environmental determinants and may also build a theoretical basis for the establishment of effective therapies, which are based on the current Chinese situations of medical care, education and psychological consultation.

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