# Current Panorama and Future Perspectives of Congenital Heart Disease Treatment in China

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## Congenital Heart Disease in China 2

# Current treatment outcomes of congenital heart disease and future perspectives

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This is the second in a Series of three papers about congenital heart disease in China. All papers in the Series are available at www.thelancet.com/series/congenital-heart-disease-china

China has the largest number of individuals with congenital heart disease (CHD) in the world and a heavy burden of CHD. Therefore, understanding current CHD treatment outcomes and patterns in China will contribute to global progress in CHD treatment and be a valuable experience. Generally, CHD treatment in China has satisfactory outcomes owing to the joint efforts by all relevant stakeholders across the country. However, efforts are needed to overcome the remaining challenges: management of mitral valve disease and paediatric end-stage heart failure needs to be improved; cohesive paediatric cardiology teams should be established and collaboration between hospitals enhanced; CHD-related medical resources need to be more accessible and equitable; and nationwide CHD databases should be enhanced. In the second paper of this Series, we aim to systematically summarise the current CHD treatment outcomes in China, discuss potential solutions, and provide future perspectives.

### *White Book of Chinese Cardiovascular Surgery and Extracorporeal Circulation* from 2017 to 2021

Since 2010, the Chinese Society of Extracorporeal Circulation has published annual reports about cardiac surgery and extracorporeal circulation for different diseases in different regions of China. As the formal document at the governmental level, these annual reports provide substantial information and development trends in cardiovascular surgery, and they aim to improve the understanding of the current status of, and the policy making for, the cardiovascular surgery specialty. Until 2021, 728 centres were included in this registry, and its administration is essential to real-world analysis.

### China Heart Transplant Registry

The National Health Commission of the People's Republic of China established the China Heart Transplant Registry in 2009. All heart centres that are qualified for heart transplantation are included in the registry. Data metrics include patients' baseline characteristics, donor information, details of heart transplantation, administration of immunosuppressants, and in-hospital and post-discharge outcomes. The *Report on Organ Transplantation Development in China* contains data from the registry and has been released to share the situation and outcomes of organ transplantation in China since 2015; it was initially a multi-year report (2015–18), but later became an annual report.

### Hospital Quality Monitoring System (HQMS)

This programme was initiated by the National Commission of the People's Republic of China in 2011 to establish a national database on the quality and efficiency of medical services. The HQMS provides essential data for the assessment and quality control of hospitals and it improves the surveillance of medical systems. This database retrieves information from each patient's medical record homepage, which contains indices of demographics, mortality, complications, outcomes, and expenditures during hospitalisation.

### China Statistical Yearbook

This yearbook is compiled by the National Bureau of Statistics of China and is published every year to report data on the economic and societal development of all administrative regions.

# Section 1 Overview of CHD treatment in China

# Rapid development since 1980s

NCCD 国家心血管病中心 NATIONAL CENTER FOR CARDIOVASCULAR DISEASES

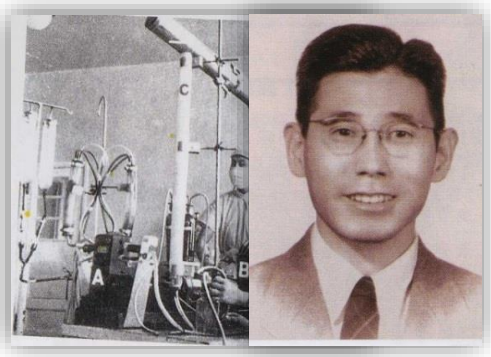
中国医学科学院阜外医院 FUWAI HOSPITAL，CAMS & PUMC

**1944**

**First CHD surgery in China —— Surgical ligation of PDA by Dr. Yingkai Wu**

**1958**

**First open-heart surgery——VSD repair by Dr. Hongxi Su & the first heart-lung machine in China**



**1987**

**First ASO surgery in China by Dr. Jiaqiang Guo**

**1989**


**First neonatal CHD surgery by Dr. Wenxiang Ding**

**Rapid development**

Lancet Child Adolesc Health. 2023 Jul;7(7):490-501.
CHD 2021;16(1):17-25.
Lancet. 2021;398(10303):870-905.

# Surgical Procedures

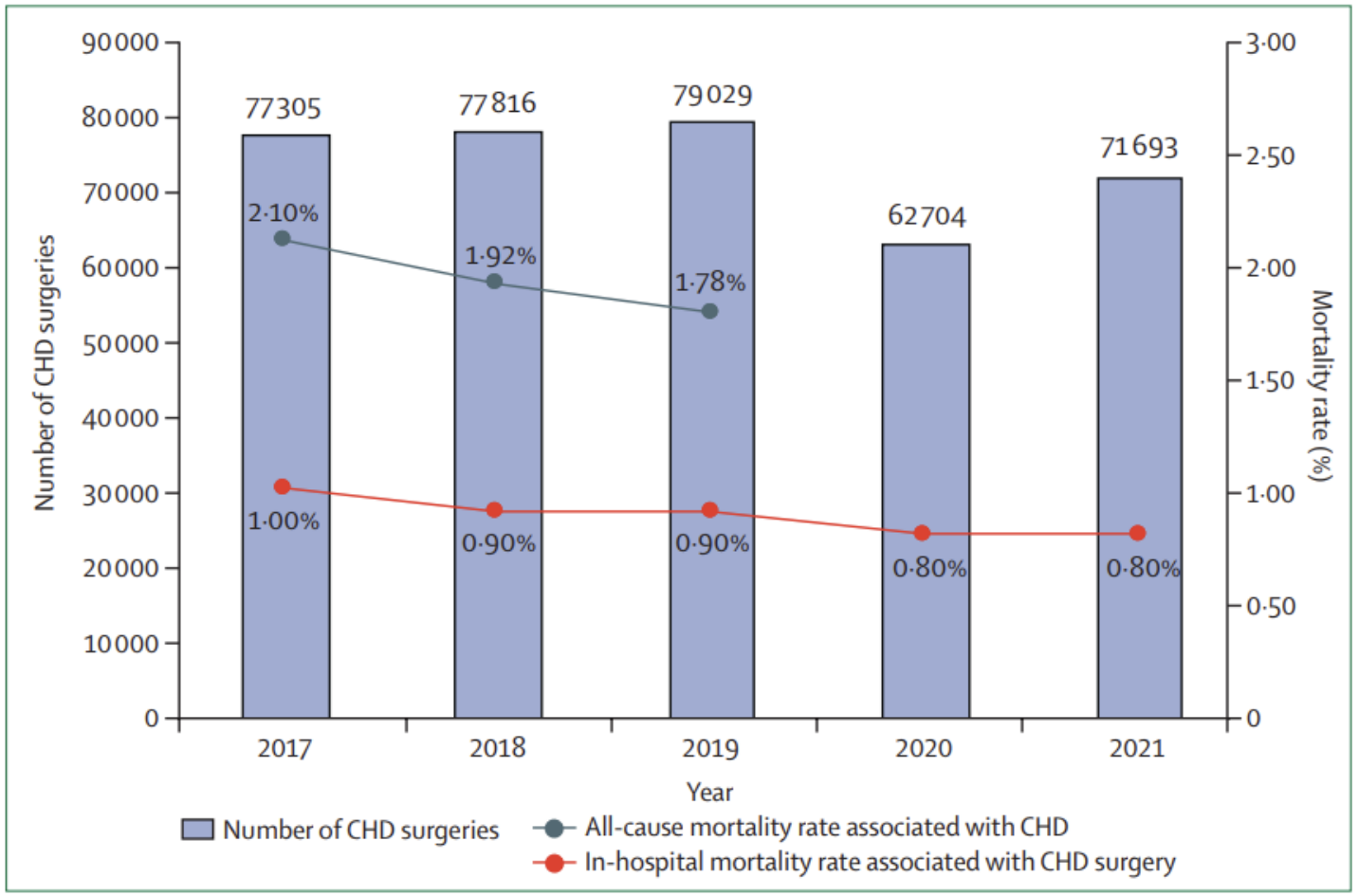
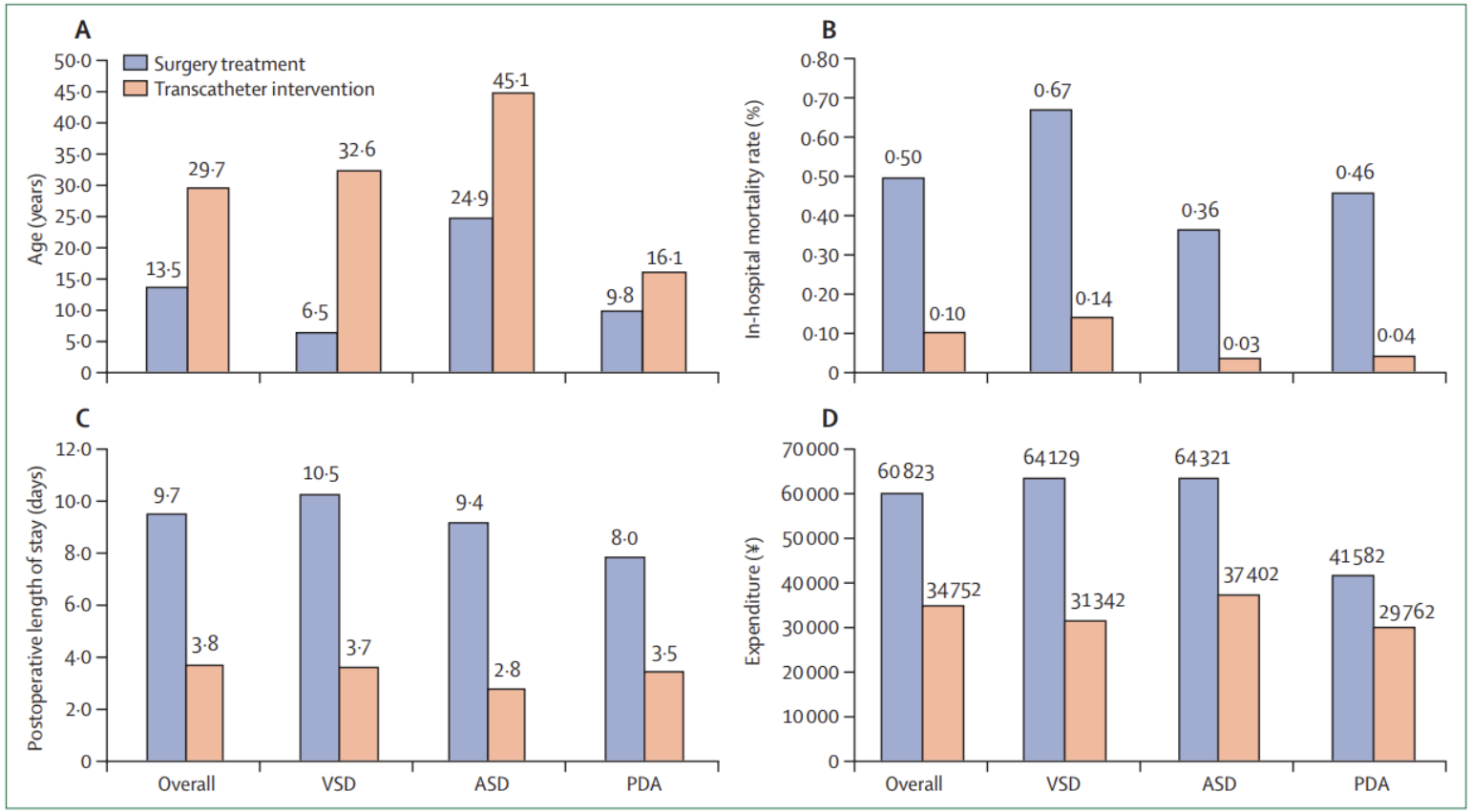



**Figure 1. Annual number of CHD surgeries and mortality rates**

- **Stable CHD surgical volume** (despite the negative impact of COVID-19).
- **Increased proportion** of individuals with CHD undergoing surgeries.
- **Lower in-hospital mortality** than STS and ECHSA database (possibly due to higher proportion of mild CHD).
- Substantial mortality after discharge and still lack of comprehensive **follow-up and lifelong management system**.

*1. HQMS. 2. White book of Chinese CVS and ECC.*
*3. CHD 2021;16(1):17-25. 4. Lancet. 2021;398(10303):870-905.*

# Mild CHD




- 326012 mild CHD procedures from 2017 to 2021 derived from HQMS.
- More patients received surgical treatment with more complex deformities and younger age.

**Figure 2: Comparison between surgical repair and transcatheter intervention according to the type of mild congenital heart disease**


*1. HQMS.*
*2. ATS 2022;113(3):896-902.*

# Complex CHD

| | Study design and population | Death* | Survival |
|---|---|---|---|
| **Tetralogy of Fallot** | | | |
| Beijing (2012–17)[37] | Single-centre cohort of 1673 patients (40% female) with tetralogy of Fallot requiring primary repair | No deaths | Not reported |
| **Pulmonary atresia** | | | |
| Guangzhou (2010–19)[41] | Single-centre cohort of 127 patients (41% female) with pulmonary atresia with VSD and major aortopulmonary collateral arteries; group 1: multi-stage complete repair (n=51); group 2: single stage complete repair (n=30); | Group 1: three early deaths and two late deaths; group 2: three early deaths and three late deaths | 88·2% at 1 year and 76·6% at 5 years |
| **Total anomalous pulmonary venous connection** | | | |
| Shanghai (2005–14)[49] | Single-centre cohort of 768 patients (33% female) with total anomalous pulmonary venous connection | 38 early deaths and 13 late deaths | Not reported |
| **Double-outlet right ventricle** | | | |
| Beijing (2005–12)[48] | Single-centre cohort of 380 patients (no data on sex) with double-outlet right ventricle | 17 early deaths and seven late deaths | 94·4% at 6 months, 93·5% at 1 year, and 93·5% at 5 years |
| **Transposition of the great arteries** | | | |
| Beijing (1997–2019)[44] | Single-centre cohort of 666 patients (26% female) with complete transposition of the great arteries | Seven early deaths and 31 late deaths | 98·2% at 30 days, 95·7% at 1 year, and 94·7% at 5 years |

**Table: Summary of published cohorts with different types of complex CHD in China (partial)**

- 54162 complex CHD procedures from 2017 to 2021 derived from HQMS, accounting for 14.2% of all hospitalizations for CHD, with an in-hospital mortality of 2.5-3.8%.
- Notable outcomes have been achieved in the most complex CHD (ToF, PAA, TGA, DORV and TAPVC).
- **Valvular diseases, pediatric heart failure and pulmonary hypertension** still remain challenging.

*1. HQMS.*

# China's Attempt

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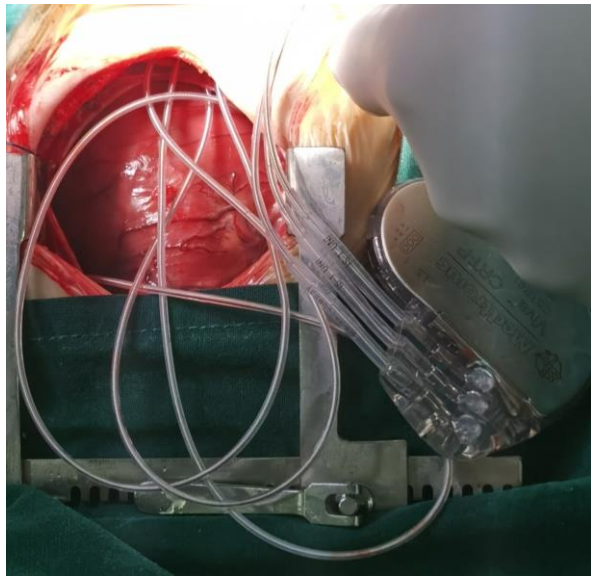
## Surgical attempt: PAB for refractory pediatric HF



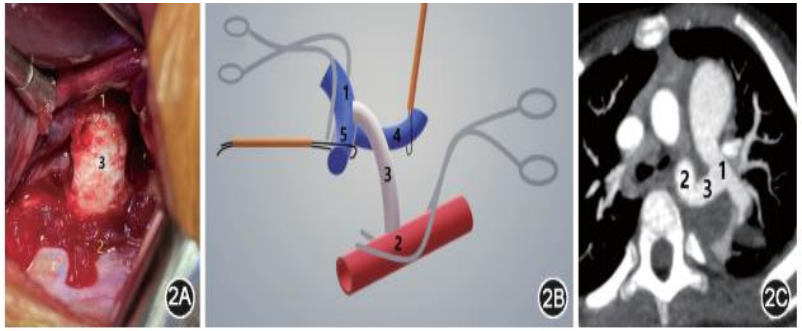
## Jun 22. 2022: First pediatric LVAD implantation in China for a 14-year-old patient

## Reversed Potts shunt to treat pediatric PAH



·病例报告·

急诊 Potts 分流术治疗儿童特发性重度肺动脉高压一例




1:左肺动脉,2:降主动脉,3:Potts 分流管道,4:左上肺动脉,5:左下肺动脉

**图 2** Potts 分流术图片及其示意图(2A 为 Potts 分流术完成效果;2B 为手术示意图;2C 为术后 CT 二维重建显示 Potts 分流管道)

Section 2

# Barriers to effective CHD treatment

# Lack of Cohesive Pediatric Cardiology Teams

Adult cardiac surgeons takes the most responsibility (in most centers).

**Insufficiency of pediatricians:**

- **4** pediatricians per 100,000 children
- **0.26** pediatric cardiac surgeons per million population (**2.08** in North America)

**Uneven development of the pediatric care system**

**Inadequately trained pediatricians**

**Low job satisfaction**

**Unmet demand for pediatric care**

- Encourage more medical students and junior doctors to specialize in pediatrics and address the large **income gap** compared with other specialties.
- Set up a more **comprehensive training program** involving pediatric cardiology, surgery, intensive care, anesthesiology, and perfusion. Early rotate to different departments related to CHD **before training in chosen specialties**.

*1. Pediatr. 2019;144(1):e20183532.*

# Inadequate Collaboration among Hospitals

- First attempt: **an integrated models of prenatal diagnosis and postpartum treatment**.
- Time interval from birth to neonatal care and surgery ↓
- Survival ↑
- Further collaboration between hospitals is needed.
- For example: **academic alignment** within a city or region for sharing expertise or rapid referral.

1. World J Pediatr. 2022;18(1):59-66.

Section 3

# Access and equity of CHD treatment

# Geographical Distribution

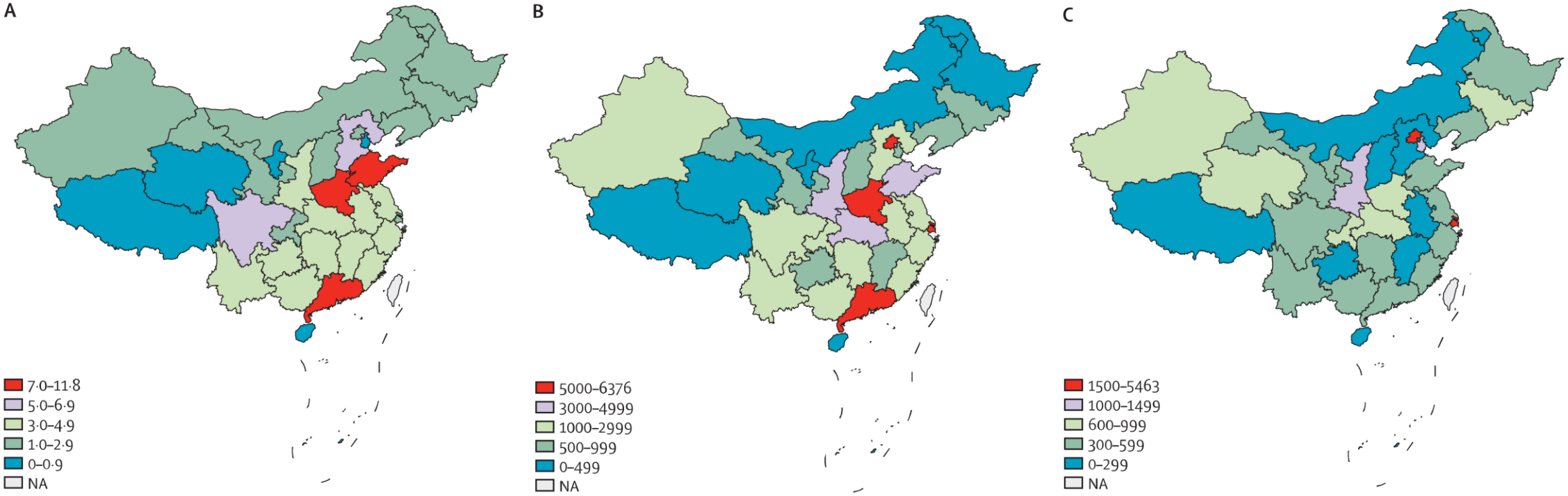



**Figure 3: Geographical distribution of livebirths, CHD surgeries, and workload**

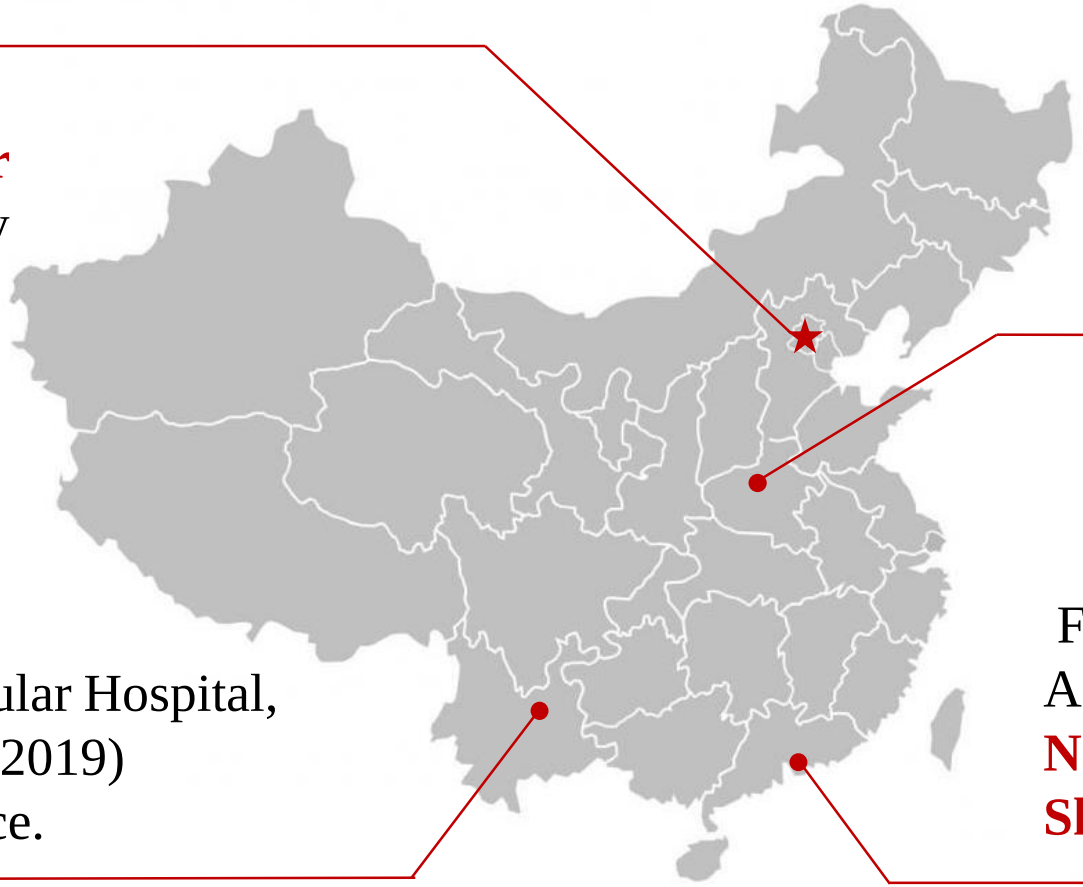
(A) Livebirths in each Chinese province in 2021, per 100000 population.
(B) Number of CHD surgeries in each province in 2021.
(C) Estimated CHD surgery workload in each province in 2021, per 100000 population; workload = the number of CHD surgeries/the number of livebirths in each province.

*1. HQMS.*

# National and Regional Medical Centers

**76 regional medical centers in 23 provinces**

Fuwai Hospital, **National Center for Cardiovascular Diseases**, Chinese Academy of Medical Sciences, **Beijing**, China.



Fuwai Central China Cardiovascular Hospital, **National medical center** (2020) **Zhengzhou**, Henan province.

Fuwai Yunnan Cardiovascular Hospital, **National medical center** (2019) **Kunming**, Yunnan province.

Fuwai Hospital, Chinese Academy of Medical Sciences, **National medical center** (2022) **Shenzhen**, Guangdong province.

# Section 5 Conclusions and future perspectives

*1. HQMS.*

# Conclusion

- **CHD treatment has progressed rapidly and obtained satisfactory outcomes in China**
- **Enhance the management of specific diseases, such as valvular diseases, heart failure and severe pulmonary hypertension**
- **Establish cohesive pediatric cardiology teams and increased collaboration between hospitals**
- **Improve the access and equity of CHD treatment in provinces with limited resource**

# Thank you!