AI adoption combined with realignment of incentives for primary care doctors improves chronic disease management: the case of Tianjin city in China

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China's healthcare system and UHC progress

2022 TEH by Source 85327.49 (100 million yuan)

- 个人现金卫生支出 Out-of-pocket health expenditure 26.89%
- 政府卫生支出 Government health expenditure 28.17%
- 社会卫生支出 Social health expenditure 44.94%

The Universal Health Coverage (UHC) Service Coverage Index, 2021

The Universal Health Coverage (UHC) Service Coverage Index is measured on a scale from 0 (worst) to 100 (best) based on the average coverage of essential services including reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access.
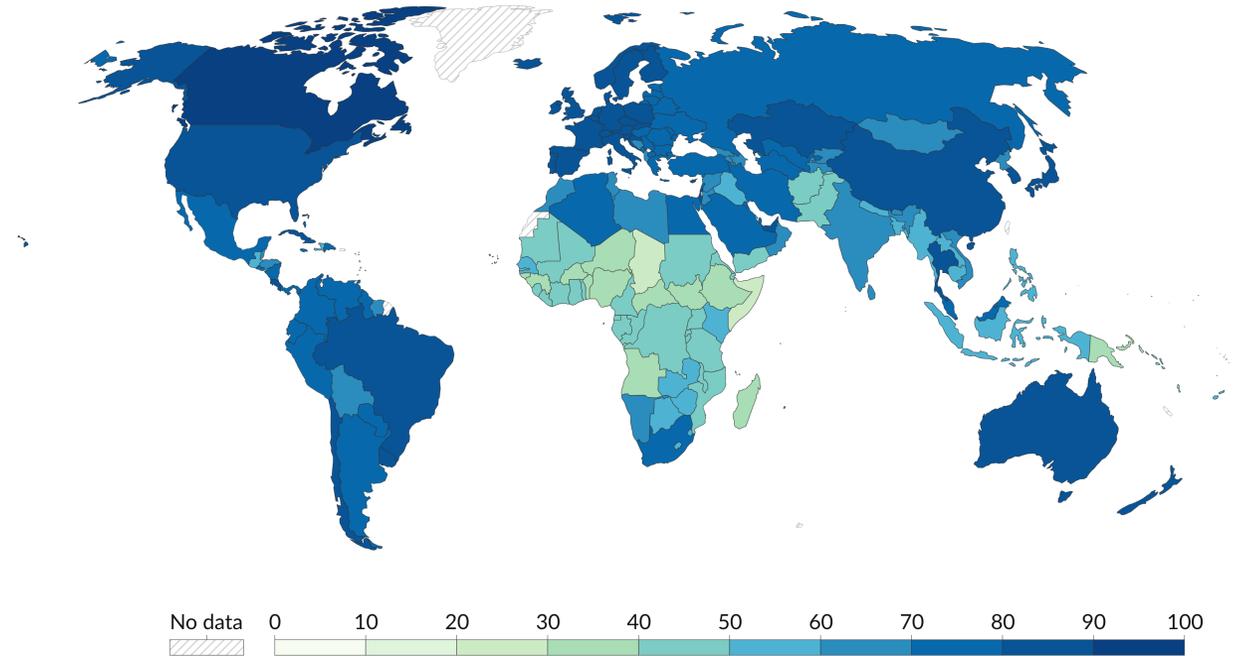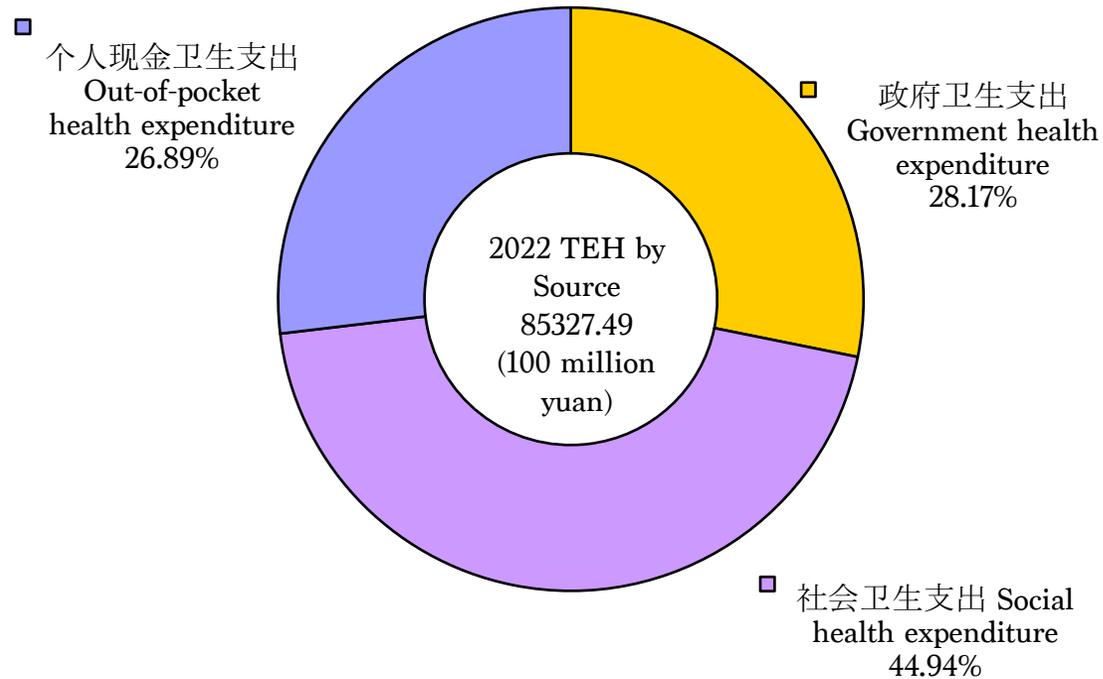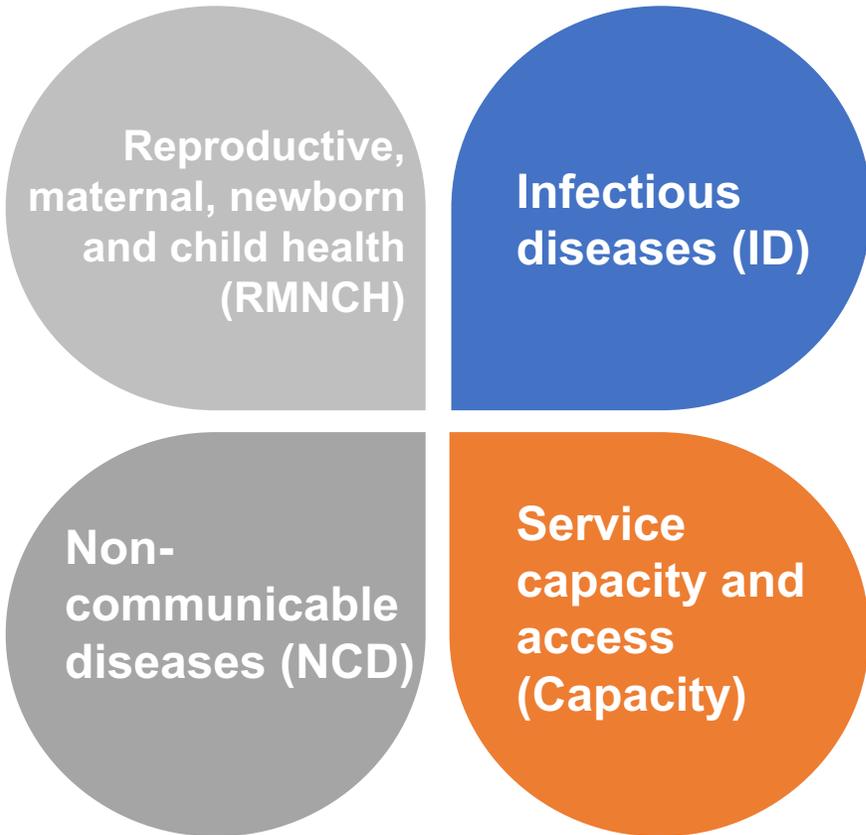
No data   0   10   20   30   40   50   60   70   80   90   100

OOP% decreased from ~60% in 2001 to 26.7% in 2022
>95% of population covered by social health insurance

China's UHC index in 2021: 81/100

Unbalanced UHC progress in China

Reproductive, maternal, newborn and child health (RMNCH)

Infectious diseases (ID)

Non-communicable diseases (NCD)

Service capacity and access (Capacity)

|	Definitions	Estimated coverage (year)
Reproductive, maternal, newborn, and child health		
Prevention		
Family planning*	Demand satisfied with modern methods, including contraceptives in all women of reproductive age irrespective of marital status	92·0% (2019)[14]
ANC4	Proportion of women receiving ANC4 during their last pregnancy	94·4% (2018)[4]
Postnatal care*	Proportion of women receiving postnatal care during their last pregnancy	78·1% (2018)[4]
Neonatal screening	Proportion of newborns receiving serological screening for Down syndrome	71·6% (2016–18)[15]
Neonatal screening	Proportion of newborns receiving hearing screening	86·5% (2016–18)[15]
Neonatal screening	Proportion of newborns receiving serological screening for inherited metabolic disorders	98·5% (2016–18)[15]
Child immunisation*	Coverage rate of National Immunisation Programme vaccines†	83·1% (2019)[16]
Child immunisation*	Coverage rate of non-National Immunisation Programme vaccines	<50% (2019)[16]
Treatment		
Children with acute respiratory tract infections	Percentage of children <5 years with acute respiratory tract infections in the past 2 weeks who sought formal care	81% (2018)[5]
Children diarrhoea treatment*	Percentage of children <5 years with diarrhoea in the past 2 weeks who sought formal care	85% (2018)[5]
Institutional delivery	Proportion of woman who gave birth at a health facility during their last birth (eg, hospitals, maternal and child health-care institutions, and township hospitals)	98·6% (2018)[6]

- Remarkable progress in the areas of RMNCH, infectious diseases, and service capacity and access
- large gaps in the service coverage of chronic diseases an little progress in controlling risk factors

Hypertension and diabetes management

Hypertension awareness, treatment and control(2014-2021)

- awareness
- treatment
- control
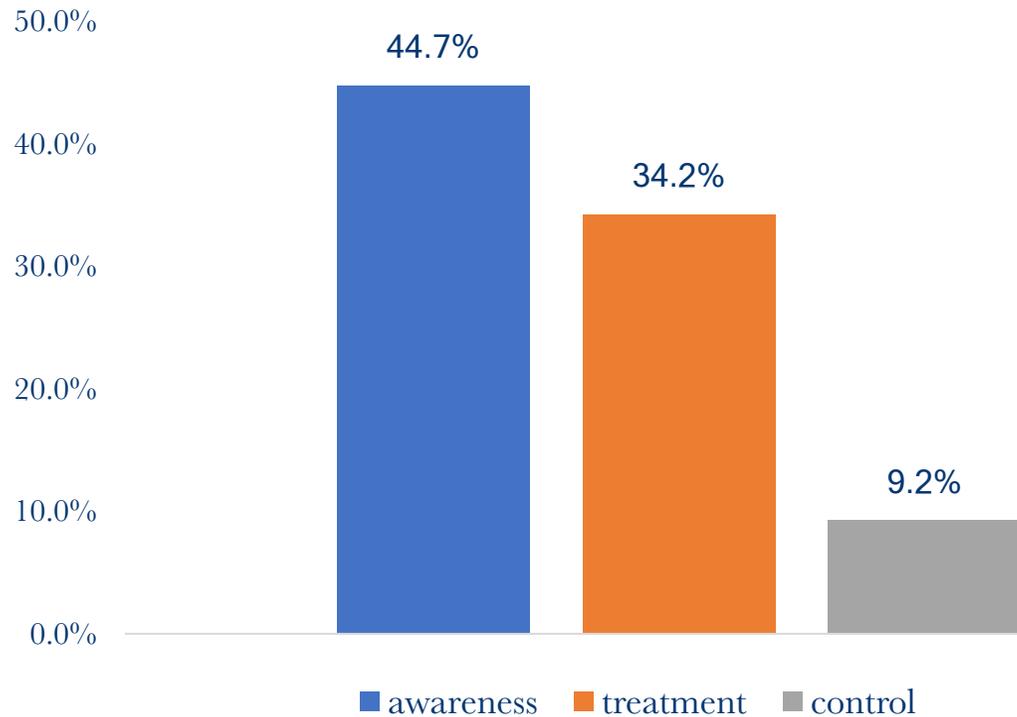
Diabetes awareness, treatment and control (2013)

- awareness
- treatment
- effectively controlled
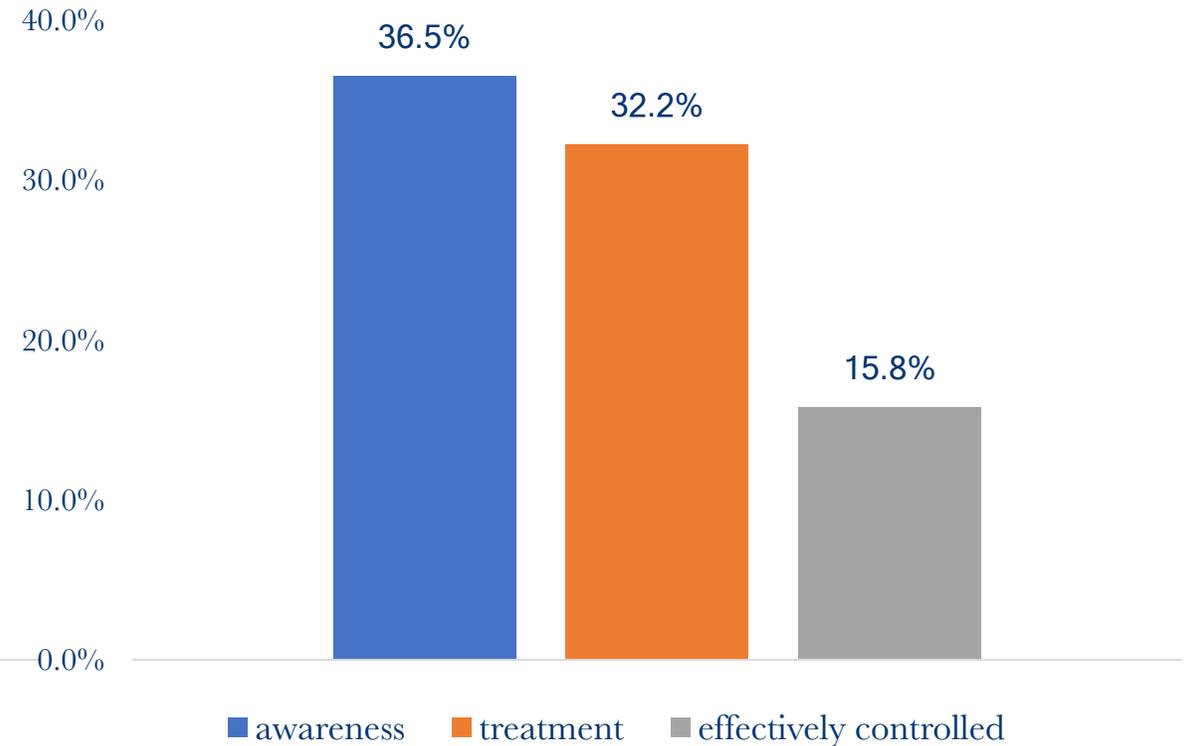
Zhou T, Wang Y, Zhang H, et al. Primary care institutional characteristics associated with hypertension awareness, treatment, and control in the China PEACE-Million Persons Project and primary health-care survey: a cross-sectional study. *Lancet Glob Health* 2023; **11**(1): e83-e94.

Prevalence and Ethnic Pattern of Diabetes and Prediabetes in China in 2013 (Limin Wang, et al., 2017, JAMA)

Underlying causes for China's gaps in UHC

- **A hospital-centric, fragmented, and treatment-focused health delivery system**

  - Public hospitals receive fiscal subsidies that account for merely 10% of their total revenues, and they are paid by a fee-for-service or case-based method with limited accountability for delivering quality or efficient healthcare.

  - Physicians have few incentives to shift from treatment-based curative care to population-based health prevention and management.

  - People do not trust primary care doctors: overuse tertiary care even for simple conditions.
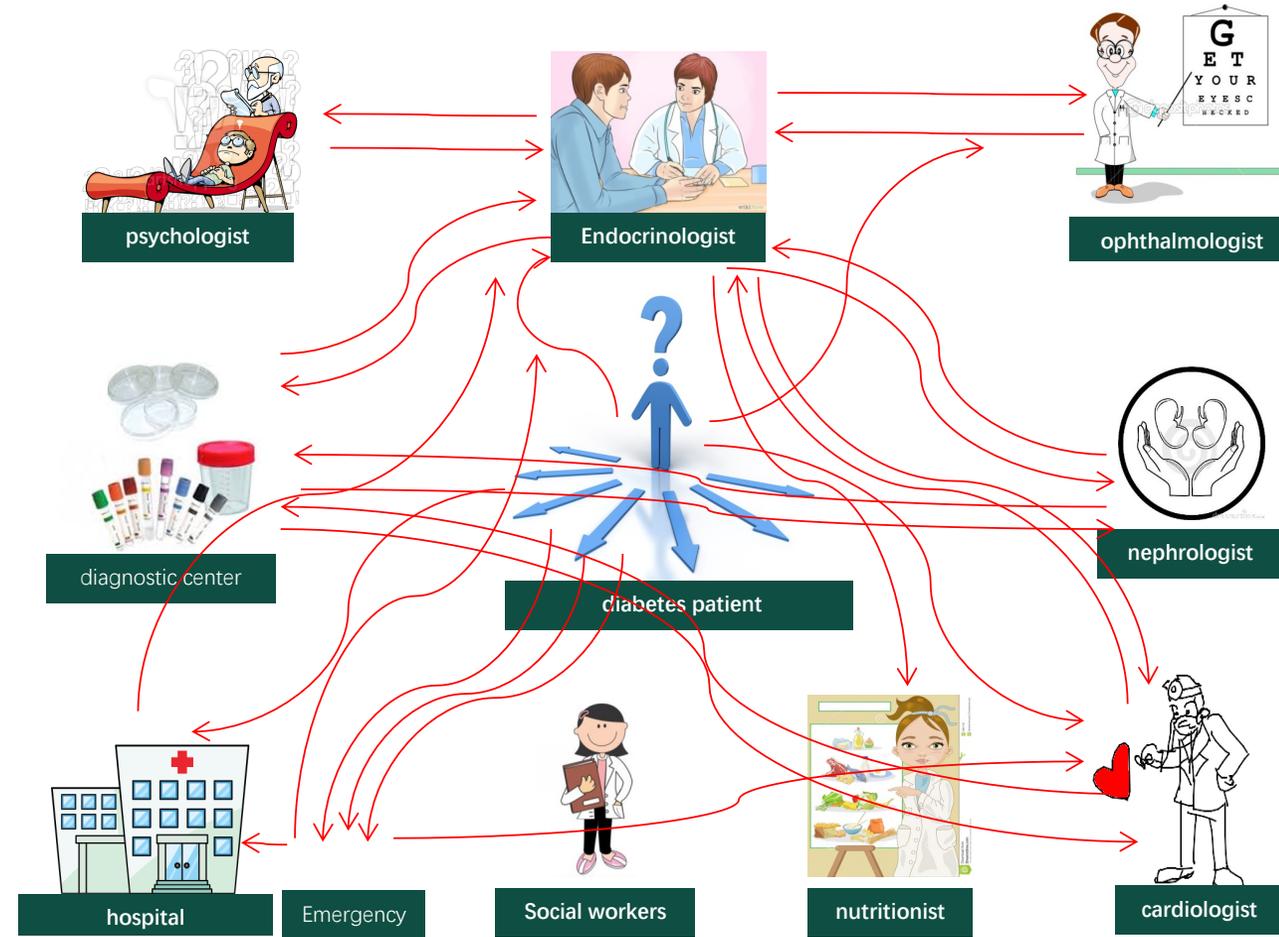
China's healthcare system
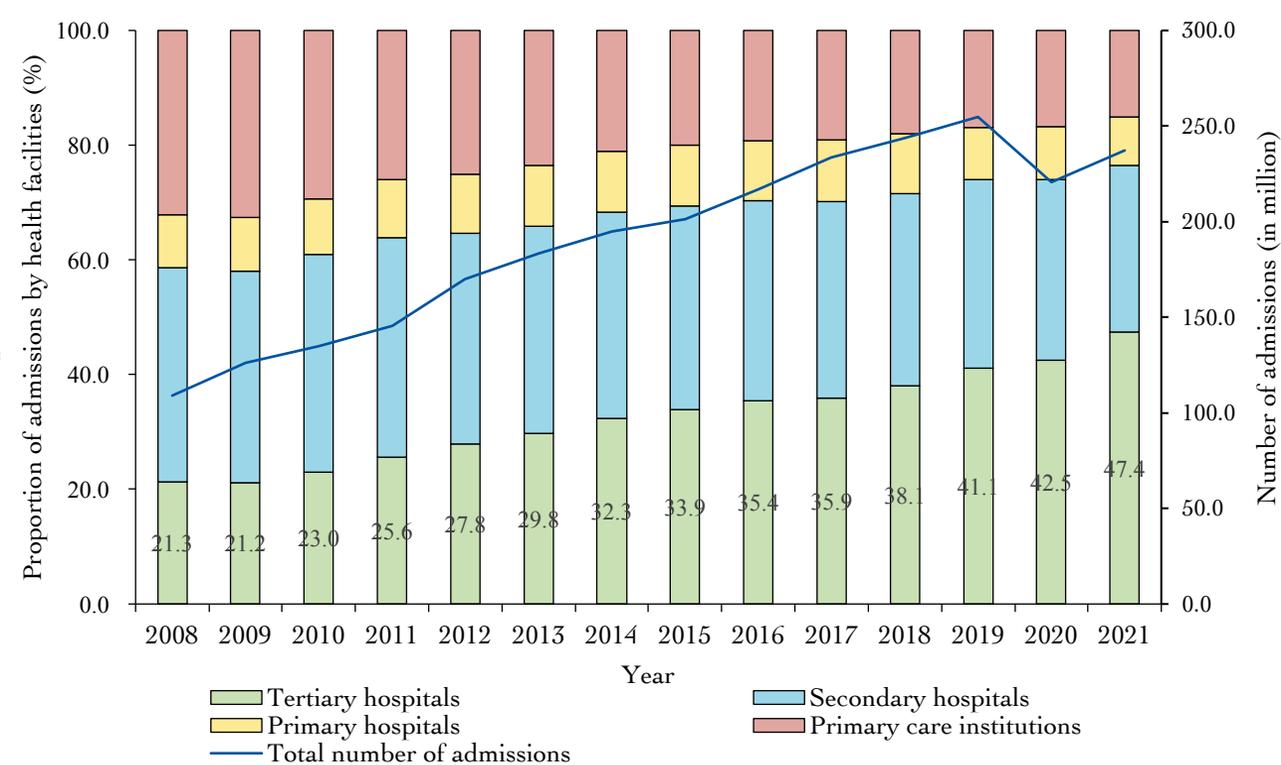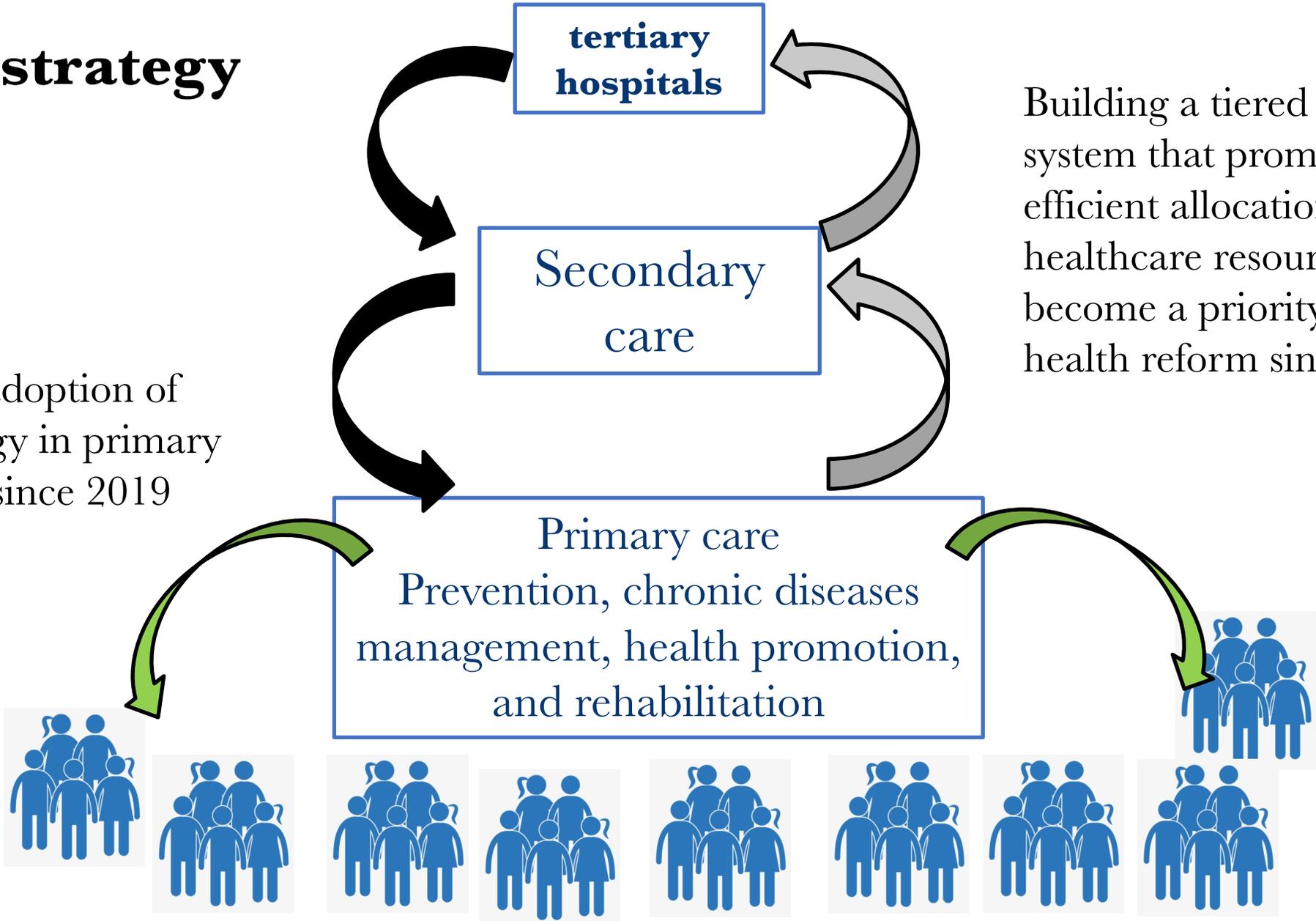
(a) Outpatient visits
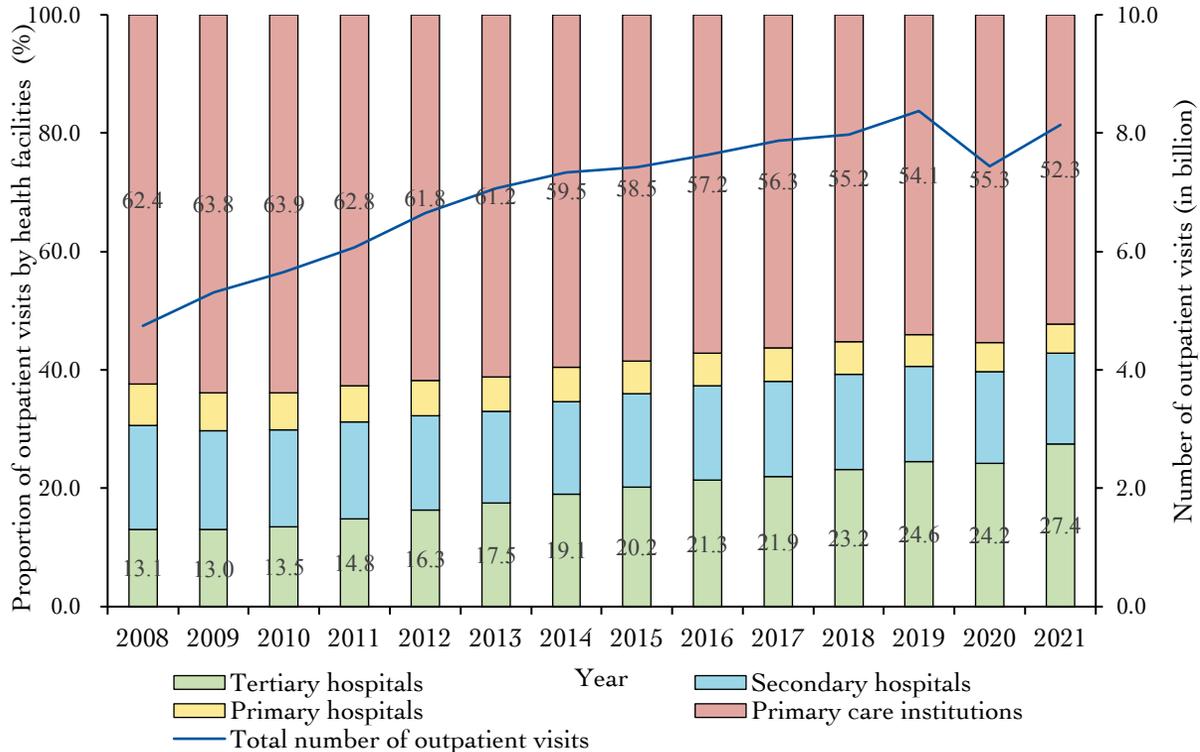
(b) Hospital admissions

Figure 2 Volume and distribution of outpatient visits (A) and hospital admissions (B) by health facility levels (2008 - 2021).
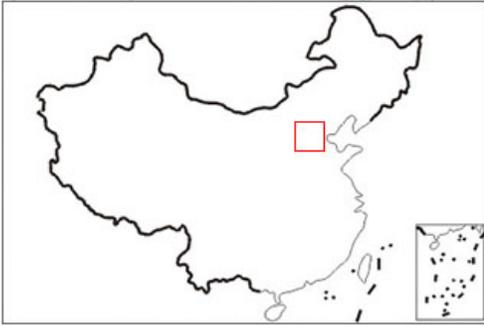
China's strategy

tertiary hospitals

Secondary care

Primary care
Prevention, chronic diseases management, health promotion, and rehabilitation

Building a tiered healthcare system that promotes efficient allocation of healthcare resources has become a priority in China's health reform since 2015
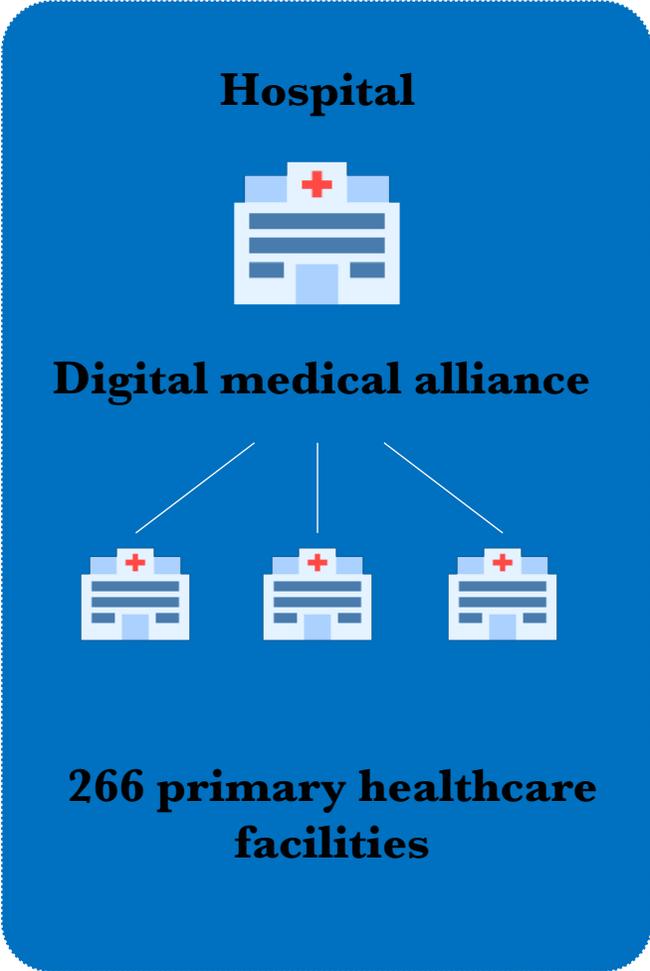
Promote the adoption of new technology in primary care facilities since 2019

The case of Tianjin city, China
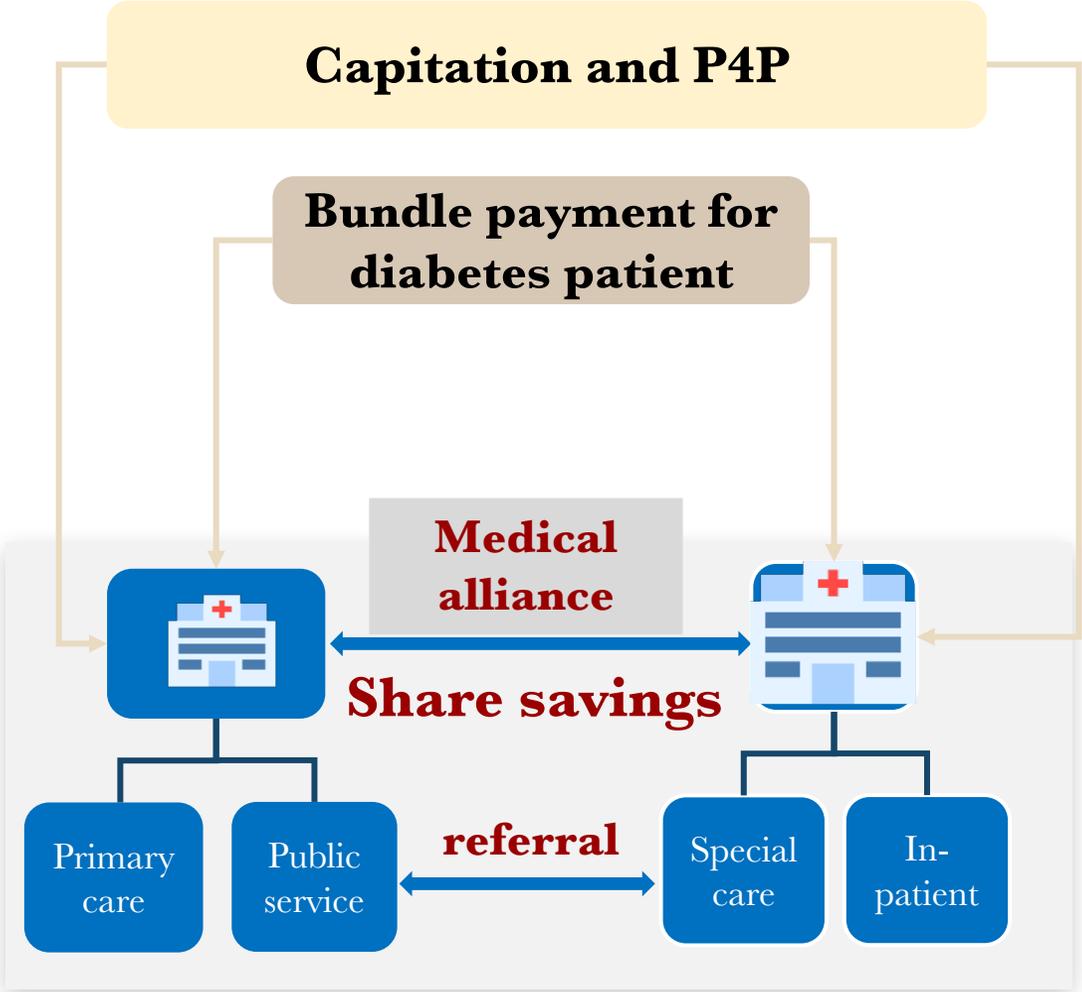

Tianjin City in China

- Located in the North China region, a municipality directly under the central government

- Population was 13.64 million. 23.5% are aged 60 and above in 2022

- $17,192 GDP per capita

- the urbanization rate in Tianjin was 85.5% in 2023

- Around 250 thousands of diabetes patients in 2022

Legend

★ Capital City

▲ Meteorological station

Beijing

Tianjin

Hebei

The case of Tianjin city since 2022

Hospital

Digital medical alliance

266 primary healthcare facilities

Vertical Integration

+

Capitation and P4P

Bundle payment for diabetes patient

Medical alliance

Share savings

referral
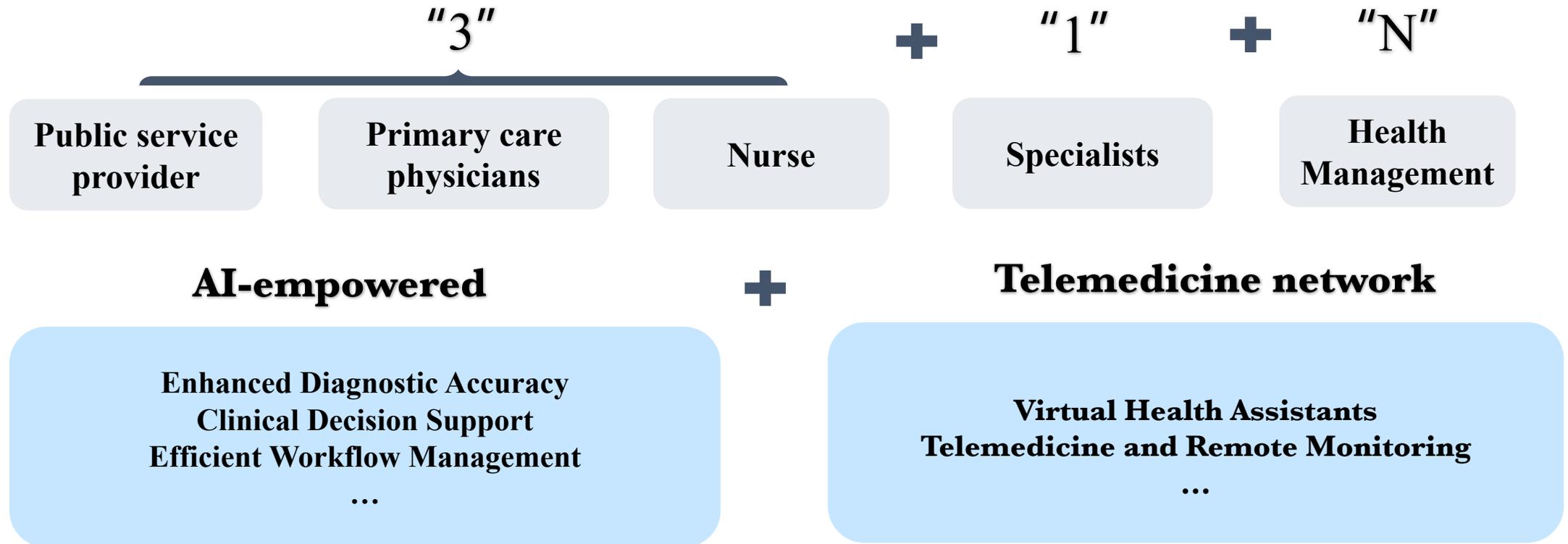
| Primary care | Public service | Special care | In-patient |

Incentive change for doctors

3+1+N service team in Tianjin city

The "3+1+N" service model involves the transformation of service teams

"3" + "1" + "N"

| Public service provider | Primary care physicians | Nurse | Specialists | Health Management |

AI-empowered + **Telemedicine network**

Enhanced Diagnostic Accuracy
Clinical Decision Support
Efficient Workflow Management
...

Virtual Health Assistants
Telemedicine and Remote Monitoring
...

AI empowered primary care

Before diagnosis

During Diagnosis

After Diagnosis

Intelligent pre-consultation and disease screening, and summarizing the patient's condition

Recommendations for diagnosis, tests and treatment

Alerts for irrational medical practice and prescription

Telemedicine network

Tele-pharmacy

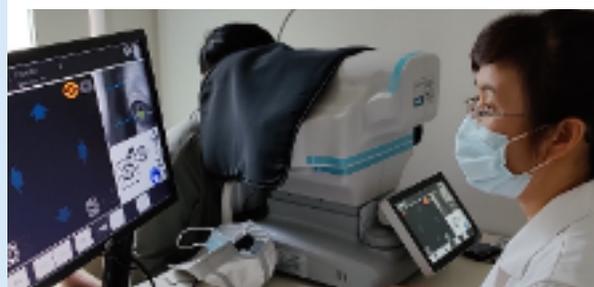**Online prescription**

Delivery

Tele-examination

Mobile Medical Unit

Online screening

Tele-service

Online consultation

Home care

Preliminary evaluation results (before and after analysis)

Health Outcome

Diabetes patients

HbA1c Target Achievement
17.8%→44.2%

Blood glucose control rate
49.5%→61.5%

Blood pressure control rate
24.8%→27.9%

Capacity building

Service volume increased by
16.2%

80.3% of diabetes patients choose primary care as the first contact

Cost savings

The surplus from the capitated management of diabetes was
24.9%

Inpatient care utilization decrease by **4.2%**

Physician income increased by
15.1% per month

*The data is a comparison between June 2024 and January 2023.

Next step in Tianjin city
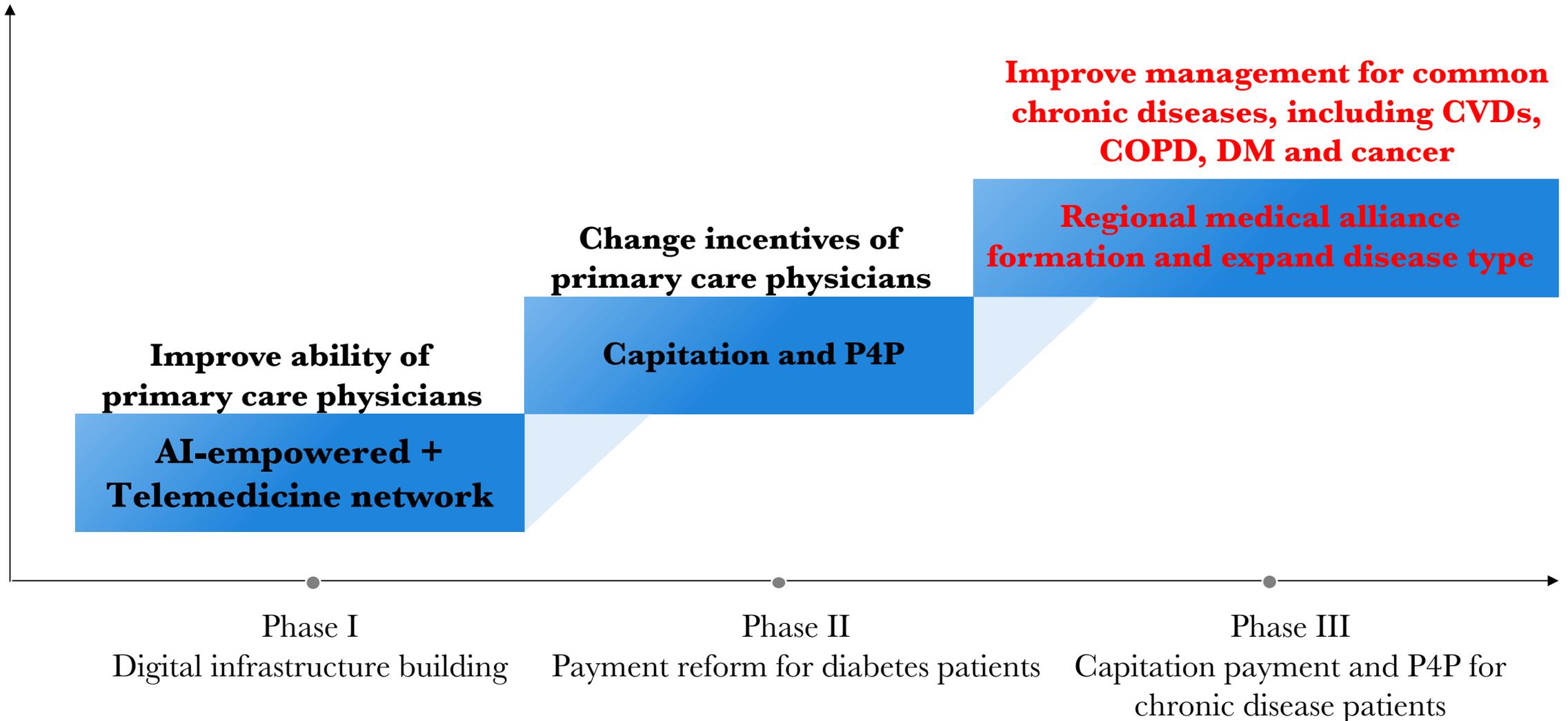
Summary and key message

- In 2022, Tianjin city in Northern China initiated an innovative chronic disease management model for patients with diabetes in its 266 primary care facilities, in which AI was widely adopted to assist primary care physicians in diagnosis and prescription, combined with capitation and pay-for-performance reforms.

- Outpatient service utilization among patients with diabetes increased by 16.2%, while inpatient care utilization decreased by 4.2% after one year since the implementation of the Tianjin model

- Moreover, the share of diabetic patients with controlled glycosylated hemoglobin (HbA1c level <7·0%) increased by 22.1 percentage points, along with declined proportion of abnormal blood pressure and glucose

Summary and key message

- Such a systemic reform, where AI adoption, payment methods, and physician compensation methods are aligned, are crucial to improving their performance

- Doctors' unwillingness and resistance are frequently cited as barriers to new technology such as telemedicine (Akhlaq et al., 2016; Smith et al., 2020).

- Integrating AI into the existing health delivery system with realignment of incentives may be a useful strategy to promote doctors' acceptance.

- Lessons from other pilots in China

Thank you!