Strengthening evidence-based policy making in support of universal healthcare

Introducing evidence-based clinical pathways for stroke and COPD in rural China

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Acronyms and abbreviations

Acronym	
ARIMA	Autoregressive integrated moving average (model)
BRICS	Brazil, Russia, India, China & South Africa
CHD	Coronary heart disease
CI	Confidence interval
COPD	Chronic obstructive pulmonary disease
CP	Clinical Pathways
CPHD	Complication of chronic pulmonary heart disease
CPOE	Computerized physician order entry
CNHDRC	China National Health Development Research Center
CT	Computed tomography
DFID	Department for International Development (UK)
EBMI	(Urban) Employees' Basic Medical Insurance
EQ-5D-3L	EuroQol health-related quality of life questionnaire – 5 dimensions – 3 levels
FFS	Fee-for-service
GDP	Gross Domestic Product
GHSP	Global Health Support Programme

Acronym	
G-I-N	Guidelines International Network
HIS	Hospital information system
HITAP	Health Intervention and Technology Assessment Program (Thailand)
HIV/AIDS	Human immunodeficiency virus and acquired immune deficiency syndrome
HPS	Health Partnership Scheme
HTA	Health Technology Assessment
HTAi	Health Technology Assessment International
ICD	International Classification of Diseases
IT	Information technology
ITS	Interrupted time-series
IV	Intravenous
LMIC	Low and middle income countries
MDG	Millennium Development Goals
M&E	Monitoring & Evaluation
MRI	Magnetic resonance imaging
MoH	Ministry of Health
MoU	Memorandum of Understanding
NCD	Non-communicable diseases
NHFPC	National Health and Family Planning Commission (China – former Ministry of Health)
NHS	National Health Service (UK)
NI	National Institute for Health and Care Excellence International (UK)
NICE	National Institute for Health and Care Excellence (UK)
NRCMS	New Rural Cooperative Medical Scheme
OOP	Out-of-pocket
P80	Cost of treating 80% of patients
PPP	Public Private Partnership
PRC	People's Republic of China
PMAC	Prince Mahidol Award Conference
QMHB	Qingdao Municipal Health Bureau
RBMI	(Urban) Residents' Basic Medical Insurance
RF	Respiratory failure
RMB	Renminbi
SAS	Statistical Analysis System (software)
TB	Tuberculosis
THE / TEH	Total health expenditure
TIA	Transient ischaemic attack
UHC	Universal Health Coverage
VAS	Visual analogue scale
WHO	World Health Organisation

Acknowledgements

This report summarises the processes and the results available to date from a collaborative project between China National Health Development and Research Centre (CNHDRC) and National Institute for Health and Care Excellence (NICE) International.

The clinical pathways and associated reforms were developed with vital contributions from clinical experts, in particular Professor Zhen Wang (Beijing Chaoyang Hospital), Prof Liping Liu (Beijing Tiantan Hospital), Prof Tom Treasure (University College London), Prof Klim McPherson (Oxford University), Prof Tony Rudd (King's College London), Prof Mike Roberts (UCL Partners; Barts Health NHS Trust). Extensive and iterative input to the project design and implementation was also contributed from staff of Qianjiang Central Hospital of Chongqing city; First People's Hospital of Hanbin district; People's Hospital of Huangdao district; and the People's Hospital of Wen county.

Quantitative and qualitative data collection and analysis for this project was conducted by CNHDRC, with technical input from NICE International. The content and analysis in this report, therefore, are owned by CNHDRC, who likewise have ownership and responsibility for conclusions and policy recommendations based on the analyses. Qualitative findings were also drawn from a report prepared by Itad (contracted by NICE), following site visits and key informant interviews with NICE, CNHDRC and health facility staff and stakeholders [1].

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Executive summary

Background and objectives (Part 1)

As part of ongoing public hospital reform in rural China, the development of evidence-based care pathways has been prioritised. The China National Health Development and Research Centre (CNHDRC) in collaboration with the National Institute for Health and Care Excellence (NICE) International embarked on a pilot project to develop and implement evidence-informed care pathways, which are linked with payment reform for two high priority disease areas (chronic obstructive pulmonary disease [COPD] and stroke).

Clinical pathways (CPs) are recognized as effective instruments for improving medical quality; reducing medical service costs and increasing the cost-effectiveness of overall health resource utilization; and coping with the changes in payment modes. Both health authorities and rural medical institutions regarded evidence-based care pathways as realistic options to contain medical costs while improving care quality in rural China.

This chapter details the existing challenges hindering reforms by the Chinese government to meet the increasing needs of patients in rural areas. There is evidence that healthcare providers have been financially incentivized to over- or under-provide healthcare services, and concerns remain that inappropriate behaviours by providers are fuelling costs and affecting quality of care and patient safety. The misuse of resources may at least be partly due to the absence of practical clinical guidelines and effective monitoring mechanisms over the use of medicine and medical devices. This is especially concerning for non-communicable diseases (NCDs), which account for an estimated 87% of annual deaths and 69% of the total disease burden in China, and are expected to absorb an increasing share of health expenditure.

The clinical pathways and payment reforms were developed as part of a long-standing collaboration between CNHDRC and NICE International. An earlier phase of this collaboration (Phase One) from 2009-12 focused on integrating CP management with case payment reform for high-priority common surgical interventions. It demonstrated beneficial changes in provider behaviour, enhanced care quality, and the containment of medical expenditure. Phase Two (2012-) focused on non-communicable disease (specifically stroke and COPD) rather than surgical interventions. These were chosen due to the morbidity and mortality rates in rural China.

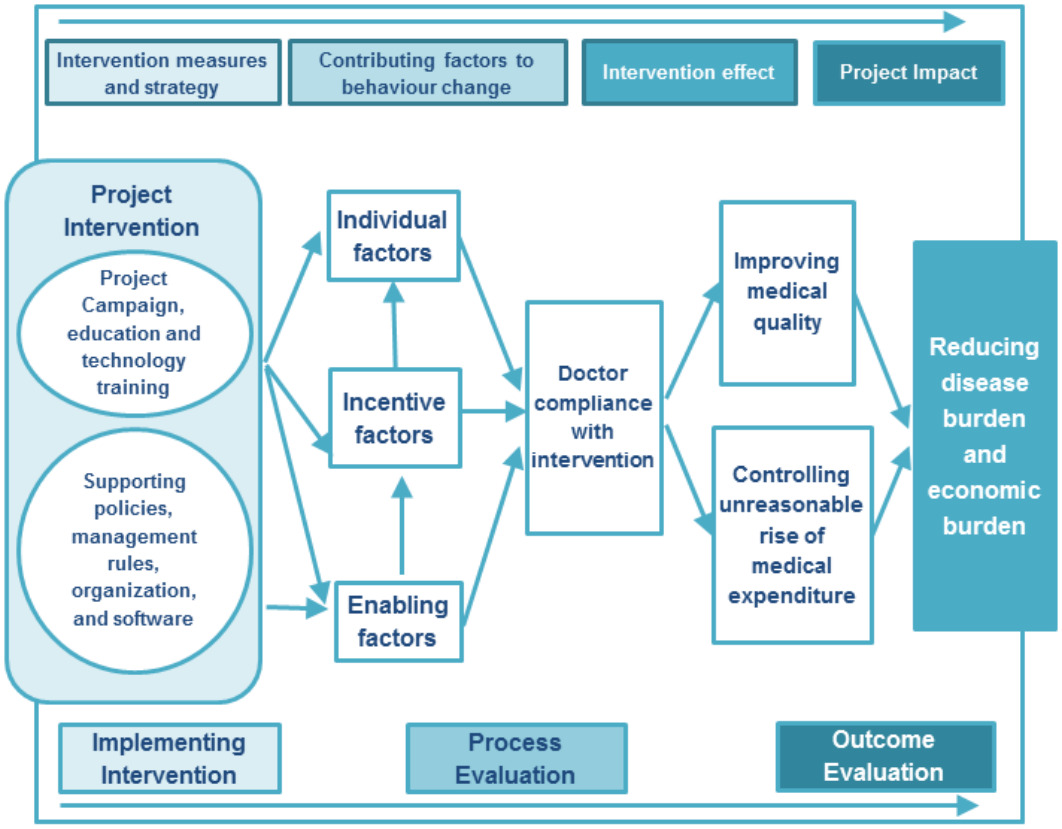
This phase was designed as integrated reform in which clinical pathways are combined with other reforms, including payment reform and development of data management systems and software, rather than as a standalone pilot of clinical pathways. It also included the initiation of a South-South dissemination strategy to share two-way learning with India and South Africa. This aims to provide useful experience and resources to other policy-makers and practitioners interested in introducing similar reforms, and share the experience more broadly of designing and implementing evidence-based policies.

Design and methods (Part 2)

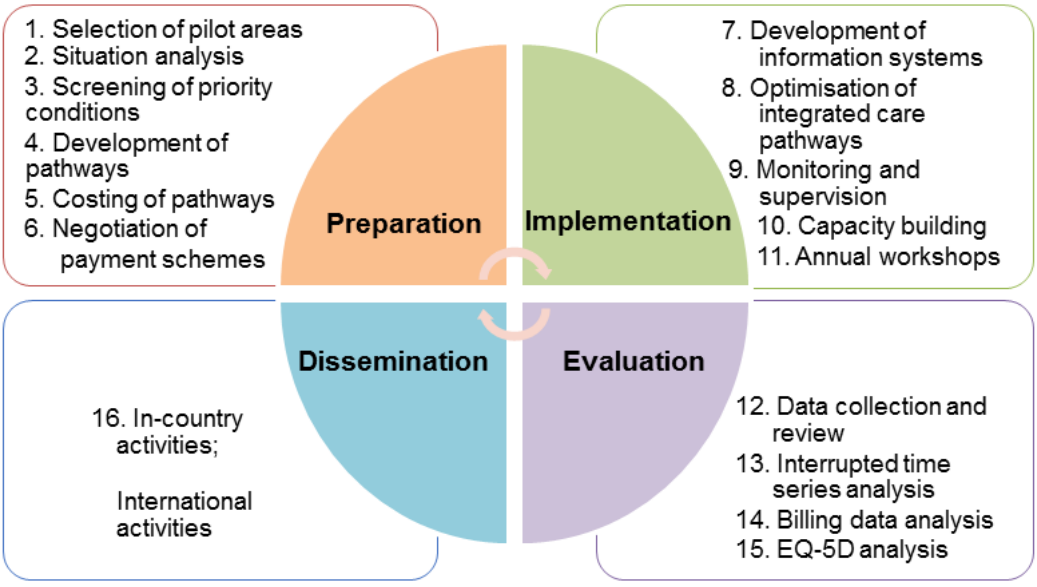
NICE International and the China National Health Development Research Centre started implementation of a pilot integrating clinical pathways with other supporting systems for selected conditions in four counties in China. Counties were chosen based on understanding and enthusiasm for the pilot and local management capacity. Hospitals included in the pilot are believed to have a 'reasonably good' level of clinical practice and to be broadly representative of this kind of institution, as well as having, for the most part, well-developed information systems. Counties included in the pilot had different levels of capacity and experience in implementing clinical pathways and/or payment reforms. Two of the project counties, Qianjiang and Hanbin, took part in the Health XI Project (World Bank-DFID China Rural Health Project) and under this carried out reforms integrating clinical pathways and payment reforms. Jiaonan was not part of the Health XI Project, but has implemented national clinical pathways policy since 2009, though this has not been integrated with payment reform.

The CNHDRC-NICE project was designed as a pilot of an integrated reform ('clinical pathways+') in which clinical pathways are combined with other reforms, rather than as a standalone pilot of clinical pathways. Core components of pilot design included development of contextually-appropriate clinical/care pathways; development of related data management systems and software in project counties; negotiation and development of remuneration systems for medical personnel to increase their support for clinical pathways; standardisation of clinical behaviour, increasing quality of services and control unreasonable growth in medical spending; enabling hospitals to provide convenient, safe, effective and reasonably-priced services; improvement of capacity for evidence-based decision making; and promotion and propagation of a model of clinical pathways and payment reform. In addition, the scope of the pilot includes trialing of integrated care across levels of the health system (county, township, village).

Planning for the project itself, and for evaluation of the results and impact of the intervention, had to take into account the national policy context including concurrent comprehensive healthcare reforms. The research and implementation team formulated a theoretical framework for intervention with reference to the PRECEDE-PROCEED model, considering the individual and institutional factors which would affect compliance with the reforms introduced.



Stakeholders and local practitioners gave continuous feedback to the research team, in order to ensure that implementation was tailored to local conditions as far as possible. Based on the project management experience of Phase One, activities comprising the intervention were outlined within four broad categories: ***preparation***, ***implementation***, ***evaluation*** and ***dissemination***.



Preparation consisted of the following activities:

1. **Selection of pilot areas:** Site investigations and discussions with various local stakeholders were conducted to assess the suitability of potential locations for the pilot. Four counties were selected, including two pilot areas from Phase One of the CNHDRC-NICE collaboration: Huangdao county of Shandong province, Wen county of Henan province, Qianjiang county of Chongqing Municipality, and Hanbin county of Shaanxi province.
2. **Situation analysis:** A situation analysis of the pilot areas collected quantitative and qualitative baseline information to facilitate cross country comparisons, including data on selected socioeconomic, demographic, health and health system indicators.

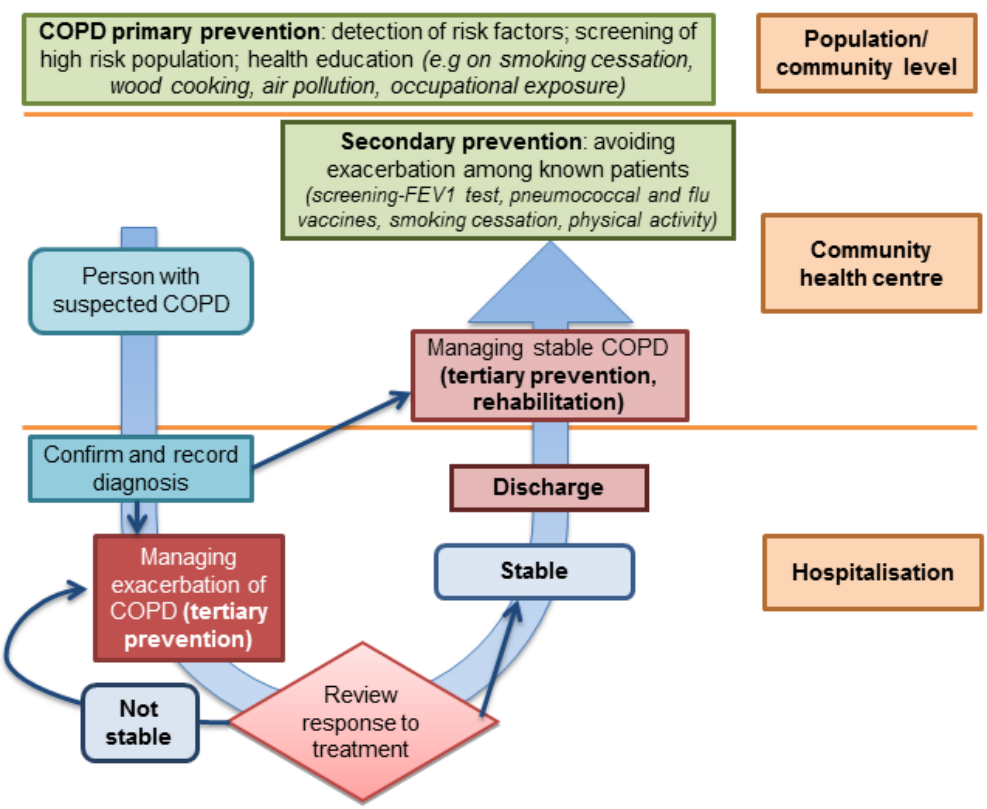
   Health care institutions in the pilot areas face varying local needs and economic contexts (see key institutional features of each hospital in table below). Note that during the Phase 1 project, the hospital in Qianjiang was upgraded to tertiary hospital status, the only such hospital in the district.

   Summary description of the four pilot hospitals before pilot implementation (2013)

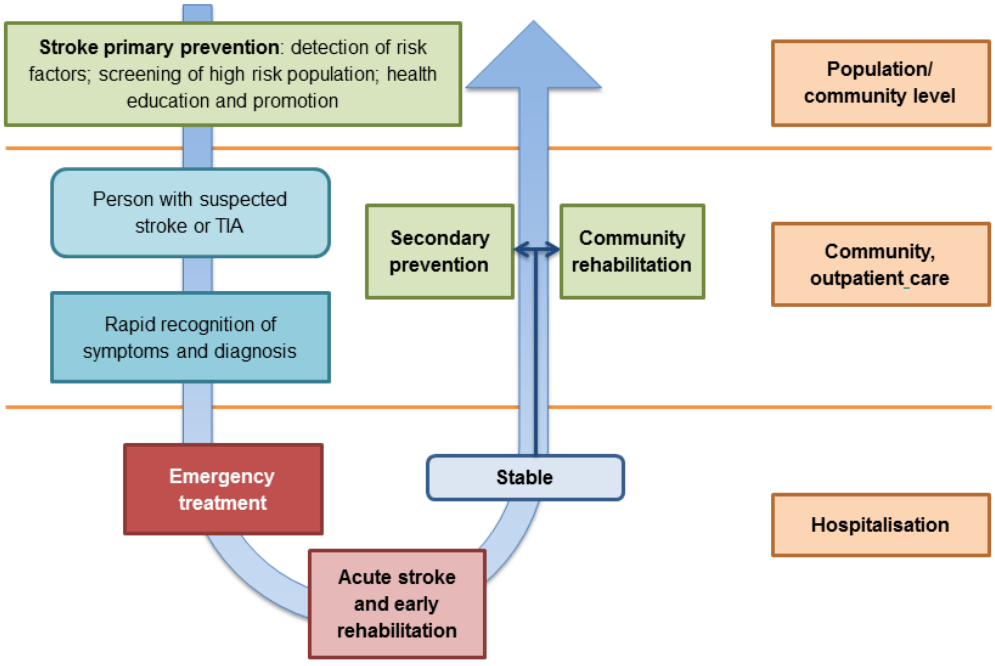
	Hanbin First Hospital	Qianjiang Central Hospital	Huangdao People's Hospital	Wenxian People's Hospital
Hospital type	General	General	General	General
Hospital level	2-A	3-A	2-A	2-A
Open beds	382	1,500	926	855
Annual outpatient amount (10,000 people-times)	15	28	50	30
Annual inpatient flow (10,000 people-times)	1.2	2.2	3.8	2.93
% diseases managed by clinical pathway	77	79	49	62
Main source of funding	Single-disease fixed payment	Fee for service	Fee for service	Fee for service

3. **Screening of priority conditions:** The research team selected feasible conditions for clinical pathways based on a literature review and analysis of inpatient data, driven in part by NCDs' role as primary threats to health in China. Chronic obstructive pulmonary disease (COPD) and stroke were chosen as conditions for the pilots, with senior consultants viewing stroke as a preventable disease and COPD as poorly diagnosed, poorly managed and overly expensive.
4. **Development of pathways:** The integrated care pathways for COPD and stroke contain sections (based on existing Chinese and NICE guidance) covering guidance for prevention, clinical pathways for hospital treatment, and guidance for rehabilitation. Community-based guidance for prevention and rehabilitative care was a key innovation developed for these pathways. Sub-pathways for complications and co-morbidities were also developed as additions to the primary disease pathways, accommodating and stabilising them alongside the treatment of COPD and stroke.

Pathway for COPD (overview)



Pathway for stroke (Overview)



Amendments to existing clinical practices were made iteratively following comments from senior Chinese and UK experts in COPD and stroke. Each template of clinical pathway comprises of a description of general principle and standard procedure in reception of treatment and a detailed list of daily prescribed actions to be taken by physicians, defined into mandatory and optional.

5. **Costing of pathways:** Payment methods other than fee-for-service (FFS) were introduced, to incentivise physicians financially to comply with the pathway. The

choice of payment method is dependent on local negotiation: case-based payment methods were implemented in Hanbin and Huangdao, with global budgets used in Wen county, and Qianjiang maintaining a modified fee-for-service schedule.

Once the payment mechanisms were determined, project staff estimated treatment costs based on the clinical pathways, in order to establish an appropriate payment level in negotiation with local healthcare providers. This included bottom-up costing of the best-practice treatment of diseases and their complications, and analysing historical data of hospitalization expenditure on diseases covered by the intervention.

6. **Negotiation of payment schemes:** Local decision-makers and healthcare providers negotiated to set rational standards for case payment. These principles were that local payers will pay more, but hospitals would be incentivized to provide better care, and critically, out-of-pocket payments by patients could not be increased. A yearly adjustment mechanism was set up to factor in general cost inflation. The researchers observed negotiations on behalf of patients' interests, and addressed any technical issues arising about the costing methodology.

Implementation consisted of the following 5 activities:

7. **Development of information systems:** Supportive information systems improve physicians' working efficiency and strengthen their behaviour change; they also increase the amount and quality of available data for monitoring and evaluation. The pilot hospitals upgraded or created clinical management modules within the existing general hospital information system, assisting existing vendors to ensure the smooth connection between systems.
8. **Optimization of integrated care pathway:** As a dynamic intervention, the pathways were updated over time to adapt to the changing local settings and the concurrent external factors arising from comprehensive health reforms. The project team conducted reviews annually and highlighted potential changes to the pathways, with physicians jointly making final decisions following recommendations from UK experts. This encouraged local health authorities to improve communication between hospitals and township health centres, which also facilitated two-way patient mobility, and secured the most cost-effective services.
9. **Monitoring and supervision:** Field trips to pilot areas every three months ensured the implementation of project activities on schedule, and allowed for hosting of international counterparts. Several rounds of routine meetings with various stakeholders also unearthed achievements and difficulties; technical problems, which were dealt with by the research team who would provide technical assistance to help them; and tips from practitioners to improve the clinical pathways.

   Through these visits, local stakeholders' understanding of evidence-informed decision making and the intervention mechanism was reinforced by engaging in problem-solving data reviews and demonstrations. This built further capacity by encouraging efficient communication.
10. **Capacity building:** Three types of capacity building are crucial to the intervention: *human resource*, *institutional*, and *informational capacity*. All were repeatedly stressed throughout an introductory course reinforcing evidence-informed decision

making, and strengthened through training workshops and study tours. Domestic and international multidisciplinary experts delivered lectures and engaged with local practitioners offering theoretical or skills-based training based on local needs.

11. **Annual workshops:** These represent prime opportunities for pilot areas to exchange experiences and raise issues. Discussion sessions were chaired by the joint research team who could verify details and correct their understanding about the project design in public. Open discussion benefited both existing and potential clients and produced in-depth engagement; there is also now potential for positive competition between pilot areas to do a better job before the next meeting. The annual gathering provides a good chance to promote the project work in progress and boost confidence among practitioners.

Summary of questions asked by project stakeholders regarding the clinical pathways policy intervention

1) Effectiveness of the intervention in the Chinese rural setting

2) Scope and extent of effectiveness

3) Threats to internal validity and external validity for further generalization

4) Feasibility of dissemination in a broader area

5) Which lessons from implementation progress are suitable for sharing with other groups and institutions

Evaluation consisted of the following 4 activities:

12. **Monthly data collection and review:** The project team used specially designed monitoring indicators and routine quantitative data collection in field visits. These were used to produce briefings on physicians' behaviour change, adjustments of management measures, introduction or change in external local factors, and stakeholders' opinions. Creating these records on a monthly basis is the immediate embodiment of developmental evaluation in this study, and they were used as supporting documents to explain the findings and contribute to the ITS analysis.

13. **Evaluation of outcomes:** The central evaluation question is to understand the short- and long-term impact of the intervention, given the possible confounding factors. This required both quantitative and non-quantitative approaches; where data allowed, the quantitative impact of the CPs on selected outcomes was assessed using interrupted time series (ITS) analysis with segmented regression. This analyses how much an intervention altered an outcome of interest, and whether there was an instant effect or a delay.

    The outcome measurements for ITS and other quantitative analysis were based on multiple assessments of aggregated patient data from each pilot site, collected using a standardized procedure to minimize bias. Data was collected for 24 monthly time points before intervention and 12 monthly time points after the intervention was introduced. As a pilot study, there was no pre-existing information available on the extent of any autocorrelation and the likely effect size.

    CNHDRC conducted focus groups and semi-structured interviews with key participants of the pilot study to qualitatively assess participants' experiences and understand the perceived utility of the clinical pathways; the keenness to use clinical pathways in future; and satisfaction with its implementation and use in practice. This further informs potential scale-up. A questionnaire was designed to capture all

practice-related activities during the study that might be confounding factors, and account for changes between baseline and post-intervention observations.

14. **Billing data analysis:** This was the most detailed information source on medical expenditure and items prescribed, so provided the best evidence to summarise changes in physicians' behaviour and expenditure patterns. Data was randomly sourced from 150 patients' records for each condition, at each pilot hospital, from three groups: pre-intervention population, post-intervention population included in clinical pathway management, and post-intervention population not included in clinical pathway management.
15. **EQ-5D analysis**: The EQ-5D-3L form is a standardized, self-reporting, and easy-to-use measuring instrument to summarise patient health states. Data was collected before and after implementation of the care pathways and at admission and discharge. This information can be used as a quantitative measure of health outcome as judged by the individual respondents. Given the absence of Chinese population-based utility weights, Japanese weights were used to process the analysis as the closest available population.

Finally:

16. **Dissemination**: Project staff shared the experiences and lessons from the pilot phase with counterparts within and between countries (detailed in Chapter 4), with the aim of contributing to health system strengthening by producing a global public good. Therefore, the key components of the project were refined so it could be applied as appropriate and feasible in different countries to improve the quality and efficiency of their healthcare systems, and enable national and regional decision-makers to act on their own priorities. Risk management strategies were also explored in case the lessons from China's experience are not relevant or not transferrable.

Results (Part 3)

The China-UK collaboration project aimed to mobilise health providers to improve the quality of healthcare services, curb high health expenditures, decrease patients' financial burdens, and improve efficient allocation of health insurance funding. This involved developing care pathways for two high priority disease areas (stroke and COPD) and where possible combining this with payment reform. Qianjiang and Wenxian districts applied fee-for-service arrangements instead of the bundled payment method on certain diseases.

Implementation of the Phase II pathways

In November 2013, the project formally launched in the pilot sites. The integrated treatment for COPD and stroke patients were implemented comprehensively, which included prevention, treatment and rehabilitation for the patients. By May 2015, 5,490 patients were managed by the Phase II clinical pathways.

During the project, four pilot sites conducted secondary prevention for COPD and stroke patients alongside the primary prevention within the national project. Notably in January 2014, local insurers (NCMS) at each of the four pilot sites fully subsidised polyvalent pneumococcal vaccine for COPD patients meeting certain inclusion criteria. Inclusion criteria were as follows: (1) above 60 years of age; (2) hospitalization during the past year due to

COPD exacerbation; (3) no contraindication to the vaccine'; (4) no pneumococcal vaccination in the past three years. Following implementation, CNHDRC undertook a 1-year follow up analysis. Vaccination was correlated with a reduction of the number of acute exacerbations of COPD and reduced resource use.

In terms of inpatient care, during the project, the four pilot hospitals admitted a total number of 10,158 COPD and stroke patients. Among them, 6,027 patients entered the clinical pathways and 5,490 of these completed the clinical pathways, yielding an average clinical pathway management rate of 54.05% (see below).

Three pilot areas' management rates reached over 60%, except for Huangdao which only achieved 20%. Comparing the four pilot hospitals, Wenxian People's hospital had the highest number of patients managed under the Phase 2 clinical pathways.

Patients completing clinical pathways (as percentage of all eligible inpatients)

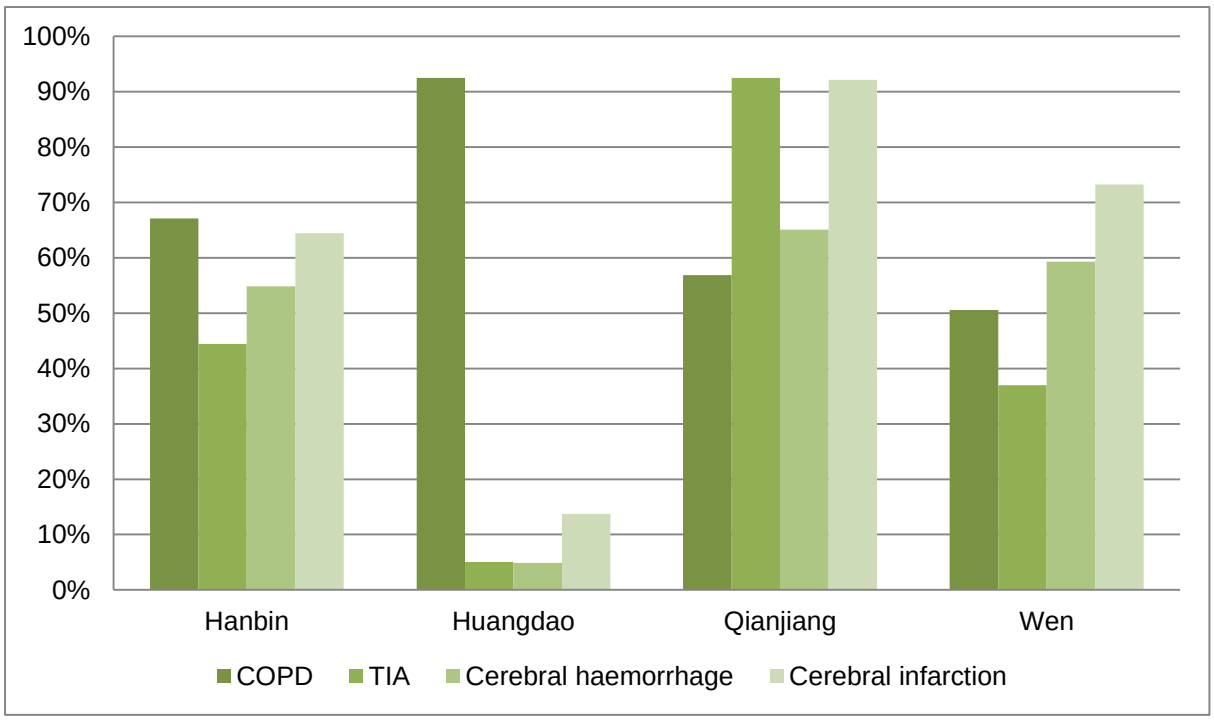


Table A: Patients enrolled in CNHDRC clinical pathways

County	Number of patients enrolled in clinical pathways (as percentage of all eligible inpatients, in brackets)				
	COPD	TIA	Cerebral haemorrhage	Cerebral infarction	Total: all pathways
Hanbin	308 (74%)	4 (44%)	44 (71%)	285 (73%)	**641**
Huangdao	206 (97%)	55 (7%)	21 (7%)	207 (16%)	**489**
Qianjiang	536 (70%)	750 (98%)	149 (73%)	299 (98%)	**1,734**

County	Number of patients enrolled in clinical pathways (as percentage of all eligible inpatients, in brackets)				
Wen	353 (54%)	305 (42%)	217 (64%)	2,288 (79%)	**3,163**
Total: all sites	**1,403**	**1,114**	**431**	**3,079**	**6,027**

Patient characteristics

Tables B and C provide a summary of the patient characteristics from the four pilot sites before and after pathway implementation. In terms of gender composition, there were more males among COPD and cerebral infarction inpatients, which might be related to differences in risk factor exposure. With respect to patient age, the majority of patients were over age 50, accounting for more than 95% in COPD and cerebral infarction patients respectively.

Table B: COPD inpatient characteristics

	Before pilot (n=744)	After pilot		
		Total (n=1,390)	Clinical pathway (n=918)	Non-pathway (n=472)
Gender (%)				
Male	52.97	57.73*	57.28*	58.61*
Female	47.03	42.27	42.72	41.39
Age (%)				
30-50	3.01	5.52	6.41	3.81
51-70	40.04	45.25	46.54	42.59
71 and above	56.95	49.24*	47.05*	53.59
Insurance type (%)				
NRCMS	73.39	78.22	81.05*	72.86
Urban Employee	14.68	17.55	15.80	20.88
Others	11.93	4.23	3.15	6.26

**Compared to before pilot, P<0.05*

Table C: Cerebral infarction inpatient characteristics

	Before pilot （n=964）	After pilot implementation		
		Total （n=4222）	Pathway (n=2652）	Non-pathway (n=1564）
Gender (%)				
Male	53.57	61.11*	66.41*	59.53*
Female	46.43	38.89	33.59	40.47
Age (%)				
30-50	5.32	4.86	6.24	1.73
51-70	31.19	43.78*	46.58*	47.95*
71 and above	63.45	51.37	47.18	50.31
Insurance type (%)				
NRCMs	77.68	80.83*	78.25	78.22
Urban employee	13.98	12.90	15.86	12.81
Others	15.57	10.26	8.86	15.09

**Compared to before pilot, P<0.05*

Rehabilitation

Stroke rehabilitation services in China are still developing. A comprehensive rehabilitation system has not yet been created. With the project's support, capacity building in the area the rehabilitation was undertaken at each pilot site. With the help of CNHDRC, all the pilot hospitals followed the advice from NICE International experts, and undertook the training courses from central rehabilitation experts. The pilot hospitals also sent their physicians to Xuanwu hospital – the best rehabilitation hospital in China – to receive further training.

The four pilot sites have now established locally developed integrated rehabilitation networks. Each pilot hospital has also set up independent rehabilitation departments.

Addressing over- and under-treatment – inpatient impact of the pathways

Over-treatment and under-treatment are common phenomena in China's healthcare system. The root problem of this present situation is closely related to the long-standing perversities in payment systems. The implementation of a single disease package payment reform can to a certain extent compensate for – at least lessen the impact – of some of the drawbacks in the current payment system, which tends underemphasize quality. On this basis, the addition of clinical pathway management information system can provide more reliable and timely evidence-based information for clinicians. It can further help support clinical decision-making and standardization of care. However, it should be recognized that standardization requires a joint effort from the government, the medical insurance department, medical institutions, medical staff and patients in the midst of a complicated patient-doctor relationship. It cannot be achieved overnight.

Recommendations for clinical pathway management of COPD and stroke

Before the project, there was both excessive and inadequate treatment of COPD and acute stroke in the four pilot hospitals. For example, some practices that have been proved to be effective, such as swallowing function assessment, early ambulation and early rehabilitation for acute stroke, were rarely carried out in pilot hospitals.

In contrast to the previous practice, the core recommendations of the Phase 2 project were as follows: for patients hospitalized for acute exacerbation of COPD, promote pulmonary function testing following confirmed COPD diagnosis, regulate the use of antibiotics, and advocate early rehabilitation and secondary prevention measures at the community level; for acute stroke patients (including TIA, cerebral haemorrhage and cerebral infarction), increase the use of aspirin and statin, reduce or avoid the use of practice which is ineffective or ambiguous, and advocate swallowing assessment and early ambulation. In order to strengthen the supervision of clinical practice, pulmonary function tests and non-invasive ventilation were fixed as mandatory practice in the pathway management information system. Optional practice were divided into two categories: one was conditionally recommended, specific to patients with certain conditions; the other was not recommend by major international guidelines but still allowed as optional practice considering the medical insurance reimbursement policy and other practical considerations.

Changes in clinical practice

The billing data analysis of the four diseases across the pilot areas revealed that, after a year since the implementation of the project, the intervention has overall strengthened the utilization and quality of services recommended by the clinical pathway. Among the services adopted by the pathway, services with the most significant increase in utilization were statins and brain imaging (within 24 hours of hospitalization) for stroke treatment. Utilization of TIA treatment services is an outstanding example of this change. On the other hand, there was no significant change in the use of oxygen and 'dehydrating agents' which were not recommended by the clinical pathway, and the utilization of nerve nutrition agent actually increased slightly.

Medical costs

In addition to standardizing clinical behaviour and raising service quality, the main aim of clinical pathway management was to improve efficiency of resource use. Following analysis of medical records, it appeared that growth in resource use and associated costs was reduced in the four pilot diseases, and the proportion of expenses made out-of-pocket (OOP) also decreased.

In addition, analysis of the pilot diseases' hospitalization costs per visit in Hanbin, Huangdao and Wenxian revealed that generally the drug costs as a proportion of total costs decreased, while the proportion of costs because of testing increased after the pilot implementation. Drug costs as a proportion of overall costs in Huangdao and Wenxian decreased by 3.8% and 2.1% respectively. Testing costs as a proportion of overall costs in Hanbin and Wenxian increased by 6% and 2% respectively. In Qianjiang, COPD, TIA and cerebral haemorrhage had no significant change in hospitalization cost compositions, whereas the proportion of drug costs in the management of cerebral infarction increased almost 10%. This might be due to the increased use of statins and antiplatelet drugs after the pilot implementation.

Analysis of out-of-pocket costs in Hanbin, Huangdao and Wenxian revealed that Change in OOP proportions before and after the pilot implementation in Huangdao and Wenxian were statistically significant. OOP expenditure in relation to the four pilot diseases in Qianjiang showed that the OOP proportion for TIA decreased by 2% after the pilot implementation, but other diseases had no significant change (Table D).

Table D: Average out-of-pocket proportions by disease in Qianjiang (%)

Disease	Before pilot	After pilot		
		Total patients	Pathway patients	Non-pathway patients
COPD	41.62%±24.01%	40.36%±20.52%	39.49%±19.26%	41.50%±22.04%
TIA	49.12%±19.18%	47.33%±21.54%*	47.13%±21.36%	40.53%±11.13%
Cerebral haemorrhage	47.81%±22.24%	45.81%±17.35%	44.21%±17.61%	35.66%±14.03%
Cerebral infarction	50.21%±19.18%	46.3%±18.1%	46.41%±18.51%	45.04%±16.28%

**Compared to before pilot, P<0.05*

Length of stay

The integrated clinical pathway diagnostic and treatment checklist defined standard hospitalization days for each disease, although these carried slightly at each site based on the local situation (Table E). In general, the implementation of pilot project led to reductions in length of stay.

Table E: Standard length of stay for the four pilot sites by disease (days)

	Hanbin	Qianjiang	Huangdao	Wenxian
COPD	7~12	10~21	7~21	10~21
TIA	5~10	9~14	5~10	5~10
Cerebral haemorrhage	15~25	14~21	8~18	7~20
Cerebral infarction	15~25	8~14	8~12	10~15

The greatest reductions in length of stay were seen in Qianjiang District Central Hospital (Table F). The length of stay of TIA patients in Wenxian People's Hospital decreased significantly, whereas in other diseases there was no statistically significant change. Length of stay of all diseases in Huangdao and Hanbin did not statistically significantly change after the pilot implementation.

Table F: Average length of stay before and after pilot by disease (days)

Disease	Hanbin		Qianjiang		Huangdao		Wenxian	
	Before pilot	After pilot	Before pilot	After pilot	Before pilot	After pilot	Before pilot	After pilot
COPD	-	-	10.37	8.51*	6.85	7.26	8.85	9.23
TIA	-	-	5.15	5.11	7.57	7.09	9.02	8.31*
Cerebral haemorrhage	14.72	15.17	16.84	13.82*	14.67	13.86	22.76	20.5
Cerebral infarction	12.81	12.85	12.46	11.97*	8.83	9.32	11.61	11.12

**Compared to before pilot, P<0.05*

Health-related quality of life

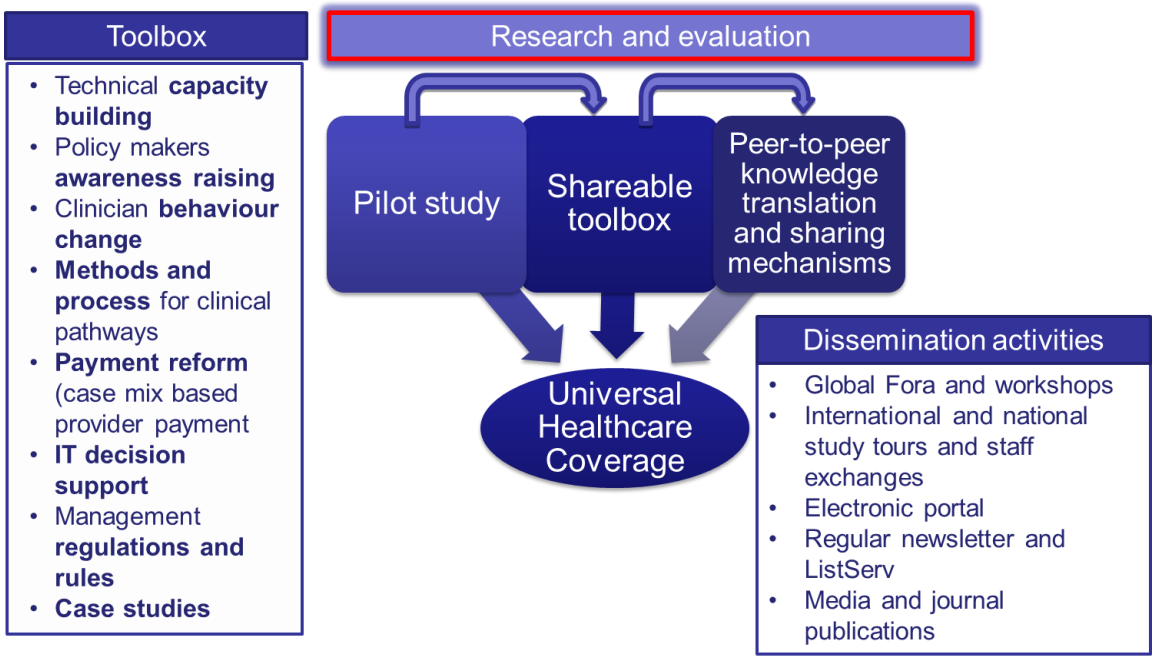
The CNHDRC research team conducted an analysis of completed EQ-5D questionnaires that had been administered to 1,045 patients in order explore the quality of life impact of the project intervention. These patients were COPD, cerebral haemorrhage and cerebral infarction patients from the Qianjiang pilot hospital as well as cerebral haemorrhage and cerebral infarction patients in the Hanbin pilot hospital. Results suggest that implementation of the Phase II pathways did not negatively affect health-related quality of life.

Dissemination and international cooperation (Part 4)

Sharing of experiences and lessons with counterparts within and between countries is an integral aspect of the China-NICE collaboration programme. The project, in its nature, was an applied piece of research with a later aim of transferring knowledge and diffusing policy nation-wide, wanting to contribute to the strengthening of the health system by producing a global public good. Considering the context of the new national healthcare reforms, dissemination within China, particularly rural areas, was targeted. A systematic dissemination strategy planned to influence healthcare providers, commissioners and policymakers alike.

Throughout the process decision makers were constantly involved, attending meetings and fieldwork. As a national think-tank, the CNHDRC's internal reporting system shares research findings with directors of all NHFPC departments and ministers, so policy briefings encouraged the incorporation of principles and experience from the pilot into national policy though active involvement. The key operational mechanisms developed whilst implementing the integrated care project were then incorporated into a recent NHFPC policy document.

The experience gained from piloting the care pathways with the technical support of project team, enabled the pilot areas to develop pathways for **80 more diseases**, accounting for more than half of discharged patients. More hospitals are using elements from the reforms and referring to the CNHDRC-NICE project. Additionally, more than twenty townships began to accommodate the integrated care pathways gradually in their health centres; all this demonstrates the self-reproductive abilities of the programme within and between counties. Other hospitals invited the project team to provide technical assistance, increasing the project's reach. Workshops spurred 6 counties of Anhui province to initiate similar hospital reform, and by the end of September 2015, 100 management conditions from this project model were introduced throughout all the counties of Anhui province. CNHDRC has also formally and informally offered several experience-sharing consultation services to other institutions.



Dissemination through the media and academic journals has been fruitful. 12 articles on Phase I in two of China's core journals were highly cited, appealing to hospital-level commissioners and researchers, plus articles on Phase II are currently being drafted. Furthermore, a book authored by two Qianjiang doctors was published and was based off our work with pilot hospitals and authorities. In A report from Itad (an external consultancy agency recruited by DFID to provide independent evaluation of the CNHDRC-NICE collaboration) observing the clinical pathways and payment reforms project, also served as an effective way to enlarge the project's profile in the international community.

As part of a dynamic partnership between DFID and China's National Health and Family Planning Commission to contribute to international health aid, the NICE-CNHDRC project was encouraged to share its research findings with other low and middle income countries (LMIC). The South-South dissemination strategy was initiated, targeting India and South Africa at project launch in 2012, and subsequently expanding to the other BRICS countries and to non-BRICS countries such as Vietnam and Indonesia. A number of shared technical and policy priorities that could help countries reach and sustain universal health coverage (UHC) were identified during discussions at the launch meeting.

International conferences and workshops provide opportunities to clarify the project, and build a network of interested representatives who might benefit from similar projects. Keynote speeches, presentations, panel sessions, poster sessions to draw attention to the project, and informal discussions all formed part of the strategy. In the last three years (2013-2015), the CNHDRC project team presented at the annual gatherings of HTAsiaLink (a regional HTA society in Asia). As most members were in the midst of their own health care reform, the project received much attention. It provided a platform to build a dissemination network among LMICs. International promotion continues through the Guidelines International Network (GIN) and the Prince Mahidol Award Conference (PMAC), to which the team has successfully submitted an abstract for the 2016 meeting.

As a result of the dissemination activities, several representatives of international counterparts from LMICs were able to come to China and conduct field visits in the pilot sites to better understand the project implementation and practical impact. These included delegations from Vietnam (February 2014), South Africa (November 2014), India (March 2015), and Indonesia (May 2015). For each visit, beneficial collaborative outcomes were reached. An agreement on the provision of technical assistance was reached with Vietnam; the South African delegation convinced their government to duplicate the payment reform model on their return; Indian policy makers sought to convince the State of Kerala to initiate clinical pathways in some pilot hospitals, and are soon to send another delegation to China; NICE and representatives of Indonesia

agreed to further cooperate in the field of community health promotion, and HITAP are to deliver a workshop to senior officials in 2016.

Conversely, in February and November of 2014, Chinese delegations visited the UK and Germany. This represents outstanding bilateral health cooperation between the UK and China, also demonstrated by the signing of an official Memoranda of Understanding between the Chinese health minister and the UK Parliamentary Secretary of State for Public Health.

Conclusions and policy recommendations (Part 5)

Getting research evidence translated into policy, and then implemented 'on the ground', remains a persistent challenge for countries with very different income levels when aiming for evidence-informed policy making. The CNHDRC led 'Clinical Pathways' project represents one means of getting 'evidence' incorporated directly intro delivery structures in order to shape behaviour change at both the individual and institutional levels.

Notably the Phase 2 Clinical Pathways project represents a very proactively delivered and complex intervention incorporating not only a description of what would be considered 'best practice' (the 'clinical pathways' themselves), but also their integration within existing hospital information systems, extensive training and support, and importantly, linked payment reform where this was possible. All this was combined with extensive stakeholder engagement with a variety of actors at national and local levels.

Results suggest Phase 2 Clinical Pathways have led to important and positive changes in the management of stroke and COPD patients in the pilot sites; these results should be regarded as provisional, requiring further verification over a longer time period, and with additional data. It is also clear and significant that at both local and national levels the perceived importance of using evidence to inform practice has changed, the need for broader improvements in hospital performance has been reinforced, and the importance of integrated care across different tiers in the system has been highlighted. In some cases, enhanced community based management, focussed on inpatient care, appears to have led to reduced hospitalisation as result of COPD exacerbations avoided. However this would need to be confirmed with further data.

Much more can still be done in re-directing resources away from the hospital sector towards community care, at least in rural China. This will require sustained investment in primary care facilities and human resources. In addition, technologies such as telemedicine may support strategies to deliver more care in the community. Further refinement is also possible using IT innovations, including electronic pathway plug-ins into billing systems, that can better monitor baseline activity and link compliance with preferred activities to appropriate reimbursement.

The very detailed clinical pathways in this project were developed through highly iterative input involving Chinese and international experts, and tailored to local settings. There is scope here, using the expertise of CNHDRC, to recommend a new approach going forward that combines international best practice with improved stakeholder engagement mechanisms. Indeed, reforming the method of developing clinical guidelines in China forms a core component of the 2015 MOU signed between NICE and CNHDRC (see Chapter 5

and Appendix I below); notably, there is also interest in using newly developed guidelines to create quality standards. Quality standards aim to cover whole pathways of care, but do not list all the necessary components of acceptable care. These may potentially represent a more parsimonious and practical mechanism to support behaviour change, since in principle they would focus only key areas of concern across the whole pathway.

The CNHDRC Clinical Pathways project has received significant government interest, and is seen as a model for replication nationwide. Further expansion should be accompanied by a well-designed prospective evaluation that takes into account the findings of this pilot evaluation, with an emphasis on developing *integrated* CPs spanning different tiers in the system. Additionally, more robust consideration of the evidence with which clinical pathways are developed is needed, calling for strengthening the use of health technology assessments.

Supporting greater collaboration between UK and China in health care

Numerous opportunities exist to further the collaboration between NICE International and CNHDRC, and build on the Clinical Pathways project. The People to People Dialogue (P2P) in September 2015 saw keynote speeches from Liu Yandong, Vice Premier of China, the Rt Hon Jeremy Hunt MP, and Margaret Chan, Director-General of the World Health Organisation, all noting the mutual benefits from greater UK-China cooperation in health. Liu Yandong wishes to learn from the "British model" of healthcare funding and provision, whilst relying on "Chinese solutions" in health system reform.

The 2015 Health Dialogue culminated in a high level panel session moderated by the UK's Chief Medical Officer, with the Chinese panellists at the 2015 Health Dialogue expressed their wish to deepen work with NICE International, and establish a similar priority setting institution in China after their UK study tour. NICE International intends to work with the NHFPC and CNHDRC in creating a regional capacity and technical assistance hub in HTA within the auspices of the International Decision Support Initiative (iDSI), to serve Chinese provinces and to support nearby countries. As CNHDRC has become an increasingly active provider of expertise domestically and internationally and its relationship to central government, it seems appropriate that it should be at the centre of a HTA network hub of research in China. NICE International, along with its partners in the International Decision Support Initiative (iDSI) will seek to work with CNHDRC in identifying and delivering on capacity building needs during 2016-18, to support the creation of such a hub, led by CNHDRC.

Part 1: Background and objectives

Key concepts and definitions	
Case payment	Fixed reimbursements to healthcare providers for each case treated, as opposed to fee-for-service reimbursement.
Clinical pathway	Tools which translate the best available evidence and guidelines into multidisciplinary plans of best practice. They include the sequence of practices, procedures and treatments that should be used with people with a particular condition to improve their quality of care.
Evidence-based medicine	An approach to teaching and practicing medicine which prioritises evidence from high quality randomised controlled trials and observational studies, in combination with clinical expertise and the needs and wishes of patients.
Integrated care	Patient care across multiple tiers of the health system, including community management. In the case of the 'Phase II' clinical pathways and payment reforms, the tiers include country hospitals, township health centres and village clinics
Non-communicable diseases	A set of chronic diseases characterized by a long latency period, prolonged clinical course and debilitating effects on quality of life. These include chronic respiratory diseases, cardiovascular disease, cancers, neurological conditions, and diabetes.

Background of rural healthcare in China

China has a population of 1.35 billion, of which around 642 million people live in rural areas [2]. The central government has been making significant efforts to improve the health outcomes of rural inhabitants and strengthen the development of rural healthcare institutions since the birth of the People's Republic of China (PRC) in1949, and launched major systemic reforms in 2009 [3]. These reforms aimed to secure public health improvements, after several decades of liberalization had transformed a fully government-based healthcare delivery model to one radically driven by profit incentives. With the reforms, the government sought to combine these models, to guarantee basic universal healthcare while maintaining a role for market space as necessary to meet demand (see Box 1) [4, 5].

The 2009 reforms adopted a strategy of maximising the population coverage of an initially shallow benefit package, with broadly three types of medical insurance available. The proportion of the population covered by available insurance schemes has increased from 87% in 2008 to over 96% by 2014 [6]. Now that this coverage has been achieved, the challenge for reformers is reducing inequity in terms of health status, financial protection, and the quality of care received. At the same time, the Chinese government is well aware of the need for improved cost control, as a mainly fee-for-service provider payment system contributed to rapid inflation of health expenditures [4, 7, 8].

Box 1: Overview of the Chinese health care system

Summary of the Chinese health care system and 2009 reforms

Despite major achievements in terms of healthcare coverage, and meeting several key MDG indicators, China has faced serious challenges preparing its health system to meet the population's rising health needs and expectations. Life expectancy now stands as 75.2 years, with demographic and epidemiological transitions in recent decades toward a primarily non-communicable disease (NCD) burden [2, 9].

Health governance and administration

Health administration is organized in a hierarchy of four tiers, with the National Health and Family Planning Commission (NHFPC, formerly the Ministry of Health) as the ultimate **national** actor. **Provincial**, **municipal** (city) and **county** (district) health bureaux are the main administrative bodies at each of the subnational tiers, and are responsible for implementing plans and programmes within their jurisdictions. Health services are also delivered at the township (community) level, but there are no independent administrative bodies [10].

Health care delivery

The rural healthcare delivery system consists of three tiers, from **county hospitals** to **township** health centres and **village** clinics. County hospitals play leading roles in local healthcare to provide advanced specialty care in term of outpatient and inpatient services. Township health centres accommodate primary care and limited treatments in outpatient and inpatient services; village clinics staffed by general practitioners provide preventive and basic primary care services, and do not offer inpatient service [10, 11].

Health financing

The health system is financed through a combination of **taxation**, **social health insurance**, **private insurance and out-of-pocket** (OOP) payments. Around 38% of total health expenditure is composed of out-of-pocket payments (although this has fallen from almost 60% in 2002), with higher rates of out-of-pocket payment among rural households, and controlling the cost burden on households is a policy priority [12, 13].

Total health expenditure (THE) has increased markedly both in absolute value and as a percentage of GDP since 2000 (see Figure 1). Aside from private expenditure, funding sources for health care and public health services (disease prevention and control, maternity and child care, etc) come from general taxation, social insurance, and company-based health insurance schemes. Spending on medicines accounts for about 43% of THE [14].

Phases of health reform

The progress to date of the rural healthcare sector can be divided into four phases, described in detail in international literature [4, 6, 10, 13, 15-17]. From **1949 to 1984**, the Chinese government created a health system gradually in similar fashion to other communist states. In this period the government owned and operated all community healthcare facilities and employed a community healthcare workforce ('barefoot doctors') to provide services for free. After **1984**, during the introduction of market forces in all economic and social sectors, the government scaled back inputs to the health sector. These changes resulted a majority of patients being left uninsured, particularly in rural areas, and unregulated entrepreneurial and revenue-seeking behaviour by health care institutions.

In **2003**, in response to rapid growth in health expenditure and popular discontent with the

health care system, the New Rural Cooperative Medical Scheme (NRCMS) was launched for rural residents to mitigate the economic burden of treatments. Starting from **2009**, the government officially abandoned the experiment with a market-based health care system and introduced reforms with a commitment to providing affordable, equitable and accessible basic health care for all Chinese people by 2020 [7].

The health reforms beginning in 2009 covered the following five areas [10]:

1. *Health insurance*

As part of efforts to reduce rural residents' disease-related economic burden and to relieve poverty induced by disease, the Chinese government developed the New Rural Cooperative Medical Scheme (NCMS) in 2002 to offer financial protection to rural citizens, implementing it on a nation-wide scale from 2003. Similar basic medical insurance schemes were developed and expanded from 2007-2012 for urban residents and employees (Table 1).

Table 1: Main forms of basic medical insurance (social health insurance)

Name		Enrolment	Typical benefits[1]	Coverage (no. people)[2]	Total per-capita premium[2]
EBMI	Urban Employees' Basic Medical Insurance	Mandatory for workers in urban areas; Financed by premiums paid by employers and employees.	Expenses for inpatient services, at outpatient clinics, and designated pharmacies.	256 million	2,308 RMB
RBMI	Urban Residents Basic Medical Insurance	Voluntary; Financed by individual premiums and government subsidies.	Covers similar expenses to EBMI in each region.	271 million	334 RMB
NCMS	New Rural Cooperative Medical Scheme	Voluntary; Financed by household premiums and government subsidy.	Covers inpatient and catastrophic outpatient expenses *(general outpatient coverage depends on region*).	807 million	305 RMB

[1] *All benefits for each form of basic medical insurance are defined at the level of county/city government.* [2] *2012 figures*

Data sources: Yip, Hsiao [4], Meng, Yang [10]

Each basic medical insurance scheme has its benefits package, reimbursement rates and deductible amounts set at the county (NCMS) or city (EBMI, RBMI) level. A Medical Financial Assistance fund is operated to subsidise basic medical insurance premiums or OOP expenses for individuals in poverty, and is financed from a combination of sources including government and social donations [10].

The stated aim of the 2009 health reforms was to expand co-payment health insurance to over

90% of the population. Reforms included expansion in coverage, reimbursement rates and government subsidisation for each of the basic medical insurance schemes, and expansion of their benefits packages to cover selected outpatient services. Policies from 2009-2011 also reformed payment systems to encourage alternatives to fee-for-service payment, including capitation, case-based payment and diagnosis-related groups.

By the end of 2012, NCMS was in place in over 2,800 counties, covering 97.5% of Chinese rural inhabitants [18]. The NCMS enrolment premium incorporates individual contributions, subsidy from local government and input from central government input; the shares paid by each of these vary over different regions based on local fiscal conditions (for example, subsidisation from central government is higher in central and western provinces than in eastern China) [10].

2. *Basic public health services*

The national government developed a package of basic public health interventions, which is provided free to all urban and rural residents to reinstate the role of government providing public goods. The package of services is costed at 40 RMB per person as of 2015, with fiscal transfers from central government subsidizing the provincial and municipal/county budgets for the programme to mitigate regional disparities. The scope of the package is agreed by a national-level expert panel and currently comprises ten kinds of basic public health services. In parallel to this basic public health service package, the government has continued to support individual programmes targeting other major public health problems (such as TB, HIV/AIDS, early pregnancy nutritional supplementation and water and sanitation).

3. *Primary health care*

To strengthen primary healthcare's role in the three-tier rural healthcare delivery system, the health reforms committed to an effective stratified division of responsibilities across levels of the health system. Reforms covered prevention, treatment and rehabilitation services anchored in properly functioning rural health institutions, including implementation of a two-way referral management system between village clinics, township health centre and county hospital.

Capacity building and training was encouraged from 2009-11 in urban and rural PHC facilities, with further construction and development of township health centres in 2012 and 2013. Reforms to PHC facilities also included a shift in financing sources to government subsidy and services charges, with pharmaceutical mark-ups no longer forming a major funding source (see below) [10]. In September 2015, the State Council issued further guidance on the stratified medical treatment system, with a goal of meeting 90% of medical demands at or below the county hospital [19].

4. *Essential medicines*

Irrational medicine use in both rural and urban regions of China is a major concern, which includes over-prescription of antibiotics and intravenous injections due to profit-seeking activities and weak health sector oversight [20]. An essential medicine procurement system was introduced for government health care facilities to improve safety and cost-efficiency of medicines. Procurement is conducted at the province level, and zero mark-up on the procurement price of essential medicines is permitted by health facilities. These reforms are also being extended over time to private facilities, village clinics and township health centres.

The latest national essential medicine list, released in March 2013, consists of 317 chemical medicines and biological products and 203 Chinese proprietary medicines [4, 21]. In addition, provinces can add supplementary medicines to the medicines list based on their resources and

special needs.

5. Public hospital reform

Overall, public hospitals in China deliver over 90% of inpatient and outpatient services. Due to low patient trust in village clinics and township health centres and weak management capacity, patients often seek care at county-level hospital for simple health problems and rehabilitation, leading to overcrowding in rural county hospitals. This continues despite initiation in most counties of tiered reimbursement systems to encourage care at village clinics and township healthcare centres, since referral systems back to these levels are typically not in place. County-level hospitals have been criticized for profit-seeking behaviour as an important driver of increased health care costs, and for under-providing unprofitable basic services. [4, 11].

County-level public hospital reform received rising attention from policy makers and was targeted as the key step to advance future healthcare reform plans. In 2012, the State Council proposed a number of mechanisms to improve treatment quality and control costs, with more than 300 rural county hospitals and hospitals in 17 cities selected to pilot these reforms. Reforms include introducing clinical pathways and electronic medical records, eliminating drug mark-ups, changing hospital financial subsidies, conducting performance-based assessment, and reforming hospitals' governance, compensation and provider payment systems [4, 22]. With conflicting interests from stakeholders, public hospital reform remains one of the most complex healthcare reforms where progress has been slower than the other four reform fields described above.

In the new round of national comprehensive healthcare reform launched in 2009, committing 850 billion RMB for the first phase (2010-2012) of reform, there are five major interdependent areas stressed in the policy known as "Recommendations on the Health System Reform" enacted by the Chinese Communist Party Central Committee and the State Council (

Box 1). These include expanding co-payment health insurance coverage to over 90% of the population, establishing a national essential medicine system to facilitate primary needs of medicine nationwide, strengthening the delivery system of basic public health services available and equal for all, improving the operating system of primary healthcare to offer more advanced and efficient treatments for patients, and conducting trials in public hospital reforms [3]. Given the size of this task and diversity across the country, the exploration of different local models of reform has been encouraged in consultation and agreement with local stakeholders. In addition, as a joint result of sustainable development of country-level hospitals and the cumulative effects of other healthcare reform policies and directives, stronger emphasis will likely be placed on evidence in generating clinical guidelines and pathways and their innovative application.

Positive achievements of health sector reforms

The evolving rural health service system and associated health security schemes are helping to address the problem of inadequate and unaffordable healthcare significantly. With the increasing number of rural healthcare institutions and the enhanced quality of diagnosis and treatment that has become available, an increasing number of rural residents have

begun to utilize rural healthcare services more than before. According to the NRCMS running analysis of 2003 and 2008 (Table 2), access to healthcare service among rural patients has improved over time [23].

Table 2: Metrics of access to care among rural outpatients and inpatients

Metric by Year	2003	2008
Percentage of patients not accessing healthcare within fortnight	45.8	37.8
% failure to access healthcare attributed to economic burden	38.6	24.9
% of rural patients who should admit but did not see doctor	30.3	24.7
% of patients not admitted as inpatients attributed to economic burden	75.4	71.4
% rural inpatients who require early discharge due to economic burden of care	63.9	55.1

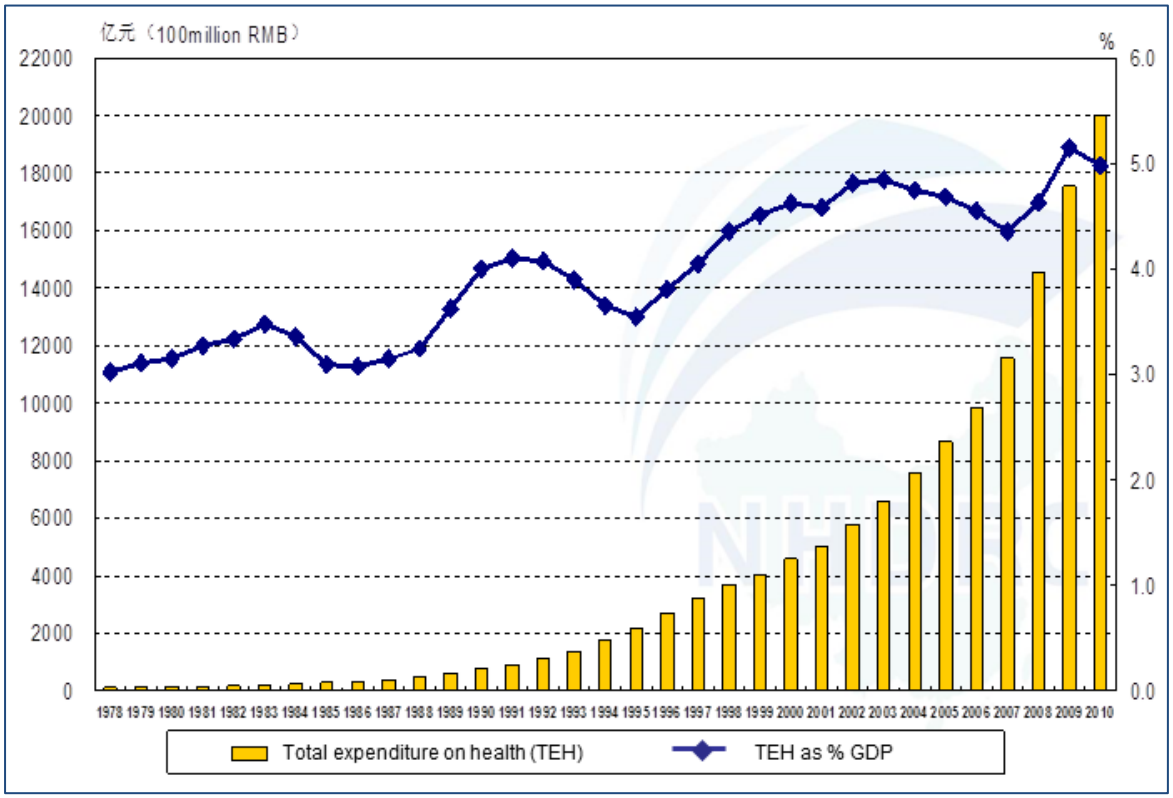
Meanwhile, the establishment of the NRCMS has to some extent made medical services more affordable than before. In contrast to OOP (out-of-pocket) data reviewing from 2004 to 2011 about rural patients, the average OOP share accounting for annual per-capita income has reduced from 80% to 30% respectively [23].These achievements provided a sound foundation for trails of clinical pathway with linked payment reform in rural pilot areas.

Existing challenges

Some existing challenges hinder the deepening of the reform to meet the increasing needs of patients. In a context of longstanding distortions of healthcare service prices and limited scope for clinical guidelines, health care providers' incomes relied heavily on the "mark-ups" gained from inappropriate prescribing of medicines, health materials and laboratory tests. In order to balance revenue losses caused by price controls by government on medical services, the process for new and high-technology diagnostic services were set above cost, and a 15% profit margin for drugs was allowed [17]. As time passes, such institutional weakness and environment seems rational and acceptable in balancing of conflict of interests among variable stakeholders of healthcare engagement, but which poses a serious risk for patient's risk and sources of health care. Total health expenditure (THE) has increased markedly both in absolute value and as a percentage of GDP since 2000 (Figure 1).

Research has previously indicated that one reason for this steady increase in costs is that hospitals have been financially incentivized to over- or under-provide healthcare services [5]. For example, it has been reported that across all pharmaceuticals, a total of 10.4 billion vials were used for intravenous (IV) injections in 2009 in China, approximating to 8 vials per person; this is far above the average of 2.5 to 3.3 vials reported internationally [24]. In contrast to other developing countries, China is unique in high use of injections, of which at least three out of ten patients were prescribed injection and two to three times than the WHO standards [20]. In 2012, medicine costs still account for 54.9% and 48.2% of per capital outpatients and inpatients costs in township health centres respectively. Another area of weakness relates to the level of managerial expertise within the hospital sector [25].

Figure 1: Trends in health expenditure in China, 1978-2010



Source: CNHDRC

The evolving rural health service system and associated health security schemes are helping to address the problem of inadequate and unaffordable care. With the increasing number of rural healthcare clinics and the enhanced quality of diagnosis and treatment that has become available, an increasing number of rural residents have begun to utilize rural healthcare services. The establishment of the NRCMS has to some extent made medical services more affordable. However, there remain concerns that inappropriate behaviours by providers are fuelling costs, and also affecting quality of care and patient safety.

Another key issue with the healthcare delivery system in rural China is a lack of effective monitoring over the usage of medicine and medical devices. Hospitals have been purchasing large diagnostic equipment such as CT scanners for attracting patients, to increase revenue and profits. Excessive reliance on diagnostic devices such as CT scanners and MRIs has led to inappropriate use and a corresponding increase in medical expenditure [26]. Aside from the issue of potentially causing harm in this particular instance due to excessive irradiation, it is arguably the case that such misuse of resources may at least be partly due to the absence of practical clinical guidelines and effective monitoring mechanisms.

While the overuse of medical services has attracted wide attention, shortages of medical services in rural areas of China cannot be ignored as well. Both of these problems can be traced to irregular behaviour of physicians, imperfect management mechanism and irrational oversight measurements. As such, there is arguably much scope to improve care quality and health outcomes at relatively low cost, especially with respect to non-communicable diseases (NCDs). These conditions typically have a prolonged clinical course and require long-term, well-planned patient management. The disease burden in China is increasingly

defined by NCDs: an estimated 87% of annual deaths and 69% of the total disease burden are caused by NCDs, with the health and economic impact of these conditions only expected to increase [9, 27].

Rationale for the intervention

Clinical pathways[1] are tools which translate the best available evidence and guidelines into multidisciplinary plans of best practice [28]. They include the sequence of practices, procedures and treatments that should be used with people with a particular condition to improve their quality of care. Pathways are developed in a particular setting to define the steps to be taken (within the local structure, systems and time-frames), which providers may be required to follow and evidence in order to be reimbursed for delivering patient care.

Clinical pathways are one important tool to reduce the unnecessary variation observed, in terms of patient care and outcomes for certain conditions. International studies have shown that the application of clinical pathway appears to enhance both individuals' health outcomes and cost-effectiveness in term of utilization of overall health resources [29, 30]. Moreover, the clinical pathway informed by evidence of best practice, is recognized as an effective instrument for reducing medical service costs and coping with changes in payment mechanism. Therefore, rural medical institutions regard the clinical pathway as a realistic option for optimizing diagnosis and treatment techniques, and as a framework to accommodate accompanying payment reform.

Evidence-based clinical pathways with supporting systems have been introduced as a solution, along with other reforms of public hospitals, to deal with both excessive and insufficient medical service problems in China's rural areas. For China's rural healthcare system, the priority conditions for reform were common and frequently occurring diseases, rather than complex and lower-prevalence illnesses like cancer. A national policy on clinical pathways was released in 2009, but this was introduced in isolation from other needed reforms (such as reform of payment by insurance agencies to healthcare providers, and management and incentivisation of health care workers), and its early impact was therefore limited.

Clinical pathways are particularly valuable tools for focusing on quality and coordination of care, as they can apply to multi-disciplinary teams and cover interventions for prevention, treatment and rehabilitation [28]. In the past twenty years, the concept of integrated care pathways, which include pathways for community care and prevention, has been considered a key element in restructuring healthcare systems in North America, Europe and elsewhere [31]. These integrated care pathways were developed in the face of fragmented healthcare services, an aging society, increasing costs and the rising chronic disease burden, which are now observed in China. As such, as clinical pathways are institutionalized in China, they must ultimately cover the different care settings for patient management within the rural health care system.

Evidence-informed payment reform, including case-based payment, has been proved as a powerful lever to trigger the chain reaction of behaviour change and improve the adherence among different stakeholders, and maximize the cumulative effects of health policy in China rural setting [11]. Development of interventions combining evidence-informed care pathways

[1] Synonymous or related terms are often used in international literature, such as: integrated care pathways, critical pathways, care plans, care pathways, care maps, or collaborative care pathways

and case payment has interested health authorities as a solution to help contain medical costs while improving care quality in rural China.

Overview of the collaboration

As part of ongoing public hospital reform in rural China, the development of evidence-informed care pathways has been emphasized by health authorities for the reasons discussed above. The China National Health Development and Research Centre (CNHDRC) in collaboration with the National Institute for Health and Care Excellence (NICE) International embarked on a pilot project on developing and implementing evidence-informed care pathways, which is linked with payment reform for target diseases. The present phase builds on the initial 'clinical pathways' (CP) project (Phase I), which was associated with the Health XI Project. Health XI is also titled the China Rural Health Project, and was initiated in 2009 with the joint support of the World Bank, DFID China and DFID UK.

Phase One (2009-12): pathways for selected surgeries

The Phase I CP project focused on integrating CP management with case payment reform for high-priority common surgical interventions. CNHDRC developed clinical pathways, taking into account costs and patient volumes in the previous three years in local hospitals, and NICE International provided technical support in the design of these pathways, drawing on UK expert advice. The clinical pathways developed were relatively straightforward, compared to those in the later phase, but implementation explored the role of incentives, supervision and other institutional arrangements. The pathways were used as the basis for deriving case payments, implemented electronically at two pilot sites. At the end of Phase One, a summative evaluation report used qualitative and quantitative data on the project; individual studies published by CNHDRC and other researchers, focussing on specific aspects of the project, are listed in Table 3. The impact on costs, patient experience and quality of care over a period of one year was assessed using matched controls and a 'difference-in-difference' design. Qualitative studies by CNHDRC included interviews with medical personnel on experiences implementing clinical pathways, and motivation analysis of staff in one Phase I pilot site. The project demonstrated beneficial changes in provider behaviour, enhanced care quality, and the containment of medical expenditure [18]. The Phase I CP approach has been scaled up in other non-pilot counties and now covers more diseases and conditions.

Table 3: Studies and publications on the Phase I project

Citation	Published	URL (if available)
Reports in Chinese		
Zhang et al. 2013. Problems, Causes and Countermeasures in Promotion of the Clinical Pathway Pilot Project	*Chinese General Practice* 16(4)	http://www.chinagp.net/upFiles/download/2013042363090093.pdf
Sui et al. 2011. Clinical Pathway Development Procedures and Principles in Rural Health Facilities	*Chinese Health Economics*	http://www.oriprobe.com/journals/zgwsjj/2011_7.html
Guo et al. 2011. Case study for development and implementation of clinical pathway information management software	*Chinese Health Economics*	
Sui et al. 2011. Clinical Pathway management	*Chinese Health*	

compensation mechanism design in pilot areas	*Economics*	
Zhao et al. 2011. Outcome evaluation of pilot research on health technology optimization and compensation mechanism in rural health facility: based on the evaluation method of difference in difference	*Chinese Health Economics*	
Guo et al. 2011. Motivation analysis of clinical pathway management implementation of pilot hospitals	*Chinese Health Economics*	http://www.oriprobe.com/journals/zgwsjj/2011_8.html
Qi et al. 2012. Study of the Effects of Clinical Pathways at Different Level Hospitals: Based on the Point Evaluation Results by Third Party	*Chinese Health Economics*	http://www.oriprobe.com/journals/zgwsjj/2012_8.html
Zhao et al. 2013. Evaluation of the effectiveness and current status of clinical pathway management trials in public hospitals: based on data collected through the clinical pathway platform	*Chinese Health Economics*	http://www.oriprobe.com/journals/zgwsjj/2013_1.html
Reports in English		
Cheng 2013. A Pilot Project Using Evidence-Based Clinical Pathways And Payment Reform In China's Rural Hospitals Shows Early Success	*Health Affairs*	doi: 10.1377/hlthaff.2012.0640

Further details on Chinese publications in Appendix A (page 123)

Phase Two (2012-)

Phase II of the CP project, with the guidance of central health authorities and financial support from DFID, has shifted focus to non-communicable disease. COPD and stroke were selected as the pilot disease topics for this second phase, in order to explore the development of integrated care pathways involving county hospitals, township health centres and village clinics. In addition, further reforms to the existing mixed payments system are piloted.

Moreover, as an essential aspect of implementation, information systems were upgraded to support the introduction of the new pathways. The process of pathway development and payment reform, and experiences of implementing and using the pathways, will be disseminated to other non-pilot sites within China and also to other developing countries.

Compared to Phase I, Phase II has the following new features:

1) Focus on *non-communicable disease* rather than surgical interventions

Notably, the focus is now on non-communicable diseases, given the very high attributed morbidity and mortality in rural China (details of topic selection in chapter 2). The aim is to develop clinical pathways that capture common co-morbidities and complications through a longer disease course, and also to explore the role of patient management in different care settings within the rural health care system.

Based on UK NHS experience, the project includes guidance to improve and measure *quality* throughout clinical care. Quality indicators are critical in ensuring that performance is maintained and even enhanced in the context of CP management, reimbursed on a capitation/global budget basis. Measures to track changes in quality of care over time include use of the EQ-5D tool as a self-reported measure of patient health, and surveys of staff and patient satisfaction.

2) Choice of stroke and COPD in CP Phase II: *highest morbidity and mortality in rural China*

Effective care in these disease areas requires coordinated intervention across multiple tiers in the system with an emphasis on community management. This project aimed (for the first time) to develop *integrated care pathways* (linked with payment reform) that include community care and prevention outside hospital setting.

3) Initiation of a *South-South dissemination strategy* to share two-way learning with India and South Africa

4) Impact assessment in Phase II

We are running a more *comprehensive and pragmatic impact evaluation* using a combination of quantitative and non-quantitative approaches alongside the CP pilots to describe their effects and inform scale up. This includes quantitative impact assessment based on an analysis of routinely collected data, and lessons drawn from interviews with a range of key participants.

The above components were not part of Phase I and will provide decision-makers with strong evidence for scale-up in and outside China.

Dissemination activities

As mentioned above, one of the key objectives of this project is to share the designing and implementation experience of evidence-based policy making with non-pilot areas within China, and between low and middle-income countries. This is in order to advocate for efficiency of health resource allocation and provide referential experience of achieving Universal Healthcare Coverage. Dissemination activities for the project are being conducted in various forms, detailed in **Chapter 4** below:

a) produce periodical project briefing to share with senior policy makers to deliver project findings;
b) publish Chinese and English literature to raise project profile in public;
c) take the opportunity of domestic and international conferences and workshops to present project findings and engage with wider network;
d) organize project experts and practitioners to introduce project experience into designed non-pilot areas, depending on their willingness;
e) invite policy makers or researchers within and between countries to conduct pilot site investigations for further understanding;
f) use a range of media, especially websites of CNHDRC & NICE international, to promote project impact.

Aims and objectives of impact evaluation

Before wider scale up is explored, it is necessary to identify the benefits and problems of implementing such pathways in the pilot settings. As such, we selected the most robust available evaluation methods in situations where randomization is not a practical option. It is important to recognise that no control groups are available, partly for pragmatic reasons and partly because the challenge of identifying appropriate controls untouched by reform, so the analysis and interpretation of our findings will be approached with caution.

A mixed methods approach was adopted, with the aim of assessing the impact of these clinical pathways based on an analysis of routinely collected data. For quantitative analysis of outcomes amenable to monthly monitoring, interrupted time series methods were applied where data allows; other longitudinal analyses were conducted using aggregated yearly data covering the periods before and after pathway implementation. Other quantitative analyses were conducted using data collected for new quality metrics, which were introduced as part of the pathways and therefore have no routinely collected data from before 2013. In this case, the research team monitored the trends in the period since the intervention began to record changes seen over the course of the intervention.

In addition, the results reported in this document include qualitative assessment in order to record the local conditions and experiences at each pilot site in greater detail, with the aim of contextualising quantitative findings and supporting overall recommendations on transferability. These reports are based on semi-structured interviews with key participants involved in the implementation of the clinical pathways. Information captured in this way includes changes in the perceived understanding of effective COPD or stroke care among clinicians and patients and practicalities of implementation (for example, in relation to IT needs).

Part 2: Design and methods

Key concepts and definitions	
PRECEDE-PROCEED	Model used for planning health and social interventions. Decision-makers begin by defining the outcomes they hope to influence, and work backwards through a causal chain identifying the preconditions and potential risk factors for these outcomes.
Interrupted time series (ITS)	Quasi-experimental study design which uses longitudinal data, collected at equally spaced intervals, to analyse the effect of an intervention or policy change.
Segmented regression analysis	Method of analyzing ITS data which models the trends in an outcome variable before and after an intervention.
Bottom up costing	An approach to estimating the cost of an intervention or set of services, which works by calculating and summing the costs of each individual component or resource required for the intervention.

Research design

The national policy context, detailed in chapter 1 above, has the following salient features for the clinical pathways pilots.

- Firstly, all rural areas in China including the pilot sites in the present study, are undergoing **comprehensive healthcare reforms** proposed by national government. The national health reform framework provides only general guidelines, encouraging local health policy makers to explore reform activities based on their own practical situations. As part of selecting the pilot sites, policymakers from the four sites selected expressed strong willingness to get involved in the Phase 2 study.
- Secondly, the Chinese public have expressed strong concerns at the persistent obstacles and high expenses in the health system. Their urgent expectations of getting better value for money have been a driver for pursuing this programme of work. The expectation is that clinical pathways combined with payment reform will help address **public demands for improved quality and value**.
- Thirdly, the **sustainable development of public medical insurance** is a significant challenge for local health policy makers in dealing with increasing demands for health care services. Efficiency gains to the medical insurance funds have been incorporated into program design to create an economic lever, helping adjust behaviours through payment reform.
- The strengthening of **health information systems in rural health institutions** is proposed as part of the national health reform framework, with the aim of facilitating project management (monitoring and evaluation) and improving connections among three-tier rural health institutions. Improvements in connectivity in this way are seen as a mechanism to strengthen integrated care.

This national context informed the design of the intervention, and also supported its implementation. In brief, the characteristics of care pathways programme can be summarized as: supporting standardised care and reducing variation; case payment reform; and the development supporting IT (and managerial?) systems.

The present Phase 2 pilot project aimed to explore the extent to which clinical pathways, as constructed as part of this present study, meet a number of core assumptions, namely that:

1. Clinical pathways with accompanying payment reform represent a practical tool for rural health institutions in the context of supporting efficiency and quality improvement;
2. Relevant clinical professionals will be sensitive to the existence of clinical pathways and change their behaviour accordingly, especially if there has been accompanying payment reform;
3. Evidence informed clinical pathways represent a useful platform to support negotiations for payment reform and greater local stakeholder interaction;
4. The clinical pathways approach as pursued in this pilot, can with appropriate adjustments, be applied in non-pilot areas.

As noted earlier, exploration of these issues is based on a mixed-methods design. Challenges in terms of the absence of controls, and other study design issues, means that any findings will be approached with caution.

Theoretical frameworks informing design and implementation

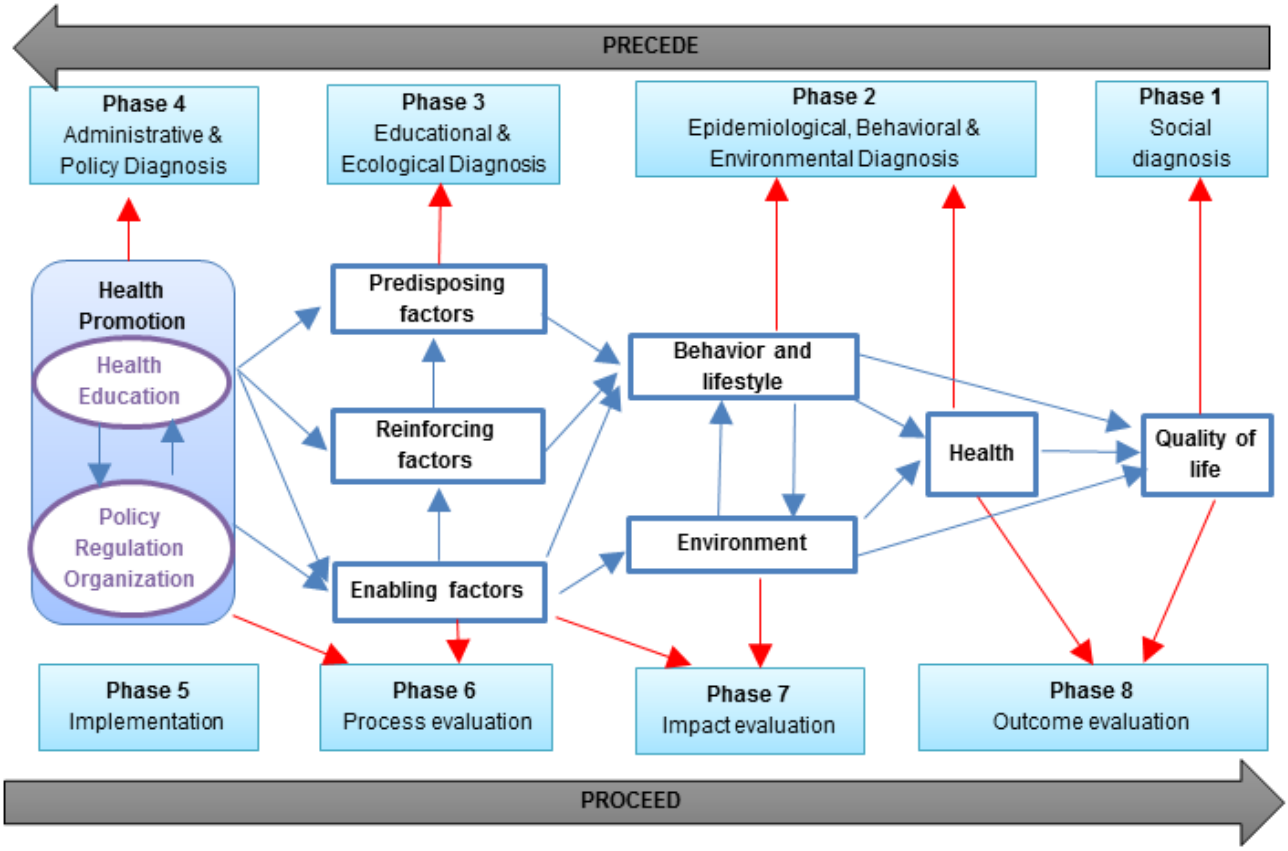
When designing the project, it was necessary to consider the factors influencing behaviour changes. The research and implementation team formulated a theoretical framework for the intervention with reference to the PRECEDE-PROCEED model, which was developed to guide public health and behaviour change projects [32, 33]. This model helps decision-makers plan a project from a starting point of defining the outcomes they hope to influence, and guides them backwards in the causal chain to identify the preconditions and potential risk factors for these outcomes [34].

Box 2: PRECEDE-PROCEED model

The PRECEDE-PROCEED model		
Stage of the model	**PRECEDE**	**PROCEED**
Acronym meaning	*Predisposing, Reinforcing, and Enabling Constructs in Educational and environmental Diagnosis and Evaluation*	*Policy, Regulatory, and Organizational Constructs in Education and Environmental Development*
Period covered	Process of designing and planning an intervention	Implementation and evaluation of the intervention

Evaluative steps required	Specification of objectives and associated baselines	Monitoring and quality improvement throughout project; assessment

Figure 2: Framework of the PRECEDE-PROCEED model

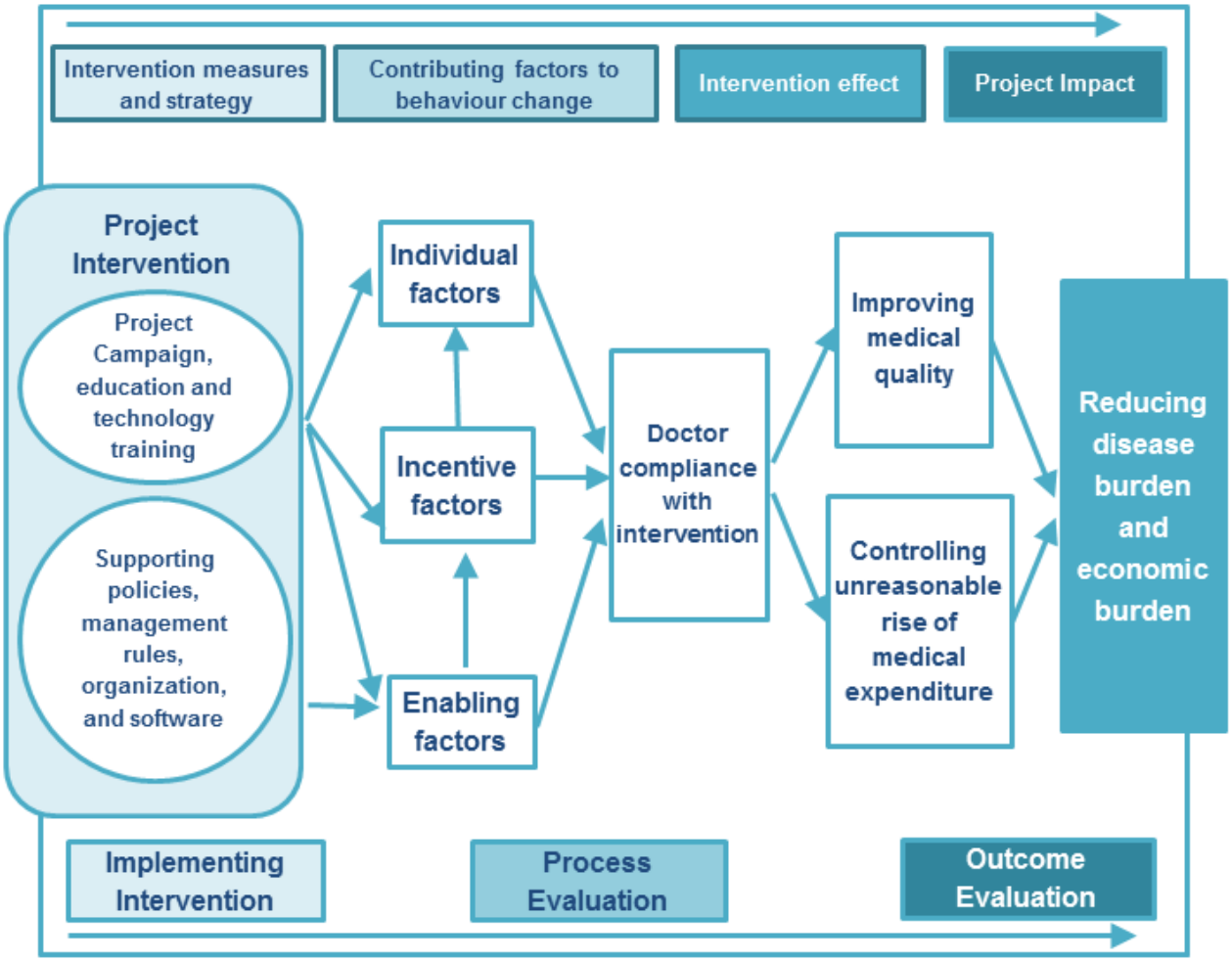


Reproduced from model authors [31]

In this model, health behaviour is defined as being influenced by both individual and environmental factors, thus has two distinct parts, which are diagnosis of the situation before and intervention is launched - PRECEDE and programme implementation and evaluation - PROCEED. An educational diagnosis of the problem is essential before developing and implementing the intervention plan, which takes into account the predisposing factors, reinforcing factors and enabling factors. Predisposing factors means personal preferences (such as knowledge, attitudes, beliefs, personal preferences, existing skills, and self-efficacy) that a group or individual bring to a behavioural choice [31]. Reinforcing factors are positive and negative consequences of an action, including social support, economic rewards, peer influences, advice and feedback of healthcare providers and physical consequences of behaviour. These reinforcing factors can determine whether the individual receives positive feedback for the behaviour and is socially supported after behaviour. The enabling factors are skills or physical factors which can facilitate the performance of an action, such as availability and accessibility of resources or services.

Based on the principles of PRECEDE-PROCEED, the research team formed its own theoretical model (Figure 3).

Figure 3: Theory framework of CP project



Approaches to project evaluation

After implementation over two years, a comprehensive evaluation is necessary to respond general concerns of different stakeholders in following aspects (Box 3). In this case, from the design phase of the intervention, stakeholders (policy makers, health institution management, physicians, etc) shared their comments and perspectives with research team. The research team worked closely with local practitioners and increase their motivations to contribute their intelligence to ensure the localization of implementation as far as possible. If some unexpected events happened or confounding factors introduced, the local policy makers and research team will work together to find an optimal solution to go through.

Box 3: Questions targeted by evaluation approaches

Summary of questions asked by project stakeholders regarding the clinical pathways policy intervention
1) Effectiveness of the intervention in the Chinese rural setting 2) Scope and extent of effectiveness 3) Threats to internal validity and external validity for further generalization 4) Feasibility of dissemination in a broader area 5) Which lessons from implementation progress are suitable for sharing with other groups and institutions

In short, the motivation for evaluation is not only to testify the effectiveness of intervention using different quantitative methods, but also to find out and analyze the causes of changes to improve intervention along the implementation progress. This draws on approaches to programme planning and evaluation such as developmental evaluation, which seeks to embed evaluation throughout the project team's activities and allows the most appropriate evaluation methods to be selected based on need and context [35]. In the case of this intervention, the central evaluation question is to validate the short-term and long-term intervention impact against possible confounding factors in term of safety, effectiveness, economy and ethicality in the setting of rural China. This required a combination of quantitative and non-quantitative approaches, including structured interviews with key hospital staff involved in the implementation of the clinical pathways to address the above questions.

Where the data allows, the quantitative impact of the clinical pathways on selected outcomes was assessed using interrupted time series (ITS) analysis with segmented regression. Segmented regression methods offer a means of statistically modelling interrupted time series data, and have the advantage of using already collected routine data [36, 37]. It can describe, in statistical terms, how much an intervention altered an outcome of interest, immediately and over time; whether there was an instant effect or a delay; whether the impact was temporary or sustained; and whether factors other than the intervention could account for the change.

From a methodological perspective, segmented regression analysis of ITS is a practical and potentially powerful approach for evaluating longitudinal effects of a time-limited intervention. Analyses using longitudinal data series before and after a health intervention in comparison with paired control group can deliver robust results and is politically acceptable.

Box 4: Interrupted time series

Overview of ITS approach

An interrupted time series (ITS) analysis is a quasi-experimental study design which use routine longitudinal data to isolate the effect of a policy change. This does not require a control group, and if using segmental linear regression can achieve statistical power with a relatively short time series [36, 37].

The general specification of a segmented linear regression of ITS data is:

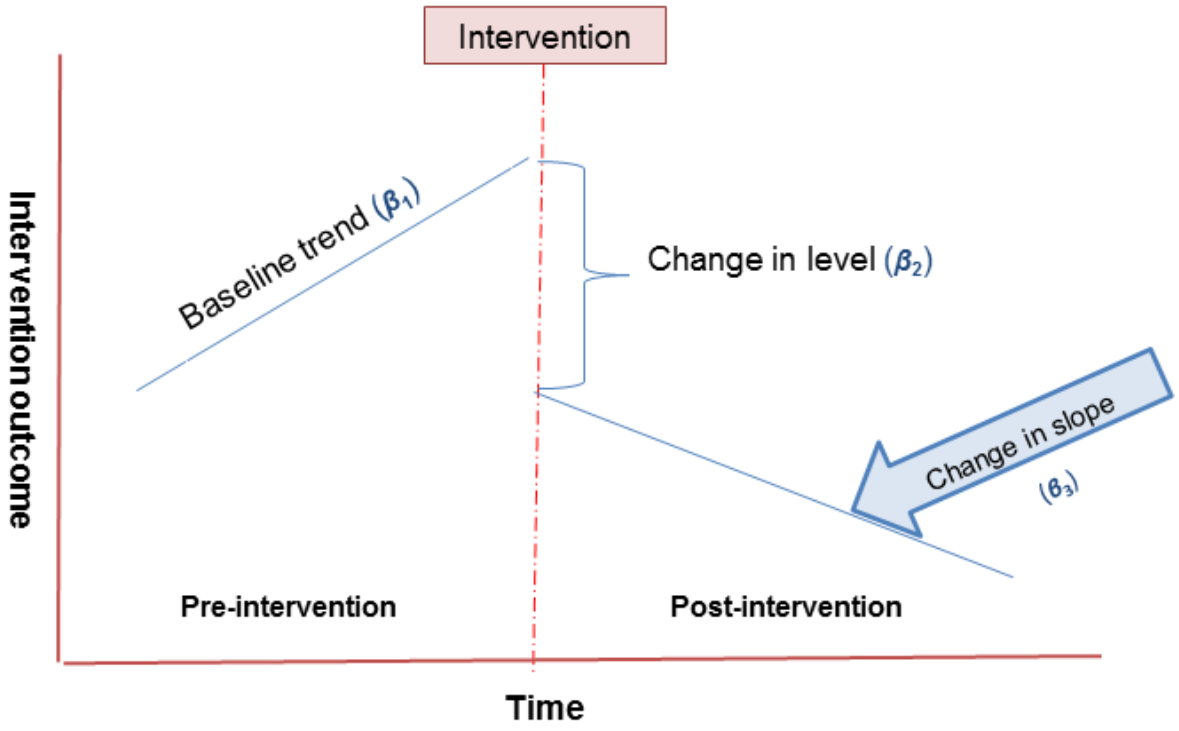
$$Y_t = \beta_0 + \beta_1 * time + \beta_2 * intervention + \beta_3 * postslope + \varepsilon_t$$

Where:

- **β_0 is the intercept**
- **β_1 is the slope prior to the intervention [baseline trend], representing the change over time before the intervention was implemented**
- **β_2 is the change in the level immediately after the intervention [level change]**
- **β_3 is the change in the slope from the pre- to post- intervention periods [trend change]**

An alternative analysis can be performed using Auto-Regressive Integrated Moving Average (ARIMA) modelling to capture systematic patterns in the longitudinal data (such as seasonal effects). However, this requires more complex statistical techniques and a time series of at least 100 points, which is not possible at this early stage of the intervention and evaluation.

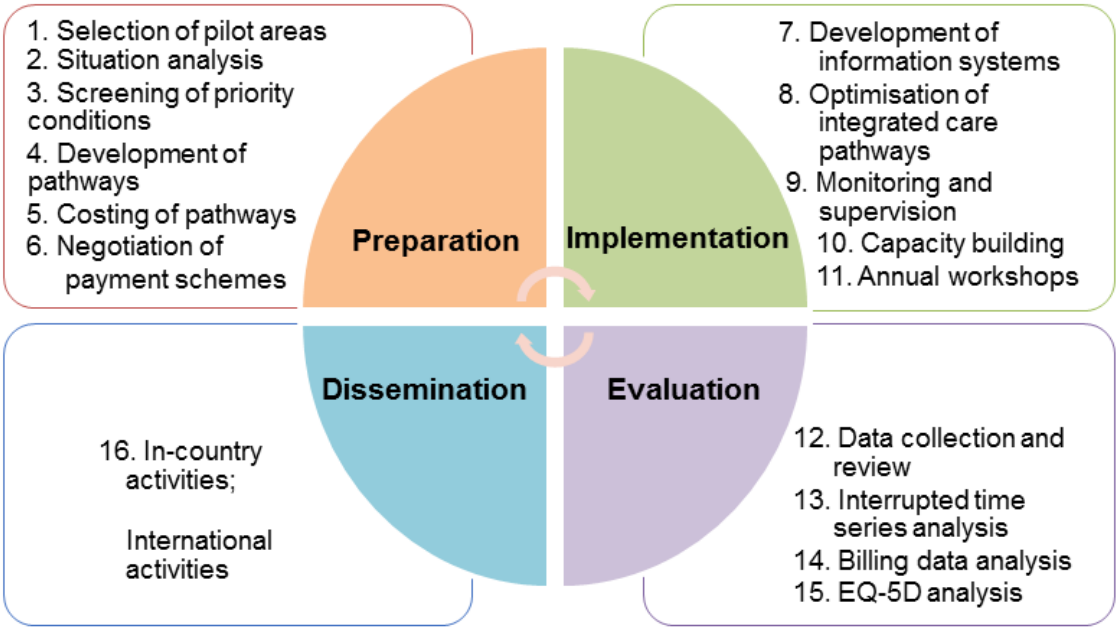
Figure 4: Results produced using interrupted time series analysis



Overview of intervention activities

Based on the project experience of phase one and engagements with stakeholders (such as local practitioners of phase one, policy makers from rural health authorities and institutions, clinical consultants, policy makers from central government, grant provider, etc), the joint research team of NICE and CNHDRC outlined the designing of intervention activities as below (Figure 5). This divides project activities as four broad parts: **preparation**, **implementation**, **evaluation** and **dissemination**. Within each part of four, there were individual project activities to accommodate the development of the intervention.

Figure 5: Overview of intervention activities



Although these are represented as forming a closed loop of sequential activities, some activities interacted with each other beyond the border of parts and pre-defined orders. For example, as a core activity of intervention, the **refinement of the integrated care pathways** continued through the whole process of intervention based on needs in the pilot areas. Similarly. in order to maximize project impact and deliver the findings in due course, the project team took up opportunities ad hoc of invitations, information requests, or international meetings to **summarise and share project deliverables** with in-country and international partners. Details of each activity are given consecutively below.

Preparation

1. Selection of pilot areas

As an intervention targeted at China rural health system, the county-level is the most logical option to conduct project activities. Two concerns were taken into consideration: firstly, that at least a county-level hospital exists in most Chinese counties. As introduced in Chapter 1,

within the three-tier China rural healthcare system, the country hospital plays a leading role and is supported by township health centres and village clinics. This organizational framework provides an ideal experimental setting/platform to test the feasibility of a care pathway involving multiple tiers of the rural healthcare system.

Secondly, the running of NRCMS is authorized directly by the county-level government, which means the corresponding rules of payment reform could be created and defined by local authority itself. In such case, the adjustment of local intervention rules can be achieved more efficiently should unexpected confounding factors arise, and the risk of failure seems more controllable in a limited range.

Before selection of areas for the pilot, discussions with project stakeholders elicited criteria that were expected to be met:

1. Strong willingness to participate among local stakeholders;
2. Sound capacity and past project experience of local stakeholders;
3. Better support of information system embedded into county hospital, township healthcare centres and village clinics;
4. Reflect the range of economic development all over the country.
5. Minimization of potential confounding factors.

The **willingness of local areas to actively participate** in the Phase 2 project was a necessary pre-condition for site selection, given its likely impact on the success of implementation. **Capacity and past experience** of local stakeholders, and an adequate **information system**, were also important considerations, since they would support the smooth implementation of project activities despite potentially changing local circumstances. The **reflection of economic status** across the pilot areas supports dissemination and reproduction at different levels of economic development in such a large country. The **minimization of potential confounding factors** aims to avoid contradicting existing health reform actions taken in each area, which would result in overestimation and underestimation in effect evaluation, and reduce the possibility of generalization.

To assess these factors, CNHDRC researchers conducted multiple site visits and discussions with various local stakeholders from different areas covering eastern, central and western China. Stakeholders (Box 5) were invited to share their experiences, recognitions and comments in regards to planning of integrated care pathway and corresponding payment reform. All the discussions and opinions were recorded as references for assessment of participation willingness. During the engagements, the research team also paid extra attention to the expectations of local health reform. Finally, the research team and local counterparts reached a consensus on what the project should aim to achieve and how they would collaborate.

Box 5: Stakeholders consulted in site selection

Local project stakeholders	Non-local project stakeholders
• Local governors • Director, Health and family planning commission • Director, social security and human resource • Director of financial bureau • Director of civil affairs • Director of hospitals and township health centres • Representatives of physicians and nurses • CNHDRC representing patient perspectives	• National and provincial health policy makers o Ministry and provincial department of health and family planning o Ministry and provincial department of social security and human resource • Senior clinical consultant • Project funder (DFID)

Figure 6: Location of pilot sites in China

Due to successful previous collaboration, two pilot areas in phase one were also included into phase two to support continuation of their reform efforts. Based on the predefined criteria above, four candidate areas were selected as the pilot areas: Huangdao county of Shandong province (located in Eastern China and representative of high-income areas), Wen county of Henan province (located in Middle China and representative of middle-income areas), Qianjiang county of Chongqing Municipality (located in Southwest China and representative of low-income areas), Hanbin county of Shaanxi province (located in Northwest China and representative of low-income areas). Further information on each site included in the pilot is given in Appendix H (page 237).

2. Situation analysis

An experimental study implemented in a real-world setting must take the context into account, and be aware of concurrent and possibly confounding factors during the project lifespan. If not documented, these factors could create threats to external and internal validity and result in a potential overestimation or underestimation of intervention effects. Therefore, after identifying the intended pilot sites, the research team conducted an independent broad-ranging situation analysis over pilot areas to collect baseline information in term of qualitative and quantitative data. Meanwhile, the data collected in relation to priority conditions were also used to create evidence of screening of priority conditions afterwards.

To facilitate cross country comparisons, this survey began by seeking general data on selected socioeconomic, demographic, health and health system indicators. However, it was not the intention of this survey to create a comprehensive account of the health situation or broader development needs in the countries and jurisdictions of interest. Finally, based on the data collected, the research team produced individual reports for each pilot area through mixture of longitudinal and horizontal analysis to serve as baseline investigation. Moreover, during the site investigation, some questions of instrument were amended based on the practical local settings. For example, most questions in section 6 were removed as they not make much sense for county-level policy makers.

The instrument for situation analysis is reproduced in Appendix B (page 129).

District characteristics

The China-UK collaboration project, “Integrated Clinical Pathway Project Phase II” selected four districts as pilot sites: Hanbin district of Shaanxi province, Qianjiang District of Chongqing, Huangdao district of Shandong province and Wenxian district of Henan province. The four districts are distributed across Eastern, Central and Western China and vary by geography. There are also large differences in the demographic characteristics of the pilot sites, and also their socio-economic status, available health resources and policy response.

Among the four pilot sites, Hanbin and Qianjiang were involved in Phase 1 and as such have more relevant experience compared with the other two sites in terms of clinical pathway management and payment reform. Both Hanbin and Qianjiang are located in relatively underdeveloped areas in western China, and have been designated by government as “national poverty districts”, eligible for special subsidies from the central authorities. Their medical services are constrained by economic status. Qianjiang is a district categorized as having old, small, marginalized, and poor areas, and is mainly surrounded by mountains with a relatively small population. Minority ethnic groups collectively comprise more than 70% of the population, and basic health insurance covers 92% of people, below the national average. Hanbin’s per capita GDP is less than 14,000 RMB/CNY.

Compared with Hanbin and Qianjiang, the new pilot sites of Huangdao and Wenxian are located in the eastern and central China respectively. They have high population densities and are comparatively more economically developed. Huangdao ranks as one of top 100 economically developed districts in China, with a per capita GDP of 74,508 RMB in 2012, close to economic level of Shanghai, Jiangsu and other developed areas (Table 4).

Table 4: Socio-economic status and health in the four pilot areas

	Hanbin, Shaanxi	*Huangdao, Shandong*	*Qianjiang, Chongqing*	*Wenxian, Henan*
Region	*Northwest China*	*Eastern China*	*Southwest China*	*Middle China*
Population (10,000)	101.26	146.52	52.68	42.18
Per capita GDP (RMB)	13,554	74,508	28,990	50,000
NCMS coverage (%)	97	100	92	96.6
COPD prevalence, over 40 years* (%)	8.2	8.2	8.2	8.2
Stroke prevalence, over 40 years (%)**	2	2	2	2

GDP: Gross domestic product; NCMS: *New Rural Cooperative Medical Scheme*
*National data; source: 2002~2004 Population COPD cross-sectional study
**National data; source: Chinese Stroke Prevention and Treatment Report 2015

Hospital characteristics

Health care institutions in the pilot areas face different environments thus different challenges and requirements (Table 4, Table 5). Huangdao and Hanbin districts have high quality and quantity of medical resources due to the competition the hospitals face with tertiary medical institutions and same-level public and private medical institutions. To compete for market share, the pilot hospitals have an urgent need to improve their medical service quality and implement policies to benefit patients.

Qianjiang and Wenxian pilot hospitals, with prior implementation of the project, excelled as local regional medical centers. Qianjiang was able to continuously improve medical quality and service efficiency, transforming from a secondary hospital to the only tertiary hospital in the district during the Phase I of the project. Its hospital beds reached 1,500, firmly and strategically establishing itself as a medical center in the whole district.

Table 5: Summary description of four pilot hospitals before pilot initiation, 2013

	Hanbin First Hospital	Huangdao People's Hospital	Qianjiang* Central Hospital	Wenxian People's Hospital
Province	*Shaanxi*	*Chongqing (Municipality)*	*Shandong*	*Henan*
Hospital type	General	General	General	General
Hospital level	2-A	2-A	3-A	2-A
Open beds	382	926	1,500	855
Annual outpatient (10,000)	15	50	28	30
Annual inpatient flow (10,000)	1.2	3.8	2.2	2.9

	Hanbin First Hospital	Huangdao People's Hospital	Qianjiang* Central Hospital	Wenxian People's Hospital
% of diseases managed by clinical pathway	77	49	79	62
Main source of funding	Single-disease fixed payment	Fee for service	Fee for service	Fee for service

*Qianjiang district covers Urban and Rural Residence Basic Medical Insurance

3. Topic selection-approach to choosing COPD and stroke

In the first phase (2009-2011) of the CNHDRC and NICE collaboration project, the surgical or simple conditions without comorbidities were highlighted in the application of clinical pathway management at Hanbin county and Qianjiang county. At the end of phase one, with the technical support of CNHDRC, the Hanbin county and Qianjiang county could manage over 80 surgical or simple conditions in model of clinical pathway. Following further undergoing of pilot work, the complex conditions with various comorbidities, which account for a big share of disease burden and economic burden, were noticed and emphasised by local colleagues and joint research team together. This was the original motivation to initiate phase two study based on the achievements of phase one.

In order to target feasible conditions, the research team conducted literature reviews for priority condition screening. With the ongoing impact of rapid industrialization, urbanization and aging, NCDs have become top threats to health in China, particularly, heart disease and stroke, cancer, diabetes, and chronic respiratory diseases accounted for 80% of all death and the number is expected to grow over time [9, 38]. Analysis from the 2010 Global Burden of Disease study shows that the leading causes of death in China were stroke (1.7 million deaths, 95% CI 1.5–1.8 million), ischaemic heart disease (948,700 deaths, 774,500–1,024,600), and chronic obstructive pulmonary disease (934,000 deaths, 846,600–1,032,300) [39]. Meanwhile, the China Health Statistics Yearbook 2011 shows that cerebrovascular and respiratory diseases ranked as the first and fourth causes of death for Chinese rural residents in 2010 [40]. COPD is a common disease of the respiratory system, and it has become a major public health problem in China because of its high prevalence, mortality, and socio-economic burden. An epidemiological survey of seven large cities in China during 2002-2003 reported COPD prevalence to be 8.2% among people aged 40 years or over; prevalence in rural areas was estimated to be 8.8%, significantly higher than that in urban areas (7.8%) [41].

Box 6: Criteria for priority condition selection

The criteria for selecting priority diseases included:

- High volume of admitted cases in the county hospitals from June 2011 to June 2012
- High-ranking median hospitalization costs for admitted cases, and overall cumulative costs for inpatients treated in the hospital (within the top 50 expenditures)
- Diseases/conditions where pathway development could support whole course management in the different tier of health institutions (county hospitals, community care centres and village clinics), covering prevention, treatment and rehabilitation.

In order to verify the findings of literature review, the research team also conducted the analysis on the inpatients data collected over four county-level hospitals of pilot areas covering in past year. In consideration of both disease burden and corresponding economic burden (Box 6), the research team produced tables ranking conditions for four pilot areas. In total, these selected conditions account for approximately 50% of annual expenditure in that county on hospitalization, with the top five conditions by expenditure accounting for 17% of expenditure on hospital episodes. The Hanbin survey is presented as an example below (Table 6), with the other three surveys delivering the similar information as Hanbin county.

Table 6: Condition ranking table (Hanbin county)

Discharge diagnosis	Total expenditure (RMB)	No. of cases	% of total annual expenditure on hospital episodes
Cerebral hemorrhage	2,175,883	300	4.16%
Gallstones	1,741,359	268	3.33%
Bronchiolitis	1,638,296	832	3.13%
Chronic bronchitis	1,605,802	488	3.07%
Angina pectoris	1,487,431	218	2.84%
Caesarean section	1,385,331	254	2.65%
Benign tumor	1,222,509	269	2.34%
Chronic maxillary sinusitis	1,140,953	233	2.18%
Kidney stones	1,065,389	223	2.04%
Simple spine fracture and dislocation	1,064,230	108	2.03%
Hypertensive heart disease	1,017,789	247	1.94%
Laceration of brain	999,346	161	1.91%

Discharge diagnosis	Total expenditure (RMB)	No. of cases	% of total annual expenditure on hospital episodes
Uterine fibroid	980,721	128	1.87%
Pneumococcal pneumonia	976,468	514	1.87%
Acute upper gastrointestinal haemorrhage	920,333	133	1.76%
Chronic pneumonia	900,152	321	1.72%
Cervical disc herniation	876,960	270	1.68%
Colorectal cancer	875,453	91	1.67%
Femoral shaft fracture	773,089	81	1.48%
Primary liver cancer	758,651	59	1.45%
Heart failure	748,256	141	1.43%
Inguinal hernia	695,298	167	1.33%
Ectopic pregnancy	687,212	111	1.31%
Primary tuberculosis	658,960	186	1.26%
Total	**26,395,871**	**5,803**	**50.43%**

COPD

A notable issue in this table is that there is no diagnosis of COPD outlined. When this was discussed with local physicians, they indicated they were not quite familiar with specific symptoms of COPD, and they normally define the obstructive respiratory illness as bronchiolitis, chronic bronchitis or pneumococcal pneumonia accordingly. The selection of COPD and stroke as key priority conditions for pathway development was agreed between NICE International and CNHDRC researchers, based on the criteria described above and project resources. Other diseases and conditions which were public health priorities, such as colorectal cancer, were not suitable at this time for developing clinical pathways based on the current clinical management in China. Later on, comments from Chinese and UK senior experts from clinical view were also collected to ensure making the appropriate choice.

During an acute exacerbation of COPD, the patient's health deteriorates sharply within a short timeframe. Costs incurred during an acute exacerbation are about 40%-70% of overall treatment costs; in a 2011 report from the Chinese Ministry of Health, the average length of an inpatient stay in hospital for each acute exacerbation episode was reported to be 20.7 days, with average costs reaching around 22,691 RMB-Yuan. Frequent exacerbations are associated with slow recovery, poorer lung function and increased risk of death. In terms of strategies to prevent and encourage the community management of COPD, early detection is fundamental. Furthermore, appropriate long term treatment which is well adhered to can prevent acute exacerbations of COPD. Patients can also reduce their risk exacerbations

through quitting smoking, influenza vaccination, and receiving pulmonary rehabilitation therapy.

Stroke

In China current levels of screening and prevention, treatment and rehabilitation are far from adequate. Consequently there is an urgent need to explore and establish efficient integration systems for screening and prevention, stroke networks to disseminate health knowledge, advocate healthy lifestyles, conduct screening for people at high risk of stroke, undergo early diagnosis and intervention, focus on and strengthen primary prevention and secondary prevention, and improve the current situation with respect to treatment and rehabilitation.

Research undertaken by CNHDRC noted that total hospitalization costs were found to be consistently high among the selected county-level hospitals with respect to stroke and COPD. Also current practice was such that patients who would otherwise be best managed in a community setting (e.g. at a village health centre), were being admitted unnecessarily to a county level hospital. Developing evidence-based pathways for stroke and COPD would support the broader objective of strengthening the role of community care for the prevention and management of ill health generally, and encourage activities such as smoking cessation, pneumococcal vaccination, and the better management of hypertension and diabetes. Findings from the data analysis on pilot areas were consistent with published national data highlighting the disease burden associated with stroke and respiratory illness and the need for better community management.

Therefore, the highlighting of COPD and stroke not only aimed at outstanding conditions on ranking table, but also provided the good opportunity to strengthen the bidirectional engagement over three tiers of rural health care system and explore the establish the whole course of disease management covering stages of prevention, treatment and rehabilitation.

4. Development of integrated care pathways

The integrated care pathways for COPD and stroke contain three sections: guidance for **prevention**, a clinical pathway for **hospital treatment**, and guidance for **rehabilitation**. As planned, the research team began with the development of inpatient clinical pathways for the pilot county hospitals, extending these to cover prevention and rehabilitation. These sections were supported by township health centres and village clinics affiliated to each county hospital.

Finally, a complete intra-regional disease management system was developed, which includes two-way patient referrals (between the township and county levels of service delivery) and specification of care delivered in each tier of the Chinese rural health system. This provides an alternative option to realize the tiered medical services system in current rural health setting, which were expected and proposed by national health authorities to relieve the problem of failures and high expenses in health care services.

Thus, a key innovation in this intervention was the inclusion of community-based guidance of prevention and rehabilitation care. The community-based care management on COPD and stroke were based on existing national Chinese guidelines and UK NICE guidance. Each hospital in the four pilot sites is affiliated with local community health service institutions and township level health facilities. Between 2 and 6 facilities at each pilot hospital were selected

to participate in the implementation of prevention and rehabilitation. In practice, however, the local practitioners put a lot of effort on clinical pathway for hospitalization rather than prevention and rehabilitation supported by township health centre and village clinics. This was understandable in reality as they cannot perfect all dimensions of designing in initial stage.

Following the stable introduction and developing experience of clinical pathway management in inpatient service, the earlier strategy with respect of prevention and rehabilitation has been implemented and emphasised by local health authority. This was introduced gradually with more confidence and inputs over time. Figures 7 and 8 give an overview of the key features of the integrated care pathway for COPD and stroke.

Figure 7: Overview of COPD pathway

Full pathway reproduced in Appendix C (page 137)

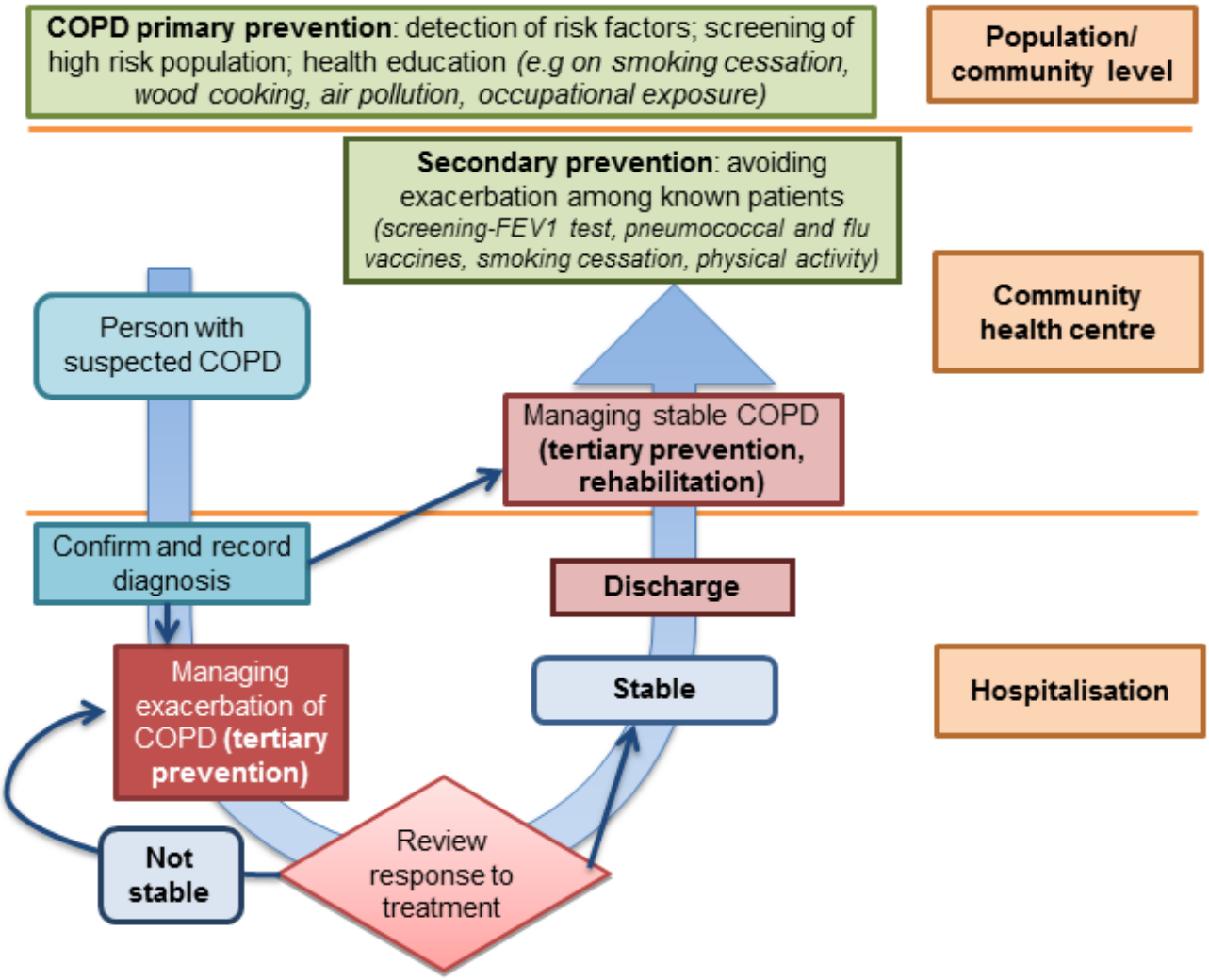
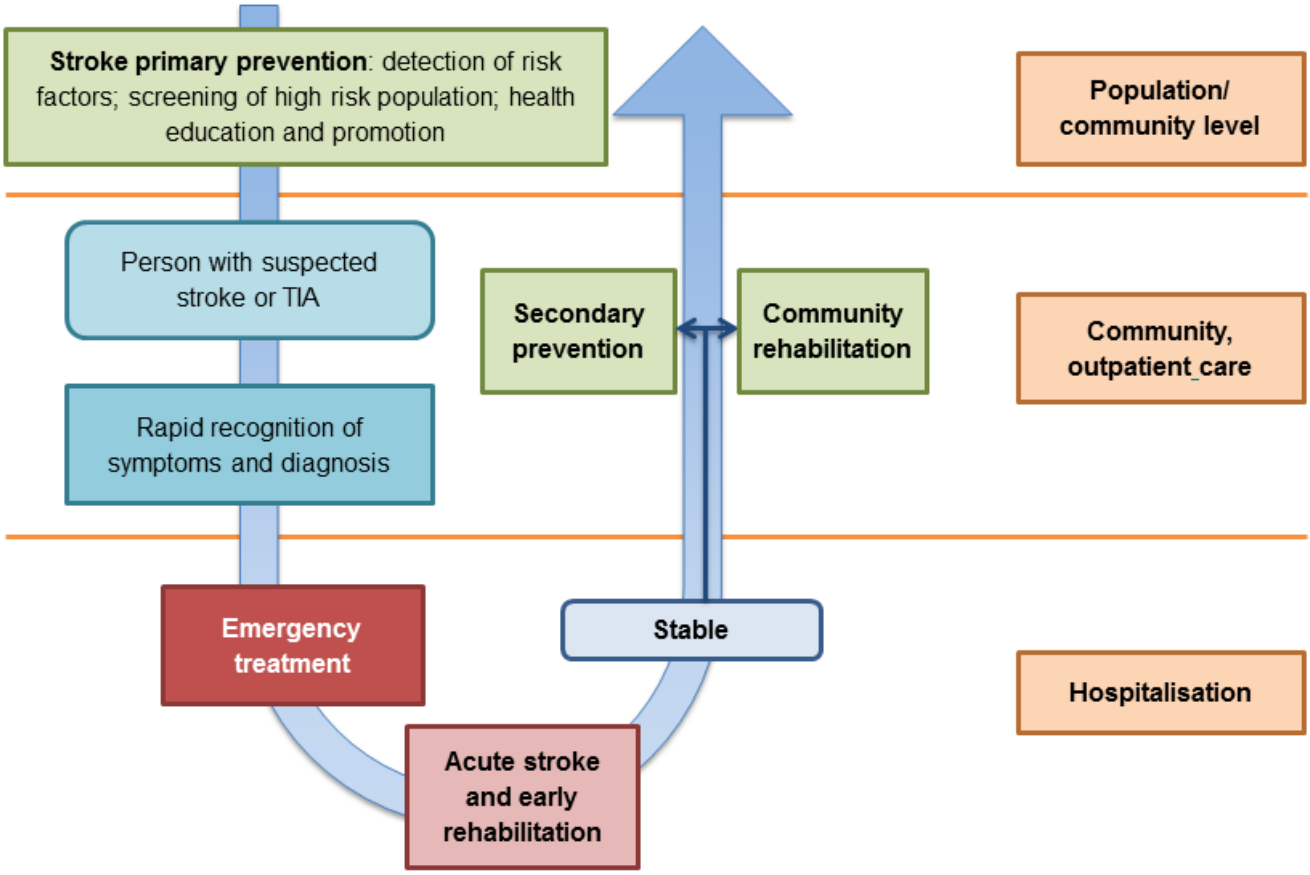


Figure 8: Overview of stroke pathway

Full pathway reproduced in Appendix D (page 157)



Taking **current clinical practice** across the four study sites as the basis for clinical pathway development, amendments to existing practices were made iteratively following comments from senior Chinese and UK experts in COPD and stroke, before reaching a consensus. Each hospital was assigned to develop initial drafts of the clinical pathways in according to their professional competencies, which were then reviewed by Chinese senior specialists before being translated into English for review by the UK specialists.

In order to increase the feasibility and inclusion rate of the clinical pathways, a selection of common complications and co-morbidities were included based on the data analysed during identification of priority conditions (Table 7). Following development of the main pathways for COPD and stroke, corresponding sub-pathways for these complications and co-morbidities were also developed as additions to the primary disease pathways. The sub-pathways do not intend to cure the complications and morbidities, but accommodate and stabilise them alongside the treatment of COPD and stroke.

Table 7: Summary of complications and comorbidities over four pilot hospitals

	COPD	TIA	Cerebral infarction	Cerebral haemorrhage
Hanbin	Hypertension; Diabetes; CHD; CPHD; RF	Hypertension; Diabetes	Hypertension; Pulmonary infection; Epilepsy; Diabetes	Hypertension; Pulmonary infection; Epilepsy; Diabetes
Qianjiang	Hypertension; Diabetes; CHD; CPHD; RF	Hypertension; Diabetes	Hypertension; Pulmonary infection; Epilepsy; Diabetes; Cerebral hernia	Hypertension; Pulmonary infection; Epilepsy; Diabetes; Cerebral hernia
Huangdao	Hypertension; Diabetes; CHD; CPHD; RF	Hypertension; Diabetes	Hypertension; Pulmonary infection; Epilepsy; Diabetes; Cerebral hernia	Hypertension; Pulmonary infection; Epilepsy; Diabetes
Wen county	Hypertension; Diabetes; CHD; CPHD; RF	Hypertension; Diabetes	Hypertension; Pulmonary infection; Epilepsy; Diabetes; Cerebral hernia	Hypertension; Pulmonary infection; Epilepsy; Diabetes

Note: CPHD: complication of chronic pulmonary heart disease; CHD: Coronary heart disease; RF: respiratory failure; PHD: pulmonary heart disease

As a dynamic intervention, the clinical pathway will be optimized continuously to match the changing of local setting (for example, improved capacity of local physicians, or greater oversight on prescriptions) and interaction with other confounding factors (implementation of essential drug policy, and competing payment reforms). This is normally done during an update or reviewing within each project year.

In order to improve the practicability and accuracy of diagnostic classification, the pathway of stroke were divided into three sub pathways: **transient ischemic attack** (TIA), **cerebral infarction,** and **cerebral haemorrhage**. The hospital in Huangdao focused on the development of TIA sub pathway, and the hospitals in Hanbin and Qianjiang drafted the cerebral infarction sub-pathway, with the hospital in Qianjiang additionally drafting the haemorrhage sub pathway. An expert based in Beijing Xuanwu hospital drafted the universal rehabilitation pathway for stroke, which can be applied within 72 hours of an acute exacerbation stage.

With respect to **COPD**, Qianjiang Central hospital initially drafted the COPD clinical pathway, and a doctor from Beijing Chaoyang district community centre was selected to draft the community management guidance with reference to the national guideline. All the drafts were reviewed by the Beijing COPD expert Prof. Wangzhen from Beijing Chaoyang hospital, and then by UK clinicians.

There are two major components for each template of clinical pathway. One is the **description of general principle and standard procedure** in reception of treatment, including but not limited to suitable objects (diagnosis with ICD code), diagnostic basis,

treatment options, length of stay, inclusive and exclusive criteria, summary of recommended tests and medicine, principle of treatment, status of discharge, etc. This general introduction serves as the simplified clinical guidance to outline the basic rules of standard procedure.

The other component is a **detailed list of daily prescribed actions** which might be taken by physicians, which were installed into hospital information system to ease use. In order to ensure the quality of service and physicians' adherence to clinical pathway, the items were defined into mandatory and optional ones according to their importance and feasibility in relation to the condition. Specifically, the mandatory items are applied to all patients admitted into clinical pathway management, and explanation must be recorded for reviewing in some extreme cases. The optional items can be ordered by physicians depends on patient's needs, which are variable in different cases.

The finalization of proposed prescribed items were reviewed iteratively by local physicians, Chinese senior physicians and UK clinical consultants together based on the views of evidence-based medicine and practical capacity of local physicians. Such designing takes both minimum requirements in service quality and patient's' individual diversity into consideration. After changing of influential factors, the clinical pathway was updated in engagement with clinical specialists.

5. Establishing costs of the integrated pathways to support payment reform

a. Designing payment methods

In order to encourage physicians to comply with the pathway, the fee-for-service (FFS) payment method was replaced, where agreed, with case payment to combine clinical pathway management in piloting hospitals with targeted financial incentives for physicians. Due to relatively low salaries in comparison with inputs, FFS incentivizes individual doctors to generate additional income through over-prescribing and excessive diagnostic testing. So To contain costs for the insurer and individual patient, and improve the quality of services provided, changing payment methods is seen as a key measure to shift behaviour towards best practice.

Expert workshops focusing on local policymakers and hospital management as well as physicians were held to discuss alternative payment methods with an emphasis on behaviour change, operational costs and human resource costs in the pilot counties. The following three options were discussed in most detail:

I. **Case-based payment methods adjusted for severity** (coupled with quality indicators to control for quality of health outcomes) are normally absent in rural China. Most medical insurance agencies adopt case payment, although very few link it with a clinical pathway. The Phase I experience shows that payment directly linked with clinical pathways is effective at altering doctor behaviour and controlling costs. The present intervention combines the single case payment for selected conditions with payment methods that take into account severity and case-mix for chronic diseases and corresponding outstanding complications and morbidities.

II. Using **case-based global budgets** is another payment reform approach in two pilot areas (Wen county and Qianjiang county). Generally, third party payers (public

insurance agency--Bureau of social security and human resource) agree a total annual budget based on total hospitalization costs by diseases in the previous 3 years. If the budget ceiling has been underestimated, providers are incentivized to under-treat, or delay treatment, or refer the patient to another health institution. In contrast, the clinical pathways coupled with quality indicators, is expected to reduce unnecessary hospitalization through overall improvement in patient management along the integrated care pathway supported by township health centre and village clinics. Standardization of care through the pathways will assist in better estimating the appropriate level of reimbursement, and potentially mitigate the perverse incentives associated with case-based global budgets based on historical costs alone.

III. **Patients' individual accounts** are a common mechanism used in outpatient insurance management, although they could potentially influence adherence with life-long medication for stroke and COPD. Individual accounts have limited funds. In order to avoid re-admission following an acute event, evidence indicates that secondary prevention is cost-effective in stroke and COPD management [42, 43]. It may be necessary therefore to move away from individual accounts into capitation payment as the preferred payment framework for secondary prevention in outpatients and at the community level.

The present study implemented the integrated pathways using a combination of payment systems I and II described above (single case-based payment and case-based global budget). The choice of payment method is dependent on the local preference. This allowed research and implementation teams to explore the effectiveness of implementing the CPs under different payment mechanisms.

b. Estimation of treatment cost based on clinical pathways

In order to set up an appropriate payment level, it was necessary first to estimate treatment costs, applying evidence for payment policy-making. To assess differences in medical services charge standards and historical data between pilot counties, costing studies were conducted across different pilot areas. There were two aspects of costing: one was a bottom-up costing based on each component of the best-practice clinical pathways of intervention diseases and their complications, and the other was analysis of historical data of hospitalization expenditure on diseases covered by the intervention.

For costing the pathways, **unit prices of services and drugs** were provided by pilot hospitals. The team calculated and integrated these prices based on the services and drugs (mandatory or optional) used, to generate the maximum/minimum costs of intervention diseases and their complications. Historical data analysis was based on collection of **hospitalization expenditure on intervention diseases** from pilot hospitals; expenditure limits with different coverage were generated under SAS software procedure.

Under overall consideration of payment capacity, sustainability and other factors, local decision makers negotiated with local healthcare providers to set rational case payment standards. A series of parameters (Table 8) were used in the process of negotiating the payment fee level. In relation to these parameters, the estimated treatment cost also aimed

to take into account potential incentives. Using the previous 3-year hospitalization data, the cost of covering 80% of patients was estimated in order to prevent artificial price inflation per case. These cost parameters served as the trade off during the negotiation between providers and payers (Table 9).

Table 8: Definitions of parameters for negotiating case payment

Parameters used when negotiating case payment	
Minimum cost	Cost of treating a patient without any optional items in clinical pathway (only mandatory items)
Maximum cost	Cost of a case with all possible optional and mandatory items included
Quintile cut-off points	Costs of potential cases which include respectively 20%, 40%, 60% or 80% of optional items
Cost of covering 80% of patients	Estimated cost of covering 80% of patients with the condition in question

Table 9: Framework of estimating treatment cost based on clinical pathways (Hanbin county)

Conditions / Parameters	Min	Quintiles				Max costs	P80 (2010)	P80 (2011)	P80 (2012)	P80 (2013)
		20% optional costs	40% optional cost	60% optional costs	80% optional costs					
COPD	**1433.0**	**4480.7**	**7528.3**	**10576.0**	**13623.6**	**16671.2**	**4458.0**	**4466.0**	**4498.0**	**4464.0**
Comorbidities:										
High blood pressure	*40.1*	*183.7*	*327.4*	*471.0*	*614.6*	*758.3*	—	—	—	—
Diabetes	*153.6*	*297.9*	*442.2*	*586.5*	*730.8*	*875.0*	—	—	—	—
Coronary heart disease	*40.0*	*660.7*	*1281.3*	*1902.0*	*2522.6*	*3143.3*	—	—	—	—
Pulmonary heart disease	*0.0*	*721.4*	*1442.7*	*2164.1*	*2885.4*	*3606.8*	—	—	—	—
Respiratory failure	*0.0*	*745.3*	*1490.7*	*2236.0*	*2981.3*	*3726.6*	—	—	—	—
Cerebral haemorrhage	**3387.5**	**5054.5**	**6721.6**	**8388.6**	**10055.6**	**11722.6**	**6285.0**	**8214.0**	**7023.0**	**6904.0**
Comorbidities:										
High blood pressure	*33.0*	*164.4*	*295.7*	*427.1*	*558.5*	*689.9*				
pulmonary infection	*157.3*	*350.5*	*543.7*	*736.9*	*930.1*	*1123.3*				
Epilepsy	*0.0*	*52.7*	*105.4*	*158.1*	*210.8*	*263.5*				
Diabetes	*468.0*	*585.7*	*703.4*	*821.0*	*938.7*	*1056.4*				
Rehabilitation	*780.0*	*3375.0*	*5970.0*	*8565.0*	*11160.0*	*13755.0*				
Cerebral infarction	**1509.1**	**4749.6**	**7990.2**	**11230.7**	**14471.3**	**17711.8**	**3538.0**	**6085.0**	**6488.0**	**6582.0**
Comorbidities:										
High blood pressure	*33.0*	*164.4*	*295.8*	*427.1*	*558.5*	*689.9*	—	—	—	—
Pulmonary infection	*157.3*	*350.5*	*543.7*	*736.9*	*930.10*	*1123.30*	—	—	—	—
Epilepsy	*0.0*	*52.7*	*105.4*	*158.1*	*210.8*	*263.5*	—	—	—	—
Diabetes	*468.0*	*587.0*	*703.4*	*821.0*	*938.7*	*1056.4*	—	—	—	—
Rehabilitation	*780.0*	*3375.0*	*5970.0*	*8565.0*	*11160.0*	*13755.0*				

Conditions / Parameters	Min	Quintiles				Max costs	P80 (2010)	P80 (2011)	P80 (2012)	P80 (2013)
		20% optional costs	40% optional cost	60% optional costs	80% optional costs					
TIA	*1341.0*	*2279.6*	*3218.2*	*4156.8*	*5095.5*	*6034.1*	—	—	—	—
High blood pressure	*33.0*	*86.0*	*139.0*	*192.0*	*245.0*	*298.0*	—	—	—	—
Diabetes	*196.0*	*252.3*	*308.7*	*365.0*	*421.4*	*477.7*	—	—	—	—

Prices rounded to nearest 0.1RMB
P80 = cost of treating 80% patients

6. Negotiation of payment scheme among stakeholders

Under overall consideration of payment capacity, sustainability and other factors, local decision-makers negotiated with local healthcare providers to set rational case payment standards. The medical insurance agencies and healthcare service providers in each site had face-to-face discussions in order to negotiate the case payment rate based on the clinical pathways by using the parameters above.

The process of negotiation was transparent and underpinned by certain principles: local payers will pay more, but local hospitals would be incentivized to provide better care, and critically, out-of-pocket payments by patients cannot be increased. The establishment of the payment fee had to account for general health cost inflation and consequently a yearly adjustment mechanism was set up to factor this in. This process saw significant controversy among the stakeholders and is interesting when viewed from the perspective of game theory as stakeholders' different interests were displayed, until finally they reached a point which balanced their conflicts of interests. The researchers played the role as an observer and on behalf of patients' interest, and responded any technical issues regarding the cost estimations.

In relation to hospitalized patients with complications and comorbidities, the incentive framework will allow hospitals and their clinical staff to retain any surpluses as a result of more efficient delivery of care. If following quality auditing surpluses arise, under usual circumstances the hospital and its doctors will be able to re-allocate this saving on a pre-defined ratio agreed by hospital management and physicians. However, if costs exceed payment, financing the short fall will be shared equally between the hospital and the doctors with the same pre-defined ratio. Normally, the largest share of saving (over 60% even more) will share by physicians and supporting medical staffs, and the rest of it will be reserved as general developmental fund to cover possible surplus by hospital management. Local insurance payers and the patient will pay the negotiated fees only.

Notably, compared to previous arrangements, the clinical pathways were designed such that third party payers pay a relatively greater share of the total costs and patients a correspondingly lower share from their out-of-pocket payments. In the case of outpatient management, incentive payments are linked to earmarked funding for any prescribed essential drug, and are conditional on performance as verified through prescription audits and other checks as necessary.

Implementation

7. Development of information system and management measures

As a necessary condition when selecting the pilot areas, supportive information systems improve physicians' working efficiency and strengthen the process of behaviour change. They also facilitate routine monitoring and evaluation through smarter data capture, increasing the amount and quality of available data. Digital healthcare furthermore has the potential to help support healthcare decision-making and delivery, by providing evidence based defaults for care delivery and facilitating audit. Put another way, it could help to bridge the knowledge-practice gap and ensure the right thing happens to patients.

The pilot hospitals therefore upgraded or created clinical management modules within the existing general hospital information system, in order to embed digital pathway templates and achieve seamless links with the original hospital information system (HIS). Moreover, electronic clinical pathways and payment information cannot be developed in isolation; all the payment information and billing data of patients are mapped into clinical pathway module automatically. Finally, all patient-oriented project data can be tracked down through the electronic management module at any time. Development of these new modules was mainly assisted by the existing vendor to ensure the smooth connection between systems.

Box 7: Electronic clinical pathways

Required minimum functionality for electronic clinical pathways:
a. Recording notes into Electronic Health Records
b. Statistics and variance recording
c. CPOE (Computerized physician order entry, the ability to order tests e.g. blood tests or imaging)
d. Activity checklists
e. Editable pathway templates

In order to motivate involvement by physicians and other medical staff, hospital management introduced a series of supportive management measures to accommodate the implementation of clinical pathway and corresponding payment reform in hospitals. These included setting the ratio of responsibilities shared when allocating savings and short-falls arising from case payment tariff; drafting regulations on internal supervision; and specifying related management rules.

In the initial stage of implementation, the management of all pilot hospitals take a small share of savings, but a big share on losses. Following growth in popularity of clinical pathways, the sharing rate was dynamic over the years and played an important role to trigger the behaviour change in engagement with physicians over time.

8. Sustainable optimization of integrated care pathway

As a dynamic intervention, the clinical pathway and integrated care pathways were required to update continuously to adapt the changing of local setting (such as improving capacity of local physicians, growing awareness of evidence-based policy making of local policy makers, changing of medicines available in pharmacy department, more strict oversight on prescriptions and so on) and interact with other coterminous factors arising from comprehensive health reform. These parallel developments included enforcement of the essential drug policy enacted in China's rural health system, proposal of tiered medical services, restriction of antibiotics prescriptions, and other concurrent payment reforms.

In similar fashion to the procedures of clinical pathway development, reviews of the clinical pathways were conducted annually by senior stroke and COPD specialists from UK and China in collaboration with local physicians. As with pathway development, changes to the clinical pathways and integrated care pathways were highlighted in comparison with previous versions. Based on the principle of evidence-based medicine, the physicians made final decisions jointly on the feasibility of changing prescription items, switching of mandatory and optional status for specific prescriptions, and availability of the supplementary items recommended by UK experts.

Meanwhile, the local health authorities also kept improving their efforts in two-way communication between hospital and township health centres, according to their growing resources and management capacity. This also improved implementation of whole-course disease management on COPD and stroke. Increasingly, the structure of tiered medical services covering prevention, hospitalization and rehabilitation, has been created resembling a pyramid structure over piloting hospital, township health centre and village clinics.

Patient mobility in this model is bidirectional and provides the most cost-effectiveness services appropriate to the severity of the condition. For example, in four pilot areas, the 23-valent pneumococcal polysaccharide vaccine was provided for free to selected COPD patients who were from pilot township health centres and admitted into hospitalization service in past year, aiming at strengthening secondary prevention of COPD and postponing the relapse of acute exacerbation. Afterwards, the positive findings in cost-effectiveness evaluation made local stakeholders pleased to integrate the vaccine into COPD integrated care pathway for cost saving in hospitalization stage.

Taking Huangdao county as another example, during the exploration of integrated care pathways, the local health authority agreed to provide six kinds of medicines to high risk group for free (compound reserpine tablets, captopril, nitrendipine, metformin, glipizide and aspirin enteric-coated tablets). This was done in order to strengthen the management of hypertension and diabetes in township health centre and village clinics, and reduce the risk factors for potential stroke hospitalization afterwards. Such measures made good efforts in embedding integrated care pathways into China rural health system. Additional feasible measures are developed and adopted with local practitioners to smooth the sustainable optimization of integrated care pathways.

9. Regular monitoring and routine supervision

Based on experience of phase one, and in order to ensure the implementation of project activities successfully, regular field trips to the pilot areas were conducted by the CNHDRC project team. The field trips involved technical and project management support, including peer-to-peer learning through the use of clinical experts, The local pilot site teams were also able to host international counterparts an d experts from the UK, Vietnam, Canada, South Africa, India and Indonesia. On average, the research team made the rounds of visit every three months.

For each regular monitoring and routine supervision, several rounds of meeting with different local stakeholders were held to find out what new achievements and difficulties in implementation of project activities had emerged since the last visit. The stakeholders were also able to provide updates actions taken in exploring and implementing the pathways, and their further plans for next steps. If they raised technical problems encountered in the implementation, with the contribution of experts, the research team would provide technical assistance to help them go through smoothly. If changes in management processes and structures were considered as demotivating the passion of health staffs, recommendations from physicians would be delivered to policy makers and hospital management in the first place for following adjustments. According to the tips of information management experts, the functionality of clinical pathway software were improved and extended quickly to support the needs of physicians and hospital management.

When challenges of policy change out of their own control were raised, the research team and accompanying experts would help local practitioners to look for alternative solutions or coordinate the engagements with others for problem-solving. Meanwhile, the research team would also review data collected by the information systems and give facility staff suggestions on improvement from the view of project evaluation.

These trips of site investigation aimed to keep stakeholders' passion alive before they got use to the normalization of interventions, and balance conflicts of interests for problem-solving using technical and communication skills. Moreover, using the opportunity of regular site investigations, the research team and accompanying experts organized knowledge workshop on different subjects (based on local needs and target population) to strengthen local stakeholders' understanding in term of evidence-based decision making and chain reactions of intervention mechanism. Capacity building in this instance included use of data and evidence in the process of decision making through identifying priority diseases based on epidemiology, resource use and costs, developing evidence-based CPs, and adapting performance-based provider payment methods.

By such means, local stakeholder' sense of evidence-informed decision making were reinforced and encouraging a demand for accessing and using evidence. In engagement with local stakeholders over pilot areas, the demonstration and explaining of evidence are the most efficient approaches to communicate with each other, not only in trial of clinical pathways, but also the health reform actions adopted in other fields.

10. Capacity building

Building capacity is a crucial feature of the intervention and was repeatedly stressed throughout the course of the project lifespan. Briefly, there are three kinds of capacity building included into research content: **1) Human resource capacity** building through integrated care pathways management; **2) Institutional capacity** building by payment reform and incentive mechanism development; **3) Informational capacity** building through creating a digital version of the integrated care pathway-development and information exchange system. By such means, the sense of evidence-informed decision making by local stakeholders were reinforced, creating a demand for accessing and using evidence independently to inform related projects in other clinical areas.

In brief, these efforts can be summarized as:

1. Training workshops

The joint research team used every opportunity, in term of site investigation, annual gathering workshops (see below) and ad-hoc meetings, to consolidate the concept of evidence-based decision making and offer corresponding theoretical or skills-based training based on local needs. The domestic and international multidisciplinary experts on subjects such as clinical topics, policy research and information management were invited to deliver lectures and engaged with local practitioners on their common concerns.

For example, at the beginning of the project, the joint research team organized the senior clinicians, health policy researchers and information professionals from UK and Beijing to provide a full range of training in human resource capacity building, institutional capacity building and informational capacity building at two new pilot counties (Huangdao county and Wen county). The training was organized in forms of three sub-groups in line with audiences' interests: evidence-based management of COPD and Stroke; payment reform and mechanisms accompanying the clinical pathways, and practical skills in information system development.

Another example is that because of the general lack of the awareness on stroke rehabilitation in early intervention, the central research team invited a rehabilitation expert from the Beijing Xuanwu Hospital to deliver a specific training for the stroke and rehabilitation clinicians from four pilot areas. Using theory and case studies, the 3-day training workshop focused on rehabilitation timing, clinical judgment, rehabilitation measures, and applications of rehabilitation tool. Afterwards, the stroke and rehabilitation physicians played a leadership role to promote awareness of prevention, treatment and rehabilitation in their local areas.

Box 8: Training workshops

Topics included in training workshops	
• Project designing and theory of change • China rural health reform: past, present and future • Evidence-informed payment mechanism: experience from international community • Clinical guidelines, quality and payment in UK • The role of NICE and potential relevance to the Chinese setting • UK Health Reform • COPD and Stroke practice in UK • Examples of international best practice for COPD and Stroke care • Severity tiering of COPD and Stroke management	• Prevention strategies for stroke and COPD • Impact evaluation--Types of data, design and methodology • The role of clinical pathway in the context of payment reform • Digital health • The hospital internal management in the setting of clinical pathway • Health Technology Assessment • Principles of evidence-based medicine • The framework of integrated care pathway • Referral protocols across the care tiers (as referral standards, procedure, record, supervision measures)

2. Study tour to UK

To learn and exchange experience with UK partners in term of payment reform, regional health planning, clinical guidelines and evidence-based decision making, a study tour formed of Chinese policy makers and researchers were accommodated in February 2014. As well as the formal in-house training events, the delegation were also invited to witness a NICE technology appraisal committee meeting, and visited community health centres, GP clinics and the stroke unit of Guy's and St Thomas hospital.

Participants of the study tour was were impressed about by the width and depth of evidence application in NHS health decision making, and interested regarding in the methods and processes of policy making in the UK, and monitoring indicators of medical quality, and alsoas well as the possibility of knowledge translation into a Chinese setting. After returning from the UK, the supports from visitors enlarged the project's impacts and brought began to a profoundly influence in capacity building of by other project stakeholders.

11. Annual gathering workshop

In order to promote exchange and communication of project experience among pilot areas, the research team organized an annual workshop, hosted by each pilot area in turn. Notably Wen county and Huangdao county hosted two annual workshops each. During each workshop, each pilot area was required to summarize their project achievements in the previous year, and share their experience and challenges in implementation. Issues raised included patient management using clinical pathways, efforts made on integrated care pathway, application of payment reform, development of information systems, defining of management measures, and the approach taken to confounding factors.

In discussion sessions, the joint research team played the role of chair, and the questions raised by a pilot area were answered by another area, rather than the project staffs or experts. This intent is not only to increase the reliability of comments contributed by speakers, but also to verify and correct their understanding about the project design in public by each other. Some problems they met were frequent, and some were specific to a pilot

site, but all questions were discussed in the form of open discussion to benefit both existing and potential clients. In order to produce in-depth engagements on specific topics, participants were separated into three groups to further discussion on the questions of interest to each: groups of policy-makers and hospital management, of clinicians, and of information management professionals. These interactions also have the potential to increase the awareness of competition between pilot areas to do a better job before next meeting.

On occasions, visiting tours were also organized by host area to show their project outcomes visually for participants, and hear friendly advice from non-local project practitioners. At the end of each event, the research team in collaboration with multidisciplinary experts would summarize the discussions before and respond the according concerns one by one. Taking the opportunity of gathering, the project designing and objectives would also be emphasized again to unify understanding among participants. Based on the experience of past two project years, the annual gathering workshop provides a good chance to promote the project work in progress and boost confidence in making work plan of following project year.

Monitoring and evaluation

12. Monthly data collection and review

In order to review the intervention's effects, the research team designed a set of monitoring indicators with 32 "indicators" to fill out by pilot hospitals monthly (Appendix G, page 233). Formal data collection began in June 2014.

Along with quantitative data, the pilot areas were also required to create narrative briefings to update on news each month. These updates included comments on physicians' behaviour change, adjustments of management measures, introduction or change in external local factors (such as concurrent health sector reforms), opinions collected from other stakeholders, and summaries of local project meeting if applicable.

These monthly records facilitated the connections between pilot areas and the joint research team well beyond regular site investigations, as problems were detected and responded timely based on report reviewing. Data collection and reviewing per month is the immediate embodiment of developmental evaluation in this study. These records and site investigation reports created by research team itself were used as supporting documents to explain the findings received from monthly quantitative analysis, and contribute to the ITS analysis afterwards.

13. Evaluation of project outcomes

As introduced when describing evaluation design ("Approaches to project evaluation" above), an interrupted time series analysis was undertaken to assess the impact of these clinical pathways (coupled with payment reform) have on a focussed set of quality metrics based on routinely collected data.

In addition, a qualitative assessment was also made based on structured interviews with key hospital staff involved in the implementation of the clinical pathways. Information captured in

this way includes changes in the perceived understanding of effective COPD or stroke care among clinicians and patients and practicalities of implementation.

Quantitative assessment

Interrupted time series

For the ITS, it was agreed for measurements to be collected on a monthly basis over three and half years. While it would be ideal to collect more data points over a longer time period, this was considered the most pragmatic option available as the timing of the intervention start dates differed over the four pilot sites. To account for the period immediately before and after the pathways went into effect, where training and sensitisation on best practice was conducted in each site, the analysis included a defined transition period after the official launch of the project as also being in the 'pre-intervention' time period.

The units of analysis were based on multiple assessments of aggregated patient data from each pilot site, and the ITS analyses developed independently for each (results reported in chapter 3). All data collection techniques, procedures, and data collection forms were standardized to minimize bias. To meet the requirements of regular data collection over time and data organization with equally spaced intervals in segmented regression, data was collected for 24 monthly time points before intervention and 12 monthly time points after the intervention was introduced. The Durbin-Watson test was used to test the presence of first-order auto-correlation; if auto-correlation was detected in outcomes of interest, a generalized least squares estimator was used to estimate the regression. All analysis for the ITS was performed using SAS 9.4.

Data sources for quantitative analysis

It is important to note that as a pilot study, there is no information on the extent of any autocorrelation and the likely effect size. The selection of study sites and issues around overall sample size were partly driven by pragmatic considerations. However, based on the quality criteria noted above and in order to maximise the robustness of any findings, measurements were collected on a monthly basis over a period of three and half years from the following data sources:

- **Data of patients' medical records**

  Data was extracted from the information contained in medical records of hospitalized patients admitted with transient ischemic attack (TIA), cerebral infarction, and cerebral haemorrhage and COPD from January 2010 to May 2015. The names of the data fields included are attached (Appendix F, page 231).

- **Data of patients' satisfaction rate**

  Monthly data of hospitalized patients admitted at department of respiratory and Stroke Unit, from January 2010 to May 2015.

- **Mortality data**

  Monthly mortality data of hospitalized patients admitted with transient ischemic attack (TIA), cerebral infarction, and cerebral haemorrhage and COPD, from January 2010 to May 2015.

- **Data of hospital infection (infections occurring within hospital)**

The monthly data of infections occurring in hospital, from January 2010 to May 2015.

- **Data of EQ-5D**

  EQ-5D data of hospitalized patients admitted with transient ischemic attack (TIA), cerebral infarction, and cerebral haemorrhage and COPD, from January 2010 to May 2015.

- **Data of project monitoring indicators collected monthly**

  The summary data of monthly monitoring indicators specific to the project, as described in section 12 above (Appendix G).

- **Patients' billing data**

  In order to find out changes of prescribing behaviours by physicians and the services received by hospitalization patients before and after the intervention, beyond general information presented by medical records, the research team also examined more detailed billing data (see section 15 below).

Qualitative assessment

During the implementation phase, CNHDRC conducted focus groups and interviews with key participants of the pilot study (e.g. policy makers, hospital and village health centre clinicians, nurse practitioners, and IT staff from each site) during site investigation visits.

The objectives of this part of the study were to better understand participants' experiences and the perceived utility of the clinical pathways; the keenness to use clinical pathways in future; and satisfaction with its implementation and use in practice. This information further informs potential scale-up of our approach to integrated care pathways linked with payment reform for chronic diseases.

Focus groups and semi-structured interviews with key informants (Box 9) were conducted frequently to generate an open discussion about participants' experiences and satisfaction with the CPs, and also to assess their readiness to use this approach in the future. Questions include participants' perceptions on barriers and facilitators to using the CPs, how the CPs functioned in practice, their perceptions of the CPs impact on their workflow, and any suggestions for improving the CPs.

We need to consider the impact of other influential events that have occurred during the implementation of the intervention that might pose a threat to the internal validity of this part of the study. Members of the research team therefore designed an accompanying questionnaire to capture all practice-related activities done by physicians and others during the study that might account for changes between baseline and post-intervention observations.

Box 9: Interview and focus group methodology

Methods for focus groups and key informant interviews	
1. Interviewees	Interviewees for focus group sessions were the staff from county NRCMS management centres, county hospital management and doctors and patients. Each sample county had two interview groups with eight participants in each group. For key informant interviews, five individuals were chosen from each selected county through purposive sampling, including one leader in the county NRCMS management centre, one director of each county hospital, and also one doctor, one nurse and one patient.
2. Interview methods	Focus groups and key informant interviews.
3. Interview instrument	Interview outline based on open questions were used to solicit the interviewees' views, attitude, satisfaction on clinical pathways management, hospital compensation mechanism and NRCMS operation and fund use, and the constraining factors, as well as the social, cultural and policy factors behind those facts. Interview sessions were audio taped and field notes also collected.
4. Interview location and time	Group interviews normally lasted for 1.5 hours and key informant interviews 30-60 minutes. Interviews were conducted in designated locations identified by the research team.

14. Billing data analysis

Billing data forms the most detailed information source on medical expenditure and items prescribed by days, and give the best supportive evidence to summarise changes in physicians' behaviour and expenditure patterns.

Data was sourced for each condition and site from a random selection of 150 patients from each of three groups: **pre-intervention population**, **post-intervention population** included in clinical pathway management, and post-intervention population not included in clinical pathway management. Therefore, a total of 450 patients' records were screened and reviewed for each condition (TIA, cerebral infarction, cerebral haemorrhage, COPD) at each pilot hospital. In cases where the total number of patients in a group was below 150, all available cases were selected for reviewing.

The changes on numbers and timing of specific prescriptions, such as brain CT scanning, MRI, dehydrating agents, anti-atherosclerosis medicine, antibiotics, expectorant, lung function tests and statins, were reviewed across pilot hospitals (results in chapter 3).

15. EQ-5D analysis

EQ-5D is a standardized, self-report, and easy-to-use instrument to measure health outcome, which is applicable to a wide range of health conditions and treatments [44]. In our study, we employed the EQ-5D-3L form, which consists of 2 pages - the EQ-5D descriptive system and the EQ visual analogue scale (EQ VAS). For the descriptive system, the respondent indicates health state by selecting the most appropriate statement for each dimension (Table 10). The EQ VAS records the respondent's self-rated health on a vertical, visual analogue scale where the endpoints are labelled 'Best imaginable health state' and 'Worst imaginable health state'. This information can be used as a quantitative measure of health outcome as judged by the individual respondents [45].

Table 10: Dimensions in EQ-5D-3L descriptive system

	No problems	*Some problems*	*Extreme problems*
Mobility			
Self-care			
Usual activities			
Pain/discomfort			
Anxiety/depression			

Data of EQ-5D was being collected before and after implementation of the care pathways and at two time points (admission and discharge) for use in face-to-face interviews conducted by nurses. Changes in EQ-5D index value (between admission and discharge) are analysed in chapter 3.

Due to the absence of Chinese population-based utility weights, we selected the Japanese set of utility weight to process the analysis, since the Japanese population most closely approximates with Chinese. In our non-economic analysis where VAS values are required, the use of self-rated VAS data were also considered in analysis of chapter 3.

Dissemination

16. In-country and international dissemination and communication

As another component in the project design and emphasis of the Global Health Support Programme (GHSP) proposed by DFID, dissemination of project experiences and lessons learned from the pilot phase is shared with counterparts within and between countries. This communication aims to contribute to health system strengthening in China and selected low-to-middle income countries, by enabling national and regional decision-makers to act on their own priorities.

The intervention measures refined through the implementation and study were planned to be transplanted and expanded to non-pilot counties in China, aiming at validating the appropriateness and efficiency of the intervention measures and popularizing clinical pathways management in the wider population. Internationally, along with the kick-off meeting held in Beijing in November 2012, the joint project team initiated a South-South dissemination strategy to share two-way learning with India, South Africa, and other potential developing countries.

A strategic plan was also developed for how the team could produce global public goods (including training modules and evidence summaries), which could be applied as appropriate and feasible in different countries to improve the quality and efficiency of their healthcare systems. To account for the risk that the lessons from China's experience are not relevant or not transferrable to other countries, the risk management strategy for this work would include early participation and joint research with institutions from LMICs interested in understanding and applying the Chinese experience. Details of dissemination activities undertaken are in Chapter 4 below.

Illustrations

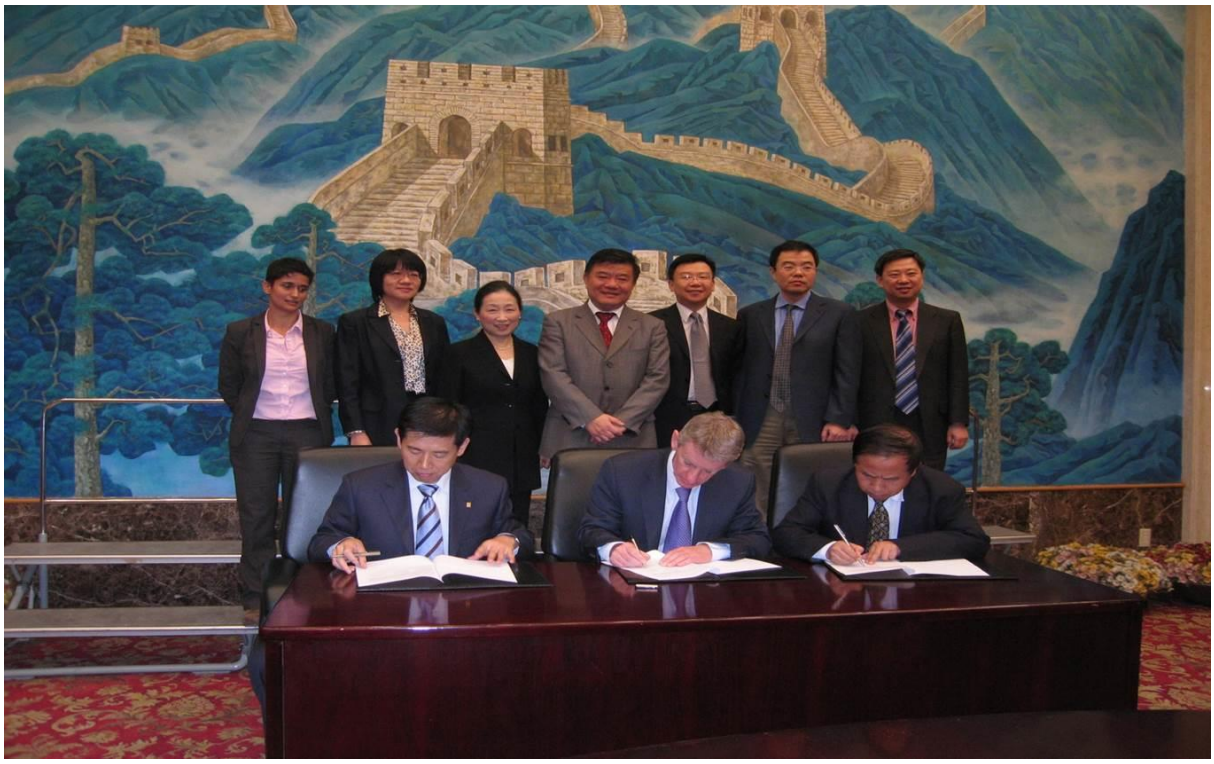
Field supervision for the Phase 1 collaborative project.

Field supervision for the Phase 1 collaborative project.

Training participants for the Phase 1 collaborative project.

Professor Zhao Kun presenting at a workshop for the Phase 1 collaborative project.

MOU signing for collaborations between NICE and CNHDRC.



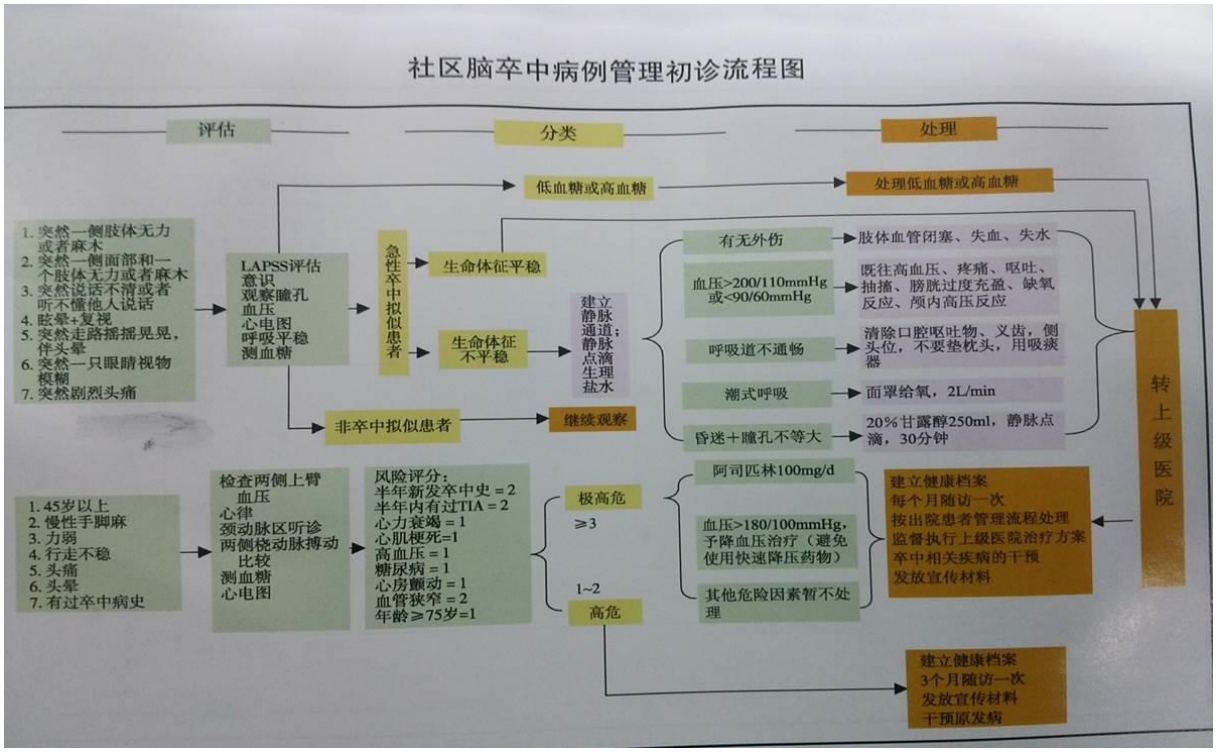
MOU signing for collaborations between NICE, CNHDRC, and CPMS.

'Phase 2' Project launch in Beijing, 6-7 November 2012.

Prof Zhao presenting the key activities of this project at the project launch.

Panel discussion with key policy makers from across Chinese Ministries (Ministry of Health, Ministry of Human Resources and Social Security, Ministry of Finance, NDRC, Ministry of Commerce) at Phase 2 project launch event.

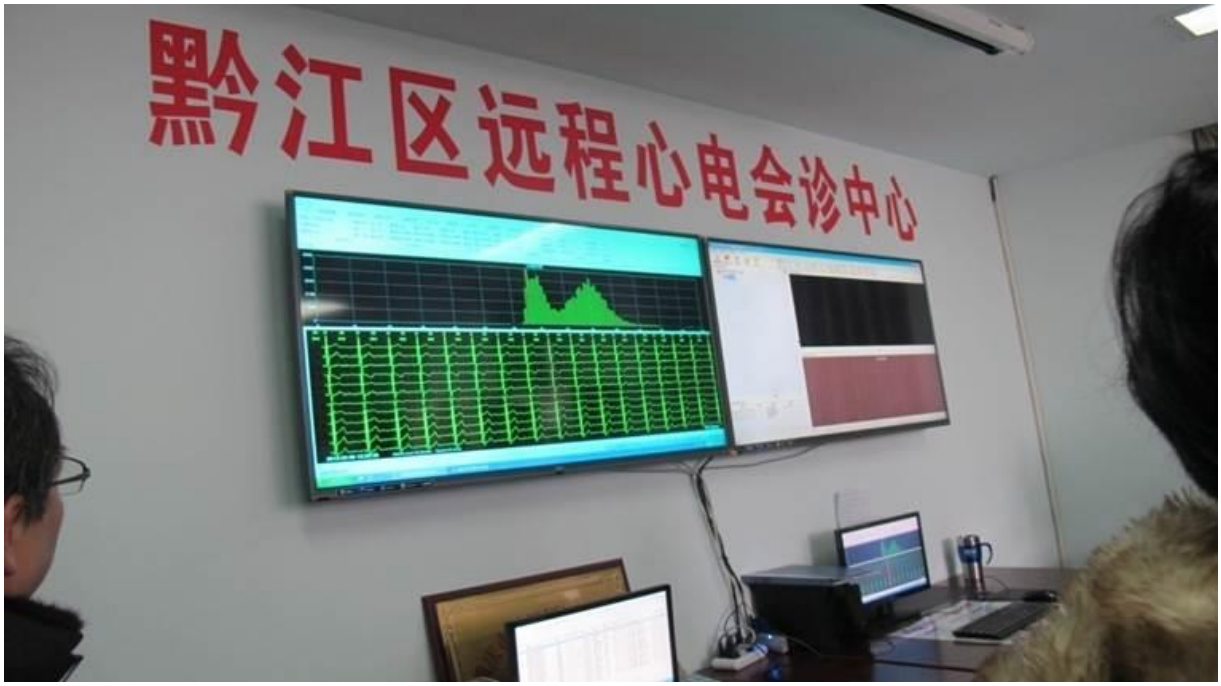
Professor Tony Rudd giving closing remarks at the project launch event



Stroke Prevention and management pathway in community health centre.

Poster in Qianjiang Central Hospital reporting on the clinical pathways and associated reforms introduced.

Information system at township health centre outside Qianjiang, linked to central hospital.



Telemedicine centre at Qianjiang Central Hospital, monitoring EEG results.

Director General Li Tao of CNHDRC presenting at HTAsiaLink 2014.

CNHDRC team at HTAsiaLink 2015.

Part 3: Results

Policy background

During the implementation of the China-UK collaboration project, "Strengthening evidence-based policy-making: Promoting universal access to basic healthcare services," China has also been experiencing a new round of health reform, of which policies and regulations vary city by city. Consequently, local implementation of any reforms has been affected by external policy changes (Table 11). These have included objectives to support equalization in basic public health services, enhancements to the national essential drug system, health insurance payment reform, national clinical pathway management pilot projects, and drug cost containment policies.

Table 11: Influential policies, projects, and regulations at a national level

Policy	*Name of instrument, circular etc*	*Abstract*
Equalization in basic public health services	<Opinion on promoting equalization of basic public health service>	To carry out the national project of equalization of basic public health services and major public health issues project, facilitate and provide basic public health services among rural and urban residents by creating and promoting: health records, health education, prevention and vaccination, prevention and treatment of infectious diseases, child care, maternal healthcare, elderly care, chronic disease management and severe mental illness management.
National essential drug system	<Management methods on National essential drug directory (provisional)>	To promote the supply and rational utilization of essential drugs in public hospitals.
	<National essential drug directory> (2012 published)	The new national essential drug directory took effect on May 1, 2013, which includes 317 chemical medicines and biological products, and 203 Chinese medicines.
Health insurance payment reform	<Guidance opinion to carry forward payment reform on New Rural Cooperative Medical Scheme>	Through the application of case payment, pay-by-beds, capitation payment, global budget, etc., NRCMS is turning to mixed payment scheme from fee-for-service. The core principle is the changing from post-payment to advance payment, to maximize efficacy of basic medical insurance and change compensation and motivation mechanisms in medical institutions.
	<Opinion to develop global budget on basic medical insurance>	To deepen payment reforms in health insurance, and explore the global budget integrating with the basic medical insurance budgeting management. To carry forward the capitation payment, case payment and other payment methods positively. Various areas can select feasible payment methods based on local settings to improve performance and

Policy	*Name of instrument, circular etc*	*Abstract*
		efficiency of medical funds.
National clinical pathway management pilot project	MOH notice on developing clinical pathway management	Clinical pathway pilot project were initiated since 2009. MOH launched 331 clinical pathways from 2009 to 2011 covering 22 clinical subjects. In initial stage, pilot projects began at 110 hospitals across 23 provinces. By the end of 2011, 3,467 medical institutions carried out clinical pathway management nationwide
Drug cost containment policy	<Guidance for hospital management evaluation (2008)>	Such guidance is the sound foundation in creating national hospital management evaluation indicator system, which is an important part of national medical quality protection and continuous improvement system. The guidance stipulates that the drug proportion in medical revenue of tertiary hospitals should be less than 45%.
	MOH regulations on controlling medical expenses	One of nine regulations is that stipulates drug proportion in medical revenue of secondary and tertiary hospital should be less than 45% and 40% respectively.

Implementation overview

With the healthcare reform nationwide, the China-UK cooperation project mobilized health providers to improve the quality of healthcare services, curb high health expenditures, decrease patients' financial burdens, and improve efficient allocation of health insurance funding. Based on the 3+1 pattern in the first phase and the two pilots' experiences with the two most severe diseases—stroke (which includes transient ischemic attack, cerebral hemorrhage, and cerebral infarction) and chronic obstructive pulmonary disease (COPD)—the China-UK cooperation project continued to explore integrated diagnosis and treatment pathway and disease management system on complex disease with complications, as well as an integrated prevention-treatment-recovery system.

Due to the lack of COPD and the prevention and treatment services on stroke in China, the achievement of early treatment for patients with an acute stroke and COPD as well as rehabilitation treatment during stable stages have relied on the cooperation of the Internal Department of Rehabilitation and the Clinic Department and the coordination of hospitals and health clinic centers.

The China-UK collaboration project aimed to mobilise health providers to improve the quality of healthcare services, curb high health expenditures, decrease patients' financial burdens, and improve efficient allocation of health insurance funding. This involved developing care pathways and where possible combining this with payment reform as

described in the methods section of this book. Because of city-level policies on health financing, Qianjiang and Wenxian districts applied fee-for-service arrangements instead of the bundled payment method that otherwise formed part of the CNHDRC-led clinical pathways project (Table 12).

Table 12: Implementation details for CNHDRC pilot project

	Hanbin	Huangdao	Qianjiang	Wenxian
Pathways began operating	Nov 2013	Jan 2014	Nov 2013	Dec 2013
Insurance types	NRCMS	NRCMS	Urban & rural residents basic medical insurance	NRCMS
Treatment pathway at acute phase (main pathway + complication pathway)	√	√	√	√
Medical insurance payment and payment standard	Single-disease fixed payment (CNY): COPD: 6,200 TIA: 3,200 Hemorrhage: 7,000 Infarction: 6,900	Single-disease fixed payment (CNY): COPD: 11,200 TIA: 6,700 Hemorrhage: 14,100 Infarction: 10,200	Fee for service	Global budget + Fee for service
Incentive system within hospitals	√	√	√	√
Pathway management information system	√	√	√	√
Integrated network	Pilot hospitals + 8 community health centers	Pilot hospitals + District CDC + 1 prevention center + 62 village clinics	Pilot hospitals + 6 urban centers + 24 township centers	Pilot hospitals + 2 township hospitals + village clinics
COPD vaccination	√	√	√	√
Community stroke screening				√
Standard management of COPD	√			
Standard management of stroke	√			
Rehabilitation clinical pathway	√	√	√	√

In November 2013, the project was formally launched in the pilot sites. The integrated treatment for COPD and stroke patients were implemented comprehensively, in that it aimed to include prevention, treatment and rehebilitation for patients.

Hospital payment systems

Fixed payment amounts with comorbidities are listed in Appendix E below (page 228). The case payment rates vary based on costs in each district of implementing the pathways, as described in Chapter 2 above; for example, Huangdao is a higher-income area than Hanbin.

Table 13: Case payment amounts for pilot conditions (excluding complications)

County	Payment rates (RMB)				
	COPD	TIA	Cerebral haemorrhage	Cerebral infarction	Approximate costs of complications
Hanbin	6,200	3,200	7,000	6,900	100 - 650
Huangdao	11,000	6,700	14,100	10,200	500 – 1,400
Qianjiang	n/a				
Wen	n/a				

Fixed payment amounts with comorbidities listed in Appendix E

Incentive payments introduced in Huangdao

Pilot sites were allowed flexibility to develop internal management tools supporting the clinical pathways, including incentive schemes. In Huangdao, Huangdao District People's Hospital established a clinical pathway reward and penalty system for key staff members in order to ensure successful implementation. This system had two components, to avoid perverse incentives which would be created by incentivising hospital staff only to enroll patients.

1. Rewards and penalties based on the monthly number of **completed clinical pathways**

Table 14: Reward and penalty system based on patients completing clinical pathways (Huangdao)

Number of completed clinical pathways (monthly)	Reward and Penalty Amount (RMB)		
	Director	Head nurse, deputy director, deputy head nurse	Case manager
60 or below	-300	-150	-200
60—69.9	-200	-100	-150
70—79.9	-100	-50	-100
80—84.9	200	100	200
85—89.9	300	200	300
90 or above	400	300	400

2. Rewards based on the monthly number of **patients initiated in clinical pathways**

Table 15: Reward system based on patients entering clinical pathways (Huangdao)

Number of patients initiated in clinical pathways (monthly)	Reward Amount (RMB)		
	Director	Head nurse, deputy director, deputy head nurse	Case manager
5-10	100	50	100
11-20	200	100	200
21 or more	300	200	300

Qualitative experiences of implementation

Itad independent external evaluation

At an early stage of the Phase Two collaboration between CNHDRC and NICE, the clinical pathways and payment reforms project was observed by consultants from Itad, an agency specialising in M&E and results measurement. This team was recruited by DFID to provide independent and external evaluation services for the bilateral collaboration project between NICE and CNHDRC. Although the remit of the report was to evaluate NICE's role in the project, the findings were also relevant and useful to CNHDRC.

Through analysis on pre-defined indicators and site investigations over China pilot sites, Itad reviewed the early changes seen as a result of the project. Consultants conducted key informant interviews with representatives of CNHDRC and other agencies in NHFPC and pilot hospital staff and managers.

On present evidence, CNHDRC, working with NICE, have packaged a handful of clinical pathways into a more comprehensive local reform and achieved buy in from county-level

stakeholders (health system managers, health insurance managers, hospital managers, medical staff). Overall, local reactions are very positive. Possibly the most important changes visible during the site visits (especially Qianjiang, which was a more successful visit than the Huangdao visit) are changes in the way in which healthcare management is being re-conceptualised. Clinical pathways function as a tool within this integrated reform package. Overall, this combination appears to be strong and to be viewed as very useful by county-level stakeholders [1].

The clearest expression of significance of the training carried out under the NICE/CNHDRC pilot is the way in which it has changed understandings in the pilot counties. At the management level, Huangdao People's Hospital described the training they had received as 'revolutionary', stating that it had changed the way they think about treatment. According to one senior interviewee, before this, clinicians based treatment on their own experience; now this is based on evidence. In Qianjiang, a considerable number of interviewees said that the CNHDRC/NICE project had changed ways of thinking, giving them new ways of understanding what they're doing. For some interviewees, notably at the management level of Qianjiang Central Hospital, and in Qianjiang Health Insurance Agency this was the most important contribution of the project.

In terms of effects on health outcomes, the main value that stakeholders perceive in the project concerns increasing efficiency, and reducing LOS, patient spending and drug use, rather than improving clinical practice or outcomes. Most interviewees state that implementation of clinical pathways has not substantially changed their clinical practice, but has improved the use of drugs, LOS, patient spending, and other similar indicators. Interviewees also report that implementation of clinical pathways is changing doctor-patient relations; clinical staff described implementation of clinical pathways as having increase communication with patients, and that this has increased transparency and patient adherence to treatment.

The Itad team also examined the influence of the project on evidence-informed priority-setting more broadly, in the districts and provinces the pilot has been operated (Box 10). Both Qingdao and Chongqing have issued policies promoting experience derived from the pilots, but it is not possible to say the extent to which this should be considered evidence-informed priority setting. Evidence from policy documents available at the time of writing, however, is insufficient to form a decision as to whether the policies will result in implementation of evidence-informed priority setting in counties where they are implemented. Qingdao government is positive on the usefulness of the Huangdao pilot and has given a green light to the pilot. The city government has put in place a pilot on clinical pathways based on experience in Huangdao.

Box 10: Influence of the CNHDRC-NICE collaboration on clinical pathways and related reforms

Policy influence	*Other forms of influence*
1. ***National policy influence**: As clearly stated by Liang Wannian, this pilot is providing a model for development of national policy and will be replicated in 1,000 counties and 100 cities nationwide. This is a very substantial achievement.*	1. *The impact of the project as a whole has been greater than the impact of the pilots: the project has had a large impact in **changing ideas and attitudes at central/policy levels**. This impact is probably greater, and of greater importance, than specific pilot experience. CNHDRC have been very good at leveraging this and getting central people involved in meetings, discussions of the pilots, and the like. They also have a direct policy channel to the centre.*
2. ***Sub-national policy influence:** The pilot is developing substantial policy traction, in both Chongqing/Qianjiang and Qingdao/Huangdao. This is a substantial achievement. Saying this, it will be important to see how other counties implement this model, and how technical support is managed to ensure that implementation is of evidence-based clinical pathways, and does not become codification of non-evidence based practices.*	2. *NICE are creating a **reputation for the UK in healthcare management**; the attention of policy-makers is now focussed on the UK and Canada, in that order. This is believed to be of greater importance than the pilots and shows an overall change in leadership thinking.*
	3. *CNHDRC, in particular the team under Zhao Kun, are getting **more attention domestically and are in great demand**. The knock on effect is that others who have been involved in CNHDRC clinical pathways work for some time, are getting asked to do the projects that CNHDRC does not directly take on.*

Patients covered by the integrated care pathways

Prevention activities

During the project, the four pilot sites conducted secondary prevention for COPD and stroke patients alongside the primary prevention within the national project, equalization of basic public health services. Main services offered by pilots included COPD patient vaccination, stroke screening, preventive drug acceptance for stroke patients and standardized management for COPD and stroke patients.

A. Pneumococcal vaccination

COPD is a preventable and treatable chronic respiratory disease. It is a severe chronic disease with massive medical costs, leading to loss of labor and reduction of the life quality of patients. Medical evidence shows that pneumococcal vaccine can help prevent COPD exacerbations [46-48].

In January 2014, the four pilot sites provided for free 23 strains polyvalent pneumococcal vaccine for COPD patients covered by local NRCMS. Inclusion criteria were

as follows: (1) above 60 years of age; (2) hospitalization during the past year due to COPD acute attack; (3) no contraindication and no pneumococcal vaccine in the past three years. Following implementation, CNHDRC undertook an analysis at 1-year of the impact of vaccination. Patients were clinically followed up once every 6 months.

Follow-up information included vaccinated outpatients' treatment and hospitalization following an exacerbation of COPD, their medical visits and costs. The status of COPD patients' vaccination and follow-up in the four areas are shown in Table 16.

Table 16: Pneumococcal vaccination and follow-up in four pilot areas

Area	Number vaccinated	Vaccination rate (%)	1st follow-up	2nd follow-up	Loss of follow-up rate (%)
Hanbin	258	80.63	258	251	0.78
Qianjiang	54	36.73	54	52	3.70
Huangdao	328	44.69	328	322	1.83
Wenxian	220	-	220	220	0.00

Vaccination was correlated with a reduction of the number of acute exacerbations of COPD and reduced resource use. In those patients experiencing exacerbations, length of stay was also found to be shorter, and patients' quality of life improved (as measured using the EQ-5D) (Table 17).

Table 17: Before and after comparison of 322 COPD patients with 23 pneumococcal vaccination in Huangdao

Indicators	Before vaccination (year 2013)	After vaccination (year 2014)	Difference
Outpatient number per capita	**0.51**±0.59	**0.35**±0.58	**-0.16**±0.82*
Hospitalization number per capita	**1.25**±0.54	**0.27**±0.52	**-0.97**±0.69*
Length of stay (day)	**9.43**±4.43	**8.05**±3.67	**-2.2**±5.60*
EQ-5D score**	**0.71**±0.16	**0.75**±0.14	**0.04**±0.18*

**p<0.05; ** using Japanese value sets*

B. Stroke screening

From 2014, Wenxian People's Hospital screened permanent residents over the age of 40 in the county with the help of the "Stroke at-risk population screening and intervention program". The main contents of the screening included preliminary assessment of stroke risk factors and rescreening of high-risk population. Specifically, the preliminary assessment of risk factors of stroke included physical examination, laboratory examination, and individual risk level classification, among others. Rescreening of high-risk population included laboratory examination and carotid ultrasound examination, etc. At the same time, based on

the results of the screening, the intervention was individualized to the different levels of high-risk groups. The individualized interventions included transferring patients of brain neck vascular lesions, suspected stroke and TIA to the local county hospital; guiding patients with medication; and other behavioural intervention for high-risk individuals. The project screened 3,000 people by October 2015, finding 448 high-risk people who continued with the intervention and follow-up visits.

C. Preventative drug usage

In order to improve the management and control of blood pressure/blood glucose in patients with hypertension and diabetes mellitus, Huangdao district provided 6 basic drugs (Compound reserpine tablets, Capoten Tablets, Nitrendipine, Metformin, Glipizide and Aspirin Enteric-coated Tablets) for free to patients, based on an earlier work of a comprehensive hypertension and diabetes prevention and control project. The township health centres purchased all 6 kinds of basic drugs and delivered them to village health clinics based on the number of hypertension and diabetes patients in the area. Then the rural doctors accordingly provided them to patients free of charge. By May 2015, a total of 51,000 patients with hypertension and 16,000 diabetes patients received the 6 kinds of basic drug treatment. The provision of the 6 basic drugs reached a value of more than 565,000 CNY.

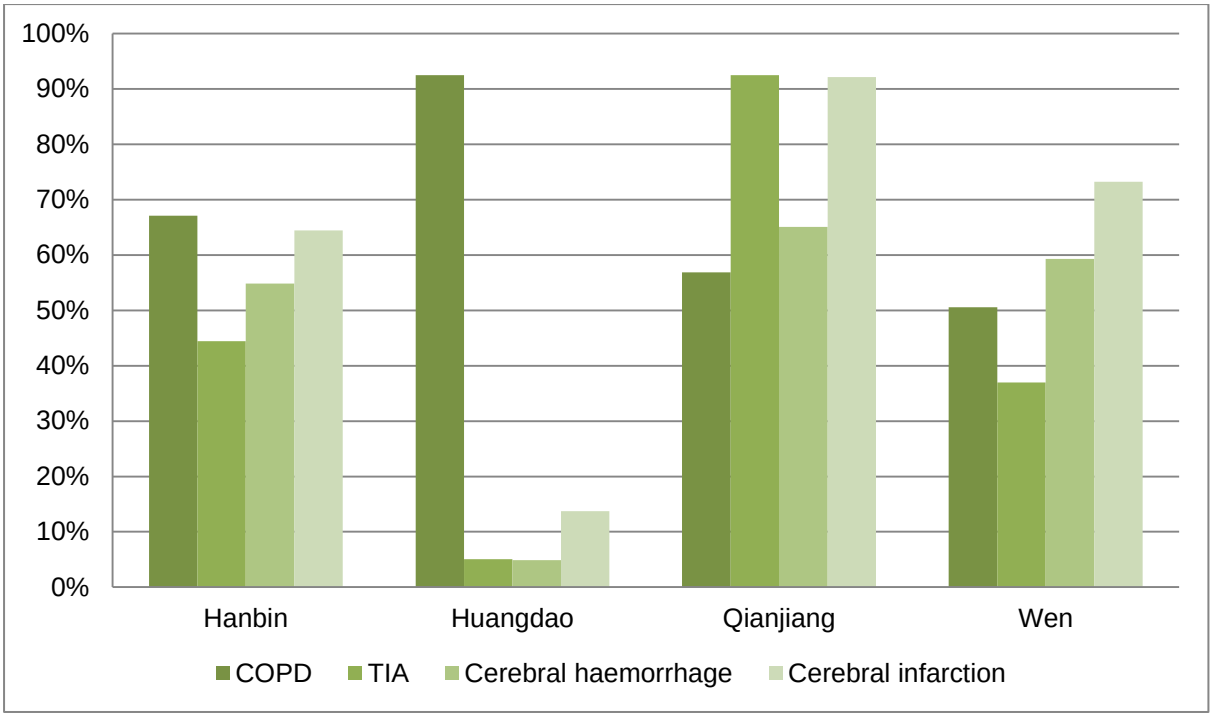
D. Standardized management of COPD and stroke patients

The COPD and stroke patients' "Standardized management project" was implemented in Hanbin, where they utilized community health education and behavioural interventions for COPD and stroke patients in support of a standardized management approach in the community. Health education included knowledge of disease risk factors and interventions. Behavioural interventions focused on smoking cessation, healthy diets, physical activity, weight control, limiting alcohol intake and mental factors. By June 2015, Hanbin district conducted standard management of 16,895 COPD patients and 7,216 stroke patients.

Enrolment of inpatients in clinical pathways

By mid- 2015, after an initial implementation period of approximately one year to eighteen months by site, a total of 6,027 patients had been enrolled in the four clinical pathways (Table 18). This represents 59% of the 10,159 inpatients eligible to join the pathway. In the same period, 5,490 patients completed care under the Phase II clinical pathways: 91% of those who had entered, and 54% of all eligible patients. A target was set for completion of the pathways, of 65% of all eligible patients.

Figure 9: Patients completing clinical pathways (as percentage of all eligible inpatients)



In cases where the target was missed (Figure 9), this was typically due to low enrolment in the pathways, rather than high rates of default (leaving the pathway). Of the patients entered onto the pathways, approximately 90% completed them.

These figures varied to some extent according to prevailing practices in each health facility. For example, in the hospital in Huangdao which was a focal point of the project, there was a very small pool of TIA patients treated as inpatients and therefore available to be managed using the clinical pathways.

By May 2015, 860 COPD patients accepted pneumococcal vaccination in the four pilots; 5,490 patients were full managed by the clinical pathway (Table 19). The management rate of patients covered by the clinical pathway was 54.05%; the early rehabilitation rate of stroke patients at acute stage was above 90%. Among the four pilots, the highest referral rate of COPD and stroke patients at stable stage to primary healthcare institutions was 41.54%.

Among patients who finished the clinical pathway, there were 1,246 COPD patients at the acute stage with a management rate of 60.57%. There were 4,244 stroke patients at the acute stage with a management rate of 52.39%.

Table 18: Patients enrolled in CNHDRC clinical pathways

County	Number of patients enrolled in clinical pathways (as percentage of all eligible inpatients, in brackets)				
	COPD	TIA	Cerebral haemorrhage	Cerebral infarction	Total: all pathways
Hanbin[1]	308 (74%)	4 (44%)	44 (71%)	285 (73%)	**641** (73%)
Huangdao[2]	206 (97%)	55 (7%)	21 (7%)	207 (16%)	**489** (19%)
Qianjiang[3]	536 (70%)	750 (98%)	149 (73%)	299 (98%)	**1,734** (85%)
Wen[4]	353 (54%)	305 (42%)	217 (64%)	2,288 (79%)	**3,163** (68%)
Total: all sites	**1,403 (68%)**	**1,114 (50%)**	**431 (47%)**	**3,079 (62%)**	**6,027 (59%)**

[1] Jun 2014-May 2015; [2] Jun 2014-Feb 2015; [3] Nov 2013-Feb 2015; [4] Nov 2013-Jun 2015

Table 19: Patients completing clinical pathways

County	Number of patients completing clinical pathways (as percentage of those entering pathways, in brackets)				
	COPD	TIA	Cerebral haemorrhage	Cerebral infarction	Total: all pathways
Hanbin[1]	281 (91%)	4 (100%)	34 (77%)	252 (88%)	**571** (89%)
Huangdao[2]	196 (95%)	38 (69%)	15 (71%)	183 (88%)	**432** (88%)
Qianjiang[3]	437 (82%)	709 (95%)	134 (90%)	281 (94%)	**1,561** (90%)
Wen[4]	332 (94%)	267 (88%)	201 (93%)	2,126 (93%)	**2,926** (93%)
Total: all sites	**1,246 (89%)**	**1,018 (91%)**	**384 (89%)**	**2,842 (92%)**	**5,490 (91%)**

[1] Jun 2014-May 2015; [2] Jun 2014-Feb 2015; [3] Nov 2013-Feb 2015; [4] Nov 2013-Jun 2015

Data for each of the four pilot sites is shown below; time trends for the number and proportion of hospital inpatients included in the clinical pathways are included in Appendix J. Comparing the four pilot hospitals, Wenxian People's hospital had the most number of patients of clinical pathway diseases (4,622), two times more than the number of Qianjiang Central Hospital or Huangdao People's Hospital, and five times more than that of Hanbin First Hospital. For clinical pathway management, Wenxian and Qianjiang pilot hospitals which did not yet implement the single-disease fixed payment package, had more number of

patients in the clinical pathway, accounting for 53.30% and 28.43% respectively from the total number of patients that completed the pathway management. In contrast, Huangdao People's Hospital, though it implemented a single disease fixed payment package and the pilot disease inpatients accounted for a fourth of the total inpatients of all pilot sites, the number of patients that completed the clinical pathway was less than 10% (Table 19).

Discussion

There are two main plausible reasons for the described occurrence. First, the competitive environment facing the pilot hospitals is an influential factor. Serving as medical centers without competitive hospitals nearby, Wenxian People's Hospital and Qianjiang District Central Hospital have been receiving more patients than the other two. In areas with rich medical resources and intense competition, Huangdao District People's Hospital and Hanbin First Hospital have limited market share. Particularly, acute stroke patients are usually sent directly to local tertiary institutions, whereas Huangdao District People's Hospital and Hanbin First Hospital are more likely to receive stable patients. However, in this case, the target group for the clinical pathway is acute patients, leading to a low recruit rate and management rate (Table 18, Figure 9).

Secondly, payment method is also a related factor. Case payment is a double-edged sword for clinical pathway management. On one hand, appropriately priced case payment can be an incentive for clinician to implement clinical pathway management and ensure the quality of health care, where costs can be reduced with the surplus given to clinicians. On the other hand, surplus value set by health insurance is within certain limits. Although hospitals may get a higher price for each case during the negotiation with the health insurance sector, if the hospitalization expense is below the minimum expense set by the health insurance, it will reimburse the case by services instead of a case payment. As a result, this will reduce the interest and enthusiasm of the hospitals and clinicians. The case payment prices for the four conditions in Huangdao district were set much higher than the actual expense, at a price that was 3,500 to 7,000 CNY higher than the price of Hanbin. Also, the price in Huangdao for COPD and stroke were two to three times the price in Hanbin.

Such price limits seriously deviating from the actual expense not only stifled the enthusiasm of clinicians, but also hindered the implementation of clinical path management. Meanwhile, under the siphon effect of local tertiary care facilities on acute stroke patients, the clinical pathway management rate of the three stroke conditions in Huangdao District People's Hospital were very low.

Characteristics of inpatients in and out of pathway

Compared with before the pilot implementation, characteristics of inpatients had no significant difference after the pilot implementation where only the proportion of patients with the New Rural Cooperative Medical Scheme (NRCMS) increased by about 5% during pilot implementation (Table 20, Table 21). This was obvious in the two pilot areas that combined pathway implementation with payment reform – Huangdao and Hanbin. Patients were no longer in a passive position, but had more decision power. At the same time, as part of the local government livelihood improvement projects, the implementation of the project improved healthcare quality and security, ensuring that medical costs would not increase patients' economic burden.

In terms of gender composition, there were more males among COPD and cerebral infarction inpatients, which might be related to differences in risk factor exposure. With respect to patient age, the majority of patients were over age 50, accounting for more than 95% in COPD and cerebral infarction patients respectively. Indeed, elderly populations with multiple comorbidities accounted for the majority of inpatients covered by the Phase II pathways. A 'single disease' clinical pathway would not address this issue adequately, underscoring the approach taken in the Phase II project – developing a main disease clinical pathway combined comorbidity sub-pathways.

Table 20: COPD inpatient characteristics

	Before pilot (n=744)	After pilot		
		Total (n=1,390)	Clinical pathway (n=918)	Non-pathway (n=472)
Gender (%)				
Male	52.97	57.73*	57.28*	58.61*
Female	47.03	42.27	42.72	41.39
Age (%)				
30-50	3.01	5.52	6.41	3.81
51-70	40.04	45.25	46.54	42.59
71 and above	56.95	49.24*	47.05*	53.59
Insurance type (%)				
NRCMS	73.39	78.22	81.05*	72.86
Urban Employee	14.68	17.55	15.80	20.88
Others	11.93	4.23	3.15	6.26

**Compared to before pilot, P<0.05*

Table 21: Stroke inpatient characteristics

	Before pilot (n=964)	After pilot implementation		
		Total (n=4222)	Pathway (n=2652)	Non-pathway (n=1564)
Gender (%)				
Male	53.57	61.11*	66.41*	59.53*
Female	46.43	38.89	33.59	40.47
Age (%)				
30-50	5.32	4.86	6.24	1.73
51-70	31.19	43.78*	46.58*	47.95*
71 and above	63.45	51.37	47.18	50.31
Insurance type (%)				
NRCMs	77.68	80.83*	78.25	78.22
Urban employee	13.98	12.90	15.86	12.81
Others	15.57	10.26	8.86	15.09

**Compared to before pilot, P<0.05*

Hanbin First Hospital

The four clinical pathway diseases of COPD, cerebral infarction, cerebral hemorrhage, and transient ischemic attack (TIA) had different implementation progress. COPD and cerebral infarction achieved high coverage and completion rate. Both achieved entrance rates of over 70% and completion rates of around 90%. Cerebral hemorrhage had relatively lower completion rate, but the overall implementation was close to the planned target. TIA had too

few patients to conduct a detail analysis. A total of 571 patients completed the clinical pathway, accounting for 89.1% of patients that have entered the clinical pathway and 64.8% of admitted patients.

Table 22: Number of patients entering and completing clinical pathways (Hanbin)

Time covered: Jun 2014-May 2015

Disease	***A:*** *Total # inpatients*	***B:*** *# of patients entering clinical pathway*	***C:*** *# patients completing clinical pathway*	*Entrance rate (%)* ***(B/A)***	*Completion rate (%)* ***(C/B)***
COPD	419	308	281	73.5	91.2
Stroke:					
TIA	9	4	4	44.4	100.0
Cerebral haemorrhage	62	44	34	71.0	77.3
Cerebral infarction	391	285	252	72.9	88.4
Total	**881**	**641**	**571**	**73%**	**89%**

Huangdao District People's Hospital

From June 2014 to Feb 2015, a total of 2,608 inpatients were admitted to departments covering the four clinical pathway diseases, from which 489 patients entered clinical pathway management system. The total entrance rate was 18.8%, with a strikingly higher proportion of COPD patients managed under the pathway. Of patients entering the pathways, the overall completion rate was 88.3% (Table 23). Mortality rate was zero for all four diseases. Average hospital-acquired infection rate was below 2%. Most patient satisfaction rates were higher than 90%.

Table 23: Number of patients entering and completing clinical pathways (Huangdao)

Time covered: Jun 2014-Feb 2015

Disease	***A:*** *Total # inpatients*	***B:*** *# of patients entering CP*	***C:*** *# patients completing CP*	*Entrance rate (%)* ***(B/A)***	*Completion rate (%)* ***(C/B)***
COPD	212	206	196	97.2	95.1
Stroke:					
TIA	752	55	38	7.3	69.1
Cerebral haemorrhage	309	21	15	6.8	71.4
Cerebral infarction	1,335	207	183	15.5	88.4
Total	**2,608**	**489**	**432**	**19%**	**88%**

Qianjiang Central Hospital

Table 24: Number of patients entering and completing clinical pathways (Qianjiang)

Time covered: Nov 2013-May 2015

Disease	*A: Total # inpatients*	*B: # of patients entering CP*	*C: # patients completing CP*	*Entrance rate (%) (B/A)*	*Completion rate (%) (C/B)*
COPD	769	536	437	69.7	81.6
Stroke:					
TIA	767	750	709	97.8	94.6
Cerebral haemorrhage	206	149	134	72.5	89.7
Cerebral infarction	305	299	281	98.2	93.9
Total	**2,047**	**1,734**	**1,561**	**85%**	**90%**

Wenxian People's Hospital

Table 25: Number of patients entering and completing clinical pathways (Wen)

Time covered: Dec 2013-Jun 2015

Disease	***A:*** *Total # inpatients*	***B:*** *# of patients entering CP*	***C:*** *# patients completing CP*	*Entrance rate (%)* ***(B/A)***	*Completion rate (%)* ***(C/B)***
COPD	657	353	332	53.7%	94.1%
Stroke:					
TIA	722	305	267	42.2%	87.5%
Cerebral haemorrhage	339	217	201	64.0%	92.6%
Cerebral infarction	2,904	2,288	2,126	78.8%	92.9%
Total	**4,622**	**3,163**	**2,926**	**69%**	**93%**

Rehabilitation

Stroke is not only the top ranking in cause of death, but is also associated with high morbidity. Early intervention treatments and rehabilitation interventions have positive impacts on the prognosis of patients with stroke, and support quicker recovery. The inpatient stroke treatment pathway, established by the Phase II China-UK Cooperation Program, is the central component of a broader integrated diagnosis and treatment pathway.

The overall pathway emphasises a close collaboration between neurology departments and rehabilitation therapists, and recommend early out-of-bed activities, swallowing dysfunction assessments, and physiotherapy. However, the relatively under-developed state of rehabilitation therapy in China leads to payment on rehabilitation services varying city by city.

Some services recommended by China-UK Cooperation Program, are excluded by the Chinese current reimbursement system. Fortunately, swallowing dysfunction assessment examinations are within it (Table 26).

Table 26: Stroke rehabilitation services recommended in pathway and their inclusion in each pilot site's medical fees catalogue

Item	Suggestion	Hanbin	Qianjiang	Huangdao	Wenxian
Freehand balance function tests	Mandatory	√	√	√	√
Evaluation of daily activities	Mandatory	√	√	√	√
Assessment of swallowing dysfunction	Mandatory	√	√	√	√
Muscular strength check	Mandatory				√
Measurement of muscle tension	Mandatory				
Examination range of motion	Mandatory				
Hemiplegia whole body movement function evaluation (simplified Fugl-Meyer Motor Function Scale)	Mandatory				
Verbal ability assessment	Optional	√	√	√	√
Hand function training	Mandatory	√	√	√	√
Comprehensive training hemiplegic limb	Mandatory	√	√	√	√
Weight loss support system training	Optional	√	√	√	√
Electric stand up bed training	Optional	√	√	√	
Balance training	Optional	√	√	√	√
Occupational therapy	Optional		√	√	√
Speech training	Optional		√	√	√
Dysarthria training	Optional		√	√	√
Swallowing dysfunction training	Optional		√	√	√
Low-frequency pulse therapy	Optional	√	√	√	√
Medium frequency Pulse electrodeposition therapy	Optional	√	√	√	√

Note: "√" means "Yes"

Capacity building for rehabilitation services

Rehabilitation in China is still developing. A comprehensive rehabilitation system has not yet been created. With the project's support, capacity building in the area the rehabilitation was undertaken at each pilot site. With the help of CNHDRC, all pilot hospitals followed the advice from NICE International experts, and undertook training courses from central rehabilitation experts. The pilot hospitals also sent their physicians to Xuanwu hospital – the best rehabilitation hospital in China – to receive further peer-to-peer training.

The four pilot sites have now established locally developed integrated rehabilitation networks. Each pilot hospital has also set up independent rehabilitation departments. In order to help the clinical pathway patients undertake early rehabilitation, physicians in rehabilitation department attended the consultation within the neurology department every afternoon, and they did their own work every morning. In addition, physicians in the neurology department who had been previously trained could also conduct swallowing assessment independently. The proportion of patients in the pilot sites who received early rehabilitation for stroke was above 90%. Moreover the proportion of patients who underwent swallowing assessment was above 95%.

Improvements in risk assessment

As part of implementation of the Phase II project, the proportion of stroke patients who were risked assessed using NIHSS had increased from 0% to nearly 100%.

Stable stage stroke rehabilitation

After the implementation of the project, the pilot hospitals established a cooperation network with local township healthcare centres. They transferred their patients to the local healthcare centers to conduct the rehabilitation during the stable stage.

From June 2014 to May 2015, Hanbin First Hospital transferred 366 patients to the lower healthcare centres which accounted for 41.54% of hospitalized patients. The average monthly proportion of patients who had been transferred to lower healthcare centres was above 30%, with the highest percentage up to 80%.

As of May 31, 2015, 174 COPD patients and 524 stroke patients have been part of the downward referral system in Qianjiang Central Hospital. Among stroke patients, there were 348 TIA patients, 22 cerebral haemorrhage patients, and 154 cerebral infarction patients.

Observed changes in prescribing behaviour after pathway implementation: addressing over- and under-treatment

Over-treatment and under-treatment are common phenomena in China's healthcare system. The causes of such practice not only relates to the absence of appropriately developed clinical guidelines, but also because of institutional issues, such as inadequacies in quality monitoring systems, medical insurance reimbursement policies and general compensation mechanisms. The root problem of this present situation is closely related to the long-standing perversities in the payment system.

The implementation of a single disease package payment reform can to a certain extent compensate for – or at least lessen the impact – of some of the drawbacks in the current payment system, which tends to underemphasize quality. On this basis, the complementary addition of clinical pathway management information systems can provide more reliable and timely information for clinicians. It can further help support clinical decision-making, medical service behaviour standardization and medical service quality improvement. However, it should be recognized that effective standardization of medical services requires a joint effort from the government, the medical insurance department, medical institutions, medical staff and patients in the midst of a complicated patient-doctor relationship. It cannot be achieved overnight.

Recommendations for clinical pathway management of COPD and stroke

Before the project, there was both excessive and inadequate treatment of COPD and acute stroke in the four pilot hospitals. For example, some practices that have been proved to be effective, such as swallowing function assessment, early ambulation and early rehabilitation for acute stroke, were rarely carried out in pilot hospitals. Additionally, some interventions for acute stroke that have been shown to be ineffective were nevertheless routinely carried out, such as the administration of 'nerve cell nutrients', electrical stimulation, steroids or mannitol treatment for cerebral oedema, brain surgery (unless suffering from cancer), stent treatment of intracranial arterial stenosis, and stent treatment of carotid artery stenosis. Some interventions which lacked clear evidence of their effectiveness in stroke management were

still widely practiced, such as intra-arterial therapy (thrombosis peel and arterial thrombosis interventional thrombolytic therapy), new thrombolytic agent, and cooling therapy.

In contrast to the previously established practice, the core recommendations of the Phase II project were as follows: for patients hospitalized for acute exacerbation of COPD, promote pulmonary function testing following confirmed COPD diagnosis, regulate the use of antibiotics, and advocate early rehabilitation and secondary prevention measures at the community level; for acute stroke patients (including TIA, cerebral haemorrhage and cerebral infarction), increase the use of aspirin and statin, reduce or avoid the use of interventions that are ineffective or ambiguous in terms of the likely clinical benefit, and advocate swallowing assessment and early ambulation. In order to strengthen the supervision of clinical practice, pulmonary function tests and non-invasive ventilation were fixed as mandatory practice in the pathway management information system.

Optional practice were divided into two categories: one was conditionally recommended, specific to patients with certain conditions; the other was not recommend by major international guidelines but still allowed as 'optional' as result of local medical insurance reimbursement policy and other pragmatic issues relating to long-standing patient preference and maintaining a goog doctor-patient relationship. Physicians were also explicitly notified during training of such optional practices that were not recommended (such as use of neurotrophic drugs, etc).

Changes in clinical behavior

The billing data analysis of the four diseases across the pilot areas revealed that, after a year since the implementation of the project, the intervention has overall strengthened the utilization and quality of services recommended by the clinical pathway. Among the services adopted by the pathway, services with the most significant increase in utilization were statins medicine anti-platelet medicine and brain imaging (within 24 hours of hospitalization) for stroke treatment. Utilization of TIA treatment services is an outstanding example of this change. However, there was no statistically significant change in oxygen and dehydrant usages which were not recommended by the clinical pathway, and the utilization of nerve nutrition agents actually increased slightly. (Table 27)

Table 27: Changes in utilisation rates on selected services before and after pilot (%)

Condition	Subject	Qianjiang		Hanbin		Huangdao		Wenxian	
		Before	After	Before	After	Before	After	Before	After
COPD	Lung function test*	16.94	13.33	13.33	-	36.43	13.41	7.95	26.74#
	Expectorant*	94.35	94.00	94.00	-	35.71	25.00#	89.77	95.97#
TIA	Anti-platelet medicine*	19.28	25.12#	25.12#	-	-	-	20.00	76.52#
	Statins medicine*	25.30	34.48#	34.48#	-	-	-	58.00	73.48#
	Nerve nutrition agent**	43.37	44.83	44.83	-	-	-	55.33	73.86

Condition	Subject	Qianjiang		Hanbin		Huangdao		Wenxian	
Cerebral hemorrhage	Brain imaging*	10.77	10.45	10.45	73.44	-	-	70.97	84.33#
	Oxygen**	89.23	87.06	87.06	-	-	-	93.55	90.10
	Dehydrant**	90.77	83.58#	83.58#	86.72	-	-	85.48	80.73
Cerebral Infarction	Brain image *	87.88	92.49	92.49	75.37	58.93	87.00#	66.94	64.81
	Anti-platelet medicine*	84.85	90.17#	90.17#	-	7.74	76.53#	27.33	68.79
	Statins medicine*	84.85	89.02#	89.02#	56.72	24.4	87.73#	64.00	61.41
	Nerve nutrition agent**	45.45	57.23#	57.23#	58.21	20.83	64.98#	43.55	70.97
	Oxygen**	57.58	60.12	60.12	39.55			9.33	15.77

**Effective service **Ineffective service*

#Compared to before pilot, P<0.05

Observed changes in medical expenditures

In addition to standardizing clinical behaviour and ensure service quality, the main aim of clinical pathway management is to improve efficiency of fund usage by controlling unreasonable increase in medical expenses. Through analysis of medical records, excessive growth of medical expenses in the four pilot diseases was effectively controlled and out of pocket (OOP) proportions also decreased. Thus, the goal to control growth of medical expenses and lower OOP costs were achieved.

Hospitalization cost per visit

Compared to before the pilot, COPD patients of Huangdao and Wenxian and cerebral infarction patients of Hanbin had significant increases in the hospitalization costs. There were no statistically significant change in other diseases and other regions.

Analysis by disease revealed that hospitalization costs per visit for COPD patients in Qianjiang did not significantly change, but they increased significantly in Huangdao and Wenxian (Table 28). There were too few patients with COPD in Hanbin to be included in the analysis. Huangdao's COPD hospitalization cost per visit had the largest increase of 2,500 CNY, compared to before the pilot. This might be because Huangdao's single disease fixed payment amount was set too high, leading to extra service provision in the clinical pathway package to reach the minimum payment amount to receive reimbursement from insurance. Huangdao's COPD situation showed that inappropriate fixed payment mechanisms could have a negative influence in the implementation of clinical pathway management. The overall hospitalization cost per visit of stroke did not change significantly, and excessive growth of costs was controlled effectively. Hospitalization costs per visit of TIA and cerebral hemorrhage also had no significant change in the four pilot areas. Cerebral infarction hospitalization expense per visit in Hanbin increased around 1,000 CNY after the pilot

implementation, whereas the other three pilot areas showed no statistically significant change.

Generally Wenxian had relatively low hospitalization costs per visit and Huangdao the highest, with almost twice the expense of other districts. Cerebral haemorrhage hospitalization costs were maintained at 5,000 CNY in Hanbin before and after the pilot implementation, which was around half that of the other three districts. Cerebral infarction hospitalization costs in Hanbin increased after the pilot implementation, higher than Wenxian but lower than in Qianjiang and Huangdao. Qianjiang's COPD and TIA costs were at a middle range among the four districts, but cerebral hemorrhage and cerebral infarction costs were the highest. In particular, the hospitalization costs of cerebral infarction were two times greater than in Hanbin and three times higher than that of Wenxian. Hospitalization costs of cerebral infarction in Wenxian was maintained around 3,700 CNY, lowest among the four pilot districts. Despite the lower costs, clinical practice in Wenxian was consistent with other districts.

Table 28: Inpatients' total hospital expenditure before and after pilot by disease

Disease categories	Hanbin		Qianjiang		Huangdao		Wenxian	
	Before pilot	After pilot	Before pilot	After pilot	Before pilot	After pilot	Before plot	After pilot
COPD	-	-	5,629	6,071	6,678	9,165*	3,673	4,508*
TIA	-	-	3,408	4,129	6,280	5,247	2,989	2,887
Cerebral hemorrhage	5,037	5,055	11,644	11,720	10,766	10,485	9,558	10,014
Cerebral Infarction	4,327	5,474*	9,095	10,523	6,120	7,215	3,763	3,690

*Compared to before pilot, P<0.05

Composition of hospitalisation expenditure

To further support standardised practice, the pilot project aimed to encourage the use of effective tests and drugs during treatment. This was also influenced and driven by the national drug control policy. Analysis of the pilot diseases' hospitalization costs per visit in Hanbin, Huangdao and Wenxian revealed that generally the drug costs as a proportion of total costs decreased, while the proportion of costs because of testing increased after the pilot implementation. Drug costs as a proportion of overall costs in Huangdao and Wenxian decreased by 3.8% and 2.1% respectively. Testing costs as a proportion of overall costs in Hanbin and Wenxian increased by 6% and 2% respectively (Table 29).

Table 29: Average cost breakdowns of total hospitalisation costs for the four pilot conditions before and after pilot

Categories	Hanbin		Huangdao		Wenxian	
	Before pilot	After pilot	Before pilot	After pilot	Before pilot	After pilot
Drug cost proportions	50.01	49.08	51.80	47.98*	48.22	46.10*
Lab test cost proportions	23.99	29.94*	23.95	22.91	25.72	27.86*

*Compared to before pilot, P<0.05

In Qianjiang (Table 30), implementation of the Phase II pathways in COPD, TIA and cerebral haemorrhage led to no statistically significant change in hospitalization cost compositions, whereas the proportion of drug costs in the management of cerebral infarction increased by almost 10%. This might be due to the increased use of statins and antiplatelet drugs after the pilot implementation.

Table 30: Average cost breakdown of total hospitalisation costs before and after pilot in Qianjiang

Disease	Cost categories	Before pilot	After pilot		
			All patients	Pathway patients	Non-pathway patients
COPD	Lab tests	28.31	31.10	30.04	33.21
	Drugs	44.83	45.83	48.10	43.30
TIA	Lab tests	36.68	40.80	40.49	44.24
	Drugs	47.75	45.21	45.55	41.40
Cerebral hemorrhage	Lab tests	20.65	26.52	26.19	27.01
	Drugs	40.53	39.95	38.99	41.42
Cerebral infarction	Lab tests	22.74	25.38	25.12	28.60
	Drugs	38.27	47.81*	48.01	45.31

Compared to before pilot, P<0.05

Patient out of pocket (OOP) costs

Results of interrupted time series analysis at each pilot site are available in Appendix J and are summarised below (Table 31).

Table 31: Out of pocket payments as proportion of total cost of hospitalisation: results of interrupted time series analysis

Site		Coefficient	Standard error	t-value	P-value
Hanbin					
	β_0: *Intercept*	**30.70**	2.18	14.07	0.000
	β_1: *Baseline trend*	**-0.17**	0.17	-1.00	0.322
	β₂: Change** in level **post-intervention	**13.45**	7.07	1.90	0.065
	β₃: Change in trend post-intervention	**-0.33**	0.27	-1.23	0.226
Huangdao			**Standard deviation**		
	β_0: *Intercept*	0.86	0.04	21.36	0.000
	β_1: *Baseline trend*	-0.59	0.22	-2.75	0.009 **
	β₂: Change** in level **post-intervention	-0.03	0.00	-9.17	0.000 ***
	β₃: Change in trend post-intervention	0.03	0.01	3.70	0.001 **
Qianjiang: no ITS data available					
Wen					
	β_0: *Intercept*	0.52	0.02	24.02	0.00
	β_1: *Baseline trend*	0.00	0.00	-1.28	0.21
	β₂: Change** in level **post-intervention	0.01	0.04	0.28	0.78
	β₃: Change in trend post-intervention	0.00	0.00	0.28	0.78

*Note: *** P < 0.001, ** P < 0.01, * P < 0.05*

Analysis of OOP expenditure in Hanbin, Huangdao and Wenxian revealed that changes in OOP proportions before and after the pilot implementation in Huangdao and Wenxian were statistically significant (Table 32).

Table 32: OOP payments as % total hospitalisation costs for pilot conditions, before and after pilot

	Before pilot	After pilot
Hanbin	28.8	28.5
Huangdao	51.05	29.14*
Wenxian	46.89	46.72*

*Compared to before pilot, P<0.05

ITS of the four diseases in Qianjiang showed that the OOP proportion for TIA decreased by 2% after the pilot implementation, but other diseases had no significant change (Table 33).

Table 33: OOP payments as % total cost of hospitalisation, by disease in Qianjiang

Disease	Before pilot	After pilot		
		Total patients	Pathway patients	Non-pathway patients
COPD	41.62%±24.01%	40.36%±20.52%	39.49%±19.26%	41.50%±22.04%
TIA	49.12%±19.18%	47.33%±21.54%*	47.13%±21.36%	40.53%±11.13%
Cerebral haemorrhage	47.81%±22.24%	45.81%±17.35%	44.21%±17.61%	35.66%±14.03%
Cerebral infarction	50.21%±19.18%	46.3%±18.1%	46.41%±18.51%	45.04%±16.28%

*Compared to before pilot, P<0.05

Observed changes in length of stay

The integrated clinical pathway diagnostic and treatment checklist defined standard hospitalization days for each disease, although these varied slightly at each site based on the local situation (Table 34). In general, the implementation of pilot project led to reductions in length of stay.

Table 34: Standard (recommended) length of stay in the four pilot sites, days

	Hanbin	Qianjiang	Huangdao	Wenxian
COPD	7~12	10~21	7~21	10~21
TIA	5~10	9~14	5~10	5~10
Cerebral hemorrhage	15~25	14~21	8~18	7~20
Cerebral infarction	15~25	8~14	8~12	10~15

The greatest reductions in length of stay were seen in Qianjiang District Central Hospital (Table 35). The length of stay of TIA patients in Wenxian People's Hospital decreased significantly, whereas in other diseases there was no statistically significant change. Length of stay of all diseases in Huangdao and Hanbin did not statistically significantly change after the pilot implementation.

Compared to the standard hospitalization days determined by the project, the actual average hospitalization days were lower in general. The following hospitalization days were all lower than the standard minimum days: cerebral hemorrhage and cerebral infarction in Hanbin; COPD and TIA in Qianjiang; and COPD in Wenxian. Setting a minimum benchmark on hospitalization days in the early implementation stage helped to make reasonable adjustments to the clinical pathway standards, while ensuring medical quality.

Table 35: Average length of stay before and after pilot, days

Disease	Hanbin		Qianjiang		Huangdao		Wenxian	
	Before pilot	After pilot	Before pilot	After pilot	Before pilot	After pilot	Before pilot	After pilot
COPD	-	-	10.37	8.51*	6.85	7.26	8.85	9.23
TIA	-	-	5.15	5.11	7.57	7.09	9.02	8.31*
Cerebral hemorrhage	14.72	15.17	16.84	13.82*	14.67	13.86	22.76	20.5
Cerebral infarction	12.81	12.85	12.46	11.97*	8.83	9.32	11.61	11.12

*Compared to before pilot, P<0.05

Observed changes in health-related quality of life

The research team conducted an analysis of completed EQ-5D questionnaires that had been administered to 1,045 patients in order explore the quality of life impact of the project intervention. These patients were COPD, cerebral hemorrhage and cerebral infarction patients from the Qianjiang pilot hospital as well as cerebral hemorrhage and cerebral infarction patients in the Hanbin pilot hospital. The CNHDRC project team applied regression techniques to analyse the impact of the pathways on health-related quality of life as measured by the EQ-5D tool. The regression model used is outlined as follows:

$$Q = a+b_1*Time+b_2*Group+b_3*Time*Group+e$$

Where Q = the quality of life score (index value); Time = pre-intervention or post-intervention (dummy variable); Group = survey at admittance or discharge (dummy variable); Time*Group (or T*G) = the net effect changes on quality of life during hospitalization; e = other confounding factors inflecting Q.

According to this analysis there were no statistically significant changes in the quality of life for patients in the pilot disease areas when attempting to compare before and after pathway implementation (See Tables 20 and 21). However, as expected the quality of life at discharge was significantly better than at admittance into hospital.

In comparison with the pre-pilot, COPD hospitalization patients had a noticeable change in their quality of life, but there were no changes among the cerebral haemorrhage and cerebral infarction patients. The analysis on VAS measurements revealed that cerebral haemorrhage hospitalization patients' quality of life changed, but not in the COPD and cerebral infarction patients.

Qianjiang

Table 36: Changes in EQ-5D scores before and after pilot in Qianjiang

Condition	Constant term	Time	Group	T*G		
				Nonstandardized coefficient	t	P
COPD	0.595	-0.093	0.067	0.191	6.164	0.000
Cerebral hemorrhage	0.33	-0.065	0.246	0.086	1.045	0.297
Cerebral infarction	0.381	-0.053	0.261	-0.041	-0.660	0.509

Table 37: Changes in VAS measurements before and after pilot in Qianjiang

Condition	Constant term	Time	Group	T*G		
				Nonstandardized coefficient	t	P
COPD	52.86	-1.944	15.826	2.708	1.545	0.123
Cerebral hemorrhage	47.189	-5.768	21.111	9.705	2.186	0.030
Cerebral infarction	51.095	-6.787	22.635	1.883	0.644	0.520

Hanbin

Data analysis for cerebral haemorrhage and cerebral infarction patients in Hanbin revealed that the quality of life did not change significantly between admittance and discharge in both before and after the pilot implementation. The EQ-5D and VAS measurement also observed a similar trend.

Table 38: Changes in EQ-5D scores before and after pilot in Hanbin

Condition	Constant term	Time	Group	T*G		
				Nonstandardized coefficient	t	P
Cerebral hemorrhage	0.131	-0.068	0.401	0.088	0.965	0.336
Cerebral infarction	0.399	-0.029	0.302	0.052	1.844	0.065

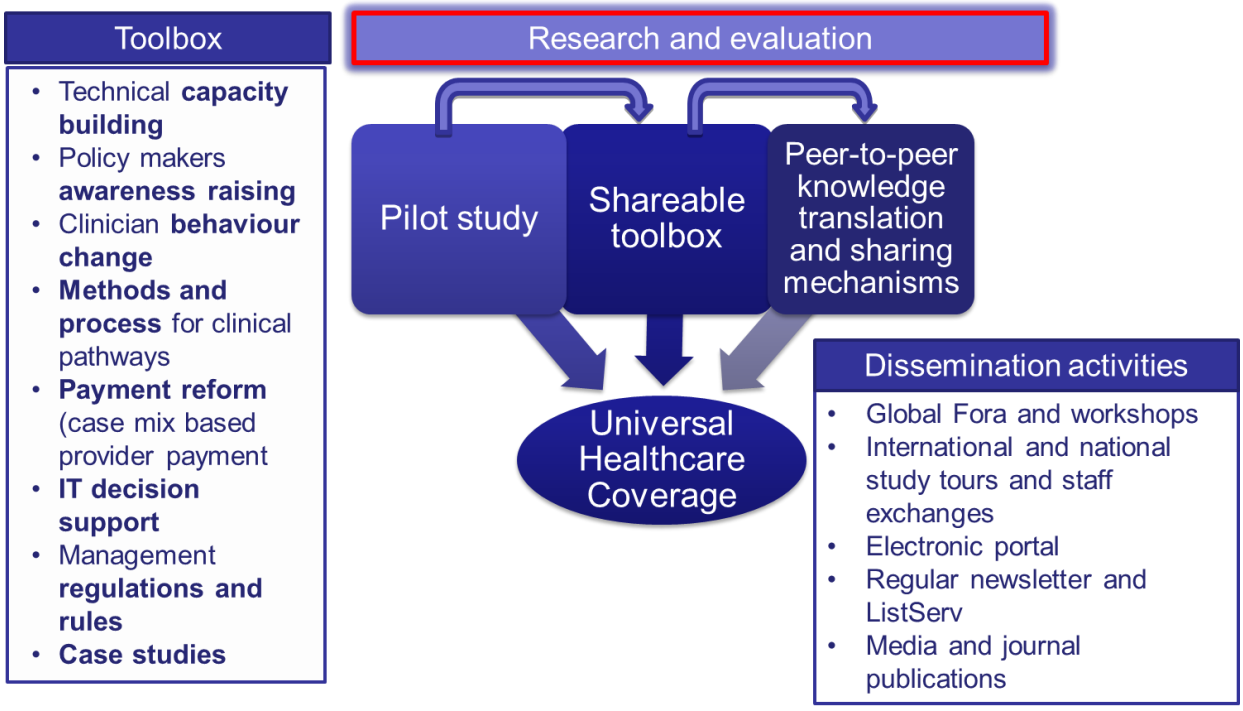
Table 39: Changes in VAS measurements before and after pilot in Hanbin

Condition	Constant term	Time	Group	T*G		
				Nonstandardized coefficient	t	P
Cerebral hemorrhage	30.077	-1.353	31.5	1.293	0.202	0.840
Cerebral infarction	42.6	-0.781	31.986	-1.012	-0.554	0.580

Part 4: Dissemination and international cooperation

Dissemination of project experiences and lessons from the pilot phase has been conducted through numerous channels, with the aim of contributing to health system strengthening in China and selected low-to-middle income countries. The dissemination strategy of the project team includes both in-country and international activity.

Figure 10: Overview of dissemination strategy



In-country dissemination strategy

The China-NICE collaborative programme has been designed from the outset to explore an approach of quality improvement and cost-limitation which could be applied in county-level public hospitals in rural China, within the context of the new national healthcare reforms. Hence, this project, in its nature, was an applied piece of research with the aim of later knowledge transfer and nation-wide policy diffusion. We expect rapid adoption of findings into policy, through a systematic communication and dissemination strategy.

Healthcare providers, commissioners and policymakers are all potential audiences for the research findings, and research findings are being circulated to each of these audiences via targeted policy briefings, conference presentations, posters, publications, and consultations. The activities carried out are described in detail below.

Targeting decision makers

One of the greatest challenges facing healthcare system reform is translating research findings into actively disseminated and widely adopted evidence-based policies and clinical practices. A series of efforts were made to translate the research findings and to implement experiences of integrated care pathways into policy.

Firstly, from the outset, project staff kept project stakeholders constantly updated of proceedings. Stakeholders were invited to attend working meetings and fieldwork, and informed of the progress of the project. This raised awareness among high-level policy of all the emerging issues and ongoing activities, which consequently helped raise policy-makers' appreciation of the programme's importance.

Secondly, the research team was required to frequently submit policy briefs to the Center for Project Supervision and Management, NHFPC. Based on the network and preferences of GHSP within NHFPC, the staged findings were delivered to NHFPC policy makers in time. Meanwhile, using the GHSP network itself, the project summary was reviewed and discussed with the stakeholders of other GHSP projects in annual GHSP meetings. This action promoted the engagement with counterparts in the Chinese healthcare sector and increased the popularity of our project among potential users.

Thirdly, as a national think tank affiliated to NHFPC, the CNHDRC has an internal reporting system which shares any research findings with senior policy makers (directors of all departments and ministers) of NHFPC. The project team produced a special policy briefing to introduce and summarise project experience in 2014, and privileged comments were received and asked to create more experience for scaling-up.

Fourthly, CNHDRC has been actively involved in providing information and evidence to support policies developed by the NHFPC, including plans for the establishment of a primary care-based coordinated health delivery system. This enabled the project team to incorporate principles and experience from the integrated care pathways pilot project into national policy. Professor Zhao Kun and CNHDRC researchers have also communicated and disseminated the outcomes from the project at meetings, as well as regional and national conferences. (examples of 2014-2015 project year in Table 40 below).

Table 40: Conferences for dissemination in 2014-15

Name of Meeting	Date	Web-link
Annual meeting of Future Health System	8-12.06.15	http://www.nhei.cn/nhei/center/web/content.jsp?news_id=4028e4814ddc62c7014eb0b2e3f2013b&f_page=search_list
Experience Sharing workshop on Integrated Care Pathway and Payment Reform	22.01.15	http://www.nhei.cn/nhei/center/web/content.jsp?news_id=4028e4814b53ac25014c2b9e96970107&f_page=yjs_kyhd&page_type=wsjspg&
3rd China Health Development Forum workshop	26.12.14	http://www.nhei.cn/nhei/center/web/content.jsp?news_id=4028e4814ab333d4014ab35eb6560004&f_page=zxxw
Health Equity workshop	12.04.14	http://www.wldsb.com/news/content_47964.html

CNHDRC held the 3rd **China Health Development Forum** workshop in November 2014 on the theme: *Primary Care–led Healthcare Delivery,* in order to prepare for the task of building a primary care led healthcare system in 2015. It was very widely attended with more than

300 attendees (including policy-makers from different central government departments and local authorities, heads of secondary and tertiary public hospitals, researchers from universities and academic institutes) meeting to consider methods that could successfully reform a tiered healthcare system. Subsequently, many media outlets began reporting in detail on how a primary-care led healthcare delivery system could be achieved [49].

Twelve relevant case studies were invited to give presentations at this forum detailing their experiences, 3 of which were from the CNHDRC–NICE collaborative programme pilot sites. The CNHDRC-NICE presenters suggested practical steps that could be taken to help commissioners and providers identify the main barriers to professional behaviour change in rural healthcare delivery, and then how to overcome these issues (such as the standard development of dual-referral mechanism coupled with IT tool, interests and responsibility sharing among county hospital, township healthcare centre, and village clinics through payment changes). As there is inadequate experience implementing similar programmes in county-level hospitals to date, the pilot sites' presentations received great attention and led to broad discussions and valuable recommendations collected the from floor, based on experiences in other sites.

With these efforts in making the policy makers understand the importance of the research and its broad involvement in informing policy making, we should now see the national adoption of findings into actual policy. The key operational mechanisms developed whilst implementing the integrated care project were incorporated into the *"*Further Action Plan to Promote Healthcare Service", a recent policy document by the NHFPC which is working towards a primary care-led health care delivery system [50]. The NHFPC proposed to put in extra effort to achieve a tiered healthcare service, such as the application of new integrated care pathway to feasible conditions.

Finally, by offering consultations on the experience of the project, staff encouraged a more widespread engagement in related studies. CNHDRC has formally or informally offered several experience-sharing consultation services to Peking University, Capital Pediatric Institute, and Statistics Center, MOH to help them to apply for research funding for various projects[2].

Self-reproduction within pilot counties

Experience from the programme has been boosted through the power of local authorities. More diseases are now included in pathway management and payment method in the pilot hospitals. In the Qianjiang and Hanbin pilot hospitals, the total amount of conditions taking similar module has risen to over 80, which accounted for more than half of discharged patients. These new clinical pathways have been developed for more conditions based on a "2+X" approach: namely, that through the experience gained from piloting COPD and stroke pathways and with extra technical support of project team, the pilot areas can develop pathways to include more conditions. This development of hospital-based clinical pathways and integrated care pathways which cover prevention, treatment and rehabilitation is a

[2] The Statistics Centre is working to integrate care across different levels of the health care system, with clinical pathways used as a mechanism to standardise quality. The Capital Pediatric Institute is developing a project to explore use of clinical pathways for quality management in pediatric care.

significant advancement in health care management, building the approach taken in this study

More hospitals in pilot counties are also using elements from the reforms, including a clinical pathway management information system, payment reforms and hospital incentive mechanisms, referring to the CNHDRC-NICE project experience. For example, in Hanbin pilot areas, beyond the first people's hospital (the initial pilot hospital in Hanbin), the other two county-level hospitals (the second people's hospital and the third people's hospital) were also required to reform using the clinical pathway approach. Furthermore, more than twenty townships with underpinned village clinics began to accommodate the integrated care pathway on stroke and COPD gradually.

Dissemination activities in non-pilot areas: technical assistance

The national dissemination activities do not require a single model for effective implementation of health care service; every hospital or local authority will have its preferred approach or way of working to improve the services they offer. Some local authorities or hospitals may wish to strictly follow examples from this project in their commissioning and health care delivery practice, but others may wish to adapt suggestions into their local improvement model and structures. However, the CNHDRC-NICE collaborative project has some common principles relating to factors which may help to foster an environment conducive to change. Experiences from the project should help providers identify the barriers to changing established practices that may impede progress in all health facilities, regardless of the specific structures and culture that are present.

The research team was invited by Chongqing Provincial Health Bureau to provide technical assistance in methods of cost estimation for clinical pathway implementation. This assistance informed the health insurance reimbursement policy in Liang Ping County, which is a national pilot site for county-level public hospital reform.

In 2013, CNHDRC were invited by Anhui Provincial Health Bureau to share the experience of the clinical pathways programme and help them to implement county hospital reform. In order to facilitate the increased understanding of the participants, selected from 9 counties over Anhui province, the research team jointly worked with practitioners from project pilot site to introduce the project designing, costing approach, mechanism of pathway development, IT management, internal management rules and skills, and corresponding experiences created by local practitioners. This targeted arrangement received great attention and clarified how detailed steps can be followed in future by own actions, particularly in relation to practices. After the workshop 6 counties of Anhui province initiated hospital reform – specifically with regards to clinical pathways accompanying payment reform – which is quite similar to the CNHDRC-NICE project initiative. By the end of September 2015, 100 management conditions from this project model were introduced throughout all the counties of Anhui province [51].

Media and publications

Presentation of research in academic journals is still a major channel for many hospital-level commissioners and researchers who are committed to informing broader policy making in China. Publications can bridge the gap between research and practice by publicising relevant evidence to the masses in accessible forms. In total, 12 academic articles on Phase I of the CNHDRC-NICE collaboration on surgical pathways were presented in a

series of China's core journals such as *Chinese Health Economics* and *China Social Security*. These articles ended up being very highly cited, and were a strand in the ensuing discussion about implementing clinical pathway management and payment reforms in a scaleable and practical way. In similar fashion, the research team is in the process of drafting and submitting articles on the current phase (Phase II) of the collaboration and the impact of integrated care pathways.

Furthermore, Doctor Liu Zhonghe, Head of Qianjiang Central Hospital, wrote a book documenting in great detail the mechanisms and requirements for implementing a clinical pathway and payment reform programme in a county level hospital. The content of this book was mainly based on work with pilot hospitals and local authorities, and articles published.

Additionally, there is plenty of opportunity to introduce the project to media through Chinese newspapers and websites, including with the ongoing project activities. For example, in 2013, the Qingdao Peninsula Metropolis Daily was reporting that the clinical pathway project had made significant progress in Huangdao District People's Hospital, and represents innovation in public hospital reform in China [52].

Holding an International Exchange Forum of the project in China

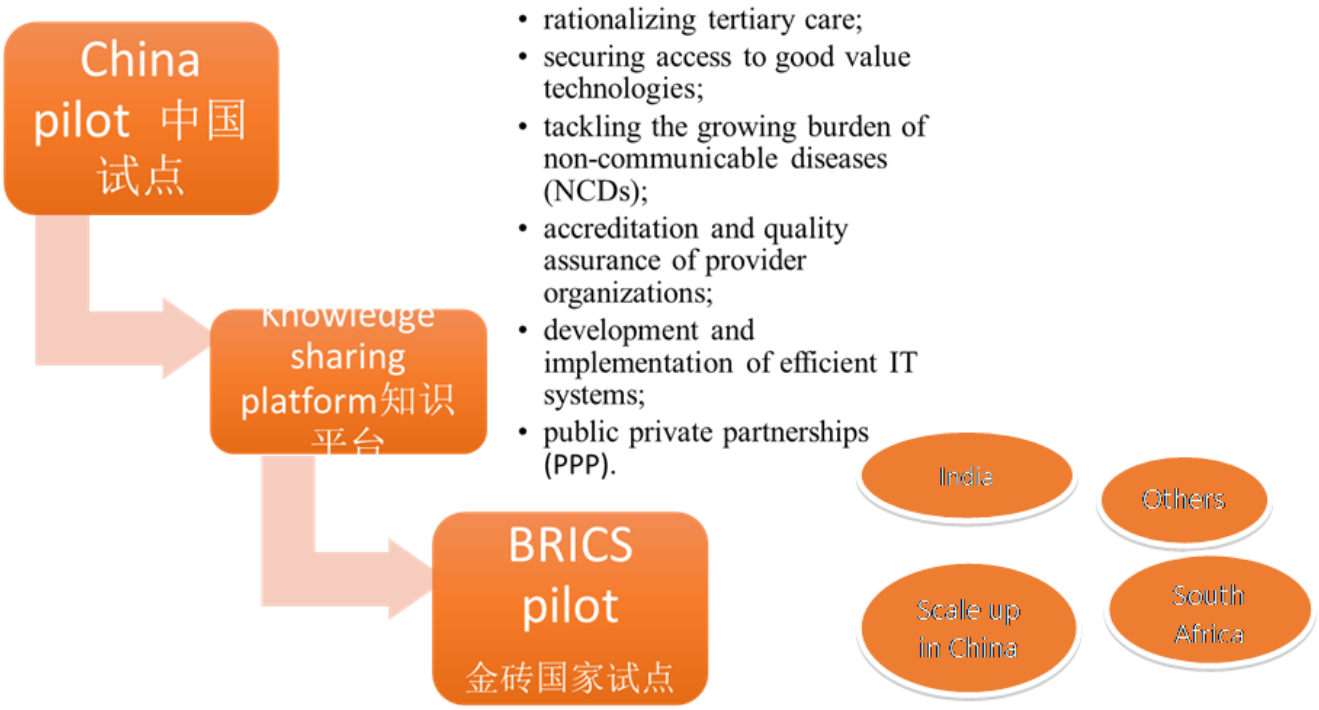
With coordination support from DFID China, CNHDRC organized a dedicated dissemination and awareness raising forum in Beijing China bringing together high-level policy makers In China and other emerging countries. Key policy makers in China include the State Council Health Sector Reform Coordination Office and its key members, such as the National Development and Reform Commission, Ministry of Finance, Ministry of Human Resources and Social Security in addition to the National Health and Family Planning Commison. Senior decision makers from the UK, China, India, and other interested countries at similar stages of development and reform (e.g. Vietnam, Thailand, Russia, South Korea) were invited in the forum.

International dissemination and cooperation

With DFID support through China's Global Health Support Programme (GHSP), a new dynamic partnership was developed between DFID and China's National Health and Family Planning Commission to strengthen and collectively contribute to international health aid. As one of a series of innovative projects, the integrated care pathway project was encouraged to share its research findings with other non-pilot sites within China and other low and middle income countries (LMIC) as much as possible.

On an international scope, NICE and CNHDRC initiated a South-South dissemination strategy on potential future mechanisms to conduct two-way learning opportunities with initial target countries (India and South Africa) along with the project launch meeting in 2012. To be noticed, the "South-South collaboration" strategy initially focused on the BRICS countries as agreed with DFID. Following the onset of the project, the scope of target countries was extended to LMIC in order to enlarge the project's impact and meet the interests of non-BRICS visitors (such as Vietnam and Indonesia).

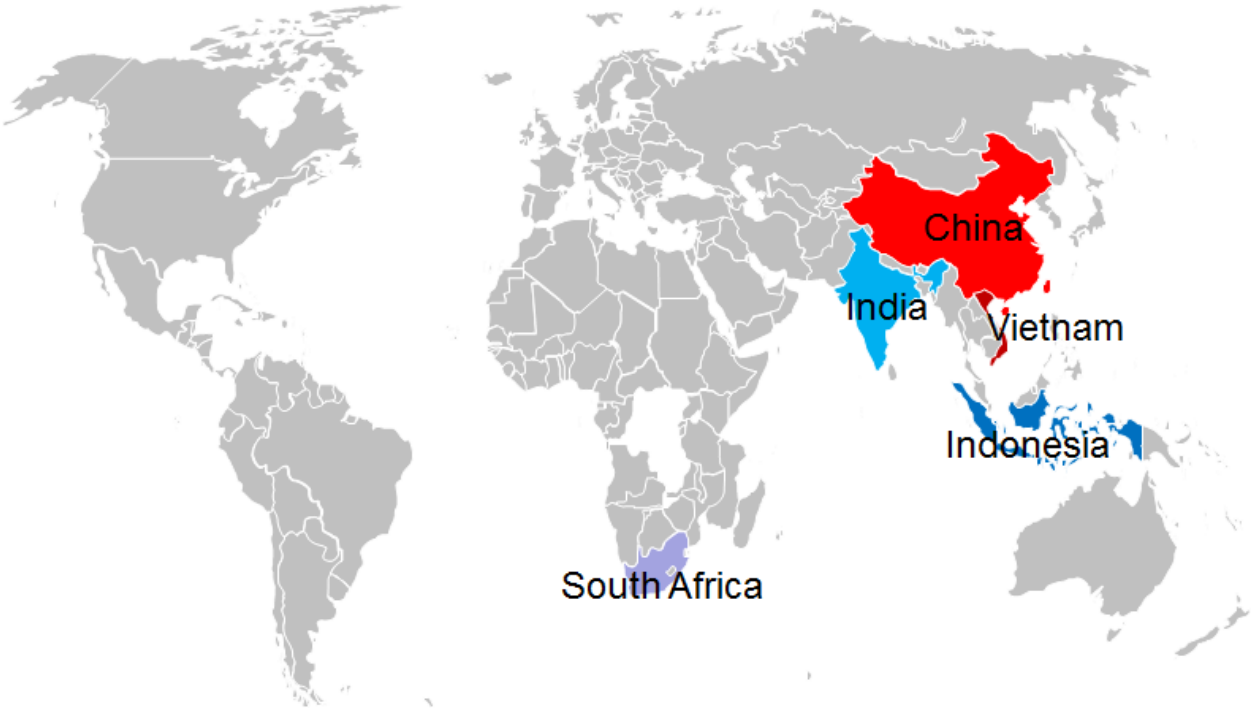
Figure 11: Plans for South-South collaborations with LMIC



As part of the implementation stage, the project team took the opportunities of press, publications, international conferences and workshops, such as the annual HTAi (Health Technology Assessment International) conference and the HTAsiaLink conference, to promote and update research findings. As a result, representatives from other countries, such as Vietnam and Indonesia, proactively expressed their interest in conducting investigations in Chinese pilot areas. Through such channels, the clinical pathway project has been receiving more international attention (Figure 12 below).

In 2013, the Chinese President Xi Jinping revealed an ambitious development strategy and framework, which was knowns as “The Silk Road Economic Belt and the 21st-Century Maritime Silk Road” (abbreviated as “the belt and road initiative” officially). At the heart of One Belt, One Road lies the creation of an economic land belt that includes countries on the original Silk Road through Central Asia, West Asia, the Middle East and Europe, as well as a maritime road that links China’s port facilities with the African coast, pushing up through the Suez Canal into the Mediterranean. This framework has played an important role in Chinese diplomatic strategy and aimed to push China into taking a bigger role in global affairs, including promoting and instructing universal health coverage globally [53, 54]. Taking the opportunity to develop“ the belt and road initiative”, the joint project team planned to initiate the collaboration with the countries which are NHFPC’s priority interests after 2015.

Figure 12: Countries included in dissemination activities



Initiation of South-South collaborations

During the two-day launch meeting in 2012, domestic representatives from relevant ministries and commissions[3] discussed extensively with international participants from India, Nepal, Sub-Saharan Africa and the UK on issues related to China's rural health reforms, the pilot project addressing non-communicable diseases, and the "South-South" collaboration strategy. The "South-South" collaboration strategy was developed for the purpose of mutually beneficial international cooperation in the areas of clinical pathway and service quality. A number of shared technical and policy priorities that could help countries reach and sustain universal health coverage (UHC) were identified during discussions at the launch meeting. Meanwhile, an agreement was reached on strategies to facilitate the project experience sharing for this project. The goals of these activities are to promote cooperation between the Emerging Powers and to share public goods and products (including methods and processes), with the ultimate aim of supporting countries to attain and sustain UHC. In short, the initiation of "South-South" collaboration strategy accommodates the principles, the partners, the approaches and the content of the dissemination activities to allow further implementation and exploration.

[3] NHFPC; Ministry of Commerce; Ministry of Finance; Ministry of Human Resources and Social Security; State Council Healthcare Reform Office of the National Development and Reform Commission (NDRC)

Figure 13: Summary of dissemination plans during launch meeting (2012)

Beyond the planned dissemination activities, some ad-hoc dissemination engagements were also conducted with countries which were interested on our comprehensive reform interventions through intentional introductions or taking the opportunity of international collaboration in other researches. Case studies from Vietnam and Indonesia are presented below.

Experience sharing with India and South Africa

Ensuring through the process of observing the pilots in China, that participants from emerging economies with an active interest in expanding coverage, such as India and South Africa, were involved early in the project. The participants were involved in implementing, evaluating, and compiling the toolbox. They will then become the first “adaptor” who will assist Chinese and NICE experts to disseminate the toolbox into their countries. We will build on NICE International’s ongoing projects, with DFID and Rockefeller support, in India (Southern States with an insurance model, and at Union level, at the Ministry of Health and Family Welfare and National Health Mission), in order to share the early Chinese experience and explore scale up across relevant settings in India and South Africa. The interaction with state level policy makers of India and South Africa started in Nov 2012, with the launch workshop in Beijing.

Table 41: Plans for international collaboration activities

Country	Type of engagement	Key stakeholders
India	Sharing experience on CPs and accompanying payment reform and electronic data collection systems, across Andhra Pradesh, Tamil Nadu and Karnataka insurance schemes, which have developed their own CPs and are looking to refine them in order to reduce supplier-induced demand. Similarly, CPs are key for National Health Mission (MoHFW) with whom NICE International is working with supported by DFID India.	State insurance schemes in AP, TN and Karnataka MoHFW/NHSRC/National Rural Health Mission (New Delhi)
South Africa	Sharing experience on CPs with provinces (e.g. Gauteng Province) and also National Dept of Health. Emphasis on diagnostic tests and their cost-effective introduction across the system.	National Dept of Health/Formulary Committee; National Health Laboratory Services; Gaiteng Province Health Authority

International conferences or workshops

CNHDRC and NICE research team has taken opportunities in international conferences and workshops to clarify the project, and also build a network of interested representatives who might benefit from similar projects. In order to maximize the dissemination efforts, the research team took advantage of keynote speeches, presentations, panel sessions and poster sessions to draw attention to the project and engage in discussions with other participants.

2013: HTAi

HTAi is a global scientific and professional society for all institutions who produce or use health technology assessment. The annual meeting of HTAi typically brings together over 700 worldwide health policy makers and researchers to share latest research, discuss policies and methods, and build a global network. During the 2013 HTAi annual meeting in Seoul, the project team conducted an independent panel session to introduce the project design and progress of implementation with international peers. Specific content covered in this panel session included an overview of the project design, development and costing of clinical pathways, the supporting system, and the evaluation framework. The audience raised many technical questions and constructive comments, particularly regarding the evaluation framework and payment reform, which helped improve implementation process in a practical way. Moreover, several governmental organizations from developing countries,

such as Vietnam and India, expressed their interests and willingness to conduct field visits in order to explore the possibility and feasibility of such project in their local health system.

2013-2015: HTAsiaLink

HTAsiaLink is a regional HTA society in Asia. In the last three consecutive years (2013-2015), the CNHDRC project team has shared the latest updates and findings from the project during the annual gatherings with regional counterparts. Most member countries of HTAsiaLink were in the midst of their own health care reform; therefore, this project received wide attention and gave interested member countries useful information to conduct similar comprehensive interventions. Furthermore, HTAsiaLink has also provided a platform to build a dissemination network among low and middle-income countries (LMIC), many of whom are target nations defined by the “South-South” collaboration strategy.

2015-2016

In 2015 and 2016, the project team continues to promote the project and research findings internationally.

Guidelines International Network (GIN) is a specialized international community to lead, strengthen and support collaboration in guideline development, adaptation and implementation. Networking between the members is enhanced through the annual conference, where participants exchange knowledge in areas such as methodology improvements. An poster on iterim project outcomes in line with the conference theme, “Engaging all stakeholders, Guidelines from a societal perspective” was presented by CNHDRC and NICE.

The Prince Mahidol Award Conference (PMAC) is an annual international conference focusing on policy-related health issues. The research team has submitted an abstract to the PMAC 2016 meeting, which has also been accepted for oral presentation. Through the abstract, the research team hopes to conduct a two-way learning with others in support of the PMAC 2016 theme, “Priority Setting for Universal Health Coverage.”

Pilot site investigation conducted by international counterparts

Due to these dissemination activities, several representatives from LMIC were able to come to China and conduct field visits in the pilot sites to better understand the project implementation and practical impact.

Vietnam

In February of 2014, a delegation from the Vietnamese Ministry of Health visited the project research team and policy-makers in China to discuss the project design and operations and necessary supporting systems, and to explore the practicality of implementation in their own country. With the health care systems in Vietnam and China being similar, the delegates were impressed by how comprehensive intervention mechanisms had been established and

the achievements thus far in the pilot sites. An initial agreement to provide technical assistance and a project toolkit was reached before their departure. Now, the Vietnam colleagues are working on their project approval and grant application; and the bilateral collaboration on specific project activities will officially be carried out afterwards.

South Africa

In November of 2014, Prof. Priscilla Reddy, the deputy executive director from the Population Health, Health Systems and Innovation (PHHSI), Human Science Research Council, South Africa, and Dr. Aquina Thulare, a technical specialist in health economics, from the National Health Insurance, National Department of Health, South Africa, were invited for an experience sharing and knowledge translation in China in accordance with the dissemination strategy adopted by the project. During their stay, these representatives communicated with policy-makers in NHFPC about the motivation and the purpose of such comprehensive intervention, as well as the possibility of knowledge translation in South Africa. Moreover, the visitors went to two pilot sites to investigate the general operation of the project and organized a series of interviews and discussions with local project practitioners, such as physicians, nurses, patients, local policy makers, and hospital managers. After returning to their home country and reporting their visit, they shared that the government was willing to duplicate the payment reform model in some pilot rural counties of South Africa.

India

In March, 2015, Dr. Nagesh Prabhu, the Joint Secretary from the Department of Health Research, Government of India, and Dr. Raju Sukumaran, a medical officer from the Comprehensive Health Insurance Agency, State of Kerala, India, made a similar investigational trip in China as the South African colleagues. They were excited to understand the complex intervention mechanism and initial results achieved by the Chinese pilot sites, since the problems of increasing costs and a lack of quality supervision were also prevalent in the rural areas of India. In their feedback, they stated that they would convince the policy makers from the State of Kerala to choose several pilot hospitals to initiate clinical pathway management in selected conditions. In the near future, they will send another delegation to learn about the technical skills of clinical pathway management and payment reform.

Indonesia

Dr. Putu, a senior researcher of the Center for Health Policy and Management at Gajah Madah University in Yogyakarta, and Dr. Gaby, the director of the HIV/AIDS research centre at the Atma Jaya University in Jakarta, were assigned by the Indonesian government to explore the effects thus far of clinical pathway management and corresponding payment reforms in China. Taking the opportunity of NICE representatives' visit to China, the project staff of CNHDRC and NICE delivered to these Indonesian representatives a joint, two-day fruitful seminar giving an overview of the project. The seminar included topics such as implementing interconnected mechanisms, the project's theory of change and details of activities, and the requirements when designing a supporting system. Furthermore, CNHDRC, NICE and representatives of Indonesia agreed to further cooperate in the field of community health promotion.

Due to the demand of translating research into policy in Indonesia, NICE, CNHDRC and Thai colleagues from HITAP (Health Intervention and Technology Assessment Program) will

deliver a workshop on their experiences to the Indonesian Parliament members and senior policy-makers in 2016.

Media

In addition to physical interactions with international partners, the research team also engaged in project dissemination activities through the press and online. In 2014, Kalipso Chalkidou, the director of NICE international, informed the periodical China Daily in an interview on rural health and hospital reforms, “NICE International is now working with the Chinese government on preventing diseases. Its work in China has received so much positive feedback that other emerging markets like Vietnam are now learning from this cooperation model. [55]” Further information and updates on key project activities is recorded in the CNHDRC and NICE websites [56, 57].

The project team also recorded an advertising video clip in English to introduce the overview of the project, preliminary results of implementation, and its impact. Both the UK and Chinese project stakeholders were invited to comment and share their opinions in the recording. This video has been played in previous conferences and will be found in upcoming international workshops and meetings to gain more attention in a broader scope.

Both phases of the collaborations clinical pathways and payment reforms have also received attention from reporters and academics external to the project team, resulting in peer-reviewed publications about the reforms as they were implemented.

Itad independent external evaluation

At an early stage of the Phase Two collaboration between CNHDRC and NICE, the clinical pathways and payment reforms project was observed by consultants from Itad, an agency specialising in M&E and results measurement. This team was recruited by DFID to provide independent and external evaluation services for the bilateral collaboration project between NICE and CNHDRC (results reported in chapter 3 above) [1].

For the project team at CNHDRC implementing and reporting on the hospital reforms, Itad’s reports served as an unexpected, but effective, way to enlarge the project’s profile in the international community. The report highlighted significant and valuable aspects of the project’s impact at local and central levels, such as influencing policy-makers’ and clinicians’ perceptions of the importance of using evidence to inform practice, and facilitating communication between doctors and patients.

Additional activities for international cooperation

UK and Germany Visits

In February and November of 2014, the project team organized two Chinese delegations which included local and central policy makers and local project practitioners. These delegations visited the UK and Germany to learn about their experience in the areas of health system reform and healthcare quality. Delegates also visited the local hospitals and community health centres to understand the practical applications of health planning and technologies.

Based on discussions and engagements with the UK and German policy makers and health practitioners, the Chinese delegates not only were able to share their concerns, but also were able to receive guidance and insights from the UK and German experience in guideline management and payment reform initiative. As a result, the project stakeholders, especially the project practitioners, had a clearer roadmap and skills for implementing the project in the local context.

Excerpt from MoU between Qingdao Municipal Health Bureau (QMHB) and the UK's National Institute for Health and Clinical Excellence (NICE), signed 27.02.2014	**Excerpt from MoU between Qingdao Municipal Health Bureau (QMHB) and NHS London, signed 27.02.2014**
The two parties will exchange their institutional expertise and experiences concerning the application of health technology assessment (HTA) and clinical guideline/disease management pathway development, including topic selection, evidence assessment and appraisal, economic evaluation, the implementation of evidence-informed decisions into practice as well as impact assessment and uptake monitoring. They will also explore self-funded opportunities for conducting collaborative technical and academic projects for strengthening evidence-informed policy-making in other resource-limited countries, particularly in Asia and Africa.	Based on the existing health collaboration which is benefiting both citizens through sharing expertise, supporting joint projects, promoting better understating and deepened friendship, the two parties wish to extend their cooperation in this Memorandum of Understanding (hereafter referred as "MOU").

After two rounds of interaction with the UK counterparts, this project has been recognized as a project with outstanding bilateral health cooperation between the UK and China. When the project delegation visited UK in Feb 2014, the Chinese deputy health minister visited the UK's NICE offices. Under the coordination of NICE International, the health authority from one of the pilot areas (Qingdao Municipal Health Bureau) signed official Memoranda of Understanding (MoU) with NHS London and NICE in the witness of the Chinese health minister and the UK Parliamentary Secretary of State for Public Health.

The MoU with NHS London aimed to explore deeper partnership in clinical service for hemorrhagic or ischemic stroke patients, education and training, professional accreditation, and continuing professional recognition together, with the goal of learning from recent reorganisations of stroke care in London.

Part 5: Conclusions and next steps

Conclusions and policy recommendations arising from the project

Getting research evidence translated into policy, and then implemented 'on the ground', remains a persistent challenge when aiming for evidence-informed policy making and practice change. This is true for countries with very different income levels. The CNHDRC led 'Clinical Pathways' project represents one means of getting 'evidence' incorporated directly intro delivery structures in order to shape behaviour change at both the individual and institutional levels. Notably the Phase 2 Clinical Pathways project represents a very proactively delivered and complex intervention incorporating not only a description of what would be considered 'best practice' (the 'clinical pathways' themselves), but also their integration within existing hospital information systems, extensive training and support, and importantly, linked payment reform where this was possible. All this was combined with extensive stakeholder engagement with a variety of actors at national and local levels. Therefore evaluating the "Clinical Pathways" project represents a very challenging proposition. This issue of complexity was noted in the Itad report as part of its evaluation of the NICE International's engagement in China, specifically in relation to the Clinical Pathways [1].

The results presented here are suggestive that the Phase 2 Clinical Pathways project has led to important and positive changes in the management of stroke and COPD patients in the pilot sites. Given the nature of the intervention as previously noted, coupled with challenges around identifying an appropriate counterfactual in the absence of controls, identifying precisely how and to what extent the project has led to practice and outcome change for providers and patients is not currently possible. In addition, some are no currently available due in part to fewer patients being identified with the target conditions. This was particularly the case with respect to Hanbin, where data is unavailable for COPD patients. The results presented here should be regarded as provisional in that sense, and require further verification over a longer time period, and with data from additional pilot sites. Nevertheless, it is clear from the qualitative evidence available that perceptions of the importance of using evidence to inform practice has changed both at local and central levels. This was also noted in the Itad evaluation. The Clinical Pathways project has additionally helped to further reinforce the need for broader improvements in hospital performance, particularly with regards to managerial capacity. Finally, the focus on non-communicable diseases has highlighted the importance of integrated care across different tiers in the system.

One of the objectives of Phase 2 was to develop pathways that linked community care with 'higher' tiers in the system. While a broad framework was developed with this aim in mind, the pathway implementation itself focused on inpatient care. However there were cases of enhanced community based management, principally secondary prevention that were implemented at the pilot sites thanks to this Phase 2 initiative. For examples, local insurers (NCMS) fully subsidised the provision of pneumococcal vaccine for COPD patients meeting certain inclusion criteria. Preliminary analysis conducted by CNHDRC appears to suggest that vaccination led to reduced hospitalisation as result of exacerbations avoided, although this would need to be confirmed with further data.

Stroke rehabilitation services are under-developed in China, however as part of the Phase 2 project, CNHDRC facilitated a capacity building strategy for the four pilot sites which involved peer-to-peer learning from a recognised site of excellence in China (Xuanwu hospital). This led to each hospital setting up rehabilitation departments.

A key opportunity going forward is for CNHDRC to work further with the pilot sites and local health bureaus in developing a practical framework for strengthening community care for both COPD and stroke, taking into account better referral systems and the need for improved rehabilitative care. Indeed it is recognised that much more can still be done in re-directing resources away from the hospital sector towards community care, at least in rural China [10]. This will require sustained investment in primary care facilities and human resources. In addition, technologies such as telemedicine may support strategies to deliver more care in the community.

The very detailed clinical pathways in this project were developed through highly iterative input involving Chinese and international experts, and tailored to local settings. Nevertheless, their foundation, quite rightly, were centrally (NHFPC) developed clinical guidelines. There is scope here however, using the expertise of CNHDRC, to examine the processes and methods used to develop these guidelines, and recommend a new approach going forward that combines international best practice technically with improved stakeholder engagement mechanisms [58, 59]. Indeed, reforming the method of developing clinical guidelines in China forms a core component of the 2015 MOU signed between NICE and CNHDRC (see below). Notably, there is also interest in using newly developed guidelines to create quality standards.

Quality standards are a concise set of evidence-informed statements, designed to drive and measure priority quality improvements within a particular area of care. Quality standards aim to cover whole pathways of care, but do not list all the necessary components of acceptable care. Such quality standards could be used as part of re-designed clinical pathways project for both rural and urban settings, also linked with financial incentives. Unlike the Phase 2 clinical pathways, which provide very detailed information on ‘compulsory’ and ‘optional’ elements, often on a day-to-day basis, CPs based on Quality Standards may potentially represent a more parsimonious and more practical mechanism to support behaviour change, since in principle they would focus only key areas of concern across the whole pathway. This may strike a better balance between local discretion in healthcare delivery and the requirements of central standard setters, and additionally help support greater compliance.

Further refinement is possible in relation to exploiting the potential of IT innovations, including electronic pathway plug-ins into billing systems, that can better monitor baseline activity and link compliance with preferred activities with appropriate reimbursement. Such tools can also serve as decision support/training tools for front line clinicians.

Next steps in the CNHDRC-NI partnership

Further work on Clinical Pathways

The CNHDRC Clinical Pathways project has received significant government interest, and has been seen by NHFPC as a model for replication in a 1000 counties and in a 100 cities nationwide [1]. Further expansion of the of the 'CP approach' should be accompanied by a well-designed prospective evaluation that takes into account the findings of this pilot evaluation.

In addition, as noted above, there is a need to emphasize more strongly the original aim of developing *integrated* care pathways that support better coordination and care delivery across the different tiers in the system. In the first instance research is perhaps required on developing effective referral guidelines combined with identifying strategies (including financial incentives link with IT innovations) to encourage better and more care in community settings.

Finally it is necessary to consider more robustly the underpinning evidence on which clinical pathways are developed, specifically in relation to clinical guidelines but also taking into account formulary inclusion and exclusion decisions. This calls for strengthening the use of health technology assessment approaches to inform listing and delisting policy, and improving the approach taken to clinical guidelines.

Supporting greater collaboration between UK and China in health care

The 2015 MOU between NICE and CNHDRC

There are a number of opportunities to take forward the collaboration between NICE International and CNHDRC, building not only on the Clinical Pathways project but also on wider government interest in deepening relationships in areas of healthcare and health more broadly.

The People to People Dialogue (P2P) is one of the UK's key ministerial-level talks with China. The 2015 P2P included a "Health Dialogue" event that took place on September 17th at the Royal College of Surgeons in Lincoln's Inn Fields, London. Keynote speeches were delivered by Liu Yandong, Vice Premier of China, the Rt Hon Jeremy Hunt MP, and Margaret Chan, Director-General of the World Health Organisation. All the speakers noted the mutual and international benefits following from greater UK-China cooperation in health. Vice Premier Liu Yandong noted that other countries including China wished to learn from the "British model" to healthcare funding and provision, highlighting however the importance of finding "Chinese solutions" to health system reform. Margaret Chan highlighted the issue of anti-microbial resistance (AMR), noting that the UK and China could work together to identify a multi sectoral approach to this challenge which also has policy coherence. Jeremy Hunt made reference to examples of important UK-China partnerships in health including the relationship between NICE International and CNHDRC. He noted that NICE and the CNHDRC had agreed a new Memorandum of Understanding (MOU) during this P2P, for further cooperation in areas of evidence informed policy making.

Building on the successful collaboration between NICE International and CNHDRC in the area of clinical pathways (Phases 1 and 2), this MOU between NICE and CNHDRC details areas of cooperation, spanning five years, on the process, methods and research needed to

develop clinical guidelines and quality standards in China. As part of the provisions of the MOU, NICE International would provide technical assistance in the development of frameworks that will ultimately lead to locally relevant and locally owned, clinical guidelines and quality standards. The collaborative project will include pilot work in high priority selected conditions which have a high disease and economic burden. AMR, drawing on NICE's recent (2015) stewardship guidelines [60], will be considered for the pilot. The MOU was signed by Li Tao, Director General of CNHDRC and Sir Andrew Dillon, CEO of NICE.

The full MOU is available in Appendix I (p241).

Building a hub to support priority setting

The 2015 Health Dialogue culminated in a panel session moderated by the UK's Chief Medical Officer, Professor Dame Sally Davies. The panellists were Director General Li Tao (CNHDRC), Director General Zhang Zongjiu of the Bureau of Medical Administration (NHFPC), Kalipso Chalkidou of NICE International, and Lord Jim O'Neill, Commercial Secretary to the UK Treasury and chair of a review into AMR. Both DG Li Tao and DG Zhang Zongjiu highlighted their key observations from their study tour to the UK, including their ambition to work with NICE through its international unit to establish a similar priority setting institution in China. DG Li Tao wished to deepen the existing collaboration with NICE International to develop health technology assessment in China.

Within the auspices of the International Decision Support Initiative (iDSI), NICE International intends to work with both the NHFPC and CNHDRC (at their request) in creating a regional capacity and technical assistance hub in HTA (through CNHDRC) to serve the evidence needs of 33 provinces within China and provide support to nearby countries, in a way consistent with the Chinese government's "One Belt One Road" strategy. With growing technical capacity and policy influence, CNHDRC has become increasingly active as a provider of expertise domestically and internationally, having recently hosted delegations from Indonesia, India and Vietnam. It is also active member of HTAsiaLink. Given also its relationship to central government, it would therefore seem appropriate that CNHDRC is at the centre of a network hub of HTA research in China. NICE International, along with its partners in the iDSI will seek to work with CNHDRC in identifying and delivering on capacity building needs during 2016-18, to support the creation of such a hub, led by CNHDRC.

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Appendices