



International Partnership for
Innovative Healthcare Delivery

Initial Findings in a Landscaping Study of Healthcare Delivery Innovation in China

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Published by the International Partnership for Innovative Healthcare Delivery
Durham, NC (USA)

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Executive Summary

Despite dramatic economic growth, increases in per-capita healthcare spending, and sweeping policy reform, innovation does not appear to be flourishing in China's healthcare delivery sector. To further explore the context of healthcare innovation in China, the International Partnership for Innovative Healthcare Delivery (IPIHD) initiated a landscaping study, with two hypotheses.

- 1 Innovations that increase access to affordable quality healthcare are present in China but are hard to identify for a range of possible reasons, including regulatory systems that do not privilege newcomers and a resulting preference among innovators to operate without attracting attention.
- 2 Structural barriers to innovation in China limit the number of emerging innovations and slow their growth, relative to other countries.

The results of this study, while tentative due to the small sample size, indicate that both hypotheses may be correct. The study identified 15 models of healthcare innovation, four of which target affordability and access for a population in need.

The analysis indicates that healthcare delivery innovation is happening in China but is not as easy to find as in other countries, in part because the public sector so strongly dominates healthcare, creating high barriers to entry for new models of care and making it more desirable for innovations to avoid attracting attention. The findings also suggest that healthcare delivery innovation is not happening in China to the same degree as in other countries and regions, despite significant access issues, disparities in quality, and overburdened systems.

Several themes emerged from analysis of these innovative models, providing insight into both why existing innovations are relatively hard to find and the structural barriers that discourage innovation.

- Economic and demographic disparities between the eastern and western regions of China influence the design of emerging healthcare innovations.
- Recent national health care reforms are creating market gaps that may encourage innovation, but it is early, and persistent opportunities for innovation are still being defined.
- Successful innovation in China often requires public-private collaboration, which can be challenging and may discourage entry of entrepreneurs into the market.
- It is unclear if "structural uncertainty" in the healthcare sector will fuel innovation as it has in China's information technology sector.

Given the healthcare challenges faced by China, including meeting the needs of the world's largest aging population, innovative models may be not just beneficial, but necessary. These findings suggest that the government should increase opportunities and support for innovators to test their ideas and enter the market. Likewise, entrepreneurs should watch policy and demographic shifts to identify emerging needs. Innovative models of healthcare delivery in China have the potential to play a transformative role and bring about results that will undoubtedly reverberate around the world as other nations search for solutions to similar challenges.



Initial Findings in a Landscaping Study of Healthcare Delivery Innovation in China

Background

The Chinese national health reforms of 2007 and 2009 indicate that recent economic growth will lead to increased priority on meeting the health needs of the Chinese population. These reforms target improvements in five areas: health insurance coverage, essential medicines, primary healthcare delivery, public health services, and public hospital reform. (See Appendix A for a description of the China healthcare system and recent reforms.) The challenges, however, are considerable. China's immense population (with the largest aging population in the world), rural and urban demographic shifts, and limited infrastructure, mean that massive investment will be needed to advance China's healthcare system and meet demand.

China's 12th Five-Year Plan for the period 2011 to 2015 emphasizes health system improvements and support for innovation (National People's Congress 2011). In line with the Five-Year Plan, a recent McKinsey report describes China's health sector as dominated by "improvements in infrastructure, further healthcare reform and significant support for innovation" (Le Deu, Parekh, and Zhang 2012). Their analysis suggests that support for healthcare innovation, in particular, is focused on biopharmaceutical research and development, rather than innovations in healthcare delivery and services.

However, healthcare delivery innovation will be required to accommodate increases in demand created by the national health reforms. While the reforms reduce the cost of care through increased government subsidies, implementation rests on an expansion of the existing healthcare delivery structures (Tan 2012). Hospitals, currently the primary care delivery mechanism in China, are facing increased revenue pressure due to policy changes that aim to eliminate significant sources of income for doctors, including tips from patients ("red envelopes") and drug rebates (Yeh and Chen 2012). China needs new efficient healthcare delivery models, including less costly outpatient options, to handle greater demand as access expands.

In other countries, the drivers of change and innovation in healthcare delivery models have been a response to the pressures of rising costs, significant barriers to access, and insufficient numbers of trained workers. Providers and entrepreneurs around the globe are finding new ways to deliver care. Many of these innovations are notable for business models that enable cost efficiencies while maintaining or improving quality, all of which makes healthcare more accessible and affordable for low-income populations. Taken together, these innovations have provided positive pressure on healthcare systems and helped to catalyze welcome reforms in healthcare in India, Kenya, and elsewhere.

China needs new efficient healthcare delivery models, including less costly outpatient options, to handle greater demand as access expands.



This drive towards accessibility and affordability occurs in a context of rising economic performance and is being facilitated by a dramatic increase in health investment.

Superficially, China's challenges appear similar in many ways, though on a larger scale, to those faced by other emerging economies. China is working to make care more available and affordable to its vast population of 1.3 billion. This drive towards accessibility and affordability occurs in a context of rising economic performance and is being facilitated by a dramatic increase in health investment that now commands 5 percent of total GDP (Le Deu, Parekh, and Zhang 2012). Health has been prioritized as an area of government and private sector investment as new financial resources become available. The healthcare reforms of 2007 and 2009 expanded social insurance coverage and consequently increased the demand for care.

The increased demand for care in an already overburdened healthcare system, coupled with significant economic growth and increased government investment in health, suggest a context ripe for healthcare delivery model innovations. However, a review of the literature conducted by the authors, including public databases of healthcare innovations around the world, identified few new healthcare delivery models in China.

This apparent dearth of innovation or "innovation invisibility" could be due to a variety of factors such as reform implementation that delays innovation and the government's historical domination of healthcare delivery in China. To further explore the context of healthcare innovation in China, the International Partnership for Innovative Healthcare Delivery (IPIHD) initiated a landscaping study, with two hypotheses.

- 1 Innovations that increase access to affordable quality healthcare are present in China but are hard to identify for a range of possible reasons, including regulatory systems that do not privilege newcomers and a resulting preference among innovators to operate without attracting attention.
- 2 Structural barriers to innovation in China limit the number of emerging innovations and slow their growth, relative to other countries.

Methodology and Findings

To uncover potential innovations in China and test the aforementioned hypotheses, IPIHD began with a review of the literature and the Center for Health Market Innovations (CHMI) database of private-sector healthcare innovation. Following this, the authors solicited information from global health academics and practitioners operating in China and more broadly with a short written introduction to the project. Written in English and Chinese, this short description asked readers to report new approaches to delivering healthcare that balance cost, quality, and access. This was posted on the IPIHD blog¹ and Duke Global Health Institute's China Health Policy Report blog² and also distributed by email to IPIHD's network and partners, multinational companies with operations and/or interests in China, professors of public health in several top Chinese universities, Chinese journalists covering healthcare, and Chinese policymakers. The authors also hosted a focus group of Chinese graduate students at Duke University (primarily medical and business students) to generate examples of healthcare innovation with which they were familiar.

By the end of February 2013, the authors received and reviewed 15 suggestions of innovative care delivery models in China, listed below. (See Appendix B for brief descriptions of these programs.)

- 1 Chinese Aged Diabetic Assistant (CADA)
- 2 12580 Hospital Booking System
- 3 Mobile health (mHealth) projects led by Professor Liu at the Chinese Academy of Science
- 4 Spring Rain Mobile Doctor phone app
- 5 China Wireless Heart Health
- 6 Intelligent Health Management Self-Service: mobile health terminals

- 7 Neusoft Healthcare Management Platform
- 8 Telemedicine Education Services for lower-level rural hospitals
- 9 Haodaifu provider information website
- 10 Premium postnatal confinement hotel model
- 11 Postnatal home care services model
- 12 Lhasa Prefecture Maternal Child Health Association, previously One Heart World-Wide
- 13 Lifeline Express Train
- 14 Marie Stopes International China (MSIC)
- 15 Le-Nest

Using available information, the authors evaluated each of these programs to identify those that met the target criteria: innovative healthcare delivery models designed to make high quality care more affordable and increase access to care for a population in need. Four models were found to best fit the criteria: Lifeline Express Train, Lhasa Prefecture Maternal Child Health Association (formerly a One Heart World-Wide program), Marie Stopes International China (MSIC), and Le-Nest. The authors conducted both telephone and in-person interviews senior leadership of these organizations. IPIHD was unable to establish contact with the Lhasa Prefecture Maternal Child Health Association, however, so only three of the four identified healthcare delivery innovations are detailed in this report.

The results of our landscaping study suggest that both hypotheses are correct. Our initial findings indicate healthcare delivery innovation is happening in China but is not as easy to find as in other countries, in part because the public sector so strongly dominates healthcare provision, training, and regulation. This creates high barriers to entry for new models of care and can make it more attractive for innovations to avoid attention.

1 <http://www.ipihd.org/blog/where-are-the-health-care-innovators-in-china/>

2 <https://globalhealth.duke.edu/media/blogs/china/where-are-all-health-care-innovators-china>



The findings also suggest that healthcare delivery innovation is not happening in China to the same degree as in other countries and regions, despite significant access issues, disparities in quality, and overburdened systems. Pooling the knowledge of many experts involved in various aspects of China's healthcare sector, the authors only uncovered 15 examples of healthcare delivery innovation in China. Relative to other markets, such as India, this number is lower than expected. Further, only four of these models are specifically targeting populations with the most significant barriers to access. Again, this is perhaps surprising, given the disparities in access and the relative size of the market in China.

Several limitations to this study may contribute to the low numbers of innovative models uncovered. The solicitation of examples of healthcare delivery innovation was done almost exclusively by email and may have been more effective if accomplished through facilitated group brainstorming and other in-person events. Secondly, the sources targeted by this study primarily represent corporations and academics. Direct engagement of more experts from within healthcare delivery in China may have yielded more examples. Finally, the study period was five months long, from October 2012 to February 2013. An expanded period, perhaps a year or longer, may have resulted in more observations of innovative models.

Despite the limitations noted above, the examples of healthcare innovation that target access, quality, and affordability uncovered by this study provide insights into what types of healthcare innovations can succeed in China and the structural barriers to innovation growth.

Examples of healthcare innovation targeting access, quality, and affordability in China

Our landscaping study identified four innovative models of healthcare delivery designed to increase access, affordability, and quality of care. To further explore these models, including the context within which they operate and plans for scale, the authors conducted both telephone and in-person interviews with Lifeline Express Train, MSIC, and Le-Nest. As noted above, the authors were unable to establish contact with the Lhasa Prefecture Maternal Child Health Association, so that organization is not detailed here.

Lifeline Express Train (Lifeline) is an eye hospital on a train that uses the advanced rail infrastructure in China to deliver free cataract surgeries to the rural poor with scarce access to advanced eye care. Experienced ophthalmologists from top-tier hospitals deliver high-quality cataract surgery on trains equipped with advanced medical instruments. The trains travel throughout China, stopping in villages, where residents are screened and treated for cataracts. The Lifeline train model was adapted from a similar concept in India, where a Lifeline train hospital treats rural children with polio.

Since its launch in China in 1997 with a train donated by the government of Hong Kong, Lifeline has grown to include four train hospitals and by the end of 2013 had made 133 stops in 27 provinces, restoring eyesight to more than 146,000 rural residents. In 2009, Lifeline established local (permanent, non-rail) cataract care centers, with the goal of performing 200 free cataract surgeries each year. By 2013, Lifeline had established 36 local centers. Exclusively funded by donations, Lifeline is managed by the Chinese Ministry of Health, Chinese Foundation for Lifeline Express, and the Lifeline Express Hong Kong Foundation.

Marie Stopes International China (MSIC) was founded in China in 2000. Marie Stopes International is headquartered in the UK and operates



in over 40 countries in Africa, Asia, Europe, Latin America and the Middle East. The MSI model was contextualized to China with the goal of providing family planning and reproductive health services to unmarried youth (age 13 to 24), migrant populations, sex workers, and people living with HIV. While access to family planning services has been emphasized by China's government health system, the services are targeted to married women, leaving a large underserved population. MSIC has been successful in filling this gap. According to MSIC estimates, approximately 22% of China's 160 million youth and young adults have had premarital sex and 50% of those who are sexually active did not use contraception during their first sexual experience. Additionally, about 21% of sexually active young women become pregnant (usually out of wedlock) and 90% of those pregnancies are terminated by abortion. MSIC targets this underserved population.

MSIC developed the *You&Me* brand for its clinics, website, condoms, publications and projects with the slogan "Talk about it, think about it, decide about it, act on it!" The branding and approach emphasizes frank communication, mutual accountability, and careful choices. *You&Me* clinics have been established in Shinan and Licang districts of Qingdao, in the cities of Nanjing and Xi'an. MSIC reports that between 2000 and 2012, it provided subsidized and free medical tests for 230,480 individuals, prevented 14,800 unwanted pregnancies, and conducted voluntary counseling and testing for HIV for 7,837 individuals.

MSIC has also worked to influence the practices and policies of government family planning clinics in China. The MSIC patient-centered, "woman-friendly" clinical experience is qualitatively different than the standard offering at a public clinic. As a result of interactions with MSIC, government family planning services in Nanjing have changed their operations and approaches to care delivery, décor, and staffing to emulate MSIC.

Le-Nest is a not-for-profit private organization launched in 2009 in Shanghai by a group of medical students with technical support from Shanghai University of Traditional Chinese Medicine, Fudan University and its affiliated hospitals, and other medical institutions. Le-Nest aims to reduce social isolation and improve health outcomes for the elderly. Through disease management education, group exercise, psychological interventions, and physical therapy, Le-Nest targets prevention and treatment of non-communicable diseases including hypertension and diabetes. Le-Nest interviews each participant at the time of enrollment and conducts an initial exam including blood pressure, weight/height (body mass index), resting heart rate, and in some cases blood samples to test blood sugar levels. Program participants are given an individualized exercise and interaction plan and follow-ups occur at the patient's discretion or as indicated in the treatment plan. Le-Nest's goal is to prevent chronic conditions when possible and to improve outcomes (and reduce unnecessary complications) for those who already suffer from hypertension or diabetes.

Le-Nest's model also builds relationships and trust between patients and doctors at primary care facilities, encouraging patients to seek care for non-critical issues from primary care doctors (largely underutilized in China's healthcare system), rather than overburdened tier III hospitals. All care at Le-Nest is provided in the community, primarily through volunteers who have recently retired from the workforce.

The first Le-Nest community station was established in Lianyang, Pudong District, Shanghai in 2009. By the end of 2012, Le-Nest established five more sites in the Putuo District, Shanghai, altogether serving a cumulative total of 1,800 elderly people. Le-Nest was launched with funding from the local government and is now transitioning to a membership-fee model to ensure sustainability.

As a result of interactions with MSIC, government family planning services in Nanjing have changed their operations and approaches to care delivery, décor, and staffing to emulate MSIC.



Emerging Themes, Opportunities, and Challenges for Healthcare Innovators in China

As noted above, the findings from this landscaping study, while tentative due to the small sample size, indicate that both hypotheses may be correct.

- 1 Innovations that increase access to healthcare are present in China but are difficult to locate.
- 2 Structural barriers to innovation in China limit the number of emerging innovations and slow their growth, relative to other countries.

Healthcare delivery innovation targeting issues of access and affordability is happening in China but this sample suggests at a smaller scale and slower rate than in other emerging economies, such as India and Kenya. Given the recent rate of economic growth that has created an astonishing 3 to 5 times increase in overall GDP over two decades (Le Deu ,Parekh, and Zhang 2012), stronger entrepreneurial growth in healthcare delivery would be expected.

Geographic disparities do not necessarily inhibit healthcare delivery innovation in the west. In fact, these geographic disparities also create opportunity for innovations targeting access issues.

Several themes emerged from analysis of the full sample of 15 innovative models, with a particular focus on the three models profiled above. These themes provide insight into both why existing innovations are relatively hard to find and what are the structural barriers that discourage and slow innovation. While no definitive conclusions can be drawn from such a small sample, these four themes suggest areas for continued inquiry to better understand how and at what rate healthcare innovation is evolving in China.

- Economic and demographic disparities between the eastern and western regions of China shape emerging healthcare innovations.
- Innovation-ready gaps are still emerging: The 2007 and 2009 health care reforms are creating gaps that may encourage innovation, but it is early, and persistent opportunities for innovation are still being defined.
- Successful innovation in China often requires public-private collaboration, which can be challenging and may discourage entry of entrepreneurs into the market.
- It is unclear if “structural uncertainty” in the healthcare sector will fuel innovation as it has in China’s information technology sector.

Healthcare and innovation in the east versus the west

There are significant economic and demographic disparities between the eastern and western regions of China. The eastern provinces have experienced fast urbanization and industrialization, while western provinces remain primarily rural and remote and have not benefited in the same way from the economic gains seen in the east. This means that emerging innovations will likely look very different depending on whether they originate in the west or the east and that models may not translate well from one region to another.





In the growing eastern economy, there are significant opportunities to meet the needs of a growing middle- and upper-income population that can afford to pay for private clinics, supplemental insurance, and out-of-pocket costs for new drugs and devices. Innovation is filling gaps created by the demand for higher quality health services for those who can afford them. Among the 15 innovative models identified by this landscaping study, eight are located exclusively in the east and another five serve eastern as well as western locations. Most of these target the growing affluent patient segment desiring higher quality care.

Geographic disparities do not necessarily inhibit healthcare delivery innovation in the west. In fact, these geographic disparities also create opportunity for innovations targeting access issues. For example, Lifeline creates a platform to export resources in the form of no-cost eye care from the east, which has more healthcare infrastructure and workforce, to poor, remote western regions. The design of MSIC is also in part designed to address east/west disparities. As migrant workers leave western regions to seek jobs in the eastern provinces, they usually do not qualify for government health services without formal-sector employment. The majority of migrants from western provinces work in the construction trade or other skilled and unskilled work in the informal work sector. Because government healthcare provision is organized at the provincial rather than national level, informal workers do not have provincial healthcare coverage as émigrés from another province. MSIC clinics fill this gap by specifically targeting this underserved population.

This study's sample, coupled with economic and demographic analysis, suggests that healthcare innovation will likely target the expanding population of economically affluent in China. However, even as recent analyses by McKinsey & Company suggest the proportion of poor is declining in

China (Le Deu, Parekh, and Zhang 2012), a significant market of greater than 200 million people exist at the base of the pyramid (BoP) due to China's sheer size. Typically entrepreneurs look for changes in technology, demographics, and social movements to find opportunity. Perhaps future Chinese healthcare innovators will be drawn to the BoP and gaps created by the east/west disparities.

Innovation-ready gaps are still emerging in the wake of recent healthcare reforms

China continues to adapt to the healthcare reforms of 2007 and 2009, which seek to improve access to and quality of care (see Appendix A for a description of the China healthcare system and recent reforms). While trends associated with the healthcare reform have been identified, the full impact of reforms and which of the existing gaps will persist is not yet clear. Innovative models targeting the underserved are less likely to emerge in such an uncertain environment because sustainability and growth prospects, critical to the success of a new venture, are difficult to project.

The success of MSIC in the sector of reproductive health suggests that innovation can fill policy-created gaps in healthcare delivery. MSIC identified patient demand that was unmet by government policies on family planning and reproductive health, which leave out certain segments of the population: migrant workers, sex workers, and patients living with HIV. MSIC provides an example of how a healthcare delivery model innovation can fill service gaps created by public health policy.

Innovative models targeting the underserved are less likely to emerge in such an uncertain environment because sustainability and growth prospects, critical to the success of a new venture, are difficult to project.



A recent Citigroup analysis of the Chinese health-care market (Yeh and Chen 2012) identifies several noteworthy features that could encourage innovative solutions. This report notes that while recent reforms have increased government funding through social health insurance for patient care, funding levels remain inadequate, given the population and disease burden facing Chinese citizens. There are key shortages in medical resources and well-trained health workers that are exacerbated by patient demand for tier III hospitals, which are perceived to have the best trained staff.³ Patients often forego underutilized neighborhood clinics and tier I and II hospitals and instead face long waits at oversubscribed tier III facilities in hopes of receiving higher quality care. Compounding these system strains is the lack of intermediate treatment facilities in China, such as rehabilitation and occupational therapy centers, resulting in longer hospital stays with no options for lower-intensity care.

Many provinces are working to remedy the problem of imbalanced demand at the tier III hospitals. In Guangzhou, for example, there have been intentional strategies to teach skills and open new clinics in tier II hospitals with the hope that patients will shift their demand to those hospitals. The results have been spotty as reported informally to IPIHD. Patients continue to seek care where they perceive the highest quality services can be found. Innovation is needed to shift demand away from the tier III hospitals, particularly for the poor who suffer direct income losses when they wait for long periods to see doctors who are oversubscribed.

Le-Nest, one of the innovations profiled above, is addressing this challenge by directing their clients away from tier III hospitals and towards community healthcare facilities for chronic disease management. They offer counseling services to their clients including information about the specialties and personalities of the physicians in their community healthcare facilities and the most efficient ways to communicate with physicians in the limited time allotted for each visit. Le-Nest's initial participant data show an increase in the number of visits to primary healthcare facilities, as well as greater satisfaction with the healthcare services.

The Chinese healthcare system is also facing pressure from a scarcity of skilled nursing facilities, physical therapy facilities and other types of rehabilitation facilities. This is an increasingly critical gap, as China has the largest population of people 65 and older in the world. Without these facilities, elderly patients are subject to long and costly hospital stays. The government has articulated a policy of 90/7/3 wherein it expects 90% of elderly care to be provided as home-based care, 7% as community care, and 3% as institutional care.

A general rule of thumb is that 5 beds per 100 elderly people are needed to meet institutional care requirements. Some estimates suggest that China's current capacity is 1.5 beds per 100 elderly people (Murray 2013). This is an enormous gap that will require investments in infrastructure and workforce development, as well as significant investment in home-based and community care. These gaps create opportunities for innovation in care delivery models to help realize China's ambitious 90/7/3 policy, particularly for poor elderly populations.

Patients often forego underutilized neighborhood clinics and tier I and II hospitals and instead face long waits at oversubscribed tier III facilities in hopes of receiving higher quality care..

3 Citigroup's analysis suggests that there are 1.8 nurses/doctors per 1,000 patients in China as compared with OECD countries that average 3.9 nurses/doctors per 1,000 patients (Yeh and Chen 2012); local experts have suggested to IPIHD that in addition to this shortage, there is wide variation in the quality of physician, nurse, and midwife training and on-the-job experience in China, with the best-qualified healthcare workers concentrated in the higher tier (II & III) hospitals.



The Minhang project in the Hongqiao district of Shanghai is an example of a project with the potential to innovate to fill the gap in care available to the elderly population. YiMei Capital, an asset management firm in China, has partnered with city and district officials to propose the building of 15,000 housing units for elderly residents near train and airport campuses. The Minhang project has the opportunity to innovate by integrating housing with preventive services for its residents that can keep them active and out of in-patient healthcare facilities. The degree to which the project will focus on health innovations rather than simply filling an elderly housing gap remains to be seen. If project developers take a long-term view, they may realize the earning potential of a housing community that provides outpatient health care services and services to support self-care.

Le-Nest is also innovating in the area of preventive and community-based care for the elderly, particularly those with hypertension and diabetes. Le-Nest provides disease management education and community-based interventions through health promotion activities to those healthy enough to be active in the community. Volunteers from the community, typically recently retired members of the community, conduct these activities. The organization also provides weekly in-home physical therapy for those with limited mobility, including training in self-management skills for patients and their primary caregivers. The Le-Nest model is also designed to address psychological issues facing the elderly such as loneliness, anxiety, and depression by strengthening social and emotional support among Le-Nest members.

More time is needed for the recent health reforms to be fully realized and for persistent gaps, particularly at the base of the pyramid, to become clearly identified. Once stabilized, the Chinese healthcare ecosystem will likely become more hospitable to innovation.

Public-private collaborations may be promising path for innovation

China's formal healthcare sector is dominated by government facilities, especially for the poor. Given the strong presence of the public sector in all aspects and sectors of healthcare delivery, public-private partnerships are a likely route for successful innovation.

Initial analysis suggests that the health-related, non-governmental sector (NGO) in China is small, relative to the market. In other healthcare markets, IPIHD has observed that the presence of innovators incites more innovators to enter the space. The small number of NGOs and private-sector innovators in China's healthcare sector appears to have not yet reached the critical mass needed to facilitate this movement. While there is no formula for the number required to create a pro-innovation environment, it does appear, when compared to other pro-innovation healthcare markets (e.g. Kenya and India), that the enabling environment in China has not yet reached sufficient size and capacity to fuel and sustain private-sector innovation adequate to meet the current healthcare needs.

A healthcare innovation enabling environment is a milieu of health and business institutions, capabilities, capital markets, legal systems, and labor markets that allow health-related businesses and organizations to form and grow (Private Sector Task Force, Global Health Workforce Alliance 2012). The enabling environment, which has also been described as an innovation ecosystem (Adner 2012), has an important effect on the manner in which innovations emerge, evolve, and in turn, act upon the environment in which they operate.

It does appear, when compared to other pro-innovation healthcare markets, that the enabling environment in China has not yet reached sufficient size and capacity to fuel and sustain private-sector innovation adequate to meet the current healthcare needs.

Partnering with the public sector, and clearly demonstrating a benefit to the public health system, can help to ensure sustainability of private-sector healthcare delivery innovations.

It appears that China's healthcare innovation enabling environment remains too underdeveloped to spawn significant private-sector innovation. Interviews with innovators in China suggest that the small NGO and innovator space stems from government domination of healthcare delivery and the continuing adaptation to policy reforms. Government policies have formally recognized a need for private-sector contributions to healthcare in China, such as recent changes that open the way for private hospitals (Yeh and Chen 2012, 297). In practice, however, these policies may be more ambivalent in their purpose than first appears. For example, the regulation requires private hospitals and clinics to put in place their service offerings, buildings, equipment, and staff for full operation, before a license to operate is granted. Risk is absorbed entirely by the entrant and, even after significant investment, the enterprise can be denied licensure.

With such a high barrier to entry, it should come as no surprise that the private-sector innovation space is relatively small in China. Our study suggests that partnering with the public sector, and clearly demonstrating a benefit to the public health system, can help to ensure sustainability of private-sector healthcare delivery innovations. MSIC and Le-Nest both highlight the potential benefits, as well as challenges, associated with developing public-private partnerships in China's healthcare delivery system.

MSIC's founders originally attempted to open a clinic in Beijing, and failed, due to significant delays and ultimately rejection of licensure by government regulators. However, MSIC has been successful in Nanjing and Xi'an where it has collaborated with the government to offer services to underserved populations. Through the

support of local political leaders, MSIC has not only scaled its own services but also influenced practices at public clinics. Much of the organization's growth is due to its strong and positive relationship with a well-positioned government leader who champions their model. This successful public-private collaboration may now be threatened as healthcare reform continues. As part of the 2011 healthcare policies to support the 2009 reforms, multiple agencies that provide child and maternal health and family planning will be consolidated. Collaborations between MSIC and government services will have to be renegotiated and perhaps restructured, due to this policy change.

Le-Nest was founded by a group of traditional Chinese medicine students who recognized a gap in public provision of healthcare: preventive healthcare services. The vast majority of regulations for healthcare providers in China are focused on hospitals and other clinical providers and, perhaps because it is an emerging field in China, there are few restrictions on preventive care providers like Le-Nest. This lack of regulation meant that Le-Nest did not face high barriers to entry, making it possible to pilot the model on a small scale. In the early days, the Le-Nest founders created allies and advocates within the local government and aligned their model with recent policy initiatives to combat hypertension and diabetes with an emphasis on home-based and community care for the elderly. This strategy appears to have worked: the Shanghai government provided critical start-up funds for their first community station and subsequent stations received financial support from the Bureau of Civil Affairs.



Structural uncertainty may lead to growth in healthcare innovation

Dan Breznitz and Michael Murphree argue in the *Run of the Red Queen: Government, Innovation, Globalization, and Economic Growth in China* (2011) that China's growth in information technology (IT) innovation has been propelled (and constrained to a lesser degree) by government policies of "structural uncertainty". Breznitz and Murphree identify four features of structural uncertainty:

- Reforms are launched by a central government;
- Bureaucracy is organized wherein multiple levels (central, provincial, municipal, as well as ministries with overlapping jurisdiction) are allowed to act and one is not necessarily inferior/superior to another;
- Personal and role-related power can be exercised in governmental agencies/ministries; and
- Ever-changing and loosely defined reforms (economic, in the case of IT innovation).

According to Breznitz and Murphree (2011), loosely structured policies at differing jurisdictional levels create policy uncertainty, which can be exploited by provinces and municipalities that interpret policies differently to pursue their own local goals. Central government may even encourage provincial or municipal competition in a loose or unstructured policy environment where the central policies suggest conservative practices, but at the local level, much more progressive practices are allowed. Powerful individuals with jurisdictional authority must be placated so as not to intervene and revert to the more conservative interpretation of policy. It is in this context of ambiguous or structural uncertainty that innovation can flourish (Breznitz and Murphree 2011).

While structural uncertainty introduces risk, it can also foster innovation when regulations are open to interpretation and private investment works together with government investment to fuel fast growth and the diffusion of innovation. The analysis presented by Breznitz and Murphree suggests that structural uncertainty is such a strong force that China's domination in IT production is happening "against the declared wishes of China's central government" (Breznitz and Murphree 2011, 196).

Could a healthcare innovation space emerge in China as robust as its IT sector? Is it possible that healthcare innovation, across all income groups, could flourish in China to the point that it could provide an important laboratory to understand how innovation is incited, scaled and replicated across major regions and cities?

An initial (and perhaps oversimplified) adaptation of the four features of structural uncertainty to China's healthcare sector suggests that this concept may provide insight into the evolution and future of innovation in healthcare delivery in China.

- Healthcare reforms have been initiated by central government.
- Many overlapping ministries at various jurisdictional levels have influence over the health sector; they operate at provincial and municipal levels to interpret and implement national policies and local priorities.
- Personal and role-specific power is exercised by individuals in the various agencies and ministries with jurisdiction over health.
- Successive reforms in 2007 and 2009 have generated significant activity and the functional meaning of these reforms is open to interpretation across jurisdictions.

While structural uncertainty introduces risk, it can also foster innovation when regulations are open to interpretation

Innovators identified in this study have demonstrated an ability to cope with the uncertainty and exploit unclear policies to initiate and grow their programs and services by aligning and collaborating with the government.

It is unclear, and beyond the scope of this landscaping study to determine, if structural uncertainty in the health sector is constraining or potentiating healthcare delivery innovation. Perhaps structural uncertainty is directing innovation toward specific gaps identified by the government or unintended gaps that result as the policies are implemented. Innovators identified in this study have demonstrated an ability to cope with the uncertainty and exploit unclear policies to initiate and grow their programs and services by aligning and collaborating with the government. As discussed in the previous section, MISC and Le-Nest have direct linkages to government at the local level; the Lifeline Express Train is connected at the central government level. One tentative hypothesis is that it is necessary to align with and collaborate with the government to manage the uncertainty created by powerful individuals and overlapping ministries.

MISC and Le-Nest are also relatively small-scale innovations and their small size reduces the risks associated with structural uncertainty. They may be too small for a ministry or powerful individual to intervene. But if they grow, and in particular if they grow beyond the expectations of the central government, like the IT sector, it will be instructive to see how they manage uncertainty while gaining size and evolving their mission and operational strategies.

Next Steps

Despite dramatic economic growth, increases in per-capita healthcare spending, and sweeping policy reform, innovation does not appear to be flourishing in China's healthcare delivery sector. This landscaping study tentatively suggests that the initial hypotheses are correct: healthcare delivery innovation is happening to some extent in China but is difficult to find; and structural barriers limit the emergence and growth of healthcare innovation in China, relative to other countries.

Several themes emerging from these findings indicate valuable areas for further study and exploration, with implications beyond China's borders. For example, the economic and demographic disparities between China's eastern and western regions may play a significant role in how and where innovations emerge and replicate, particularly for models that target access, quality, and affordability in needy populations. New models of healthcare delivery that succeed in China's western provinces will likely have lessons for healthcare delivery in other remote and rural regions around the world. Chinese healthcare delivery models that leverage the resources of the east to meet the needs of the west, such as Lifeline, may also have implications for other nations with significant geographic disparities. New research should capture these lessons from Chinese innovators so they can be applied in future contexts.

Additionally, new gaps in healthcare delivery will emerge as the 2007 and 2009 health reforms continue to be implemented across China, potentially encouraging an increase in innovative models to fill these gaps. Further research should explore whether the presence of healthcare delivery innovation grows as reform implementations slows and persistent opportunities for innovation are defined. This context provides an opportunity to consider how the implementation of policy change affects innovation over time. Related questions of how to create successful public-private partnerships and how to reduce barriers to entry for private-sector innovations will be relevant to other countries with public-sector dominant healthcare systems.

Given the healthcare challenges faced by China, including meeting the needs of the world's largest aging population, innovative models may be not just beneficial, but necessary. Our findings here suggest that the government should increase opportunities and support for innovators to test their ideas and enter the market. Likewise, entrepreneurs should watch policy and demographic shifts to identify opportunities to meet emerging needs. Innovative models of healthcare delivery in China have the potential to play a transformative role in China's healthcare reform, and bring about results that will undoubtedly reverberate around the world as other nations search for solutions to similar challenges.

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Appendix A: Overview of Chinese Healthcare System and Recent Reforms

Structure and Regulation

China's local government structure is made up of five levels from top to bottom: province, prefecture, county, township and village. China is divided into 34 provincial-level regions (including 23 provinces, 4 municipalities, 5 autonomous regions and 2 special administrative regions), and then further into 334 prefecture-level regions (The Central People's Government of the People's Republic of China 2013). The State Council, chaired by the Premier and representing each national governmental department and agency, directly supervises provincial governments and is responsible to ensure that national policies are implemented by the provincial-level regions (Hillier and Shen 1996). Provincial-level governments oversee the prefecture-level governments, prefecture-level governments oversee the county-level governments and so on.

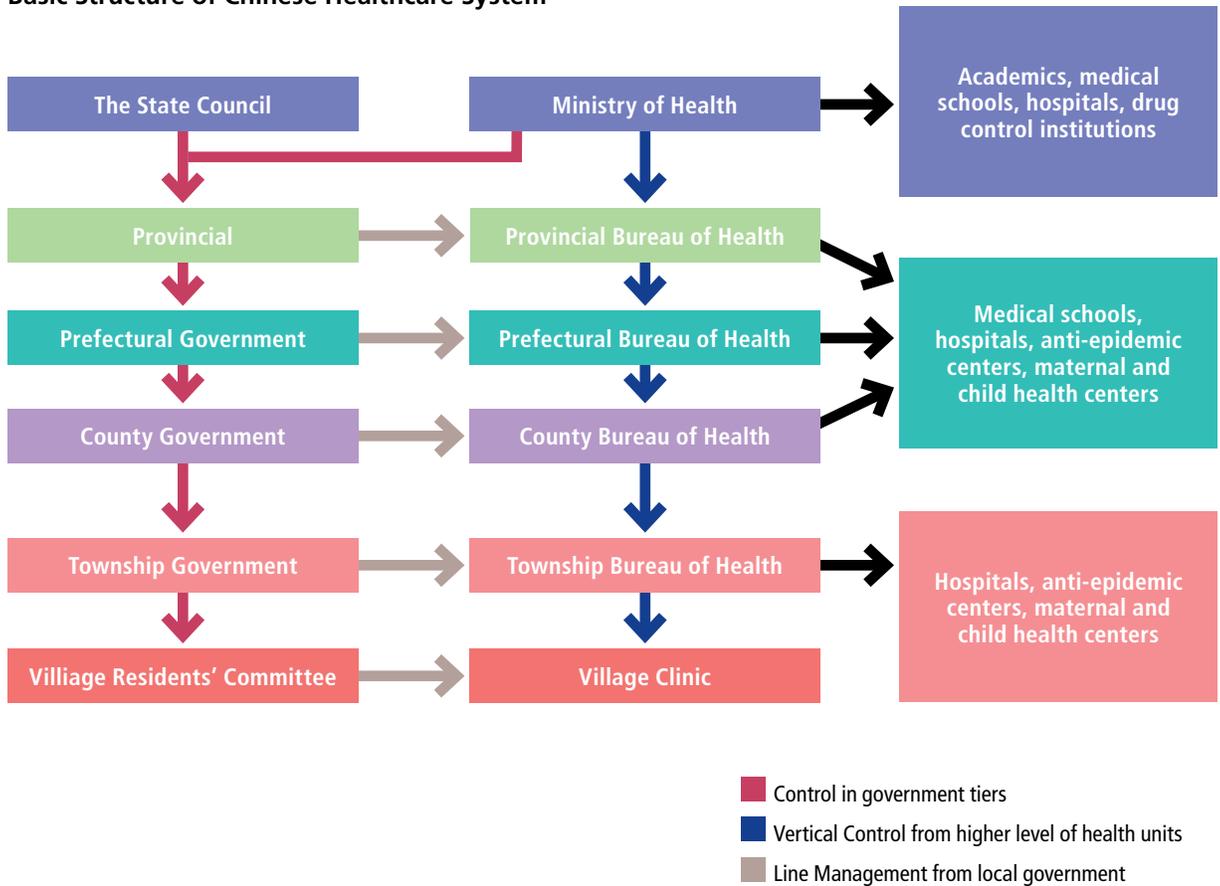
The administrative structure of the Chinese healthcare system mimics that of the government (see figure to the right for the basic structure of the Chinese healthcare system). The Ministry of Health (MOH) is the central (national) department subordinate to the State Council. Below the MOH, there are Departments of Health at the provincial level, Bureaus of Health at prefecture and county level, and township health centers and village clinics. The MOH holds the central budget and directly controls and funds several medical schools, hospitals and research institutions. The MOH is primarily responsible for: 1) facilitating the healthcare system reform including strategic development goals, plans, and policies, and drafting legal proposals on health, food security, medicines, etc; 2) regulating drug purchases, delivery, and use; 3) creating and managing food security standards; 4) coordinating the distribution

of healthcare resources; 5) making policies for the development of community health and maternal and child health; 6) addressing health emergencies and disease prevention; 7) supporting the development of traditional Chinese medicine; and 8) medical education (Ministry of Health of the People's Republic of China 2008). The Department of Health (provincial level) and Bureau of Health (prefecture and county level) share in these responsibilities but at a lower administrative level.

At the provincial level, there are tertiary hospitals, a traditional Chinese medicine hospital, and specialized centers involved with maternal and child health, maintenance of pharmaceutical standards, and the prevention and control of epidemics. There are also top or middle-rank medical schools and other institutions for training healthcare professionals.

At the prefecture and county levels, there are tertiary and secondary hospitals, a traditional Chinese medicine hospital, a center for pharmaceutical standards, specialized clinics for maternal and child health and containment of epidemics, and small and low-rank health schools for training rural doctors and nurses. The provincial specialized centers or prefectural specialized clinics serve as primary health providers (Bhattacharyya et al. 2011). Townships usually have a small hospital with doctors trained in middle- or low-rank medical schools. Villages typically have clinics staffed by village doctors, also known as "barefoot doctors," who received minimal medical or paramedical training and practiced medicine in villages without a license before receiving further formal medical training and licensure (Hillier and Shen 1996).

Basic Structure of Chinese Healthcare System*



*Source: Hillier and Shen 1996

In addition to the health institutions embedded in the government health structure, other companies and organizations are also involved in healthcare delivery. The People's Liberation Army (PLA) and some large state-owned industries such as the railways have their own hospitals and medical schools. Most hospitals and medical schools affiliated with PLA are considered to be of high quality and provide services to political

leaders (Hillier and Shen 1996). Although public hospitals deliver 90 percent of healthcare services, the market share of private hospitals is growing, especially after the 2009 healthcare reforms (see the section below on healthcare reform for more detailed information about privatization of public hospitals) (Yip et al. 2012).

Although the share of out-of-pocket health expenditures decreased from 2005 to 2010, the high proportion of out-of-pocket expenditures still remains one of the major problems in the current Chinese healthcare system.

Funding and Insurance

The Chinese healthcare system is financed by the government, state-owned and private enterprises, and individuals. Government contributions are covered by taxation, various user fees, and other income sources such as the public welfare lottery (Hougaard, Osterdal, and Yu 2011). State-owned enterprises substantially contributed to the Urban Employee Basic Medical Insurance (UEBMI) scheme, an employment-based insurance that covers urban workers, immediately after healthcare reforms in the late 1990s, but more recently, the central government is working to also encourage participation of private enterprises. In addition, individual payment plays a significant role in financing the current Chinese health system. As a result of the 1990s reforms, government and social health expenditures decreased dramatically and out-of-pocket payments increased significantly (Hougaard, Osterdal, and Yu 2011). Although the share of out-of-pocket health expenditures decreased from 53 percent in 2005 to 38 percent in 2010, largely due to the 2009 reform, the high proportion of out-of-pocket expenditures still remains one of the major problems in the current Chinese healthcare system (Long, XU, Bekedam and Tang).

The current healthcare insurance system in China is the product of a series of reforms and local experiments enacted since the 1990s. Generally speaking, there are four types of public medical insurance schemes that finance healthcare expenditures for four population categories: urban employees, urban residents without formal employment, rural residents, and low-income populations (Hu et al. 2008).

Urban workers employed in the formal sector are covered by the UEBMI scheme mentioned above, which was established by the State Council at the end of 1998. The employer-based scheme consists of a pooled fund for inpatient services and an individual medical account for outpatient services. The employer pays approximately 6 percent of the individual's gross income into the scheme, of which 30 percent is allocated to the individual medical account and 70 percent to the pooled fund (contribution rates may vary by region) (Hougaard, Osterdal, & Yu 2011). In turn, the individual pays 2 percent of their gross income into their individual medical account (Hu et al. 2008). In 2010, inpatient care expenses were reimbursed at a rate of 68.2 percent and all outpatient expenses were paid using the individual medical account (Yip et al. 2012).

Starting in 2007, urban residents without formal employment could choose to participate in the Urban Resident Basic Medical Insurance (URBMI) scheme. The URBMI targets urban residents who are not covered by other schemes, including children, students and migrants (Hu et al. 2008). According to Yip et al. (2012), the government paid 300 Renminbi (RMB) to assist with enrollment and individual contributions ranged from 20 to 250 RMB from western to eastern provinces in 2010. In 2010, the average annual premium was 138 RMB per person. URBMI does not cover outpatient services and the inpatient service reimbursement rate was 47.9 percent in 2010. The goal of the central government was to enroll 50 percent of cities by the end of 2008 and all cities by 2010. Available data shows that the actual enrollment rate reached nearly 64 percent in 2008 and 93 percent in 2010 (Yip et al. 2012).

For the rural population, comprising more than half of China's total population, the New Cooperative Medical Scheme (NCMS) was established in 2003. This set up a local voluntary insurance scheme for which both provincial and local governments provide subsidies for enrollment (Hu et al. 2008). The rural cooperative healthcare fund only reimburses inpatient service expenses, which are usually reimbursed after patients have paid the costs upfront. In this scheme, the government paid 300 RMB to assist with enrollment and individual contributions ranged from 20 to 50 RMB from western to eastern provinces in 2010 (Yip et al. 2012). In 2010, the average annual premium was 157 RMB per person (Yip et al. 2012). The NCMS reimbursement rate increased from 37.8 percent in 2008 to 43.9 percent in 2010. By 2010, 96.6 percent of rural residents had enrolled in the scheme (Hougaard, Osterdal, and Yu 2011).

In addition to UEBMI, URBMI, and NCMS, a Medical Assistance (MA) program to pay premiums for the very poor was piloted in 2003 and 2005 and later expanded nationwide in 2006 and 2008 (Barber and Yao 2010). It is funded by governments at all regional levels, social donations, and a public welfare lottery and is managed by the Civil Affairs Ministry (Hu et al. 2008; Yip et al. 2012). The MA program provides financial assistance to urban and rural residents for enrollment in the URBMI and NCMS as well as temporary medical assistance (Barber and Yao 2010). By the end of 2009, more than 93 million low-income residents were covered by URBMI and NCMS through the MA program and two-thirds of those were rural residents (Barber and Yao 2010).

Healthcare Workforce

The healthcare workforce in China is primarily comprised of healthcare professionals and management staff. Healthcare professionals include licensed doctors, licensed assistant doctors, nurses, pharmacists, laboratory technicians, clinical radiologists and other technical staff involved in health research (Anand et al. 2008).

As Anand et al. (2008) describe in their appendix, China offers a variety of medical education programs, with training ranging from one to eleven years. Doctor training programs fall into three ranks: primary education (1 to 3 years) for training of village doctors, secondary training (2 to 3 years) for doctors who will work in secondary hospitals, and tertiary training (3 to 11 years) for doctors who will work in secondary and tertiary hospitals. Programs of the highest rank are further divided based on the official degree received: 3-year associate degree, 4- or 5-year bachelor's degree, and 7-year (or more) master's and doctoral degrees. As for nurse training, there are 2-year secondary and 3- to 5-year tertiary education programs. Medical graduates who have received a bachelor's or higher degree are eligible to become licensed doctors after a one-year internship in a hospital and successful completion of the doctor licensing examination (DLE). Those who receive lower degrees are eligible to become licensed assistant doctors after completing an internship (length is degree-dependent) and passing the assistant doctor licensing examination (ADLE). Licensed assistant doctors are also eligible to take the DLE after a period of time practicing (length is degree-dependent) to become licensed doctors. Graduates of a tertiary nursing education program are exempt from the nursing certification examination, while those coming out of secondary programs are required to take it (Anand et al. 2008).

With the stable growth of graduates and the relatively low entry burden to become a doctor, China has far more doctors than nurses.

The wide range of medical education programs and comparatively low standard for qualifying as a doctor in China partially explains the public's widespread mistrust of doctors, which leads to overburdened tertiary hospitals and tense doctor-patient relationships. In 2005, only about one-third of China's doctors had received education at a university level or higher and the proportion of nurses was only 2 to 3 percent (Anand et al. 2008). Doctors with better medical education primarily work in tertiary hospitals in large cities, hospitals that are overcrowded with patients whose health issues are intended be treated at primary or secondary healthcare facilities. One of the major aims of the 2009 healthcare reform was to build a strong delivery system based on primary healthcare. Recent results show there is still room for improvement (Yip et al. 2012). In addition to the low percentage of highly trained doctors and overcrowding problems at tertiary hospitals, doctors in China are often regarded as profit-oriented and cold-hearted. The frequent attacks on physicians by relatives of patients in recent years underscore the need to ease the tense doctor-patient relationship (Hesketh et al. 2012).

Over the past 50 years, both the absolute number and the density of doctors and nurses have increased steadily (except during the ten years of Cultural Revolution from 1966-76). One major reason for the increase is the massive expansion of medical education, especially since 1998. However, data indicates that there is still a misalignment between the number of workers produced and the actual number of workers needed, as many medical school graduates choose to pursue other professions. In fact, between 2000 and 2005, the stock of all health workers increased by 131,000 while the total the number of health workers graduating from all health education institutions was nearly 2 million (Anand et al. 2008).

With the stable growth of graduates and the relatively low entry burden to become a doctor, China has far more doctors than nurses. In 2005, the national ratio of doctors to nurses was 1.4:1, with a ratio of 1.3:1 in urban areas and almost 2:1 in rural areas (Anand et al. 2008). However, due to geographic disparities, the high number of doctors does not result in high rates of access to healthcare services in rural areas. Medical professionals predominately practice in urban areas and this imbalance is even more pronounced among the most highly trained health workers. The density of high-quality health professionals is more than three times as high in urban areas than in rural areas, making the access to high-quality healthcare for the rural poor even more limited (Anand et al. 2008).

Health Reform

The Chinese healthcare system has long been accused of failing to efficiently deliver healthcare services at an affordable cost. Out-of-pocket payments rose from 20 percent in 1980 to 59 percent in 2000, then decreased to 38 percent in 2010 (Hu et al. 2008; Long, XU, Bekedam, and Tang). Additionally, insurance coverage has been insufficient with a large gap existing between urban and rural residents and limited high-quality healthcare resources are unevenly distributed between rural and urban areas, further narrowing access to care for rural residents. A series of health reforms have been designed to address these issues as well as escalating costs and incentives for doctors to make profits from over-prescribing pharmaceuticals.

The government instituted reforms, including URBMI and NCMS, to increase insurance coverage between 2003 and 2008 (Meng et al. 2012). In addition, a comprehensive healthcare reform was launched in April 2009, with the goal of providing affordable and basic healthcare for all by 2020. The central government committed to spending about \$125 billion USD between 2010 and 2012 to accomplish comprehensive universal healthcare coverage (Yip et al. 2012). The current reform targets five areas: health insurance coverage, essential medicines, primary healthcare delivery, public health services, and public hospital reform.

As Yip et al. (2012) describe, by subsidizing rural and urban residents to enroll in the URBMI and NCMS insurance schemes, the reform aims to expand insurance coverage to more than 90 percent of the Chinese population. Recent data shows that the coverage had reached 92 percent by 2011 (Keqiang 2011). The reimbursement rate for the three insurance schemes has increased since 2008, with NCMS experiencing the greatest increase.

Drug issues, including counterfeiting, overuse of antibiotics, and unregulated intravenous injection, are prevalent in China. To regulate pharmaceutical drug use, the Chinese government introduced an essential medicine program for public primary healthcare institutions to improve access to safe and effective drugs. A national essential medicine list containing 307 generic medicines was created based on need of disease burden, safety and clinical efficacy, affordability, past use patterns, and availability of supply. All public primary healthcare institutions are required to stock and prescribe only the medicines on the list (Yip et al. 2012).

Non-communicable diseases (NCDs) account for 80 percent of China's annual deaths. To address this issue, the government has committed extra funding to deliver a defined package of basic public health services targeted to combat the NCD burden. The government subsidized 15 RMB per person in 2009, increasing subsidies to 25 RMB in 2011. The subsidy is shared by multiple levels of government, with the central government providing a higher proportion for lower-income provinces (Yip et al. 2012).

In China's primary health system, patients are allowed to refer themselves to see primary care and specialist doctors. However, the quality of training and ability of doctors practicing medicine in China varies substantially and there is a general lack of trust in those who work at primary healthcare facilities. As a result, patients who could be treated in primary healthcare facilities instead visit tier III hospitals, overburdening those hospitals while lower-level facilities are underutilized. To address this challenge, the government is improving the infrastructure of local community health centers, especially in rural areas, and enhancing capacity building of local health practitioners. For example, the government encourages medical students to work in township health centers by waiving their tuition if they are willing to work there for at least three years after graduation. It also offers opportunities for the healthcare workers in rural healthcare facilities to receive on-the-job training in tertiary hospitals and encourages specialists in tertiary hospitals to rotate to rural healthcare facilities to assist with capacity building (Yip et al. 2012).

Public hospitals are the backbone of the Chinese healthcare delivery system, accounting for more than 90 percent of outpatient and inpatient services.

Public hospitals are the backbone of the Chinese healthcare delivery system, accounting for more than 90 percent of outpatient and inpatient services. However, the cost, efficiency, and quality of services provided are frequently questioned and may be negatively affected by the structure of hospital governance (Yip et al. 2012). For example, the MOH and National Development and Reform Commission (NDRC) share investment decisions for public hospitals although the MOH functions to prioritize health improvement and NDRC works to promote social and economic development. As a result, public hospitals may receive conflicting policies and regulations. The monopoly of the healthcare market by public hospitals further contributes to low standards of efficiency.

In response, the 2009 reform pilots several strategies across 16 sites, including 1) clearly stating the roles and functions of hospitals; 2) shifting strategy to market competition by privatizing public hospitals; 3) setting up special commissions to coordinate between various government departments in regards to their conflicting policies toward hospital governance; 4) reorganizing the responsibilities and power of governing departments by creating a new agency to manage public hospitals; and 5) adjusting the decision-making power of individual public hospitals. The actual effect of the reform remains largely unknown (Yip et al. 2012).

The Chinese healthcare system faces many challenges including escalating costs, perverse provider incentives (90 percent of provider income comes from fees for medical services and sale of medicines), access disparities, lack of preventive and primary care services, and credibility problems (Hougaard, Osterdal, and Yu 2011). The 2009 comprehensive reform aims to address these issues. An increase in health insurance coverage and inpatient reimbursement has been observed in the past three years. Recent data suggest several ongoing challenges, including ineffective implementation of the medicine list, lack of demand for primary care providers, insufficient insurance coverage, especially for migrant workers, and financial and technical problems that adversely affect implementation at the local level (Yip et al. 2012). Policy makers are now focusing on the goal of providing universal health care by 2020.

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Appendix B:

Description of Healthcare Innovations Included in Analysis

Name	Innovation	Purpose and population	Location	Funding source
Chinese Aged Diabetic Assistant (CADA) (mHealth)	Smartphone app delivers an age- and culturally- appropriate interactive diabetes self-management support system	Improve diabetes management and increase quality of life among elderly diabetics	Beijing	Created by Microsoft Research, purchased by individual consumers
12580 Hospital Booking System (mHealth)	Mobile system provides multiple patient contact services to facilitate booking of hospital appointments	Ease the difficulty in scheduling appointment with doctors, especially in tier III hospitals; improve access to high-quality healthcare for rural residents	Guangdong province; 93 hospitals have joined the network	Created by China Mobile, purchased by individual consumers
Mobile health projects led by Professor Liu at the Chinese Academy of Science (mHealth)	1) a clinical decision support system for personalized medical practice; 2) mHealth initiatives for household management of hypertension and diabetes; 3) internet-based telemedicine system to bridge community clinics and tier III hospitals	Design and test new ways to leverage available mobile technology to improve healthcare and health outcomes	Shanghai	Shanghai Advanced Research Institute, Chinese Academy of Science
Spring Rain Mobile Doctor (mHealth)	Smartphone app provides remote consultation services to patients through text, pictures or phone calls; information for self-diagnosis; and locations of nearest doctors, pharmacies and hospitals	Support better health management and disease treatment via mobile technology	Nationwide	Purchased by individual consumers
China Wireless Heart Health (mHealth)	Provide rural health clinics with 3G-enabled smartphones with built-in electrocardiogram sensors to allow remote screening and monitoring of cardiovascular diseases	Prevent and manage cardiovascular diseases, especially among patients in resource-scarce settings	Nationwide	Created by Qualcomm
Intelligent Health Management Self-Service (mHealth)	Self-service terminals provide remote consultation and diagnosis services to rural residents via fixed and 3G/GPRS mobile networks	Increase access to high-quality healthcare resources for rural residents	Guangzhou and Guizhou	Created by China Mobile; initially launched as free but now implementing fee model
Neusoft Healthcare Management Platform (mHealth)	Patient health information is monitored in real time and connected through a health management platform to regional medical centers; provider is alerted if data indicates a health problem	Support a healthier life, targets middle- and upper-income population	Several economically developed cities in China	Created by Neusoft, purchased by individual consumers
Telemedicine Education Services (for lower-level rural hospitals)	Telemedicine network that enables long-distance courses and consultations to increase the capacity of hospital providers in resource-poor settings	Improve capacity and skills of rural providers and increase access to high-quality healthcare for people in remote areas	Based in Chengdu; hospitals in ten western provinces have joined the network	West China Hospital & Hong Kong Government

Name	Innovation	Purpose and population	Location	Funding source
Haodaifu provider information website	Website provides detailed information about doctors in more than 3,200 hospitals of 31 provinces in China to facilitate outpatient visits; enables patients to select a doctor and schedule appointments online; and provides remote consultation services	Ease the difficulty in scheduling appointment with doctors in tier II and III hospitals and provide a platform where patients can communicate among themselves as well as with registered doctors	Nationwide	Supported through ads and partnerships with Baidu, Sina, Sohu, Xinhua Net, Renmin Net and others.
Premium postnatal confinement hotel model	Professional residential postnatal support provided to new mothers	Ease transition for new mothers, provide education about common issues; targets upper-income population	Mainland China and Taiwan	Patients
Postnatal home care services model	Women trained by hospitals to provide in-home support to mothers after birth	Ease transition for new mothers, provide education about common issues; targets middle- and upper-income populations	Mainland China and Hong Kong	Hospitals and NGOs
Lhasa Prefecture Maternal Child Health Association, previously One Heart World-Wide	Community-based participatory approach to increasing local awareness and teaching good practices for childbirth	Reduce preventable deaths related to pregnancy and childbirth among vulnerable populations	Tibet	Charitable foundations and donations
Lifeline Express Train	Railway trains retrofitted to provide free cataract surgeries throughout China	Heal preventable blindness caused by cataracts, increase access to care for rural population	Headquartered in Beijing; 4 trains cover 27 provinces with more than 100 care locations	Charitable foundations and donations
Marie Stopes International China (MSIC)	Patient-centered model provides high-quality and low-cost sexual and reproductive health services, outreach, and education	Meet reproductive health needs of underserved population; targets unmarried youth and migrants	Qingdao, Nanjing, and Xi'an	Marie Stopes International and patients
Le-Nest	Community-based model provides health education and low-cost interventions for prevention and management of chronic diseases among the elderly, specifically targeting hypertension and diabetes	Ease the chronic disease burden in China and facilitate healthier aging for the elderly	Shanghai	Shanghai Government and enrolled members

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Before coming to Duke in 2001, Moe was an executive at GlaxoSmithKline. He received his Ph.D. in Organization Development and Institutional Studies from the University of North Carolina at Chapel Hill in 1981. He graduated from the Northwestern University Kellogg School of Management Executive Development Program in 1997.

Moe is residing in Shanghai, China from December 2013 through June 2014 to work on four research streams: ethics case studies, identification of innovative health care delivery models, policies to promote greater research on rare diseases endemic to Asia, and management approaches to improve the effectiveness and capabilities of health care delivery organizations.

Shu Chen grew up in Sichuan, China and received a bachelor's degree from Peking University in 2012. She interned at the George Institute for Global Health, China as a project manager on a verbal autopsy project from 2011 to 2012. Driven by the desire to increase access to high-quality healthcare resources for the underprivileged in China, Shu came to Duke University to pursue a master's degree in global health and will graduate in May 2014.

For her master's research, Shu spent 12 weeks in Singapore researching the cost-effectiveness of a new method of screening for ocular tuberculosis. Shu has worked as a research assistant with IPIHD since 2012, studying healthcare innovation in China. Her primary research interests are evidence-based policy making, health outcome evaluation, health systems, and health innovations.

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About IPIHD

The International Partnership for Innovative Healthcare Delivery (IPIHD) is an impact-driven non-profit dedicated to increasing access to cost-effective and high-quality healthcare around the world. IPIHD supports a diverse and global network of healthcare innovators, industry leaders, funders, and governments. Founded in 2011 by the World Economic Forum, McKinsey & Company, and Duke University, and supported by corporations, foundations, and governments, IPIHD works directly with organizations bringing to market transformative innovations that increase access to affordable high-quality care.

IPIHD provides targeted programming, connections, and resources to help these innovators scale and replicate their models. The knowledge that IPIHD gains from research and working directly with the innovators is translated into insights and reports used to increase understanding of the potential of innovations to transform health systems globally. The IPIHD network includes more than 40 innovators and 15 corporate and foundation supporters.

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Acknowledgements

The authors would like to thank everyone who contributed to this paper, especially the leaders of Le-Nest, Lifeline Express Train, and MSIC, who generously shared their stories and work. We are also grateful to Richard Bartlett, Junjian Gaoshan, Lori Hu, and the Duke China Healthcare Network, for their assistance in identifying examples of healthcare innovation in China, and we thank Sarah Gelfand and Sylvia Sable for their review of the paper.



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