Digital Healthcare Transformation and Artificial Intelligence: Where is China heading?

Gert Bruche, Na Wang – Digital Health Asia Conference – Asia-Pacific Week 2018, April 24, Berlin
Proposition 1

China‘s healthcare is a broken system - and one of the challenges for China‘s CP

China Healthcare Flashlight

After great progress in the past, the explosion of non-communicable diseases challenges China’s healthcare system.

China Healthcare Flashlight

The current healthcare system is top-heavy, based on ‘self-selection’, and unable to cope with growing demand

<table>
<thead>
<tr>
<th>Class III</th>
<th>Class II</th>
<th>Private</th>
<th>CHCs/THCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,875</td>
<td>6,764</td>
<td>11,963</td>
<td>~70,000</td>
</tr>
<tr>
<td>Patient inflow, mn*</td>
<td>63,4</td>
<td>70,5</td>
<td>20,0</td>
</tr>
</tbody>
</table>

The Patient

- High out-of-pocket cost
- Repetitive exams
- Long waiting lines
- Overburdened & badly paid doctors

* 2014; **CHC: Community Health Centers, THC: Township healthcare centers. Source Süssmuth-Dyckerhoff/Then (2017)
China Healthcare Flashlight

China works on a massive transformation of its healthcare system and wants to solve its problems by 2030*

Five year plans

Policy guidance

Equal access to urban & rural population

Expand primary healthcare services

Public hospital reform

Encourage private healthcare investment

Increase # of doctors & improve training

Basic health insurance
✓ Gradually reduce out-of-pocket

Prioritize domestic equipment manufacturers

Reform of medical device distribution

Reform of drug distribution

Healthy China 2030*

*excludes digitalization policies

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Proposition 2

In healthcare digitalization and AI application China is in an early stage, but very dynamic.
China HC digitalization

Three overlapping arenas shape the digitalization of China‘s healthcare system and the use of AI

Healthcare provision (Hospitals, CHCs)

Regionalized patient management

Patient & consumer access

- Clinical workflows and decision support & automation
- Remote data sharing, 'vertical' referral & consultation among specialists
- Regional health cloud
- Patient – doctor interaction; Self- diagnosis / monitoring; Wearables

China‘s enabling IT - Infrastructure
China HC digitalization

Government policies touch upon all three areas...

Healthcare provision (Hospitals, CHCs)

Regionalized patient management

Patient & consumer access

Health cloud

e.g.

Adoption of EMR systems (along w hospital reform)

2017.7 Development Plan on the New Generation of Artificial Intelligence (The State Council)

2017.8 CDFA regulates AI-aided Dx, impl. by 8.2018

2014.Clarification of telemedicine service models (B2B, B2C)

2015-2010 Plan:
Promotes Internet-based services; supports wearable device service technology

Promote Internet plus action plan in healthcare (online healthcare platforms)

Long-distance medical system; cloud-based data handling within regions

'Healthy China Cloud Service Plan' till 2020

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Healthcare Provision (Hospitals, CHCs)

In the ‘digitalization‘ of its hospitals China is still in an early stage….  

**EMR Adoption Model (HIMSS)**

<table>
<thead>
<tr>
<th>Cumulative Capabilities*</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete EMR (data sharing, warehousing, continuity across all patients)</td>
<td>7</td>
</tr>
<tr>
<td>Physician doc. struct. templates; full CDSS closed loop medication</td>
<td>6</td>
</tr>
<tr>
<td>Full RAD PACS (different aspects in other regions)</td>
<td>5</td>
</tr>
<tr>
<td>Clinical practitioner order entry, clin. decision support (St. protocols)</td>
<td>4</td>
</tr>
<tr>
<td>Nursing/clinical doc, clinical decision support (error checking), PACS outside radiology</td>
<td>3</td>
</tr>
<tr>
<td>Clinical data and basic decision support; sharing possible</td>
<td>2</td>
</tr>
<tr>
<td>Three basics installed: Radiology, Laboratory, Pharmacy</td>
<td>1</td>
</tr>
<tr>
<td>No full installation of three basic clinical info systems</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>848 Tertiary Hospitals**</th>
<th>All***</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>0</td>
<td>4.2%</td>
</tr>
<tr>
<td>2018</td>
<td>0,3%**</td>
<td>27.1%</td>
</tr>
<tr>
<td></td>
<td>0,1%</td>
<td>10.1%</td>
</tr>
<tr>
<td></td>
<td>0,6%</td>
<td>35.9%</td>
</tr>
<tr>
<td></td>
<td>2,7%</td>
<td>16.4%</td>
</tr>
<tr>
<td></td>
<td>32,2%</td>
<td>2.6%</td>
</tr>
<tr>
<td></td>
<td>31,7%</td>
<td>1.7%</td>
</tr>
<tr>
<td></td>
<td>12,0%</td>
<td>2.1%</td>
</tr>
<tr>
<td></td>
<td>30,7%</td>
<td></td>
</tr>
</tbody>
</table>

* Simplified, adapted terminology; **HIMMS Asia: Analytics (2018)

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The most promising clinical AI applications in the medium term are in diagnostic imaging, with a number of American and Israeli Startups in the lead...

Computer Aided Detection (CADe)

Computer Aided Diagnosis (CADx)

Quantitative Tools

Decision Support

Integration
multidisciplinary, multiparametric
EMR, health databanks

Classification
per modality
(e.g. benign/malignant)

Measurement
(properties e.g. density, volume)

Detection
regions of Interest
(e.g. pot. cancerous lesions)

Healthcare Provision (Hospitals)

Chinese players are entering AI based diagnostic imaging as well, often jumping right away to CADx, i.e. automated classification/diagnosis

Tencent Miying

- 11.2017: Government plan to build national AI innovation platform w four partnering companies
- Tencent’s AIMIS chosen as national diagnostic imaging platform
- CADx platform: lung, breast, colorectal, esophagel cancer, …
- Tested in 10 Level III hospitals, ~ 100 more hospitals lined up
- Will probably become first choice for many hospitals

Regional Patient Management

All over China experiments with cloud-based regional data storing, regionalized patient management and teleconsulting networks are ongoing.

Case example: the 'hierarchical medical solution' for Anhui Province by Shanghai United Imaging Healthcare Ltd.

"For so many years in the medical reform and among all the pilot projects, this one is the most practical, most popular and most down-to-earth one." – NHFPC Inspection Group (2017)

Source: http://www.uihcloud.com/hierarchy-med-solution-position; own translation

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The use of internet to access healthcare and remote services is currently ‘exploding’, with the Tencent - WeChat ecosystem in the lead

WeChat’s rapidly growing ecosystem for patient access

- Symptom checker, medical dictionary
- Online consultation, + booking of hospital appointments (38000 hospitals with WeChat accounts, 60% offer consultation and booking)
- WeChatpay: settling medical bills
- Wesure: private medical insurance (test phase)
- E-prescribing (test phase)
- ....

Guahao 挂号

Localized direct booking system

Chunyu Doctor

- Self-diagnosis (free)
- Doctor consultation (phone: 25 €; text/photos: 30 €, whole week: 100 €)
- Doctors’ CVs and ratings
- Sells also OTC drugs

Source of phone screenshots: own enquiry
Startup Investment Scene

Starting in 2011 private investment in digital healthcare Startups is heating up with an increasing focus on the application layer, especially on diagnostic imaging.

Examples (Status 12.2017)

Proposition 3

Advancing rapidly with AI-based healthcare automation
China will eventually leapfrog other countries
Leapfrogging Drivers

China has four drivers of ‘leapfrogging‘ which other countries don‘t have (to the same extent)

**Strengths**
Developmental State

**Resources**
Leadership in AI resources by 2020?

**Culture**
Unrestrained future orientation

**Urgency**
Broken healthcare system

Leapfrogging Drivers

China has four drivers of 'leapfrogging' which other countries don’t have (to the same extent)

- Strengths: Developmental State
- Urgency: Broken healthcare system
- Resources: Leadership in AI resources by 2020?
- Culture: Unrestrained future orientation

Develomental State with Dynamic Capabilities

- East Asian model of state-led growth (Japan & four tigers)
- …. with Chinese characteristics
- Consistant government guidance with power to back-up long range policies
- Resist external demands from MNCs
- Control infighting within the nation
- [„the collapse of the collapse theory“]
Leapfrogging Drivers

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  - Developmental State

- **Urgency**
  - Broken healthcare system

- **Resources**
  - Leadership in AI resources by 2020?

- **Culture**
  - Unrestrained future orientation

**Meeting of Association for Advancement of AI;**

in the US (February 2018):
- China: ‘Paper Submissions‘: 25% > than US
- ‘Accepted Papers‘: just 3 behind US
- Europe, even as a whole no match

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* Source CB Insights (2018)

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Leapfrogging Drivers

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- **Data privacy**: no concern of population
- **Healthcare data regulations**: still ‘under review’, probably subordinate to ‘win AI race’
- **Superior AI capability**: as spill-off of ‘social scoring’: Computer vision/pattern recognition, natural language processing, big data handling [Orwellian future seems no problem for Chinese]
- **Typical Chinese**: mobile affinity, experimenting with fast & pragmatic adjustment
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Summary Conclusion

Advancing rapidly, China will leapfrog other countries…

…and have the world’s most digitalized and AI-operated healthcare system by 2030

iFlyTek created the first AI-powered robot which passed the doctor licensing exam in China (2017)
BGM Associates

Partners

Prof. Dr. Gert Bruche | Co-Founder/Partner
Office +49 (0)30 8148 7126
Mobile +49 (0)151 6111 7526
gert.bruche@bgmassociates.com

Prof. Dr. Hans Maier | Co-Founder/Managing Director
Office +49 (0)30 8148 7126
Mobile +49 (0)151 6111 7505
hans.maier@bgmassociates.com

Friedrich-W. Gause | Co-Founder/Managing Director
Office +49 (0)30 8148 7126
Mobile +49 (0)151 6111 7334
friedrich.gause@bgmassociates.com

Berlin / Head Office

Address:
Winkler Straße 11
14193 Berlin, Germany

Office:
+49 (0)30 8148 7127

Seoul / Asia Liaison Office

Dr. Park Kwon | Managing Director
Mobile +82 (0)10 3784 0222
park.kwon@bgmassociates.com

Address:
#703, DaeWoo Elrose County, 1467-3
Seocho-3-Dong, Seocho-Gu
Seoul, South Korea

For more information
www.bgmassociates.com