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Sector Report

Sector Report Healthcare

Early stage calls for prudence…Initiate sector w/ SELL

September 15, 2021

INVESTMENT SUMMARY

- The combined market caps of JDHealth, AliHealth and four leading offline pharmacies has reached 80% of the pharmacy valuation of Walgreens Boots and CVS Health while China's retail drug sales is only 20% of that of the US. Public sector domination, drug O2O and lack of hierarchical diagnosis are all inhibitors.
- China's healthcare industry is successful in its own way and will continue so. Public sector will play a dominant role which is already evident in state Rx procurement within and after-school-tutoring crackdown externally. Profit margins on all healthcare activities, with the exception of innovative drugs, will be depressed.
- We suggest investors to wait for better entry points. We initiate JDHealth and YIDU Tech with SELL and downgrade PAGD to HOLD and AliHealth to SELL.

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China's digital health: too expensive and too early

BUY HOLD **SELL**

- We initiate China's digital healthcare sector with a SELL rating.
- Online pharmacy valuations have greatly surpassed offline while we believe the split between online B2C, O2O and offline will be 1/3 each in out-hospital.
- PAGD's valuation still depends on drug sales. YIDU should be valued as a system integrator instead of a medical big data company, in our view.

Online pharmacy has too great expectations

Despite China having an outsized healthcare spending on drugs, 65% of drugs are still sold in hospitals. The transition to retail will happen but state Rx procurement will both delay the process and depress on price. Offline pharmacies' overwhelming sales force suits China's lack of hierarchical diagnosis (分级诊疗). The solution to hospital crowding will be increasing supply. Lastly, Meituan is already a formidable player in drug O2O which we believe will build its own drug distribution capability like grocery. All these led to China's retail drug sales being only 20% of US yet the market caps of JDHealth and AliHealth have reached 80% of Walgreens Boots and CVS Health's global pharmacy businesses.

Commercial insurance is beautiful but profit picture is moot

China achieved world-leading life expectancy with world-beating level of spending. Profitability will not reach the level of US providers. Commercial insurance plays a critical role in the profitability of US healthcare providers but we believe in China public healthcare insurance will stay, expand and dominate.

PAGD has the best LT prospects but numbers still don't add up

A parent with the largest commercial health insurance market share and a successful subscription business model are PAGD's unique advantage that will protect its margins as it enters Rx drug sales. But PAGD is still too expensive.

YIDU has noble aspirations that not yet matched with reality

We calculate the total public R&D spending on medical and life science to be Rmb25bn a year. As an enabler, YIDU already captured 1.5% of it in 2020. We believe YIDU today is more of a healthcare IT system integrator than a big data platform. We believe its gross margin of 30-40% is not sustainable in the long run.

Key financial of stock mentioned

	Revenues			Non-IFRS op. profit			Non-IFRS NI		
(Rmb $mn)	FY2020/ 2021	2021E/ 2022E	2022E/ 202E3	FY2020/ 2021	2021E/ 2022E	2022E/ 2023E	FY2020/ 2021	2021E/ 2022E	2022E/ 2023E
JD Health	19,383	29,576	39,459	732	1,229	1,755	715	1,335	1,590
Alibaba Health*	15,518	22,133	28,631	59	319	431	740	1,020	1,154
Ping An Healthcare	6,866	8,962	11,774	(674)	(1,966)	(2,048)	(498)	(1,614)	(1,786)
YIDU Tech	867	981	1,159	(309)	(316)	(346)	(275)	(307)	(341)

Source: JDHealth, AliHealth, Ping An Healthcare, YIDU Tech, BLRI (2021/9/11)

Top picks

	Ticker	Rating	Target
None	-	-	-

Source: BLRI (2021/9/14)

What has changed

	To	From
JD Health	SELL	-
YIDU Tech	SELL	-
Ping An Healthcare	HOLD	BUY
Alibaba Health	SELL	HOLD

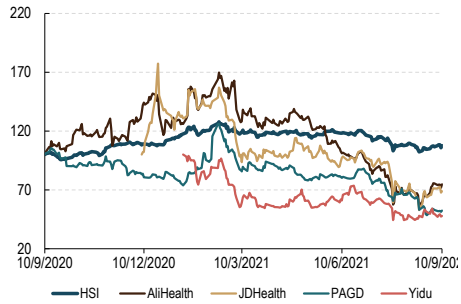
Source: BLRI (2021/9/14)

Stocks mentioned

Name	BBG code	Rating	TP	Curr. price	Next yr PE
Ping An HC	1833 HK	HOLD	HK$57	HK$58	
Alibaba Health	241 HK	SELL	HK$4.1	HK$13	
JD Health	6618 HK	SELL	HK$30	HK$76	
YIDU Tech.	2158 HK	SELL	HK$10	HK$31	
MedLive	2192 HK	NA	NA	HK$32	
Waterdrop	WDH US	NA	NA	US$3.4	

Source: BLRI, Bloomberg, (2021/9/10)

Price performance and volume data



Source: Bloomberg, (2021/9/10)

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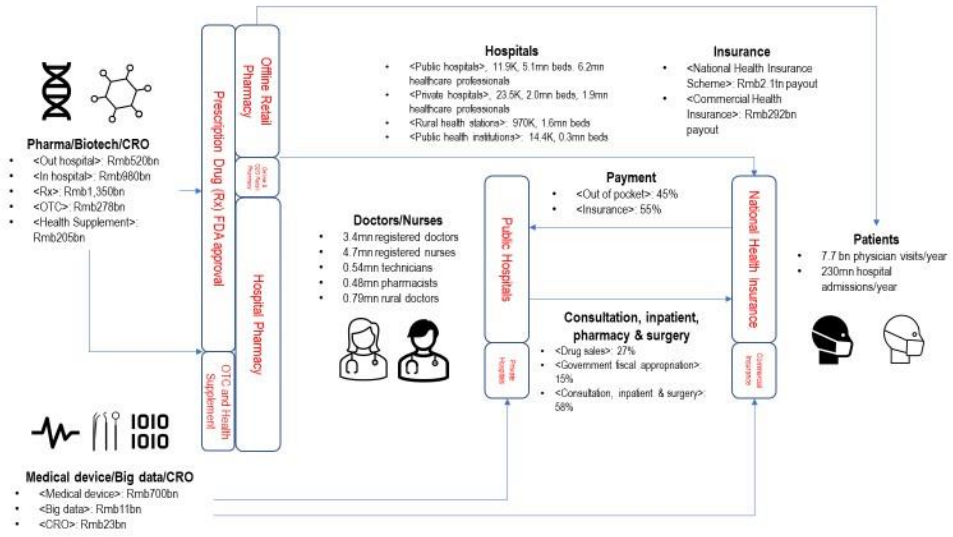
Summary of key recommendations

- We recommend to wait for better entry points on digital health stocks;
- Platform profitability will be contained by the government, we suggest investors to look for "content providers" that provide irreplaceable value to the health wellbeing of the Chinese people;
- We recommend to look at companies that form its own patients-doctor-biopharma close loop or close loop of the surrogates, in order to protect profit margins in the long run against state intervention;
- Chinese government will not make making money on healthcare, education and housing easy.

Healthcare ecosystem has separation of recipients and payors



Summary of key recommendations

- The market capitalizations of online pharmacies have reached 4-5x of the market cap of offline pharmacies of the similar revenues;
- AliHealth and JDHealth are trading on par with A-share valuations;
- PAGD is trading below its US comparable Teladoc in terms of PS ratio;
- MedLive helps doctors research like YIDU. But it has an operating profit margin of ~50%, vs. YIDU's (52%).

Comparable business models of digital health enterprises, China vs. US

Chinese	Ticker	Market cap (US$ bn)	CY2020 rev. (US $bn)	US equivalent/ aim-to-be	Market cap (US$ bn)	2020 rev. (US$ bn)
PAGD	1833 HK	8.4	1.07	Kaiser Permanente/ UHC (Optum)/ Teladoc	Private/395/23	89/257/1.1
AliHealth	241 HK	22.8	2.19	Walgreens/CVS	42/110*	139/269
JDHealth	6618 HK	30.8	3.02	Walgreens/CVS	42/110	139/269
MedLive (医脉通)	2192 HK	2.9	0.033	WebMD	Privatized at 2.8	NA
MedBank (思派科技)	Pre-IPO	NA	0.422	Flatiron	Acquired at 1.9	NA
Burning Rock Biotech (燃石医学)	BNR US	2.1	0.067	Foundation Medicine	Acquired at 5.3	NA
New Horizon Health (诺辉健康)	6606 HK	2.2	0.011	Foundation Medicine	Acquired at 5.3	NA
YIDU Tech	2158 HK	3.9	0.123	Flatiron/Change Catalyst	Acquired at 1.9/2.7	NA/
Goodwill (嘉和美康)	Pre-IPO	NA	0.083	Cerner/EPIC/Allscripts	23/Private/2.0	5.5NA/1.5
Winning Health (卫宁健康)	300253 CH	4.9	0.354	Cerner/EPIC/Allscripts	23/Private/2.0	5.5/NA/1.5
B-Soft (创业惠康)	300451 CH	1.9	0.255	Cerner/EPIC/Allscripts	23/Private/2.0	5.5/NA/1.5
Yifeng (益丰药房)	603939 CH	5.9	2.05	Walgreens/CVS	42/110	139/269
DSL (大参林)	603233 CH	5.4	2.28	Walgreens/CVS	42/110	139/269
LBX (老百姓)	603883 CH	3.1	2.18	Walgreens/CVS	42/110	139/269
YXT (一心堂)	002727 CH	2.7	1.98	Walgreens/CVS	42/110	139/269

*Due to CVS's acquisition of Aetna in 2018 roughly half of CVS's revenue is commercial health insurance.

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Exhibit 1. China health care industry market size master table

	2019	2020	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Total healthcare expenditure (RMB bn)	**6,520**	**7,231**	**7,994**	**8,793**	**9,673**	**10,620**	**11,629**	**12,676**	**13,792**	**14,964**	**16,236**	**17,616**
YoY growth	*10.3%*	*10.9%*	*10.6%*	*10.0%*	*10.0%*	*9.8%*	*9.5%*	*9.0%*	*8.8%*	*8.5%*	*8.5%*	*8.5%*

Pharmaceutical product (Rmb bn)	2019	2020	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
In-hospital (OTC+Rx)	**1,120**	**980**	**1,031**	**1,070**	**1,110**	**1,147**	**1,172**	**1,208**	**1,233**	**1,253**	**1,264**	**1,262**
% of total	*69%*	*65%*	*63%*	*60%*	*56%*	*53%*	*49%*	*46%*	*43%*	*40%*	*37%*	*34%*
YoY growth	*5.2%*	*(12.5%)*	*5.2%*	*3.8%*	*3.7%*	*3.3%*	*2.2%*	*3.0%*	*2.0%*	*1.6%*	*0.9%*	*-0.2%*
Out-hospital	**513**	**520**	**605**	**729**	**872**	**1,038**	**1,220**	**1,418**	**1,634**	**1,879**	**2,153**	**2,449**
% of total	*31%*	*35%*	*37%*	*41%*	*44%*	*48%*	*51.0%*	*54.0%*	*57.0%*	*60.0%*	*63.0%*	*66.0%*
Out-hospital offline	**467**	**436**	**466**	**517**	**575**	**627**	**676**	**715**	**742**	**759**	**762**	**769**
% of total	*29%*	*29%*	*28%*	*29%*	*29%*	*29%*	*28.3%*	*27.2%*	*25.9%*	*24.2%*	*22.3%*	*20.7%*
% of out-hospital channel	*91%*	*84%*	*77%*	*71%*	*66%*	*60%*	*55.4%*	*50.4%*	*45.4%*	*40.4%*	*35.4%*	*31.4%*
YoY growth	*6.4%*	*(6.6%)*	*7%*	*11%*	*11%*	*9%*	*7.8%*	*5.7%*	*3.8%*	*2.3%*	*0.4%*	*0.9%*
Out-hospital O2O	**7.10**	**15.70**	**36.44**	**65.71**	**100.50**	**150.70**	**207.67**	**276.82**	**359.80**	**460.67**	**581.59**	**710.63**
% of total	0.43%	1.05%	2.23%	3.65%	5.07%	6.90%	8.68%	10.54%	12.55%	14.71%	17.02%	19.15%
% of out-hospital channel	1.38%	3.02%	6.02%	9.02%	11.52%	14.52%	17.02%	19.52%	22.02%	24.52%	27.02%	29.02%
YoY growth	*34.0%*	*121.1%*	*132.1%*	*80.3%*	*52.9%*	*50.0%*	*37.8%*	*33.3%*	*30.0%*	*28.0%*	*26.2%*	*22.2%*
Out-hospital online B2C sales	**39**	**68**	**103**	**146**	**197**	**260**	**336**	**427**	**532**	**659**	**809**	**969**
% of total	*2.4%*	*4.5%*	*5.0%*	*6.0%*	*7.0%*	*8.0%*	*10.0%*	*15.0%*	*20.0%*	*25.0%*	*30.0%*	*35.0%*
% of out-hospital channel	*7.6%*	*13.1%*	*17.1%*	*20.1%*	*22.6%*	*25.1%*	*27.6%*	*30.1%*	*32.6%*	*35.1%*	*37.6%*	*39.6%*
YoY growth	*30%*	*74%*	*52%*	*41%*	*35%*	*32%*	*29.3%*	*26.8%*	*24.8%*	*23.8%*	*22.7%*	*19.8%*
Total pharmaceutical product	**1,633**	**1,500**	**1,636**	**1,799**	**1,983**	**2,185**	**2,393**	**2,626**	**2,867**	**3,131**	**3,417**	**3,710**
YoY growth	*6.5%*	*(8.1%*	*9.1%*	*9.9%*	*10.2%*	*10.2%*	*9.5%*	*9.8%*	*9.2%*	*9.2%*	*9.1%*	*8.6%*
Online B2C+O2O as total	*2.8%*	*5.6%*	*8.5%*	*12%*	*15%*	*19%*	*23%*	*27%*	*31%*	*36%*	*41%*	*45%*

Vitamin, Dietary & Supplement (Rmb bn)	2019	2020	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
In-hospital	**18**	**10**	**10**	**10**	**10**	**9.4**	**8.3**	**6.5**	**3.8**	**2.0**	**1.1**	**0.**
% of total	8%	4%	3.5%	3.0%	2.5%	2.0%	1.5%	1.0%	0.5%	0.3%	0.1%	0.1%
Out-hospital	**205**	**240**	**276**	**323**	**385**	**454**	**531**	**616**	**708**	**805**	**906**	**1010**
% of total	92.0%	96.0%	96.5%	97.0%	97.5%	98.0%	98.5%	99.0%	99.5%	99.8%	99.9%	99.9%
Out-hospital offline	**121**	**120**	**116**	**116**	**115**	**111**	**100**	**83**	**56**	**40**	**36**	**30**
% of total	*54%*	*48%*	*40%*	*35%*	*29%*	*24%*	*19%*	*13%*	*8%*	*5%*	*4%*	*3%*
% of out-hospital channel	59%	50%	42%	36%	30%	24%	19%	13%	8%	5%	4%	3%
YoY growth		(1%)	(3%)	0%	(1%)	(4%)	(9%)	(18%)	(32%)	(28%)	(10%)	(16%)
Out-hospital O2O	**1**	**3**	**9**	**17**	**27**	**41**	**62**	**87**	**107**	**130**	**155**	**183**
% of total	0.6%	1.1%	3.0%	5.0%	6.9%	8.9%	11.4%	14.0%	15.0%	16.1%	17.1%	18.1%
% of out-hospital channel	1%	1%	3%	5%	7%	9%	12%	14%	15%	16%	17%	18%
YoY growth		99%	223%	92%	66%	51%	49%	41%	23%	21%	20%	18%
Out-hospital online B2C	**82**	**118**	**152**	**191**	**242**	**302**	**369**	**446**	**545**	**635**	**715**	**797**
% of total	37%	47%	53.0%	57.2%	61.4%	65.1%	68.4%	71.7%	76.6%	78.7%	78.8%	78.8%
% of out-hospital channel	40%	49%	55%	59%	63%	66%	69%	72%	77%	79%	79%	79%
YoY growth		43%	29%	26%	27%	25%	22%	21%	22%	17%	13%	11%
Total VDS	**223**	**250**	**286**	**333**	**395**	**463**	**539**	**622**	**712**	**807**	**907**	**1,010**
YoY growth	18%	12%	14%	16%	18%	17%	16%	15%	14%	13%	12%	11%
Online B2C+O2O as total	38%	48%	56%	62%	68%	74%	80%	86%	92%	95%	96%	97%

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Online Consultation (Rmb bn)	2019	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Online consultation	**9.0**	**22**	**35**	**52**	**75**	**100**	**125**	**150**	**173**	**190**	**204**	**214**
YoY growth	*80.0%*	*144.4%*	*59.1%*	*48.6%*	*44.2%*	*33.3%*	*25.0%*	*20.0%*	*15.0%*	*10.0%*	*7.5%*	*5.0%*

Medical Consultation Volume	2019	2020	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Out-patient (门诊)	8.7	7.7	8.1	8.5	9.2	9.7	10.3	10.8	11.4	11.9	12.5	13.1
YoY growth	*5%*	*(12%)*	*5%*	*6%*	*8%*	*6%*	*6%*	*4%*	*5%*	*5%*	*5%*	*5%*
% of total	*91%*	*85%*	*81%*	*77%*	*74%*	*71%*	*69%*	*67%*	*66%*	*65%*	*65%*	*64%*
In-patient (住院)	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6
% of total	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*
Online consultation	**0.57**	**1.09**	**1.60**	**2.22**	**2.86**	**3.57**	**4.19**	**4.82**	**5.33**	**5.86**	**6.31**	**6.76**
% of total	*6%*	*12%*	*16%*	*20%*	*23%*	*26%*	*28%*	*30%*	*31%*	*32%*	*33%*	*33%*
Total	**9.58**	**9.08**	**9.99**	**11.09**	**12.42**	**13.72**	**14.95**	**16.08**	**17.20**	**18.32**	**19.42**	**20.49**
YoY growth	6.4%	(5.3%)	10.0%	11.0%	12.0%	10.5%	9.0%	7.5%	7.0%	6.5%	6.0%	5.5%

Health and wellness (Rmb bn)	2019	2020	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Healthcare services (医院)	**4,543**	**4,335**	**4,820**	**5,403**	**6,072**	**6,812**	**7,595**	**8,490**	**9,439**	**10,503**	**11,676**	**12,922**
% of total	*55.9%*	*56.1%*	*56.5%*	*56.8%*	*57.2%*	*57.4%*	*57.7%*	*57.9%*	*58.2%*	*58.4%*	*58.7%*	*58.9%*
Drugs (Rx+OTC)	**1,633**	**1,500**	**1,636**	**1,799**	**1,983**	**2,185**	**2,393**	**2,626**	**2,867**	**3,131**	**3,417**	**3,710**
% of total	*20.1%*	*19.4%*	*19.2%*	*18.9%*	*18.7%*	*18.4%*	*18.2%*	*17.9%*	*17.7%*	*17.4%*	*17.2%*	*16.9%*
Vitamin, Dietary & Supp. (VDS)	**223**	**250**	**286**	**333**	**395**	**463**	**539**	**622**	**712**	**807**	**907**	**1,010**
% of total	*2.7%*	*3.2%*	*3.4%*	*3.5%*	*3.7%*	*3.9%*	*4.1%*	*4.2%*	*4.4%*	*4.5%*	*4.6%*	*4.6%*
Medical equipment	**797**	**754**	**845**	**951**	**1,050**	**1,121**	**1,186**	**1,262**	**1,333**	**1,414**	**1,501**	**1,589**
% of total	*9.8%*	*9.8%*	*9.9%*	*10.0%*	*9.9%*	*9.4%*	*9.0%*	*8.6%*	*8.2%*	*7.9%*	*7.5%*	*7.2%*
Consumer healthcare (医美,体检)	**756**	**734**	**820**	**903**	**983**	**1,068**	**1,202**	**1,356**	**1,521**	**1,708**	**1,916**	**2,139**
% of total	*9.3%*	*9.5%*	*9.6%*	*9.5%*	*9.3%*	*9.0%*	*9.1%*	*9.3%*	*9.4%*	*9.5%*	*9.6%*	*9.8%*
Healthcare infrastructure	**180**	**152**	**130**	**121**	**140**	**216**	**256**	**303**	**356**	**417**	**486**	**563**
% of total	*2.2%*	*2.0%*	*1.5%*	*1.3%*	*1.3%*	*1.8%*	*1.9%*	*2.1%*	*2.2%*	*2.3%*	*2.4%*	*2.6%*
Total	**8,132**	**7,725**	**8,537**	**9,510**	**10,622**	**11,865**	**13,170**	**14,659**	**16,227**	**17,980**	**19,903**	**21,934**
YoY growth	*11.4%*	*(5.0%)*	*10.5%*	*11.4%*	*11.7%*	*11.7%*	*11.0%*	*11.3%*	*10.7%*	*10.8%*	*10.7%*	*10.2%*

Source: BLRI, Frost & Sullivan, NHC (2021/9/10)

Exhibit 2. China's pharmaceutical demand market size estimate

(Rmb bn)	2019	2020	2021E	2022E	2023E	2024E
In-hospital (OTC+Rx)	1,120	980	1,031	1,070	1,110	1,147
% total	*69%*	*65%*	*63%*	*60%*	*56%*	*53%*
Out-hospital (OTC+Rx)	513	520	605	729	872	1,038
% total	*31%*	*35%*	*37%*	*41%*	*44%*	*48%*
Offline pharmacy	467	436	472	524	584	637
YoY growth	*6.4%*	*(6.6%)*	*8.1%*	*11%*	*11%*	*9%*
% out-hospital	*91%*	*84%*	*78%*	*72%*	*67%*	*61%*
O2O Pharmacy	7.1	16	36	66	100	151
YoY Growth	*34%*	*121%*	*132%*	*80%*	*53%*	*50%*
% out-hospital	*1.4%*	*3.0%*	*6.0%*	*9%*	*12%*	*15%*
Online B2C pharmacy	39	68	97	139	188	250
YoY growth	*30%*	*74%*	*43%*	*43%*	*35%*	*33%*
% out-hospital	*7.6%*	*13%*	*16%*	*19%*	*22%*	*24%*
Total	**1,633**	**1,500**	**1,636**	**1,799**	**1,983**	**2,185**
YoY growth	*6.5%*	*(8.1%)*	*9.1%*	*10%*	*10%*	*10%*

Source: NHC, BLRI (2021/9/13)

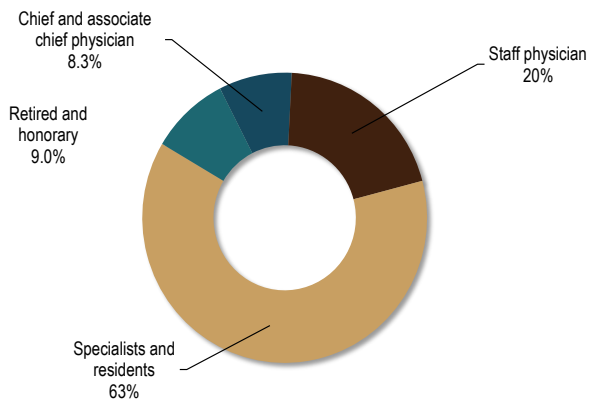
Exhibit 3. China's out-hospital drug sales by channel

(Rmb bn)	2019	2020	2021E	2022E	2023E	2024E
Rx	**294**	**283**	**355**	**445**	**550**	**670**
Offline	270	235	273	316	358	403
O2O	1.5	3.9	11	32	62	95
Online B2C	22	44	70	97	130	172
OTC	**219**	**237**	**251**	**284**	**323**	**367**
Offline	197	201	198	208	226	235
O2O	5.6	12	25	34	39	55
Online B2C	17	24	27	42	58	78
VDS	**205**	**233**	**268**	**313**	**373**	**440**
Offline	121	120	122	124	125	123
O2O	1.3	2.7	8.4	16	27	40
Online B2C	82	110	137	173	221	276
Total out-hospital	**718**	**753**	**873**	**1,042**	**1,245**	**1,478**
Offline	*82%*	*74%*	*68%*	*62%*	*57%*	*51%*
O2O	*1.2%*	*2.4%*	*5.1%*	*7.9%*	*10%*	*13%*
Online B2C	*17%*	*24%*	*27%*	*30%*	*33%*	*36%*

Source: NHSA, MOHRSS, BLRI (2021/9/6)

See the last page of the report for important disclosures

Exhibit 4. Chinese doctors by experience, total=3.2mn



Source: NHC, BLRI (2021/9/13)

Exhibit 5. No. of doctors on platforms, Shanghai

Shanghai	PAGD	JDHealth	AliHealth	WeDoctor	Good Doctor
Total No. of doctors	**1,029**	**1,372**	**987**	**5,654**	**12,552**
Effective No. of doctors	1,012	842	702	5,917	10,954
Effective ratio	**98%**	**61%**	**71%**	**93%**	**87%**
Chief and associate chief	60%	50%	38%	62%	52%
Staff	35%	41%	51%	33%	35%
Resident and others	5.2%	9.2%	4.1%	5.3%	14%
Total	100%	100%	100%	100%	100%

Source: PAGD, JDHealth, AliHealth, WeDoctor, GoodDoctor, BLRI (2021/9/6). Effective means No. of consultation>0. After removing duplications

Exhibit 6. Distribution of consultation frequency, Shanghai

Consultation frequency	JDHealth	AliHealth	WeDoctor	Good Doctor
0	39%	29%	7.3%	13%
1-10	31%	30%	20%	18%
11-100	17%	25%	31%	24%
101-1,000	8.2%	14%	34%	28%
1001-10,000	4.2%	2.6%	7.3%	15%
10001+	1.0%	0.0%	0.2%	1.4%
Total	**100.0%**	**100.0%**	100%	**100.0%**
No. of doctors	1,372	987	5,654	12,552

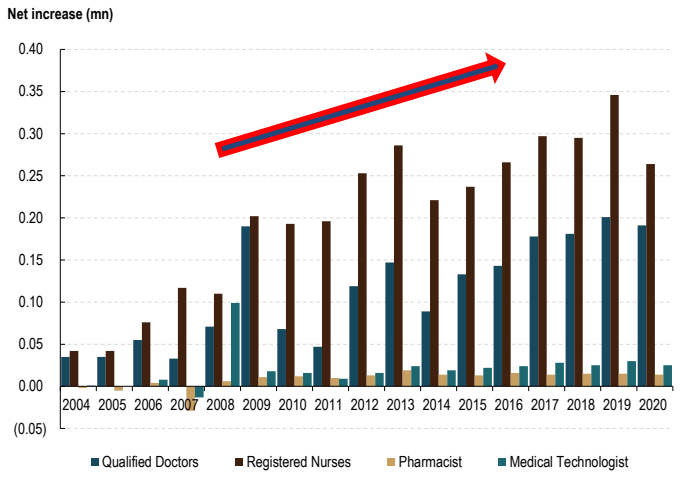
Source: JDHealth, AliHealth, WeDoctor, Good Doctor, BLRI (2021/9/13). PAGD data is not available

Exhibit 7. Key matrices of Internet healthcare platforms

C1Q21	PAGD	JD Health	Ali Health	We Doctor	Good Doctor
MAU (mn)	9.84	0.41	2.08	0.81	1.07
DAU (mn)	1.05	0.03	0.20	0.08	0.098
Time spent/mo. (mn min)	262.3	8.6	22.9	17.1	27.8
Time spent/user/ day (min)	8.24	8.45	3.91	6.86	9.32
No. doctors (K)	23	110	60	120*	820
Consultation/Yr. (mn)	330	37	66	18	NA
Consultation/doctor/day	39	0.91	3.00	0.41	NA
Revenue (Rmb mn)	1,565	1,172	284	1,832	NA

Source: Questmobile, PAGD, JDHealth, AliHealth, WeDoctor, GoodDoctor, BLRI (2021/9/6) *available for online appointments

Exhibit 8. Net increase in doctors and nurses (mn) in China



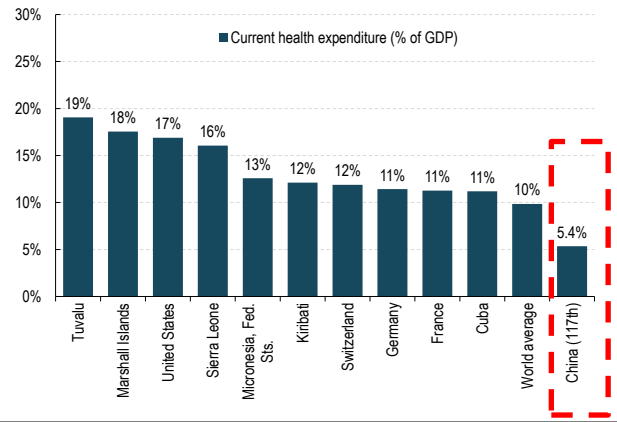
Source: NHC, BLRI (2021/9/13)

Exhibit 9. Medical consultation comparison

	US	China	HK
Consultation per year (mn)	901	**7,740**	25
Population (mn)	330	**1,445**	7.4
Consultation per capita	2.73	**5.35**	3.40
By:			
General/family/health station	23%	**44%**	23%
Specialists or hospitals	77%	**56%**	77%
Pediatrics (儿科)	16%	**5.0%**	NA
Internal medicine (内科)	9.2%	**13%**	NA
Obstetrics (妇产科)	8.3%	**4.5%**	NA
Dermatology (皮肤科)	5.6%	**NA**	NA
Orthopedic (外科)	3.4%	**5.9%**	NA
Psychiatry (精神科)	3.4%	**NA**	NA
All others	31%	**18%**	NA

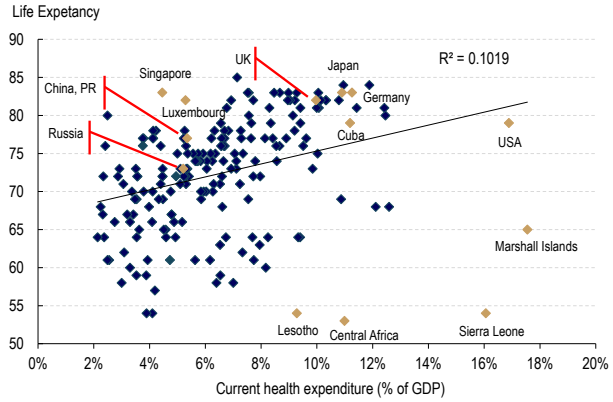
Source: NHC, CDC, DHHK, HKHA, Blue Lotus (2021/9/6).

Exhibit 10. Healthcare expenditure as GDP, global comparison



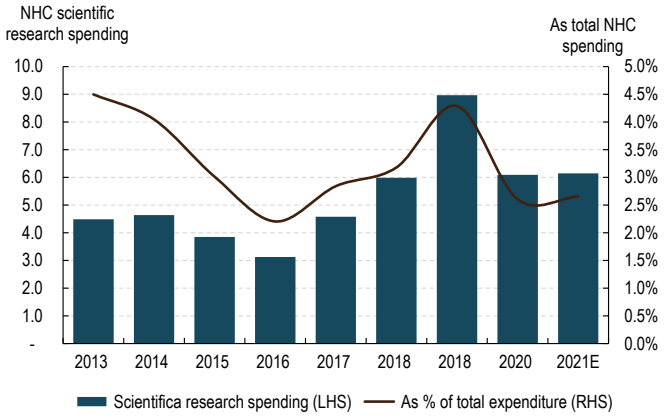
Source: WHO, BLRI (2021/8/21). Current healthcare exp. excl. investments

Exhibit 11. Current healthcare exp./GDP vs. life expectancy



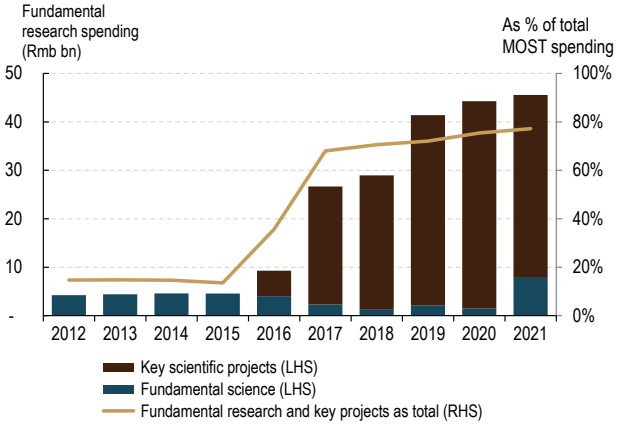
Source: WHO, BLRI (2021/8/21). Current healthcare exp. excl. investments

Exhibit 12. NHC scientific spending breakdown



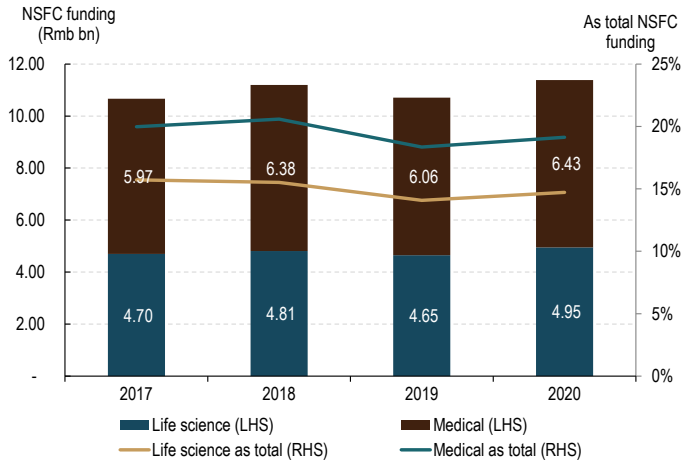
Source: NHC, BLRI (2021/6/13)

Exhibit 13. MOST spending on fundamental research



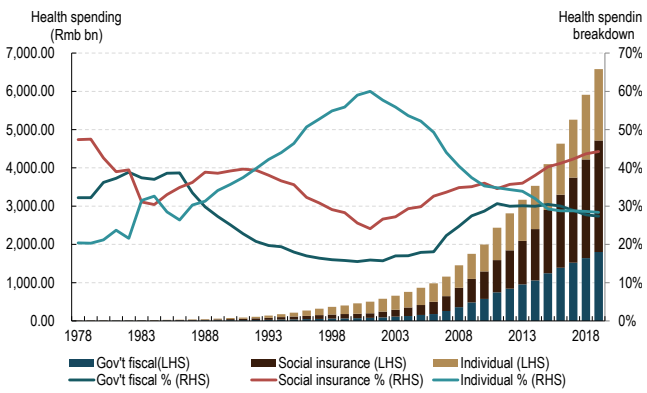
Source: MOST, BLRI (2021/6/6)

Exhibit 14. NSFC medical and life science research funding



Source: NSFC, Blue Lotus (2021/9/13)

Exhibit 15. Total healthcare spending and breakdown



Source: NHC, Blue Lotus (2021/9/6). Gov't=direct fiscal, Social=national insurance

Exhibit 16. China's five state Rx procurement programs

Exhibit 17. Sales marketing cost and employees

	1st	2nd	3rd	4th	5th
Start time	Sept., 18	Mar., 19	Jan., 2020	Jan., 2021	Jun., 2021
No. of drugs	31	25	56	45	62
Doses (bn)	1.64	1.55	20	6.81	5.49
Coverage	11 cities	25 provinces	All provinces	All provinces	All provinces
Estimated value (Rmb bn) *	NA	NA	23	25	56

Source: SMPAA, Blue Lotus (2021/9/8). *Estimation based on bidding cap, real value can be lower

	DSL (大参林)	Yifeng (益丰)	YXT (一心堂)	LBX (老百姓)	JD Health	Ali Health
Sales mkt. as 1P	26%	26%	22%	22%	6.8%	9.5%
G&A as total	4.7%	4.1%	4.1%	4.7%	1.9%	2.6%
No. of mkt. staff	27,219	24,621	25,959	21,985	295	~150
No. of total staff	32,337	28,655	30,129	27,212	2,099	1,033
Mkt staff as total	*84%*	*86%*	*86%*	*81%*	*14%*	*~15%*
No. of stores	5,705	5,356	7,205	4,892	500*	0

Source: AliHealth, JDHealth, PAGD, Meituan, DSL, Yifeng, YXT, LBX, Blue Lotus (2021/9/9). *Affiliated

Financial Summary – JD Health International Inc.

Fiscal year ends 31-Dec.

Exhibit 18. Income statement

(Rmb mn)	FY2020	FY2021	FY2022
Revenues	19,383	29,576	39,459
- Product	16,774	25,110	33,451
- Service	2,609	4,311	6,008
Cost of revenues	(14,465)	(22,022)	(29,186)
Gross profit	4,917	7,554	10,273
Gross margin	25.4%	25.5%	26.0%
- Fulfilment expenses	(1,995)	(2,944)	(3,826)
- Selling and marketing expenses	(1,435)	(2,362)	(3,153)
- Research and development expenses	(609)	(907)	(1,263)
- General and administrative expenses	(527)	(1,312)	(474)
Of which: share-based compensation	(380)	(1,200)	(197)
Operating profit / (loss), IFRS	352	29	1,558
Operating margin, IFRS	1.8%	0.1%	3.9%
Operating profit / (loss), non-IFRS	732	1,229	1,755
Operating margin, non-IFRS	3.8%	4.2%	4.4%
Finance income	149	356	300
Finance costs	(3)	(2)	0
Profit/(loss) before income tax	(17,072)	366	1,859
Income tax expense	(163)	(248)	(465)
Profit/(loss) for the year/period	(17,235)	118	1,394
EPS per basic and diluted shares	(7.81)	0.04	0.45

Source: JD Health, Blue Lotus (2021/9/10)

Company Description

JD Health is the largest online healthcare platform in China by revenues. It is a wholly owned subsidiary of JD.com (~70%). Online pharmacy contributed ~100% of its revenues with the ratio of direct sales to platform GMV being ~1:2. We estimate JDHealth's GMV market share in China online (excl. O2O) Rx (Prescription)+OTC(Over-the-counter)+VDS (Vitamin-Dietary-Supplement) market to be ~48% in 2021.

Industry View

We expect China's online pharmacy (online B2C+O2O) penetration in Prescription (Rx), OTC and VDS markets to grow from 3.9%, 12% and 48% in 2020 to 39%, 64% and 97%, respectively. With the market size of these three growing from Rmb46, 37 and 120bn in 2020 to Rmb1,097, 583 and 979bn in 2030.

Exhibit 19. Balance sheet

	FY2020	FY2021	FY2022
Cash and cash equivalents	32,271	31,513	35,692
Restricted cash	39	39	39
Prepayments and other receivables	555	1,753	1,327
Trade and bills receivables	75	89	152
Inventories	1,732	2,729	3,021
Total current asset	42,705	42,647	46,756
Property and equipment	18	33	51
Intangible assets	28	40	53
Investments in joint ventures	606	606	606
Total non-current assets	1,290	1,428	1,586
Total assets	43,995	44,075	48,342
Trade payable	2,900	2,192	4,556
Accrued expenses	1,299	2,212	2,441
Contract liabilities	179	227	312
Total current liabilities	4,682	4,660	7,337
Convertible preferred shares	-	-	-
Total equity	39,252	39,354	40,944
Total liabilities & shareholder equity	43,995	44,075	48,343

Source: JD Health, Blue Lotus (2021/9/10)

Exhibit 20. Cash flow statement

	FY2020	FY2021	FY2022
Profit/(loss) for the year/period	(17,235)	118	1,394
Adjustments for:			
Income tax expense	163	248	465
Share-based payments expenses	380	1,200	197
Depreciation and amortization	27	72	122
Finance income	(149)	(356)	(300)
Changes in working capital:	2,916	(1,955)	2,748
Net cash flows generated from/(used in) operating activities	3,699	(545)	4,461
Purchases of property and equipment	(16)	(24)	(31)
Purchases of intangible assets	(22)	(33)	(45)
Payments for right-of-use assets	(1)	(154)	(205)
Net cash flows used in investing activities	(7,843)	(211)	(281)
Net cash (used in)/ generated from financing activities	32,029	(2)	-
Net (decrease)/increase in cash and cash equivalents	27,886	(758)	4,180
Balance b/f	4,965	32,271	31,513
Balance c/f	32,271	31,513	35,692

Source: JD Health, Blue Lotus (2021/9/10)

Financial Summary – Alibaba Health Information Technology Ltd.

Fiscal year ends 31-Mar.

Exhibit 21. Income statement

(Rmb mn)	FY2021	FY2022	FY2023
Net revenues	15,518	22,133	28,637
Pharmaceutical direct business	13,216	19,164	24,913
Pharma. e-comm. platform	1,965	2,588	3,285
Medical and healthcare svs	284	312	344
Digital infrastructure	53	69	96
Cost of revenues	(11,901)	(17,178)	(22,426)
Gross profit	3,617	4,955	6,211
Gross margin	23.3%	22.4%	21.7%
Fulfilment expenses	(1,619)	(2,255)	(2,808)
Sale and marketing expenses	(1,222)	(1,496)	(1,824)
Administrative expenses	(294)	(443)	(573)
Product development expenses	(424)	(443)	(573)
Share-based compensation	(397)	(443)	(573)
Operating profit (loss), IFRS	59	319	434
Operating margin, IFRS	0.4%	1.4%	1.5%
Operating profit (loss), non-IFRS	456	762	1,007
Operating margin, non-IFRS	2.9%	3.4%	3.5%
Profit before tax	401	728	879
Income tax expense	(59)	(109)	(220)
Loss for the period, IFRS	343	619	659
Non-IFRS loss per share	0.06	0.08	0.09

Source: AliHealth, BLRI (2021/9/10)

Company Description

Alibaba Health (AliHealth) is China's largest online healthcare platform by GMV. It is a wholly owned subsidiary of Alibaba Group (69%). Online pharmacy contributed ~100% of its revenues with the ratio of direct sales to platform GMV being ~1:8. The company was formerly known as CITIC 21CN, renamed as AliHealth in October 2014. We estimate AliHealth's GMV market share in China online (excl. O2O), Rx+OTC+VDS market to be ~52% in 2021.

Industry View

We expect China's online pharmacy (online B2C+O2O) penetration in Rx, OTC and VDS markets to grow from 3.9%, 12% and 48% in 2020 to 39%, 64% and 97%, respectively. With the market size of these three growing from Rmb46, 37 and 120bn in 2020 to Rmb1,097, 583 and 979bn in 2030.

Exhibit 22. Balance sheet

(Rmb mn)	FY2021	FY2022	FY2023
Cash and cash equivalents	11,637	13,016	14,504
Restricted cash	11	11	11
Prepayments, other receivables and other assets	770	1,071	1,353
Trade and bills receivables	314	443	567
Inventories	1,469	1,997	2,463
Total current asset	14,200	16,593	19,009
Property and equipment	13	19	30
Investments in associates	2,174	2,147	2,120
Financial assets at fair value through profit or loss ("FVPL")	984	929	874
Total assets	17,739	20,044	22,378
Trade and bills payables	2,552	3,326	3,959
Other payables and accruals	588	756	889
Contract liabilities	191	271	348
Total current liabilities	3,401	4,423	5,266
TOTAL LIAIBILITIES	3,458	730	972
Total liabilities	2,710	2,707	3,592
Total liabilities & shareholder equity	17,739	20,044	22,378

Source: AliHealth, BLRI (2021/9/10)

Exhibit 23. Cash flow statement

(Rmb mn)	FY2021	FY2022	FY2023
Loss before tax	401	(949)	(1,809)
Depreciation	6	170	114
Share-based compensation	397	443	573
Adjustments for balance sheet	295	64	(30)
Cash generated from/(used in) operations	876	1,129	1,319
Net cash flows generated from/(used in) operating activities	978	1,328	1,443
Purchases of items of property and equipment	(17)	(25)	(32)
Capital injection in associates	(276)	-	-
Capital injection in a joint venture	-	-	-
Net cash flows used in investing activities	(4,961)	51	45
Issue of new shares	8,917	-	-
Net cash flows generated from financing activities	8,922	-	-
Balance b/f	2,595	11,637	13,016
Balance c/f	11,637	13,016	14,504

Source: AliHealth, BLRI (2021/9/10)

Financial Summary – Ping An Healthcare and Technology Company Ltd.

Fiscal year ends 31-Dec

Exhibit 24. Income statement

(Rmb mn)	FY2020	FY2021	FY2022
Total revenue	6,866	8,962	11,774
Medical services	1,565	2,119	3,180
Consumer healthcare	1,383	1,902	2,544
Health mall	3,714	4,703	5,751
Health management and wellness interaction	204	239	298
Cost of sales	(5,002)	(6,662)	(8,601)
Gross profit	1,864	2,301	3,173
Gross margin	27.2%	25.7%	27.0%
Selling and marketing expenses	(1,587)	(2,442)	(2,943)
Administrative expenses	(1,017)	(1,928)	(2,395)
Other income	205	233	200
Other gains/(losses)-net	(385)	(91)	0
Share-based payments	(65)	(103)	(118)
Operating loss -IFRS	(919)	(1,928)	(1,965)
Operating margin, IFRS	(13.4%)	(21.5%)	(16.7%)
Operating loss, non-IFRS	(674)	(1,966)	(2,048)
Operating margin, non-IFRS	(9.8%)	(21.9%)	(17.4%)
Finance income/(costs)-net	100	153	100
Share of losses of associates and joint ventures	(122)	(19)	(19)
Profit before tax	(941)	(1,795)	(1,885)
Income tax expense	(7)	(14)	(19)
Profit/loss for the period, IFRS	(949)	(1,809)	(1,904)
EPS, non-IFRS- Basic and diluted (RMB)	(0.48)	(1.43)	(1.50)

Source: PAGD, BLRI (2021/9/10)

Company Description

Ping An Healthcare and Technology (PAGD) is China's largest internet healthcare platform in terms of average MAUs and daily average online consultations. In 2020, 17%, 59% and 24% of revenues came from online medical consultation, Rx+OTC+VDS sales and 2B businesses. In 2020, PAGD provided 330mn medical consultations online, most by its 2,247 in-house doctors and AI robots. We estimate PAGD's online medical consultation revenue share to be ~50% in 2020.

Industry View

We expect China's online medical consultation market to grow from Rmb22bn in GTV in 2020 to Rmb214bn in 2030. Consultation volume will grow from 1.09bn in 2020 to 6.76bn in 2030, with penetration growing from 12% in 2020 to 33% in 2030. We expect booking revenue per consultation to grow from Rmb20 in 2020 to Rmb32 in 2030.

Exhibit 25. Balance sheet

(Rmb mn)	FY2020	FY2021	FY2022
Cash and cash equivalents	7,920	6,529	5,064
Financial assets at fair value	3,566	3,566	3,566
Prepayments and other receivables	439	573	753
Contract assets	102	133	175
Trade receivables	1,058	1,381	1,815
Inventories	160	209	275
Total current asset	15,256	14,402	13,658
Goodwill	970	970	970
Property, plant and equipment	166	181	201
Investments in associates	383	363	344
Investments in joint ventures	69	69	69
Prepayments and other receivables	77	77	77
TOTAL ASSETS	18,563	17,703	16,961
Trade and other payables	1,863	2,481	3,203
Contract liabilities	730	972	1,255
Total current liabilities	2,668	3,553	4,587
Trade and other payables	1,863	2,481	3,203
Lease liabilities	730	972	1,255
Total non-current liabilities	39	39	39
TOTAL LIABILITIES	2,707	3,592	4,626
Total equity	15,833	14,087	12,311
TOTAL LIABILITIES, AND SHAREHOLDERS' EQUITY	18,563	17,703	16,961

Source: PAGD, BLRI (2021/9/10)

Exhibit 26. Cash flow statement

	FY2020	FY2021	FY2022
Loss for the year	(949)	(1,809)	(1,904)
Depreciation and amortization	170	114	141
Share option expenses	65	103	118
Changes in assets and liabilities:	(631)	348	313
Net cash flows from/(used in) operating	(1,102)	(1,376)	(1,412)
Payments for PPE and intangible assets	(73)	(120)	(157)
Proceeds from sales of financial assets	5,522	0	0
Payments for financial assets	(7,174)	0	0
Net cash flows used in investing	(2,497)	(121)	(158)
Net cash flows generated from financing	6,922	106	106
NET INCREASE IN CASH AND CASH EQUIVALENTS	3,323	(1,391)	(1,465)
Balance b/f	4,965	7,920	6,529
Balance c/f	7,920	6,529	5,064

Source: PAGD, BLRI (2021/9/10)

See the last page of the report for important disclosures

Financial Summary – YIDU Tech

Fiscal year ends 31-Mar.

Exhibit 27. Income statement

(Rmb mn)	FY2021	FY2022	FY2023
Revenue from contract with customers	867	981	1,159
Cost of sales and services	(540)	(619)	(748)
Gross profit	327	362	410
Gross margin	37.8%	36.9%	35.4%
Selling and marketing expenses	(239)	(251)	(273)
Administrative expenses	(310)	(316)	(333)
Research and development expenses	(222)	(246)	(285)
Net impairment loss	(16)	(18)	(21)
Other income	30	27	26
Other loss/gains	(24)	0	0
Share based compensation	(135)	(135)	(135)
Loss from operations, IFRS	(453)	(441)	(476)
IFRS operating margin	(52.3%)	(45.0%)	(41.1%)
Loss from operations, non-IFRS	(309)	(316)	(346)
Non-IFRS operating margin	(35.6%)	(32.3%)	(29.9%)
Finance income	1	0	0
Finance costs	(3)	0	0
Fair value change of convertible preferred shares	(3,246)	0	0
Loss before tax	(3,693)	(441)	(476)
Income tax credit	(1)	0	0
Loss for the year, IFRS	(3,695)	(441)	(476)
Loss per share, non-IFRS	(0.54)	(0.60)	(0.66)

Source: YIDU, BLRI (2021/9/10)

Company Description

Founded in 2014, YIDU Tech develops a suite of data analytics-driven solutions for the healthcare industry. In FY2021, 46% of revenues came from selling big data platform to hospitals and regulators, 21% from providing digital CRO service to biopharmas and 29% from providing specialty online medical consultations.

Industry View

We expect China's public medical and life science R&D spending to increase from Rmb25.2bn in 2020 Rmb45.1bn in 2030. We expect China's life science digital infrastructure market, including digital CRO, RWE and digital commercialization) to grow from Rmb5.1bn in 2020 to Rmb59.3bn in 2030.

Exhibit 28. Balance sheet

(Rmb mn)	FY2021	FY2022	FY2023
Cash and cash equivalents	740	986	1,159
Trade receivables	366	414	489
Inventories	32	36	44
CURRENT ASSETS	5,150	5,461	5,743
PPE	28	88	144
Intangible assets	39	42	45
Deferred tax assets	1	0	0
TOTAL ASSETS	5,250	5,622	5,967
Trade and other payables	177	202	245
Salary and welfare payables	184	211	256
CURRENT LIABILITIES	415	455	541
NON-CURRENT LIABILITIES	83	90	90
CAPITAL AND RESERVES	4,730	4,339	3,929
TOTAL EQUITY AND LIABLITIES	5,250	5,622	5,967

Source: YIDU, BLRI (2021/9/10)

Exhibit 29. Cash flow statement

(Rmb mn)	FY2021	FY2022	FY2023
Loss before income tax	(3,693)	(441)	(476)
Depreciation and amortization	36	28	31
Share-based compensation	135	135	135
Fair value change of CB	3,246	0	0
Change in working capital	(79)	32	(6)
Net CASH (USED IN)/GENERATED FROM OPERATING ACTIVITIES	(331)	(211)	(280)
Payments for investments in wealth management products	0	0	0
Payments for property, plant and equipment	(14)	(20)	(23)
Proceeds from wealth management products	(3,866)	0	0
NET CASH USED IN INVESTING ACTIVITIES	(3,874)	(24)	(27)
Net proceeds from issuance of ordinary shares relating to the initial public offering	3,810	0	0
NET CASH GENERATED FROM FINANCING ACTIVITIES	4,259	481	481
NET INCREASE IN CASH AND CASH EQUIVALENTS	53	246	173
CASH AND CASH EQUIVALENTS, BEGINNING OF YEAR	720	740	986
CASH AND CASH EQUIVALENTS, END OF YEAR	740	986	1,159

Source: YIDU, BLRI (2021/9/10)

Contents

What can we learn from education regulation?

In 2020, the after school tutoring (AST) sector was roiled by the storm of regulation. In our view, it has become apparent that in areas critical to the cost of living, Chinese government will not allow the existence of excessive, easy or permanent profitability. We believe such also applies to healthcare. We believe only companies who can direct contribute to the health well-being of Chinese people will see their business practices unchecked. To this end, we believe that prescription drug gross margin of online pharmacies, medical consultation take-rate of consultation platforms, as well as profit margin of healthcare infrastructure digitalization, will all come under pressure in due time. Besides looking for uniqueness and differentiation, investors should also look for private funding channels, SOE umbrellas and bundled pricings to avoid scrutiny from the regulators.

Entities that operate in the living cost sectors that do not focus on enlarging the supply but rather on reshuffling it will be scrutinized.

Healthcare, so far, is different from after school tutoring

However, comparing to the after school tutoring sector (AST), which is nearly 100% private owned, healthcare institutions today are still predominantly public. Further, unlike AST, which exists as a derivative of the in-school-teaching (IST) and often perceived as a counter-productive one, most of the private healthcare institutions are still in the primary healthcare provision business. One of the persistent AST criticisms is that it lures talents from IST and achieves success on the decay of IST. Such problem isn't yet pronounced in healthcare. Private hospitals with dubious medical merits, such as cosmetic surgery, are so far allowed to operate with adequate disclosure and truthful advertising.

State Owned Enterprise (SOE) umbrella means operating in a sector that is dominantly public can often deflect regulation scrutiny.

But long-term profit margin for platform business will not be high

We believe Chinese government will tolerate, or even reward, companies who address the supply demand imbalance problem but will not tolerate rent-seeking. Companies that bring tangible value to enhance the welfare of the people, such as innovative drugs and medical devices, will be awarded profit windows of various lengths. Companies that merely shift wealth from one pocket to another will be largely denied profit opportunities. To this end we believe:

- **The profit margin and take rate of online pharmacy will diminish over time:** This will be executed through the price control of prescription drugs (Rx) and less so on the Over-the-counter (OTC) drugs and Vitamin-Dietary-Supplements (VDS);
- **The take rate of online consultation will normalize over time:** If we divide WeDoctor's medical service revenue of Rmb707mn in 2020 by the 18mn of consultation made, we got a booking fee of Rmb39/consultation, which represents one third to one tenth of the typical hospital registration fee (挂号费) of Rmb5-20 plus diagnosis fee (诊疗费) of Rmb100-500, depending on seniority of the doctor. We believe such take rate is clearly not sustainable. If we have to venture a guess, we believe government will not allow online consultation take rate to exceed 3%. PAGD, with its internal doctor term and AI robots providing consultation, however, might see its revenue per consultation rising towards registration fee and diagnosis fee;
- **Serving public hospitals may not be a good business**: Chinese hospitals as a whole loses money and relies on fiscal appropriation from the government to breakeven. In 2019, fiscal

We believe WeDoctor's average take rate between 1/10 to 1/3 of hospital registration fee and diagnosis fee is not sustainable. Traffic referral model will not work in healthcare.

appropriation contributed to 8.7% of revenue of the public hospitals and 33% of the revenue of public health stations (*Source: NHC*). Such revenues carry with them regulation scrutiny as a given.

Private, direct, subscription and cost saving are alternatives

This also implies that:

Commercial health insurance is less than a quarter of national health insurance, a reversal of the situation in the US.

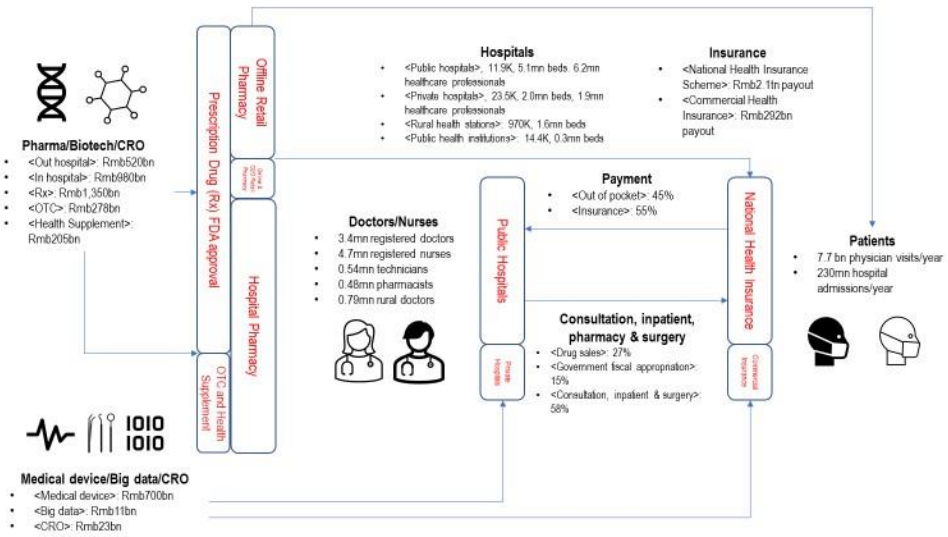
- **Focusing on private domain can yield more stable profits**: Unfortunately, private sector is a small sector in China's healthcare landscape. Still, we believe closed loop and private ownership are two characteristics that we will award a premium. In a typical healthcare scenario, patients are service buyers while doctors, drug makers and medical equipment makers are service sellers. But these parties have surrogates. The surrogate of the patients is the insurer, and the surrogate of the doctors is hospital. Commercial health insurance is an important surrogate of the patient which dominates the healthcare industry in the US (Exhibit 30). But in China commercial health insurance was less than a quarter the size of the national health insurance (Exhibit 32). PAGD's parent, Ping An Insurance, had the largest market share in commercial health insurance of 20-25% (Exhibit 31).

- **Direct model might be more sustainable than platform model**: In both pharmacy and consultation, we believe the government wants to see companies directly engaging in providing the service while leaving the task of resource coordination to the government;

Patients, doctors and drug makers are direct buyers and sellers, but they act with insurers, hospitals and pharmacies as commercial surrogates.

- **Subscription might be a better way to monetize than transaction**: Because healthcare does not have direct consumption-payment relationship, and government plays its visible hands often, we believe companies who can bundle their services into a subscription package can solve the difficult problem of monetization better than those who can't. Companies with a transactional business model might see their potential topped out quicker than expected.

Exhibit 30. Relationships and market sizes of healthcare value chain



Source: Blue Lotus (2021/6/13)

Commercial insurance (商保) is the next nexus of competition

Because of the reason aforementioned, we believe commercial health insurance is a very important frontier for investors because to some degree it evades the profit scrutiny of the government. However, after examining the sector we found the expansion pace of the sector had been very conservative. Innovative business models, like Waterdrop, was denied the license in 2019. We believe part of the reason was the severe lack of insurance understand of Chinese consumers.

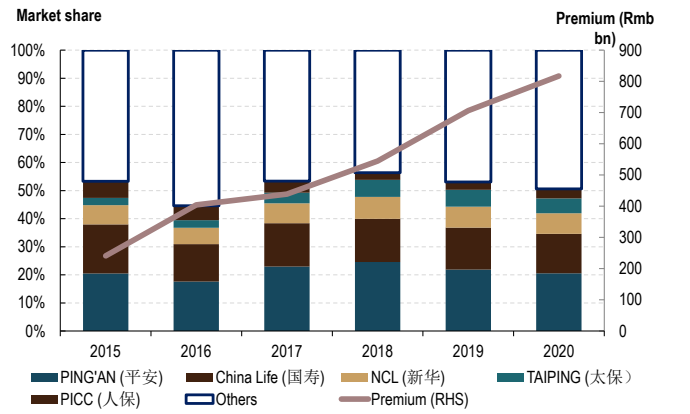
A virtuous interaction between insurer and insured hasn't arrived in China

In 2020, China's national health insurance scheme, despite claiming a coverage ratio of nearly 100%, paid out only Rmb2.1tn in claims, less than 1/3 of China's healthcare expenditure. Forty-five percentage of China's healthcare expenditure is still paid out of pocket and we believe this ratio underestimated the spending on nurses, which mostly are out-of-pocket in China. The true comparable figure to developed countries like US, with nursing cost covered, has even greater gap.

From 2015 to 2020, premium underwritten by China's commercial health insurers grew at a CAGR of 28% (Exhibit 31). Ping An Insurance (610318 CH/2318 HK/PNGAY US, NR) commanded the largest share at 20-25%, followed by China Life (601628 CH/2628 HK/LFC US, NR), NCL (601336 CH/1336 HK, NR), Taiping (966 HK/CTIHY US, NR) and PICC (1339 HK/PPCCY US, NR). But still commercial healthcare insurance constituted only 33% of national health insurance in premiums and 14% in payments (Exhibit 32). Despite this, the surplus of commercial health insurance is 138% of that of national health insurance. This industry seems to be more interested in skimming profit than matching with its public peer. With the exception of Ping An, all top commercial health insurers are stated owned.

China's commercial health insurance is very profitable and most of the top five are state owned, which we believe is an example of SOE umbrella.

Exhibit 31. Premium and market share of commercial health insurance in China



Source: Ping An, China Life, NCL, Taiping, PICC, Blue Lotus (2021/6/13)

Exhibit 32. Growth of commercial health insurance vs. national health insurance

(Rmb bn)	2018	2019	2020	2021E	2022E	2023E
Commercial health insurance surplus	370	472	**525**	658	790	940
Premiums	545	707	**817**	1,025	1,230	1,463
Payment	(174)	(235)	**(292)**	(366)	(440)	(523)
National health insurance surplus	356	339	**381**	412	444	477
Premiums	2,138	2,334	**2,485**	2,683	2,891	3,108
Payment	(1,782)	(1,995)	**(2,103)**	(2,271)	(2,447)	(2,631)
Commercial/National	1.04	1.39	**1.38**	1.60	1.78	1.97
Premiums	25%	30%	**33%**	38%	43%	47%
Payment	10%	12%	**14%**	16%	18%	20%

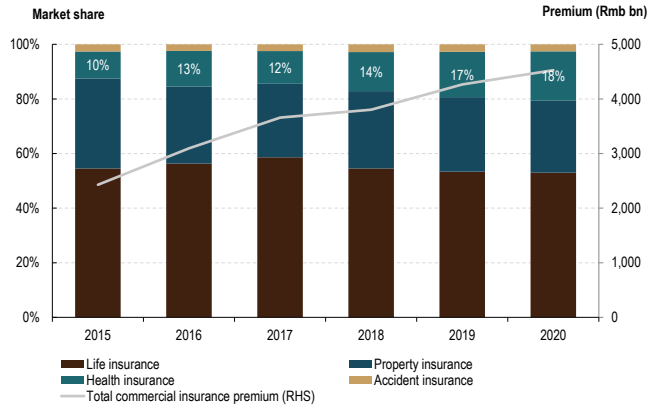
Source: NHSA, CBIRC, Blue Lotus (2021/8/6).

According to CBIRC, commercial health insurance premium now constituted 18% of China's total premium of commercial insurances (Exhibit 33). The weight of health insurance has been rising each year within commercial insurance. In 2020, China's insurance premium reached Rmb4.53tn, or 4.5% of China's GDP. Comparing to the US figure of US$2.6tn, 12% of GDP (Exhibit 34) and Japanese figure of 8.1% of GDP, China is underpenetrated in insurance as a whole. But even so, the entry barriers to insurance are seemingly high so the top players aren't in a hurry to penetrate. We believe this phenomenon stems from the risk averseness of the Chinese regulators in their approach

It seems Chinese regulators are very cautious in insurance.

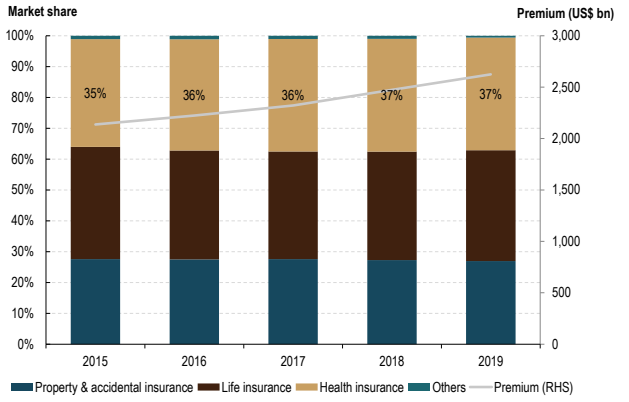
to insurance. If we count SOE commercial insurer as public, then Chinese government has a monopoly in the business of insurance to see it policies carried out absolutely each time.

Exhibit 33. Commercial insurance market share China



Source: China Banking and Insurance Regulatory Commission (CBIRC), Blue Lotus (2021/6/13)

Exhibit 34. Commercial insurance market share, US



Source: NAIC, Blue Lotus (2021/8/6).

Coverage content of national health insurance varies greatly from city to city

The biggest reason why Chinese people needs commercial health insurance is because the national healthcare insurance scheme is balanced on a city level, which means in-land or poor cities do not have very good coverages.

Based on our observation, the differences of local versions of national health insurance are:

- **Residential status**: Most cities are classified by urban and rural residential status. But some, like Shenzhen has three classes of national health insurance schemes. Class I has the highest contribution and broadest coverage, typically reserved for people with Shenzhen family registration, or *Hukou*, and certain talents the city government wants to attract;
- **Deductibles**: Different cities have different deductible schedules for different hospitals, usually vary by the class (I, II and III) of the hospital and for different clinical purposes, such as outpatient (门诊/急诊), inpatient (住院) and critical illness (大病). Class III hospitals tend to have higher deductibles because they are usually the most expensive;
- **Co-payment:** Different cities have different copayment schedules for different hospitals and for different clinical purposes. Co-payment ratio for critical illness also varies greatly from city to city;
- **Annual cap:** Most cities have different annual cap of medical expenses that are reimbursable;
- **Designated hospitals:** Most cities have designated hospitals for certain classes of coverages;
- **Length of time in scheme:** Most cities have different co-payment, annual cap and deductible schedules for insurance recipients with different length of time in the scheme. Shanghai, for example, has different coverage for first year and non-first-year scheme participants;
- **Coverage of illnesses:** NHSA (National Health Security Administration) maintains three national health insurance catalogs (医保目录) of consultations, facilities and drugs. The drug catalog contains only ~2,500 drugs (Class A and B), or only 2% of the drugs approved by

Each Chinese city is a mini-HMO. There are many parties, government, local governments and companies intermixed, in the health insurance business.

NMPA (China's FDA). which means 98% of drugs approved for sale by NMPA (National Medical Products Administration) in China aren't covered by China's national health insurance scheme. Among this 2,500, ~1900 (Class B) requires co-payment, with co-payment level varies from city to city. Many consultations, including health check-ups, oversea medical trips, nurses, vaccination, infertility, dentistry, cosmetic surgery, artificial body parts and advanced diagnostic techniques (PETCT/CT), as well as many facilities that perform the above services, are not in the coverage;

The difference of national health insurance scheme in Shenzhen and Shanghai likely reflects the age profile and SOE concentration differences of the two cities.

- **Coverage of critical illnesses:** Most cities pay for critical illnesses only for items on the NHSA approved catalog, which means many newest and imported drugs and treatments aren't included and has to pay out of pocket;
- **Post retirement coverage**: Different city has different policy for retirees to reflect their municipal obligations.

Exhibit 35 and 36 explain the difference of national health insurance schemes in Shanghai and Shenzhen. The policy in Shanghai makes the distinction between urban worker and rural residents, as well as employed versus retirees, reflecting the diversity of Shanghai's population. The policy in Shenzhen, however, made no such distinctions, reflecting the city's residents being mostly young immigrants. The biggest distinction of coverage in Shenzhen is the ability to choose hospitals. Both Shanghai and Shenzhen make a distinction in the length of time in the scheme and the income level of the recipient.

Exhibit 35. Summary of national health insurance, Shanghai

	Urban worker			Rural resident
Age	<44	>45	Retiree	4 age groups
Baseline (Rmb/yr.)	Social average salary		155-430	NA
Employer contribution	10.5%		Paid for by gov't	Rmb155-430/yr.
Individual contribution	2.0%			
Freelancer contribution	11.5%			
Outpatient deductible (Rmb)	1,500/time		300-700/ time	300-500/yr.
Outpatient co-pay	35-50%	25-40%	10-30%	20-50%
Inpatient deductible (Rmb)	1,500/time		700-1,200/time	50-300/time
Inpatient copay	15-20%		8-20%	10-40%
Critical illness copay	35-40%			

Source: Shanghai HSA, Blue Lotus (2021/6/13)

Exhibit 36. Summary of national health insurance, Shenzhen

	Class I	Class II	Class III
Baseline (Rmb/yr.)	Higher of salary & 60% social avg. salary	Social average salary	Social average salary
Employer contribution	5.2%	0.6%	0.45%
Individual contribution	2.0%	0.2%	0.1%
Hospital choice	Any		Designated
Outpatient deductible (Rmb)	100-300/time		
Outpatient co-pay	10-40%		
Outpatient registration fee	Self-pay	Rmb1,000	
Inpatient deductible (Rmb)	1,500/time		700-1,200/time
Inpatient bed fee (Rmb/day)	60		38
Annual deductible (K Rmb)	120-1,670		

Source: Shenzhen HSA, Blue Lotus (2021/6/6)

The Chinese version of *Medicare Advantage* caught fire but had to scale down

As Exhibit 32 shows, China's commercial health insurance has a decent surplus, which is high comparing to the developed countries. In the US, commercial health insurance surplus was 4.0% of its premium in 2020 (*Source: NAIC*), comparing to 11% in Japan (*Source: SEIHO*) and 64% in China. We believe this phenomenon has to do with the relatively short history, license barrier and regulatory conservatism. Since 2016, there has been various effort at achieving greater penetration through lower premiums. So far, only the national health insurance scheme has been a raging success.

We believe that over time the surplus level of China's commercial health insurance will come down.

Effort 1: Huimin Insurance (惠民保) focuses on price: The latest try was an insurance product called the Commoners Beneficence Insurance, or Huimin Insurance (Huiminbao). A Huimin Insurance is organized by the local government and bid for by commercial insurers. The idea of Huiminbao is to use the credibility of government to market the product, but to rely on the incentives and experiences of the commercial insurers to operate and maintain.

Huiminbao caught fire in 2020. It is the Chinese equivalent of Medicare Advantage in the US. But Huiminbao only shows the potential. Its size is very small.

First launched through the collaboration of Ping An Insurance and Shenzhen Municipal Government as a supplement insurance for critical illnesses in 2015, Huiminbao grew to only five cities by 2019. Yet in 2020 it caught fire and now has more than 128 varieties offered in 92 cities, as of July 2021 (Exhibit 37), among a total of 663 cities in China. Huiminbao usually has very low premium (Rmb50-80/year) and disclosure requirements (usually zero), but is only payable after exhausting the benefits of national health insurance and other commercial health insurances schemes.

The penetration of Huiminbao has been very rapid over a short time. According to Huize, total Huiminbao policy holders was 23mn in August, after an early crackdown by CBIRC. Local news put the accumulative Huiminbao policy holders at 40mn and average annual premium at Rmb125.

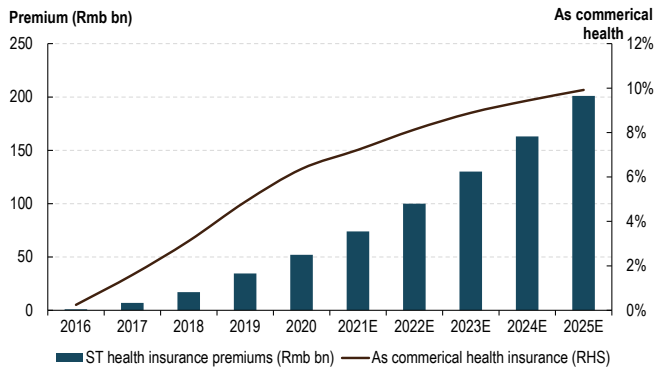
Taking average annual premium of Rmb125, 23-40mn policy holders only means an annual premium stream of Rmb2.88-5.00bn, or 0.35-0.61% of China's commercial health insurance market. Apparently, Huiminbao only shows the mass market potential but insurers must think twice how to monetize. People bought Huiminbao for its eye-catching low price and apparent value for money. As time goes on, report shows Huiminbao has been raising price in many cities.

Exhibit 37. Huiminbao (Commoner's Beneficence) cities

	No. of Huiminbao	City with Huiminbao
Nationwide	1	0
Guangdong, Jiangsu, Zhenjiang, Shandong (>10)	58	39
Sichuan, Anhui, Hunan, Fujian (5-10)	31	20
Henan, Jiangxi, Liaoning, Hebei, Beijing, Hainan, Guangxi, Hubei, Guizhou (2-5)	29	24
Chongqing, Gansu, Heilongjiang, Jilin, Ningxia, Shanghai, Shanxi, Tianjin, Yunnan (1)	9	9
Total	**128**	**92**

Source: Blue Lotus (2021/6/13)

Exhibit 38. Premium size of short-term health insurance



Source: iResearch, Zhong'an Insurance, Blue Lotus (2021/6/6)

Effort 2: Million Rmb Health Plan plays with duration: Before Huiminbao, another hot selling commercial health insurance product was short term health insurance, often called "Million Rmb Health Plan" (百万健康险). Million Rmb Plan means its payment can reach millions while premium is only in the few hundreds a year. However, the durations of such plan are renewable once a year and the longest automatic renewal period is six years. Commercial insurers can terminate coverage at any time when risk-payment ration is unfavorable. Short term health insurance also has strict pre-condition disclosure requirements. According to iResearch, premium of short-term health insurance reached Rmb34.5bn in 2019, or 4.9% of the market for commercial health insurance, up 103% YoY (Exhibit 38). Policy holders reached 90mn. Average premium was Rmb540 per year.

Before Huiminbao, short term health insurance caught fire and grew to 4.9% of the commercial health insurance market.

In January 2021, CBIRC published a decree to regulate the short-term health insurance market. In this decree (《中国银保监会办公厅关于规范短期健康保险业务有关问题的通知》), CBIRC stipulated that short term commercial health insurance cannot mislead consumers on duration and renewability of their products. It also required commercial insurers to disclose their insurance loss ratio (annual payment over premium) twice a year.

Effort 3: Internet mutual aid bordered on the line of a Ponzi scheme: Before short term health insurance and Huiminbao, Internet mutual aid caught the imagination of Chinese consumers. The earliest pioneer of mutual aid scheme is a cancer assistance community called Resist Cancer Commune (康爱公社), established in 2011. Waterdrop Mutual Aid (水滴互助) started operation in March, 2016. Alibaba's Mutualbao (相互宝) started in 2018. Both exceeded 100mn mark in accumulative participants before winding/scaling down their operations in 2021 at the request of the government. Waterdrop Mutual Aid transitioned to selling other insurers products and has since become a public company (WDH US, NR).

As reimbursement rolling in, Mutualbao has to raise its monthly due by 10x, leading to a wave of redemptions.

The idea of mutual aid is a membership program with monthly dues. Members with critical illness can get help from the membership fee pool. Similar to Huiminbao and Million Rmb Plan, mutual aid programs typically started with very low premiums. But as payments starting to roll in, they must also raise premium levels, in Mutualbao's case, in the magnitude of more than ten times. Many members feel cheated and redeemed.

According to Waterdrop, management fee revenue from its mutual aid and crowdfunding business amounted to Rmb143mn at its peak in 2019. The take rate announced by Mutualbao was 8%. This means the premium collected by Waterdrop was likely in the neighborhood of Rmb1.79bn, a mere 0.25% of the commercial health insurance market. Adding Mutualbao and other market participants, the premium market share of mutual aid programs likely did not exceed 0.5% of the market. For such a small contribution of premiums but for such a big social issue caused by a failed Ponzi scheme, no wonder the government took the action.

The common problem of Huiminbao, Million RMB and mutual aid schemes is they just don't have enough money to pay for claims.

Huiminbao, Million Rmb and mutual aid schemes are all great eye-catchers that raise the awareness of commercial health insurance for average citizens. Yet their common problem is that all are marketing gimmicks, with the premium raised cannot cover medical claims.

Difficulty to get surrogates to pay will be a salient problem

As Exhibit 30 shows, the buyers and sellers of healthcare service aren't the end consumers and producers. Patients, doctors and biopharmas each function through a surrogate party when interacting with each other, which are insurers, hospitals and FDA/pharmacies. Regulators regulate the surrogates. Because surrogates determine what is the best interest of their patrons, they have strong incentives to control costs. This means for producers of healthcare service, to get the surrogates to pay will be a difficult task. Further, surrogates have a strong incentive to insource.

The buyers and sellers of healthcare are regulated and managed by surrogates, which makes the commercial relationship complicated.

Judged from our survey of the pre-IPO companies, monetization seems to be a common issue for healthcare producers that cater their service to the surrogates. Difficulty to monetize is a common problem.

- **MedLive (2192 HK, NR) – China's WebMD:** Serious doctors' information portal has existed in Japan's M3, US's WebMD and Sermo and China's MedLive (医脉通) and DXY (丁香园). According to its filing, while serving 58% of China physicians with an MAU more than 1mn, MedLive only generated Rmb213mn in revenues but Rmb103mn in operating profit in 2020. Growth requires expansion to new businesses which will hurt profitability;

Finding sustained revenue and profit has been challenging in healthcare.

- **MedBank (思派健康) – specialist doctors group:** Started in 2014, MedBank built a doctor's group around the speciality of cancer treatment. It is the biggest Site Management Organization (SMO) for cancer clinical trials as well as the largest distributor of the latest, some unapproved, cancer drugs. It works with 42K doctors in 1.1K hospitals with 44 insurance companies serving 10K members. Yet in 2020, 92% of its revenues still came from drug sales with a low gross margin of 4-6%. Its service businesses to doctors, CRO's, pharma and patients amounted to only Rmb218mn in 2020 and grew only 25% YoY (Exhibit 40). Like YIDU, MedBank participated in 11 Huiminbao programs nationwide in an effort to broaden its monetization;

- **LinkDoc (零氪) – specialist doctor group:** Despite LinkDoc's claim of itself as a big data platform, it still relies on drug sales as its main revenue source. In 2020, 81% of its revenue came from selling cancer drugs, with the remaining 19%from SMO and CRO business similar to MedBank (Exhibit 40). LinkDoc only has 9mn longitudinal health cards and 2.5mn tracked patients, making it far smaller than YIDU's claim;

Both MedBank and LinkDoc started as big data company modeled after Flatiron and Foundation Health, but in reality they both monetize by selling special cancer drugs.

- **YIDU Cloud (2158 HK, NR) – EHR/EMR data miner**: YIDU claimed to access 1.3bn longitudinal health records over 300mn patients legitimately. YIDU derives data from Electronic Health Record (EHR) and Electronic Medical Record (EMR) systems like Goodwill (嘉和美康), Winning Health (300253 CH, NR) and Haitai (海泰医疗) to perform data analysis for hospitals, biopharmas and regulators at a price tag of Rmb4-5mn per year, which is the only exception to our hypothesis that serving healthcare surrogates is a tough business;

The biggest EHR/EMR company only generated a revenue stream of ~Rmb200mn a year. Yet data miner using EHR/EMR can generate a revenue stream of ~Rmb900mn a year.

- **Goodwill (嘉和美康) – China's EPIC/Cerner:** According to IDC, Goodwill is China's biggest EHR system company with 19% market share, followed by Winning Health (卫宁健康) and Haitai at 10-12% each. Yet according to its prospectus, Goodwill generated Rmb440mn in revenues in 2019, of which only 44% was EHR/EMR. Goodwill, Winning and Haitai are also vertical ERP+SI (system integrator) vendors for hospitals, with hardware, software and service revenues bundled in one;

- **Infervision (推想医疗)** – **Medical imaging AI**: Medical imaging has been the realm of GPS (GE Health, Philips and Siemens) and NCF (Nikon, Canon and Fujifilm), who have added AI as supplements to their equipment sales. AI start-ups like Arterys and CureMatrix usually work with GPS to generate sales. For 2020, Infervision generated a revenue of only Rmb27.7mn (Exhibit 40). The company was founded in 2016 with a focus on lung and heart diagnosis (Exhibit 39);

AI imaging companies cannot charge very high because they rely on their customers, the hospitals, to provide them with data.

- **AirDoc (鹰瞳) – Medical imaging AI:** AirDoc was founded in 2015 with a focus on diabetics diagnosis. For 2020, AirDoc generated a revenue of only Rmb47.6mn;

- **KEYA Medical (科亚医疗) – Medical imaging AI**: KEYA was founded in 2018 with a focus on heart diagnosis. For 2020, KEYA generated a revenue of only Rmb709K (Exhibit 40).

Is YIDU Cloud China's Flatiron?

YIDU is an outlier, if not exception, to our thesis that serving the surrogates has no money to make. YIDU does not rely on drug sales like MedBank and LinkDoc. Nor do it rely on hardware and system integration sales like it's A-share peers like Winning Health and B-Soft (300451 CH, NR).

EHR/EMR is at early stage and unreliable

To our understanding, China's EHR/EMR penetration has rolled out rapidly but EHR/EMR sharing across hospitals has been at early stage. The same patient might have activities across different departments and at the pharmacy. He/she may also have activities in different hospitals. According to NHC's 2018 legislation <EHR/EMR System Application Level Grading Management Method> (《电子病历系统应用水平评级管理办法》), Class III hospitals must achieve intra-hospital information sharing (Level 4) and Class II must achieve critical department interconnection (Level 3), by 2020, which is equivalent to reaching Stage 2 EHR implementation in the US, emphasis on care coordination and patient information exchange, according to the Health Information Technology for Economic and Clinical Health (HITECH Act) of 2009.

EHR/EMR implementation has been challenging due to data quality issues in both US and China.

Exhibit 39. Medical imaging AI companies and their specialties

	Lung	Cardinal	Optic	Ossature	Neck	Gland
Infervision	L/P			P	P	
AirDoc			L/P			
KEYA	P	L/P			P	
Deepwise (深睿+依图)	L/P	P		L/P	P	P
Shukun (数坤)	P	L/P			P	
UII (联影智能)	L/P	P		L/P	P	P
Ping An Pasmart (平安智慧城市)	P		P		P	P
Biomind (安德医智)		P			L/P	P
HYHY (汇医慧影)	P			L/P		
Vistel (智远慧图)			L/P			

Source: Blue Lotus (2021/6/13). L=Type 3 medical device license (highest), P=Product

Exhibit 40. Financials of medical big data + AI companies

(Rmb mn)	Company	2018	2019	2020
Revenue	MedBank	133	1,039	2,700
Gross Profit		10	82	187
Op. loss		(184)	(272)	(375)
Revenue	YIDU	82	444	790
Gross Profit		4.1	111	282
Op. loss		(387)	(556)	(489)
Revenue	LinkDoc	NA	499	942
Gross profit		NA	67	77
Op. loss		NA	(399)	(245)
Revenue	MedLive	83	122	214
Gross Profit		50	77	156
Op. profit		16	37	105
Revenue	Infervision	NA	30	48
Gross Profit		NA	16	29
Op. loss		NA	(46)	(52)
Revenue	AirDoc	NA	6.6	28
Gross Profit		NA	5.0	23
Operating loss		NA	(172)	(263)

Source: MedBank, YIDU, LinkDoc, MedLive, Infervision, AirDoc, Blue Lotus (2021/6/6)

We therefore estimate that by 2021, most of China's patient health records were digitalized, but most were cross department, few were cross hospital and ever fewer can share externally and incorporate non-clinical data. Our channel check also suggested that only very few hospitals have achieved the levels of five an above under NHC's classification (Exhibit 41).

We estimate most of China's health records are digital, but few are cross hospital, most are cross department and even fewer can share externally and incorporate non-clinical data.

EHR data usually needs tremendous cleaning before becoming usable, because different doctors and hospitals use different nomenclatures, formats and habits. Even in US, EHR data is not

considered high quality. Foundation Medicine, the world's largest cancer genomic database claim to have only 500K+ patient sample profiled (*Source: Foundation Medicine*). In 2017, in a cooperation with National Cancer Institute (NCI), Foundation Medicine provided NCI with a gene sequence data set of merely 18K adult cancer patient, helping NCI growing its database 2x.

R&D spending by the public sector has a small budget size

YIDU's hardware revenue and outsourcing cost suggest it is an effective seller of things.

Therefore, there are two possible answers to the question of why YIDU is able to monetize where others find it hard to:

- YIDU works with, or leads its customers to believe that work with on EHR/EMR data to generate medical insight is more valuable than gathering and storing EHR/EMR itself, or,
- YIDU today is a sales channel that sells a variety of products to the hospitals, regulators and biopharmas in their effort to digitalize. We notice that YIDU's revenues do contain an undisclosed portion of hardware. In FY2021, hardware and software constituted ~1/3 of YIDU's cost of revenues, with another quarter from outsourcing cost.

Exhibit 41. Nine levels of China's hospital EHR certification

Level in China	Equivalent stages in US	Information use	Overall goal
0		Do not use computer	Less than 3 departments use computers
1	Stage 1	Single PC	Doctor dictation, checkup, inpatient drug use must use computers
2		Cross department information sharing	Doctor dictation, checkup, inpatient drug use must use networked computers but do not interconnect
3		Getting information internally and externally	Doctor dictation, checkup, inpatient drug use must have interconnection
4	Stage 2	All departments achieve information sharing	All patient-related flow of information digitized and sharable. Hospital pharmacy drug use also interconnected
5		Can provide clinical best practices and unified drug use databases.	Digital information can standardize. Support decision making, hospital management and clinical research
6	Stage 3	Closed loop medical data management. All business can record, store and process information	Digital information system supports auxiliary functions such as surgery and blood transfusion. Entire hospital shares knowledge base.
7		Sharing information with external parties.	Actively management entire hospital process. Able to share information with patients
8		Integrate non-clinical information	Able to compare with other hospitals in the area and mark for improvements

Source: NHC, CMS, Blue Lotus (2020/8/25)

We believe YIDU is a pioneer in enabling cutting edge healthcare research in China. But today its business likely contains a lot of channel selling.

The fundamental research spending on innovative drug and treatment discovery is clearly on the rise. But the size is still very small, at around Rmb25bn a year.

- **NHC spending on healthcare research is flattish**: NHC spent Rmb6.14bn in scientific research in 2020, or 2.7% of its total spending of Rmb232bn, flat from Rmb6.09bn in 2019. Among this Rmb6.14bn, Rmb4.60bn was from fiscal appropriation, with the remaining Rmb1.5bn from NHC's revenue generating research hospitals, speciality clinics, training facilities, etc. Exhibit 42 shows the scientific research spending by NHC and its contribution to the NHC budget, both have been flattish in recent years;

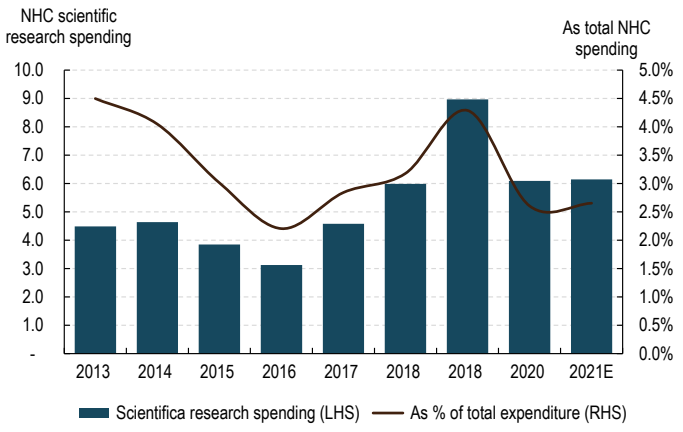
- **Local government spending on healthcare research is on the rise**: (1) In 2018, Guangdong government launched an initiative to build cutting-edge research hospitals. The plan, named Peak Ascend Plan (登峰计划), planned to spend Rmb6bn over three years to upgrade ~20 public hospitals to national champions. In 2019, the number of such hospitals was raised to 30 and the total spending was raised to Rmb9bn. To our understanding, other provinces also have similar projects but none reached the magnitude of Guangdong; (2) In 2017, NHC and NDRC launched an initiative to collaborate with provinces to build 100 provincial healthcare hubs to diagnose and treat difficult and complicated illnesses (疑难病症医疗中心). By 2018, 113 hospitals were selected to the project to receive research fundings and equipment budgets; (3) In June 2021, State Council stipulated <The Opinion about Pushing for High Quality Development of Public Hospitals> (《关于推动公立医院高质量发展的意见》) which reasserts the role of public hospitals in taking the quality of healthcare to the next level;

China accelerated government support of fundamental research from 2017 through the investment of key projects.

- **Ministry of Science and Technology (MOST) spending on fundamental research accelerated and continued to accelerate:** (1) As shown in Exhibit 43, MOST spending on fundamental research gained momentum sharply in 2017 through the creation of key projects, such as 973, 863 and SUPPORT. However, we estimate <10% of these key projects were healthcare related, translating to an annual budget of Rmb4-5bn; (2) Under the context of US-China standoff, Chinese government stepped up spending on fundamental research. In 2021, MOST hiked budget for basic research, commercializing scientific research and research infrastructure by 65%, 49% and 116%, respectively, (3) MOST also manages the National Natural Science Foundation (NSFC) budget. The funding of NSFC on medical and life science research amounted to Rmb11.4bn, ~1/3 of NSFC's total spending of Rmb34bn in 2020. The split between medical and life science was roughly 45:55 in 2020 (Exhibit 44).

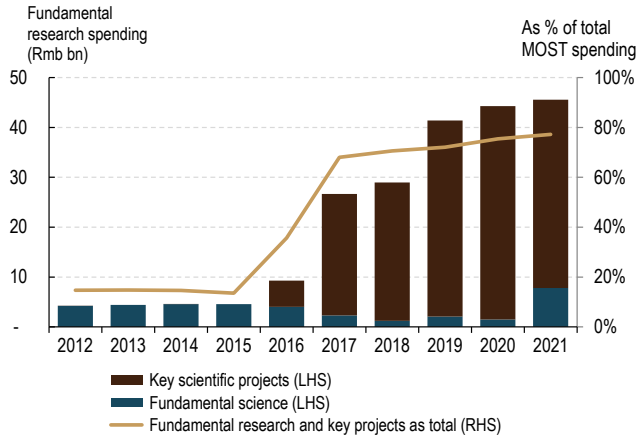
While most of national key research projects are defense related, ~1/3 of NSFC funding goes to life science and healthcare related fields.

Exhibit 42. NHC scientific spending breakdown



Source: NHC, Blue Lotus (2021/6/13)

Exhibit 43. MOST spending on fundamental research



Source: MOST, Blue Lotus (2021/6/6)

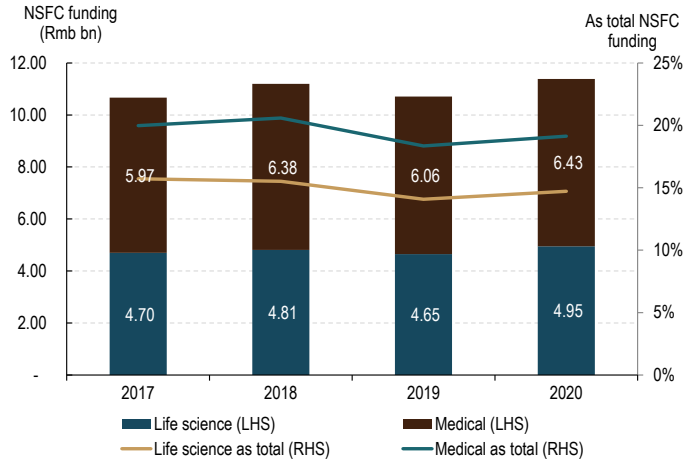
Therefore, as a whole, the amount of government dispensed healthcare related spending amounted to the neighborhood of Rmb26-27bn a year, consisting of (1) NHC budget spending or ~Rmb6bn, (2) Local government spending of ~Rmb5bn, (3) MOST budget spending of Rmb4-5 and (4) NSFC funding Rmb11bn. YIDU's fiscal year 2021 (ending March) revenue for big data platforms of Rmb402mn represents ~1.5% of the public R&D spending on medical and life science. As an enabler of the fundamental research, we consider this ratio to be high.

We estimate YIDU's revenue in its biggest addressable market was ~1.5% in 2020.

See the last page of the report for important disclosures

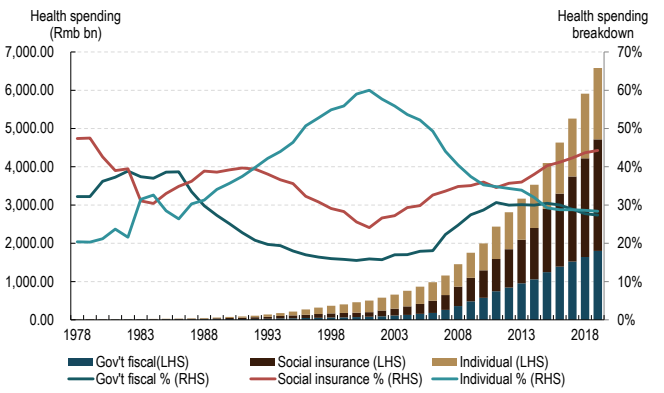
Is it big? We believe it has room to expand but at this stage represents fair risk reward ratio for investors, which also means YIDU likely need to invest aggressively to build entry barriers in the near future. We believe YIDU benefits from China's undefined data privacy environment for patients and uses its big data advantage to drive the sales of a variety of digitalization projects which we believe may not be totally big data in nature. But in general, China's government spending on fundamental research is rising across the board, with medical and life science taking no exceptions.

Exhibit 44. NSFC medical and life science research funding



Source: NSFC, Blue Lotus (2021/6/13)

Exhibit 45. Total healthcare spending and breakdown



Source: NHC, Blue Lotus (2021/6/6). Gov't=direct fiscal, Social=national insurance

As Exhibit 45 shows, government's fiscal spending on healthcare has been growing at a CAGR of 16% from 1978-2018, only 1ppt below the total spending on healthcare. Over the past 30 years, while both government's direct (fiscal) spending and indirect (social, meaning national health insurance) spending have dipped for almost a decade, both returned to their 1980 levels in terms of percentage of total, which we attribute to the healthy fiscal condition of the Chinese government. We can foresee robust growth in fundamental R&D spending going forward but the magnitude is likely to deviate materially from what we see today.

Government spending on fundamental medical research has been on the rise, thanks to healthy fiscal incomes in recent years.

YIDU's is spending to become a general purposed Flatiron

Outside of China there are two famous examples of medical big data applications. In 2018, Roche acquired oncology big data companies Flatiron Health and Foundation Medicine for US$1.9bn and US$5.3bn, respectively. Both acquisitions took place in cancer treatment, for a reason. The new kinds of bio-targeting cancer drugs require genomic profiling to choose the drug with the right biotarget, which makes a critical difference in patients' life and death. Genomic data therefore becomes an asset. New bio-targeting drugs are also being developed continuously, many of which haven't passed the FDA approval, thereby requiring constant patient, doctor, biopharma interactions to tailor the treatment for each cancer patient. The need for a big data and process management platform thus risen.

Medical big data in US concentrates in cancer treatment.

Based on our understanding, Flatiron Health is basically a cancer specific EHR/EMR and Foundation Medicine is basically a cancer specific genetic testing service. They can exist because the special circumstances existed in anti-cancer drug development, which led to an agreed compromise of patient data privacy. Both successfully carved out a niche against generic EHR/EMR companies like EPIC/Cerner/Allscripts and generic gene testing services like BGI (300676 CH, NR)

and Illumina (ILMN US, NR). In China, generic cancer screening companies like Burning Rock Biotech (BNR US, NR) and New Horizon Health (6606 HK, NR) perform similar roles as Foundation Medicine. But instead of selling big data, both have to sell specialty drugs to make a living.

Data privacy is a future risk to YIDU.

Business model wise, YIDU's big data platform business is similar to Flatiron but the two operates in very different markets. Like due to data security issues, only in specialized fields like cancer treatment does medical big data insight is allowed to commercialize in the US. In the US, the Health Insurance Portability and Accountability Act (HIPAA) 1996 allows disclosure of individual's health information only to approved parties, the so called "covered entities", for approved purposes. The "covered entities" include healthcare providers, insurers, insurance clearinghouse and their employees. Approved purposes include necessity for the flow of healthcare service as well as for public interests. We believe that thanks to the overwhelming presence of public hospitals in China's healthcare system, to roll out something similar to HIPAA is not difficult. Yet at this point there has been no equivalent of HIPAA in China. Under this context, YIDU has been successful in persuading the hospitals to share EHR/EMR data for research purposes.

Specialty drug + commercial insurance by membership is nirvana but data insight and market share are critical

Similar to Kaiser Permanente's origin of a company (Kaiser Shipyard) outsourcing its employees' healthcare needs to a doctor's group (Dr. Sidney Garfield), PAGD started by serving the internal needs of Ping An Insurance. The Kaiser model forms a closed loop of healthcare including in-house doctors/hospitals and patients/insurers. Such practice has been widely adopted, from United Healthcare's (UHC US, NR) Optum to CVS's acquisition of Aetna. Forming a doctor, pharmacy and insurance three-way closed loop is a way to lock-in revenue and preserve profit margins.

To borrow Internet parlance, the Kaiser model is healthcare's JD.com model. We believe both PAGD and JDHealth will pursue this route.

The advantage of having its own doctor's group, instead of working with external hospitals, is the ability to control quality and cost. The disadvantage is that it is labor intensive and management heavy. Yet we believe that such practice is safe in the eyes of the Chinese regulators and can yield long term value through good management.

In April 2018, JD.com partnered with Allianz to form JD Allianz. It currently offers health and auto insurance products and has a minuscule scale.

At market maturity, forming doctor, pharmacy and insurer closed loop might be a way to lock in revenue and profit margins. Before that, spend for market share might be a given.

In our view, to form doctor-pharmacy-insurer closed loop requires in depth knowledge and meaningful market shares in one or two of these three fields. The key benefit of these market shares is data insight, especially applied on commercial insurance policy formation and payments. As of now, the market shares of PAGD and JDHealth/AliHealth in medical consultation, drug distribution and health insurance are all in the single digits, with most of the data still scattered in isolated islands, which means all three must be investing heavily in the coming years to own and consolidate these data.

Although PAGD has arguably the best prospects, considering the barriers to entry to commercial insurance, the return of its investors is not guaranteed if the alignment with its parent is not favorable. PAGD might be gaining data insight for Ping An Insurance without getting a fair reward for its spending. We believe such is the biggest risk/concern of us towards PAGD.

PAGD might be gaining data insight for its insurance parent but not getting a fair reward for its spending.

Exhibit 46. China healthcare service business models and their US equivalents

Chinese	Ticker	Market cap (US$ bn)	CY2020 rev. (US$bn)	US equivalent/ aim-to-be	Market cap (US$ bn)	2020 rev. (US$ bn)
PAGD	1833 HK	8.4	1.07	Kaiser Permanente/ UHC (Optum)/ Teladoc	Private/395/23	89/257/1.1
AliHealth	241 HK	22.8	2.19	Walgreens/CVS	42/110*	139/269
JDHealth	6618 HK	30.8	3.02	Walgreens/CVS	42/110	139/269
MedLive (医脉通)	2192 HK	2.9	0.033	WebMD	Privatized at 2.8	NA
MedBank (思派科技)	Pre-IPO	NA	0.422	Flatiron	Acquired at 1.9	NA
Burning Rock Biotech (燃石医学)	BNR US	2.1	0.067	Foundation Medicine	Acquired at 5.3	NA
New Horizon Health (诺辉健康)	6606 HK	2.2	0.011	Foundation Medicine	Acquired at 5.3	NA
YIDU Tech	2158 HK	3.9	0.123	Flatiron/Change Catalyst	Acquired at 1.9/2.7	NA/
Goodwill (嘉和美康)	Pre-IPO	NA	0.083	Cerner/EPIC/Allscripts	23/Private/2.0	5.5NA/1.5
Winning Health (卫宁健康)	300253 CH	4.9	0.354	Cerner/EPIC/Allscripts	23/Private/2.0	5.5/NA/1.5
B-Soft (创业惠康)	300451 CH	1.9	0.255	Cerner/EPIC/Allscripts	23/Private/2.0	5.5/NA/1.5
Yifeng (益丰药房)	603939 CH	5.9	2.05	Walgreens/CVS	42/110	139/269
DSL (大参林)	603233 CH	5.4	2.28	Walgreens/CVS	42/110	139/269
LBX (老百姓)	603883 CH	3.1	2.18	Walgreens/CVS	42/110	139/269
YXT (一心堂)	002727 CH	2.7	1.98	Walgreens/CVS	42/110	139/269

Source: Blue Lotus (2020/8/25)

Specialty drug and consultation showed their potentials

LinkDoc, MedBank and Causa Health of YIDU showed the monetization potential of selling specialty drug and providing specialty consultation over general drug and general consultation.

Besides LinkDoc and MedBank, which sells speciality cancer drug as their main businesses. YIDU's third business line also showed such potential. In fiscal year 2021, 29% of YIDU revenue came from an online medical consultation business called Causa Health (因数健康), which offers online medical consultation for chronical diseases. To our understanding it also sells drugs and insurances. Such business generated a revenue of Rmb252mn, or 21% of PAGD's online medical consultation of the same year. Also MedBank's drug sales revenue Rmb2.5bn already reached 63% of PAGD's Rx sales in 2020.

Another 21% of YIDU's revenue came from selling big data to biopharmas and device makers, which to our understanding is developing into a digital CRO.

The 2B market is not yet available to Chinese companies

The US healthcare industry has a robust and sizable private sector to optimize. In China startups have to start from ground zero, or servicing the SOE's.

Founded in 2002, Teladoc Health (TDOC US, NR) is the world's largest virtual healthcare provider. Later Teladoc was joined by American Well (AMWL UR, NR) and Doctor On Demand (Private) in 2006 and 2012, respectively. However, the critical difference of these three with PAGD is that they mainly sell to employers, health plans and insurance companies as an alternative to lower their health service cost. It requires a large private sector presence in healthcare which today in China doesn't exist. Public hospitals and insurers dominate.

Teladoc counts half of the Fortune 500 companies as its clients and serve more than 50 health plans (HMO's), some of which are the largest in the US. Its annual reports suggested that on average its clients saved US$472 per medical visit from using Teladoc instead of receiving health service other settings (*Source: Teladoc*). Teladoc/Amwell/DoD are 2B while PAGD is 2C. Because of this clear value proposition, Teladoc can ramp up its revenue very quickly to a revenue of US$1.09bn in 2020.

The same private and sophisticated client base does not exist in China. Beside this, Teladoc mainly outsourced its health providers while PAGD chose to build its own doctor's teams and hospitals.

State Rx procurement rolled back drug de-hospitalization

The success of national health insurance scheme from 2017 and state Rx procurement program from 2019 provided a new line of thinking for China's medical regulators. Instead of addressing the demand of healthcare and trying to change people's habit, it might be far more effective to address the supply. Public hospitals provide an ideal handler for these supply driven initiatives. We believe more regulatory changes will come on the supply side and the public control of the health industry will further strengthen.

Comparing to demand side reforms like hierarchical diagnosis, supply side reforms like national health insurance and state Rx procurement have proven far more successful over far shorter time.

State Rx procurement (处方药集采) is now 6% of China's Rx market

In November 2018, Central Committee for the Comprehensive Deepening of Reform (中央全面深化改革委员会) ordered National Medical Product Administration (NMPA) to carry out collective procurement of 31 Rx drugs, totaling 1.64bn doses, on behalf of 11 cities: Beijing, Shanghai, Shenzhen, Guangzhou, Tianjin, Chongqing, Chengdu, Xi'an, Shenyang, Dalian and Xiamen, and thus ushered the start of so called <4+7 state procurement program> (*Source: SMPAA*). In March 2019, National Healthcare Security Administration (NHSA), who oversees China's National Health Insurance Scheme (医保), issued a decree asking local branches in these 11 cities to pay for drugs on the winning bid list and reduce payment for comparable drugs not on the list. In September, 2019, NMPA launched the 2nd state procurement program expanding to 25 provinces procuring 25 drugs, totaling 1.55bn doses. All 25 drugs overlapped with the first procurement program. In July 2020, NMPA launched the 3rd state procurement program expanding to all provinces. Total drug list expanded to 56, totaling 20bn doses. In 2021, NMPA launched two, instead of one, state procurements (Exhibit 47), totaling 107 drugs and 12.3bn doses.

In a rapid succession of events, Chinese government now conducts state Rx procurement twice a year, with scale approaching 6% of the market.

Local media reported average price reduction was close to 80% with market shares of drugs on the procurement list averaging 80% with the help of state procurement. Starting from the 3rd state procurement, retail pharmacy was allowed to participate but the majority of procured drugs went to hospital pharmacies, under the condition that they sell these drugs at the procured price with a channel markup. Chinese government's influence in public hospitals ensured the implementation.

The majority of state procured drugs went to the hospital channel. Chinese government also use state procurement as a bargaining chip to lower drug price in retail.

We estimate the value of the state procurement program to be Rmb81bn in 2021, up 252% from 2020. While it only constituted 6.2% of China's Rx market and 4.2% of total Rx+OTC+VDS market, the long-term effect can be a delay of Rx drugs de-hospitalization.

Retail pharmacy focusing on service can preserve their margins

Drugs not on the state procurement list will lose their competitiveness in the hospital channel but will instead focus on the retail channel. As state procurement program deepening, more and more biopharmas choose to stay out of the state procurement list to preserve their profit margins. To accomplish a sale under NMPA's equal efficacy rule means selling at a higher price than the procured drug. This will put extra work on the services of the pharmacy. An alternative payment source, or commercial health insurance, can also help.

Retail pharmacies, if selling drugs not on the procurement list, will actually see their margin improved in the short run.

In the long run, while NMPA has not reason to discriminating out-hospital over in-hospital channel, it can use the drugs on the state procurement list to pressure retail pharmacies to lower their drug price, itself a manifested goal of NMPA. In fact, NMPA already requested retail pharmacy to guarantee sales target in exchange for receiving supply of drugs on the state procurement list, leading to permanently lower gross margins. The essence of state procurement of Rx drug, in our view, is to ensure nobody can have scale and margin at the same time, thereby lowering the overall profitability of the industry. Only innovative drugs with irreplaceable value can escape. NMPA has stated that any drug with >3 manufacturers with equal efficacy becomes candidate for state procurement.

The essence of the state procurement program is nobody can have scale and margin at the same time.

Exhibit 47. China's five state Rx procurement programs

	1st	2nd	3rd	4th	5th
Start time	Sept., 18	Mar., 19	Jan., 2020	Jan., 2021	Jun., 2021
No. of drugs	31	25	56	45	62
Doses (bn)	1.64	1.55	20	6.81	5.49
Coverage	11 cities	25 provinces	All provinces	All provinces	All provinces
Estimated value (Rmb bn) *	NA	NA	23	25	56

Source: SMPAA, Blue Lotus (2021/9/8). *Estimation based on bidding cap, real value can be lower

Exhibit 48. Sales marketing cost and employees

	DSL (大参林)	Yifeng (益丰)	YXT (一心堂)	LBX (老百姓)	JD Health	Ali Health
Sales mkt. as 1P	26%	26%	22%	22%	6.8%	9.5%
G&A as total	4.7%	4.1%	4.1%	4.7%	1.9%	2.6%
No. of mkt. staff	27,219	24,621	25,959	21,985	295	~150
No. of total staff	32,337	28,655	30,129	27,212	2,099	1,033
Mkt staff as total	*84%*	*86%*	*86%*	*81%*	*14%*	*~15%*
No. of stores	5,705	5,356	7,205	4,892	500*	0

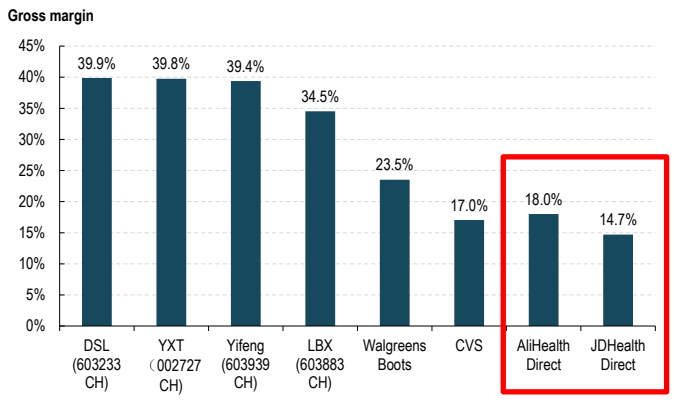
Source: AliHealth, JDHealth, PAGD, Meituan, DSL, Yifeng, YXT, LBX, Blue Lotus (2021/9/9). *Affiliated

Embracing procurement might be online pharmacy's best interest

Offline pharmacies with their isolated localities and in-store sales force can practice consultation+drug sales. Online pharmacies cannot. But online pharmacies can lower their operation cost under large scale. This means cutting cost might be to the best interest of online pharmacies. In 1H21, JD Health and AliHealth grew their GMV 59% but gross profit only grew 48%. On the contrary, the four leading offline pharmacies grew their revenues YoY 14% but grew gross profit 20%. Offline pharmacies actually achieved a gross margin expansion of 1.8ppt while online pharmacies suffered 1ppt gross margin decline.

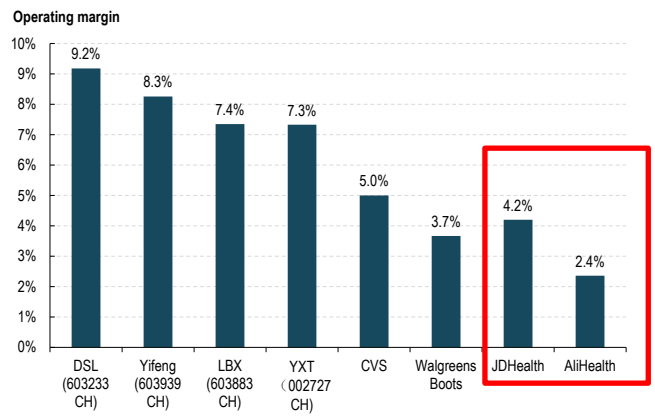
Gross margin of offline pharmacies gained 1.8ppt while online pharmacies declined 1ppt YoY.

Exhibit 49. Life-time average of gross margins since public



Source: DSL, YXT, Yifeng, LBX, Walgreens Boots, CVS, AliHealth, JDHealth, Blue Lotus (2021/9/8)

Exhibit 50. Life-time average of operating margin since public



Source: DSL, YXT, Yifeng, LBX, Walgreens Boots, CVS, AliHealth, JDHealth, Blue Lotus (2021/9/8)

This reflects different strategies of the two when approaching state procurement, with offline pharmacies managing profitability while online pharmacies managing GMV and revenues. Not only so, online pharmacies non-IFRS operating margins also suffered declines.

We view online pharmacies lost of margins with alert because we believe for low frequency, price insensitive purchases like drug, losing margin might be irreparable.

Sales clerks in offline pharmacies can recommend OTC drugs without pharmacist's qualification. Only Rx needs pharmacist involvement.

Main cost component of offline pharmacy is sales clerks

Globally, the gross margins of JDHealth and AliHealth are in line with their overseas offline counterparts, yet significantly lower than China's offline pharmacies (Exhibit 49). On the other hand, offline pharmacies' operating margins are much common (Exhibit 50). Upon examination we found the main reason for this gap is sales and marketing cost (Exhibit 48), which to our understanding is equivalent to the pharmacist cost. Recommending OTC drugs do not need pharmacist's qualification and most offline pharmacies have 80-90% of their staff classified as sales marketing employees. The average sales marketing cost of these four leading offline pharmacies since public is 22%, ~2x of the level of sales marketing in online pharmacies (Exhibit 48). These sales clerks actually play the role of primary physicians free of charge.

Our channel check suggested that for most popular drugs price trend is not pronounced (Exhibit 51), which to us means drugs with a proven brand doesn't need the help of the sales clerk. But it is those which do make up all the differences in profitability.

Online pharmacy has advantage for repeated drug purchases

Due to lack of face-to-face consultation, online pharmacies must focus on price for repeated purchases as sweet spot.

For online pharmacies to counter the local sales force of offline pharmacies it must build an effective online consultation business. But even so, online consultation isn't as effective as local face-to-face selling, in our opinion. Because out-of-pocket expense constitutes a significant portion of medical bill, ordinary people might prefer sales over medical professions to get their question answered to get their money's worth.

Exhibit 51. Top selling drugs and their price comparison in Rmb

Drug name	Chinese name	JD Health	Ali Health	PAGD	Meituan
Amoxycillin	白云山阿莫西林	13	13.8	12	18
Erythromycin Eye Ointment	白云山红霉素眼膏	4.8	4.9	5.0	6.2
Isatis Root	三九板蓝根颗粒	26	26	16.8	15.5
YNBY Aerosol	云南白药气雾剂	45	45	43	35
Sanjiu Flu Granule	三九感冒灵	15	15	13.9	12.4
Ibuprofen Capsules	芬必得布洛芬胶囊	29.5	24.5	24	39.8
Gastric Resiperobic Tablets	江中健胃消食片	16	7.8	9.0	5.3
JXZQ Oral Liquid	藿香正气口服液	23.8	23.8	16.9	16.7
LHQW Capsule	连花清瘟胶囊	14.8	11.9	17.9	14.8
Metronidazole Gel	丽芙甲硝唑凝胶	17.9	18	16.2	18
Average		21.78	19.87	18.37	18.17

Source: AliHealth, JDHealth, PAGD, Meituan, Blue Lotus (2021/9/9)

Thus, prices for repeated purchases become the sweet spot of online pharmacies. Chronical disease patients are the natural users of online pharmacies. This isn't surprise to us as in the early days of e-commerce, online retailers relied on offline SKU's to establish their selling points. The difficulty, however, is that purchase frequency of drugs is too low to remove such reliance. We see online

pharmacies to increasingly resort to price discounts, popular drugs and high-volume drugs to support their growth. Drugs on the state procurement program fits this bill.

Allowing hospitals to sell drugs but with a strict hand of anti-corruption and drug price control can theoretically work.

State procurement delays separation of hospital and pharmacy

Rx state procurement basically means 6-15% of Rx drug will stay permanently in the hospital channel. It puts a cap on the Rx split between in-hospital and out-hospital.

In 2021, 63% of drugs in China were sold via hospitals, which had already come down from 70%+ five years ago. The same figure is reversed in other developed countries. Relying on drug sales for revenue has been a persistent illness of China's healthcare system. But the past endeavors to spin off pharmacy from hospitals have not been very successful. Neither is the effort to establish hierarchical diagnosis to relieve the over-crowding in major Class III hospitals. The success of national health insurance scheme and state Rx procurement opened new lines of thinking. Instead of liberalizing hospitals to private hands, Chinese government is taking hospitals back and use administrative measures to rein in the abuse of hospital selling drugs. We might see more such supply-side reforms in the future.

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The impact on the retail pharmacies will be mixed, in our view. Forcing hospital pharmacy to use state procured drugs will depress the profit margin of the hospital pharmacies and squeeze out the unselected drugs to the retail channel. Biopharmas seeking ways to make up for the profitability lost will switch more drugs to the retail channel, where price control isn't as strict, and rely more on retail. As the list of state procurement expands to eventually ~15% of Rx market, by our estimate, pharmacy and biopharmas will work together to divide the remaining pie to maximize their profitability. The benefit to retail pharmacy will first go to these who can effectively sell, who sells to price insensitive patients, or who enjoys some forms of pricing power, either virtual or in physical world. With increasing time spent online, both offline and online pharmacies have the opportunity to establish such user stickiness and selling prowess. As Exhibit 69 shows, PAGD currently led in user engagement matrices, paving the way for it to grow in Rx drug sales with profitability.

Selling drugs to high income patients and packaging drugs into therapy are two ways to mitigate the impact of state procurement.

State hospital-insurance-pharmacy complex threatens private enterprise profitability

In the US, the existence of hospital-insurance-pharmacy complex is the way to ensure sustained profitability. Such vertically integrated complexes took place when UHC formed Optum in 2011, CVS merged with Aetna in 2017, Cigna (CI US, NR) acquired Express Scripts in 2018 and Humana (HUM US, NR) acquired Kindred in 2018. In China, a state hospital-insurance complex has now come into place. Chinese government controls 70-80% of hospitals and >90% of health insurers and by controlling hospitals, also 60-70% of pharmacies. The only question left is whether China will allow privately dominated pharmacy to enter into hospitals and insurance. So far, the answer doesn't seem likely to us.

Chinese government has controlled 70-80% of hospitals, 90% of insurers and 60-70% of pharmacies. It has virtually created a hospital-insurance-pharmacy triple complex like UHC, CVS and Cigna in the US.

The existence of hospital-insurance-pharmacy complex is corner stoned on insurance. With data, the complex can price healthcare service accurately to each individual and maximize profitability based on a person's health status, propensity to illness and ability to pay. The silver lining is by its founding principle, the Chinese state healthcare complex is mandated with providing universal and non-profit coverage. But in the realm of commercial health insurance, whether China will allow the existence of a private hospital-insurance-pharmacy complex is highly doubtful, in our view.

See the last page of the report for important disclosures

Where does China *think* it stands in healthcare

China achieved decent life expectancy at low healthcare expenditure, mainly through a nationalized-hospital and a Beveridge/Bismarck/Single-payer hybrid payment model. However, what measures healthcare's success is the satisfaction level of citizens. Out-of-pocket expenses for Chinese patients are relatively high comparing to the developed countries, especially when patient care costs are included. This, together with low doctor income and the resulted over-medication, has caused wide-spread discontent among Chinese patients against the healthcare system. We foresee China healthcare reform's near-term priority to be (1) balancing the healthcare resources, (2) filling the funding gap for China's aging elders, (3) addressing the doctor's income-medication dilemma.

China pays for healthcare expenditure through a national insurance scheme and a public hospital system that performs ~85% of diagnoses.

China healthcare achieved high life expectancy at low cost

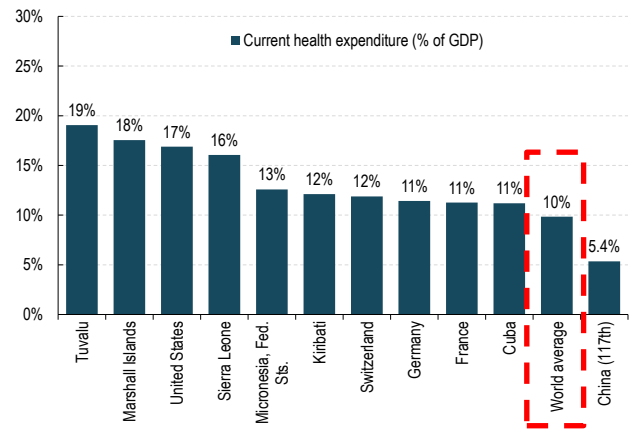
In 2020, China's total healthcare expenditure (incl. investments) totaled RMB 7.2tn, growing 10.9% YoY, contributing to 7.1% of China's GDP (*Source: NBS*). Using World Bank's data of current healthcare expenditure (excl. investments) as GDP, China ranks 117th in the world, roughly half of the world average yet achieved life expectancy of 77 years old, only 2 years old smaller than the of USA, which spent 16.9% of GDP.

China's healthcare appears to be cost efficient from a spending vs. life expectancy point of view. There is no reason to rock the boat.

Such phenomenon isn't unique. In fact, World Bank data suggested that Singapore (4.5%), Luxembourg (5.3%), UAE (4.2%), Egypt (5.0%), India (3.5%), Indonesia (2.9%), Thailand (3.8%) and Malaysia (3.8%) all have lower current healthcare expenditure per GDP than China, yet provide adequate healthcare to their citizens, as shown in their life expectancies. As shown in Exhibit 53, the correlation (R^2=0.10) between healthcare expenditure per GDP and life expectancy is weak. China and most of the developed countries are above the correlation line while US is below.

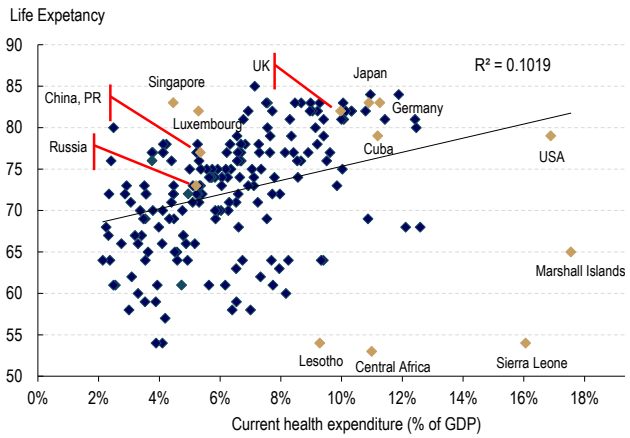
We believe many factors can play into the correlation between healthcare expenditure and life expectancy of the country. Infant mortality, social stability, diet and universal health coverage all play important role on life expectancy. But we need to acknowledge that China's healthcare system appears to be building on a solid foundation. There is no reason to rock the boat.

Exhibit 52. Healthcare expenditure as GDP, global comparison



Source: World Health Organization (WHO), BLRI (2021/8/21). Current healthcare expenditure excl. healthcare investments

Exhibit 53. Current healthcare expenditure/GDP vs. life expectancy



Source: World Health Organization (WHO), BLRI (2021/8/21). Current healthcare expenditure excl. healthcare investments

China's low health expenditure is built on low paying professionals

China's healthcare expenditure is low across the board. It is about 1/3 of the US by absolute levels and about 1/15 per capita. China's drug spending per capita is ~1/9 of that of the US. But relatively speaking, China underspends on doctors and overspend on medicine. It spends only 13% of its healthcare expenditure on doctors and nurses but 21% on drugs. The US, on the contrary, spent 36% on doctors and 15% on drugs (Exhibit 55). We estimate doctor's compensation is only 6.5% of that in the US and nurse's compensation is 5% (Exhibit 54).

We estimate China's doctors are paid only 6.5% of their US counterparts and nurses 5%.

China has a very low nurse-to-doctor ratio of about 1.1. In fact, the comparison of healthcare expenditure between China and US aren't apple to apple because China doesn't include patient care cost in its expenditure while US does. In China, patient care is usually carried out by family members and relatives or external care workers paid out of the pocket by the patient. While in the US, it is carried out by professional nurses paid by the medical insurance (Medicare and Medicaid).

In China care of patients and elders are usually undertaken by relatives or hired workers, paid out of pocket by the patient.

Exhibit 54. Doctor, nurse and drug sales per capita

	China	USA	Japan	Singapore
No. of doctors (mn)*	3.87	1.39	0.76	0.01
No. of nurses (mn) **	4.44	4.10	1.22	0.04
Population (mn)	1,444	329	126	5.7
Avg. salary doctors (US$ K/yr.)	34	522	205	163
Average salary of nurses	8.1	161	46	53
Nurse-to-doctor ratio	1.1	2.9	1.6	3.0
Doctors per K population	2.68	4.22	6.01	2.49
Nurses per K population	3.07	12.4	9.65	7.50
Drug sales per capita (US$)	177	1,625	562	564
Healthcare spending per capita (US$)	724	11,077	2,510	2,824

Source: NHC, CDC, MoH, BLRI (2021/8/6)

Exhibit 55. Healthcare spending breakdown, China vs. others

US$ bn & %	China	USA	UK	Canada
Healthcare expenditure (US$ bn)	1,222	3,649	318	220
As % GDP	7.1%	16.9%	11.0%	11.5%
Healthcare consumption	84%	94%	96%	94%
Healthcare institutions	55%	69%	80%	63%
Doctor's compensation	10.8%	19.2%	11.7%	14.9%
Nurse and technical staff	2.9%	17.5%	28.4%	10.9%
Others & profit	41%	33%	39%	38%
Drug sales	21%	14%	14%	16%
Retail prescription	3.9%	8.9%	6.3%	10.4%
Retail OTC	2.5%	1.8%	4.1%	1.0%
Hospital Rx+OTC	14.5%	3.5%	3.8%	4.3%
Gov't administration	1.4%	3.7%	1.9%	2.9%
Insurance profit	6.6%	6.8%	-	12.3%
Healthcare investment	16.4%	6.1%	4.5%	5.8%
Total healthcare expenditure	100%	100%	100%	100%

Source: NHC, CDC, MoH, BLRI, (2021/8/6)

Nationalized supply is the key for low healthcare expenditure

Why does China spend so little on healthcare? Some of it is history. Chinese healthcare system is dominantly public, inherited from the Soviet Union in a *Beveridge Model* which is still being practiced by British and Hong Kong. In a *Beveridge Model* the government provides healthcare through fiscal spending. However, close to half of Hong Kong's healthcare expenditure is spent on private hospitals (*Source: FHB*). We estimate the ratio for China is <15%, similar to UK's level (*Source: ONS*). Private hospitals in China contribute ~2/3 of the hospitals, ~30% of the hospital beds, ~20% of healthcare workers, ~15% of diagnoses and ~15% of industry revenues by our estimate (Exhibit 56). Even though the contribution of private hospitals has been on the rise, the pace of the rise has slowed down in recent years. China's hospital remains predominantly public.

Private hospitals contribute 2/3 of hospitals, ~30% of hospital beds, ~20% of health workers, ~15% of diagnoses and ~15% of industry revenues.

Private hospitals/clinics cannot challenge the public ones

The composition of China's private hospital differs materially. Revenue wise we estimate 30-35% of China's legitimate private hospitals practice Traditional Chinese Medicine (TCM), ~10% practices obstetrics, ~10% practices ophthalmology, ~10% performs health checkups, ~5% practices cosmetology and plastic surgeries and ~5% practices dentistry (Exhibit 58). We can see that private hospitals typically operates near the borderline between consumption and medicine.

China's private hospitals are mostly peripheral in nature and profit motivated in operation.

There is also a very large number of private hospitals practicing on the borderline of legitimacy, including andrology and male erectile dysfunctions (MED), oncology and non-medical grade cosmetology and plastic surgeries. We estimate these illegitimate practice fields, adding together, can double the size of the private healthcare sector.

Exhibit 56. Hospital by number, beds, worker and diagnoses

	2015	2016	2017	2018	2019	2020
No. hospitals	100%	100%	100%	100%	100%	100%
Public	47%	44%	40%	36%	35%	33%
Private	53%	56%	60%	64%	65%	67%
Hospital beds	100%	100%	100%	100%	100%	100%
Public	81%	78%	76%	74%	72%	71%
Private	19%	22%	24%	26%	28%	29%
Health workers	100%	100%	100%	100%	100%	100%
Public	84%	83%	81%	79%	79%	78%
Private	16%	17%	19%	21%	21%	22%
Diagnoses	100%	100%	100%	100%	100%	100%
Public	88%	87%	86%	85%	85%	85%
Private	12%	13%	14%	15%	15%	15%
Revenues	100%	100%	100%	100%	100%	100%
Public	91%	90%	87%	88%	87%	86%
Private	8.9%	9.8%	13.3%	12.0%	13.1%	14.3%

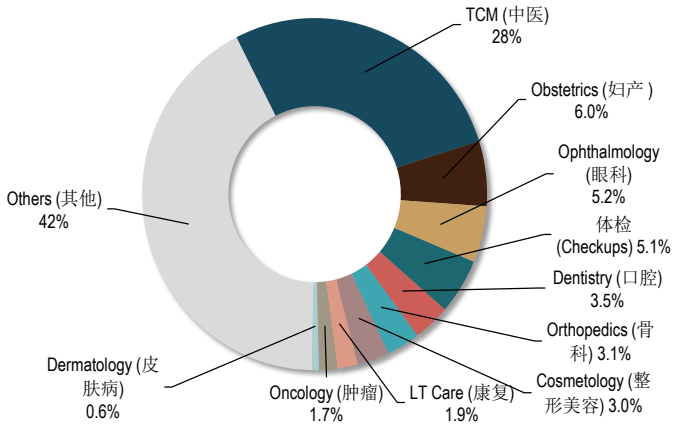
Source: NHC, BLRI (2021/6/6)

Exhibit 57. Healthcare payment and provider breakdown

US$ bn or bn	China	USA	Japan
Personal healthcare expenditure	643	3,076	392
Private insurance	5.6%	35%	46.0%
National health insurance	50%	40%	7.4%
Out of pocket	45%	12%	12.0%
Others	0%	13%	34.0%
Nat'l health insurance scheme			
Premium	379	795	121
Payout	(322)	-796	-116
Accumulated value	483	303	2
Number of diagnoses	3.84	883	252
Public hospital/clinic	85%	No Data	No Data
Private hospital/clinic	15%	No Data	No Data

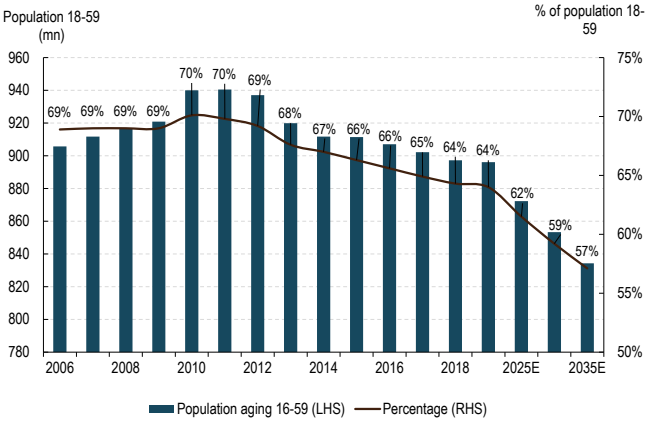
Source: NHC, BLRI (2021/6/6)

Exhibit 58. Estimate of legitimate private hospital revenue shares



Source: NHFPC, BLRI (2021/6/6). Total=Rmb540bn. TCM=Traditional Chinese Medicine.

Exhibit 59. Chinese population between 16-59



Source: BLRI (2021/6/6)

China's private hospitals are mostly in the specialty function categories and are strongly profit motivated. They are not consumption upgrades of public service. But rather they operate in areas serious hospitals do not operate.

In most developed countries, private hospital, clinics and health groups mainly serve two purposes:

- **Primary care**: Acting as primary physicians to serve as a foundation of hierarchical medical diagnoses (分级诊疗) to sieve and diverge patient flows to the big, general and regional hospitals,
- **Consumption upgrade**: Providing consumer-oriented healthcare values like timeliness, spaciousness, friendliness, etc., for a higher price. Among the developed countries, US goes to the extreme of relying most of its healthcare service to private providers but most others realize the value of nationalizing, to some degree, the supply side of healthcare.

In China public hospitals compete in the fields that should belong to the private ones.

So far, private healthcare providers in China have not performed the similar functions like their peers in the developed countries, leaving the heavy-duty burden of basic healthcare service on the public hospitals, exaggerating resource allocations and straining patient-doctor relationships.

Chinese public hospitals are competitive because doctors are underpaid

Why has China's private hospitals not taken up the task of hierarchical medical diagnoses and patient-friendly healthcare? Part of it is regulation. <PRC Law of Medical Practitioners> (执业医师法) requires medical professionals to have 1-5 years of experience in licensed medical institutions before being qualified to take the license exam. They must also practice medicine in licensed institution after passing the exam. <Regulations on the administration of medical institutions> (医疗机构管理条例) stipulates on various requirements to become eligible to operate a licensed medical institution. These regulations pretty much mean health professionals must start their career in the public hospitals.

The reason that private hospitals do not take up the role of hierarchical diagnoses and consumer-oriented healthcare is because public hospitals are also getting in there.

But another important reason, in our view, is that competitions from public hospitals elevated the entry barriers of private hospitals, forcing them to seek profit to survive. The reason that public hospitals expanding to areas that should be operated by private hospitals is because the doctors are underpaid. Lastly, patients do not want to be diverged to primary care doctors. They still flock to big, general hospitals. This actually vindicates the competitiveness of the public hospitals.

This means that to address the imbalance the healthcare resources one should not only adjust the supply side, but should also adjust the demand side. Unfortunately, this is an unpopular thing to do. We notice that Singapore also has a low healthcare expenditure with a high life expectancy. Among other reasons, Singapore's healthcare payment scheme allocates some of the healthcare cost to each individual's forced saving account (Medisave), forcing patients to pay a significant amount of diagnostic fee by itself, at least initially. This demand side adjustment prevents the abuse of the healthcare system and diverge the patient flow. As a result, Singapore had high life expectancy, low healthcare expenditure *and* high doctor pay.

Singapore forced patients to pay from their own pocket for a significant portion of initial diagnosis so as to adjust the demand side of healthcare equation.

Persistently low doctor's compensation leads to an inadequacy of medical professionals, which leads to a range of issue including (1) lack of experienced doctors to act as primary care physicians, (2) lack of trust between general hospitals and primary care physicians in two-way referral, (3) lack of experienced pharmacist to station in pharmacy stores to fill up prescriptions and provide consultation. If doctors are not making enough money, their hospitals will not turn away patient visits, then primary physician outside the hospital cannot make a living and hierarchical diagnosis will never happen.

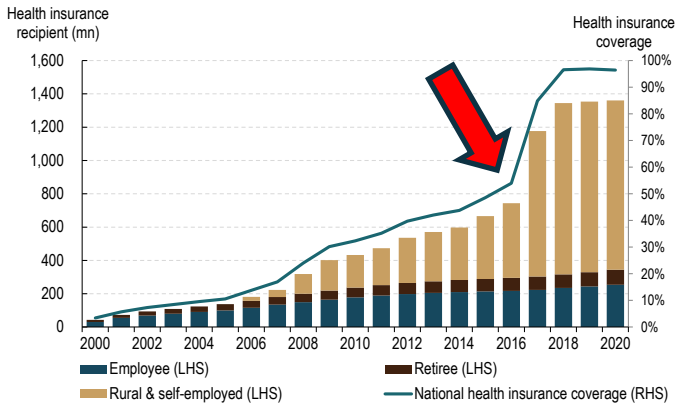
Expanding national health coverage provides near term leverage for change

China's healthcare system underwent a major makeover between 1985 and 2003 from a *Beveridge Model* to a *Bismarck/Single Payer* hybrid model. Later on, it also incorporated the Singapore feature of forced saving account. Before 1985, China inherited a *Beveridge Model* similar to that practiced in the UK, Soviet and Cuba, in which the government owns all/most hospitals, pays all/most doctors and treats all/most patients through fiscal spending. From 1985 to 2003, China underwent a series of social experiments, eventually leading to the establishment of a co-contribution health insurance fund that covered urban workers through payroll deductions, similar to the *Bismarck Model* pioneered in Germany. Starting from 2003, this national health insurance scheme extended to the rural populations and the self-employed by allowing voluntary but encouraged participation, effectively adopting the *Single Payer Model* practiced in Canada, Taiwan and South Korea. In 2020, China's national health insurance scheme received premium of Rmb2.46tn and paid out Rmb2.09tn. By this year it had an accumulated value of Rmb3.14tn (*Source: NHSA*), after paying out Rmb19.4bn for COVID-19 relief (Exhibit 57), comparing to the trust funds' balance of US$303bn for Medicare, after repeated appropriations by the Congress.

Roll out of national health insurance has been especially rapid after 2016, where coverage jumped from ~50% to almost 100%.

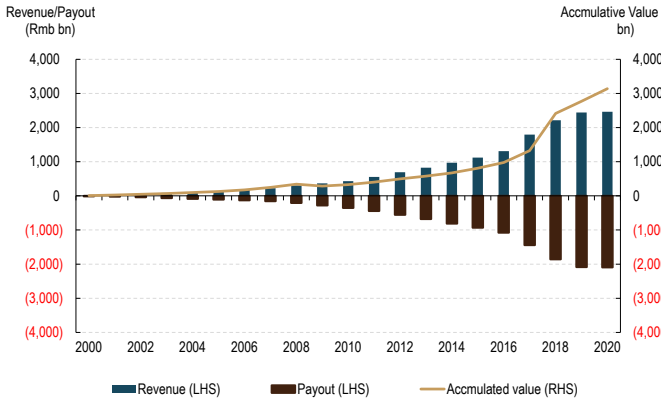
China's national health insurance scheme now has a annual surplus with a balance bigger than Medicare.

Exhibit 60. China's health insurance recipient and coverage



Source: NHSA (2021/9/6)

Exhibit 61. Profit and accumulative value of health insurance



Source: NHSA, MOHRSS, BLRI (2021/9/6)

Going forward, with aging population (1) exiting the workforce and (2) requiring more healthcare service (Exhibit 59), China's national health insurance scheme will be pinched from both revenue and cost ends. According to our estimate, by 2035, China's eligible workforce will be reduced by ~60mn. If we assume retirees will go up by the same number, using 2020's health insurance premium and cost per capita, we estimate national insurance's annual surplus of ~Rmb400bn will likely be cut by half. If older citizens costs more, the reduction will be more. By that time China may have to face the dilemma of either increasing health insurance contribution or extend the retire age.

Simple math suggests that China's healthcare insurance surplus will be cut by half if only population trends are considered.

With national healthcare insurance coverage already reaching nearly 100%, premium revenues aren't likely to get meaningfully higher, which means surplus will shrink nonetheless. Yet in 2020, 45% of Chinese patients still pay out of pocket. If we take into consideration that China's healthcare expenditure is likely underreported due to classification of nursing care, out of pocket expense is

Establishment of a singer payer can push for change across the healthcare value chain.

actually even higher, which explains the persistent complaint from the citizenry about feeling difficult and costly to see a doctor (看病难，看病贵).

We believe with the broad rollout of national health insurance; China now has a rare chance to leverage this single payer channel to influence the behaviour of the players in the healthcare ecosystem to achieve better efficiency. Initiatives like (1) hierarchical medical diagnosis, (2) detachment of hospital and drug sales (医药分离), (3) preventive (预防) and rehabilitation (康复) medical care and (4) Real World Data/Evidence (RWE) drug development, (5) digital currency can now be put to use or trial. We believe it is very likely the case China will try to leverage artificial intelligence and Internet-of-things (AIOT), big data and cloud to try to achieve the goal of having a more balanced healthcare system before population ages.

The problem is there. But how to solve it China must find its own answer.

Leverage technology to put the healthcare house in order

We first believe China needs to take the timely advantage of national health insurance to deploy technology to achieve the end goal of a more balanced healthcare system and a more satisfied populace. It starts with our understanding that China's real healthcare expenditure is likely not as low as it seems.

Is China's healthcare cost really low? We think it is underestimated.

China's real healthcare expenditure is likely higher than reported

We estimate China's real healthcare expenditure is underreported by ~Rmb1.3tn. Adding it back will raise China's healthcare expenditure as GDP by ~1.3% to 8.4%. We believe these three factors contributed to the underreporting:

- **Patient care/nursing cost**: In China family members and hired external care takers often perform the tasks of professional nurses and the cost is mostly out of pocket. If we include this cost, it would add ~Rmb450bn to the health expenditure;

Illegitimate hospitals used to contribute tens of billions of advertising revenue to search sites like Baidu each year.

- **Illegitimate hospitals and medicine**: Before government crackdowns, many public hospitals outsourced their peripheral departments to external parties. For example, according to NHS, cosmetology and plastic surgery hospitals only generated Rmb16bn of revenue in 2019. This vastly understates the industry which used to contribute >Rmb10bn of advertising revenue to Baidu each year. The gross margin of their businesses was 50-80%. Similar hospitals exist widely in oncology and MED. If we include the revenue of illegitimate hospitals, it would add ~Rmb500bn to the health expenditure;

Traditional Chinese Medicine (TCM), regulated and unregulated, service and medicine, added up to nearly a trillion Rmb a year.

- **Alternative TCM clinics and medicine:** According to NHS, TCM hospitals had a total revenue of Rmb497bn in 2019. Legitimate TCM hospitals and clinics are covered by national healthcare insurance. But there are many TCM clinics operating in the sphere of alternative medicines like acupuncture, massage, Qigong (气功) and preservation (养生), which are not regulated. China had TCM law in draft version since 2016 and State Council had several planning documents for promoting the TCM industry. HK new IPO candidate, TCM hospital group Gushengtang (固生堂) forecasted in its prospectus that TCM market was worth Rmb994bn in 2020 and will grow at a CAGR of 11% to Rmb3.0tn by 2030. We estimate the size of unregulated alternative TCM industry (excl. VDSs) to be worth ~Rmb350bn in 2020.

Underreporting of healthcare expenditures suggests that despite remarkable achievements and progresses made, China's healthcare miracle isn't as miraculous as it seems. With population getting old, reform will remain to be a living topic for years to come.

Big data, artificial intelligence and IOT can help

At this juncture we believe China's healthcare system has four major improvement areas which we believe the government also concur, and are likely the focus of the forthcoming reforms.

China's hospitals are unevenly distributed and mainly serve local residents.

- **Imbalance of healthcare capacity**: Public-dominated healthcare systems tend to get abused, leading to a mismatch of medical resources for the truly need and overmedication. Most developed countries have hierarchical medical system in which patients are first seen by primary medical institutions with two-way referrals among hospitals. China's situation is that most of its best hospitals are congregated in large urban areas and serve mainly the local residents. Implementing hierarchical medical system (分级诊疗) is going to be the uttermost priority of Chinese healthcare reform in the foreseeable future but to date it hasn't been successful;

Technology will play an important role in leveraging national health insurance to improve efficiency and resource allocation.

- **Balance of hospital's profit motives**: A major factor behind the illness of China's healthcare system is that its doctors are underpaid, which manifests itself in a range of symptoms. Many top-notch public hospitals are doing the jobs of the private hospitals in the developed countries. They rolled out spacious special wards for rich or overseas patients while neglecting the duty of public hospitals to provide basic health service to all;
- **Overmedication**: China's overmedication doesn't necessarily mean patients taking a lot of medicines. According to NMPA, China has 150K kinds of domestically produced and ~4K imported drugs, comparing to FDA which has approved ~20K drugs in total. Many Chinese drugs are modified version of generic drugs, with dubious efficacy. If doctors cannot make enough money, maybe selling drugs can help;

The rapidly emerging national health insurance is wielding enormous power in reshaping the healthcare value chain.

- **Single payer transparency:** As Exhibit 60 and 61 shows, national health insurance scheme has rapidly emerged as the single payer that is consolidating the fragmented healthcare industry of China. However, policies and processes in using this single payer funding source are still in the process of perfection. Who gets reimbursed and who do not? How to discern between innovation and fraud? There are many details to be ironed out.

Big data, AI and IOT can provide real world data to guide the decision of healthcare authorities, which is acutely needed in China's upgrade of its healthcare infrastructure. Augment Reality and Virtual Reality (AR/VR) can also greatly enhance teaching effectiveness, alleviating China's shortage of healthcare professionals.

Expect the reform process to be cautious but firm

China doesn't have the issue of cost overrun in its healthcare system like in many developed countries. A more pressing improvement area is recipient satisfaction.

We believe the reform process will be cautious but firm. Fundamentally speaking, China's healthcare system does its job well. It delivers above average life expectancy at below average cost, which is well acknowledged by the policy makers and their audiences.

But the recipients of an efficient healthcare system aren't happy about it. Why? Because the quality and the coverage of the system leaves much to be desired. This means the main goal of healthcare reform is to enhance the recipients' satisfaction.

As a result, we expect Chinse government to approach technology in healthcare carefully, being mindful of the pitfalls of technology use, such as privacy and profit motives, may well reduce the satisfaction of the healthcare recipients instead of enhancing it.

There is no perfect system in healthcare

As we summarize, over-medication, low doctor's pay and inefficient public hospitals are the illnesses of China's healthcare system. But cost for money is its shining point. We see China borrows from successful experiences of other countries but has come to realize that there is no perfect system that satisfies everybody. We therefore expect no major overhaul in the future.

As patients growing suspicious of doctor's motivations, they demand equipment reading as proof of diagnoses.

Over-medication is a result of low doctor pay and the *Beveridge Model*. As Exhibit 55 shows, 24% of China's healthcare expenditure was spent on drugs, comparing to 15% in the US. On the other hand, doctor's compensation only accounts for 11% of China's healthcare spending, comparing to 19% in the US. We estimate Chinese doctors are paid at 6.5% of their US peers and Chinese nurses 5.0% (Exhibit 55). The consequence of underpaying doctors is that Chinese hospitals seeking to sell drugs as a source of income, leading to 27% of hospital revenues, 21% of health expenditure and 69% of all drugs (Rx & OTC) sold in China are drugs sold through the hospital channel, comparing to 5.1%, 3.5% and 25% in the US (Exhibit 55).

Such practice has caused several government crackdowns since 2009. Before that ~40% of hospital revenues came from selling drugs. While Chinese healthcare underpays the doctors and nurses, it spends more on equipment purchases and healthcare fixed assets. Sixteen percent of China's healthcare expenditure is investment, comparing to 6.1% in the US. Patients are less trustworthy of the doctors and trust more on medical tests. US government expenses R&D efforts (NIH) through 3.7% of healthcare spending while China lacks similar research-oriented health organizations (Exhibit 55).

Structurally China is over-medicated but since China underspends on healthcare as whole average Chinese still gets less drug than Americans.

We should note, that on an absolute level or on a per capita basis, China's drug consumption is still quite low. Despite China's over-medication, drug sales in China are still less than half of the US in absolute amount. On a per person basis, China's drug spending per person is ~1/9 of that of the US. This, however, comes as no surprise because China underspends, as a whole, on healthcare. China's healthcare spending expenditure per capita is only spends 1/15 of that of the US.

Our comparison also shows China spends more on healthcare administration than US. Assuming most Chinese hospitals operating near the breakeven line, Chinese hospitals spend 41% of their revenues on administration and depreciation while US hospitals spend only 33%.

Online pharmacy and hospital have challenges

Both online pharmacy and online hospital have reform drivers behind and thus should enjoy robust growth. However, each has its problems. For online pharmacy, profit margin and drug O2O competition are its challenges. For online hospital, consultation quality is still not on par with offline.

Under paid doctors are roadblocks for curing overmedication

Hospital channel sells 2/3 of China's drugs, OTC included.

In 2019, ~27% of China's hospital (excl. health stations and disease control centres) revenues came from selling drugs. In the same year, 69% of all drugs (Rx and OTC) sold were sold through the hospital channel (*Source: Frost & Sullivan*). We believe this is about right. Within the 31% of drug sold through retail channel, 91% were sold through offline pharmacy chains, 1.4% O2O, and 7.6% online B2C. We expect that by 2030, drugs sold by hospital channel will be reduced from 69% to 34% while Online B2C will reach 37% from 8% and O2O will increase from 1.4% to 27% (Exhibit 62). What remain to be sold in hospitals will be mainly in-patient medication and therapy supplies, which will be untransferable. But we believe the road to detach drug sales from hospital service will be a long and treacherous one. By 2030, we estimate percentage of hospital revenue coming from drugs will fall by half, to ~15%.

There are ways to crackdown on hospital's profit motives if most hospitals stay in public hands.

Fair speaking, selling drugs through hospital pharmacy has nothing wrong, if the hospital is non-profit to begin with. If there are inappropriate sale of drugs by hospitals, there can always be a corrective mechanism. This is why the de-hospitalization of drug sales does not contradict with state procurement of Rx drugs.

In our view, the Chinese government actually wants to diversify the ownership base of the hospitals, on the condition that private hospitals also shoulder some of the responsibility of public care. Effective regulation always invites effective counter measures. In most geographies, hospitals are effectively local monopolies, with no replacement. If hospitals want to make money, there are always ways to do it. After the government cracked down on overmedication, many hospitals raised or segmented their registration fees (挂号费), entered new businesses like health check-ups, and prescribed more-than-necessary medical tests. Solving old problem created new problems.

The government's end goal is citizen satisfaction. Introducing new problem when solving old doesn't help this end goal.

Therefore, overmedication is the symptom, not the root cause. To solve the root cause, Chinese government is likely to:

- **Raise the compensation level of the doctors and nurses**. This means the overall healthcare expenditure as GDP will rise. In March and June 2021, State Council and premier Li Keqiang repeatedly touched upon public hospital compensation reform in various occasions. However, it is not clear where the money is going come from;
- **Introduce competition to hospitals by forming a hierarchical medical system:** Primary care physicians can diverge the patient flow from hospitals and break the hospital-big-pharma industry complex. Establishing this hierarchical medical system, however, cannot happen without the blessing and cooperation of the hospitals;

- **Expand national health insurance coverage to more patient touchpoints outside the hospitals:** Industry estimates ~1/3 of Rx drugs, mostly repeated drug purchases for chronical diseases and follow-on prescriptions after initial diagnosis, should easily be dispensed out of hospital. However, national health insurance is balanced on a local basis. Currently the most prevalent scope of coverage is by city. This means health insurance policies must take into consideration of local interests, of which part is local hospital's interests.

Currently most national health insurance scheme is balanced on a local basis. The most prevalent scope of locality is by city.

As shown in Exhibit 62, reform to separate hospital and pharmacy will result in drug sales by hospital channel to drop from 65% in 2020 to 53% by 2024, according to our estimate. Within the out-hospital channel, we expect online penetration to double from 13% to 24%. As drug sales transitioning out of hospitals will benefit all pharmacies.

Exhibit 62. China's pharmaceutical demand market size estimate

(Rmb bn)	2019	2020	2021E	2022E	2023E	2024E
In-hospital (OTC+Rx)	1,120	980	1,031	1,070	1,110	1,147
% total	*69%*	*65%*	*63%*	*60%*	*56%*	*53%*
Out-hospital (OTC+Rx)	513	520	605	729	872	1,038
% total	*31%*	*35%*	*37%*	*41%*	*44%*	*48%*
Offline pharmacy	467	436	472	524	584	637
YoY growth	*6.4%*	*(6.6%)*	*8.1%*	*11%*	*11%*	*9%*
% out-hospital	*91%*	*84%*	*78%*	*72%*	*67%*	*61%*
O2O Pharmacy	7.1	16	36	66	100	151
YoY Growth	*34%*	*121%*	*132%*	*80%*	*53%*	*50%*
% out-hospital	*1.4%*	*3.0%*	*6.0%*	*9%*	*12%*	*15%*
Online B2C pharmacy	39	68	97	139	188	250
YoY growth	*30%*	*74%*	*43%*	*43%*	*35%*	*33%*
% out-hospital	*7.6%*	*13%*	*16%*	*19%*	*22%*	*24%*
Total	**1,633**	**1,500**	**1,636**	**1,799**	**1,983**	**2,185**
YoY growth	*6.5%*	*(8.1%)*	*9.1%*	*10%*	*10%*	*10%*

Source: NHC, BLRI (2021/9/13)

Exhibit 63. China's out-hospital drug sales by channel

(Rmb bn)	2019	2020	2021E	2022E	2023E	2024E
Rx	**294**	**283**	**355**	**445**	**550**	**670**
Offline	270	235	273	316	358	403
O2O	1.5	3.9	11	32	62	95
Online B2C	22	44	70	97	130	172
OTC	**219**	**237**	**251**	**284**	**323**	**367**
Offline	197	201	198	208	226	235
O2O	5.6	12	25	34	39	55
Online B2C	17	24	27	42	58	78
VDS	**205**	**233**	**268**	**313**	**373**	**440**
Offline	121	120	122	124	125	123
O2O	1.3	2.7	8.4	16	27	40
Online B2C	82	110	137	173	221	276
Total out-hospital	**718**	**753**	**873**	**1,042**	**1,245**	**1,478**
Offline	*82%*	*74%*	*68%*	*62%*	*57%*	*51%*
O2O	*1.2%*	*2.4%*	*5.1%*	*7.9%*	*10%*	*13%*
Online B2C	*17%*	*24%*	*27%*	*30%*	*33%*	*36%*

Source: NHSA, MOHRSS, BLRI (2021/9/6)

Online pharmacy will get 1/3 of Rx and 1/2 of OTC

In 2019, we estimate China's Rx and OTC market to have market sizes of Rmb1,633bn (Exhibit 62), of which Rx was Rmb1,355bn and OTC Rmb278bn. VDS added another Rmb205bn by our estimate. Currently there are three models servicing drug retail, which are online B2C, drug O2O and offline. The market share of each in each product category are shown in Exhibit 63. Drug O2O was still the smallest but has doubled in share in 2020. In 2020, we estimate online B2C, O2O and offline constituted 24%, 2.4% and 74% of the out-hospital drug market, which in turn constituted 35% of the total drug sales in China (Exhibit 62). We expect online B2C, O2O and offline to constitute 36%, 13% and 51% of out-hospital drug market by 2024 and 51% (online B2C), 26% (O2O) and 23% (offline) by 2030 (Exhibit 63).

Hospital drug sales will decrease from 2/3 of all drug sold to 1/3.

Drug O2O will have the fastest growth among out-hospital drug sales

Our outlook of China's drug distribution is the following:

Rising tide will shift all boats. Shift out of drug sales from in-hospital channel will benefit all pharmacies, the biggest being O2O.

- First, we estimate out-hospital drug sales will increase from 31% in 2019 to 66% of drug sales by 2030, amid government initiative to separate drug sales from hospital revenues. Hospital will retain ~1/3 of total drug sales, mainly due to in-patient (住院用药) drug usages;
- Second, we estimate that within out-hospital channel, online B2C, O2O and offline will each get 1/3 of market share by 2030 for Rx, mainly because elder people will likely retain the habit of getting their prescriptions filled by offline pharmacies providing face to face interactions. For OTC, however, we believe online B2C's market share will be higher, perhaps reaching as high as 50% by 2030. For VDS, we believe online B2C's market share will be even higher, perhaps reaching as high as 80% by 2030;
- Lastly, O2O drug sales represents the bigger growth opportunity. As Exhibit 63 shows, we expect O2O drug sales to grow from 2.4% of out-hospital market in 2019 to 13% in 2024 and further to 26% by 2030.

Drug's low frequency of purchase means drug O2O must be built on existing O2O infrastructures of high frequency purchases like take-out and grocery.

Currently, speed is the biggest advantage of offline and O2O pharmacies. For price insensitive drug buyers buying infrequently of standard products, time to drug is more important than price, brand and attribute. We therefore foresee O2O drug sales gaining more traction as online drug sales getting into mainstream. Young people, repeat purchases, chronical disease patients may find online B2C drug sales suit them just fine. But the majority of drug purchase occasions are unrepeated.

Meituan and PDD can be formidable players in drug O2O

Grocery O2O operators with established infrastructure can easily add drug O2O business after acquiring necessary licenses and logistics facilities.

Today O2O drug sales mainly take the form of leveraging the inventory of existing offline pharmacies. This will not always be the case if online grocery is of any guide. Early pioneers of grocery O2O also sourced from local wet and super markets, but operators quickly selected high frequency SKU's to sell through forward warehouses (前置仓), leading to faster delivery, more consistent customer experience and higher profit margins. Companies like Missfresh (MF US, NR), Dingdong (DDL US, NR) and Pupumall (Private) adopted the forward warehouse models, competing with smart supermarkets like Alibaba's HEMA, which in our view, can also enter the drug O2O business. Lastly, COVID-19 ushered in new competitors of community group buying, including Meituan, Pinduoduo, DIDI and XSYX (兴盛优选). Now there are three distinctive models serving the O2O grocery market, each more granular than its predecessor. We believe all three can meet the needs for drug O2O. A typical offline pharmacy stocks 0.6-0.8K SKU of drugs, comparing to 0.8-1.5K for community group buying, 3-4Kfor forward warehouses and 8-20K for smart supermarkets like HEMA (*Source: Blue Lotus*). As a result, adding drug O2O present no challenge to the grocery O2O players.

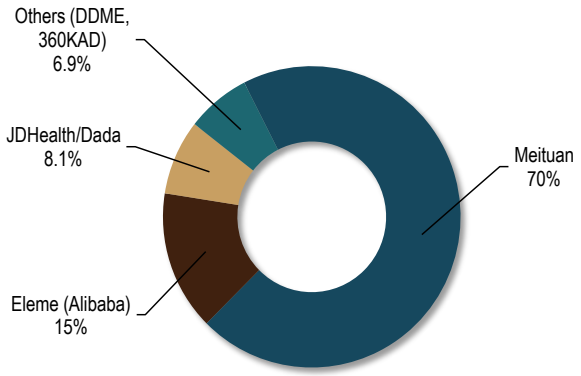
Pharmacy has the smallest SKU's comparing to community group buying, forward warehouse and smart supermarkets.

In the early stages of the market, offline pharmacies and drug wholesalers had an advantage in drug O2O because they are familiar with the SKU's. Dingdang Medicine Express (DDME), for example, is a spin-off from OTC/supplement maker Renhe Group (仁和集团) and has filed for IPO. Its business mainly relies on Meituan, according to our channel check. As competition intensifying, take out and grocery O2O leaders will likely enter the drug O2O market. After they overcome the licensing barrier and SKU knowhows, their low-cost infrastructure and high frequency purchasing flow will become their powerful weapons for competition, in our opinion. These advantages, however, will be deterred by the local reimbursement policy of the national healthcare scheme,

We expect B2C and O2O to merge in drug retail. As such PDD can also be a capable player.

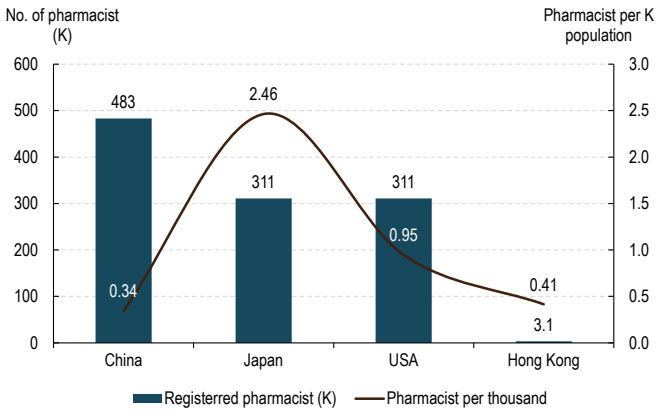
which we expect big Internet platforms to do on behalf of the merchants. In the long run we expect Meituan to be a major force for drug distribution. PDD, with its community group buying business adding to its O2O capability, can also become a merged B2C+O2O player in drug distribution, in our opinion. Exhibit 64 shows our calculation of drug O2O market shares by GMV.

Exhibit 64. Drug O2O market share in 2020, by platform



Source: Blue Lotus (2021/9/13)

Exhibit 65. Number of pharmacists in China and elsewhere



Source: NHSA, MOHRSS, BLRI (2021/9/6)

O2O fits with payment arrangement of health insurance better than B2C

China's national health insurance scheme is balanced on a local city level. Residents in different cities will be entitled to different national health insurance coverage according to that city's fiscal condition. Wealthier patients will purchase commercial health insurance to mitigate the gap, if any. Paying for drugs through national health insurance online likely will incur two process layers, one for identifying local payment policies (authorization) and another for connecting with local health insurance scheme's bank for payment (payment processing). We believe the task of connecting these two process layers will likely be undertaken by O2O platforms like Meituan, Eleme, AliHealth and JD Health. There are plenty of Internet platforms that can do this job.

Paying for Rx drug through national health insurance will need to clear at the local city level, both from entitlement and payment processing standpoint.

According to NHSA, in 2020, NHSA paid Rmb104bn for 7.25mn patients at 44K medical institutions for inter-city clearance of medical claims, comprising 4.9%, 0.2% and 4.3% of the national total (*Source: NHC, NHSA*), suggesting inter-city clearance was still mainly used to treat critical, difficult and niche diseases in centralized hospitals. It hasn't become the mainstream of settlement of medical services.

To balance their budgets, we believe local governments will likely be cautious in approving inter-city insurance reimbursements. We would also expect them to prefer the tax dollar of drug sales to go to local coffers to help balance the local insurance budget. We therefore believe drug O2O might stay for a very long time, perhaps more than a decade, before gradually merging with online B2C.

Like online grocery, drug O2O will see forward warehouses replacing offline stores as basic infrastructure. However, the market sizes of retail food and food materials are ~9x of retail drugs, which means the O2O infrastructure of distributing drugs will likely exist as auxiliary as the one distributing groceries, not vice versa.

We don't think the infrastructure for drug O2O will be independent from the one for grocery.

Beneficiaries of drug O2O is Meituan>>Eleme>JD Health>AliHealth>PAGD

We estimate Meituan commanded 70-80% of drug O2O market in 2020 (Exhibit 64). Dingdang Medical Express (叮当快药) had the biggest market share on Meituan at about 15-20%, by our estimate. All major offline pharmacies, such as LBX (603883 CH, NR), Yifeng (603939 CH, NR), Nepstar (private) and Guoda (000028 CH, NR) conduct business on Meituan, Eleme and JD Health. We understand Nepstar (海王星辰) has the biggest market share on Eleme platform (*Source: Yimian*).

Meituan is a hidden champion of drug O2O, commanding 70-80% of drug O2O by our estimate.

Currently, Eleme's drug O2O GMV and revenue are not consolidated into AliHealth, despite the fact that the Eleme's general manager, Kun Yang (昆阳), used to run AliHealth. We attribute this likely to the divided opinion of the importance of drug O2O vs. B2C within Alibaba at the time of AliHealth's formation. While drug O2O does serve one-time, speed sensitive and locally reimbursed Rx drug purchases well, it doesn't serve repeat, chronical, OTC/supplement, price sensitive customers as well as B2C does.

Frequently used, chronical, price sensitive, OTC and VDS are ideal for B2C.

In 2020, we estimate JDHealth's drug O2O business delivered through DADA (DADA US, NR) amounted to Rmb1.3bn in GMV, or ~1.6% of JDHealth's total. This would give JDHealth/Dada a market share of 8.1% in drug O2O in 2020, roughly half of Eleme's market share in 2020 (Exhibit 64).

AliHealth likely has to buy drug O2O business from Eleme through parent Alibaba through an arms-length transaction.

Face to face consultation with pharmacist has value

With China's lack of hierarchical medical diagnosis, local pharmacies, with their equipped sales clerks today and pharmacists in the future, serve an irreplaceable purchase. Offline pharmacy can serve not only a node in drug distribution, but also as a node for chronical diseases management, vaccination, patient education, primary care, clinical trials, etc.

In 2020, there were 483K certified pharmacist in China, comparing to 311K in US, 311K in Japan and 3.1K in Hong Kong (Exhibit 65). China pharmacist density isn't too low comparing to the developed nations, but most of China's pharmacists are today employed at the public hospitals, which are unlikely to switch to private pharmacy chains, in our view. The lack of qualified pharmacist will also slow down the expansion of online pharmacies in Rx drug sales, in our view.

There isn't a lack of pharmacist in China, but there is a lack of pharmacists working in retail settings and in private enterprises.

Online consultation cannot take the role of hierarchical diagnosis

With a strong feedback loop existing between big urban hospitals and medical learning curves, we would expect online medical consultation offering an ideal solution to achieve hierarchical diagnosis (分级诊疗) in China's healthcare reforms. Senior doctors no longer need to relocate to residential communities to act as primary physicians. After being seen by senior doctors, patients no longer need to flock to big urban hospitals to congest the medical resources. The imbalance of healthcare resources that have been troubling China's healthcare reforms can finally be solved.

Today most of China's community hospitals and medical stations are staffed by junior doctors, with whom patients do not want to consult..

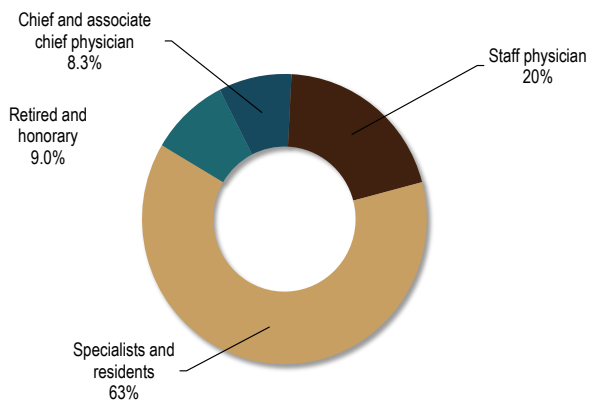
But the reality seems not so. Our tracking of five Internet healthcare platforms showed that there is a lack of senior doctors, doctor activism and viable business model for online medical consultation.

Online medical consultation frequency is lopsided

As shown in Exhibit 66, there are a total 3.2mn doctors in China, of which ~8% are senior doctors, ~20% are junior doctors, ~9% are honorary or retired, and the rest are specialists. If we remove specialists and residents then roughly 47% of China's doctors are senior doctors (Chief, associate chief, retired and honorary) and 53% are junior doctors (Staff). The classification is granted by the Chinese government.

See the last page of the report for important disclosures

Exhibit 66. Chinese doctors by experience, total=3.2mn



Source: NHC, BLRI (2021/6/13)

Exhibit 67. No. of doctors on platforms, Shanghai

Shanghai	PAGD	JDHealth	AliHealth	WeDoctor	Good Doctor
Total No. of doctors	**1,029**	**1,372**	**987**	**5,654**	**12,552**
Effective No. of doctors	1,012	842	702	5,917	10,954
Effective ratio	**98%**	**61%**	**71%**	**93%**	**87%**
Chief and associate chief	60%	50%	38%	62%	52%
Staff	35%	41%	51%	33%	35%
Resident and others	5.2%	9.2%	4.1%	5.3%	14%
Total	100%	100%	100%	100%	100%

Source: PAGD, JDHealth, AliHealth, WeDoctor, GoodDoctor, BLRI (2021/8/6). Effective means No. of consultation>0. After removing duplications

Upon a survey of doctor listing in Shanghai, we found 39% and 29% of doctors on JDHealth and AliHealth had consultation frequencies of zero. Further there were further 31% and 30% of doctors on these two platforms having less than 10 times consultation since their listing (Exhibit 67).

The real number of doctors is probably only half of what is reported by major listco's.

JDHealth's low effective ratio might be due to its short operating history in the online medical consultation business. But based on our observation, majority of online medical consultations concentrated on selected few doctors. The pattern of online medical consultation is a replica of offline, which means online consultation doesn't achieve the purpose of hierarchical diagnosis.

Healthcare Q&A ≠ digital consultation

Judging from the number of the doctors, effective ratio (>0 consultation) and consultation frequencies, WeDoctor and Good Doctor significantly outperformed the listco platforms of JDHealth, AliHealth and PAGD (Exhibit 67 and 68).

Currently online medical consultation doesn't alleviate the problem of medical resource imbalance, in our view.

However, judging from traffic data from Questmobile, PAGD vastly outperformed the rest while AliHealth also outperformed WeDoctor and Good Doctor (Exhibit 69). JDHealth have both low consultation frequency and low traffic performance.

According to PAGD, this is because PAGD relies on its internal doctors and AI robots for service.

Exhibit 68. Distribution of consultation frequency, Shanghai

Consultation frequency	JDHealth	AliHealth	WeDoctor	Good Doctor
0	39%	29%	7.3%	13%
1-10	31%	30%	20%	18%
11-100	17%	25%	31%	24%
101-1,000	8.2%	14%	34%	28%
1001-10,000	4.2%	2.6%	7.3%	15%
10001+	1.0%	0.0%	0.2%	1.4%
Total	**100.0%**	**100.0%**	100%	**100.0%**
No. of doctors	1,372	987	5,654	12,552

Source: JDHealth, AliHealth, WeDoctor, Good Doctor, Blue Lotus (2021/6/13). PAGD data is not available

Exhibit 69. Key matrices of Internet healthcare platforms

Data as of C1Q21	PAGD	JD Health	Ali Health	We Doctor	Good Doctor
MAU (mn)	9.84	0.41	2.08	0.81	1.07
DAU (mn)	1.05	0.03	0.20	0.08	0.098
Time spent/mo. (mn min)	262.3	8.6	22.9	17.1	27.8
Time spent/user/ day (min)	8.24	8.45	3.91	6.86	9.32
No. doctors (K)	23	110	60	120*	820
Consultation/Yr. (mn)	330	37	66	18	NA
Consultation/doctor/day	39	0.91	3.00	0.41	NA
Revenue (Rmb mn)	1,565	1,172	284	1,832	NA

Source: Questmobile, PAGD, JDHealth, AliHealth, WeDoctor, GoodDoctor, Blue Lotus (2021/8/6) *available for online appointments

Can Internet hospital really alleviate China's medical resource imbalance?

In a supply constrained industry, online medical consultation helps to smooth the demand. We believe it doesn't address the problem.

The answer seems no, at least in the short run. Most online medical consultations aren't the same as the offline medical consultations, which has a publicized figure from NHC each year at 7.7bn in 2020. The number of consultations by PAGD, AliHealth and JDHealth has surpassed 500mn, yet we don't believe the two figures are comparable. The definition of consultation varies greatly among companies. For WeDoctor, Good Doctor and Chunyu Doctor, online consultation means making appointment with doctors in the hospital. For PAGD, it means consultation done by internal doctors and AI robots. AliHealth and JDHealth have a mix of both.

Medical consultation done today are more general Q&A and health inquiries in nature. Its benchmark is Baidu's medical related search.

- **Appointment making adds little value**: The historical origin of WeDoctor, Good Doctor and Chunyu Doctor (春雨医生) are doctor's appointment making services. Such service does not alleviate the shortage and imbalance of medical resources in China. And as shortages alleviate, such service tends to lose value. Top doctors receive more appointments than they can handle. Young doctors receive no appointment regardless of online or offline. Net, online consultation does not improve the number of patients a doctor can see. It only improves the conveniences of the patient;
- **General healthcare Q&A is helpful, but not critical**: We acknowledge that part of the job of a primary doctor is general healthcare Q&A, which is what most online medical consultation is today. The mix of serious medical consultation and general healthcare Q&A can only be improved through better patient education, which comes with time. We believe general health Q&A are substitutes of Baidu search, carried out by certified professionals;
- **General healthcare Q&A helps sell OTC drugs and VDS**: We believe online medical consultation today mostly serves as a precursor for OTC drug sales, which previously would not result in a clinical visit. To this end, online medical consultation makes business sense as a complement to the online pharmacy business;

PAGD's online medical consultation fee is similar to a reasonable take rate of a doctor's visit.

- **PAGD's medical consultation is different from all the others**: PAGD actually does online medical consultation by its in-house doctors, even though we still believe most of these consultations are general Q&A's, judged by the volume of consultations handled by PAGD's doctors. In 2020, a team of ~1,800 handled a consultation volume of 330mn, translating to a workload of 495 per doctor per day. Apparently, consultation like this cannot be medical in nature but PAGD does generate a revenue per consultation of Rmb3.5, which comparing to a serious clinical visit registration+diagnosis fee of Rmb100-500 makes sense.

The definitions of online medical consultation vary greatly among the Internet platforms. For example, in 2020, WeDoctor claimed to have 270K registered doctors, of which 120K are available for online appointments, performing 18mn consultations, or 0.41 online consultation per doctor per day, according to its prospectus (Exhibit 69). The definition of WeDoctor on medical consultation likely fits with the definition of NHC, as WeDoctor is an appointment making service and charge a take rate. NHC stated that in 2020, Chinese doctors performed total consultation of 7.7bn times. Therefore, WeDoctor would have a market share of only 0.23%. If the time spent market share of Good Doctor, another serious medical consultation platform, maps with its consultation market share, then we estimate the combined market share of serious online medical consultation to be <0.6% of total consultation as per NHC's definition (serious medical definition).

If we only count the serious medical consultation as consultation, then we estimate the combined market share of five platforms to be likely <1% in China. Put in another way, we believe that currently online medical consultation does not compete against offline medical consultation, despite the various statistics in doctor's penetration, MAU/DAU, total consultation volume and time spent that might suggest otherwise. For example, according to our tracking, the total number of doctors featuring on five Internet healthcare platforms (PAGD, JDHealth, AliHealth, WeDoctor and Good Doctor), after removing duplications, was ~15K, or 18% of the 82.3K doctors registered in Shanghai (*Source: Shanghai Municipal Health Commission*).

Currently online medical consultation does not compete against offline medical consultation, in our view.

Some of the company's disclosures support our observation. PAGD, for example, stated that about half of consultations being healthcare Q&A's, mostly answered by voice robots, according to the company. A full 85% of inquiries were undertaken by PAGD's in-house team of ~2,200 doctors.

Using 50% of Baidu's medical-related search revenue as benchmark, general healthcare Q&A is now half-way to its saturation point. But serious medical consultation online hasn't even started.

The benchmark for online consultation is Baidu's health-related search

At its peak, Baidu generated a search revenue of Rmb57bn, of which ~40% were medical related, translating to an annual revenue of Rmb23bn. If we assume half of such revenue is transferrable to online medical consultation, we would put the short term revenue cap of such business at Rmb10-12bn.

As of 2020, we estimate the combined revenue of the five online medical consultation platforms to be Rmb5.5bn. Therefore, online medical consultation is about half way to its peak revenue under the current business model, in our opinion. The real online consultation, measured by serious medical purposes, has even started, in our view.

The silver linings are doctor numbers and improving habits

In our opinion, online medical consultation saved the time of the patients, but not much the time of the doctors. China's healthcare industry is supply constrained, but online medical consultation aims to optimize the demand curve, which in our view cannot be effective. According to NHC, there are only 8.5% out of a total of 35,394 hospitals are Class III hospitals, among which about half are Class III Grade A (三甲). Yet Class III hospitals contributed 42% of hospital beds and 54% of the consultations among hospitals in 2020. Online medical consultation does not solve this imbalance.

We estimated ~18% of doctors in Shanghai had featured themselves on Internet platforms, yet they likely conduct only 1% of serious medical consultation comparable to the offline.

The violent solution to resource imbalance may be resource abundance

Chinese patients love to visit Class III Grade A hospitals because they know good doctors tend to stay with Class III Grade A hospitals. Heavy patient inflow also provides these hospitals with good teaching grounds for the young doctors. In an environment where private medical practice is rare and referrals in and out of big hospital are also rare, the feedback loop dictates good doctors and patient flows tend to stay in big hospitals. According to NHC, an average doctor in Class III hospitals consults 6.3 patients, versus 5.8 for Class II and 4.5 for Class I. Since 2010, the workload of Class III hospital doctors has consistently been higher than that of Class II and I hospitals (Exhibit 70).

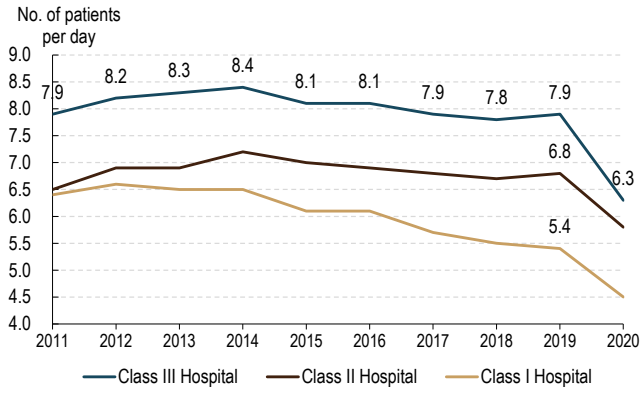
We believe online medical consultation are replacing OTC demand that previously does not result in a clinical visit.

However, there seems to be a silver lining in solving the issue from a totally different direction, which is to enlarge the supply of doctors.

In 2020, China graduated 1.2mn bachelor degree and vocational medical students, of which ~20% are destined for clinical (临床) fields. Each year, about 500-800K candidates took the Medical Practitioners Qualification Exam, of which ~30% pass to become eligible for medical residency,

most of who are medical graduates. This means about 150-240K doctors entering the workforce each year. NHC data shows the number of registered Chinese doctors growing at 150-200K each year for the past decade (Exhibit 72), which suggest that despite Chinese doctors are underpaid and medical work is taxing, the attrition rate of the profession is reasonable at 10-15%.

Exhibit 70. Doctor's workload, nationwide



Source: NHC, Blue Lotus (2021/6/13)

Exhibit 71. Serious medical consultation breakdown

	2015	2016	2017	2018	2019	2020
Total consultation (bn)	7.69	7.93	8.18	8.31	8.72	7.74
By hospitals (bn)	3.08	3.27	3.44	3.58	3.84	3.32
Percentage hospitals	*40.1%*	*41.2%*	*42.1%*	*43.1%*	*44.0%*	*42.9%*
By Class III hospitals (bn)	1.5	1.63	1.73	1.85	2.06	1.8
Percentage Class III Hospital	*48.7%*	*49.8%*	*50.3%*	*51.7%*	*53.6%*	*54.2%*
No. of internal doctors (K)						
PAGD	0.59	0.80	0.89	1.20	1.41	2.25
JDHealth	0.0	0.0	0.0	0.0	0.07	0.20
WeDoctor	NA	NA	NA	NA	NA	0.52

Source: NHC, Blue Lotus (2021/8/6).

For comparison, in 2020, US medical schools graduated 20,387 medical doctors (MD), most of whom passed Medical License Examination (MLE). Each year, USMLE passed 20-25K domestic test takers (*Source: USMLE*). This means China admits 7-8x more doctors into practice than US each year.

Both bachelor and vocational degree can become doctors through standard exams. China admits 7-8x more doctors each year than US. The attrition rate is reasonable.

Judging from NHC data on medical consultation, hospitals have been gaining patient share over health stations, and within hospitals, Class III hospitals have been gaining patient share over Class I and II hospitals (Exhibit 71), which means, instead of diverging patient flow from the Class III hospitals, more doctors are entering them to debottleneck their workloads.

Younger doctors can be more comfortable of performing consultation online

This means that China is trying to enlarge the supply of doctors while high-quality Class III and hospital doctors are taking the consultation share from low quality Class I/II and health station doctors. Over time, as doctors age, there will be sufficient doctors with sufficient experiences, which by then, might be the opportune time to carry out hierarchical diagnosis as many envisioned. As shown in Exhibit 72, China's professional clinical workforce has been expanding at an annual rate of 6-8% for the last decade, despite the law of large numbers.

With more doctors joining the workforce, can online medical consultation become more serious? Likely.

When there are enough doctors around in high quality hospitals, will online medical consultation be different from the one we saw today?

Exhibit 73 shows that on a per capita basis, Chinese patients are indeed over-consulted and over-consulted by generalists, which shows the consequence of lacking a family doctor in most cases.

The mix of health Q&A and consultation is a consumer behaviour issue

As shown in Exhibit 73, if we compare the number of medical consultations in China and physician visits in US and Hong Kong, we found Chinese was over-consulted comparing to the Americans and Hong Kong residents. Each year, a Chinese consults doctor 5.35 times while an American and a Hong Kong resident only consult doctors 2.68 and 3.40 times, respectively.

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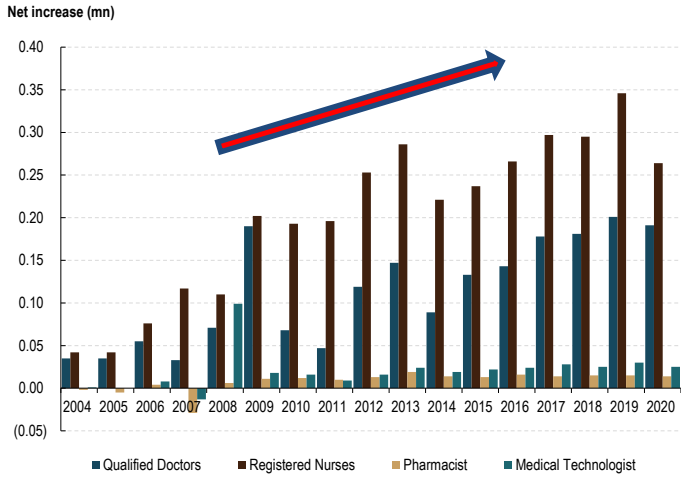
Exhibit 72. Net increase in doctors and nurses (mn) in China



Source: NHC, Blue Lotus (2021/6/13)

Exhibit 73. Medical consultation comparison, China vs. US

	US	China	HK
Consultation per year (mn)	901	**7,740**	25
Population (mn)	330	**1,445**	7.4
Consultation per capita	2.73	**5.35**	3.40
By:			
General/family or health station	23%	**44%**	23%
Specialists or hospitals	77%	**56%**	77%
Pediatrics (儿科)	16%	**5.0%**	NA
Internal medicine (内科)	9.2%	**13%**	NA
Obstetrics (妇产科)	8.3%	**4.5%**	NA
Dermatology (皮肤科)	5.6%	**NA**	NA
Orthopedic (外科)	3.4%	**5.9%**	NA
Psychiatry (精神科)	3.4%	**NA**	NA
All others	31%	**18%**	NA

Source: NHC, CDC, DHHK, HKHA, Blue Lotus (2021/8/6).

Chinese is about 2-3x overly consulted medically comparing to Americans.

Below the line also tells the difference. In both US and Hong Kong, only 23% physician visits are to general practice or family doctors while in China 44% of medical consultation are to health stations. We believe this shows the absence of an effective family practice and personal health profile leading to duplicating visits to clinical facilities. Within specialist visits it is also worthwhile to mention that almost a quarter of Americans' physician visits, or a third of specialist visits are child or child-birth related, while only a tenth of Chinese's medical consultation, or a fifth of specialist visits are child-related. We believe this also suggests that Chinese are over-consulted medically comparing to the Americans.

Ironically, despite being overly consulted and overly medicated, Chinese patients still have low satisfaction. Will it change? We believe:

Chinese patients are likely to consult less if health reform is successful.

- **The number of medical consultations will likely come down if China's healthcare system is better organized**. We believe a by-product of hierarchical diagnosis, if achieved, is to reduce the number of general health Q&A's in the mix of medical consultations. This reduction will be achieved through dedicated family doctors who are familiar with the patient's clinical history, as well as better record keeping that facilitates effective joint diagnosis;
- **The pricing power of online medical consultation rests on the ability to provide must-have service when China's health system becomes better organized, or to piggyback with an existing monetizable service**: Global evidence shows that citizens tend to be over-consulted and over-medicated when the country's medical resources are not effectively allocated first to the true needs and second to the ability to pay. Today they are neither, which is a persistent criticism of *the Beveridge Model*. China's over-consultation and over-medication of its patients actually co-exist with low doctor pay and low drug authenticity, leading to low patient satisfaction. Both in our view are likely to get addressed in China's upcoming health reforms.

Valuation has crossed the reasonable line

As shown in Exhibit 74, US offline pharmacies (Walgreens and CVS) and drug wholesalers (Amerisource Bergen, Cardinal and McKeson) are trading at forward PE of 10-12x while China offline pharmacies (LBX, Yifeng, DSL and YXT) are traded at significantly higher PE multiples than Chinese drug wholesalers (Sinopharm and Shanghai Pharma). But Chinese online pharmacies (AliHealth and JDHealth) are trading at 6-7x of the PE multiples of offline pharmacies and 20-30x of the PE multiples of drug wholesalers.

Chinese online pharmacy is trading at 15-20 times the PE multiple of their US counterparts and 6-7x of their Chinese counterparts.

Exhibit 74. Digital healthcare comparison table

Sector		Price	Mkt Cap	PE (consensus)			PEG	PS (consensus)		EV/EBITDA (consensus)	
	Ticker	(Local)	(US$m)	2021E	2022E	2023E	2021E	2021E	2022E	2021E	2022E
China Health Information Systems											
Ping An Healthcare	1833 HK	55.2	8,141	(32.7)	(40.7)	(63.2)	NM	5.84	4.44	(169)	(208)
YIDU Tech Inc	2158 HK	30.4	3,808	303	(39.1)	(57.6)	NM	17.2	10.6	(390)	(465)
Winning Health	300253 CH	14.4	4,773	49.6	36.9	27.8	1.5	10.5	8.31	277	208
Medlive Technology	2192 HK	33.0	3,021	193	92.8	60.2	2.4	54.6	31.2	1,128	538
Average/Total			**19,743**	**86**	**(1.2)**	**(21)**	**0.7**	**17**	**11**	**95**	**(43)**
China Healthcare Distribution											
Alibaba Health	241 HK	12.1	21,018	265	141	85.2	3.5	5.71	3.88	3,397	1,539
JD Health International	6618 HK	77.5	31,746	312	185	106	4.4	7.14	5.01	(7,475)	3,866
Laobaixing (LBX)	603883 CH	47.5	3,011	25.5	21.7	17.5	1.2	1.15	0.93	117	94.9
Yifeng Pharmacy Chain	603939 CH	51.2	5,703	37.4	28.9	22.6	1.3	2.26	1.79	156	121
DaShenLin (DSL)	603233 CH	42.1	5,157	26.2	20.3	15.9	0.9	1.87	1.48	122	92.7
Yixintang (YXT)	002727 CH	28.9	2,669	17.3	14.0	11.4	0.7	1.16	0.96	88.6	72.9
Sinopharm	1099 HK	21.1	8,465	6.7	6.0	5.6	0.75	0.10	0.09	47.7	44.0
Shanghai Pharma.	2607 HK	16.2	7,908	9.6	8.7	7.6	0.77	0.23	0.21	52.9	46.6
Average/Total			**85,676**	**188**	**109**	**65**	**2.82**	**4.42**	**3.11**	**(1,902)**	**1,838**
Global Health Information Systems											
Cerner Corp	CERN US	74.5	22,021	22.4	20.6	19.0	2.6	3.80	3.61	12.1	11.2
Allscripts Healthcare	MDRX US	14.3	1,793	15.7	14.4	12.0	1.1	1.19	1.16	7.7	7.3
Change Healthcare Inc	CHNG US	21.7	6,758	(149)	255	45.8	NM	1.98	1.89	12.3	10.2
Evolent Health Inc	EVH US	26.0	2,266	(164)	1,976	115.6	NM	2.56	2.25	44.8	33.3
Health Catalyst Inc	HCAT US	54.7	2,730	(128)	(186)	(434)	NM	11.44	9.40	(251)	4,746
Signify Health Inc	SGFY US	24.2	5,475	(229)	89.4	48.6	NM	7.23	6.05	34.6	27.0
Premier Inc.	PINC US	38.6	4,738	24.7	28.0	17.4	1.3	2.87	3.39	11.9	10.4
Average/Total			**45,781**	**(51.2)**	**148**	**3.81**	**1.44**	**4.14**	**3.81**	**0.53**	**296**
Global Healthcare Distribution											
Walgreens Boots	WBA US	49.2	42,540	10.9	10.4	9.7	1.9	0.32	0.31	11.3	12.2
CVS Health Corp	CVS US	84.5	111,517	10.8	10.2	9.6	1.8	0.39	0.38	9.74	9.38
AmerisourceBergen	ABC US	123.6	25,691	15.3	12.1	10.8	0.8	0.12	0.11	9.94	8.92
Cardinal Health	CAH US	53.0	15,379	17.3	10.8	9.8	0.5	0.09	0.09	7.60	6.62
McKesson Corp	MCK US	206.0	31,869	14.5	9.1	8.3	0.5	0.13	0.12	9.23	6.60
Matsumoto Kiyoshi	3088 JP	5300.0	5,262	23.3	16.4	14.6	0.9	0.91	0.62	11.1	9.47
Zur Rose Group	Rose SW	401.0	4,579	(27.8)	(45.4)	181.8	NM	2.38	1.70	(49.6)	(161)
Shop Apotheke Europe	SAE GY	144.6	3,092	(69.9)	(477)	88.3	NM	2.38	1.83	505.9	79.8
Average/Total			**239,929**	**10.7**	**3.14**	**14.0**	**1.35**	**0.37**	**0.33**	**15.1**	**6.94**

Source: Bloomberg, BLRI (2021/9/14)

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Because there lacks a credible online pharmacy comparable in the developed market, we have to reason that the high multiples of Chinese offline pharmacies are justified because their overwhelming sales force acts as a form of primary doctors when it comes to sell the drugs. As such they can enjoy a higher gross margin than their US counterparts. Such phenomenon, while unlikely to last forever, will probably persist for a fairly long period of time. To change this phenomenon, hierarchical diagnosis will cost money.

Current valuation gap reflects market expectation of online pharmacy taking over the healthcare distribution industry.

We believe low valuations of China's drug wholesalers are justified because China's clinical facilities are congregated in hospitals, especially Class III, urban hospitals with drug sales also done there. The role of a wholesaler is limited.

The current valuation reflects market's expectation that online pharmacy shall dominate China's drug distribution landscape in both retail and wholesale, which we don't think will be the case.

Similarly, traditional EHR/EMR companies like Cerner and Allscripts have a forward PE multiple of 15-20x while their Chinese counterparts like Winning have 2x the multiple, presumably reasonable given China's patient size. Yet the PE multiple of YIDU runs to hundreds to negative. We believe medical big data builds on the foundation of EHR/EMR. It is unlikely that EHR/EMR companies will not enter the field of medical data down the road. We doubt there will be much obstacle to stop them, except in specialty fields like cancer.

We believe medical big data company shouldn't trade much above EHR/EMR companies.

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