Deutsche Bank
Markets Research

Rating
Buy

Asia
China

Health Care
Pharmaceuticals / Biotechnology

Company
Hengrui Medicine

Reuters	Bloomberg	Exchange	Ticker
600276.SS	600276 CH	SHH	600276

Date
14 August 2017

Company Update

Price at 11 Aug 2017 (CNY)	53.17
Price target - 12mth (CNY)	58.50
52-week range (CNY)	60.22 - 42.67
Shanghai Composite	3,210

Valuation & Risks

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Price/price relative

Performance (%)	1m	3m	12m
Absolute	7.4	-4.9	19.2
Shanghai Composite	0.2	4.8	6.9

Source: Deutsche Bank

Updates on middle/late-stage pipeline

Multiple catalysts ahead; late-stage pipeline represents 17% market cap by DBe

We update pipeline progress following the meeting with Chairman Sun. Major catalysts are: 1) approval of 19K and Abraxane generic by YE17; 2) resubmission of retagliptin in the near term; 3) clarity on pyrotinib development, including an earlier submission of marketing approval; 4) updates on clinical progress for camrelizumab; and 5) phase 3 data release on Incyte's ECHO-301. We also highlight potential upside from additional US IND approval and clinical progress of its novel compounds in the US. Our NPV analysis indicated the pipeline value is RMB9.2 per share. This comprehensive report includes key ongoing clinical studies for all mid/late study compounds, as well as competitors' studies.

Camrelizumab as the largest driver; IDO inhibitor provides significant upside

We have updated our peak sales for camrelizumab to RMB5-6bn in China and increased the probability of success to 75-85%, based on the strong ORR data from the phase 1 study. Four registration trials are being conducted at present. We expect Hengrui to get the first domestic PD-1 approval, with safe data from sufficient number of patients required by the CFDA. Additionally, we expect IND approval for its IDO inhibitor from CFDA in the near term, following US IND approval in May. We believe it would be significantly positive to the IO franchise and we forecast RMB3-4bn peak sales for the IDO inhibitor.

DB proprietary patient-based PD-1/PD-L1 model

Our model indicates that the addressable market for PD-1/PD-L1 would be RMB19bn in China in 2017 and RMB29bn in 2030, representing a CAGR of 15%. NSCLC and GC are likely to be the largest indications due to a large patient base and unmet medical need. Our model is based on 14 tumor types, including the approved indications and major indications being investigated. Among domestic names, we identified six companies that are conducting late stage studies for their PD-1/PD-L1 with Hengrui being the leader.

Valuation and risks

Our current valuation for the late stage pipeline represents 17% of the market cap, vs. 15% as of our first attempt in September 2016. Our TP of RMB58.5 is based on 42x 2018E EPS. We believe 42x is justified, as A-share peers are trading at 29x with 18% EPS growth in 2017 (vs. the 24% we model for Hengrui). We believe the premium is justified, given the top China pipeline, major upside from exports and the potential earnings growth acceleration driven by blockbuster launches. Key risks include product launch delays and price cuts.

Related Reports

China Watch P263 - PD-1/PD-L1 patient-based model for China, 14 Aug 2017
Hengrui - Take-aways from Chairman meeting, 27 Jul 2017
Hengrui - The PD 1 race continues, 9 Jun 2017
Hengrui - Camrelizumab Phase 1 data released; IDO US IND approved, 18 May 2017
Hengrui - Revising estimates due to pipeline prioritization, 16 Nov 2016
Hengrui - Deep dive into late stage pipeline, 21 Sep 2016
China Watch P260 - ASCO take-aways: Physician feedback on IO Chinese trials, 7 Jun 2016

Late-stage pipeline analysis

Revisiting our estimates to reflect recent updates

Our updated valuation for the late-stage pipeline represents 17% of the market cap, vs. 15% when we first attempted to value Hengrui's late-stage pipeline. We summarize the key changes to our estimates on Hengrui's pipeline below.

- We increased our peak sales estimate for camrelizumab to RMB5-6bn from RMB1.2-1.8bn as we expect substantial opportunities for China-specific unmet medical needs, such as LC, GC and EC. Our POS is also revised to 75-85% from 60-70%, as the company is already conducting four registration trials with initial encouraging data.
- We added SHR9146, an IDO inhibitor, to our analysis. While the drug is pending clinical trial approval by CFDA, it has already received IND approval from the US FDA. If successful, we estimate peak sales to be RMB3-4bn. We believe this will be a significant value driver going forward.
- We increased our peak sales estimate for pyrotinib to RMB2-2.8bn from RMB1.2-1.6bn. Our POS is also revised to 85-95% from 80-90% as we anticipate Hengrui to file production approval to the CFDA, based on phase 2 data. We expect better efficacy data vs. T-DM1.
- For henagliflozin, we revised our POS to 85-95% from 75-85% as the company initiated a phase 3 study in May 2017.
- For hetrombopag olamine, we increased our POS to 80-90% from 70-80%, as the company moved the drug into a phase 3 study in July 2017, based on public records.
- We added SHR4640 to our analysis. As an URAT1 inhibitor, a phase 2 trial is being conducted for this drug in the treatment of gout.
- We increased our peak sales estimate to RMB2.5-3bn from RMB2-2.5bn as we are more upbeat on the growth outlook on COPD therapeutics.
- We removed Exforge generic from the model as we are unable to identify a new BE study after the withdrawal of the application.
- We now model NPV of RMB9.2 per share from these potential blockbusters, vs. RMB7.3 previously in November 2016 and RMB6.8 at first in September 2016. We summarize our estimates in the following exhibits.

Despite the aforementioned efforts, we still believe we undervalued Hengrui's pipeline because: 1) we did not model any early stage pipeline compounds, 2) we did not model global opportunities for three drugs in early development in the US, especially SHR-1314, which would be likely to become the third to market IL-17 in the US, 3) we did not model US ANDA generic opportunities but expect significant upside as it is highly likely Hengrui would address billion-dollar market opportunities dominated by branded innovative drugs.

Figure 1: Valuation of late-stage pipeline

Drug	Indication	Launch date	Peak sales (RMBm)	Probability of success (low-end)	Probability of success (high-end)	Value per share (Prob. Adjusted)
Innovative drugs						
19K	Oncology	2H17	1,200-1,500	95%	99%	0.58
Retagliptin	Diabetes	2H18	1,600-2,200	83%	93%	0.80
Pyrotinib	Breast cancer, NSCLC	1H19	2,000-2,800	85%	95%	0.91
SHR1210 (anti-PD-1 mAb)	Liver cancer, gastric cancer	2H19	5,000-6,000	75%	85%	1.88
SHR3680 (AR antagonist)	Prostate cancer	2H19	800-1,200	50%	60%	0.24
SHR6390 (CDK4/6 inhibitor)	Breast cancer	2H19	1,500-2,000	35%	45%	0.67
Henagliflozin	Diabetes	2H19	1,000-1,400	85%	95%	0.51
Remimazolam	Anesthetics	2020	800-1,200	75%	85%	0.34
Hetrombopag Olamine	Idiopathic thrombocytopenic purpura	2020	800-1,200	80%	90%	0.37
SHR4640	Gout	2020	800-1,000	70%	80%	0.29
GLP-1	Diabetes	2020	800-1,000	80%	90%	0.32
SHR9146 (IDO)	Oncology	2022	3,000-4,000	50%	65%	0.59
Subtotal						**7.5**
Generic drugs						
Cialis	Erectile dysfunction	1H18	1,000-1,400	85%	95%	0.31
Celebrex	Autoimmune disease	1H18	1,000-1,500	85%	95%	0.32
Abraxane	Oncology	2H17	1,000-1,200	85%	95%	0.31
Advair	Respiratory	1H20	2,500-3,000	55%	65%	0.43
Lyrica	CNS	2020	1,200-1,800	85%	95%	0.35
Subtotal						**1.7**
Total						**9.2**

Source: Deutsche Bank

We highlight the innovative drugs developed by Hengrui in the following exhibit.

Figure 2: Pipeline summary for Hengrui

Phase 1	Phase 2	Phase 3	NDA
SHR1539 (Hedgehog inhibitor) # Solid tumors	**Remimazolam (GABA receptor agonist)** Analgesics	**Hetrombopag Olamine (TPOR) *** ITP	**Retagliptin (DPP-4 inhibitor) *** Diabetes
SHR3162 (PARP inhibitor) # Solid tumors	**Pyrotinib (EGFR/Her2 inhibitor) *** NSCLC/Gastrointestinal tumor	**Apatinib (VEGFR-2 inhibitor)** NSCLC/Liver cancer	**19K (long acting GCSF)** Oncology
SHR6390 (CDK4/6 inhibitor) Solid tumors	**SHR3680 (AR antagonist) #** Prostate cancer	**Pyrotinib (EGFR/Her2 inhibitor) *** HER2+ breast cancer	
SHR7390 (MEK inhibitor) Solid tumors	**SHR4640 (URATI inhibitor) #** Hyperuricacidemia/Gout	**Retagliptin/metformin** Diabetes	
SHR0534 (GPR40 agonist) * Diabetes	**GLP-1 agonist** Diabetes	**Henagliflozin (SGLT2 inhibitor)** Diabetes	
SHR0302 (JAK1 inhibitor) Rheumatoid arthritis	**SHR1210 (PD-1 mAb) #** cHL	**SHR1210 (PD-1 mAb) #** Liver cancer/Gastric cancer/NSCLC	
SHR-1314 (Il-17 mAb) Psoriasis			* US phase 1 ongoing # Australia phase 1 ongoing
			Chemical drug
			Biological drug

Source: Deutsche Bank, Company data

Camrelizumab: the largest value driver in the pipeline

We highlight camrelizumab (SHR1210) is the top priority for the pipeline of Hengrui. There are four registration studies being conducted at present, including a P2 study for classical Hodgkin Lymphoma (cHL), a P3 study for 1L NSCLC, a P3 study for relapsed/refractory esophageal cancer, and a P2/3 study for relapsed/ refractory liver cancer.

These data suggest Hengrui has the largest PD-1 clinical program among all domestic players. Recall recently that CFDA articulated a willingness to approve IO drugs based on a single arm P2 study; however, CFDA also made it clear the approval would also require sufficient safe data from a large number of patients. According to management, Hengrui is likely to have safety data from 800-1,000 patients by 2H18 when the cHL study completes. We highlight there are 1,250 patients from all ongoing P2/3 studies.

We continue to think that Hengrui is likely to be the first domestic company to launch PD-1 in China. Among domestic competitors, Beigene entered cHL in April 2017 with a P2 study scheduled to enroll 68 patients (60 in China and the rest in South Korea) among 17 sites (14 in China), while another compound, IBI308, entered P2 in April, as well as targeting 90 patients among 29 hospitals. For global companies, we highlight two PD-1 mAbs, pembrolizumab from Merck and nivolumab from BMS, are in phase 3 while two PD-L1 mAbs, atezolizumab from Roche and durvalumab from AZN, are in phase 3 in China. We summarize all ongoing trials of the aforementioned drugs below.

Figure 3: Ongoing trials for SHR1210 by Hengrui

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
SHR-1210	CTR20170322	1L Non-Small Cell Lung Cancer	Phase 3	SHR-1210+chemotherapy (carboplatin + pemetrexed) vs. chemotherapy (carboplatin + pemetrexed)	412	37	PFS	May-17
SHR-1210	CTR20170307	2L Advanced Esophageal Cancer	Phase 3	SHR-1210 vs. Docetaxel vs. Irinotecan	438	44	OS	May-17
SHR-1210	CTR20160871	2L Advanced Hepatocellular Carcinoma	Phase 2/3	SHR-1210 Q2W vs. SHR-1210 Q3W	60	18	6-month OS%, ORR	Nov-16
SHR-1210	CTR20170090	3L Non-Small Cell Lung Cancer	Phase 2	SHR-1210 Q2W+ apatinib 250mg/d vs. SHR-1210 Q2W+ apatinib 500mg/d	118	3	AE, SAE, ORR	Mar-17
SHR-1210	CTR20170196	Advanced Hepatocarcinoma	Phase 2	SHR-1210+Apatinib vs. SHR-1210+FOLFOX4 regimen	36~48	6	AE, SAE	Apr-17
SHR-1210	CTR20170299	2L Non-Small Cell Lung Cancer	Phase 2	SHR-1210 Q2W	120	11	ORR	May-17
SHR-1210	CTR20170500	Refractory classical Hodgkin Lymphoma	Phase 2	SHR-1210 Q2W	60	2	ORR, CR, PR	Jun-17
SHR-1210	CTR20170267	1L Nasopharyngeal carcinoma	Phase 1	SHR-1210 Q1W+Gemcitabine Hydrochloride +Cisplatin	20	1	Safety	Apr-17
SHR-1210	CTR20160248	Advanced Solid Tumor	Phase 1	SHR-1210 dose escalation	27~36	1	Safety, tolerability	Apr-16
SHR-1210	CTR20160207	Advanced Melanoma	Phase 1	SHR-1210 dose escalation	24~36	1	Safety, tolerability	Apr-16
SHR-1210	CTR20160175	Advanced Solid Tumor	Phase 1	SHR-1210 dose escalation	32~51	1	Safety, tolerability	Apr-16

Source: : Deutsche Bank, chinadrugtrials.org.cn

Figure 4: Ongoing trials for JS001 by Shanghai Junshi

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
JS001	CTR20160900	Melanoma	Phase 2	JS001	120	7	ORR	Dec-16
JS001	CTR20170347	2L Urothelial Bladder Carcinoma	Phase 2	JS001	200	1	Safety, tolerability, ORR	Apr-17
JS001	CTR20160740	2L Advanced Gastric Adenocarcinoma, Esophageal Cancer, Nasopharyngeal Carcinoma, Head and Neck Squamous Cell Carcinoma	Phase 1/2	JS001	326	23	ORR	Dec-16
JS001	CTR20160176	Advanced Solid Tumor	Phase 1	JS001	12	1	Safety, tolerability, DLT	Mar-16
JS001	CTR20160412	2L Advanced Triple Negative Breast Cancer	Phase 1	JS001	12~24	1	AE, ECG, vital signs	Aug-16
JS001	CTR20160187	Advanced Tumor	Phase 1	JS001	18	1	Safety, tolerability, DLT, MDT/RD	Apr-16
JS001	CTR20160274	Advanced or Recurrent Malignant Tumor	Phase 1	JS001	27	1	Safety, tolerability, atineoplasmic activity	May-16
JS001	CTR20160813	2L Advanced Triple Negative Breast Cancer	Phase 1	JS001	72	1	AE, ECG, vital signs	Dec-16
JS001	CTR20160976	2L Advanced Triple Negative Breast Cancer	Phase 1	JS001	54	1	AE, ECG, vital signs	Dec-16
JS001	CTR20170109	Advanced Renal Carcinoma & Melanoma	Phase 1	JS001	24	1	AE, ECG, vital signs	Mar-17
JS001	CTR20170345	Advanced Neuroendocrine Tumor	Phase 1	JS001	40	1	Safety, tolerability, ORR	Apr-17
JS001	CTR20170747	Malignant Lymphoma	Phase 1	JS001	12	1	Tolerability, safety, ORR	Jul-17

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 5: Ongoing trials for BGB-A317 by BeiGene/ Celgene

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
BGB-A317	CTR20170071	2L Urothelial Bladder Carcinoma	Phase 2	BGB-A317	110	13	ORR	Apr-17
BGB-A317	CTR20170119	Refractory classical Hodgkin Lymphoma	Phase 2	BGB-A317	68	17	ORR	Apr-17
BGB-A317	CTR20170515	1L Esophageal Cancer, Gastric Cancer, Gastroesophageal Junction Carcinoma	Phase 2	BGB-A317	30	6	AE, SAE, medical checkup, vital signs, ECG	Jun-17
BGB-A317	CTR20170361	1L Advanced or Metastatic Non-Squamous Non-Small Cell Lung Cancer, Squamous Cell Lung Cancer, Extensive Small Cell Lung Cancer	Phase 2	BGB-A317	60	2	ORR	Jul-17
BGB-A317	CTR20160872	Advanced Solid Tumor	Phase 1	BGB-A317	300	13	Safety, tolerability, PK, MTD, RP2D, ORR	Dec-16

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 6: Ongoing trials for IBI308 by Innovent

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
IBI308	CTR20170380	2L Advanced or Metastatic Squamous Non-Small Cell Lung Cancer	Phase 3	IBI308 vs. Docetaxel	266	28	OS	May-17
IBI308	CTR20170258	2L Esophageal Cancer	Phase 2	IBI308 vs. Paclitaxel vs. Irinotecan Hydrochloride	180	8	OS	Mar-17
IBI308	CTR20170281	Recurrent or Refractory classical Hodgkin Lymphoma	Phase 2	IBI308	90	29	ORR	Apr-17
IBI308	CTR20160735	Advanced Solid Tumor	Phase 1	IBI308	104	3	Safety, tolerability, antineoplasmic activity	Oct-16

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 7: Ongoing trials for GLS-010 by Gloria Pharma

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
GLS-010	CTR20170433	Advanced Solid Tumor (Gastric Cancer, Esophageal Cancer)	Phase 1	GLS-010	84	1	AE, vital signs, medical checkup, 12-lead ECG, ECOG, SAE	May-17

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 8: Ongoing trials for KN035 by Alphamab

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
KN035	CTR20170036	Advanced Solid Tumor	Phase 1	KN035	14~36	1	Safety, tolerability, DLT, AE, SAE, vital signs, medical checkup, 12-lead ECG	Mar-17

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 9: Ongoing trials for Nivolumab/BMS-936558 by BMS

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Nivolumab	CTR20170340	1L Non-Small Cell Lung Cancer	Phase 3	Nivolumab vs. Nivolumab + Ipilimumab vs. Nivolumab + Platinum doublet chemotherapy vs. Platinum doublet chemotherapy	2,210	24	OS	Aug-15
Nivolumab	CTR20160578	2L Relapsed Small-cell Lung Cancer	Phase 3	Nivolumab vs. Topotecan Hydrochloride	480	197	OS	Sep-15
Nivolumab	CTR20160605	Advanced Hepatocellular Carcinoma	Phase 3	Nivolumab vs. Sorafenib tosylate	1,000	140	OS, TTP	Dec-15 - international; Sep-16-China
Nivolumab	CTR20150767	Advanced or Metastatic Non Small Cell Lung Cancer	Phase 3	Nivolumab vs. Docetaxel	500	25	OS	Dec-15
Nivolumab	CTR20170371	Advanced or Recurrent Gastric Cancer or Urothelial Bladder Carcinoma	Phase 3	Nivolumab + Ipilimumab vs. Nivolumab + Oxaliplatin+Capecitabine vs. Nivolumab + Oxaliplatin+Leucovorin+Fluorouracil vs. Oxaliplatin+Capecitabine vs. Oxaliplatin+Leucovorin+Fluorouracil	1,266	145	OS	May-17
Nivolumab	CTR20170694	Extensive small cell lung cancer	Phase 3	Nivolumab + Ipilimumab vs. Nivolumab + Ipilimumab placebo vs. Nivolumab placebo + Ipilimumab placebo	810	207	OS	Oct-15
Nivolumab	CTR20170541	2L Advanced or Metastatic Non Small Cell Lung Cancer	Phase 3	Nivolumab + Pemetrexed+ Cisplatin/Carboplatin vs. Pemetrexed+ Cisplatin/Carboplatin vs. Nivolumab + Ipilimumab	500	16	PFS	Apr-17
Nivolumab	CTR20150755	Advanced or Recurrent Solid Tumor	Phase 1/2	Nivolumab	56	1	AE, SAE, death, ECG, vital signs, medical checkup	Jan-16

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 10: Ongoing trials for Pembrolizumab/MK-3475 by Merck

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Pembrolizumab	CTR20160097	1L Metastatic or Advanced Non-Small Cell Lung Cancer	Phase 3	Pembrolizumab vs. Carboplatin + Pemetrexed Disodium for Injection+Paclitaxel Injection	1,240	218	OS	Nov-14 - international; Aug-16-China
Pembrolizumab	CTR20160205	2L Non-Small Cell Lung Cancer	Phase 3	Pembrolizumab vs. Paclitaxel	740	31	OS, PFS	Sep-16
Pembrolizumab	CTR20160588	2L Advanced Esophageal Cancer	Phase 3	Pembrolizumab vs. Paclitaxel or Docetaxel or Irinotecan Hydrochloride	600	194	PFS, OS	Dec-15 - international; Dec-16-China
Pembrolizumab	CTR20160587	2L Advanced Gastric Adenocarcinoma	Phase 3	Pembrolizumab vs. Paclitaxel	NA	34	OS, PFS	Feb-17 - international; Feb-17 -China
Pembrolizumab	CTR20170044	1L Metastatic Squamous Non-Small Cell Lung Cancer	Phase 3	Pembrolizumab +Carboplatin +Paclitaxel Injection vs. Carboplatin +Paclitaxel Injection	560	150	PFS, OS	Jul-16 - international; Apr-17-China
Pembrolizumab	CTR20160320	Local Advanced or Metastatic Melanoma	Phase 1b	Pembrolizumab	80	6	Safety, tolerability, efficacy	Jul-16
Pembrolizumab	CTR20160103	Non-Small Cell Lung Cancer	Phase 1	Pembrolizumab	42	1	Safety, tolerability, PK	Aug-16

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 11: Ongoing trials for Atezolizumab/MPDL3280A by Roche

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Atezolizumab	CTR20160994	Non-Squamous or Squamous Non-Small Cell Lung Cancer	Phase 3	Atezolizumab vs. Carboplatin/ Cisplatin + Pemetrexed/ Gemcitabine	555	13	PFS, OS	Jul-15
Atezolizumab	CTR20160680	Myometrial Invasive Urothelial Carcinoma	Phase 3	MPDL3280A	700	78	DFS, UC relapse, death	Jun-15-international; Mar-17-China
Atezolizumab	CTR20160510	Non-Small Cell Lung Cancer	Phase 3	MPDL3280A vs. Best Supportive Care	760	276	DFS	Oct-15
Atezolizumab	CTR20170064	Non-Squamous Non-Small Cell Lung Cancer	Phase 3	Atezolizumab + Carboplatin or Cisplatin + Pemetrexed vs. Carboplatin or Cisplatin + Pemetrexed	568	8	PFS, OS	Apr-16
Atezolizumab	CTR20170061	Locally Advanced or Metastatic Urothelial Carcinoma	Phase 3	Atezolizumab vs. Atezolizumab + Gemcitabine+ Carboplatin/Cisplatin vs. Placebo+ Gemcitabine + Carboplatin/Cisplatin	1,200	116	PFS, OS	Jun-16
Atezolizumab	CTR20160054	Non-Small Cell Lung Cancer	Phase 3	MPDL3280A vs. Docetaxel	563	44	OS	Jul-16
Atezolizumab	CTR20160988	Extensive-Stage Small Cell Lung Cancer	Phase 3	Atezolizumab + Carboplatin + Etoposide vs. Placebo + Carboplatin + Etoposide	500	12	PFS, OS	Apr-17
Atezolizumab	CTR20160381	Locally Advanced or Metastatic Solid Tumors	Phase 1	MPDL3280A	120	6	PK	Aug-16

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 12: Ongoing trials for Durvalumab/MEDI4736 by AstraZeneca

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Durvalumab	CTR20170012	1L Non-Small Cell Lung Cancer	Phase 3	MEDI4736 vs. Paclitaxel + carboplatin or Gemcitabine + cisplatin or Gemcitabine + carboplatin or Pemetrexed + cisplatin or Pemetrexed + carboplatin	440	28	PFS, OS	Jan-17-international; Feb-17-China
Durvalumab	CTR20170135	1L Advanced Urothelial Carcinoma	Phase 3	MEDI4736 vs. MEDI4736 + Tremelimumab vs. Cisplatin + Gemcitabine or Carboplatin+Gemcitabine	1,005	42	OS, PFS	Nov-15-international; Apr-17-China
Durvalumab	CTR20170158	Non-Small Cell Lung Cancer	Phase 3	MEDI4736 vs. Placebo	1,100	105	DFS	May-17
Durvalumab	CTR20160926	Advanced Malignancies	Phase 1	MEDI4736 vs. MEDI4736+Tremelimumab	24	3	PK, AE, medical checkup,vital signs, ECG	Nov-16

Source: Deutsche Bank, chinadrugtrials.org.cn

Diabetes

The company has several innovative compounds being developed for diabetes in its pipeline. The lead compound is retagliptin, a DPP4 inhibitor, and we expect the company to resubmit its application in the near term. Additionally, the company started a phase 3 study for henagliflozin, a SGLT2 inhibitor. We believe the company would be the first domestic player to launch a self-developed DPP4 inhibitor and SGLT2 inhibitor.

Additionally, according to clinicaltrial.gov, there are three clinical studies conducted by Hengrui for PEX168, a GLP-1 agonist. However, public records indicated that the clinical trial approval for PEX168 belongs to Jiangsu Hansoh and Jiangsu Hansoh is also conducting late stage trials for the drug. We expect more clarity for the development of this program in the near term. We summarize the ongoing trials by Hengrui and its major competitors below.

Figure 13: Ongoing trials for Retagliptin by Hengrui in China

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Retagliptin	CTR20160943	Type 2 Diabetes	Phase 3	Retagliptin + Metformin vs. Placebo + Metformin	360	1	Baseline	Dec-16
Retagliptin	CTR20160328	Type 2 Diabetes	Phase 1	Retagliptin different dosages	24	1	Plasma PK, urinary PK	May-16
Retagliptin	CTR20160327	Type 2 Diabetes	Phase 1	Retagliptin different dosages	30	1	Plasma PK AUC0-t, Cmax , Tmax, t1/2, CL/F, urinary PK, urine volume	May-16
Retagliptin	CTR20160309	Type 2 Diabetes	Phase 1	Retagliptin + Simvastatin	24	1	Plasma PK AUC0-24, Cmax	Jun-16
Retagliptin	CTR20160277	Type 2 Diabetes	Phase 1	Retagliptin + Metformin	24	1	Plasma PK AUC0-24, Cmax	May-16
Retagliptin	CTR20160276	Type 2 Diabetes	Phase 1	Retagliptin + Valsartan	24	1	Plasma PK AUC0-24, Cmax	May-16
Retagliptin	CTR20160193	Type 2 Diabetes	Phase 1	Retagliptin	24	1	Metabolites, Plasma PK AUC0-72h, Cmax	Apr-16

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 14: Ongoing trials for Henagliflozin by Hengrui in China

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Henagliflozin	CTR20170527	Type 2 Diabetes	Phase 3	Henagliflozin 5mg+Placebo vs. Henagliflozin 10mg+Placebo vs. Placebo	450	1	HbA1c, AE, vital signs, medical checkup, 12-lead ECG, GLU, Urine test, SMBG, Fingerstick	May-17
Henagliflozin	CTR20140414	Type 2 Diabetes	Phase 1	Henagliflozin vs. Placebo	30	3	AE, medical checkup, blood test, urine test, CM, CK, urine test, UCAR, renal tublar marker, weight, 12-lead ECG, PK, PD	Jun-14
Henagliflozin	CTR20140415	Type 2 Diabetes	Phase 1	Henagliflozin	12	1	PK	Jun-14
Henagliflozin	CTR20150098	Type 2 Diabetes	Phase 1	Henagliflozin vs. Placebo	168	1	Vital signs, medical checkup, 12-lead ECG, blood pregnancy, blood test, CM, urine test, TSH, blood CK, UCAR, renl tubular marker, AE, max Css, min Css, HbA1c, FPG, 2hPBG, AUCO-2h	Mar-15
Henagliflozin	CTR20150099	Type 2 Diabetes	Phase 1	Henagliflozin+Metformin vs. Placebo	168	1	Vital signs, medical checkup, 12-lead ECG, blood test, CM, CK, urine test, TSH, CKMB, UCAR, renal tublar marker, AE	Mar-15
Henagliflozin	CTR20150155	Type 2 Diabetes	Phase 1	Henagliflozin+Retagliptin	12	1	PK	Jul-15
Henagliflozin	CTR20150650	Type 2 Diabetes	Phase 1	Henagliflozin	32	1	PK	Oct-15
Henagliflozin	CTR20150812	Type 2 Diabetes	Phase 1	Henagliflozin	32	1	PK	Nov-15

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 15: Completed trials for GLP-1 agonist by Hengrui in China

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
GLP-1 agonist	NCT01965509	Type 2 Diabetes	Phase 2	GLP-1 agonist vs. Placebo	120	1	HbA1C	May-12
GLP-1 agonist	NCT01976858	Type 2 Diabetes	Phase 1	GLP-1 agonist vs. Placebo	50	1	Serum concentrations	Jun-11
GLP-1 agonist	NCT01965496	Type 2 Diabetes	Phase 1	GLP-1 agonist	64	1	HbA1C	Mar-12

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 16: Late-stage ongoing trials by competitors in China

Company	Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Boehringer Ingelheim	Linagliptin	CTR20150659	Type 2 Diabetes	Phase 4	Linagliptin vs. Placebo	7,003	807	MACE	Jul-13-international; Mar-16-China
Boehringer Ingelheim	Linagliptin	CTR20160560	Type 2 Diabetes	Phase 3	Linagliptin + insulin or Linagliptin + insulin +Metformin vs.Linagliptin placebo +insulin or +Linagliptin placebo +insulin+ Metformin	206	28	HbA1c	Oct-16
BMS/AZ	Saxagliptin	CTR20140696	Type 2 Diabetes	Phase 3	Saxagliptin + Metformin vs. Saxagliptin placebo + Metformin placebo	639	25	HbA1c	Nov-14
BMS/AZ	Saxagliptin	CTR20140311	Type 2 Diabetes	Phase 3	Saxagliptin + insulin or Saxagliptin + insulin +Metformin vs. Saxagliptin placebo +insulin or +Saxagliptin placebo +insulin+ Metformin	444	21	HbA1c, AE	Jul-15
Janssen	Canagliflozin	CTR20150744	Type 2 Diabetes	Phase 3	Canagliflozin vs. Placebo	3,700	890	ESKD, serum creatinine, mortality	Feb-14-international; Mar-16-China
BMS/ AstraZeneca	Dapagliflozin	CTR20131268	Type 2 Diabetes	Phase 3	Dapaglifozin Film vs. Placebo for Dapaglifozin Film	260	30	HbA1c	Feb-14
AstraZeneca	Dapagliflozin	CTR20150102	Type 2 Diabetes	Phase 3	Dapaglifozin Film vs. Placebo for Dapaglifozin Film	17,150	934	Mortality	Apr-13-international; Mar-15- China
Chipscreen	Chiglitazar	CTR20140262	Type 2 Diabetes	Phase 3	Chiglitazar vs. Sitagliptin (Januvia®)	741	37	HbA1c	Sep-14
Mitsubishi Tanabe	Teneligliptin	CTR20160445	Type 2 Diabetes	Phase 3	Teneligliptin +Metformin vs. Placebo+Metformin	240	34	HbA1c	Oct-16
Mitsubishi Tanabe	Teneligliptin	CTR20160443	Type 2 Diabetes	Phase 3	Teneligliptin vs. Placebo	240	31	HbA1c	Oct-16

Source: Deutsche Bank, chinadrugtrials.org.cn

TKI (tyrosine kinase inhibitor)

We continue to expect indication expansion opportunities for apatinib, including major cancer types such as NSCLC and liver cancer. Hengrui is currently conducting phase 3 trials for these two indications. Additionally, we believe pyrotinib is likely to be a key focus in the next few years as a differentiated therapeutics with better efficacy/ AE profile vs. available drugs. It is likely that the company would file production approval for pyrotinib based on phase 2 data, and it might be the first Chinese oncology drug approved based on P2 data. We summarize the ongoing trials for apatinib, pyrotinib and their key competitors below.

Figure 17: Ongoing trials for apatinib by Hengrui

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Apatinib	CTR20160019	3L Advanced Gastric Cancer	Phase 4	Apatinib	2,000	100	AE	Jan-16
Apatinib	CTR20132427	2L Advance Liver Cancer	Phase 3	Apatinib vs. Placebo	360	27	OS	Apr-14
Apatinib	CTR20150124	3L EGFR Wild-type Advanced Non-Small Cell Lung Cancer	Phase 3	Apatinib vs. Placebo	417	48	OS	Feb-15
Apatinib	CTR20160284	3L Advanced Gastric Cancer	NA	Apatinib different dosages	60	4	Tmax, Cmax, AUC, t1/2, Css, AUCss, MRT	Jan-17
Apatinib	CTR20160304	Gastric Cancer	NA	Apatinib Mesylate+Itraconazole	20	1	AUC, Cmax, t1/2	May-16
Apatinib	CTR20160319	Gastric Cancer	NA	Apatinib Mesylate+Rifampin	20	1	AUC, Cmax, t1/2	May-16

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 18: Ongoing trials for pyrotinib by Hengrui

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Pyrotinib	CTR20160442	3L HER2-positive Advanced Breast Cancer	Phase 3	Pyrotinib+Capecitabine vs. Placebo +Capecitabine	350	26	PFS	Jul-16
Pyrotinib	CTR20170251	3L HER2-positive Metastatic Breast Cancer	Phase 3	Pyrotinib+Capecitabine vs. Lapatinib +Capecitabine	240	15	PFS	Mar-17
Pyrotinib	CTR20160434	HER2 Mutation Advanced Non-Small Cell Lung Cancer	Phase 2	Pyrotinib	55	14	ORR	Oct-16
Pyrotinib	CTR20150279	HER2-positive Metastatic Breast Cancer	Phase 1/2	Pyrotinib+Capecitabine vs. Lapatinib +Capecitabine	128	1	ECOG, vital signs, medical checkup, UA, CMP, ECG, UCG, AE	Jun-15
Pyrotinib	CTR20132629	HER2-positive Advanced Breast Cancer	Phase 1	Pyrotinib dose escalation	38	1	DLT, MTD	Feb-13
Pyrotinib	CTR20150177	HER2-positive Advanced Breast Cancer	Phase 1	Pyrotinib + Capecitabine dose escalation	32	1	MTD	Sep-14
Pyrotinib	CTR20150178	HER2-positive Advanced Gastric Cancer	Phase 1	Pyrotinib + Docetaxel dose escalation	44	4	MTD	Sep-14
Pyrotinib	CTR20160326	ErbB-2(HER2) over-expressed Breast Cancer	NA	Pyrotinib 80/160 mg vs. Pyrotinib 200mg	42	1	AUC, Tmax, Umax	May-16
Pyrotinib	CTR20170528	ErbB-2(HER2) over-expressed Breast Cancer	Phase 1	Pyrotinib	4~6	1	PK, metabolites	Jun-17

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 19: Late-stage ongoing trials by competitors for apatinib and pyrotinib in China

Company	Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Pfizer	Sunitinib Malate	CTR20140783	Pancreatic neuroendocrine tumor	Phase 4	Sunitinib Malate	80	51	PFS	Jun-12
Pfizer	Sunitinib Malate	CTR20150183	Non resectable well-differentiated Pancreatic Neuroendocrine Tumor	Phase 4	Sunitinib Malate	100	15	AE	Dec-14
Roche	Erlotinib	CTR20140102	1L Advanced EGFR-mutation Non-Small Cell Lung Cancer	Phase 3	Erlotinib vs. Cisplatin + Gemcitabine	217	29	PFS	Mar-11
Roche	Erlotinib	CTR20140049	Advanced Non-Small Cell Lung Cancer	Phase 3	Erlotinib + Cisplatin + Gemcitabine vs. Placebo + Cisplatin + Gemcitabine	451	29	PFS	Apr-09-international; Nov-09-China
Roche	Erlotinib	CTR20131154	1L Advanced Non-Small Cell Lung Cancer	Phase 3	Erlotinib +chemotherapy vs. Placebo +chemotherapy	151	9	PFS	Nov-09
Boehringer Ingelheim	Afatinib	CTR20140651	Head and Neck Squamous Cell Carcinoma	Phase 3	Afatinib vs. Methotrexate	300	55	PFS	Jun-13
Boehringer Ingelheim	Afatinib	CTR20140229	Non-Small Cell Lung Cancer	Phase 3	Afatinib	500	31	AE	Oct-13-international; Aug-14-China
Boehringer Ingelheim	Afatinib	CTR20131407	2L Lung Squamous Carcinoma	Phase 3	Afatinib vs. Erlotinib	790	201	OS	Jul-12
Boehringer Ingelheim	Afatinib	CTR20131408	EGFR-positive mutation Lung Adenocarcinoma	Phase 2	Afatinib vs. Gefitinib	570	65	PFS, TTF, OS	Jun-12
Boehringer Ingelheim	Afatinib	CTR20160453	HER2-mutation Non-Small Cell Lung Cancer	Phase 2	Afatinib	40	7	ORR	Oct-16-international; Jan-17-China
Pfizer	Dacomitinib	CTR20132919	2L Advanced Non-Small Cell Lung Cancer	Phase 3	Dacomitinib vs. Erlotinib	878	5	PFS	Jun-11-international; Jun-12-China
Pfizer	Dacomitinib	CTR20132928	1L Advanced Non-Small Cell Lung Cancer	Phase 3	Dacomitinib vs. Gefitinib	440	24	PFS	Mar-14
Bayer	Regorafenib	CTR20132928	2L Hepatocellular Carcinoma	Phase 3	Regorafenib vs. Placebo	530	166	PFS	Nov-13
Bayer	Sorafenib	CTR20132870	HER2-negative Breast Cancer	Phase 3	Sorafenib+Capecitabine vs. Placebo +Capecitabine	780	234	PFS, AE	Feb-11-international; Aug-12-China
Bayer	Sorafenib	CTR20131621	Tumor	Phase 3	Sorafenib	196	92	Safety	Dec-07-international; Aug-12-China
Hutchison Medipharma	Fruquintinib	CTR20130967	3L Advanced Non-squamous Non-Small Cell Lung Cancer	Phase 3	Fruquintinib vs. placebo	521	45	OS	Dec-18
Hutchison Medipharma	Fruquintinib	CTR20161072	2L Advanced Non-Small Cell Lung Cancer	Phase 2	Fruquintinib +Gefitinib	20	1	ORR, AE	Jun-18
Hutchison Medipharma	Fruquintinib	CTR20140396	3L Advanced Non-Small Cell Lung Cancer	Phase 2	Fruquintinib +BSC vs. placebo +BSC	90	12	PFS	Jun-14
SBP	Dasatinib	CTR20160921	Leukemia	Phase 3	Dasatinib+prednisone acetate	55	10	ORR	Jan-17
Betta	Icotinib	CTR20150304	EGFR-sensitive Mutation Non-Small Cell Lung Cancer	Phase 3	Icotinib vs. Vinorelbine Bitartrate Injection+Cisplatin Injection	320	30	DFS	Jul-15
Roche	Alectinib	CTR20160367	Advanced ALK-positive Non-Small Cell Lung Cancer	Phase 3	Alectinib vs. Crizotinib	187	31	PFS	Aug-16
Roche	Alectinib	CTR20150592	ALK-positive Non-Small Cell Lung Cancer	Phase 3	Alectinib vs. Crizotinib	303	164	PFS	Aug-14-international; Nov-15-China
SBP	Anlotinib	CTR20170146	Small Cell Lung Cancer	Phase 2	Anlotinib vs. placebo	90	12	PFS	Feb-17
SBP	Anlotinib	CTR20140777	Metastatic colorectal cancer	Phase 2	Anlotinib vs. placebo	450	33	OS	Dec-14
SBP	Anlotinib	CTR20160073	Gastric cancer	Phase 2	Anlotinib vs. placebo	378	36	OS	Jul-15
SBP	Anlotinib	CTR20150454	Advanced Non-Small Cell Lung	Phase 2	Anlotinib vs. placebo	450	40	OS	Mar-15
SBP	Anlotinib	CTR20150736	Medullary thyroid carcinoma	Phase 2	Anlotinib vs. placebo	90	21	PFS	Sep-15
SBP	Anlotinib	CTR20130323	Medullary thyroid carcinoma	Phase 2	Anlotinib	15~48	10	PFS	Jul-13
SBP	Anlotinib	CTR20150735	Differentiated thyroid carcinoma	Phase 2	Anlotinib vs. placebo	120	21	PFS	Sep-15
SBP	Anlotinib	CTR20150531	Soft tissue sarcoma	Phase 2	Anlotinib vs. placebo	319	26	PFS	May-15
SBP	Anlotinib	CTR20130324	Soft tissue sarcoma	Phase 2	Anlotinib	150	16	PFR 12w	May-13
SBP	Anlotinib	CTR20160078	Esophageal squamous cell carcinoma	Phase 2	Anlotinib vs. placebo	144	18	PFS	Jan-16
SBP	Anlotinib	CTR20150129	Advanced renal cell carcinoma	Phase 2	Anlotinib vs. sunitinib	180	18	PFS	Jan-14
SBP	Anlotinib	CTR20150331	Advanced renal cell carcinoma	Phase 2	Anlotinib	60	18	PFS	Dec-13
SBP	Anlotinib	CTR20150333	Advanced Cancer	Phase 2	Anlotinib	40-50	1	PFS	Sep-13
BMS	Dasatinib	CTR20131053	Leukemia	Phase 2	Dasatinib	NA	17	CHR, OHR, MCyR	Nov-07
BMS	Dasatinib	CTR20132365	Leukemia	Phase 2	Dasatinib vs. Imatinib	180	65	MMR %	Sep-12 international; May-14-China
Pfizer	Crizotinib	CTR20140093	ROS1-positive Non-Small Cell Lung Cancer	Phase 2	Crizotinib	127	41	ORR	Sep-13
Hutchison Medipharma	Volitinib	CTR20160581	Locally advanced or metastatic Sarcomatoid Carcinoma of the Lung	Phase 2	HMPL-504	46	17	ORR, PFS, DCR, DoR,	Feb-17
ACEA Pharma	Avitinib Maleate	CTR20161018	Advanced Non-Small Cell Lung	Phase 2	Avitinib Maleate capsule	219	1	ORR	Dec-16

Source: Deutsche Bank, chinadrugtrials.org.cn

Central Nervous System

Remimazolam tosilate is a GABA receptor agonist applied to general anesthesia. Both the efficacy and safety of remimazolam tosilate are expected to be prior to midazolam and propofol. Given that the domestic analgesics drugs market in China is dominated by Hengrui, Humanwell and NHWA, we see good potential of remimazolam tosilate. We highlight that Hengrui received phase 3 clinical trial approval from CFDA this June, while Humanwell is doing phase 1 study for remimazolam.

We summarize the major analgesics by Hengrui and competitors as follows.

Figure 20: Ongoing trials for analgesics by Hengrui and competitors

Company	Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Hengrui	Esketamine hydrochloride injection	CTR20160922	General anesthesia	Phase 3	Esketamine hydrochloride injection vs. Ketamine Hydrochloride Injection	300	14	Time to resuscitation	Dec-16
Hengrui	Remimazolam Tosilate	CTR20150191	General anesthesia	Phase 2	Remimazolam Tosilate vs. Disoprofol	144	7	Sedation success rate	Feb-15 (completed)
Hengrui	Remimazolam Tosilate	CTR20160908	Sedation - Gastroscope	Phase 2	Remimazolam Tosilate vs. Disoprofol	150	9	Sedation success rate	Nov-16
Hengrui	Dexmedetomidine hydrochloride Injection	CTR20170336	Sedation	NA	Dexmedetomidine hydrochloride Injection vs. Placebo	240	9	Average total dose of propofol	Apr-17
Haisco	HSK3486	CTR20170009	Anesthesia	Phase 2	HSK3486 dose escalation	40~90	4	Vital signs, 12-ECG, AE, success rate	Dec-16
Haisco	HSK3486	CTR20161031	Sedation, anesthesia	Phase 2a	HSK3486 dose escalation	40~90	3	Vital signs, 12-ECG, AE, success rate	Dec-16
Humanwell	Remimazolam	CTR20150721	Sedation, anesthesia	Phase 1	Remimazolam Tosilate vs. Midazolam vs. Placebo	60	1	AE, MOAA/S, BIS, dose-effect relationship	Oct-15
Huaxi Pharma	Dexmedetomidine hydrochloride Injection	CTR20130958	Sedation	NA	Dexmedetomidine hydrochloride Injection	30	1	T1/2, Cmax, Ke	Apr-14
Easton/Sunheal	Glycopyrrolate Bromide	CTR20170002	Anesthesia	NA	Glycopyrrolate Bromide +Neostigmine vs. Atropine +Neostigmine	260	1	AUC	May-17
Haohai	Lidocaine hydrochloride	CTR20160593	Anesthesia for ocular surgery	NA	HLCT2015-1 vs. Placebo	220	5	Anesthesia success rate in 5 min	Oct-16

Source: Deutsche Bank, chinadrugtrials.org.cn

We also summarize the ongoing trials for other innovative drugs from Hengrui below; however, the majority of these drugs are still in early stage trials.

Figure 21: Ongoing trials for other class 1.1 drugs by Hengrui

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
SHR4640	CTR20170584	Hyperuricacidemia, Gout	Phase 2	SHR4640 vs. Placebo vs. Benzbromarone	200	20	Proportion of subjects with a serum uric level≤360 μ mol/l	Jun-17
SHR4640	CTR20170205	Gout	Phase 1	SHR4640+Febuxostat+Colchicine	15	1	PK	Mar-17
SHR3680	CTR20160047	Advanced Castration-resistant Prostate Cancer	Phase 1/2	SHR3680 dosage escalation	120~140	1	DLTS, MTD, time to progression	Mar-16
Hetrombopag Olamine (TPOR) *	CTR20140392	Idiopathic Thrombocytopenic Purpura	Phase 1	Hetrombopag	24	5	PK	May-14
Hetrombopag Olamine (TPOR) *	CTR20150543	Idiopathic Thrombocytopenic Purpura	Phase 1	Hetrombopag	29	12	AE, vital signs, ECG, medical checkup, ophthalmic testing	Aug-15
Hetrombopag Olamine (TPOR) *	CTR20150667	Idiopathic Thrombocytopenic Purpura	Phase 1	Hetrombopag	12~32	3	AE, vital signs, ECG, medical checkup, ophthalmic testing	Oct-15
SHR-1314	CTR20160824	Psoriasis	Phase 1	SHR-1314 vs. Placebo	52	1	AE	Oct-16
SHR1539	CTR20150231	Solid tumor	Phase 1	SHR1539 dosage escalation	30	1	Safety	Nov-14
SHR6390	CTR20160067	Advanced Melanoma	Phase 1	SHR6390	30	1	DLT, MTD	Feb-16
SHR6390	CTR20160066	Solid tumor	Phase 1	SHR6390	40	1	DLT, MTD	Feb-16
SHR7390	CTR20160718	Solid tumor	Phase 1	SHR7390	60	1	DLT, MTD	Dec-16
SHR7390	CTR20170611	Advanced Solid Tumor	Phase 1	SHR7390+SHR-1210	60	1	MTD	Jun-17
SHR0534	CTR20160733	Type 2 Diabetes	Phase 1	SHR0534 ante cibum vs. SHR0534 post cibum	12	1	PK, safety	Oct-16
SHR0534	CTR20150194	Type 2 Diabetes	Phase 1	SHR0534 vs. Placebo	48	2	Safety, tolerability, PK, PD	Apr-15
SHR0534	CTR20150193	Type 2 Diabetes	Phase 1	SHR0534 vs. Placebo	51	1	Safety, tolerability, PK	Apr-15
SHR0302	CTR20170453	Rheumatoid Arthritis	Phase 1	SHR0302 vs. Methotrexate	14	1	PK	Jun-17
SHR0302	CTR20160717	Rheumatoid Arthritis	Phase 1	SHR0302 ante cibum - post cibum vs. SHR0302 post cibum - ante cibum	14	1	PK	Sep-16
SHR0302	CTR20150251	Rheumatoid Arthritis	Phase 1	SHR0302 vs. Placebo	64	1	PK, pSTAT3, safety, tolerability	May-15
SHR0302	CTR20150872	Rheumatoid Arthritis	Phase 1	SHR0302 vs. Placebo	48	3	Safety, tolerability	Jul-16
HAO472	CTR20150246	Acute Myeloid Leukemia	Phase 1	HAO472 dose escalation	36	1	DLT, MTD	Jul-15
M6G	CTR20150706	M6G	Phase 1	M6G dose escalation	30	1	AUC, Tmax, Cmax, T1/2, CL, VAS	Oct-15
Bevacizumab Injection	CTR20170174	Carcinoma of Colon and Rectum, Non-Small Cell Lung	Phase 1	Bevacizumab Injection vs. Avastin®	72	1	AUC0-t, Cmax	Mar-17

Source: Deutsche Bank, chinadrugtrials.org.cn

Generic drugs

The company has a decent pipeline of generic drugs covering a number of therapeutic areas. We highlight the following key generic drugs.

- Abraxane generic: the company is competing with CSPC being FTM for this drug. We assign 60% probability on simultaneous approval of nabpaclitaxel from Hengrui and CSPC, as a bear case scenario is now less likely for either company. We expect Hengrui to grab the majority of the market share and forecast peak sales of RMB1.0-1.2bn.
- Advair generic: we expect the drug could reach peak sales of RMB2.5-3.0bn if the company is able to launch it. However, due to technical barriers, we assign a POS of 55-65% at present. We also believe SBP might be ahead of Hengrui for this drug.
- Cialis generic: the company started a BE study in Feb 2017 and we expect resubmission of the drug in the near term. We forecast peak sales of RMB1.0-1.4bn.
- Celebrex generic: a BE study was completed in June 2017 and we expect resubmission soon. We estimate peak sales to be RMB1-1.5bn.
- Lyrica generic: a phase 1 study is being conducted and we forecast peak sales to be RMB1.2-1.8bn.

We summarize the trials of key generics from Hengrui and some of its key competitors below.

Figure 22: Ongoing trials for key generic drugs by Hengrui

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Paclitaxel for Injection (AlbuminBound)	CTR20160110	Breast cancer, Gastric cancer, Non-small pancreatic cancer, Cell carcinoma	Phase 1	Paclitaxel for Injection (AlbuminBound) (Hengrui) vs. Abraxane®	25	1	AUC, Tmax, Cmax, T1/2, CL	Mar-16 (completed)
Salmeterol Xinafoate and Fluticasone Propionate Powder for Inhalation	CTR20170153	Bronchial asthma	BE study	Salmeterol Xinafoate 50ug/Fluticasone Propionate 100ug for Inhalation vs. Seretide®	300	20	FEV1	Feb-17
Tadalafil	CTR20170037	Erectile dysfunction	BE study	Tadalafil vs. Cialis®	48	1	AUC, Tmax, Cmax, T1/2	Feb-17
Celecoxib	CTR20170563	Osteoarthritis, Rheumatoid arthritis, Adult acute pain, Ankylosing spondylitis	BE study	Celecoxib vs. Celebrex®	80	1	Cmax, AUC0-t, AUC0-∞	May-17 (completed)
Pregabalin	CTR20160462	Analgesics	Phase 1	Pregabalin (T1) vs. Pregabalin (T3) vs. Lyrica®	9	1	AUC, Tmax, Cmax, T1/2, CL	Dec-15
Pregabalin	CTR20150819	Analgesics	Phase 1	Pregabalin vs. Lyrica®	24	1	AUC, Tmax, Cmax, T1/2, CL	Nov-15

Source: Deutsche Bank, chinadrugtrials.org.cn

Figure 23: Ongoing trials by competitors for key generic drugs

Company	Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
CSPC	Paclitaxel for Injection (AlbuminBound)	CTR20160139	Breast Cancer	Phase 1	Paclitaxel for Injection (AlbuminBound) (CSPC) vs. Abraxane®	48	5	AUC, Tmax, Cmax, T1/2, CL, PFS	Feb-16
Qilu	Paclitaxel for Injection (AlbuminBound)	CTR20170268	Breast Cancer	Phase 1	Paclitaxel for Injection (AlbuminBound) (Qilu) vs. Abraxane®	24	1	AUC, Tmax, Cmax, T1/2, CL	Mar-17
Hisun	Paclitaxel for Injection (AlbuminBound)	CTR20160843	Breast Cancer, Gastric Cancer	BE study	Paclitaxel for Injection (AlbuminBound) (Hisun) vs. Abraxane®	30	1	AUC0→t, AUC0→∞, Cmax, Tmax, T1/2, Kel, CL, Vd, F	Nov-16
SBP	Salmeterol Xinafoate and Fluticasone Propionate Powder for Inhalation	CTR20140916	1L Bronchial asthma	Phase 2	Salmeterol Xinafoate and Fluticasone Propionate Powder for Inhalation + Seretide ® placebo vs. Salmeterol Xinafoate and Fluticasone Propionate Powder for Inhalation placebo+ Seretide®	240	9	FEV1	Jan-15
SBP	Salmeterol Xinafoate and Fluticasone Propionate Powder for Inhalation	CTR20160787	Asthma, Chronic Obstructive Pulmonary Disease	BE study	Salmeterol Xinafoate and Fluticasone Propionate Powder for Inhalation vs. Seretide®	72	1	AE	Oct-16
Humanwell	Tadalafil	CTR20160957	Erectile dysfunction	BE study	Tadalafil vs. Cialis®	84	1	Cmax, AUC0-72, AUC0-96, Tmax	Dec-16
Haiyue Pharma	Tadalafil	CTR20160979	Erectile dysfunction	BE study	Tadalafil vs. Cialis®	76	1	PK	Dec-16
SBP	Tadalafil	CTR20170160	Erectile dysfunction	BE study	Tadalafil vs. Cialis®	84	1	AUC, Cmax	Mar-17
Qilu	Tadalafil	CTR20170259	Erectile dysfunction	BE study	Tadalafil vs. Cialis®	48	1	AUC, Cmax	Apr-17
Tasly	Tadalafil	CTR20160862	Erectile dysfunction	BE study	Tadalafil vs. Cialis®	48	2	AUC0-t, AUC0-∞, Cmax	Mar-17
SBP	Celecoxib	CTR20160512	Osteoarthritis, Rheumatoid arthritis, Adult acute pain, Ankylosing spondylitis	BE study	Celecoxib vs. Celebrex®	48	2	AUC, Cmax, vital signs, ECG, AE	Aug-16 (completed)
SBP	Celecoxib	CTR20160513	Osteoarthritis, Rheumatoid arthritis, Adult acute pain, Ankylosing spondylitis	BE study	Celecoxib vs. Celebrex®	48	1	AUC, Cmax, vital signs, ECG, AE	Oct-16 (completed)
Shanghai Chenpon	Pregabalin	CTR20130894	Epilepsy	Phase 2	Pregabalin vs. Placebo	NA	14	28-Day reaction rate, efficacy	Aug-10 (completed
Fujian Leephick	Pregabalin	CTR20140857	Neurological diseases	Phase 1	Pregabalin vs. Lyrica®	22	1	PK	Dec-14
CR Double Crane	Pregabalin	CTR20170487	Postherpetic neuralgia	BE study	Pregabalin vs. Lyrica®	60	1	Cmax, AUC0-t, AUC0-∞	May-17

Source: Deutsche Bank, chinadrugtrials.org.cn

We summarize the ongoing trials for other generics of Hengrui below.

Figure 24: Ongoing trials for other generic drugs by Hengrui

Drug	Registration number	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Peramivir Trihydrate and Sodium Chloride Injection	CTR20131184	Influenza A and B	Phase 3	Peramivir +Oseltamivir Phosphate Capsules placebo vs. Oseltamivir Phosphate Capsules +Peramivir placebo	NA	8	Duration of influenza	Jan-14
Peramivir Trihydrate and Sodium Chloride Injection	CTR20131182	Influenza A and B	Phase 3	Peramivir Trihydrate and Sodium Chloride Injection +Oseltamivir Phosphate Capsules placebo vs. Oseltamivir Phosphate Capsules +Peramivir Trihydrate and Sodium Chloride Injection placebo	NA	25	Duration of influenza	Feb-13
Peramivir Trihydrate and Sodium Chloride Injection	CTR20131185	Influenza A and B	NA	Peramivir Trihydrate and Sodium Chloride Injection	NA	1	PK	Nov-13
IvabRadine hemisulfate Sustained-release Tablets	CTR20132240	Chronic Systolic Heart Failure	Phase 3	IvabRadine hemisulfate Sustained-release Tablets vs. Placebo	336	33	LVESVI	Aug-14
IvabRadine hemisulfate Sustained-release Tablets	CTR20131265	Chronic unstable angina pectoris	BE study	IvabRadine hemisulfate Sustained-release Tablets vs. Ivabradin (Procoralan®)	NA	2	PK	Aug-13
Tolvaptan tablet	CTR20131274	Hyponatremia	Phase 3	Tolvaptan tablet vs. Placebo	240	25	Blood sodium level	Feb-12
Pregabalin	CTR20150675	Fibromyalgia	Phase 3	Pregabalin vs. Placebo	240	25	NRS	May-16
Pregabalin	CTR20150477	Postherpetic neuralgia	Phase 3	Pregabalin vs. Placebo	280	27	Response rate	Mar-15
Esketamine hydrochloride injection	CTR20160922	General anesthesia	Phase 3	Esketamine hydrochloride injection vs. Ketamine Hydrochloride Injection	300	14	Time to resuscitation	Dec-16
Paracetamol	CTR20160436	Analgesics	Phase 2/3	Paracetamol +Morhpine PCA vs. Sodium Chloride Injection+Morhpine PCA	348	16	Dose of Morphine in 24h	Sep-16
Paracetamol	CTR20170026	Analgesics	Phase 1	Paracetamol different dosages	24	1	AUC, Tmax, Cmax, T1/2, CL	Feb-17
Pregabalin	CTR20160462	Analgesics	Phase 1	Pregabalin (T1) vs. Pregabalin (T3) vs. Lyrica®	9	1	AUC, Tmax, Cmax, T1/2, CL	Dec-15
Pregabalin	CTR20150819	Analgesics	BE study	Pregabalin vs. Lyrica®	24	1	AUC, Tmax, Cmax, T1/2, CL	Nov-15
Roflumilast	CTR20150708	Chronic Obstructive Pulmonary Disease, inflammation	Phase 1	Roflumilast	24	1	AUC, Tmax, Cmax, T1/2, CL	Oct-15
Ondansetron Oral Soluble Film	CTR20170396	Vomit	BE study	Ondansetron Oral Soluble Film vs. Zuplenz®	52	1	AUC0-t, AUC0-∞, Cmax	Apr-17
Pramipexole Dihydrochloride Sustained Release Tablets	CTR20170374	Parkinson's disease	BE study	Pramipexole Dihydrochloride Sustained Release Tablets vs. Mirapex ER®	56	1	Tmax, Cmax, AUC0-t, AUC0-∞, λz,t1/2, Vd/F, CL/F, F	Apr-17
Tamsulosin Hydrochloride Sustained Release Capsules	CTR20170363	Prostate Hyperplasia	BE study	Tamsulosin Hydrochloride Sustained Release Capsules vs. Harnal®	60	1	Cmax, AUC0-t, AUC0-∞	May-17
Ambroxol Hydrochloride	CTR20170321	Respiratory disease	BE study	Ambroxol Hydrochloride Tablets vs. Expectorant®	48	1	Cmax, AUC0-t, AUC0-∞	Apr-17
Carvedilol sulfate	CTR20150261	Hypertension, heart failure	BE study	Carvedilol sulfate vs. Carvedilol phosphate (COREG CR®)	24	1	AUC, Cmax	Sep-14
Carvedilol sulfate	CTR20150260	Hypertension, heart failure	BE study	Carvedilol sulfate vs. Carvedilol phosphate (COREG CR®)	24	1	AUC, Cmax	Aug-14
Carvedilol sulfate	CTR20131272	Essential hypertension, heart failure, left ventricular dysfunction	NA	Carvedilol sulfate does escalation	NA	2	PK	Feb-14
Abiraterone Acetate Tablet	CTR20170296	Castration resistant prostate cancer	BE study	Abiraterone Acetate vs. Zytiga ®	64	1	AUC0-t, AUC0-∞, Cmax	Apr-17
Omega -3- acid ethyl ester 90	CTR20150739	Hypertriglyceridemia	NA	Omega -3- acid ethyl ester 90 vs. Placebo	240	23	TG	Nov-15
Dexmedetomidine hydrochloride Injection	CTR20170336	Sedation	NA	Dexmedetomidine hydrochloride Injection vs. Placebo	240	9	Average total dose of propofol	Apr-17

Source: Deutsche Bank, chinadrugtrials.org.cn

PD-1/ PD-L1 patient-based model for China

Summary of PD-1/ PD-L1 theoretical market size

We summarize the overall PD-1/PD-L1 market in China as below. Our forecast is based on market breakdown of first line/ second line and beyond patient-based model of 14 cancer types.

Figure 25: PD-1/ PD-L1 market size in China

in RMBm	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Gastric cancer (GC)	**6,512**	**6,810**	**7,103**	**7,390**	**7,670**	**7,945**	**8,212**	**8,472**	**8,725**	**8,971**	**9,209**	**9,440**	**9,663**	**9,879**
1L patients - High PD-L1 expressors	3,440	3,597	3,751	3,903	4,051	4,196	4,337	4,475	4,609	4,738	4,864	4,986	5,104	5,218
1L patients - non/low PD-L1 expressors	2,064	2,158	2,251	2,342	2,431	2,518	2,602	2,685	2,765	2,843	2,918	2,992	3,062	3,131
2L+ patients	1,009	1,055	1,100	1,145	1,188	1,231	1,272	1,313	1,352	1,390	1,427	1,463	1,497	1,530
Hepatocellular carcinoma (HCC)	**2,975**	**3,111**	**3,244**	**3,375**	**3,504**	**3,629**	**3,751**	**3,870**	**3,985**	**4,098**	**4,206**	**4,312**	**4,414**	**4,512**
1L patients	2,479	2,592	2,704	2,813	2,920	3,024	3,126	3,225	3,321	3,415	3,505	3,593	3,678	3,760
2L+ patients	496	518	541	563	584	605	625	645	664	683	701	719	736	752
Non-small cell lung cancer (NSCLC)	**4,474**	**4,679**	**4,880**	**5,077**	**5,270**	**5,458**	**5,642**	**5,821**	**5,994**	**6,163**	**6,327**	**6,485**	**6,639**	**6,787**
1L patients - High PD-L1 expressors	1,131	1,183	1,233	1,283	1,332	1,380	1,426	1,471	1,515	1,558	1,599	1,639	1,678	1,716
1L patients - non/low PD-L1 expressors	2,036	2,129	2,220	2,310	2,398	2,483	2,567	2,648	2,728	2,804	2,879	2,951	3,021	3,088
2L+ patients	1,307	1,367	1,426	1,484	1,540	1,595	1,649	1,701	1,752	1,801	1,849	1,895	1,940	1,983
Small cell lung cancer (SCLC)	**2,646**	**2,767**	**2,886**	**3,002**	**3,116**	**3,228**	**3,337**	**3,442**	**3,545**	**3,645**	**3,742**	**3,835**	**3,926**	**4,014**
1L patients (extensive disease)	1,294	1,353	1,411	1,468	1,524	1,579	1,632	1,683	1,734	1,783	1,830	1,876	1,920	1,963
2L+ patients	1,352	1,414	1,475	1,534	1,592	1,649	1,705	1,759	1,811	1,862	1,912	1,960	2,006	2,051
NSCLC and SCLC combined	**7,120**	**7,446**	**7,765**	**8,079**	**8,386**	**8,686**	**8,978**	**9,263**	**9,540**	**9,808**	**10,069**	**10,321**	**10,565**	**10,800**
Ovarian cancer (OC)	**1,077**	**1,126**	**1,174**	**1,222**	**1,268**	**1,313**	**1,358**	**1,401**	**1,443**	**1,483**	**1,523**	**1,561**	**1,598**	**1,633**
1L patients	633	662	691	719	746	773	799	824	849	872	896	918	940	961
2L+ patients	443	464	484	503	522	541	559	577	594	611	627	643	658	672
Renal cell carcinoma (RCC)	**568**	**594**	**620**	**645**	**669**	**693**	**717**	**739**	**762**	**783**	**804**	**824**	**843**	**862**
1L patients	390	408	425	442	459	475	491	507	522	537	551	565	578	591
2L+ patients	179	187	195	203	210	218	225	232	239	246	253	259	265	271
Diffuse large B-cell lymphoma (DLBCL)	**189**	**197**	**206**	**214**	**222**	**230**	**238**	**245**	**253**	**260**	**267**	**274**	**280**	**286**
1L patients	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2L+ patients	189	197	206	214	222	230	238	245	253	260	267	274	280	286
Urothelial Cancer (UC)	**101**	**106**	**110**	**115**	**119**	**123**	**128**	**132**	**136**	**139**	**143**	**147**	**150**	**153**
1L patients	83	87	91	95	98	102	105	109	112	115	118	121	124	127
2L+ patients	18	19	19	20	21	22	22	23	24	24	25	26	26	27
Squamous Cell Carcinoma of the Head and Neck (SCCHN)	**92**	**96**	**100**	**104**	**108**	**112**	**116**	**119**	**123**	**126**	**130**	**133**	**136**	**139**
1L patients	79	82	86	89	93	96	99	102	106	109	111	114	117	119
2L+ patients	13	14	14	15	15	16	16	17	17	18	18	19	19	20
MSI-H colorectal cancer (CRC)	**82**	**86**	**90**	**94**	**97**	**101**	**104**	**107**	**110**	**114**	**117**	**120**	**122**	**125**
1L patients	64	67	70	73	75	78	81	83	86	88	91	93	95	97
2L+ patients	18	19	20	21	22	22	23	24	25	25	26	27	27	28
Follicular lymphoma (FL)	**79**	**82**	**86**	**89**	**93**	**96**	**99**	**102**	**105**	**108**	**111**	**114**	**117**	**119**
1L patients	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2L+ patients	79	82	86	89	93	96	99	102	105	108	111	114	117	119
Advanced melanoma	**43**	**45**	**47**	**49**	**50**	**52**	**54**	**56**	**57**	**59**	**60**	**62**	**63**	**65**
1L patients	35	37	38	40	41	43	44	46	47	48	50	51	52	53
2L+ patients	8	8	8	9	9	9	10	10	10	11	11	11	11	12
Classical Hodgkin lymphoma (cHL)	**41**	**43**	**44**	**46**	**48**	**50**	**51**	**53**	**55**	**56**	**58**	**59**	**60**	**62**
1L patients	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2L+ patients	41	43	44	46	48	50	51	53	55	56	58	59	60	62
Metastatic tiple negative breast cancer (TNBC)	**21**	**22**	**23**	**24**	**25**	**25**	**26**	**27**	**28**	**29**	**30**	**30**	**31**	**32**
1L patients	17	17	18	19	20	20	21	22	22	23	23	24	25	25
2L+ patients	4	5	5	5	5	5	5	6	6	6	6	6	6	7
Total market size	**18,899**	**19,763**	**20,612**	**21,445**	**22,260**	**23,056**	**23,832**	**24,587**	**25,322**	**26,034**	**26,726**	**27,395**	**28,043**	**28,668**
YoY growth rates		5%	4%	4%	4%	4%	3%	3%	3%	3%	3%	3%	2%	2%
1L patients	11,680	12,214	12,739	13,254	13,757	14,249	14,729	15,196	15,649	16,090	16,517	16,931	17,331	17,718
	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%

Source: Deutsche Bank, Company data

Key assumptions of the model

Assume 75% discount vs. US pricing and NRDL inclusion

Executives engaged in late stage PD-1 studies believe that the government is likely to accept a 50% price cut of PD-1 global pricing as an entry point for inclusion in the NRDL, based on our initial discussion with them. As such, a listed price of RMB250,000 per year is likely for domestic PD-1, translating into an effective pricing of RMB125,000 for six-month therapy with additional courses for free. We model each indication based on the aforementioned prices with RMB125,000 as a price ceiling per patient regardless of treatment duration.

Treatment ratio and affordability

To start, we believe a treatment ratio of 20% could be reasonable as the number represents the entire urban population.

These assumptions are the largest variables with the highest uncertainty. We do not claim to have a crystal ball, while only listing our assumptions in the following so that buyside could stand on our shoulder to make different but appropriate assumptions.

We assume 20% treatment ratio for new cancer patients of each indication, started from 1.4bn population and incidence ratios.

- We examined distribution of population covered by three main insurance schemes, distribution of respectively funding consumed, as well as the source of funding. We highlight that urban employees, which represented only 21% population, consumed 62% of the entire insurance funding, as such, we believe a 30% treatment ratio is appropriate to start with, assuming another 10% population would be covered (which would consume the rest 38% of the insurance funding)

- We shave off 1/3 of the aforementioned numbers to arrive 20% treatment ratio, based on our belief that these pricy oncology drugs would have a quota system set up by the government payors. Recently, we have learned that it is likely a quota system would be introduced, for those drugs included in the new NRDL through negotiation.

Figure 26: Breakdown of medical insurance schemes and covered population (2015)

Insurance scheme	Funding (RMBbn)	Population covered (mn)	As % of total population	As % of total insurance funding
UEBMI	753	289	21%	62%
URBMI	178	377	27%	15%
NRCMS	289	736	53%	24%
Total	**1,220**	**1,402**		

Source: Deutsche Bank, MoHRSS, NBS

We believe 60% affordability ratio is a reasonable starting point, as we assume patients would have to pay at least 20% out-of-pocket fees, which include an additional RMB25,000 (assume RMB125,000 effective price per treatment course) on top of the entire expenses for a complete cancer treatment.

- A recent survey included 14,594 cancer patients in China, who received treatment between 2012-2014. The results indicated that average spending for a cancer patient is USD9,739, vs. annual household income of USD8,607. Assuming a USDCNY rate of 7, this represents treatment expense of RMB68,173 per annum. Additionally, the survey indicated that self-pay is about 78.8%, translating into out-of-pocket payment of RMB54,000. (*HY Huang et al, Chin J Cancer (2017), 36:41*)
- We assume an additional RMB25,000 price tag would reduce the available number of patients by 1/3, which ends with approximately 67% affordability ratio.
- We took an additional 7% cut on this, as the survey was based on 37 tier 1 hospitals from 13 provinces. Recall our previous assumption for treatment ratio include patients from rural area, which may not have the same household income.

Duration of therapy

We generally use clinical data from US pivotal studies. However we adjusted key data based on feedback we received from physicians so far, including:

- We reduce duration of treatment to 8 months for 1L NSCLC, from 10.3 months demonstrated in KN-024 (pembrolizumab P3 study). We have learned that response rate is lower at EGFR- patients from PD-1/chemo combo vs. US studies (for all comers). While we are not sure whether ORR would be much different in PD-L1 high level patients, we lower duration of treatment in order to be cautious
- We reduce duration of treatment to 4 months for 1L melanoma, from 6.1 months demonstrated from KN006 (pembrolizumab) and CM-066 (nivolumab). We have learned that ORR ranges from 20-25% among Chinese melanoma patients, vs. 35-40% in US patients. We highlight the difference resides in disease histology and etiology. *(please see our reported published on June 7, ASCO take-aways: physician feedback on IO Chinese studies)*

We await further clarity on key Chinese studies on GC, NSCLC and HCC to further adjust this assumption.

Available number of patients for 1L vs. 2L/2L+ therapy

In our view, it is unlikely 100% 2L patients would receive PD-1/PDL1 again after they receive these drugs as 1L therapy. While we realize the market opportunity would be artificially lower than actual size **by assuming a fraction of 2L patients as available patients for IO therapy,** our objective is to assess a proper overall market size. This is the largest difference between our model vs. US model.

- For gastric cancer, meta-analysis suggested 40-60% high PD-L1 expressors among Asian GC patients *(Liu et al, Onco Targets Ther (2016) 9: 2649-54).* As such, we assume 100% treatment ratio for all high expressors and 60% for non/low expressors. Additionally, we only assume 44% of the patients would receive PD-1 in 2L therapy, as 1) aforementioned assumptions leave 20% GC patients as IO naïve for 2L; 2) we assume 30% patients that received 1L PD-1/PD-L1 would receive these drugs again in 2L.
- Likewise for NSCLC, we assume 60% treatment ratio for non/low PD-L1 expressors, while assuming 51% treatment ratio for 2L patients because 1) our assumptions for 1L leave 30% patients as IO naïve for 2L; 2) we assume 30% patients that received 1L PD-1/PD-L1 would receive these drugs again in 2L.

Figure 27: Advanced Gastric cancer (GC)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Gastric cancer (GC)														
Incidence (2)	685,077	687,664	689,962	691,966	693,681	695,109	696,261	697,152	697,799	698,222	698,439	698,466	698,313	697,985
Incidence rate	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%
Patients with advanced disease	342,538	343,832	344,981	345,983	346,841	347,555	348,130	348,576	348,900	349,111	349,220	349,233	349,156	348,992
% with advanced disease (3)	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Patients with advanced disease receiving treatment	45,862	48,937	52,081	55,291	58,564	61,896	65,285	68,728	72,225	75,774	79,374	83,023	86,720	90,462
% high PD-L1 expressors (4)	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Treatment ratio (5)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (6)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients - High PD-L1 expressors	22,931	24,469	26,041	27,646	29,282	30,948	32,642	34,364	36,113	37,887	39,687	41,511	43,360	45,231
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (7)	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Average months of payment	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	**3,440**	**3,597**	**3,751**	**3,903**	**4,051**	**4,196**	**4,337**	**4,475**	**4,609**	**4,738**	**4,864**	**4,986**	**5,104**	**5,218**
1L patients - non/low PD-L1 expressors	22,931	24,469	26,041	27,646	29,282	30,948	32,642	34,364	36,113	37,887	39,687	41,511	43,360	45,231
Treatment ratio	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
Patients receiving treatment	13,759	14,681	15,624	16,587	17,569	18,569	19,585	20,619	21,668	22,732	23,812	24,907	26,016	27,139
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (7)	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Average months of payment	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	**2,064**	**2,158**	**2,251**	**2,342**	**2,431**	**2,518**	**2,602**	**2,685**	**2,765**	**2,843**	**2,918**	**2,992**	**3,062**	**3,131**
2L+ patients	20,179	21,532	22,916	24,328	25,768	27,234	28,725	30,240	31,779	33,341	34,924	36,530	38,157	39,803
% 2L+ patients (8)	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (9)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Theoretical market size (RMBm)	**1,009**	**1,055**	**1,100**	**1,145**	**1,188**	**1,231**	**1,272**	**1,313**	**1,352**	**1,390**	**1,427**	**1,463**	**1,497**	**1,530**
Total gastric cancer market size (RMBm)	**6,512**	**6,810**	**7,103**	**7,390**	**7,670**	**7,945**	**8,212**	**8,472**	**8,725**	**8,971**	**9,209**	**9,440**	**9,663**	**9,879**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Approximately 50% of patients have locally advanced or metastatic disease at diagnosis (SEER database)
(4) Approximately 50% are PD-L1 high expressors, Onco Targets Ther (2016) 9: 2649-54
(5) Deutsche Bank estimates
(6) Deutsche Bank estimates
(7) Based on the median PFS of 6.6 months for Keytruda in KN059 cohort 2
(8) An estimated 30% of patients in the US and Europe and 70-80% in Japan receive 2L treatment, ASCO GI 2014
(9) Based on the median PFS of 2.0 months for Keytruda in KN059 cohort 1

Source: Deutsche Bank, Company data

Figure 28: Advanced Hepatocellular carcinoma (HCC)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Hepatocellular carcinoma (HCC)														
Incidence (2)	352,652	353,984	355,166	356,198	357,081	357,816	358,409	358,867	359,201	359,418	359,530	359,544	359,465	359,296
Incidence rate	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%
Patients with advanced disease	123,428	123,894	124,308	124,669	124,978	125,236	125,443	125,604	125,720	125,796	125,836	125,840	125,813	125,754
% with advanced disease (3)	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
Patients with advanced disease receiving treatment	16,526	17,634	18,767	19,923	21,102	22,303	23,524	24,765	26,025	27,304	28,601	29,916	31,248	32,596
Treatment ratio (4)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (5)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	16,526	17,634	18,767	19,923	21,102	22,303	23,524	24,765	26,025	27,304	28,601	29,916	31,248	32,596
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (6)	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	**2,479**	**2,592**	**2,704**	**2,813**	**2,920**	**3,024**	**3,126**	**3,225**	**3,321**	**3,415**	**3,505**	**3,593**	**3,678**	**3,760**
2L+ patients	4,958	5,290	5,630	5,977	6,331	6,691	7,057	7,430	7,808	8,191	8,580	8,975	9,374	9,779
% 2L+ patients (7)	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (8)	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Theoretical market size (RMBm)	**496**	**518**	**541**	**563**	**584**	**605**	**625**	**645**	**664**	**683**	**701**	**719**	**736**	**752**
Total HCC market size (RMBm)	**2,975**	**3,111**	**3,244**	**3,375**	**3,504**	**3,629**	**3,751**	**3,870**	**3,985**	**4,098**	**4,206**	**4,312**	**4,414**	**4,512**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Approximately 35% of patients have metastatic disease at diagnosis (SEER database)
(4) Deutsche Bank estimates
(5) Deutsche Bank estimates
(6) Placeholder assumption (pending PFS data from PD-1/PD-L1 studies for 1L HCC)
(7) Approximately 30% of patients treated with 1L sorafenib discontinue treatment due to disease progression; based on interim data from the GIDEON
(8) Placeholder assumption (pending PFS data from PD-1/PD-L1 studies for 2L HCC)

Source: Deutsche Bank, Company data

Figure 29: Advanced Non-Small Cell Lung Cancer (NSCLC)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Non-small cell lung cancer (NSCLC)														
Incidence (2)	643,586	646,017	648,175	650,057	651,669	653,010	654,093	654,930	655,538	655,935	656,139	656,164	656,020	655,712
Incidence rate	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%
% of NSCLC (3)	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%
Patients with advanced NSCLC (Stage IIIB/IV)	450,510	452,212	453,723	455,040	456,168	457,107	457,865	458,451	458,876	459,155	459,297	459,315	459,214	458,999
% with advanced NSCLC (Stage IIIB/IV) (4)	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
Non-ALK/EGFR expressors	225,255	226,106	226,861	227,520	228,084	228,554	228,932	229,225	229,438	229,577	229,649	229,657	229,607	229,499
% non-ALK/EGFR expressors (5)	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
High PD-L1 expressors	56,314	56,526	56,715	56,880	57,021	57,138	57,233	57,306	57,360	57,394	57,412	57,414	57,402	57,375
% high PD-L1 expressors (6)	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
High PD-L1 expressors receiving treatment	7,540	8,045	8,562	9,090	9,628	10,176	10,733	11,299	11,874	12,457	13,049	13,649	14,257	14,872
Treatment ratio (7)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (8)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients - High PD-L1 expressors	7,540	8,045	8,562	9,090	9,628	10,176	10,733	11,299	11,874	12,457	13,049	13,649	14,257	14,872
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (9)	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Average months of payment	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	**1,131**	**1,183**	**1,233**	**1,283**	**1,332**	**1,380**	**1,426**	**1,471**	**1,515**	**1,558**	**1,599**	**1,639**	**1,678**	**1,716**
1L patients - non/low PD-L1 expressors	22,619	24,136	25,687	27,270	28,884	30,527	32,199	33,897	35,622	37,372	39,147	40,947	42,770	44,616
Treatment ratio	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
Patients receiving treatment	13,572	14,482	15,412	16,362	17,330	18,316	19,319	20,338	21,373	22,423	23,488	24,568	25,662	26,770
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (10)	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Average months of payment	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	**2,036**	**2,129**	**2,220**	**2,310**	**2,398**	**2,483**	**2,567**	**2,648**	**2,728**	**2,804**	**2,879**	**2,951**	**3,021**	**3,088**
2L+ patients	15,381	16,413	17,467	18,543	19,641	20,758	21,895	23,050	24,223	25,413	26,620	27,844	29,084	30,339
% 2L+ patients (11)	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (12)	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Theoretical market size (RMBm)	**1,307**	**1,367**	**1,426**	**1,484**	**1,540**	**1,595**	**1,649**	**1,701**	**1,752**	**1,801**	**1,849**	**1,895**	**1,940**	**1,983**
Total NSCLC market size (RMBm)	**4,474**	**4,679**	**4,880**	**5,077**	**5,270**	**5,458**	**5,642**	**5,821**	**5,994**	**6,163**	**6,327**	**6,485**	**6,639**	**6,787**
YoY		4.57%	4.30%	4.04%	3.80%	3.58%	3.37%	3.17%	2.99%	2.82%	2.66%	2.51%	2.36%	2.23%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Estimates from industry expert that 87% of all lung cancer patients are NSCLC
(4) China Journal of Oncology, June 2013, Vol 35, No.6
(5) China Journal of Oncology, June 2013, Vol 35, No.6
(6) Merck estimates that 25% of patients are high PD-L1 expressors
(7) Deutsche Bank estimates
(8) Deutsche Bank estimates
(9) Median PFS was 10.3 months for Keytruda in KN024, however we estimate response rate of Chinese patients from 1L NSCLC PD-1/chemo-combo study in EGFR patients is much lower than reported US data, as such we reduced duration of therapy to 8m from 10.3m
(10) Based on the median duration of exposure of 8.0 months for Keytruda in KN021G
(11) Deutsche Bank estimates
(12) Based on the median duration of exposure of 3.5 months for Keytruda in KN010, 3.0 months for Opdivo in two trials, and 3.7 months for Tecentriq

Source: Deutsche Bank, Company data

Figure 30: Advanced Small Cell Lung Cancer (SCLC)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Small cell lung cancer (SCLC)														
Incidence (2)	96,168	96,531	96,854	97,135	97,376	97,576	97,738	97,863	97,954	98,013	98,044	98,047	98,026	97,980
Incidence rate	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
% of SCLC (3)	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Patients with extensive disease	64,433	64,676	64,892	65,080	65,242	65,376	65,484	65,568	65,629	65,669	65,689	65,692	65,677	65,647
% with extensive disease (4)	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%	67%
Patients with extensive disease receiving treatment	8,627	9,205	9,797	10,400	11,016	11,643	12,280	12,928	13,586	14,253	14,930	15,617	16,312	17,016
Treatment ratio (5)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (6)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients (extensive disease)	8,627	9,205	9,797	10,400	11,016	11,643	12,280	12,928	13,586	14,253	14,930	15,617	16,312	17,016
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (7)	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	**1,294**	**1,353**	**1,411**	**1,468**	**1,524**	**1,579**	**1,632**	**1,683**	**1,734**	**1,783**	**1,830**	**1,876**	**1,920**	**1,963**
2L+ patients	9,013	9,617	10,235	10,866	11,509	12,164	12,830	13,507	14,194	14,892	15,599	16,316	17,043	17,778
% 2L+ patients (8)	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (9)	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	**1,352**	**1,414**	**1,475**	**1,534**	**1,592**	**1,649**	**1,705**	**1,759**	**1,811**	**1,862**	**1,912**	**1,960**	**2,006**	**2,051**
Total SCLC market size (RMBm)	**2,646**	**2,767**	**2,886**	**3,002**	**3,116**	**3,228**	**3,337**	**3,442**	**3,545**	**3,645**	**3,742**	**3,835**	**3,926**	**4,014**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

Source: Deutsche Bank
(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Estimates from industry expert that 13% of all lung cancer patients are SCLC
(4) The American Cancer Society (ACS) estimates that two-thirds of SCLC patients have extensive disease at diagnosis
(5) Deutsche Bank estimates
(6) Deutsche Bank estimates
(7) Placeholder assumption (pending PFS data from PD-1/PD-L1 studies for 1L SCLC)
(8) SCLC recurs in a majority of patients after 1L treatment
(9) Placeholder assumption (pending PFS data from PD-1/PD-L1 studies for 2L SCLC)

Source: Deutsche Bank, Company data

Figure 31: Advanced Ovarian cancer (OC)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Ovarian cancer (OC)														
Incidence (2)	52,559	52,757	52,933	53,087	53,219	53,328	53,417	53,485	53,535	53,567	53,584	53,586	53,574	53,549
Incidence rate	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%
Patients with advanced disease	31,535	31,654	31,760	31,852	31,931	31,997	32,050	32,091	32,121	32,140	32,150	32,151	32,144	32,129
% with advanced disease (3)	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
Patients with advanced disease receiving treatment	4,222	4,505	4,795	5,090	5,392	5,698	6,010	6,327	6,649	6,976	7,307	7,643	7,984	8,328
Treatment ratio (4)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (5)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	4,222	4,505	4,795	5,090	5,392	5,698	6,010	6,327	6,649	6,976	7,307	7,643	7,984	8,328
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (6)	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	633	662	691	719	746	773	799	824	849	872	896	918	940	961
2L+ patients	2,956	3,154	3,356	3,563	3,774	3,989	4,207	4,429	4,654	4,883	5,115	5,350	5,589	5,830
% 2L+ patients (7)	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (8)	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	443	464	484	503	522	541	559	577	594	611	627	643	658	672
Total ovarian cancer market size (RMBm)	**1,077**	**1,126**	**1,174**	**1,222**	**1,268**	**1,313**	**1,358**	**1,401**	**1,443**	**1,483**	**1,523**	**1,561**	**1,598**	**1,633**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Approximately 60% of patients have metastatic disease at diagnosis (SEER database)
(4) Deutsche Bank estimates
(5) Deutsche Bank estimates
(6) Placeholder assumption (pending PFS data from PD-1/PD-L1 studies for 1L OC)
(7) An estimated 85% of patients who achieve remission following 1L treatment will develop recurrent disease (Oncology Journal; 2013)
(8) Placeholder assumption (pending PFS data from PD-1/PD-L1 studies for 2L OC)

Source: Deutsche Bank, Company data

Figure 32: Advanced Renal cell carcinoma (RCC)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Renal cell carcinoma (RCC)														
Incidence (2)	60,649	60,878	61,082	61,259	61,411	61,537	61,639	61,718	61,775	61,813	61,832	61,834	61,821	61,792
Incidence rate	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%
Patients with advanced disease	19,408	19,481	19,546	19,603	19,651	19,692	19,725	19,750	19,768	19,780	19,786	19,787	19,783	19,773
% with advanced disease (3)	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%
Patients with advanced disease receiving treatment	2,598	2,773	2,951	3,133	3,318	3,507	3,699	3,894	4,092	4,293	4,497	4,704	4,913	5,125
Treatment ratio (4)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (5)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	2,598	2,773	2,951	3,133	3,318	3,507	3,699	3,894	4,092	4,293	4,497	4,704	4,913	5,125
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (6)	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7
Average months of payment	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	390	408	425	442	459	475	491	507	522	537	551	565	578	591
2L+ patients	1,299.24	1,386.36	1,475.43	1,566.36	1,659.07	1,753.46	1,849.46	1,947.02	2,046.09	2,146.63	2,248.60	2,351.97	2,456.70	2,562.72
% 2L+ patients (7)	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (8)	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Theoretical market size (RMBm)	179	187	195	203	210	218	225	232	239	246	253	259	265	271
Total RCC market size (RMBm)	**568**	**594**	**620**	**645**	**669**	**693**	**717**	**739**	**762**	**783**	**804**	**824**	**843**	**862**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Approximately 32% of patients have locally advanced or metastatic disease at diagnosis (SEER database)
(4) Deutsche Bank estimates
(5) Deutsche Bank estimates
(6) Based on the median PFS of 11.7 months for Tecentriq (+Avastin) in IMmotion150
(7) PFE estimates that 40-65% of patients receive 2L treatment
(8) Based on the median duration of exposure of 5.5 months for Opdivo in CM-025

Source: Deutsche Bank, Company data

Figure 33: Advanced Diffuse large B-cell lymphoma (DLBCL)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Diffuse large B-cell lymphoma (DLBCL)														
Incidence (2)	23,490	23,578	23,657	23,726	23,785	23,834	23,873	23,904	23,926	23,940	23,948	23,949	23,944	23,932
Incidence rate	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%
Patients receiving treatment	3,145	3,356	3,572	3,792	4,016	4,245	4,477	4,713	4,953	5,196	5,443	5,693	5,947	6,203
Treatment ratio (3)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (4)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	3,145	3,356	3,572	3,792	4,016	4,245	4,477	4,713	4,953	5,196	5,443	5,693	5,947	6,203
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy														
Theoretical market size (RMBm)														
2L+ patients	1,258	1,342	1,429	1,517	1,606	1,698	1,791	1,885	1,981	2,079	2,177	2,277	2,379	2,481
% 2L+ patients (5)	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (6)	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	189	197	206	214	222	230	238	245	253	260	267	274	280	286
Total DLBCL market size (RMBm)	**189**	**197**	**206**	**214**	**222**	**230**	**238**	**245**	**253**	**260**	**267**	**274**	**280**	**286**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Deutsche Bank estimates
(4) Deutsche Bank estimates
(5) An estimated 50-60% of DLBCL patients achieve and maintain complete remission after 1L therapy (South Asian J Cancer; 2014)
(6) Placeholder assumption (pending PFS data from PD-1/PD-L1 studies for 2L DLBCL)

Source: Deutsche Bank, Company data

Figure 34: Advanced Urothelial cancer (UC)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Urothelial cancer (UC)														
Incidence (2)	73,088	73,364	73,609	73,823	74,006	74,158	74,281	74,376	74,445	74,490	74,513	74,516	74,500	74,465
Incidence rate	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Patients with advanced disease	8,040	8,070	8,097	8,120	8,141	8,157	8,171	8,181	8,189	8,194	8,196	8,197	8,195	8,191
% with advanced disease (3)	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Patients with advanced disease receiving treatment	1,076	1,149	1,222	1,298	1,375	1,453	1,532	1,613	1,695	1,778	1,863	1,949	2,035	2,123
Treatment ratio (4)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (5)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	1,076	1,149	1,222	1,298	1,375	1,453	1,532	1,613	1,695	1,778	1,863	1,949	2,035	2,123
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (6)	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Theoretical market size (RMBm)	83	87	91	95	98	102	105	109	112	115	118	121	124	127
2L+ patients	215	230	244	260	275	291	306	323	339	356	373	390	407	425
% 2L+ patients (7)	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (8)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Theoretical market size (RMBm)	18	19	19	20	21	22	22	23	24	24	25	26	26	27
Total urothelial cancer market size (RMBm)	**101**	**106**	**110**	**115**	**119**	**123**	**128**	**132**	**136**	**139**	**143**	**147**	**150**	**153**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Approximately 11% of patients have locally advanced or metastatic disease at diagnosis (SEER database)
(4) Deutsche Bank estimates
(5) Deutsche Bank estimates
(6) Based on the median duration of exposure of 2.8 months for Keytruda in KN052 and 3.5 months for Tecentriq in IMvigor210 (cohort 1)
(7) An estimated 20% of patients require 2L treatment (First- and second-line therapy for metastatic urothelial carcinoma of the bladder; Urologic Oncology; 2011)
(8) Based on the median duration of exposure of 3.5 months for Keytruda in KN045, 3.3 months for Opdivo, 2.8 months for Tecentriq in IMvigor210 (cohort 2), and 3.5 months

Source: Deutsche Bank, Company data

Figure 35: Advanced Squamous Cell Carcinoma of the Head and Neck (SCCHN)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Squamous Cell Carcinoma of the Head and Neck (SCCHN)														
Incidence (2)	13,619	13,670	13,716	13,756	13,790	13,818	13,841	13,859	13,872	13,880	13,884	13,885	13,882	13,875
Incidence rate	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Patients with metastatic HNC	4,358	4,374	4,389	4,402	4,413	4,422	4,429	4,435	4,439	4,442	4,443	4,443	4,442	4,440
% with metastatic HNC (3)	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%	32%
Patients with squamous cell HNC	3,922	3,937	3,950	3,962	3,971	3,980	3,986	3,991	3,995	3,997	3,999	3,999	3,998	3,996
% with squamous cell HNC	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Patients with advanced disease receiving treatment	525	560	596	633	671	709	748	787	827	868	909	951	993	1,036
Treatment ratio (4)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (5)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	525	560	596	633	671	709	748	787	827	868	909	951	993	1,036
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (6)	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	79	82	86	89	93	96	99	102	106	109	111	114	117	119
2L+ patients	200	213	227	241	255	269	284	299	314	330	345	361	377	394
% 2L+ patients (7)	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%	38%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (8)	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Theoretical market size (RMBm)	13	14	14	15	15	16	16	17	17	18	18	19	19	20
Total SCCHN market size (RMBm)	**92**	**96**	**100**	**104**	**108**	**112**	**116**	**119**	**123**	**126**	**130**	**133**	**136**	**139**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) An estimated 32% of patients experience distant metastasis (Clinical Cancer Research; 2012)
(4) Deutsche Bank estimates
(5) Deutsche Bank estimates
(6) Placeholder assumption (pending PFS data from PD-1/PD-L1 studies for 1L SCCHN)
(7) An estimated 25-50% of patients with advanced cancer experience locoregional recurrence (Magazine of European Medical Oncology; 2014)
(8) Based on the median duration of exposure of 3.3 months for Keytruda in KN012 and 1.9 months for Opdivo in CM-141

Source: Deutsche Bank, Company data

Figure 36: Advanced MSI-H colorectal cancer (CRC)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
MSI-H colorectal cancer (CRC)														
Incidence (2)	379,612	381,046	382,319	383,429	384,380	385,171	385,809	386,303	386,662	386,896	387,016	387,031	386,946	386,764
Incidence rate	0.027%	0.027%	0.027%	0.027%	0.027%	0.027%	0.027%	0.027%	0.027%	0.027%	0.027%	0.027%	0.027%	0.027%
Patients with advanced disease	79,718	80,020	80,287	80,520	80,720	80,886	81,020	81,124	81,199	81,248	81,273	81,276	81,259	81,221
% with advanced disease (3)	21%	21%	21%	21%	21%	21%	21%	21%	21%	21%	21%	21%	21%	21%
Patients with MSI-H tumors	3,189	3,201	3,211	3,221	3,229	3,235	3,241	3,245	3,248	3,250	3,251	3,251	3,250	3,249
% with MSI-H tumors (4)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Patients with advanced disease receiving treatment	427	456	485	515	545	576	608	640	672	705	739	773	807	842
Treatment ratio (5)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (6)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	427	456	485	515	545	576	608	640	672	705	739	773	807	842
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (7)	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	64	67	70	73	75	78	81	83	86	88	91	93	95	97
2L+ patients	320	342	364	386	409	432	456	480	504	529	554	580	605	632
% 2L+ patients (8)	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (9)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Theoretical market size (RMBm)	18	19	20	21	22	22	23	24	25	25	26	27	27	28
Total MSI-H CRC market size (RMBm)	**82**	**86**	**90**	**94**	**97**	**101**	**104**	**107**	**110**	**114**	**117**	**120**	**122**	**125**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Approximately 21% of patients have metastatic disease at diagnosis (SEER database)
(4) An estimated 4% of advanced CRC patients have mismatch repair deficiency (Clinical Cancer Research; 2016)
(5) Deutsche Bank estimates
(6) Deutsche Bank estimates
(7) Placeholder assumption (pending PFS data from PD-1/PD-L1 studies for 1L MSI-H CRC)
(8) 75% of patients with metastatic CRC received 2L therapy in the FOCUS study (the UK MRC FOCUS (CR08) trial)
(9) Based on the median PFS of 2.3 months for Keytruda in KN164

Source: Deutsche Bank, Company data

Figure 37: Advanced melanoma

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Advanced melanoma														
Incidence (2)	20,176	20,252	20,320	20,379	20,429	20,471	20,505	20,532	20,551	20,563	20,570	20,570	20,566	20,556
Incidence rate	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
Patients with advanced disease (Stage III or IV)	2,623	2,633	2,642	2,649	2,656	2,661	2,666	2,669	2,672	2,673	2,674	2,674	2,674	2,672
% with advanced disease (3)	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Patients with advanced disease receiving treatment	351	375	399	423	448	474	500	526	553	580	608	636	664	693
Treatment ratio (4)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (5)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	351	375	399	423	448	474	500	526	553	580	608	636	664	693
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (6)	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Theoretical market size (RMBm)	35	37	38	40	41	43	44	46	47	48	50	51	52	53
2L+ patients	101.84	108.67	115.65	122.78	130.05	137.44	144.97	152.62	160.38	168.26	176.26	184.36	192.57	200.88
% 2L+ patients (7)	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%	29%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (8)	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Theoretical market size (RMBm)	8	8	8	9	9	9	10	10	10	11	11	11	11	12
Total melanoma market size (RMBm)	**43**	**45**	**47**	**49**	**50**	**52**	**54**	**56**	**57**	**59**	**60**	**62**	**63**	**65**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Approximately 13% of patients have locally advanced or metastatic disease at diagnosis (SEER database)
(4) Deutsche Bank estimates
(5) Deutsche Bank estimates
(6) Based on the median duration of exposure of 5.6 months for Keytruda in KN006 and 6.5 months for Opdivo in CM-066, however existing data from Chinese patients indicated a much lower response rate
(7) Approximately 29% of patients received 2L treatment in a retrospective analysis of US patients with metastatic melanoma (Journal of Skin Cancer; 2014)
(8) Based on the median duration of exposure of 4.3 months for Keytruda in KN002 and 5.3 months for Opdivo in CM-037, however existing data from Chinese patients indicated a much lower response rate

Source: Deutsche Bank, Company data

Figure 38: Advanced Follicular lymphoma (FL)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Follicular lymphoma (FL)														
Incidence (2)	19,575	19,649	19,714	19,772	19,821	19,861	19,894	19,920	19,938	19,950	19,957	19,957	19,953	19,944
Incidence rate	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
Patients receiving treatment	2,621	2,797	2,976	3,160	3,347	3,537	3,731	3,928	4,127	4,330	4,536	4,744	4,956	5,170
Treatment ratio (3)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (4)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	2,621	2,797	2,976	3,160	3,347	3,537	3,731	3,928	4,127	4,330	4,536	4,744	4,956	5,170
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Theoretical market size (RMBm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2L+ patients	524	559	595	632	669	707	746	786	825	866	907	949	991	1,034
% 2L+ patients (5)	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (6)	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	**79**	**82**	**86**	**89**	**93**	**96**	**99**	**102**	**105**	**108**	**111**	**114**	**117**	**119**
Total FL market size (RMBm)	**79**	**82**	**86**	**89**	**93**	**96**	**99**	**102**	**105**	**108**	**111**	**114**	**117**	**119**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Deutsche Bank estimates
(4) Deutsche Bank estimates
(5) An estimated 20% of FL patients experience progression within two years of initial chemoimmunotherapy (Journal of Clinical Oncology; 2015)
(6) Placeholder assumption (pending PFS data from PD-1/PD-L1 studies for 2L FL)

Source: Deutsche Bank, Company data

Figure 39: Advanced Classical Hodgkin lymphoma (cHL)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Classical Hodgkin lymphoma (cHL)														
Incidence (2)	10,143	10,182	10,216	10,245	10,271	10,292	10,309	10,322	10,332	10,338	10,341	10,342	10,339	10,334
Incidence rate	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
Patients receiving treatment	1,358	1,449	1,542	1,637	1,734	1,833	1,933	2,035	2,139	2,244	2,350	2,458	2,568	2,679
Treatment ratio (3)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (4)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	1,358	1,449	1,542	1,637	1,734	1,833	1,933	2,035	2,139	2,244	2,350	2,458	2,568	2,679
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Theoretical market size (RMBm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2L+ patients	272	290	308	327	347	367	387	407	428	449	470	492	514	536
% 2L+ patients (5)	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (6)	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Average months of payment	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Theoretical market size (RMBm)	41	43	44	46	48	50	51	53	55	56	58	59	60	62
Total cHL market size (RMBm)	**41**	**43**	**44**	**46**	**48**	**50**	**51**	**53**	**55**	**56**	**58**	**59**	**60**	**62**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Deutsche Bank estimates
(4) Deutsche Bank estimates
(5) An estimated 80% of patients are cured with 1L treatment (Lymphoma Research Foundation)
(6) Based on the median duration of exposure of 8.4 months for Keytruda in KN087 and 11.0 months for Opdivo in CM-205

Source: Deutsche Bank, Company data

Figure 40: Advanced triple negative breast cancer (TNBC)

	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
China population (1)	1,383,288,000	1,388,513,000	1,393,152,000	1,397,198,000	1,400,662,000	1,403,545,000	1,405,871,000	1,407,670,000	1,408,977,000	1,409,831,000	1,410,269,000	1,410,323,000	1,410,014,000	1,409,352,000
YoY growth	0.4%	0.4%	0.3%	0.3%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Metastatic triple negative breast cancer (TNBC)														
Incidence (2)	274,797	275,835	276,757	277,561	278,249	278,822	279,284	279,641	279,901	280,070	280,157	280,168	280,107	279,975
Incidence rate	0.020%	0.020%	0.020%	0.020%	0.020%	0.020%	0.020%	0.020%	0.020%	0.020%	0.020%	0.020%	0.020%	0.020%
Patients with metastatic disease	16,488	16,550	16,605	16,654	16,695	16,729	16,757	16,778	16,794	16,804	16,809	16,810	16,806	16,799
% with metastatic disease (3)	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Patients with metastatic TNBC	2,473	2,483	2,491	2,498	2,504	2,509	2,514	2,517	2,519	2,521	2,521	2,522	2,521	2,520
% with metastatic TNBC (4)	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Patients with advanced disease receiving treatment	331	353	376	399	423	447	471	496	521	547	573	599	626	653
Treatment ratio (5)	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%
Affordability ratio (6)	62%	63%	64%	65%	66%	67%	68%	69%	70%	71%	72%	73%	74%	75%
1L patients	331	353	376	399	423	447	471	496	521	547	573	599	626	653
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (7)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Theoretical market size (RMBm)	17	17	18	19	20	20	21	22	22	23	23	24	25	25
2L+ patients	83	88	94	100	106	112	118	124	130	137	143	150	157	163
% 2L+ patients (8)	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
Cost per patient per month (RMB)	25,000	24,500	24,010	23,530	23,059	22,598	22,146	21,703	21,269	20,844	20,427	20,018	19,618	19,226
YoY		-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%	-2.00%
Average months of therapy (9)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Theoretical market size (RMBm)	4	5	5	5	5	5	5	6	6	6	6	6	6	7
Total TNBC market size (RMBm)	**21**	**22**	**23**	**24**	**25**	**25**	**26**	**27**	**28**	**29**	**30**	**30**	**31**	**32**
YoY		4.6%	4.3%	4.0%	3.8%	3.6%	3.4%	3.2%	3.0%	2.8%	2.7%	2.5%	2.4%	2.2%

(1) World Bank estimates
(2) Cancer Statistics in China, 2015
(3) Approximately 6% of patients have metastatic disease at diagnosis (SEER database)
(4) MRK estimates that 10-20% of diagnosed patients present with the triple negative form
(5) Deutsche Bank estimates
(6) Deutsche Bank estimates
(7) Based on the median PFS of 2.0 months for Keytruda in KN086 cohort A
(8) The Metastatic Breast Cancer Network estimates that 20-30% of patients experience a recurrence of disease
(9) Based on the median PFS of 2.1 months for Keytruda in KN086 cohort B

Source: Deutsche Bank, Company data

Outlook of PD-1/PD-L1 treatment

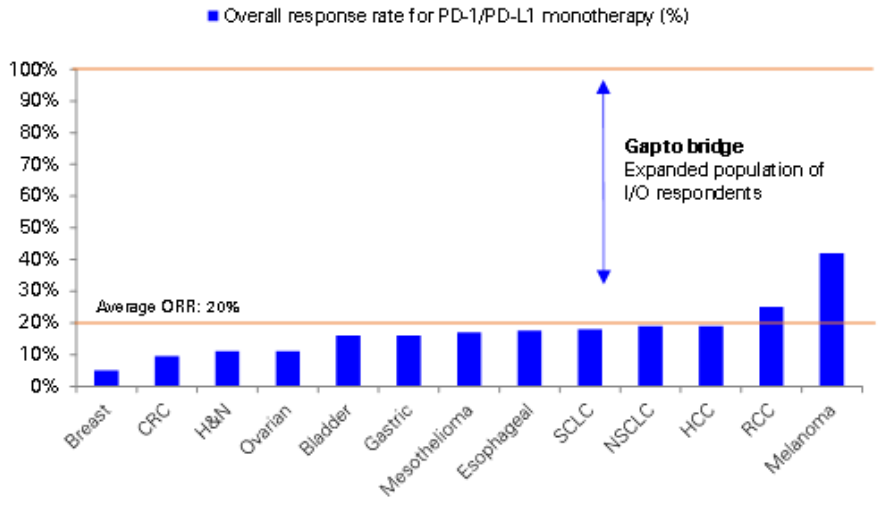
The PD-1 (programmed cell death–1) receptor and ligands PD-L1/PD-L2 belong to the family of immune checkpoint proteins, which can halt or limit the development of the T cell response. PD1/PD-L1 interaction ensures that the immune system is activated only at the appropriate time in order to minimize the possibility of chronic autoimmune inflammation.

The PD1/PD-L1 pathway represents an adaptive immune resistance mechanism that is exerted by tumor cells in response to endogenous anti-tumor activity. Two cancer immunotherapy agents targeting the PD-1 receptor has been marketed, Opdivo/ nivolumab and Keytruda/ pembrolizumab. Both anti-PD-1 agents produced high complete response or partial response in numerous tumors. Three PD-L1 therapies have been approved by FDA, based on significant clinical benefits in the immuno-oncology space.

Overall high response rate vs. other therapies

Anti-PD-1/ PD-L1 therapies stands out from the traditional anti-tumor inhibitors on the back of superior ORR (overall response rate), duration of response and moderate safety profile. We summarize the ORR rates for different tumor types udner PD-1/PD-L1 therapies as below. Notably, melanoma has the highest ORR with c. 43%, compared to average ORR of 20% for all tumors.

Figure 41: Overall response rate for PD-1/PD-L1 monotherapy (%)



Source: Deutsche Bank, Company data

PD-1/ PD-L1 pathway future to IO treatments

As of FY2016, Rituxan, Revlimid and Avastin are the top 3 best-selling oncology drugs based on worldwide sales data. Top three blockbusters achieved total revenue of USD7.4bn/ 7.0bn/6.9bn respectively in 2016. Among the top 20 oncology drugs, three of them are from the PD-1/PD-L1 class, despite their relative new appearance and approval. Evaluate Pharma projected that five checkpoint inhibitors will be among top 20 best-sellers by 2022E, which are Opdivo, Keytruda, Tecentriq, Yervoy and Imfinzi. Estimated sales for Opdivo, Keytruda and Yervoy in 2022E are USD11.2bn/8.0bn/2.7bn respectively, implying CAGR 2016-22E of 15%, 34%, 17%.

Figure 42: Top 20 drugs in 2016 vs. 2022E, based on total global sales

	Oncology: Top 20 drugs ranked 2016	USD mn	Oncology: Top 20 drugs ranked 2022	USD mn
1	Rituxan	7,410	Revlimid	13,556
2	Revlimid	6,974	Opdivo	11,216
3	Avastin	6,885	Imbruvica	8,195
4	Herceptin	6,884	Keytruda	7,983
5	Opdivo	4,815	Darzalex	5,824
6	Gleevec	3,323	Ibrance	4,935
7	Xtandi	2,670	Xtandi	4,890
8	Velcade	2,357	Perjeta	4,853
9	Alimta	2,283	Tecentriq	4,656
10	Zytiga	2,260	Avastin	4,410
11	Imbruvica	2,218	Herceptin	3,466
12	Ibrance	2,135	Yervoy	2,730
13	Perjeta	1,874	Rituxan	2,686
14	Sprycel	1,824	Pomalyst	2,604
15	Tasigna	1,739	Ninlaro	2,467
16	Afinitor	1,516	Gazyva	2,369
17	Keytruda	1,402	Imfinzi	2,308
18	Pomalyst	1,311	Tagrisso	2,300
19	Sutent	1,095	Jakafi	2,080
20	Yervoy	1,053	Tasigna	1,958

Source: Deutsche Bank, Company data, Evaluate Pharma

The overall cancer/ immuno-oncology market is expected to surpass USD34bn in 2024E, with checkpoint inhibitors leading the future treatment algorithms. We summarize below the top 6 checkpoint inhibitors based on projected 2022E global sales. Among them, two PD-1 inhibitors (Opdivo and Keytruda) captured accounted for USD19bn market size, followed by three PD-L1 inhibitors (Tecentriq/ Bavencio/ Imfinzi) and one CTLA-4 inhibitor Yervoy. We believe PD-1 and PD-L1 inhibitors are likely to become one of the mainstream treatment algorithms for cancer and auto-immune diseases given its superior clinical efficacy, and decent safety profile.

Figure 43: Top 6 checkpoint inhibitors by 2022E sales

Company	Drug name	Compound	Target	Sales in 2022E (USDmn)
BMS	Yervoy	Ipillimumab	CTLA-4	2,730
BMS	Opdivo	Nivolumab	PD-1	11,216
Merck	Keytruda	Pembrolizumab	PD-1	7,983
Genentech	Tecentriq	Atezolizumab	PD-L1	4,656
Merck/Pfizer	Bavencio	Avelumab	PD-L1	788
AstraZeneca	Imfinzi	Durvalumab	PD-L1	2,308

Source: Deutsche Bank, Company data, Evaluate Pharma

PD-1/ PD-L1 ongoing trials in China

As of June 2017, 6 compounds developed by domestic companies were undergoing clinical trials, and 1 compound yet to start patients enrollment after obtaining approval. Among them, Hengrui, Shanghai Junshi pharma and BeiGene are the names with most advanced clinical progress, for compounds SHR-1210 (camrelizumab), JS001 and BGB-A317 respectively.

SHR-1210/ camrelizumab (Hengrui)

SHR-1210 is a humanized anti-PD-1 IgG4 antibody that blocks the binding of PD-L1 and PD-L2 to PD-1. According to ASCO abstract e15572, a total of 58 patients were treated with SHR-1210 at 3 dose levels and schedules: 60 mg Q2W (12 patients); 200 mg Q2W (34 patients), and 400 mg Q2W (12 patients). 49/58 patients received > 2 cycles (each cycle was 28 days) while 36/58 patients were receiving ongoing treatment at the time of abstract preparation.

SHR-1210 displayed decent safety profile, as the most common AEs are reactive capillary hemangiomas (79.3%), hypothyroidism (29.3%), pruritus (19.0%) and elevated transaminase (13.8%). Among the 46 cases of hemangiomas, only 5 patients were with grade 2, and others evaluated as grade 1. Potentially serious AEs related to camrelizumab include acute exacerbation of chronic obstructive pulmonary diseases, elevated cardiac troponin, thrombocytopenia and neutropenia. Overall, the objective response rate (ORR) stood at 31.0%, with a disease control rate of 46.5%. As for tumor response, zero patients had CR (compete response), while eighteen patients had PR (partial response), including 10 esophageal squamous cell carcinoma patients (10/29), three gastric cancer patients (3/8), one lung cancer patient (1/3), one nasopharynx cancer patient (1/3), one hepatocellular carcinoma patient (1/3), one colorectal carcinoma patient (1/3), and one bladder cancer patient (1/1).

We summarize the ongoing trials for SHR-1210 in the following table.

Figure 44: Hengrui SHR-1210 ongoing trials

Drug	Registration No.	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
SHR-1210	CTR20170322	1L Non-Small Cell Lung Cancer	Phase 3	SHR-1210+chemotherapy (carboplatin + pemetrexed) vs. chemotherapy (carboplatin + pemetrexed)	412	37	PFS	May-17
SHR-1210	CTR20170307	2L Advanced Esophageal Cancer	Phase 3	SHR-1210 vs. Docetaxel vs. Irinotecan	438	44	OS	May-17
SHR-1210	CTR20160871	2L Advanced Hepatocellular Carcinoma	Phase 2/3	SHR-1210 Q2W vs. SHR-1210 Q3W	60	18	6-month OS%, ORR (phase 2)	Nov-16
SHR-1210	CTR20170500	Refractory classical Hodgkin Lymphoma	Phase 2	SHR-1210 Q2W	60	2	ORR assessed by IRC, CR, PR	Jun-17
SHR-1210	CTR20170299	2L Non-Small Cell Lung Cancer	Phase 2	SHR-1210 Q2W	120	11	ORR	May-17
SHR-1210	CTR20170090	3L Non-Small Cell Lung Cancer	Phase 2	SHR-1210 Q2W+ apatinib 250mg/d vs. SHR-1210 Q2W+ apatinib 500mg/d	118	3	AE, SAE, ORR	Mar-17
SHR-1210	CTR20170196	Advanced Hepatocarcinoma	Phase 2	SHR-1210+Apatinib vs. SHR-1210+FOLFOX4 regimen	36 - 48	6	AE, SAE	Apr-17
SHR-1210	CTR20170267	1L Nasopharyngeal carcinoma	Phase 1	SHR-1210 Q1W+Gemcitabine Hydrochloride +Cisplatin	20	1	Safety	Apr-17
SHR-1210	CTR20160248	Advanced Solid Tumor	Phase 1	SHR-1210 dose escalation	27 - 36	1	Safety, tolerability	Apr-16
SHR-1210	CTR20160207	Advanced Melanoma	Phase 1	SHR-1210 dose escalation	24 - 36	1	Safety, tolerability	Apr-16
SHR-1210	CTR20160175	Advanced Solid Tumor	Phase 1	SHR-1210 dose escalation	32 - 51	1	Safety, tolerability	Apr-16

Source: Deutsche Bank, chinadrugtrials.org.cn

JS001 (Shanghai Junshi Pharma)

JS001 is a humanized anti-PD-1 IgG4K antibody that blocks PD-1 interactions with its ligands PD-L1 and PD-L2. According to ASCO abstract 3067, a total of 36 patients were enrolled for 3 indications (melanoma, n=22/ UC, n=9/ RCC, n=5).

JS001 displayed superior safety and tolerability profile, as the most common treatment-related AEs were of grade 1/2, including hyper-thyroidism (42%), rash (39%), fever (28%), leukopenia (22%) and elevation of liver enzymes (19%). Grade 3 AEs include proteinuria (n = 1), and elevated lipase (n = 2). Company highlighted that emergence of AEs is not dose related. Its PK analysis showed dose-dependent exposure with the elimination half-life of 6 to 12 days. Among 32 evaluable patients, one melanoma patient has complete response, 7 have partial response, and 10 patients achieved stable disease, registering an ORR of 23% and a DCR of 53%. Notably, two groups benefited most from JS001 treatment, patients with high tumor-infiltrating lymphocytes (TIL) (50% ORR) and subjects with > 1% PD-L1 expression in tumor biopsy (46% ORR). Phase 1 study suggests that JS001 demonstrated promising anti-tumor activity, especially in previously under-evaluated acral and mucosal melanomas.

We summarize the ongoing trials for JS001 as below.

Figure 45: Junshi JS001 ongoing trials

Drug	Registration No.	Indications	Stage	Treatment regimen	Enrollment	Number of sites	Primary endpoint	Start date
JS001	CTR20170347	2L Urothelial Bladder Carcinoma	Phase 2	JS001 single arm	200	1	Safety, tolerability, ORR	Apr-17
JS001	CTR20160900	Melanoma	Phase 2	JS001 single arm	120	7	ORR	Dec-16
JS001	CTR20160740	2L Advanced Gastric Adenocarcinoma, Esophageal Cancer, Nasopharyngeal Carcinoma, Head and Neck Squamous Cell Carcinoma	Phase 1/2	JS001 single arm	326	23	ORR	Dec-16
JS001	CTR20170345	Advanced Neuroendocrine Tumor	Phase 1	JS001 single arm	40	1	Safety, tolerability, ORR	Apr-17
JS001	CTR20170109	Advanced Renal Carcinoma & Melanoma	Phase 1	JS001 single arm	24	1	AE, ECG, vital signs	Mar-17
JS001	CTR20160976	2L Advanced Triple Negative Breast Cancer	Phase 1	JS001 single arm	54	1	AE, ECG, vital signs	Dec-16
JS001	CTR20160813	2L Advanced Triple Negative Breast Cancer	Phase 1	JS001 single arm	72	1	AE, ECG, vital signs	Dec-16
JS001	CTR20160412	2L Advanced Triple Negative Breast Cancer	Phase 1	JS001 single arm	12 - 24	1	AE, ECG, vital signs	Aug-16
JS001	CTR20160274	Advanced or Recurrent Malignant Tumor	Phase 1	JS001 single arm	27	1	Safety, tolerability, atineoplasmic activity	May-16
JS001	CTR20160187	Advanced Tumor	Phase 1	JS001 single arm	18	1	Safety, tolerability, DLT, MDT/RD	Apr-16
JS001	CTR20160176	Advanced Solid Tumor	Phase 1	JS001 single arm	12	1	Safety, tolerability, DLT	Mar-16
JS001	CTR20170747	Malignant Lymphoma	Phase 1	JS001 single arm	12	1	Tolerability, safety, ORR	Jul-17

Source: Deutsche Bank, chinadrugtrials.org.cn

BGB-A317 (co-developed by BeiGene and Celgene)

BGB-A317, a humanized IgG4 variant monoclonal antibody engineered to have no Fc gamma receptor binding, targets the programmed cell death-1 (PD-1) receptor. It is being developed in solid and hematologic malignancies with doses of 200 mg IV Q3W. The Phase 1/1b study is designed to evaluate the efficacy of combo therapy of BGB-A317 and BGB-290 (a potent inhibitor of PARP 1/2) in patients with advanced solid tumors. Upon completion of the trial, further investigation on indication expansion into ovarian, breast, prostate, gastric, bladder, pancreatic and small cell lung cancers is expected to commence.

According to the ASCO abstract 3013, both compounds displayed solid safety profile, as the most common AEs were fatigue and nausea . Immune-related AEs were grade 3 hypophysitis (n = 1), grade 3/4 autoimmune hepatitis (n = 2), and grade 2 elevated AST/ALT (n = 1). Decreases in tumor burden have been observed

in 16 subjects; 7 achieved PR (5 with ovarian cancer, one each for uterine and pancreatic cancer) and one CR was observed in ovarian cancer.

We summarize the ongoing trials for BGB-A317 as below.

Figure 46: BeiGene BGB-A317 ongoing trials

Drug	Registration No.	Indications	Stage	Treatment regimen	Enrollment	Number of sites	Primary endpoint	Start date
BGB-A317	CTR20170361	1L Advanced or Metastatic Non-Squamous Non-Small Cell Lung Cancer, Squamous Cell Lung Cancer, Extensive Small Cell Lung Cancer	Phase 2	BGB-A317 single arm	60	2	ORR	Jul-17
BGB-A317	CTR20170515	1L Esophageal Cancer, Gastric Cancer, Gastroesophageal Junction Carcinoma	Phase 2	BGB-A317 single arm	30	6	AE, SAE, medical checkup, vital signs, ECG	Jun-17
BGB-A317	CTR20170119	Refractory classical Hodgkin Lymphoma	Phase 2	BGB-A317 single arm	68	17	ORR	Apr-17
BGB-A317	CTR20170071	2L Urothelial Bladder Carcinoma	Phase 2	BGB-A317 single arm	110	13	ORR	Apr-17
BGB-A317	CTR20160872	Advanced Solid Tumor	Phase 1	BGB-A317 single arm	300	13	Safety, tolerability, PK, MTD, RP2D, ORR	Dec-16

Source: Deutsche Bank, chinadrugtrials.org.cn

IBI308 (Innovent Biologics)

IBI308 is a monoclonal antibody developed for tumor immunotherapy, with R&D and commercialization collaboration with Eli Lilly. As of July 2017, four trials are being conducted in China for IBI308, with NSCLC in Phase 3, followed by recurrent/ refractory cHL and esophageal cancer in Phase 2 status. We summarize the current clinical trials on IBI308 as below.

Figure 47: Innovent IBI308 ongoing trials

Drug	Registration No.	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
IBI308	CTR20170380	2L Advanced or Metastatic Squamous Non-Small Cell Lung Cancer	Phase 3	IBI308 vs. Docetaxel	266	28	OS	May-17
IBI308	CTR20170281	Recurrent or Refractory classical Hodgkin Lymphoma	Phase 2	IBI308 single arm	90	29	ORR	Apr-17
IBI308	CTR20170258	2L Esophageal Cancer	Phase 2	IBI308 vs. Paclitaxel vs. Irinotecan Hydrochloride	180	8	OS	Mar-17
IBI308	CTR20160735	Advanced Solid Tumor	Phase 1	IBI308 single arm	104	3	Safety, tolerability, antineoplasmic activity	Oct-16

Source: Deutsche Bank, chinadrugtrials.org.cn

We also listed the other three PD-1/PD-L1 drugs undergoing clinical trials, from domestic companies including Gloria Pharma (co-develop with Wuxi AppTec), Alphamab, and Gener Bio. PD-1 compounds GLS-010 and KN035 are both targeting advanced solid tumor, in open-label, single arm Phase 1 trial setting. As for GB226 from Genor Bio, the company obtained clinical trial approval in Dec 2016, but is yet to start patient enrollment.

Figure 48: Summary of ongoing PD-1/PD-L1 clinical trials (domestic companies)

Company	Drug	Registration No.	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
Gloria Pharma/ Wuxi AppTec	GLS-010	CTR20170433	Advanced Solid Tumor (Gastric Cancer, Esophageal Cancer)	Phase 1	GLS-010 single arm	84	1	AE, vital signs, medical checkup, 12-lead ECG, ECOG, SAE	May-17
Alphamab	KN035	CTR20170036	Advanced Solid Tumor	Phase 1	KN035 single arm	14 - 36	1	Safety, tolerability, DLT, AE, SAE, vital signs, medical checkup, 12-lead ECG	Mar-17
Genor Bio	GB226	Clinical trial pending							

Source: Deutsche Bank, chinadrugtrials.org.cn

We summarize PD-1/PD-L1 drug trials developed by global players as below.

Figure 49: Summary of ongoing PD-1/PD-L1 clinical trials (global companies)

Company	Drug	Registration No.	Indications	Stage	Clinical regimen	Enrollment	Number of sites	Primary endpoint	Start date
BMY	Nivolumab/ BMS-936558	CTR20170371	Advanced or Recurrent Gastric Cancer or Urothelial Bladder Carcinoma	Phase 3	Nivolumab + Ipilimumab vs. Nivolumab + Oxaliplatin+Capecitabine vs. Nivolumab + Oxaliplatin+Leucovorin+Fluorouracil vs. Oxaliplatin+Capecitabine vs. Oxaliplatin+Leucovorin+Fluorouracil	1,266	145	OS	May-17
BMY	Nivolumab/ BMS-936559	CTR20170340	1L Non-Small Cell Lung Cancer	Phase 3	Nivolumab vs. Nivolumab + Ipilimumab vs. Nivolumab + Platinum doublet chemotherapy vs. Platinum doublet chemotherapy	2,210	24	OS	Aug-15
BMY	Nivolumab/ BMS-936560	CTR20160605	Advanced Hepatocellular Carcinoma	Phase 3	Nivolumab vs. Sorafenib tosylate	1,000	140	OS, TTP	12/7/2015 - international; 9/30/2016 - China
BMY	Nivolumab/ BMS-936561	CTR20160578	2L Relapsed Small-cell Lung Cancer	Phase 3	Nivolumab vs. Topotecan Hydrochloride	480	197	OS	9/14/2015- international
BMY	Nivolumab/ BMS-936562	CTR20150767	Advanced or Metastatic Non Small Cell Lung Cancer	Phase 3	Nivolumab vs. Docetaxel	500	25	OS	Dec-15
BMY	Nivolumab/ BMS-936563	CTR20150755	Advanced or Recurrent Solid Tumor	Phase 1/2	Nivolumab	56	1	AE, SAE, death, ECG, vital signs, medical checkup	Jan-16
Roche	Atezolizumab/ MPDL3280A	CTR20160994	Non-Squamous or Squamous Non-Small Cell Lung Cancer	Phase 3	Atezolizumab vs. Carboplatin/ Cisplatin + Pemetrexed/ Gemcitabine	555	13	PFS, OS	Jul-15
Roche	Atezolizumab/ MPDL3280A	CTR20160680	Myometrial Invasive Urothelial Carcinoma	Phase 3	MPDL3280A	700	78	DFS, UC relapse, death	10/6/2015- international;3/ 21/2017 - China
Roche	Atezolizumab/ MPDL3280A	CTR20160510	Non-Small Cell Lung Cancer	Phase 3	MPDL3280A vs. Best Supportive Care	760	276	DFS	Oct-15
Roche	Atezolizumab/ MPDL3280A	CTR20160054	Non-Small Cell Lung Cancer	Phase 3	MPDL3280A vs. Docetaxel	563	44	OS	Jul-16
Roche	Atezolizumab/ MPDL3280A	CTR20170064	Non-Squamous Non-Small Cell Lung Cancer	Phase 3	Atezolizumab + Carboplatin or Cisplatin + Pemetrexed vs. Carboplatin or Cisplatin + Pemetrexed	568	8	PFS, OS	Apr-16
Roche	Atezolizumab/ MPDL3280A	CTR20170061	Locally Advanced or Metastatic Urothelial Carcinoma	Phase 3	Atezolizumab vs. Atezolizumab+Gemcitabine+Carboplatin/Cisplatin vs. Placebo+Gemcitabine+Carboplatin/Cisplatin	1,200	116	PFS, OS	Jun-16
Roche	Atezolizumab/ MPDL3280A	CTR20160988	Extensive-Stage Small Cell Lung Cancer	Phase 3	Atezolizumab + Carboplatin + Etoposide vs. Placebo + Carboplatin + Etoposide	500	12	PFS, OS	Apr-17
Roche	Atezolizumab/ MPDL3280A	CTR20160381	Locally Advanced or Metastatic Solid Tumors	Phase 1	MPDL3280A	120	6	PK	Aug-16
AstraZeneca	Durvalumab/ MEDI4736	CTR20170158	Non-Small Cell Lung Cancer	Phase 3	MEDI4736 vs. Placebo	1,100	105	DFS	May-17
AstraZeneca	Durvalumab/ MEDI4736	CTR20170135	1L Advanced Urothelial Carcinoma	Phase 3	MEDI4736 vs. MEDI4736 + Tremelimumab vs. Cisplatin +Gemcitabine or Carboplatin+Gemcitabine	1,005	42	OS, PFS	11/2/2015- international; 4/21/2017 - China
AstraZeneca	Durvalumab/ MEDI4736	CTR20170012	1L Non-Small Cell Lung Cancer	Phase 3	MEDI4736 vs. Paclitaxel + carboplatin or Gemcitabine + cisplatin or Gemcitabine + carboplatin or Pemetrexed + cisplatin or Pemetrexed + carboplatin	440	28	PFS, OS	1/1/2017- international; 2/24/2017- China
AstraZeneca	Durvalumab/ MEDI4736	CTR20160926	Advanced Malignancies	Phase 1	MEDI4736 vs. MEDI4736+Tremelimumab	24	3	PK, AE, medical checkup,vital signs, ECG	Nov-16

Source: Deutsche Bank, chinadrugtrials.org.cn

Approved PD-1/PD-L1 drugs and indications from MNCs

We summarize the internationally approved PD-1/PD-L1 compounds with corresponding tumor types and clinical trial efficacy details in the following tables. Notably, Opdivo and Keytruda has 7/6 approved tumor indications respectively, as the first two launched PD-1 inhibitors. Tecentriq is the first anti-PD-L1 agent with two approved cancer indications, Bavancio/ Imfinzi have 2/1 approved tumor indications respectively.

We summarize the approved five IO treatments with corresponding indications and lines of therapy as below:

Figure 50: Summary of approved PD-1/PD-L1 and indications

Indications	Line of therapy
Opdivo (nivolumab)	
Metastatic melanoma	2L+
Metastatic melanoma	1L
Metastatic melanoma	
Squamous NSCLC	2L
Non-Squamous NSCLC	2L
Renal cell carcinoma	2L+
Classical Hodgkin lymphoma (cHL)	R/R
Classical Hodgkin lymphoma (cHL)	R/R
Squamous cell carcinoma of the head and neck (SCCHN)	2L+
Urothelial carcinoma (UC)	2L
Microsatellite Instability-High Cancer (MSI-H cancer)	2L+
Keytruda (pembrolizumab)	
Melanoma	1L
Melanoma	2L
NSCLC	1L
Non-Squamous NSCLC	1L
NSCLC	2L+
Squamous cell carcinoma of the head and neck (SCCHN)	2L+
Classical Hodgkin lymphoma (cHL)	R/R
Urothelial carcinoma (UC)	1L
Urothelial carcinoma (UC)	2L
Microsatellite Instability-High Cancer (MSI-H cancer)	3L
Tecentriq (atezolizumab)	
Urothelial carcinoma (UC)	1L
Urothelial carcinoma (UC)	2L
NSCLC	2L+
NSCLC	2L+
Bavencio (avelumab)	
Metastatic Merkel cell carcinoma (MCC)	2L
Urothelial carcinoma (UC)	2L+
Imfinzi (durvalumab)	
Urothelial carcinoma (UC)	2L+

Source: Deutsche Bank, Company data

Opdivo (nivolumab)

Opdivo is a human programmed death receptor-1 (PD-1) blocking antibody. It was first approved by US FDA for second line and beyond treatment in unresectable or metastatic melanoma in Dec 2014. The compound received accelerated approval given superior overall response rate of 32% in advanced melanoma patients that failed Yervoy treatment previously.

Following the first indication approval in year end 2014, Opdivo expanded indications to squamous and non-squamous NSCLC, cHL, SCCHN, RCC, UC and MSI-H cancer. As of July 2017, Bristol is conducting trials in cancers including SCLC, GC, TNBC, OC, as well as combo therapy with other checkpoint inhibitors or chemo drugs.

Figure 51: FDA approved indications and trial results for Opdivo (as of Jul 17)

Indications	Line of therapy	Study design	Primary endpoint	Enrollment	Treatment regimen	Efficacy results	Date
Metastatic melanoma	2L+	Randomized (2:1), open-label	ORR, DOR	370	OPDIVO vs. chemotherapy	ORR 32%, consisting of 4 complete responses and 34 partial responses in OPDIVO arm	Dec-14
Metastatic melanoma	1L	Randomized (1:1), double-blind	ORR	418	OPDIVO plus Ipilimumab vs. Ipilimumab	ORR 34% vs. 9%, primary OS not reached	Jan-16
Metastatic melanoma		Randomized (1:1:1), double-blind	PFS, OS	945	OPDIVO plus Ipilimumab vs. OPDIVO vs. Ipilimumab	ORR 50% vs. 40% vs. 14%, mPFS 11.5m vs. 6.9m vs. 2.9m	Jan-16
Squamous NSCLC	2L	Randomized (1:1), open-label	OS	272	OPDIVO vs. docetaxel	ORR 20% vs. 9%, mOS 9.2m vs. 6.0m	Mar-15
Non-Squamous NSCLC	2L	Randomized (1:1), open-label	OS	582	OPDIVO vs. docetaxel	ORR 19% vs. 12%, mOS 12.2m vs. 9.4m	Oct-15
Renal cell carcinoma	2L+	Randomized (1:1), open-label	OS	821	OPDIVO vs. everolimus	ORR 21.5% vs. 3.9%, mOS 25.0m vs. 19.6m	Nov-15
Classical Hodgkin lymphoma (cHL)	R/R	Single arm, open-label	ORR	243		ORR 69% in cHL after Autologous HSCT	May-16
Classical Hodgkin lymphoma (cHL)	R/R	Single arm, open-label	ORR	23		ORR 66% in cHL after Autologous HSCT and Post-transplantation Brentuximab Vedotin	May-16
Squamous cell carcinoma of the head and neck (SCCHN)	2L+	Randomized (2:1), open-label	OS	361	OPDIVO vs. cetuximab/ methotrexate/ docetaxel	ORR 13.3% vs. 5.8%, mOS 7.5m vs. 5.1m	Nov-16
Urothelial carcinoma (UC)	2L	Single arm	ORR, DOR	270		ORR 19.6% vs. 15.1% vs. 25.0%, mDOR 10.3m vs. 7.6m vs. NE	Feb-17
Microsatellite Instability-High Cancer (MSI-H cancer)	2L+	open-label, single arm	ORR, DOR	74		ORR 32% vs. 28%	Jul-17

Source: Deutsche Bank, Company data

Keytruda (pembrolizumab)

Keytruda is the first anti-PD-1 therapy approved in the US and received FDA's Breakthrough Therapy designation. It was first approved by the FDA for advance melanoma indication in Sep 2014. The compound demonstrated significant ORR of 24% among 89 patients, with one complete response and 20 partial response.

Following the first indication approval, Keytruda successfully expanded to treatment for NSCLC, SCCHN, UC, cHL and MSI-H cancer. Merck is currently conducting clinical trials for indication expansion to tumors including SCLC, RCC, GC and HCC, under monotherapy or combo therapy setting.

Figure 52: FDA approved indications and trial results for Keytruda (as of May 17)

Indications	Line of therapy	Study design	Patients profile	Primary endpoint	Enrollment	Clinical regimen	Efficacy results	Date
Melanoma	1L	Randomized (1:1:1), open-label	Ipilimumab-Naive Melanoma	OS, PFS	912	KEYTRUDA every 2 weeks, vs. KEYTRUDA every 3 weeks, vs. ipilimumab	mPFS 4.1m vs. 5.5m vs. 2.8m	Sep-14
Melanoma	2L	Randomized (1:1:1), open-label	Ipilimumab-Refractory Melanoma	OS, PFS	540	KEYTRUDA every 2 weeks, vs. KEYTRUDA every 3 weeks, vs. chemotherapy	mOS 13.4m vs. 14.7m vs. 11.0m	Sep-14
NSCLC	1L	Randomized (1:1), open-label	High PD-L1 expression of over 50%	PFS	305	KEYTRUDA vs. chemotherapy	mPFS 10.3m vs. 6.0m, OS not reached	Oct-16
Non-Squamous NSCLC	1L	Randomized (1:1), open-label	Treatment naive	ORR	123	KEYTRUDA + Pemetrexed + Carboplatin vs. Pemetrexed + Carboplatin	ORR 55% vs. 29%	May-17
NSCLC	2L+	Randomized (1:1), open-label		OS, PFS	1,033	KEYTRUDA 2 mg/kg vs. KEYTRUDA 10 mg/kg vs. docetaxel	mOS 14.9m vs. 17.3m vs. 8.2m for TPS above 50% group; mOS 10.4m vs. 12.7m vs. 8.5m for all patients	Oct-15
Squamous cell carcinoma of the head and neck (SCCHN)	2L+	Non-randomized, open-label		ORR	174	KEYTRUDA 10 mg/kg every 2 weeks (n=53) or 200 mg every 3 weeks (n=121)	ORR 16% (95% CI: 11, 22) with a complete response rate of 5%	Aug-16
Classical Hodgkin lymphoma (cHL)	R/R	Non-randomized, open-label	relapsed or refractory cHL	ORR, CRR, DOR	210	KEYTRUDA 200 mg every 3 weeks	ORR 69% (62, 75), mDOR 11.1m	Mar-17
Urothelial carcinoma (UC)	1L	Open-label, single-arm	Cisplatin Ineligible Patients	ORR	370	KEYTRUDA 200 mg every 3 weeks	ORR 29% (24, 34)	May-17
Urothelial carcinoma (UC)	2L	Randomized (1:1), open-label	Failed platinum-containing chemotherapy	OS, PFS	542	KEYTRUDA vs. chemotherapy	mOS 10.3m vs. 7.4m	May-17
Microsatellite Instability-High Cancer (MSI-H cancer)	3L	Open-label, single-arm	MSI-H or mismatch repair deficient (dMMR)	ORR	149	KEYTRUDA 200 mg every 3 weeks or 10 mg/kg every 2 weeks	ORR 39.6% (31.7, 47.9)	May-17

Source: Deutsche Bank, Company data

Tecentriq (atezolizumab)

Tecentriq is the first PD-L1 inhibitor approved by the US FDA, under accelerated approval track. It targets the PD-1/PD-L1 pathway (proteins found on the body's immune cells and some cancer cells). By blocking these interactions, Tecentriq may help the body's immune system fight cancer cells.

The first indication approved for atezolizumab was urothelial carcinoma/ bladder cancer for patients that failed platinum-containing chemotherapy. In April 2017, it was then approved for first line therapy of UC. Meanwhile, Tecentriq also received approval to second line and beyond treatment of NSCLC in October 2016; based on significantly enhanced efficacy from 1,137 patients. Roche is currently conducting clinical trials for indication expansion to cancers including 1L NSCLC, melanoma, CRC, and TNBC, under monotherapy or combo therapy regimen.

Figure 53: FDA approved indications and trial results for Tecentriq (as of Apr 17)

Indications	Line of therapy	Study design	Patients profile	Primary endpoint	Enrollment	Clinical regimen	Efficacy results	Date
Urothelial carcinoma (UC)	1L	Open-label, single-arm	Cisplatin Ineligible Patients	ORR, DOR	119	TECENTRIQ IV of 1200mg every 3 weeks	ORR 23.5% for all patients, 21.8% for PD-L1 expression of < 5%, 28.1% for PD-L1 expression over 5%	Apr-17
Urothelial carcinoma (UC)	2L	Open-label, single-arm	Failed platinum-containing chemotherapy	ORR, DOR	310	TECENTRIQ IV of 1200mg every 3 weeks	ORR 14.8% for all patients, 9.5% for PD-L1 expression of < 5%, 26.0% for PD-L1 expression over 5%	May-16
NSCLC	2L+	Randomized (1:1), open-label	Failed platinum-containing chemotherapy	OS	850	TECENTRIQ vs. docetaxel	mOS 13.8m vs. 9.6m	Oct-16
NSCLC	2L+	Randomized (1:1), open-label	Failed platinum-containing chemotherapy	OS	287	TECENTRIQ vs. docetaxel	mOS 12.6m vs. 9.7m	Oct-16

Source: Deutsche Bank, Company data

Bavencio (avelumab)

Bavencio is the second approved PD-L1 inhibitor, under accelerated approval track from the US FDA. Similar to atezolizumab, avelumab is also an immune checkpoint inhibitor that helps keep the immune system in check. Studies suggested that Bavencio may also attack tumor cells through a second mechanism, called antibody-dependent cell-mediated cytotoxicity.

The first approved indication for avelumab is Metastatic Merkel cell carcinoma (MCC), which demonstrated statistically-significant improved response rate with decent safety/ tolerance. FDA granted Bavencio the second indication of UC in May 2017, in second line treatment setting. The PD-L1 inhibitor is currently undergoing clinical trials for tumors including NSCLC, GC, RCC and OC, under monotherapy or combo therapy setting.

Figure 54: FDA approved indications and trial results for Bavencio (as of May 17)

Indications	Line of therapy	Study design	Primary endpoint	Enrollment	Treatment regimen	Efficacy results	Date
Metastatic Merkel cell carcinoma (MCC)	2L	Open-label, single-arm	ORR	88	BAVENCIO IV of 10 mg/kg every 2 weeks	ORR 33.0%, CR of 11.4%, PR of 21.6%	Feb-17
Urothelial carcinoma (UC)	2L+	Open-label, single-arm	ORR	242	BAVENCIO IV of 10 mg/kg every 2 weeks	ORR 13.3% for over 13 weeks; ORR 16.1% for over 6 months	May-17

Source: Deutsche Bank, Company data

Imfinzi (durvalumab)

Imfinzi, a human mAb directed against PD-L1, targets to block the interaction of PD-L1 with PD-1 and CD80. Durvalumabis currently undergoing clinical investigation in the Phase 3 DANUBE trial as first-line treatment in urothelial carcinoma as monotherapy and in combination with tremelimumab. AstraZeneca is also conducting additional studies on efficacy of durvalumab in indication expansion to tumors including SCCHN, HCC, NSCLC, GC and TNBC, as both monotherapy and combo therapy regimen.

Figure 55: FDA approved indications and trial results for Imfinzi (as of May 17)

Indications	Line of therapy	Study design	Patients profile	Primary endpoint	Enrollment	Clinical regimen	Efficacy results	Date
Urothelial carcinoma (UC)	2L+	Open-label, single-arm	Failed platinum-chemotherapy	ORR, DOR	182	IMFINZI IV of 10 mg/kg every 2 weeks	ORR 17.0% for all patients. ORR 26.3% for PD-L1 high, 4.1% for PD-L1 low groups	May-17

Source: Deutsche Bank, Company data

Model updated: 29 June 2017

Running the numbers

Asia

China

Pharmaceuticals / Biotechnology

Hengrui Medicine

Reuters: 600276.SS Bloomberg: 600276 CH

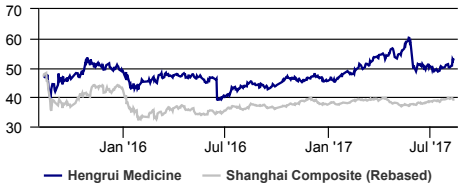
Buy

Price (11 Aug 17)	CNY 53.17
Target Price	CNY 58.50
52 Week range	CNY 42.67 - 60.22
Market cap (m)	CNYm 124,820 USDm 18,719

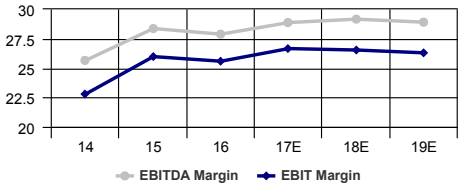
Company Profile

Jiangsu Hengrui Medicine Co. Ltd. was established in 1970 and its headquarters is in Lianyungang, Jiangsu province. The company is primarily involved in the manufacture and R&D of drugs, including those for oncology, muscle relaxation and anesthetics, contrast agents, electrolytes, and anti-infective drugs. Apart from its domestic business, Hengrui exports drugs to the US, Europe, and other countries.

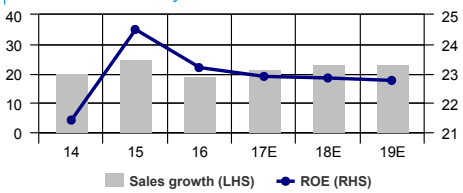
Price Performance



Margin Trends



Growth & Profitibility



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Fiscal year end 31-Dec	2014	2015	2016	2017E	2018E	2019E
Financial Summary						
DB EPS (CNY)	0.64	0.92	1.10	1.13	1.39	1.72
Reported EPS (CNY)	0.65	0.92	1.10	1.13	1.39	1.72
DPS (CNY)	0.05	0.06	0.08	0.08	0.10	0.12
BVPS (CNY)	3.3	4.2	5.3	5.4	6.7	8.3
Weighted average shares (m)	2,338	2,348	2,345	2,817	2,817	2,817
Average market cap (CNYm)	61,188	100,841	106,134	124,820	124,820	124,820
Enterprise value (CNYm)	58,103	96,055	101,627	119,001	116,826	113,657
Valuation Metrics						
P/E (DB) (x)	40.9	46.5	41.0	47.2	38.2	31.0
P/E (Reported) (x)	40.4	46.4	41.1	47.2	38.2	31.0
P/BV (x)	8.63	11.58	8.62	9.76	7.89	6.38
FCF Yield (%)	2.1	1.9	1.4	1.1	1.7	2.4
Dividend Yield (%)	0.2	0.1	0.2	0.1	0.2	0.2
EV/Sales (x)	7.8	10.3	9.2	8.8	7.0	5.5
EV/EBITDA (x)	30.4	36.3	32.8	30.6	24.1	19.2
EV/EBIT (x)	34.2	39.7	35.8	33.2	26.5	21.1
Income Statement (CNYm)						
Sales revenue	7,452	9,316	11,094	13,459	16,594	20,483
Gross profit	6,139	7,944	9,659	11,857	14,653	18,127
EBITDA	1,912	2,643	3,094	3,887	4,840	5,921
Depreciation	209	218	248	292	429	527
Amortisation	4	4	7	6	7	7
EBIT	1,699	2,420	2,838	3,588	4,404	5,387
Net interest income(expense)	81	148	166	138	182	255
Associates/affiliates	0	0	0	0	0	0
Exceptionals/extraordinaries	-7	-7	5	-7	0	0
Other pre-tax income/(expense)	27	1	4	17	17	20
Profit before tax	1,800	2,562	3,013	3,736	4,602	5,662
Income tax expense	227	338	379	519	639	786
Minorities	57	52	45	42	42	42
Other post-tax income/(expense)	0	0	0	0	0	0
Net profit	1,516	2,172	2,589	3,175	3,921	4,834
DB adjustments (including dilution)	-19	-1	1	0	0	0
DB Net profit	1,497	2,171	2,590	3,175	3,921	4,834
Cash Flow (CNYm)						
Cash flow from operations	1,574	2,277	2,593	2,653	3,488	4,369
Net Capex	-298	-394	-1,110	-1,077	-996	-819
Free cash flow	1,276	1,883	1,482	1,577	2,492	3,549
Equity raised/(bought back)	136	19	14	0	0	0
Dividends paid	-122	-150	-196	-222	-274	-338
Net inc/(dec) in borrowings	-10	0	-10	0	0	0
Other investing/financing cash flows	1	-67	-1,512	0	0	0
Net cash flow	1,280	1,684	-221	1,354	2,217	3,211
Change in working capital	-198	-169	-259	-862	-912	-1,042
Balance Sheet (CNYm)						
Cash and other liquid assets	3,449	5,133	4,912	6,267	8,484	11,695
Tangible fixed assets	1,624	1,770	2,474	3,259	3,825	4,117
Goodwill/intangible assets	200	196	285	279	272	265
Associates/investments	1	79	81	81	81	81
Other assets	3,812	4,319	6,578	7,420	8,874	10,023
Total assets	9,087	11,497	14,330	17,305	21,537	26,181
Interest bearing debt	10	0	0	0	0	0
Other liabilities	923	1,139	1,456	1,435	1,978	2,085
Total liabilities	933	1,139	1,456	1,435	1,978	2,085
Shareholders' equity	7,798	9,931	12,388	15,341	18,987	23,483
Minorities	355	426	486	529	571	613
Total shareholders' equity	8,154	10,358	12,874	15,869	19,558	24,096
Net debt	-3,439	-5,133	-4,912	-6,267	-8,484	-11,695
Key Company Metrics						
Sales growth (%)	20.1	25.0	19.1	21.3	23.3	23.4
DB EPS growth (%)	23.4	44.5	19.3	2.2	23.5	23.3
EBITDA Margin (%)	25.7	28.4	27.9	28.9	29.2	28.9
EBIT Margin (%)	22.8	26.0	25.6	26.7	26.5	26.3
Payout ratio (%)	8.1	6.9	7.5	7.0	7.0	7.0
ROE (%)	21.4	24.5	23.2	22.9	22.8	22.8
Capex/sales (%)	4.0	4.2	10.0	8.0	6.0	4.0
Capex/depreciation (x)	1.4	1.8	4.4	3.6	2.3	1.5
Net debt/equity (%)	-42.2	-49.6	-38.2	-39.5	-43.4	-48.5
Net interest cover (x)	nm	nm	nm	nm	nm	nm

Source: Company data, Deutsche Securities estimates

Appendix 1

Important Disclosures

*Other information available upon request

Disclosure checklist

Company	Ticker	Recent price*	Disclosure
Hengrui Medicine	600276.SS	53.17 (CNY) 11 Aug 2017	NA

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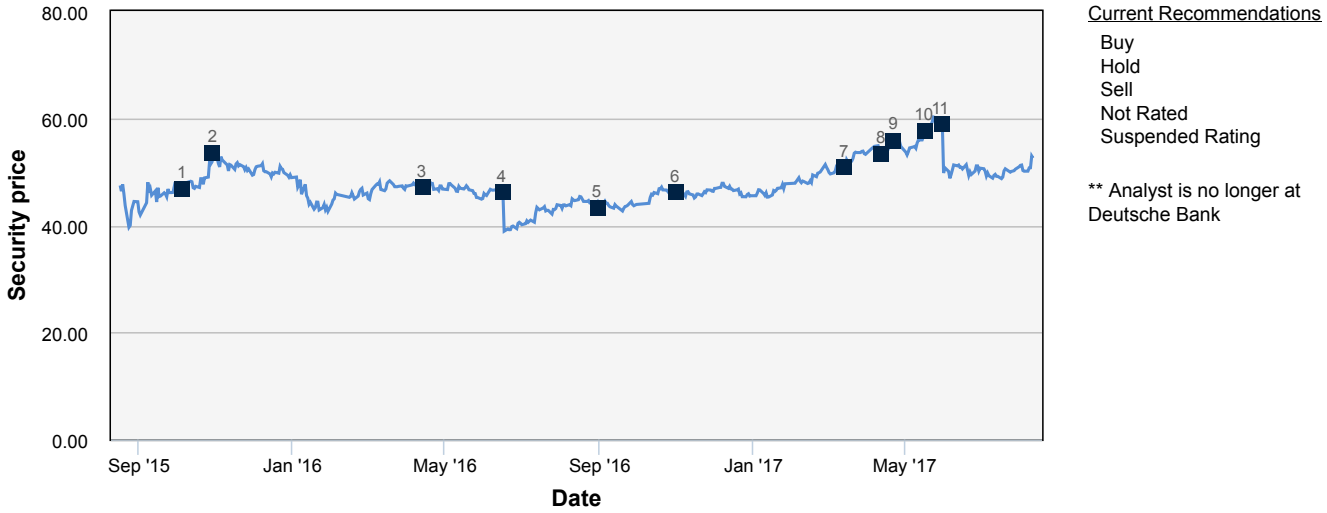
Historical recommendations and target price. Hengrui Medicine (600276.SS)

(as of 08/11/2017)



1.	10/06/2015	Buy, Target Price Change CNY 55,00 Jack Hu, Ph.D
2.	10/30/2015	Buy, Target Price Change CNY 60,00 Jack Hu, Ph.D
3.	04/14/2016	Buy, Target Price Change CNY 59,50 Jack Hu, Ph.D
4.	06/16/2016	Buy, Target Price Change CNY 49,50 Jack Hu, Ph.D
5.	08/31/2016	Buy, Target Price Change CNY 50,00 Jack Hu, Ph.D
6.	11/01/2016	Buy, Target Price Change CNY 55,00 Jack Hu, Ph.D
7.	03/15/2017	Buy, Target Price Change CNY 60,00 Jack Hu, Ph.D
8.	04/13/2017	Buy, Target Price Change CNY 63,50 Jack Hu, Ph.D
9.	04/23/2017	Buy, Target Price Change CNY 65,00 Jack Hu, Ph.D
10.	05/18/2017	Buy, Target Price Change CNY 70,00 Jack Hu, Ph.D
11.	05/31/2017	Buy, Target Price Change CNY 58,50 Jack Hu, Ph.D

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Sell: Based on a current 12-month view of total share-holder return, we recommend that investors sell the stock.
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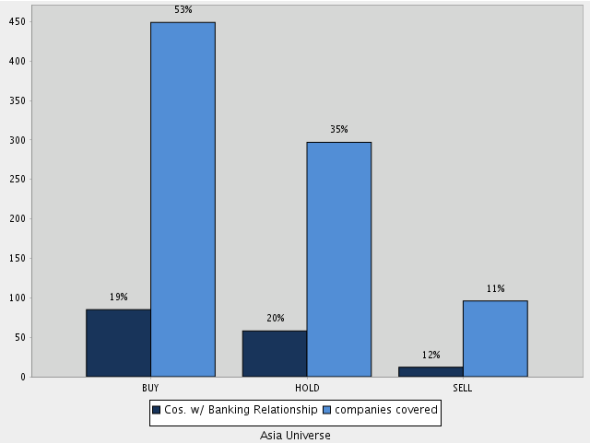
Equity rating dispersion and banking relationships



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