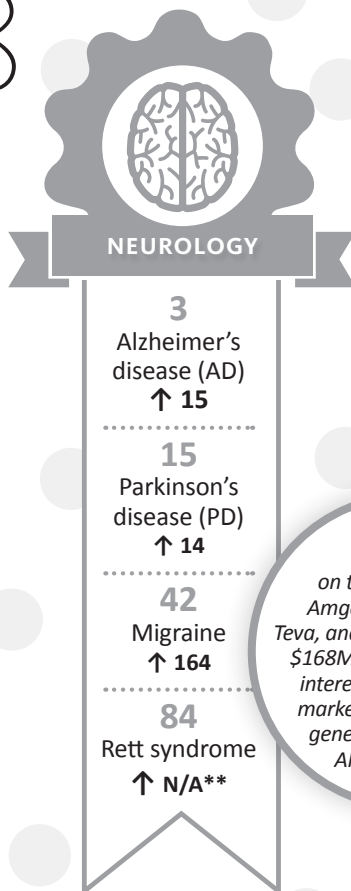


HOT INDICATIONS LIST 2018

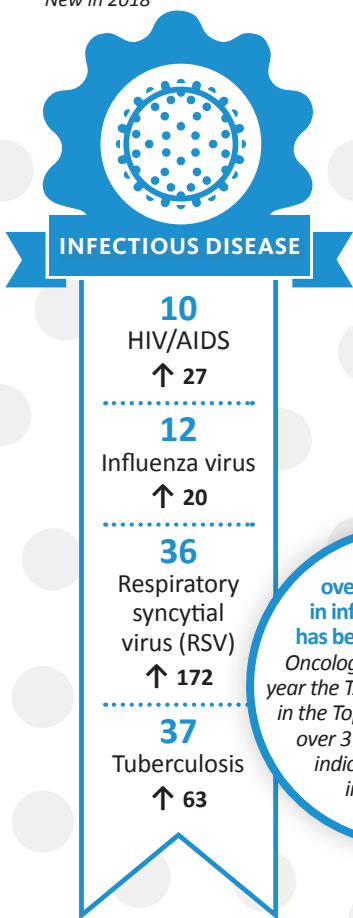
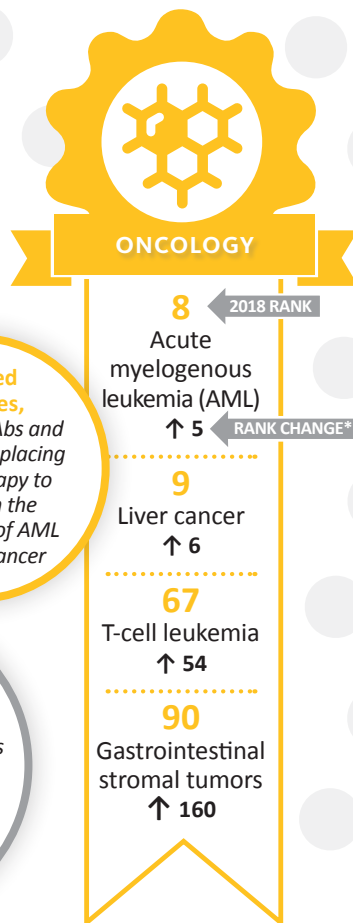
Kaiser's 4th annual analysis of global R&D investment has identified the top indications and therapeutic areas (TAs) for industry focus in 2017. These 20 indications jumped significantly in the ranking, based on major changes in investment from 2016-2017. Big movers such as **Migraine (#42)** and **Obesity (#18)** were driven by new or renewed interest in previously static indications with large market potential. On the TA level, Infectious Diseases was the biggest mover, buoyed by increased investment across multiple indications. To learn more about Kaiser's Hot Indications methodology, see Page 4.

*Change from 2017 rank
**New in 2018

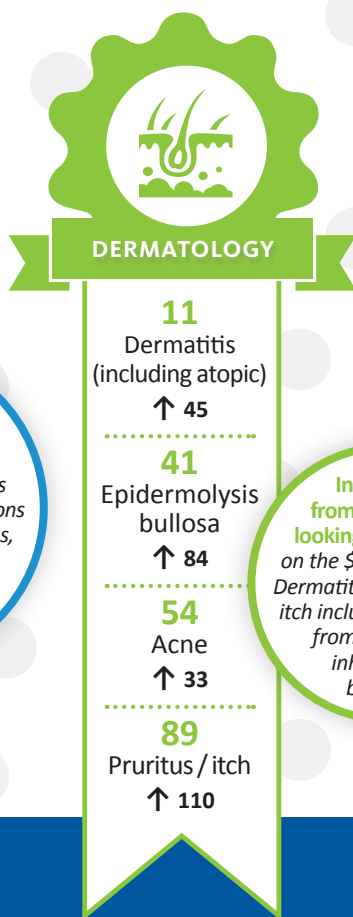


Targeted therapies, including mAbs and CAR-T, are replacing chemotherapy to transform the landscapes of AML and liver cancer

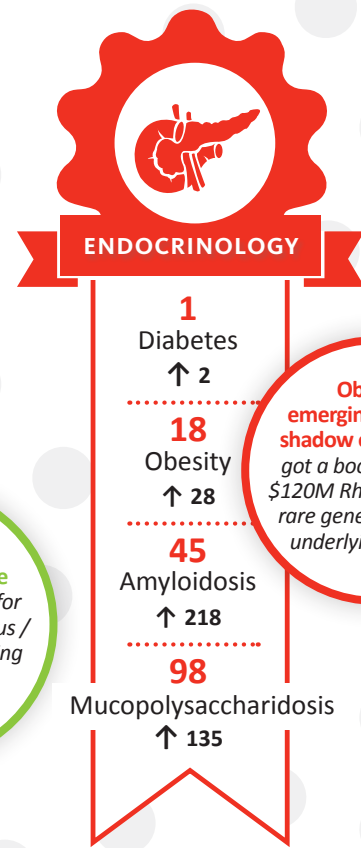
CGRP mAb approvals on the horizon from Amgen, Lilly, Allergan, Teva, and biotech (Biohaven's \$168M IPO) have sparked interest in the Migraine market, until now highly genericized outside of Allergan's Botox



While overall investment in infectious diseases has been second only to Oncology in past years, this year the TA boasts 8 indications in the Top 50 Hot Indications, over 3 in 2016 and 2017, indicating increasing interest in the category



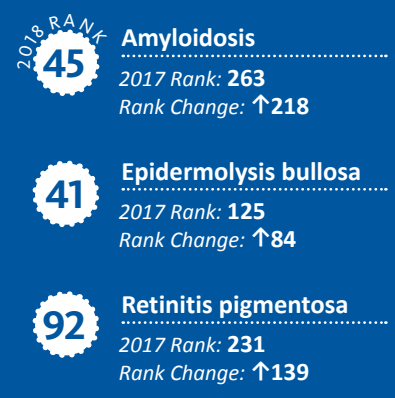
Innovation from companies looking to capitalize on the \$4B+ market for Dermatitis and Pruritus / itch includes everything from topical JAK inhibitors to biologics



Obesity, emerging from the shadow of Diabetes, got a boost from the \$120M Rhythm IPO for rare genetic diseases underlying obesity

ORPHAN HOT INDICATIONS

Orphan indications continue their run as truly Hot Indications, with a record 77 FDA orphan drug approvals in 2017. Much of the orphan drug activity comes from innovative, rare-disease focused biotech, where Orphan Drug Designations help attract investment¹. Kaiser's analysis reveals key orphan indications where VC and IPO investment drove R&D growth in 2017. For example, BridgeBio Pharma collected \$135M to fund development of therapies for genetic diseases including Gorlin Syndrome / basal cell carcinoma (**skin cancer, #53**), **epidermolysis bullosa (#41)**, and **amyloidosis (#45)**. Gene therapies are particularly attractive for orphan indications; Nightstar Therapeutics raised \$76M in its IPO to fund gene therapy programs for choroideremia and **retinitis pigmentosa (#92)**. However, 2017 also presented new challenges for orphan drugs. In December, US lawmakers agreed to cut the Orphan Drug Research Credit in half as part of a major tax reform bill². Further change may be on the horizon: FDA Commissioner Gottlieb asked, "Do we have the right incentives in place?"³, a question which may have major implications for companies and investors in 2018.



REFERENCES: ¹Orphan Drug Designations as Valuable Intangible Assets for IPO Investor in Pharma-Biotech Companies. NBER Working Paper No. 24021, November 2017. ²RAPS Regulatory Focus, December 18, 2017. ³NPR, December 22, 2017.

2018 Ranking	Indication	Therapeutic Area	2017 Ranking	Change
1	Diabetes	Endocrinology	3	↑ 2
2	Breast cancer	Oncology	1	↓ -1
3	Alzheimer's disease (AD)	Neurology	18	↑ 15
4	Prostate cancer	Oncology	5	↑ 1
5	Non-Hodgkin's lymphoma (NHL)	Oncology	4	↓ -1
6	Pain	Neurology	9	↑ 3
7	Non-small cell lung cancer (NSCLC)	Oncology	2	↓ -5
8	Acute myelogenous leukemia (AML)	Oncology	13	↑ 5
9	Liver cancer	Oncology	15	↑ 6
10	HIV / AIDS	Infectious Disease	37	↑ 27
11	Dermatitis (including atopic)	Dermatology	56	↑ 45
12	Influenza virus	Infectious Disease	32	↑ 20
13	Asthma	Inflammatory	17	↑ 4
14	Colorectal cancer	Oncology	7	↓ -7
15	Parkinson's disease (PD)	Neurology	29	↑ 14
16	Age-related macular degeneration (AMD)	Ophthalmology	41	↑ 25
17	Melanoma	Oncology	6	↓ -11
18	Obesity	Endocrinology	46	↑ 28
19	Hepatitis B virus (HBV)	Hepatology	92	↑ 73
20	Rheumatoid arthritis (RA)	Immunology	10	↓ -10
21	Hypertension	Cardiovascular	94	↑ 73
22	Head & neck cancers	Oncology	22	0
23	Ovarian cancer	Oncology	11	↓ -12
24	Osteoarthritis	Immunology	48	↑ 24
25	Psoriasis	Dermatology	20	↓ -5
26	Multiple myeloma (MM)	Oncology	16	↓ -10
27	Pancreatic cancer	Oncology	8	↓ -19
28	Anemia	Hematology	59	↑ 31
29	Chronic obstructive pulmonary disease (COPD)	Pulmonology	28	↓ -1
30	Staphylococcus	Infectious Disease	45	↑ 15
31	Autism	Psychiatry	118	↑ 87
32	Infertility	Endocrinology	236	↑ 204
33	Glioblastoma multiforme (GBM)	Oncology	12	↓ -21
34	Multiple sclerosis (MS)	Immunology	23	↓ -11
35	Incontinence	Urology & Women's Health	191	↑ 156
36	Respiratory syncytial virus (RSV)	Infectious Disease	208	↑ 172
37	Tuberculosis	Infectious Disease	100	↑ 63
38	Small cell lung cancer	Oncology	43	↑ 5
39	Ebola	Infectious Disease	218	↑ 179
40	Cystic fibrosis (CF)	Pulmonology	40	0
41	Epidermolysis bullosa	Dermatology	125	↑ 84
42	Migraine	Neurology	206	↑ 164
43	Respiratory infection	Pulmonology	80	↑ 37
44	Hepatitis C virus (HCV)	Hepatology	73	↑ 29
45	Amyloidosis	Endocrinology	263	↑ 218
46	Rabies	Infectious Disease	137	↑ 91
47	Sickle cell disease	Hematology	141	↑ 94
48	Hyperlipidemia	Endocrinology	24	↓ 24
49	Depression	Psychiatry	33	↓ -16
50	Dengue fever	Infectious Disease	189	↑ 139



WHAT ARE THE NEXT
INNOVATIONS IN ONCOLOGY?

HOT INDICATIONS DEEP DIVE: ONCOLOGY

Coming June 2018

2018 Ranking	Indication	Therapeutic Area	2017 Ranking	Change
51	Glaucoma	Ophthalmology	79	↑ 28
52	Schizophrenia	Psychiatry	66	↑ 14
53	Skin cancer	Oncology	185	↑ 132
54	Acne	Dermatology	87	↑ 33
55	Rhinitis	ENT	50	↓-5
56	Post-traumatic stress disorder	Psychiatry	170	↑ 114
57	Uterine fibroids	Urology & Women's Health	86	↑ 29
58	Malaria	Infectious Disease	115	↑ 57
59	Amyotrophic lateral sclerosis (ALS)	Neurology	44	↓-15
60	Neuropathy	Neurology	51	↓-9
61	Ataxia	Neurology	57	↓-4
62	Crohn's disease	Gastroenterology	42	↓-20
63	Graft-versus-host disease (GvHD)	Transplant	76	↑ 13
64	Lung cancer, general	Oncology	31	↓-33
65	Bone repair	Musculoskeletal	74	↑ 9
66	Glioma	Oncology	53	↓-13
67	T-cell leukemia	Oncology	121	↑ 54
68	Dry eye	Ophthalmology	49	↓-19
69	Bladder cancer	Oncology	82	↑ 13
70	Kidney transplant	Nephrology	146	↑ 76
71	Skin and skin structure infection (SSSI)	Dermatology	64	↓-7
72	Congestive heart failure (CHF)	Cardiovascular	35	↓-37
73	Ulcerative colitis	Gastroenterology	19	↓-54
74	Gram-negative bacterial infection	Infectious Disease	103	↑ 29
75	Emesis	Gastroenterology	214	↑ 139
76	Pulmonary hypertension	Pulmonology	52	↓-24
77	Epilepsy	Neurology	70	↓-7
78	DiGeorge syndrome	Other	N/A	New in 2018
79	Stroke	Neurology	39	↓-40
80	Chronic lymphocytic leukemia (CLL)	Oncology	14	↓-66
81	Norovirus	Infectious Disease	513	↑ 432
82	Hemophilia	Hematology	120	↑ 38
83	Lupus	Immunology	36	↓-47
84	Rett syndrome	Neurology	N/A	New in 2018
85	Irritable bowel syndrome	Gastroenterology	63	↓-22
86	Duchenne muscular dystrophy	Musculoskeletal	129	↑ 43
87	Urinary tract infection (UTI)	Urology & Women's Health	148	↑ 61
88	Non-alcoholic steatohepatitis (NASH)	Hepatology	25	↓-63
89	Pruritus / itch	Dermatology	199	↑ 110
90	Gastrointestinal stromal tumors (GIST)	Oncology	250	↑ 160
91	Sepsis	Infectious Disease	96	↑ 5
92	Retinitis pigmentosa	Ophthalmology	231	↑ 139
93	Osteoporosis	Musculoskeletal	116	↑ 23
94	Pulmonary fibrosis	Pulmonology	30	↓-64
95	Peripheral vascular disease (PVD)	Cardiovascular	60	↓-35
96	Cough	Pulmonology	195	↑ 99
97	Addiction	Psychiatry	62	↓-35
98	Mucopolysaccharidosis	Endocrinology	233	↑ 135
99	Renal cancer	Oncology	21	↓-78
100	Hyperuricemia / gout	Endocrinology	160	↑ 60



WHAT ARE THE NEXT
INNOVATIONS IN ONCOLOGY?

HOT INDICATIONS DEEP DIVE: ONCOLOGY

Coming June 2018

METHODOLOGY

Kaiser Associates' methodology is designed to assess investment intensity of drug development for each indication through a comprehensive and balanced analysis of the key drivers and metrics.

Our Hot Indications analysis framework considers the volume of ongoing scientific investigation, as well as the types of companies and level of funding supporting these trials. Kaiser's analysis evaluated 20,087 drug programs ongoing in 2017, categorized them into 572 unique indications, and compared available data for these indications across three main criteria:

1. PIPELINE SCORE

The Pipeline Score measures the overall level of drug development activity for an indication. The score gives greater value to later-stage programs, higher volumes of programs overall, and indications with greater numbers of companies with programs.

2. R&D FUNDING

R&D Funding estimates the availability of financing to support the development of each drug program to its reasonable endpoint. For some programs, this endpoint will be FDA approval, while for others it will be discontinuation in preclinical or Phase I.

The score measures availability of funds and willingness to invest based on two main inputs for each indication. First, the R&D FundingScore quantifies the historical track record of sponsor companies, based on the number of drugs each company has successfully developed. Second, the score measures initial public offering and venture capital investment fundraising activity in 2017 for

each indication, with the expectation that the financing from such events will be major contributors in supporting ongoing R&D programs.

3. ACADEMIC FOCUS

Academic Focus measures the overall publication activity for each indication, based on the absolute number and the one-year change in publications citing the indication for the evaluation period.

Hot Indications Ranking

For each of the 572 indications, the overall ranking score is calculated by a weighted average of Pipeline Score (50%), R&D Funding (40%) and Academic Focus (10%).

Therapeutic Areas

Each indication is categorized into one of 21 TAs, which include 20 major fields of medicine and an "Other" group. In general, indications are categorized based on the medical specialty most likely to treat patients with a disease or disorder.

Systemic diseases, such as autoimmune disorders, or TAs representing a variety of medical specialties, such as Musculoskeletal, are grouped on a case-by-case basis. For example, Crohn's disease and ulcerative colitis are included in Gastroenterology rather than Immunology, whereas Multiple Sclerosis is included in Immunology due to the variety of symptoms it presents.



WHAT ARE THE NEXT
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HOT INDICATIONS DEEP DIVE: ONCOLOGY

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ABOUT KAISER

Founded in 1981, Kaiser Associates is an international strategy consulting firm that serves as a key advisor to the world's leading companies. We provide our clients with the unique insight to drive critical decision-making and solve their most pressing problems.

Kaiser's Global Healthcare Practice engages with executives at leading Life Sciences companies, including pharmaceutical, medical device, clinical diagnostics, consumer health, and health IT. We work with our clients to identify new growth markets, develop long-term portfolio strategies, and maximize commercial success.

The foundation of Kaiser's service offering is its world-class "outside-in" methodology, which involves delivering critical facts and insights from the complex external environment to drive strategic decision-making. Kaiser possesses the unique ability to generate insights across physicians, thought leaders, patients, competitors, partners, regulators, suppliers, and payers. Kaiser uses its deep industry experience and analytical tools to synthesize this diverse set of insights and develop high-impact solutions.

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