

2023

Executive Summary



FOCUSED
ULTRASOUND
FOUNDATION

Advancements and Trends

2022 Data Analysis

New this year is an Executive Summary section where we highlight the major advancements in the field by topic area. If you are unable to review the entire document in detail, the next twenty or so pages should give you a good feel for what is going on at a high level. We are hopeful that these bite-sized nuggets of knowledge will spur your intellectual curiosity. When time is available, you will be able to do a deeper dive into the topics of particular interest to you.

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Indication Development Pipeline

7

New indications

3

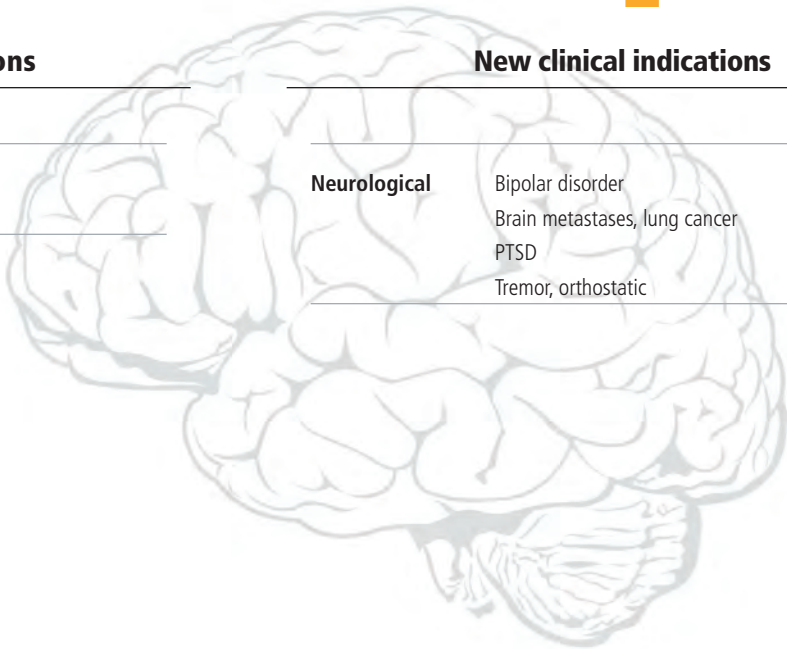
New preclinical indications

Gastrointestinal	Periodontal disease
Neurological	Autism Cerebral palsy

4

New clinical indications

Neurological	Bipolar disorder Brain metastases, lung cancer PTSD Tremor, orthostatic
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2022 advancements

We saw seven new indications added to the focused ultrasound landscape in 2022. Four of these indications were identified when we learned of the first-in-human clinical trials for bipolar disorder, brain metastases for lung cancer, post traumatic stress disorder, and orthostatic tremor. It should be noted that six of the seven new indications are in the neurological space. New indications at the preclinical stage of development for 2022 include autism, cerebral palsy, and periodontal disease.

For further details
[Chapter 2: Indication Development Pipeline](#)

Clinical Trials with New MOAs

No. of Trials	Biological Effect	Indication	Clinical Trial ID
1	Histotripsy		
	Alteration of tissue mechanics	Heart valve calcifications	NCT05235568
1	Hyperthermia		
	Radiosensitization	Bone metastases	NCT05167669
18	Nonthermal		
	Liquid biopsy	Glioblastoma	NCT05383872
	Neuromodulation	Anxiety	NCT05228964
		Bipolar disorder	NCT05228964
		Dementia	NCT05417555
		Depression	NCT05228964, NCT05301036, NCT05697172
		Essential tremor	NCT05475340
		Neuropathic pain	NCT05145426, NCT05303415, NCT05624762
		Obsessive-compulsive disorder	NCT05467085
		Parkinson's disease, dyskinesia	NCT04593875
		Parkinson's disease, tremor	NCT05475340
		PTSD	NCT05228964
	Radiosensitization	Melanoma	NCT05620290
	Sonodynamic therapy	Glioblastoma	NCT05362409
		Pontine glioma	NCT05123534
2	Nonthermal, BBB opening		
	Drug delivery	Alzheimer's disease	NCT05469009
	Drug delivery, Immunotherapeutic	Brain metastases, lung cancer	NCT05317858

New ways to treat disease

As evidenced by the data in the referenced chapter, most research being conducted around other mechanisms of action is still early-stage, and the clinical trials underway are generally first-in-human safety and feasibility studies. Note that thermal ablation tissue destruction is the only mechanism of action that currently has regulatory approval and is commercially available for 32 indications.

New in 2022, we learned of a group using focused ultrasound to address the blood-nerve barrier to deliver drugs to the spinal cord and particular cells within the peripheral nerves that are notoriously difficult targets for drug delivery.

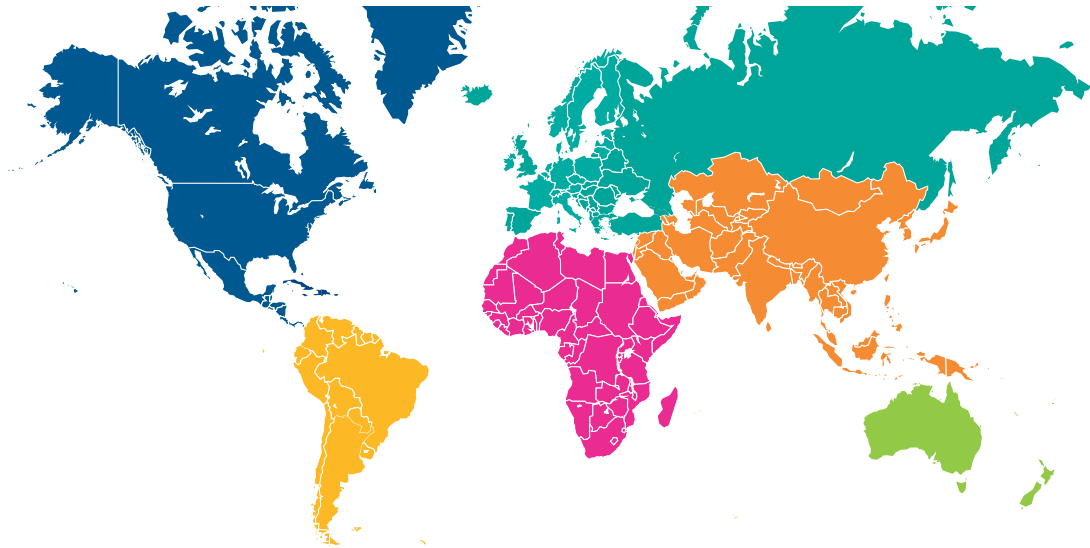
[For further details](#)
[Chapter 3: Mechanisms of Action](#)

Research Sites

21%

Increase over 2021 in clinical research sites

	Total	North America	Europe	Asia	South America	Oceania	Africa
Clinical research	293	85	104	99	–	5	–
Preclinical research	152	69	41	39	–	3	–
Mechanisms of action research	180	80	42	55	–	3	–
Technical research	151	61	49	39	–	2	–



Research and commercial sites expand globally

In 2022, the focused ultrasound field saw gains of 51 new clinical research sites worldwide. The greatest growth occurred in North America, with 25 additional new sites. The US became the top country in clinical research growth clocking in at 77 sites.

For further details
Chapter 4: Research Sites

Centers of Excellence

10

Centers of Excellence

2%

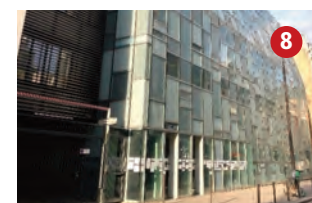
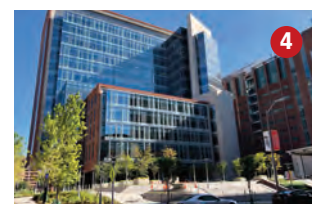
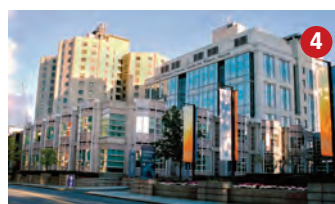
of the research sites worldwide are COEs

30%

of FUS publications came from COEs

Centers of Excellence

- 1 University of Virginia Health System
- 2 The Institute of Cancer Research and The Royal Marsden
- 3 Brigham and Women's Hospital
- 4 University of Maryland School of Medicine
- 5 Sunnybrook Health Sciences Centre
- 6 Stanford University School of Medicine
- 7 Inserm - LabTAU
- 8 Physics for Medicine Paris
- 9 Children's National Hospital
- 10 University Medical Center Utrecht



COEs lead the field

There are 10 Centers of Excellence (COEs) around the world. In 2022, the total number of publications by those 10 COEs was 202. Another way to say this is while only 2 percent of the focused ultrasound research sites are COEs, they contributed nearly a third of the scientific papers in 2022.

[For further details](#)
[Chapter 5: Centers of Excellence](#)

Awareness

677

FUS publications

Top three topics: radiology, engineering, and neurological science

FUS abstracts presented

72%

Increase at FUS meetings

108%

Increase at other symposia

518

Abstracts presented at FUS meetings

394

Abstracts presented at other symposia

Abstracts and publications gain a wider audience

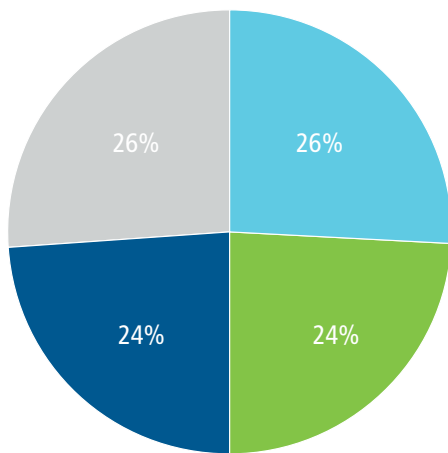
In 2022 we began tracking an additional 12 symposia that are associations or societies of medical professionals, where focused ultrasound technology is consistently beginning to see wider exposure and rising levels of interest from practicing clinicians. We view this as an encouraging trend and hope it will lead to an increase in patient access to the technology in future years.

[For further details](#)
[Chapter 6: Awareness](#)

Patient Treatments

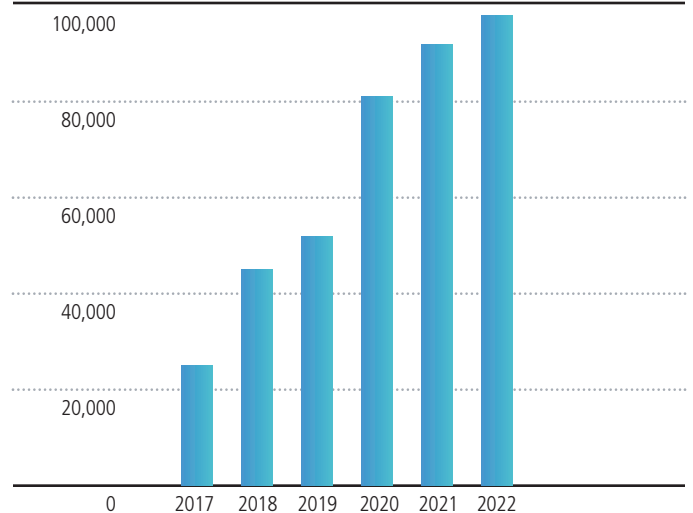
98,048

Treatments in 2022
565,210 cumulative treatments



2022 Indications treated

■ Uterine fibroids ■ Liver tumors
■ Pancreatic tumors ■ Other



Annual patient treatments

Commercial treatments center on cancer and women's health

Patient treatments increased in 2022 for both pancreatic and liver tumors. These two indications, combined with uterine fibroids, comprise nearly 75 percent of the total patient treatments last year.

[For further details](#)
[Chapter 7: Patient Access](#)

Commercial Treatment Sites

932

Sites

25%

North America

Annualized growth from 2013–2022

219 sites

4%

Europe

Annualized growth from 2013–2022

290 sites

12%

Asia

Annualized growth from 2013–2022

405 sites

4%

South America

Annualized growth from 2013–2022

7 sites

19%

Oceania

Annualized growth from 2013–2022

4 sites

15%

Africa

Annualized growth from 2013–2022

7 sites

Treatment sites grow with potential for further expansion

As of 2022 there are nearly 1,000 treatment sites worldwide, a mere 10 percent of the 10,000 potential treatment sites we estimate would exist if the global market were saturated.

[For further details](#)
[Chapter 7: Patient Access](#)

FUS Industry

104

Companies

17

Newly identified companies

10

Clinical device manufacturers

5

OEM

2

Microbubble

16

Companies with approved devices

3

North America

4

Europe

9

Asia

An expanding ecosystem

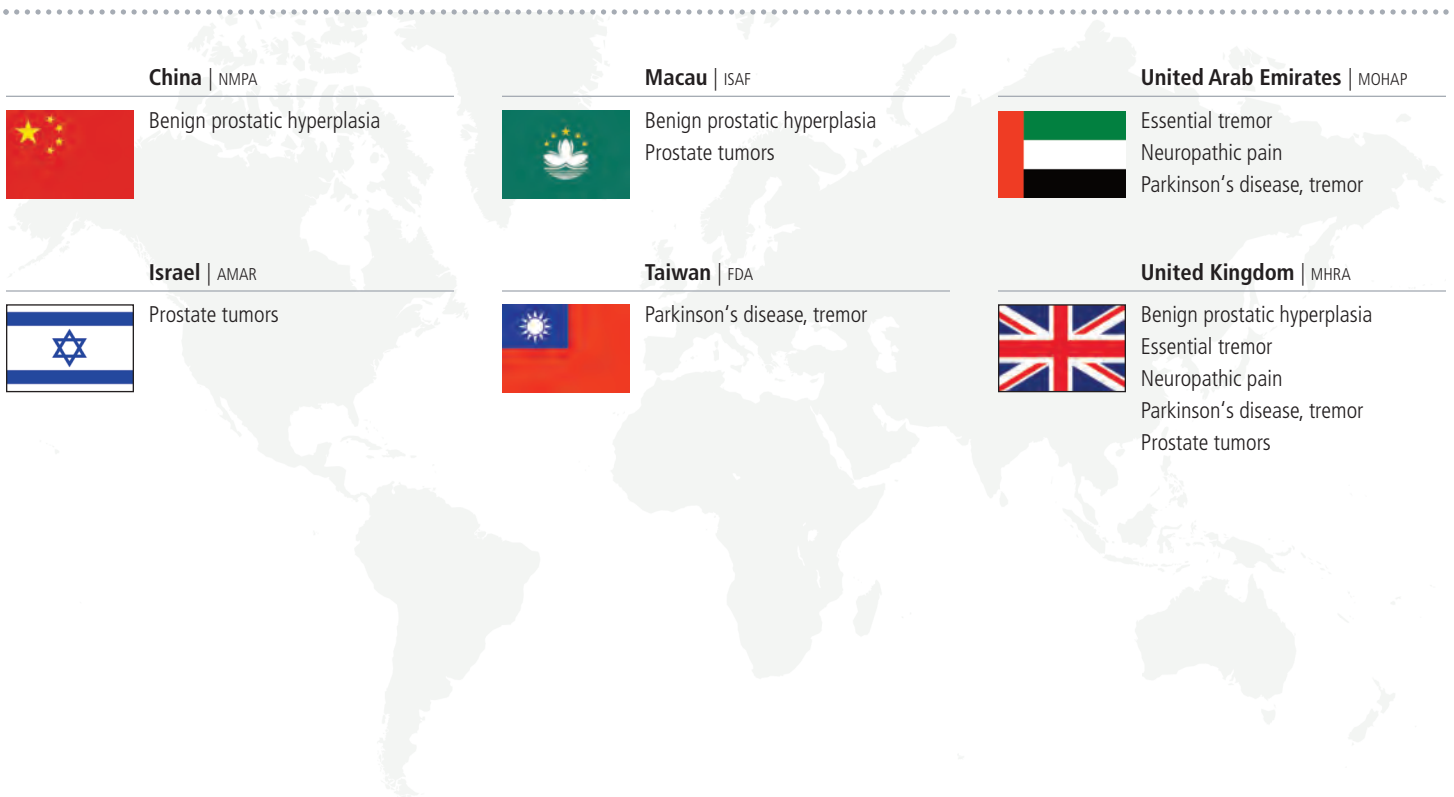
During 2022, 17 new focused ultrasound companies entered the ecosystem—ten manufacturers, five OEM, and two microbubble companies. We estimate the field employs approximately 3,000 individuals spread around the world. Just under half of the worldwide employee count is concentrated in the United States, Israel, and France. The median company size is 12 employees, and two thirds of the companies have 20 or fewer employees.

[For further details](#)
[Chapter 8: FUS industry](#)

Regulatory Approvals

13

New global regulatory approvals



Previously approved indications spread to additional countries

Last year 13 new regulatory approvals were granted by six regulatory bodies. Two new countries, Macau and the United Arab Emirates, became part of the focused ultrasound treatment community.

For further details

[Chapter 9: Regulatory Approvals](#)

Approved Device Manufacturers

32

Unique approved Indications

39

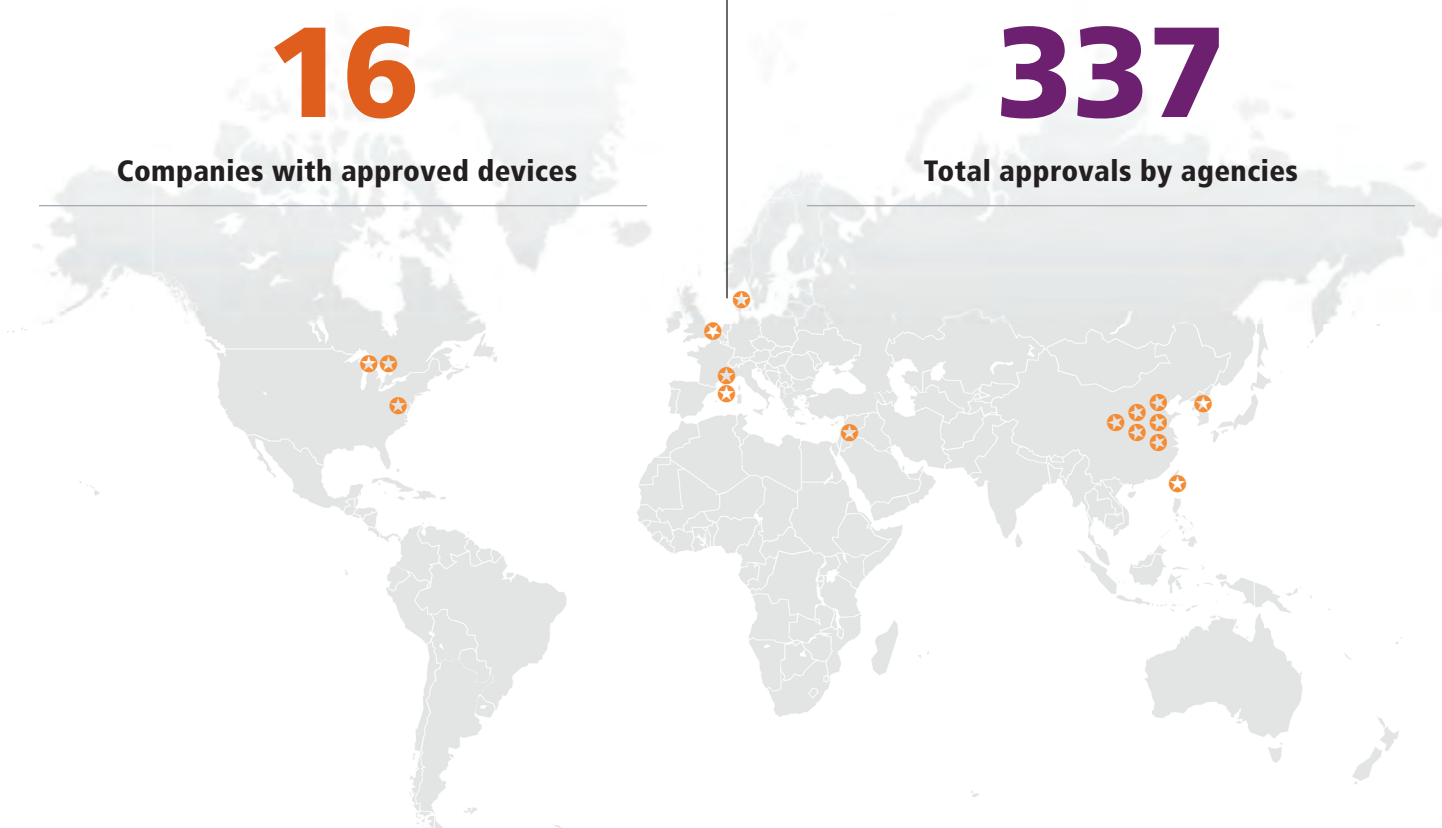
Regulatory agencies

16

Companies with approved devices

337

Total approvals by agencies



Commercialization

We are seeing increasing evidence that the field is transitioning from primarily a science-based research environment to commercialization with patient treatment spaces focused on marketing and sales.

[For further details](#)

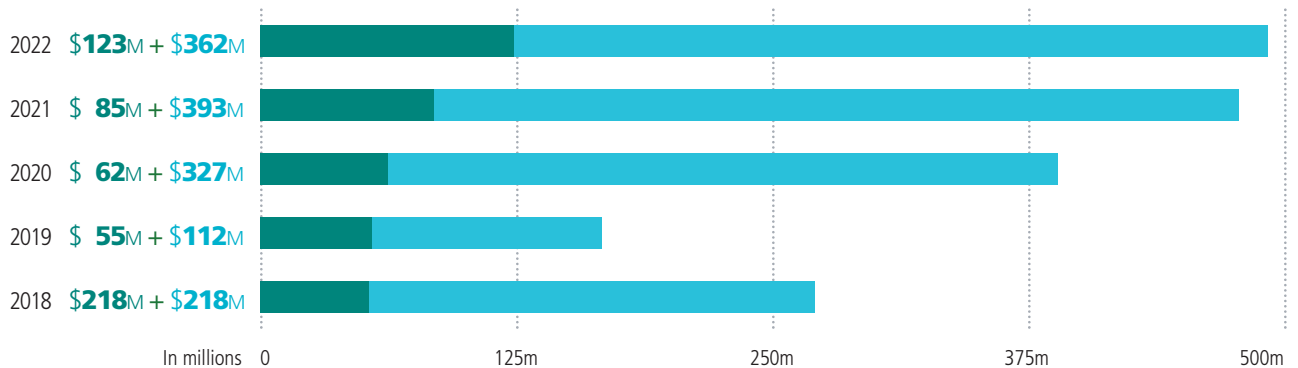
[Chapter 10: Commercial FUS Manufacturers](#)

★ Location of device manufacturers with regulatory approval

Investments

\$3.14^BIndustry investments
Cumulative\$362.3^MIndustry investments
in 2022\$122^MUS government investments
in 2022

FUS funding ■ US government grants ■ Industry investment



By the numbers

For the third year in a row more than 300 million dollars was invested in focused ultrasound industry companies bringing the total for those three years to more than one billion dollars. Additionally, 2022 was the first year that the US government invested more than one hundred million dollars in research funding.

Last year we saw the first investment in focused ultrasound from a pharmaceutical company. We also saw existing

investors in the ecosystem diversify with investments in additional companies—noteworthy investors include Johnson and Johnson Innovations, OrbiMed Advisors, and the Yongjin Group.

[For further details](#)
[Chapter 11: Financial Landscape](#)

Reimbursement

32

Indications with regulatory approvals
Worldwide

44%

have reimbursement
with varying levels in at least one country

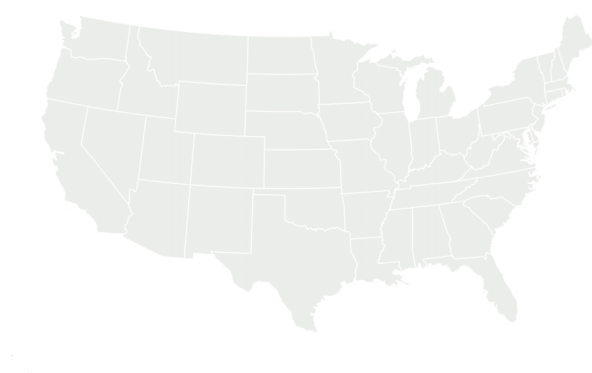


8

Indications with US FDA approvals

63%

have reimbursement
5 indications are insured in some US states



Breaking a barrier to treatment

Since very few patients can pay out-of-pocket for their medical care, reimbursement of medical procedures is a critical element of the healthcare ecosystem. Despite its importance, the process of medical reimbursement is not straightforward. As patients and physicians alike experience, reimbursement is a complicated system that involves a labyrinth of policies. What works in one country, or even region within a country, does not in others. In the coming years, the issue of reimbursement will become

more important as the field collectively moves the technology through clinical trials and regulatory approvals.

Reimbursement is critical to patient access and to driving further investment in the field as early-stage investors need to know there is a profitable road map.

For further details
Chapter 12: Reimbursement

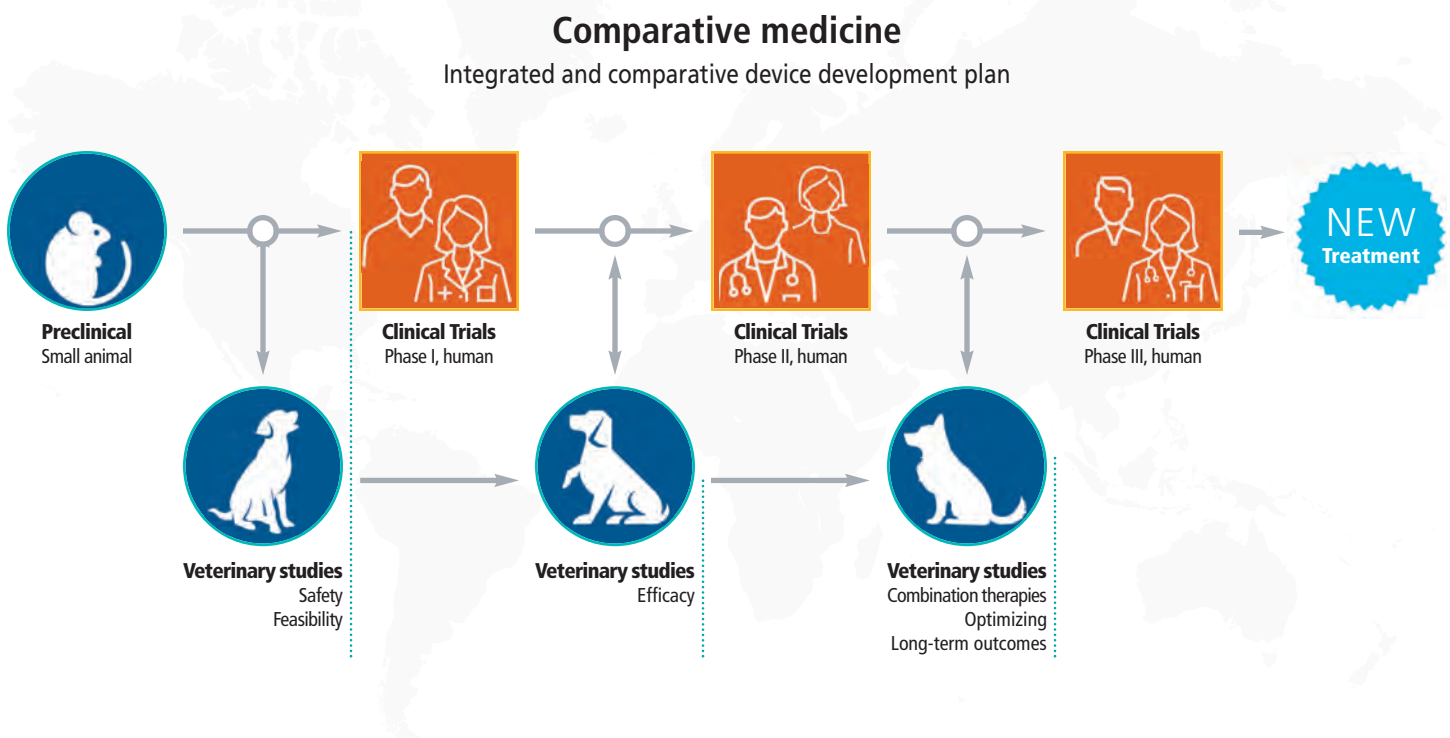
Veterinary Program

67%

Sites growth rate
from 2021 to 2022

14

Indications studied in clinical trials
Active or completed trials



Research and growth in treating companion animals

Veterinary medicine offers researchers a unique opportunity to expand their research and introduce commercial focused ultrasound applications into a market with reduced regulatory burdens, while also collecting data in naturally occurring disease models to support human clinical trials.

For further details
Chapter 13: Veterinary Medicine