Dogs can "smell" cancer

In 1989, the journal **Lancet** reported a case study where a woman was diagnosed with early-stage skin cancer because her dog kept sniffing at a mole.

Reference: Williams H, Pembroke A. Sniffer dogs in the melanoma clinic? Lancet 1989

breathonix

Overview

- At Breathonix, our mission is to develop disruptive, ultrasensitive breathalyzer for detecting diseases that are otherwise hard to diagnose.

- With Breathonix breath test, results are available within 60 seconds on site.

- Breathonix has successfully detected COVID-19, early-stage lung cancer patients, as well as tuberculosis patients in breath.

- Several clinical trials are in pipeline to broaden test menu and expand to global markets.

Key Highlights

Technology developed by 6+ years of research in National University of Singapore

Platform technology that can adapt to a range of diseases, i.e. Lung cancer, tuberculosis, NPC etc.

MedTech Sector Winner (out of 2400 startups) of Slingshot 2019 competition

Backed by NUS Enterprise and Antler

Clinical Trials:
Ongoing COVID-19 clinical trials with NCID,CAG and Partner in UAE
Clinical trial pipelines for other diseases

INDUSTRY
Healthcare; Diagnostic and Medical Laboratories; Medical Devices

MARKET SIZE
USD 55B

TARGET CUSTOMERS
Airlines; Checkpoints;
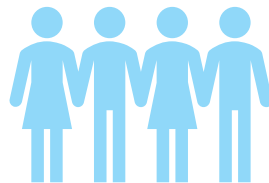Hospitals and screening centers

USE CASES
Mass Screening; Annual Screening; Disease diagnostics and management

1

Technology and Product

Technology

Breathonix technology allows the total turnaround time from breath collection to diagnostic results to be **less than 1 minute**
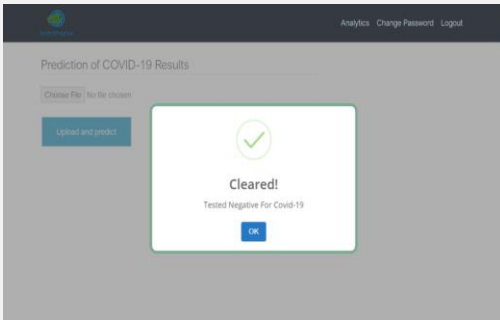
Initial Clinical Trials for **Covid-19** and **Lung Cancer** detection have shown promising results of **more than 90% and 80% accuracy** respectively
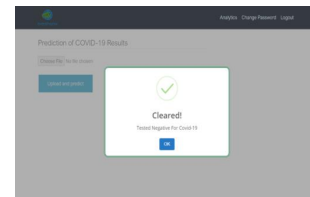
Software with proprietary algorithm and secure API.

Current Breath VOC Testing System

V1

Business Model for Current System:

Breathonix provide the software to customers as a service and charge on a per-test basis.

60-second Breath Test Station
1. Mass spec
2. Breathonix breath sampler
3. Breathonix software

Measures to prevent cross-infection:
- Disposable one-way mouthpiece
- Disposable face shield
- Disposable sampling tubing
- Inside system>70°C
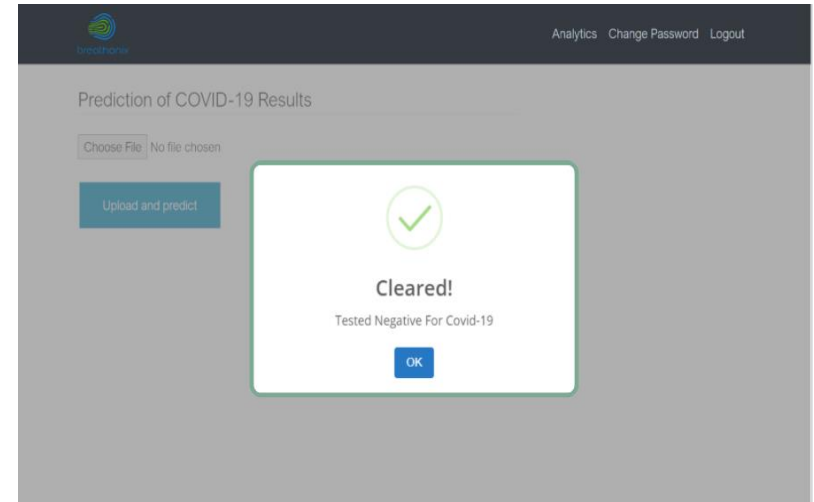
Better User Experience

One Simple Exhalation with one-way disposable mouthpiece

Breathing into breath bag for remote sampling

Quick turn-around

Breath VOC Testing Products

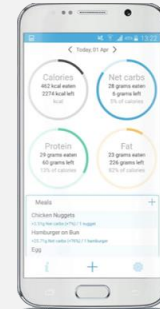Developing next generations of integrated breathalyzer solutions

V1

Current Mass Spectrometer
- 1 minute breath test station
- Platform technology that can be adapted for a range of diseases
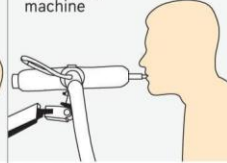
V2

Portable breath test sensors for point-of-care and home use
- R&D in progress
- Collaborating with NUS sensor technologies for breath VOC testing

Competitive Analysis (Covid-19)

	Polymerase chain reaction test	Antigen rapid test	Breath test
How people are tested	A swab is either inserted all the way to the back of each nostril, or midway up each nostril and to the back of the throat, and twirled	A swab is inserted around 2.5cm up each nostril and twirled	A person breathes into a tube that is connected to a specialised machine
What it detects	Genetic sequences of Covid-19	Proteins on the surface of the virus called antigens	Particles known as volatile organic compounds, produced by biochemical reactions in human cells
How soon people can get their results	A few days	Around 15 to 30 minutes	One minute or less
How specific and sensitive the test is*	Sensitivity rate: >93% Specificity rate: >95%	Sensitivity rate: 82% Specificity rate: 99%	Sensitivity rate: 93% Specificity rate: 95%
How much it costs**	Up to $200	Unknown; still undergoing trials	Estimated at around $27
What it is used for	Clinical confirmation of someone's Covid-19 status	Pre-event rapid testing before being admitted to mass events, or on board cruises to nowhere	Intended for use at high-traffic-flow places such as airports
Status	The "gold standard" of testing and the default test used here	Currently being used for pilot programmes in pre-event testing	Clinical trial ongoing at NCID; plans to have more tests in public places

NOTE: *Sensitivity is the test's ability to identify those infected as positive, while specificity is the ability to identify those not infected as negative. The rates here are estimates and may differ between different test brands.
**These are rough estimates. Costs are in SGD and differ based on factors such as logistics, manpower and economies of scale.
Sources: BREATHONIX, MOH   STRAITS TIMES GRAPHICS

Source: Straits Times

Competitive Analysis (Breath Test)

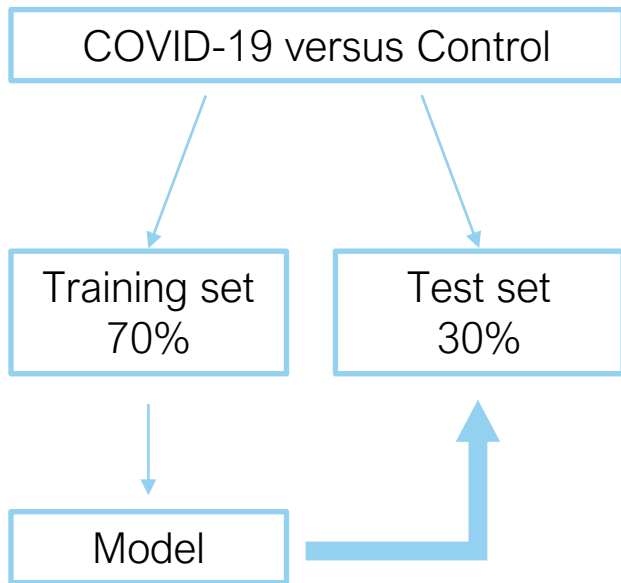|	breathonix	OWLSTONE MEDICAL	MENSSANA RESEARCH, INC.	Breath Diagnostics	Breathomix
Turn around time for one test	< 1 min	20-30 mins	20-30 mins	20-30 mins	10-20 mins
VOC identification	✓	✓	✓	✓	✗
VOC quantification	✓	✓	✓	✓	✗
Full spectrum VOC detection	✓	✗	✗	✗	no quantification
Rigorous clinical study design	✓	not published	✓	✗	not published

2

COVID-19 Clinical Trial Result

In Collaboration with NCID, Singapore

Clinical PI: Dr. Shawn Vasoo (Clinical Director of NCID)

COVID-19 Clinical Trial Initial Data (NCID)

```
┌─────────────────────────────────┐
│     COVID-19 versus Control     │
└─────────────────────────────────┘
         ↓              ↓
┌──────────────┐  ┌──────────────┐
│ Training set │  │   Test set   │
│     70%      │  │     30%      │
└──────────────┘  └──────────────┘
         ↓              ↑
┌──────────────┐       │
│    Model     │───────┘
└──────────────┘
```

Statistics	Training Set	Test Set
Accuracy	98.4%	94.5%
Sensitivity	93.9%	93.3%
Specificity	100.0%	95.0%
PPV	100.0%	87.5%
NPV	97.9%	97.4%
TP	31	14
TN	92	38
FN	2	1
FP	0	2

Breathonix proprietary software built based on machine learning algorithm

3

Breath Testing Platform Beyond COVID-19

Problem 1: Late Diagnosis of Lung Cancer

2 million new lung cancer patients, **1.8 million** deaths per year

IF DETECTED AT

Stage I

Stage IV

OUT OF 100

80

5

Will survive Lung cancer
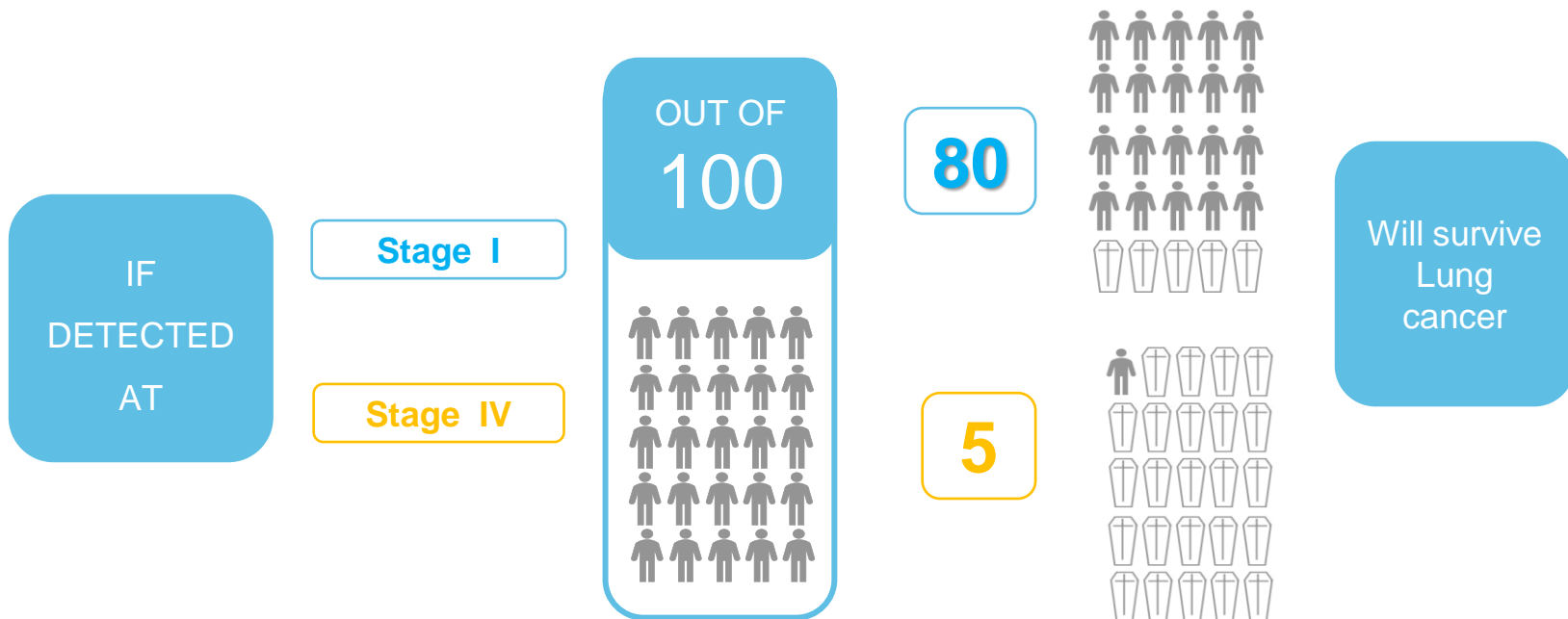
Reference: The National Lung Screening Trial Research Team, "Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening," *N. Engl. J. Med.*, vol. 365, no. 5, pp. 395–409, Aug. 2011

Market Size

1.4 Billion China population

100 Million Annual Screening

USD 3 Billion

7.5%*

$30/test

300 Million US population

22.5 Million Annual Screening

UDS 675 Million

7.5%

$30/test
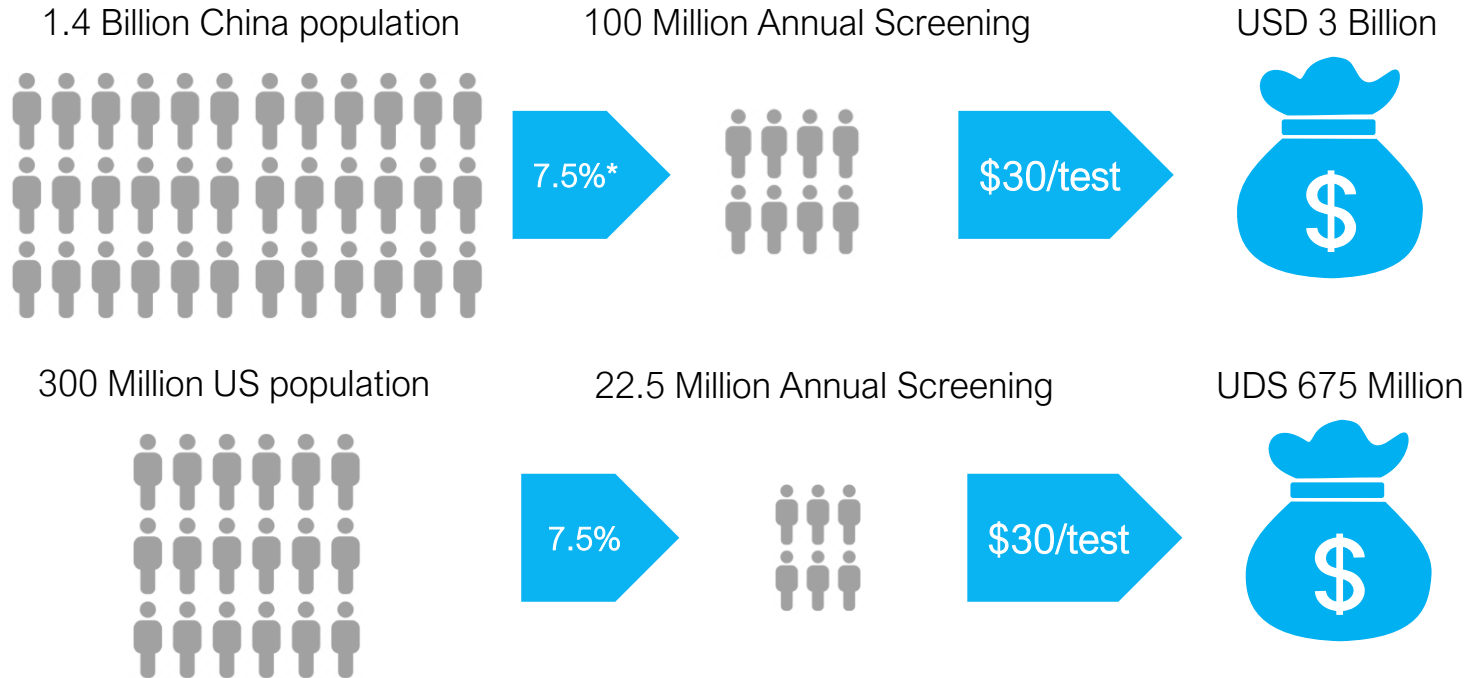
Source: Target% by U.S. Department of Health and Human Services
https://health.gov/healthypeople/objectives-and-data/browse-objectives/cancer/increase-proportion-adults-who-get-screened-lung-cancer-c-03

Pilot Clinical Results for Lung Cancer and TB

In our clinical study, we've successfully differentiated lung cancer patients and the control group. We also managed to identify the TB patients who had been misdiagnosed as lung cancer

Sensitivity 79%, specificity 81% (Sample size 80)
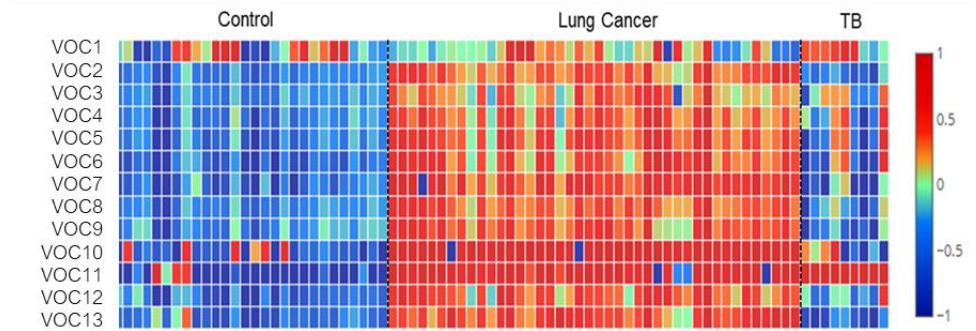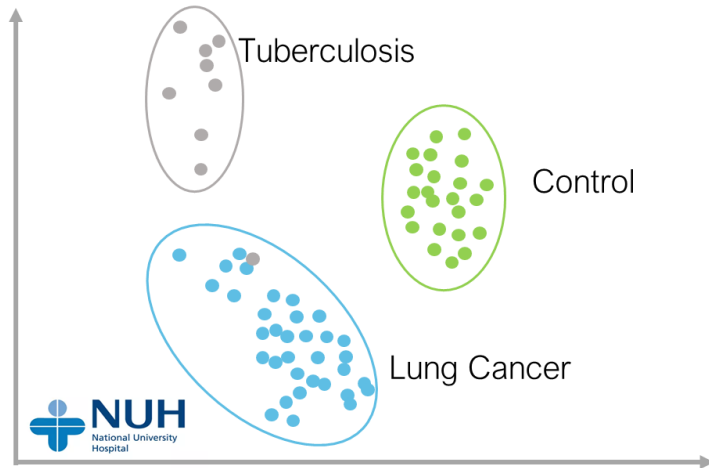
Problem 2: High Incidence of NPC in Asia

Nasopharyngeal carcinoma (NPC) is one of the most common cancers in areas of Asia, especially in Southern China. The incidence of Southeast Asia was 6.4 per 100,000 for males and 2.0 per 100,000 for females, which is the highest in the world.
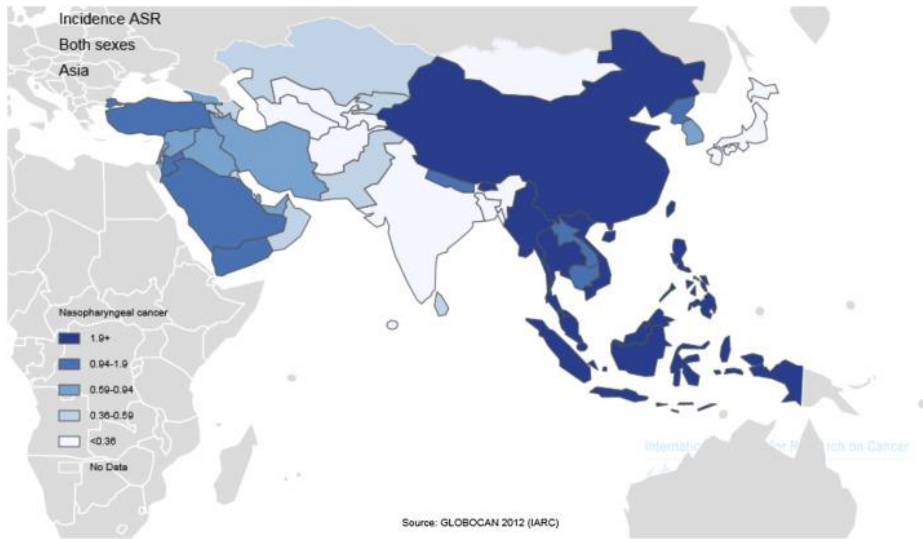

Incidence ASR
Both sexes
Asia

Nasopharyngeal cancer
- 1.9+
- 0.94-1.9
- 0.59-0.94
- 0.36-0.59
- <0.36
- No Data

Source: GLOBOCAN 2012 (IARC)

- No early detection technique available for NPC

- Breathonix has partnered with ENT (Ear Nose Throat) specialists in Tan Tock Seng Hospital to conduct a clinical trial on Breathonix breath test solution.

- Team has obtained IRB approval.

Reference: Chang ET, Adami HO. The enigmatic epidemiology of nasopharyngeal carcinoma. Cancer Epidemiology Biomarkers Prev. 2006;15:1765–77.

Founding Team

Dr Jia Zhunan (Co-Founder & CEO)
- Ph.D in breath analysis for early detection of lung cancer, NUS
- 6 years of R&D experience in Breathomics
- Author of 3 peer-reviewed papers
- Inventor of 2 patents

Prof T Venkatesan (Co-Founder & Advisor)
- Former director of NUS Nanoscience and Nanotechnology Institute
- Highly cited scientist, h-index 110
- Founder of 6 deep-tech start-ups

Du Fang (Co-founder & COO)
- M.Sc. in Electrical Engineering, NUS
- 6 years in Sales and Business development

Wayne Wee (Co-founder & BDM)
- B.Eng. in Mech Engineering (Honors), NUS
- Entrepreneurship studies, SCDP in Stanford University
- 1-year startup experience in Silicon Valley

Advisors

Prof Freddy Boey
- NUS Deputy President (I&E)
- Filed 118 patents, and founded several medtech spin-offs
- His customizable hernia mesh has received US and China FDA approvals, with US-China funding

Dr Christina Tong (Regulatory)
- Senior Consultant, NUS Enterprise Industry liaison office (ILO)
- Previously Group Director of Health Sciences Authority (HSA) Singapore
- 15 years Venture Capital experience with Vertex Management

Ajeesh Ashraf (Commercial)
- Senior Manager at Johnson & Johnson
- 16 years experience in Medical Device Strategy, Commercial Education & Strategic Account Management

Dr Amit Jain (Clinical Trials)
- Oncology consultant at National Cancer Centre of Singapore (NCCS)
- Specialises on Lung cancer

Traction

- Ongoing COVID-19 pilot trials in Dubai
- Ongoing COVID-19 clinical trial in Singapore Changi Airport
- Ongoing COVID-19 clinical trials with Singapore National Center of Infectious Disease
- Invited to presentation to Temasek Holdings Mdm Ho Ching
- Hosted visit of Singapore Minister of Transport Mr Ong Ye Kung in Breathonix's office
- Presented to Singapore Minister of Education Lawrence Wong
- MedTech Sector Winner (out of 2400 startups) of Slingshot 2019 competition
- Selected into JUMPStart MedTech program
- Backed by NUS Enterprise and Antler
- Featured in Global News Media

Ong Ye Kung is with NUS Enterprise and 2 others.
October 21 at 7:04 PM ·

This is a breathalyser test for COVID-19. It is being developed by an NUS start-up, aptly named "breathonix".

The test works by detecting Volatile Organic Compounds (VOCs) present in a person's exhaled breath. Test results are delivered in less than 60 seconds.

Testing is key to reopening economies. Scientists and researchers all over the world are racing against time. Airports, especially, will find such speedy test means to be useful as they embark on reopening international borders.

Glad I was tested negative for COVID-19, even though it was just a prototype!

You, Noel Wong, Ng You Qian and 5.5K others   172 Comments 1.7K Shares

Investment Opportunity

FUNDING GOAL
USD 5 million

Expense Breakdown (Year 1)

- Ordinary & Necessary Expenses
- Manpower 19%
- R&D Assets 17%
- R&D 25%
- Clinical Trials & Regulatory Preparation 29%
- IP 5%
- Regulatory Approval 1%
- Ordinary & Necessary Expenses 4%

Investment Opportunity
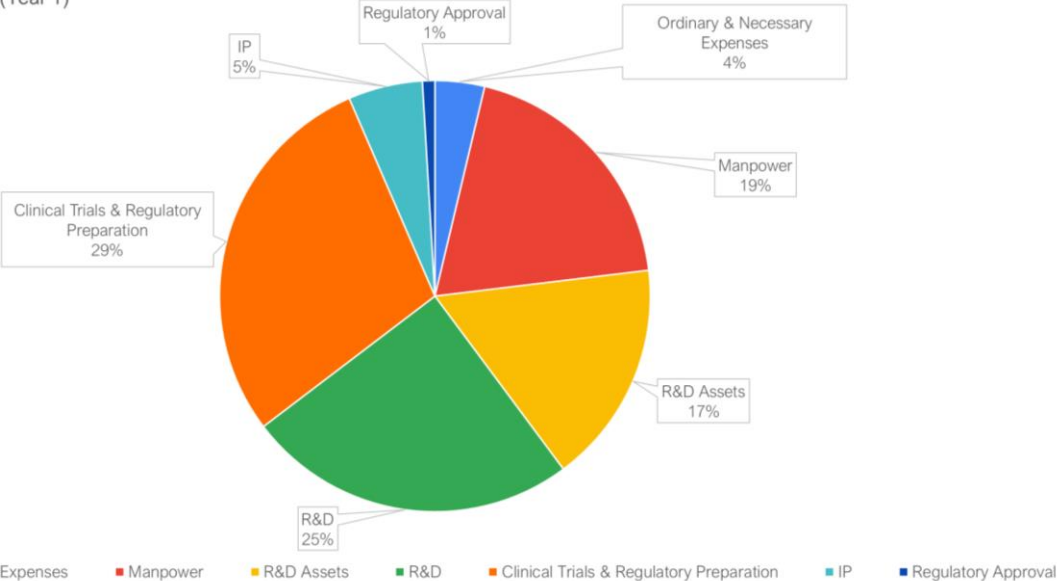
FUNDING GOAL
USD 5 million

Your support will allow us to:

- Provide additional runway of 12 months
- Secure capital equipment necessary for clinical trials and R&D
- Clinical trials for Covid-19 and other fatal diseases
- Commercialization and deployment for Covid-19 mass screening tests
- Develop our commercial and expand our R&D team
- Implement IP Strategy

breathonix

Diagnostics Reimagined

Email: wayne@breathonix.com   Website: http://breathonix.com