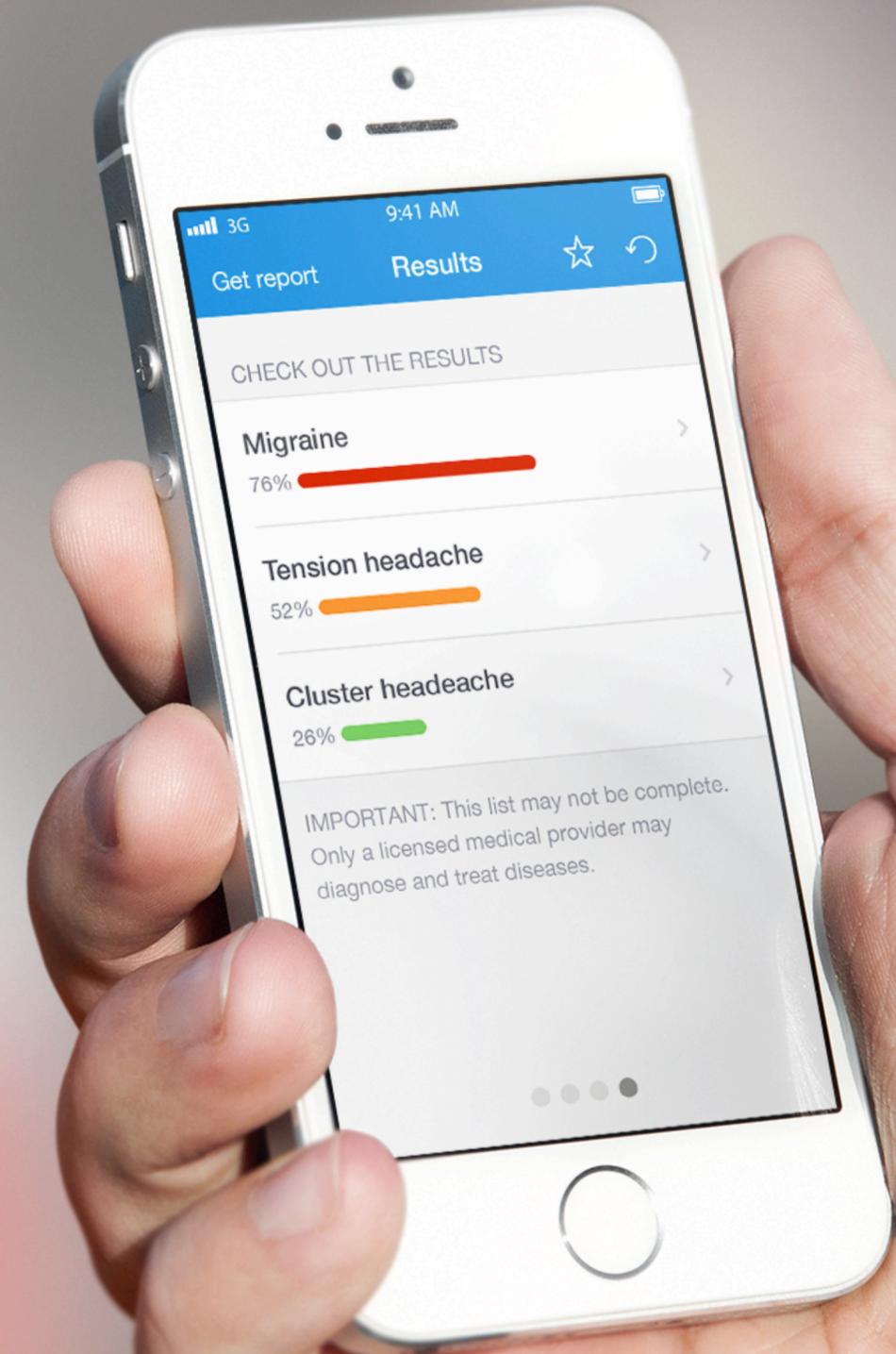


Empowering Healthcare Companies  
with Artificial Intelligence

 **Infermedica**

# Introduction

We are on a mission to create the most advanced reasoning technology for **preliminary medical diagnosis**, for use by patients and healthcare professionals.



# Problem

3 in 4

U.S. adults use Internet for health information

77%

of online seekers begin at a search engine<sup>1</sup>

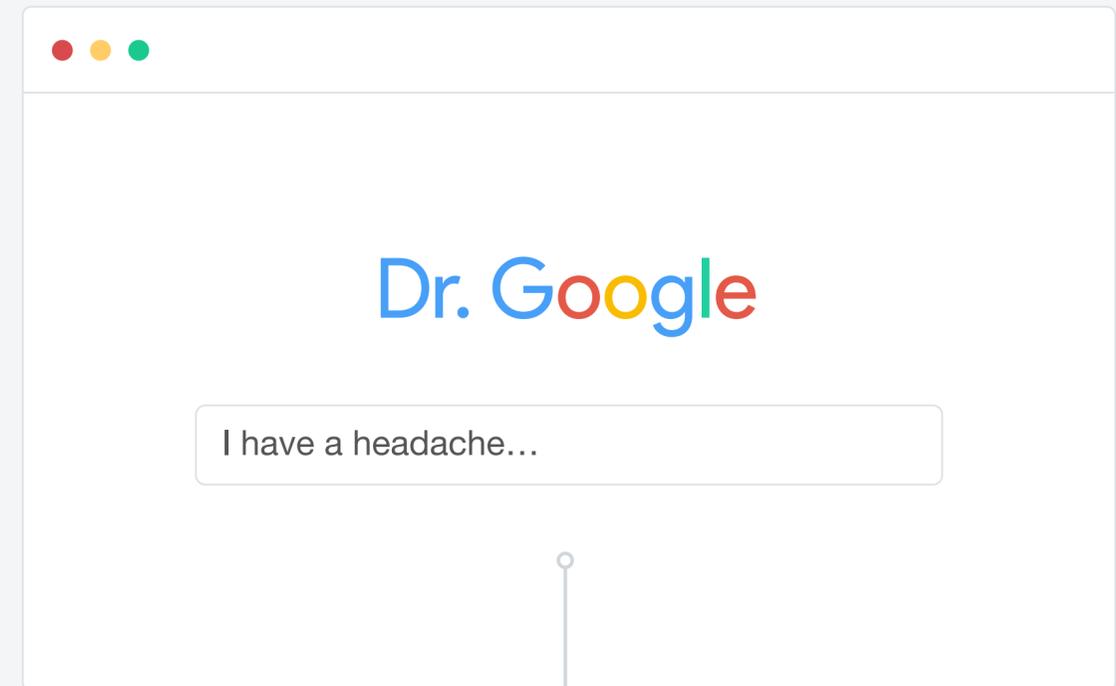
\$38B

in wasteful spending due to ED overuse<sup>2</sup>

56%

of all ED visits are avoidable<sup>3</sup>

1 – Pew Research Center's Internet & American Life Project, Health Online 2013; 2 – NEHI Research Brief. (2010). A matter of urgency: reducing emergency department overuse. New England Healthcare Institute; 3 – Weirick R, Billings J, Thorpe J. (2003) Ambulatory Care Sensitive Emergency Department Visits: A National Perspective.



Misinformed decisions  
Unnecessary appointments  
Over-triage

# How we started

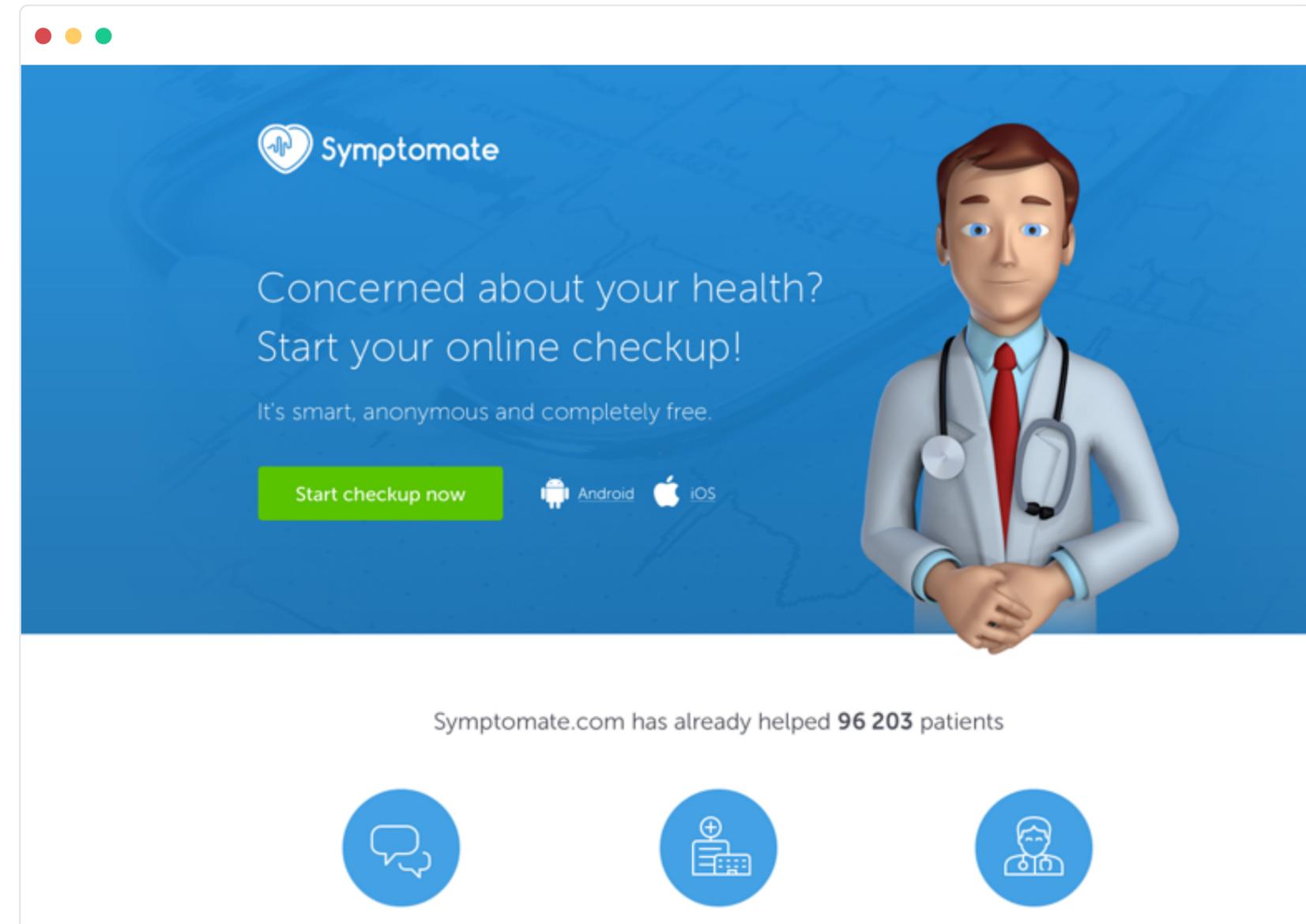
Symptomate

Used to obtain preliminary information regarding potential conditions. Provided over 2M health checkups. One of the top ranked symptom checkers in Google Play.



**Mindy Lewis**  
(Google Play Reviews)

Could have saved life! App diagnosed an extremely rare neuro disorder for other half. Worried, we went to the hospital - turns out it was correct!



# Interview completion rate shows high patient engagement



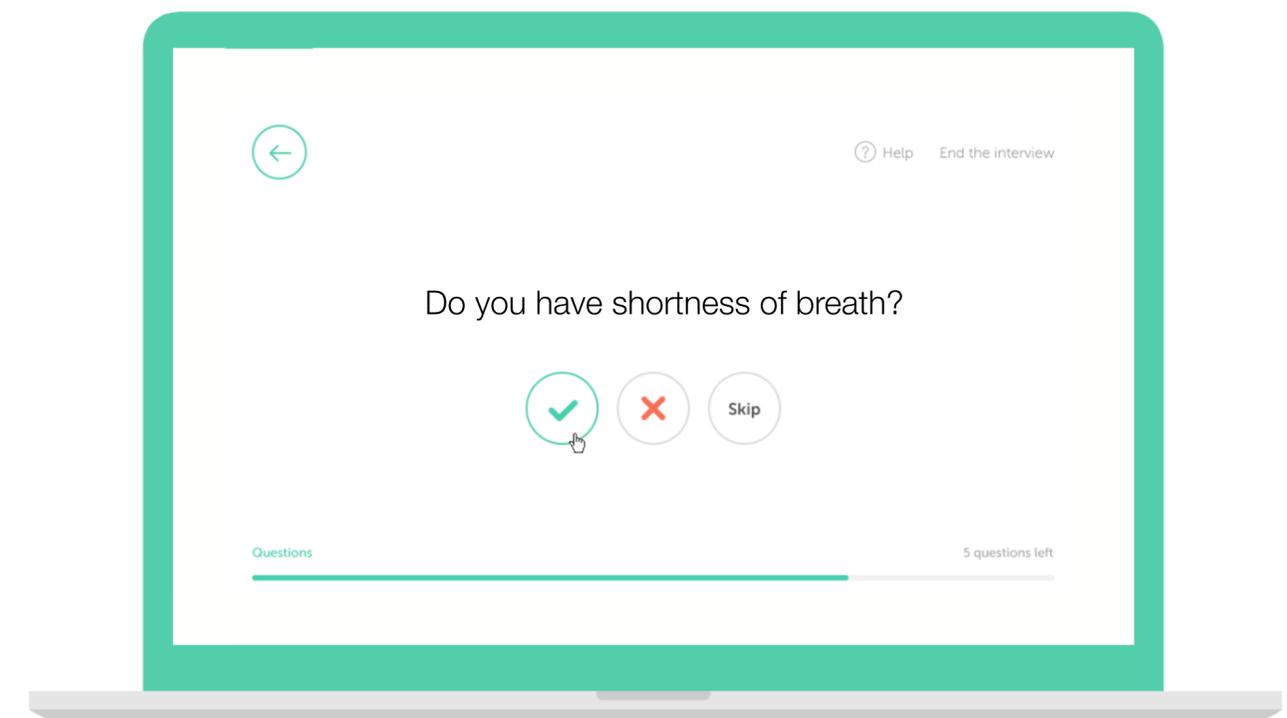
Number of patients starting the process

Patients receiving final recommendations

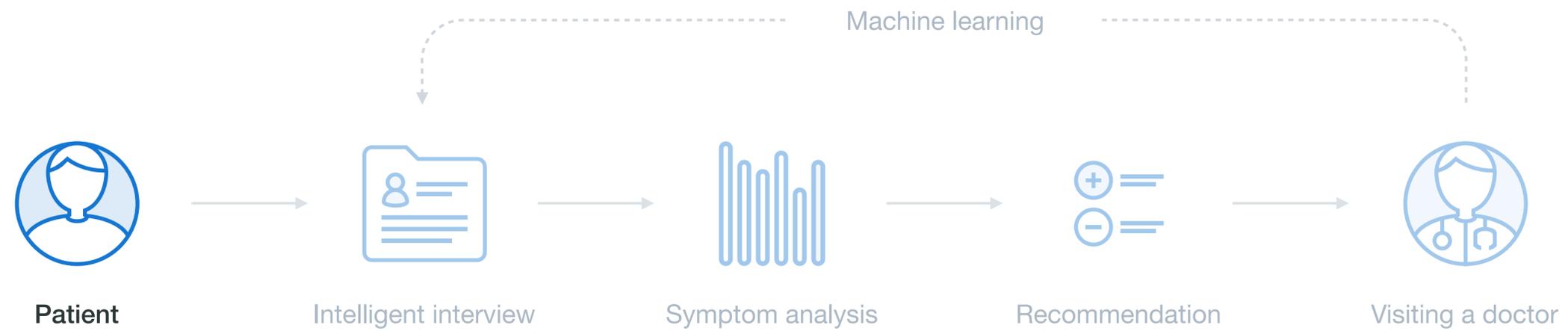
# Solution

In order to help patients make best decisions regarding their symptoms, we have developed a state-of-the-art **AI diagnostic technology** designed to:

- Ask intuitive questions – like a real doctor does.
- Accurately pre-diagnose and triage.
- Connect patients to appropriate services.
- Provide doctors with information prior to the visit.

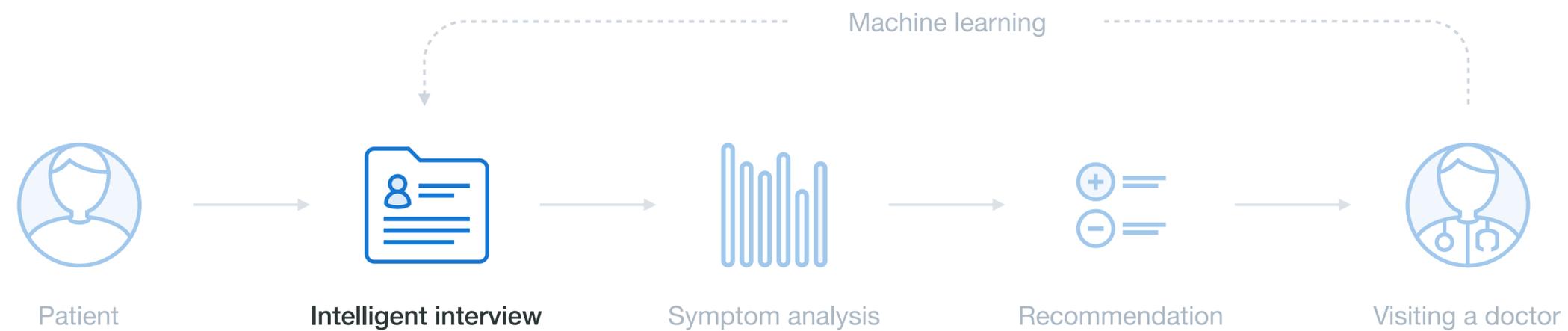


# How does it work?



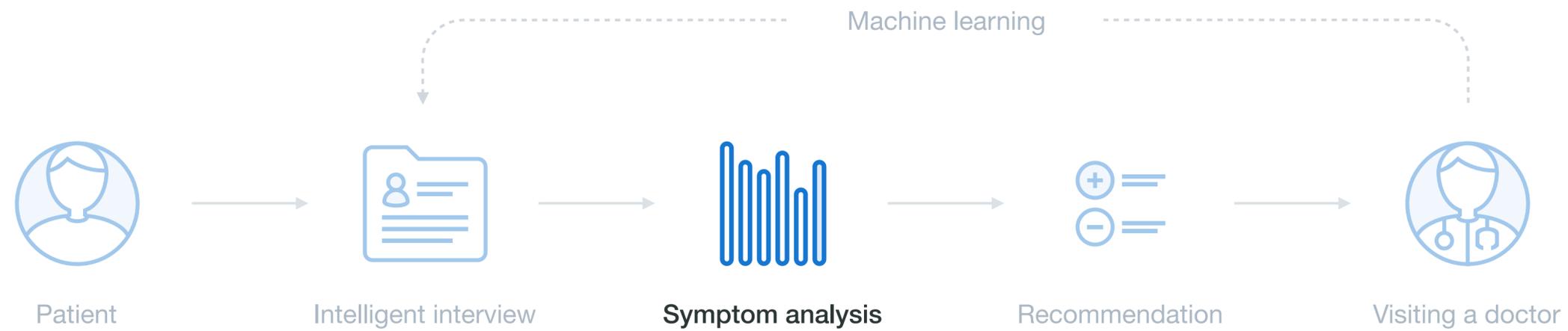
A patient seeks health information online and uses an intelligent symptom checker provided by Infermedica. Available user interfaces include a chat-bot, mobile app, web-based patient portal or a voice-enabled app.

# How does it work?



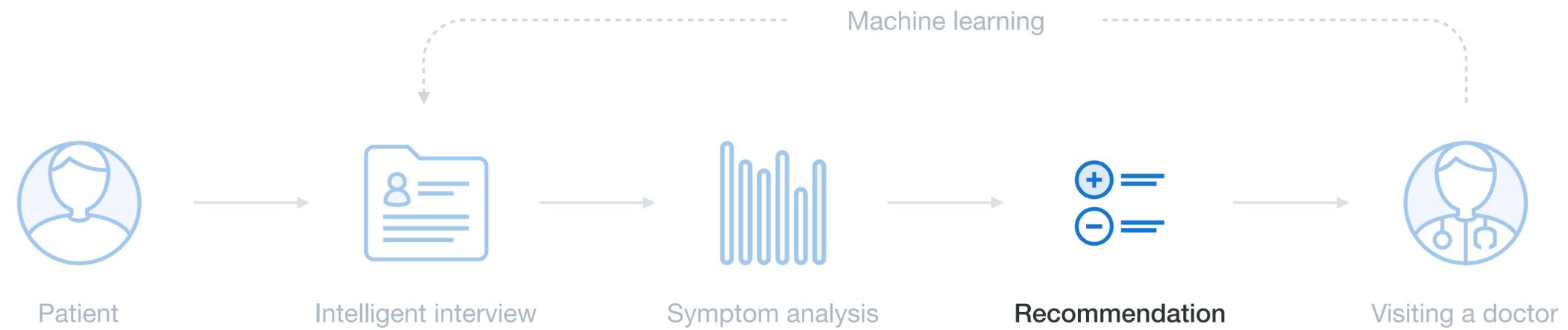
We collect patient intake using Infermedica's probabilistic inference engine. We only **ask relevant questions** and the algorithm can change the diagnostic hypothesis dynamically if new evidence suggests a better fit - just like a real doctor does.

# How does it work?



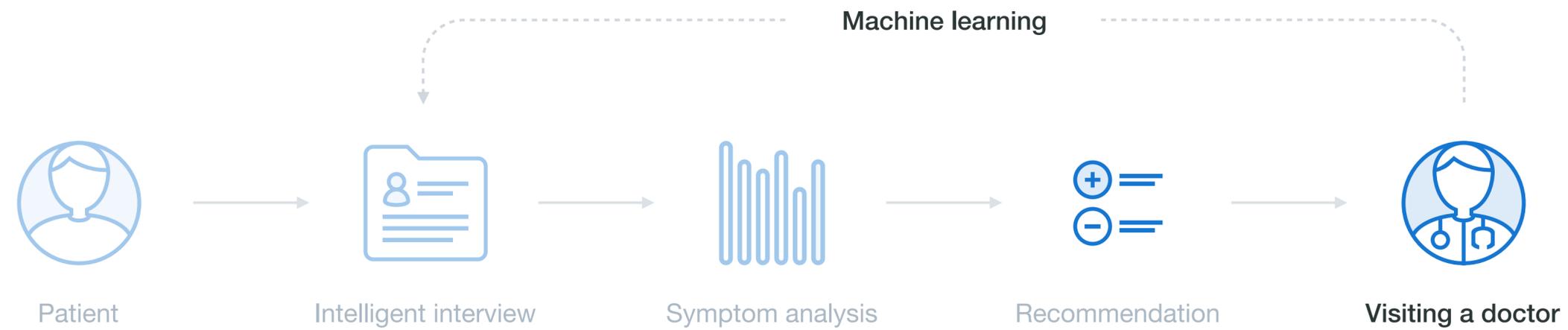
Given patient's demographics, symptoms, risk factors and lab test results Infermedica **recommends a level of medical urgency** by verifying severity of the reported symptoms and their likely causes.

# How does it work?



Based on the collected patient information a recommendation algorithm **suggests the most suitable action** to take such as visiting or calling a doctor, self-care treatment or going to an Emergency Department in case of highly severe symptoms.

# How does it work?



The patient receives the most suitable care and the preliminary intake is made available to the clinical staff. Physicians's feedback is collected to further enhance the diagnostic algorithms with machine learning.

# Value proposition



## Patient

- **Fast and reliable** health assessment.
- **Tailored recommendations** of suitable actions to take.
- **Highly engaging** and interactive interview process.



## Provider / Teleconsultant

- **Preliminary intake**, less data entry.
- **Convenient information** about the reason for a visit.
- **Higher efficiency** of a visit, more time to interact with a patient.
- **Interactive decision support** to help make the best diagnosis.



## Organization

- Saves money by **preventing unnecessary visits** and recommending alternative services.
- Minimizes **over and undertriage**.
- **Optimizes clinical workflows** through automatically collected intake.
- **Collects structured information** about the customers.

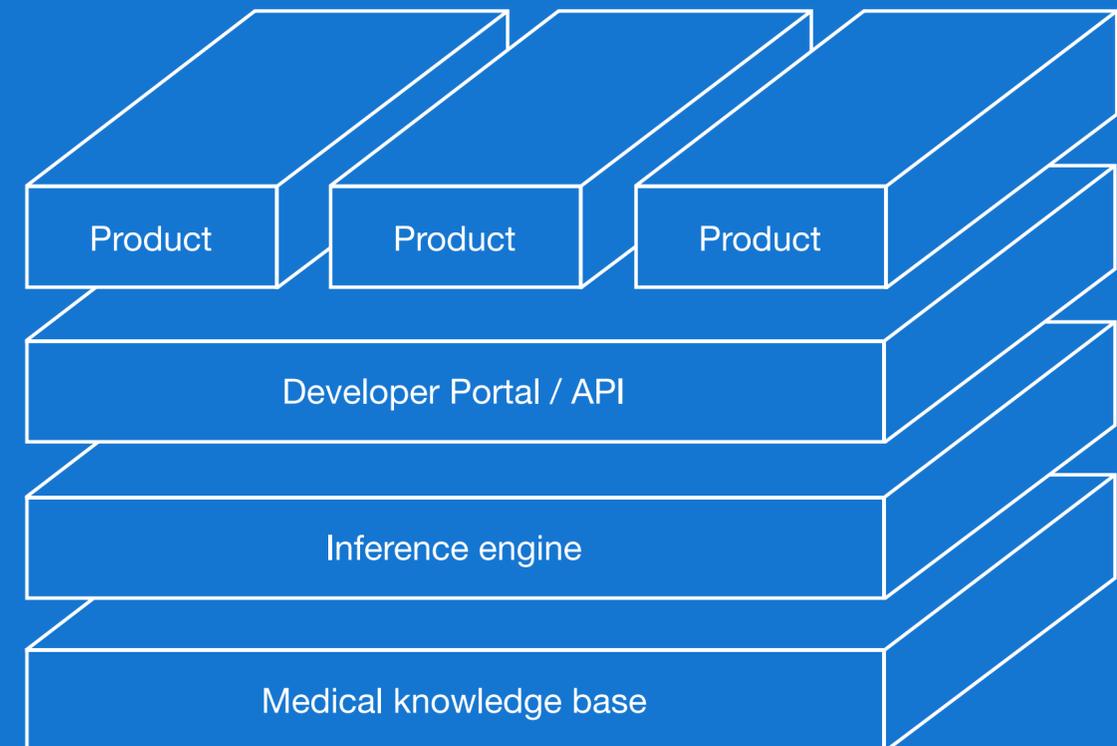
# Technology

## Inference engine

Designed to resemble reasoning of **expert level human diagnosticians**.  
Unique data modeling approach and unmatched query response time suitable for **real time applications**.

## Medical knowledge base

Meticulously assembled by our team of doctors and data extraction algorithms.  
Currently includes over **800** conditions, **1,500** symptoms and **550** lab tests.



# How does it learn?



## Expert knowledge

The foundation of the medical knowledge base is maintained and curated by our medical board of experts.



## Machine learning

Anonymized patient data including doctor findings are processed via machine learning to enrich the medical knowledge base.



## Medical knowledge base

Infermedica's medical knowledge is stored in a proprietary database of probabilistic relationships between various diagnostic variables such as conditions and symptoms.

# How does it learn?



## Expert knowledge

- Over **10,000** hours of physician review
- Respected literature and publications



## Machine learning

- Clinical notes from **1.2M** patients
- **400K** structured patient visits
- **2M+** symptom checker queries
- Doctor-verified feedback loop



## Medical knowledge base

- **1500** symptoms
- **550** lab tests
- **110** risk factors
- **800** conditions
- **20,000+** relations between them

# How do we validate it?

## Assembling clinical cases

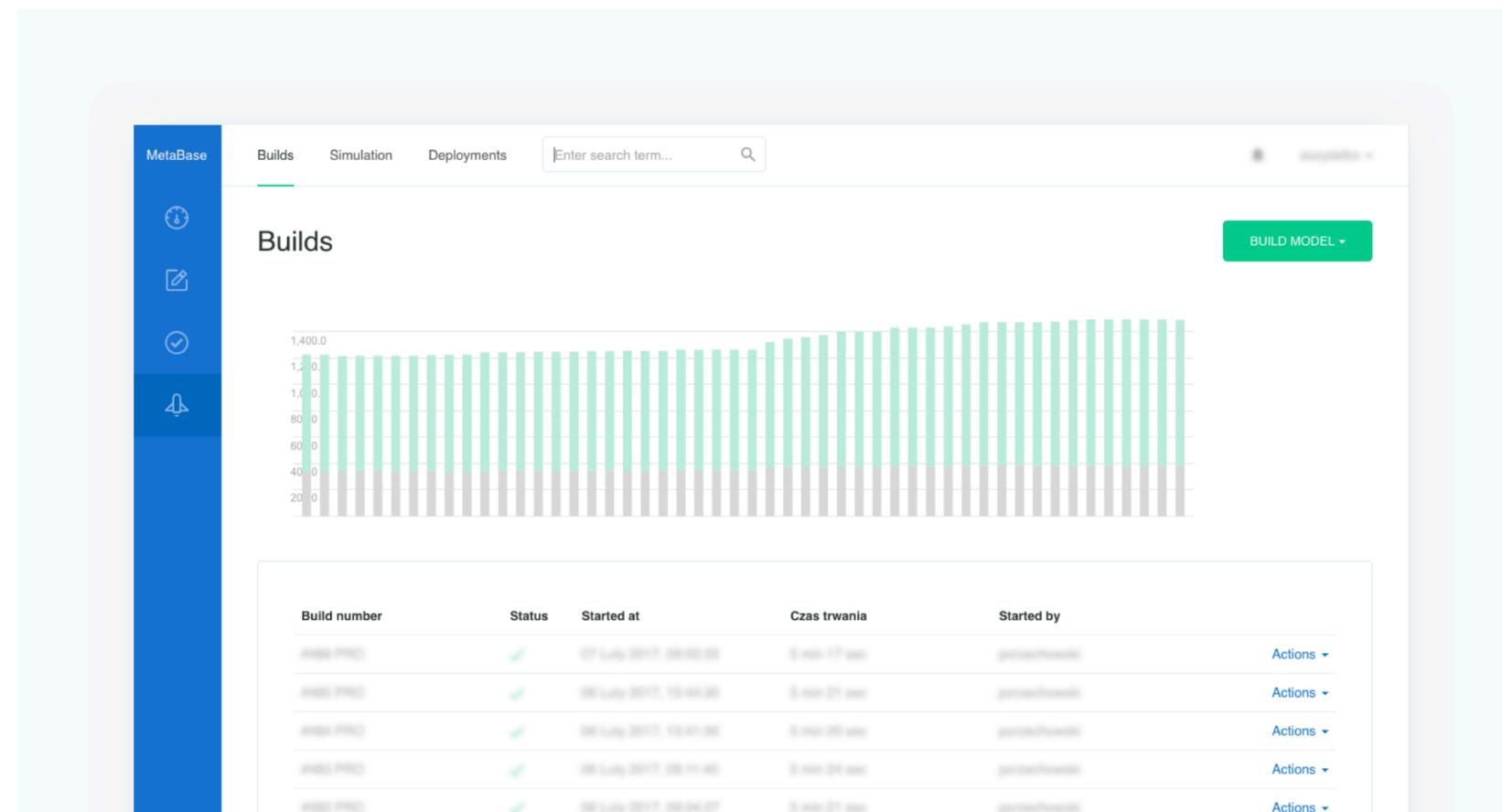
Several thousand real patient clinical cases collected from reputable and well-known sources (BMJ, NEJM, JAMA, Mayo Clinic).

## Testing methodology

We send the cases to Infermedica's engine to check if the expected condition is ranked in the top of the differential diagnosis ranking,

## Regression

After each change of the knowledge base we execute all clinical cases again. It allows us to test how the newly introduced content influences the performance of the previous model.

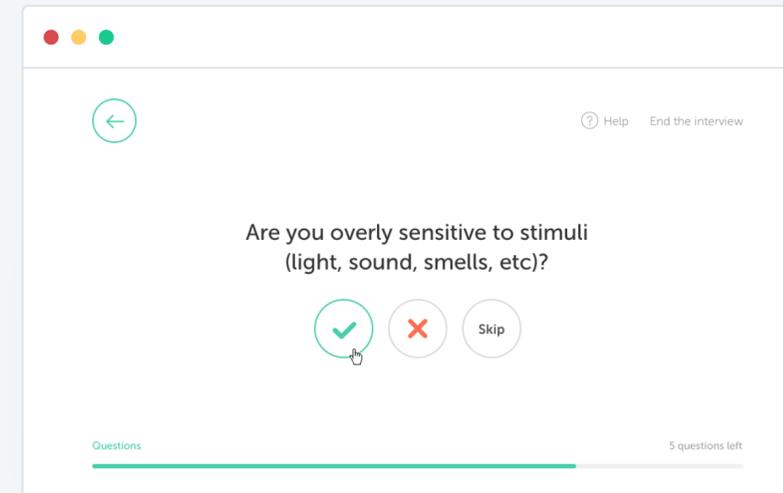


Read more  
<https://developer.infermedica.com/docs/content>

# Business model

We are **B2B-only** and offer our diagnostic engine to healthcare and health-tech organizations.

Infermedica is available in a form of two complementary **SaaS** products.



A screenshot of a web-based medical questionnaire interface. The question is "Are you overly sensitive to stimuli (light, sound, smells, etc)?". There are three response options: a green checkmark icon, a red X icon, and a "Skip" button. A progress bar at the bottom indicates "5 questions left".

```
{
  "question": {
    "type": "single",
    "text": "Do you have abdominal pain?"
    "items": [
      {
        "id": "s_13",
        "name": "Abdominal pain",
        "choices": [
          {
            "id": "present",
            "label": "Yes"
          }
        ]
      }
    ]
  }
}
```

## HealthForm

White-labelled enterprise platform.

[DEMO](#)

## Medical API

“Stripe” for medical diagnosis.

[DEV PORTAL](#)

# Business model

	 <b>HealthForm</b> White-labelled enterprise platform.	 <b>Medical API</b> “Stripe” for medical diagnosis.
Target group	<ul style="list-style-type: none"><li>• health insurance companies</li><li>• hospitals and clinics</li></ul>	<ul style="list-style-type: none"><li>• telemedicine providers</li><li>• medical devices</li><li>• EHRs</li></ul>
Value proposition	<ul style="list-style-type: none"><li>• prevents unnecessary visits,</li><li>• minimizes over and under-triage,</li><li>• improves doctor’s time utilization,</li><li>• reduces risk of misdiagnosis</li></ul>	<ul style="list-style-type: none"><li>• easily implement HealthForm diagnostic capabilities into existing products,</li><li>• scale faster and more efficiently,</li><li>• reduce time &amp; costs of development</li></ul>

# Key customers

## Allianz Worldwide Partners

INSURANCE

Started June 2017

Piloting HealthForm symptom checker embedded into a mobile application for policy holders called Allianz MyHealth. Allianz Worldwide Partners is a global leader in consumer specialty insurance, specializing in travel insurance, tuition insurance, and assistance services.



The screenshot shows a web browser window with the Allianz logo in the top left corner. The main content area is titled "Add your symptoms" and includes a search bar with the placeholder text "e.g. headache". Below the search bar, a green pill-shaped button contains the text "Abdominal pain" with a small 'x' icon to its right. A yellow warning box below the button contains the text "Please try to choose more than one symptom." To the right of the text is a green line-art illustration of a female human figure. Below the figure is a blue circular arrow icon with the text "Rotate model". At the bottom of the interface, there are two buttons: a blue button with a left-pointing arrow and the text "< Back", and a green button with the text "Next". The footer of the page contains the copyright notice "© Infermedica 2017".

# Key customers

## Medicover Poland

INSURANCE

Started April 2017

Piloting HealthForm preliminary intake and a clinical decision support tool integrated into an EHR. Medicover is an international company offering a full range of medical care. In Poland they take care of more than 8 500 companies and over 660 000 individual patients.



The screenshot shows a patient profile for Marie Mayers, updated 2 hours ago. The interface is divided into several sections: Basic information, Chief complaints, Interview, and Differential diagnoses. The Basic information section lists Sex (Female), Age (23), and City (Adelaide). The Chief complaints section lists Reported symptoms (Sore throat, Fever, 37.7 C) and Duration (less than 2 days). The Interview section lists Confirmed symptoms (Pharyngeal pain when swallowing, Pharyngeal erythema, Dry cough, Diminished appetite) and Denied symptoms (Muscle pain, Headache, Nasal congestion). The Differential diagnoses section lists Acute pharyngitis (High likelihood) and Influenza (Moderate likelihood), both with an Expand button.

**Marie Mayers**  
2 hours ago

### Basic information

Sex	Female
Age	23
City	Adelaide

### Chief complaints

Reported	<ul style="list-style-type: none"><li>Sore throat</li><li>Fever, 37.7 C</li></ul>
Duration	less than 2 days

### Interview

Confirmed	<ul style="list-style-type: none"><li>Pharyngeal pain when swallowing</li><li>Pharyngeal erythema</li><li>Dry cough</li><li>Diminished appetite</li></ul>
Denied	<ul style="list-style-type: none"><li>Muscle pain</li><li>Headache</li><li>Nasal congestion</li></ul>

### Differential diagnoses

Name	Likelihood	
Acute pharyngitis	• High	<a href="#">Expand</a>
Influenza	• Moderate	<a href="#">Expand</a>

Click Expand to see details, suggested questions and lab tests.

# Key customers

## Dovera

INSURANCE

Started July 2017

Piloting HealthForm symptom checker integrated into a patient portal. Dovera is the largest private health insurance company in Slovakia with 1.4 million members.



A screenshot of the DÓVERA patient portal interface. The page has a light blue header with the "DÓVERA" logo. A vertical sidebar on the left contains a menu with items: "Vitajte", "Pohlavie", "Vek", "Príznaky", "Rozhovor", and "Výsledok" (highlighted in blue). The main content area is divided into two sections. The top section features a blue house icon and the heading "Potrebujete lekársku starostlivosť" (Do you need medical care?), with the text "Navštívte prosím lekára v najbližších dňoch." (Please visit your doctor in the next few days.). The bottom section is titled "Výsledok" (Result) and includes a note: "Remember that the list doesn't include all possible conditions." Below this, there are three items, each with a colored progress bar and a label: 1. A red progress bar next to "Syndróm dráždivého čreva" (Irritable bowel syndrome) with the text "Silný dôkaz" (Strong evidence). 2. A yellow progress bar next to "Funkčná dyspepsia" (Functional dyspepsia) with the text "Stredne silný dôkaz" (Moderate evidence). 3. A green progress bar next to "Generalizovaná úzkostná porucha" (Generalized anxiety disorder) with the text "Stredne silný dôkaz" (Moderate evidence). In the top right corner of the results section, there are two buttons: "Všetko" (All) and "Bežr" (Bežr).

# Selected users

 **Infermedica**



**HealthLoop**  
Health IT (USA)



**Cigna**  
Insurance (USA)



**Citrix**  
Health IT (USA)



**Dialogue**  
Telehealth (Canada)



**Pediatr 24/7**  
Telehealth (Russia)



**Affidea**  
Medical imaging (Poland)



*Undisclosed*  
Internet search engine

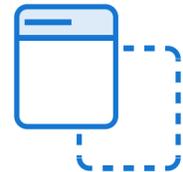


**Dr. Sintomas**  
Health IT (Brazil)



**Neuca**  
Clinical trials

# Key advantages



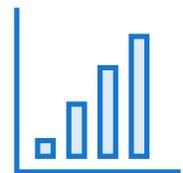
## Customizable

We have a complete authoring tool that allows you to freely customize and expand the medical content to specialize the solution to your needs.



## Intelligent

Our adaptive probabilistic inference engine can change the diagnostic hypothesis if new evidence suggests a better fit (just like human clinicians do).



## Improving over time

Our medical knowledge is constantly expanding thanks to machine learning capabilities and content provided by human experts.



## Fast and scalable

The system is fully scalable in terms of users and size of the medical knowledge base and offers unmatched query response time (real-time).

# Founders



**Piotr Orzechowski**

*Chief Executive Officer*

Co-founded a successful Dropbox clone in Poland. Ex-software agency.

[More on LinkedIn](#)



**Irv Loh, MD**

*Chief Medical Officer*

30+ years of clinical experience. Board certified internist and certified cardiac specialist. Advisor at Sermo, Doximity.

[More on LinkedIn](#)



**Roberto Sicconi, Ph.D.**

*Chief Science Officer*

Leading expert in man-machine conversational interfaces. Former IBM Watson Research Leader with significant experience in healthcare.

[More on LinkedIn](#)

Patient triage and physician pre-briefing platform

Proposal

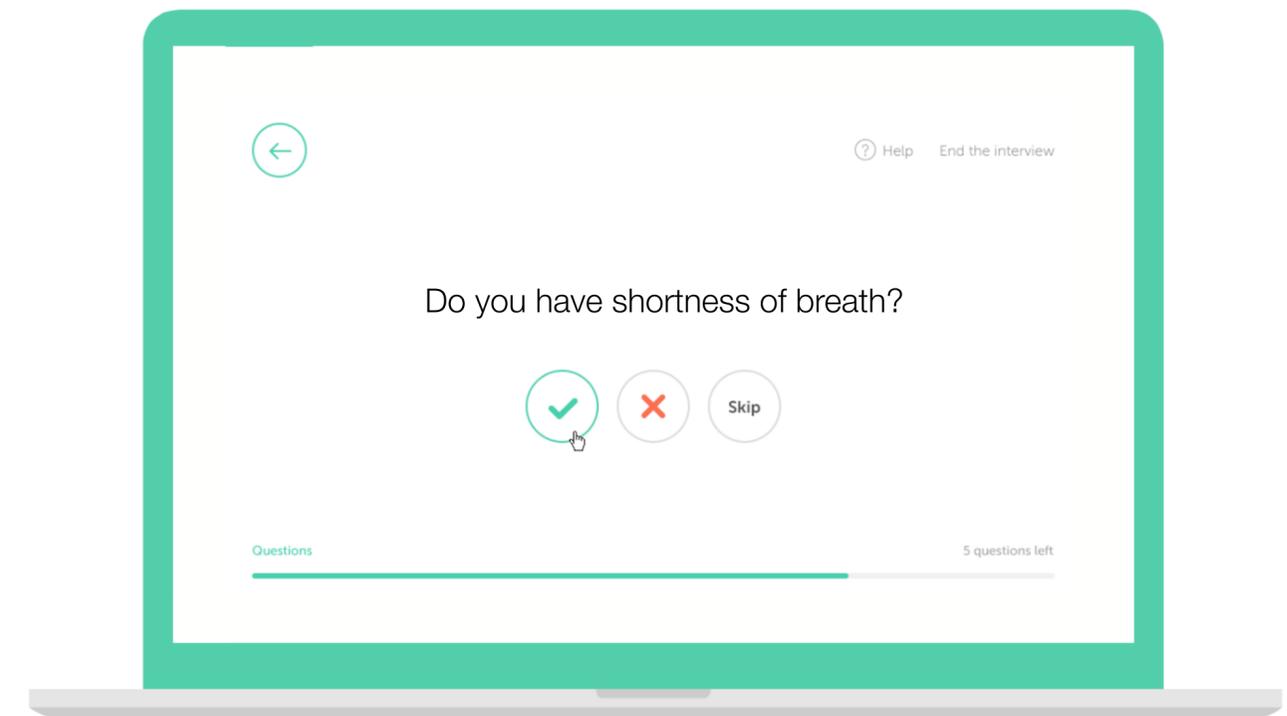
 **Infermedica**

# Solution

In order to help patients make best decisions regarding their symptoms, we have developed a state-of-the-art **AI diagnostic technology** designed to:

- Ask intuitive questions – like a real doctor does.
- Accurately pre-diagnose and triage.
- Connect patients to appropriate services.
- Provide doctors with information prior to the visit.

See a demo version [here](#).





### Patient

A patient seeks health information online and uses an intelligent symptom checker provided by Infermedica.

- Patient portal
- Mobile app
- Chatbot (only English)

1



### Data analysis

Based on patient's demographics, symptoms, risk factors and lab test results Infermedica **recommends a level of medical urgency** by verifying severity of the reported symptoms and their likely causes.

3



### Visiting a doctor or teleconsultation

The patient receives the most suitable care and the **preliminary intake is available to the clinical staff**.

Physicians's feedback may be provided to further enhance the diagnostic algorithms with machine learning.

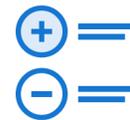
5



### Intelligent interview

We collect patient intake using Infermedica's probabilistic inference engine. We only **ask relevant questions** and the algorithm can change the diagnostic hypothesis dynamically if new evidence suggests a better fit - just like a real doctor does.

2



### Personalized recommendations

Based on the collected patient information a recommendation algorithm **suggests the most suitable action** to take such as:

- Teleconsultation
- Visiting a doctor
- Emergency Department
- Self-care

4

# Value proposition



## Patient

- **Fast and reliable** health assessment.
- **Tailored recommendations** of suitable actions to take.
- **Highly engaging** and interactive interview process.



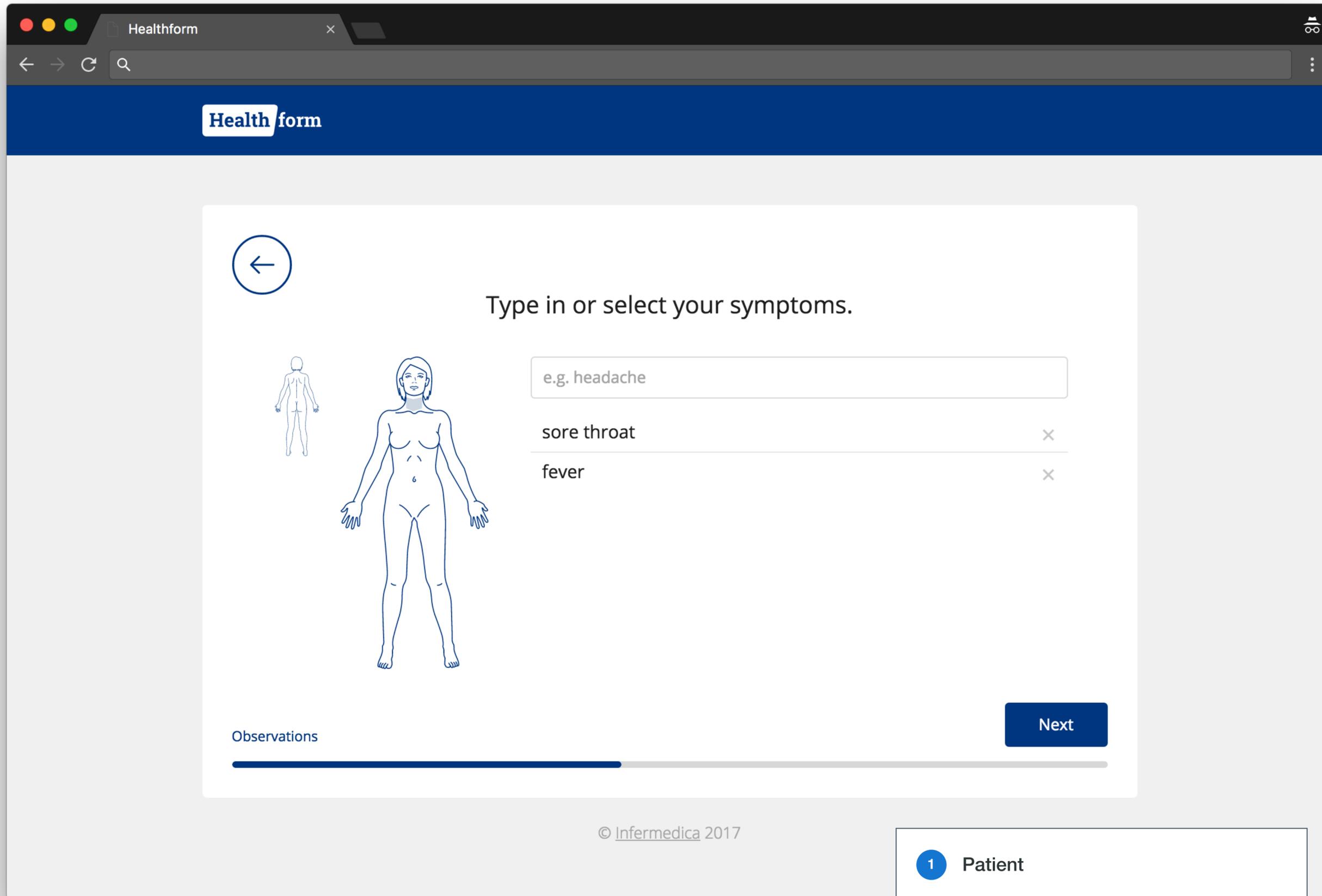
## Provider / Teleconsultant

- **Preliminary intake**, less data entry.
- **Convenient information** about the reason for a visit.
- **Higher efficiency** of a visit, more time to interact with a patient.
- **Interactive decision support** to help make the best diagnosis.



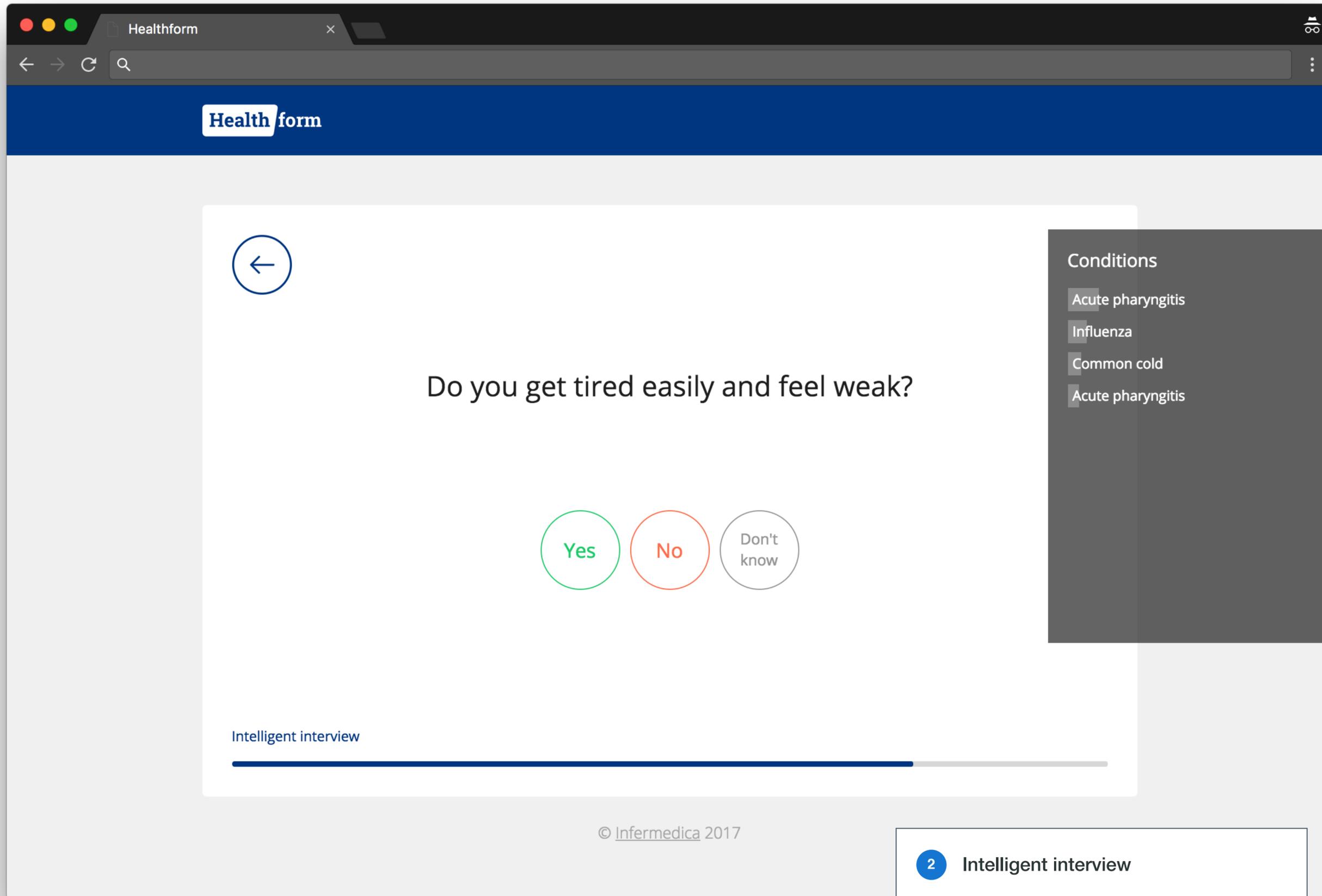
## Organization

- Saves money by **preventing unnecessary visits** and recommending alternative services.
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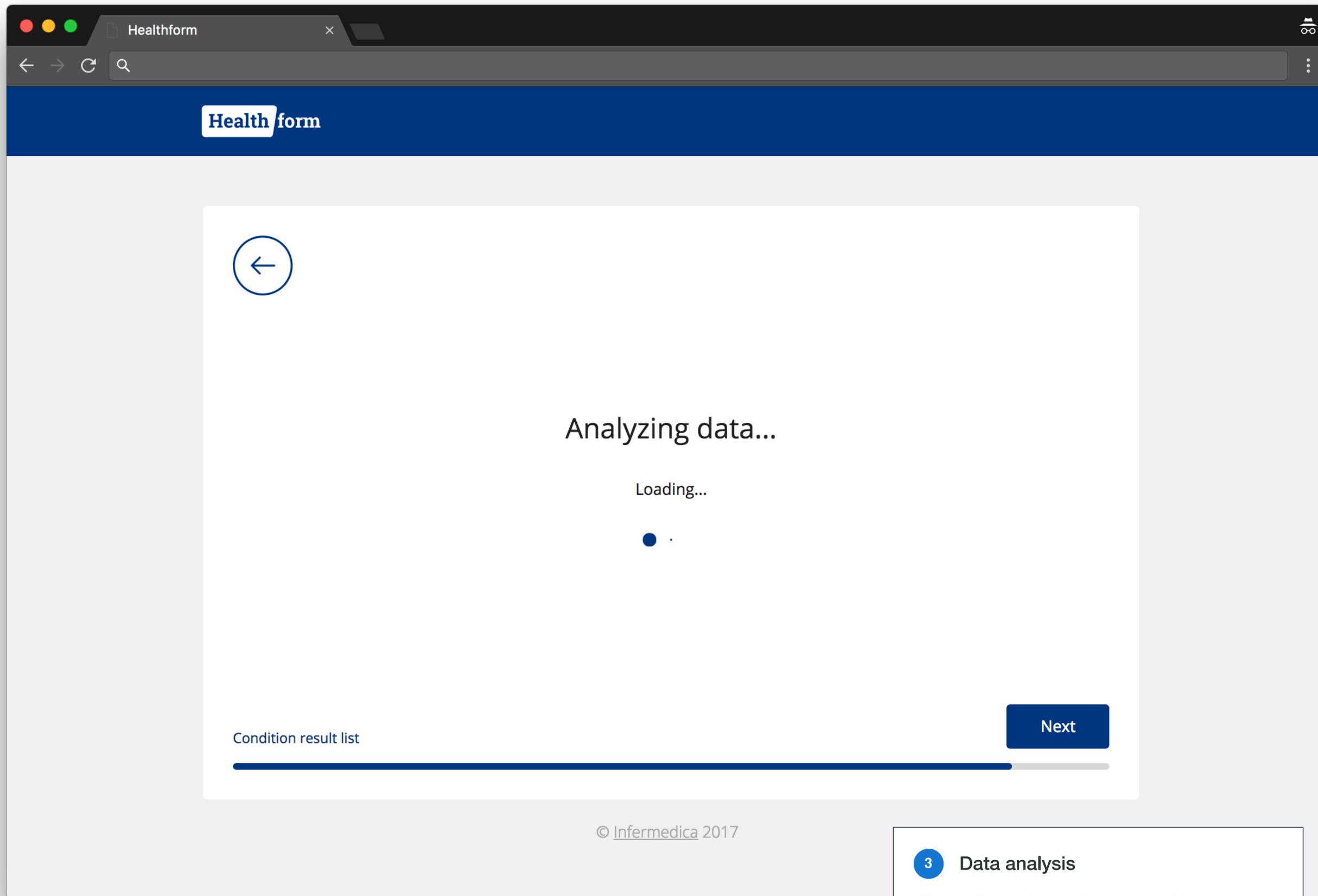
**1 Patient**

A patient starts a check up on a website, mobile app or a chatbot.



**2 Intelligent interview**

The patient is asked follow up questions about symptoms and risk factors.



**3 Data analysis**

The collected data is analyzed by Infermedica's diagnostic engine.



Healthform

# Health form

## ← Results of your checkup

### Acute pharyngitis – Laryngology/ENT

Probability 

Hint See your family doctor. You may also need to consult an ENT specialist.

Severity Mild

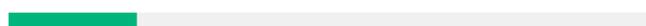
Explanation I suggested this condition on the basis of the following symptoms:

- ↑ Pharyngeal pain
- ↑ Fever
- ↑ Fever between 99.5 and 101 F
- ↑ Lethargy
- ↑ Dysphagia
- ↑ Pharyngeal erythema
- ↑ Chills

[Hide details](#)

---

### Influenza – Infectiology

Probability 

Hint See your family doctor, and you may also need to consult an infectious disease

**4 Personalized recommendations**

The patient can view an explanation of the checkup results.

Healthform x

Piotr

Marie Mayers  
2 hours ago

**Basic information**

Sex Female  
Age 23  
City Adelaide

**Chief complaints**

Reported • Sore throat  
• Fever, 37.7 C  
Duration less than 2 days

**Interview**

Confirmed • Pharyngeal pain when swallowing  
• Pharyngeal erythema  
• Dry cough  
• Diminished appetite  
Denied • Muscle pain  
• Headache  
• Nasal congestion

**Differential diagnoses**

Name	Likelihood	
Acute pharyngitis	• High	Expand
Influenza	• Moderate	Expand

Click Expand to see details, suggested questions and lab tests.

**5 Pre-briefing during a visit**  
The clinical staff gets access to the summaries of the patients' checkups.

MetaBase

Builds Simulation Deployments Enter search term...

porzechowski

## Simulation

Patient: male, 40 years old  
[Change patient data](#)

Model: Build #379 PRO

All findings Selected (1)

Abdominal pain + - 🗑️

Suggested findings Next question

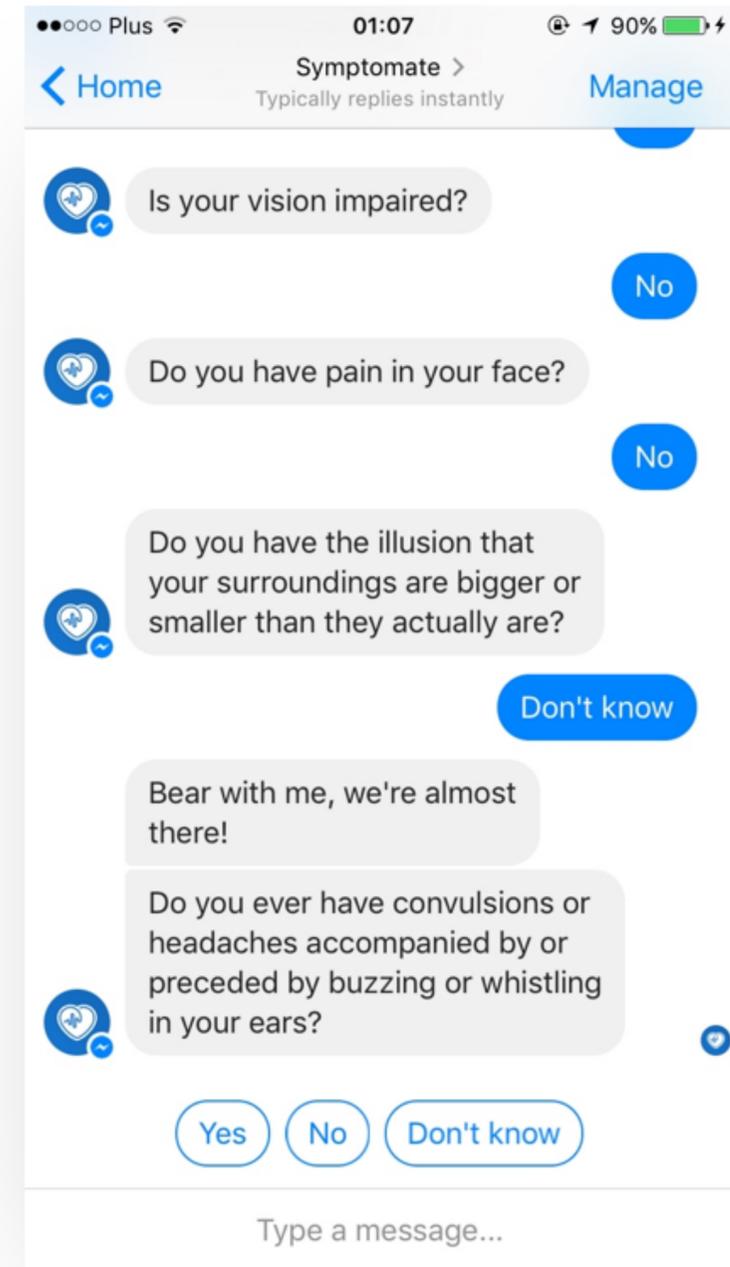
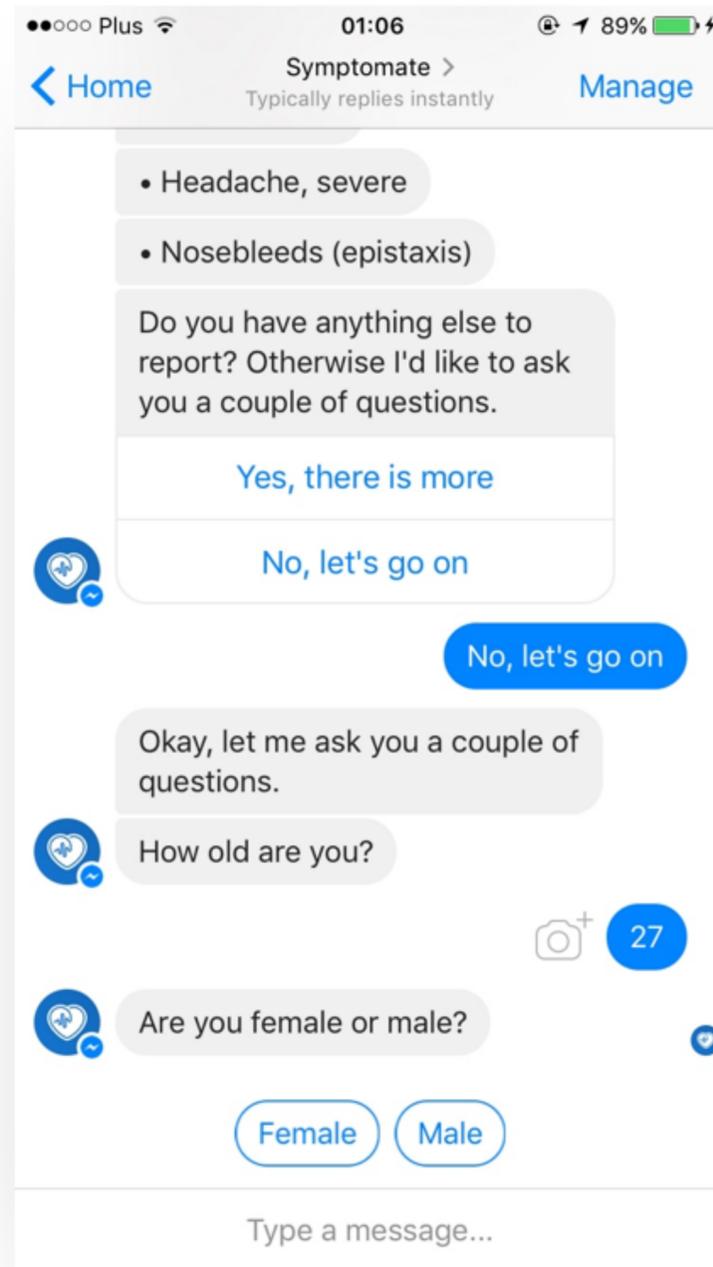
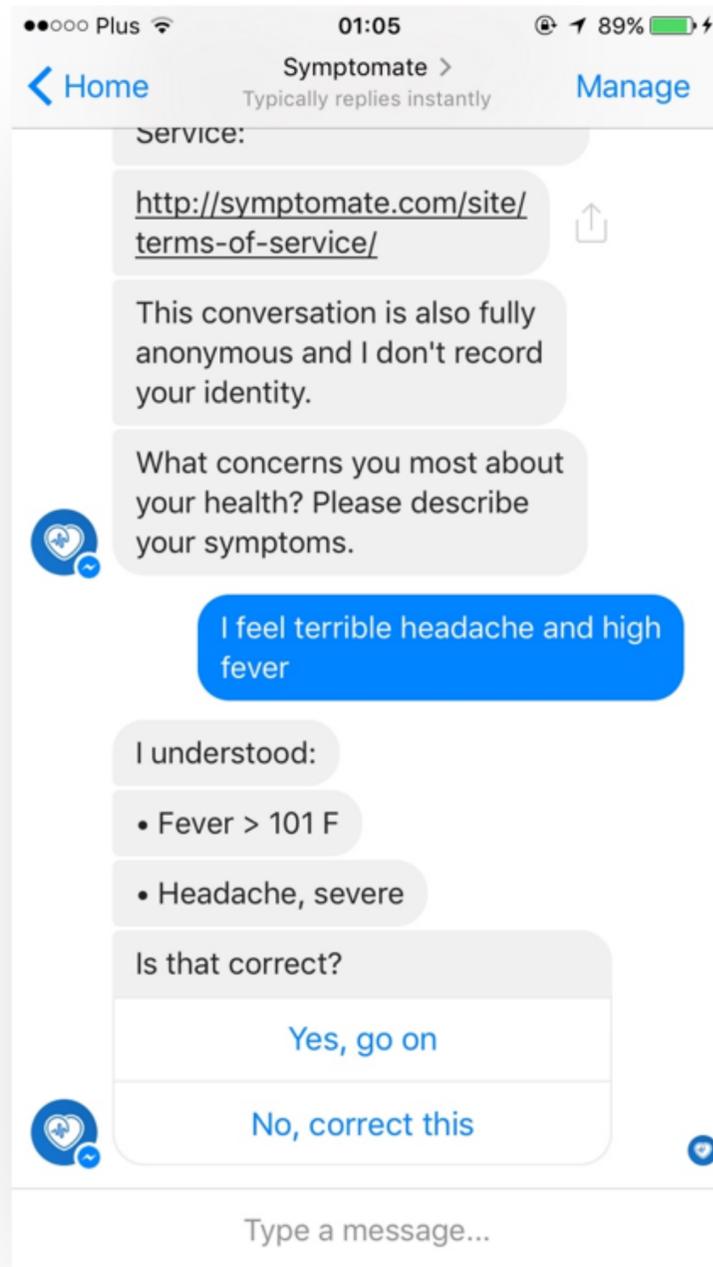
- Blood in stool + -
- Myalgia + -
- Dizziness + -
- Abdominal pain, periumbilical + -
- Vomiting + -
- Abdominal pain, flare-ups and remissions + -
- Headache + -
- Mucous secretion in stool + -
- Steatorrhea + -
- ▼ **Laboratory tests** 22
- Detection of intestinal pathogens in stool - +
- Fecal calprotectin N ↑
- Urine sodium (Na) concentration ↓ N ↑
- Urine pH ↓ N ↑

Common Rare

- Irritable bowel syndrome (IBS) 3% 🗑️
- Gallstone disease 3% 🗑️
- Gastroenteritis 3% 🗑️
- Lactose intolerance 2% 🗑️
- Food poisoning 2% 🗑️
- Peptic ulcer 2% 🗑️
- Appendicitis 1% 🗑️
- Gastritis 1% 🗑️
- Bleeding peptic ulcer 1% 🗑️
- Nephrolithiasis 1% 🗑️
- Urinary tract infection (UTI) 1% 🗑️
- Cholecystitis 1% 🗑️
- Pyelonephritis 1% 🗑️
- Diverticulosis 1% 🗑️
- Chronic constipation 1% 🗑️
- Cystiti

+ **Interactive decision support**

In the next step, rich clinical decision support features can be offered to clinicians.

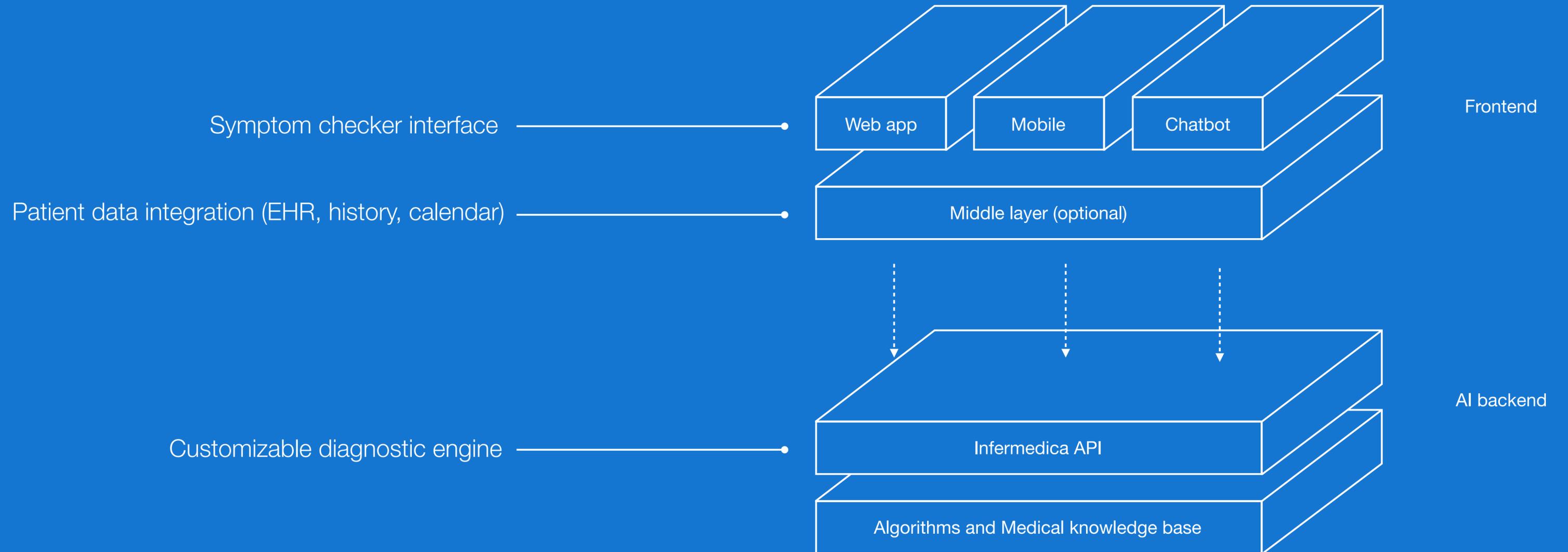


[Click here to see a demonstration of the chatbot](#)

**+ Chatbot interface**

The checkup can be also provided through a conversational chatbot.

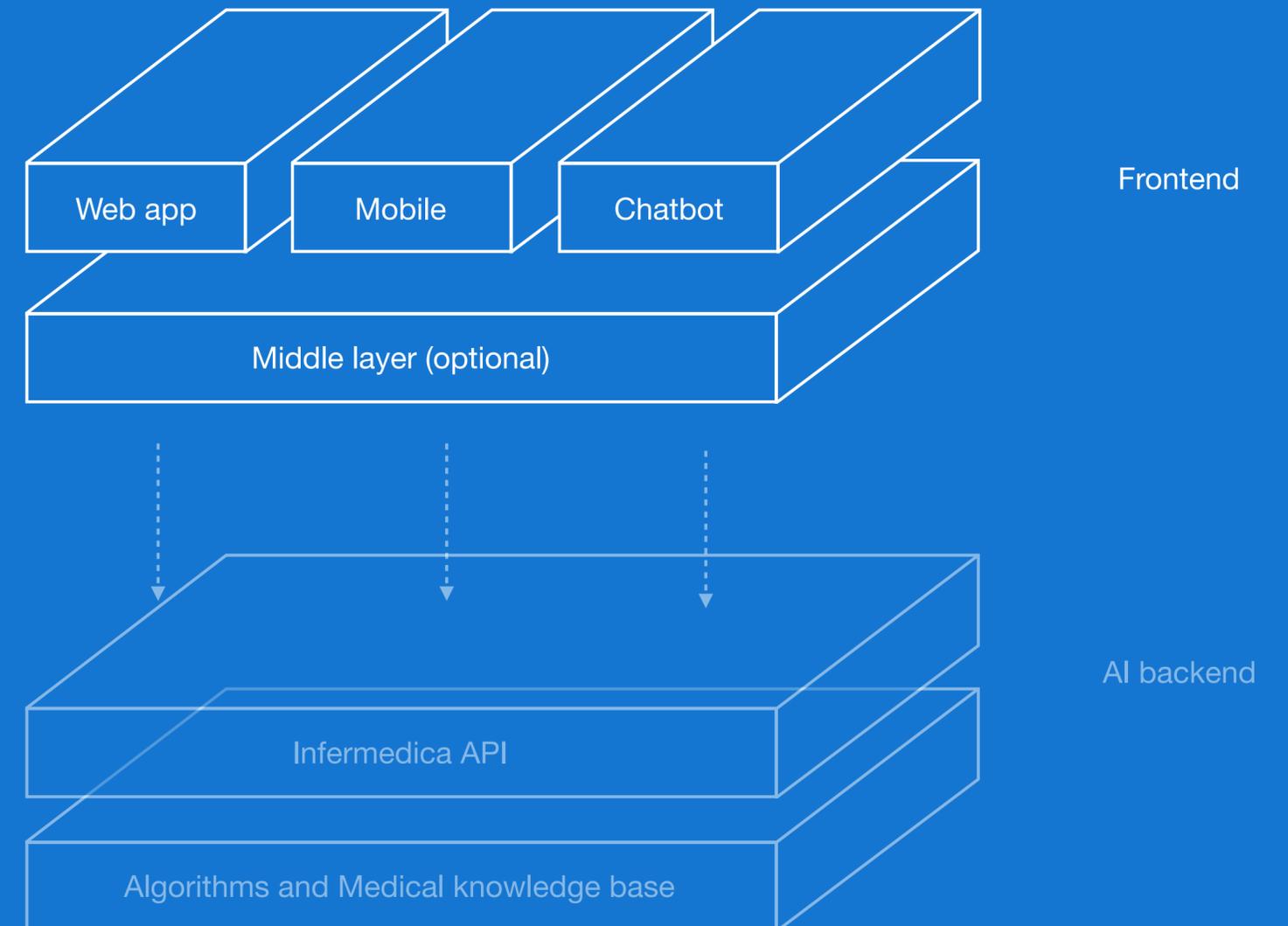
# Platform components



# Frontend

Key decisions:

1. Standalone apps or integrated.
2. Platforms (web, mobile).
3. Level of integration with external systems.
  1. Pulling data in and out
  2. Classification (ICD-10, SNOMED CT).
4. Design & implementation:
  1. Infermedica, or
  2. Your team or a 3rd party, or
  3. Mix of both.

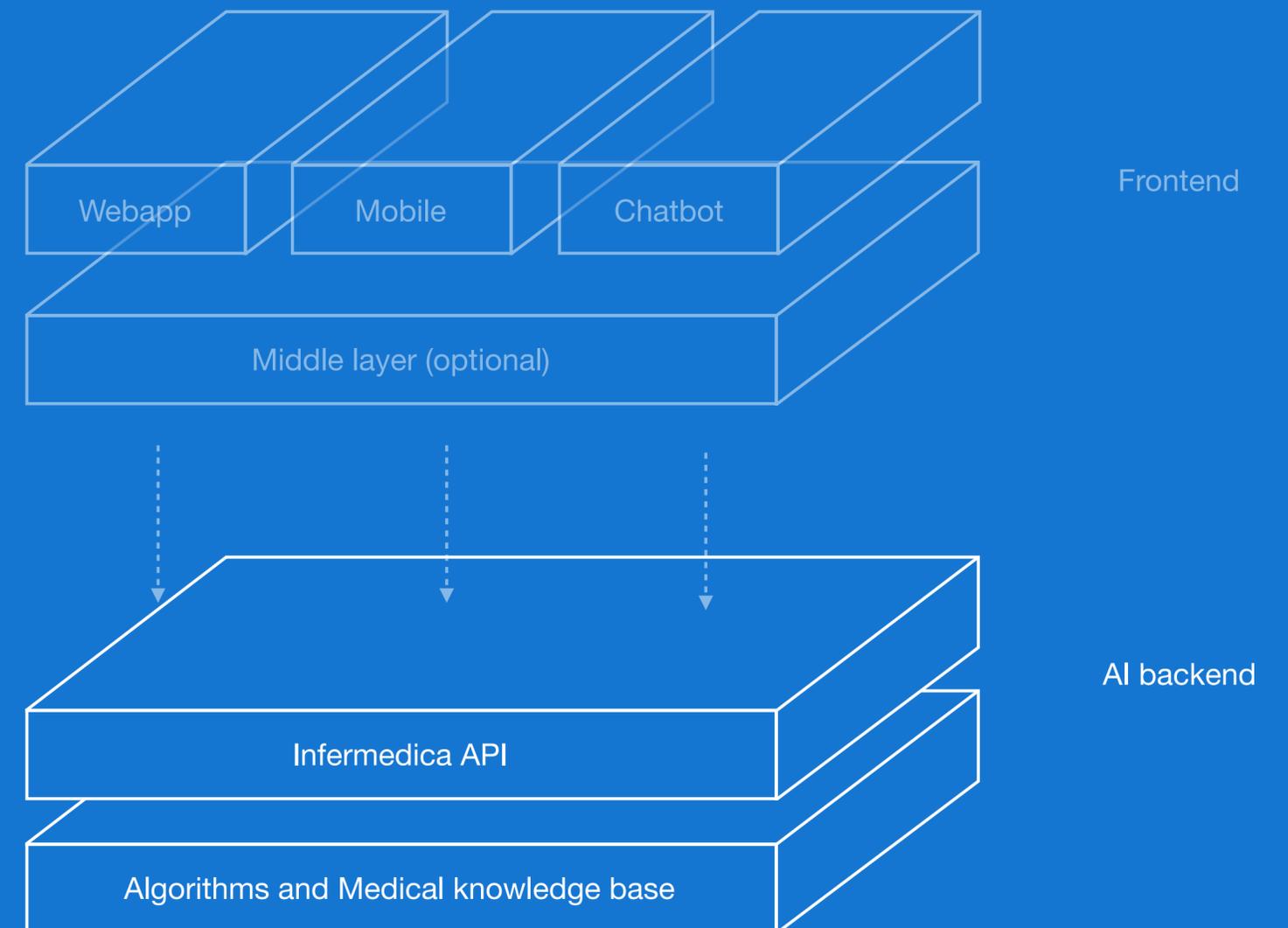


# Backend

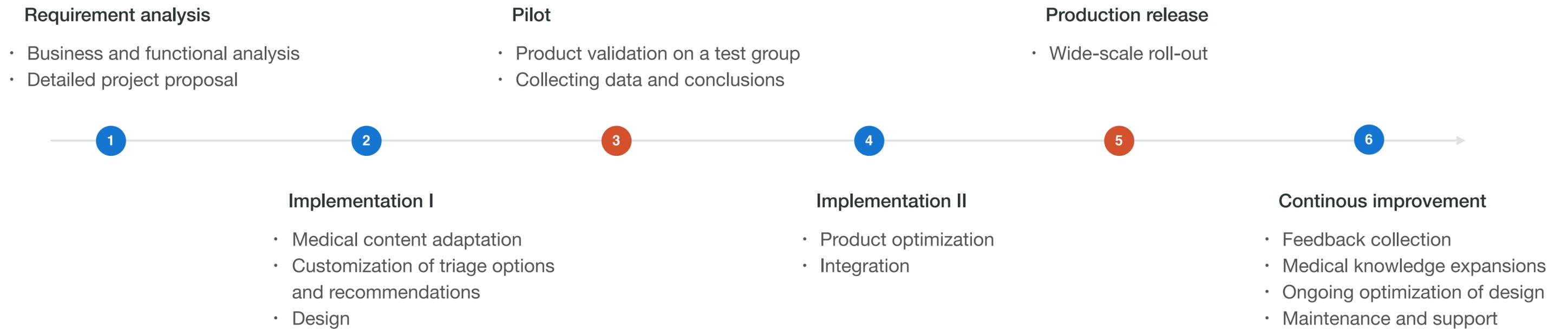
Fully provided by Infermedica with assistance of your medical team.

Adaptation steps:

1. Localization / translation.
2. Customization of medical content.
3. Pilot deployment.
4. Feedback loop integration.



# Phasing



Empower your digital health solutions  
with Artificial Intelligence.

---



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The End? It's just a beginning.