

# Tools for Digital Health that Transform the Patient Experience

**David Thompson MD FACEP**  
Founder and CEO  
Health Navigator, LLC



**HEALTH NAVIGATOR**

# Background



## Emergency Medicine, Northwestern Memorial Hospital, Chicago, IL





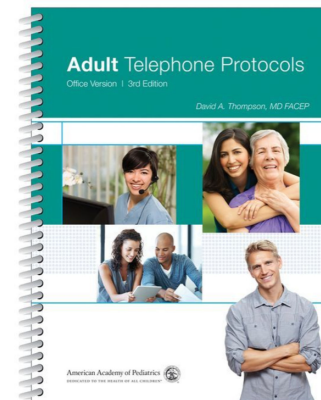
# Background



Emergency Medicine, Northwestern Memorial Hospital, Chicago, IL



Telehealth and Telephone Triage, 20+ years



# Background



Emergency Medicine, Northwestern Memorial Hospital, Chicago, IL



Telehealth and Telephone Triage, 20+ years



Clinical Informatics, Medical Coding, Physician Documentation

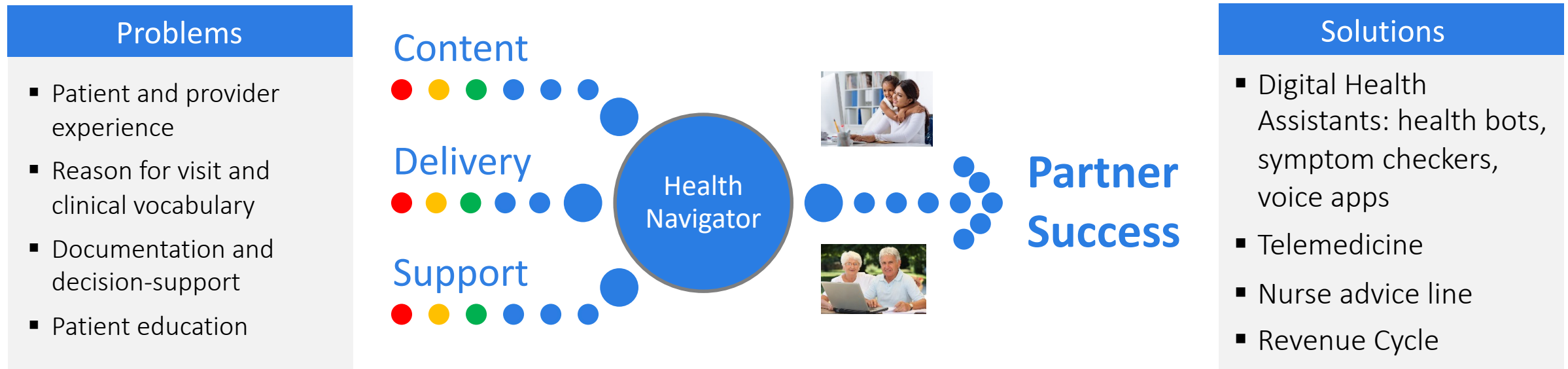


# Health Navigator

What do we do?



## Artificial Intelligence and Decision Support Tools



The Health Navigator platform is a comprehensive clinical vocabulary and decision-support system designed to support eHealth and telemedicine encounters – from the presenting chief complaint to the final diagnosis.

# Health Navigator

Who are our partners?



Telemedicine



Advanced Medical  
Support



Consumer Health Bot, Symptom  
Checker, and Voice Apps



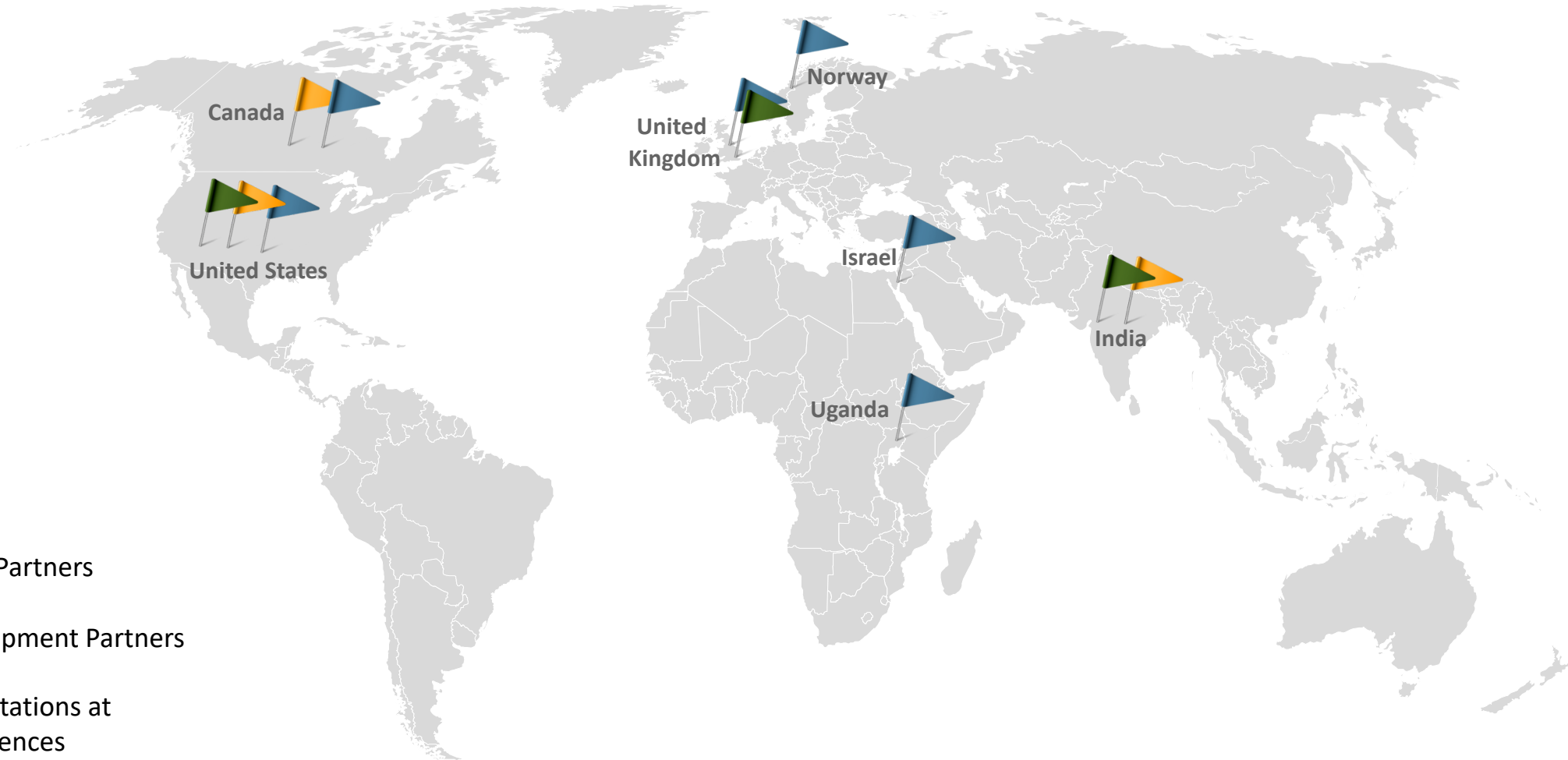
Nurse Advice Line



Other, Development Partners

# Health Navigator

Where are our partners?



Client Partners

Development Partners

Presentations at  
Conferences

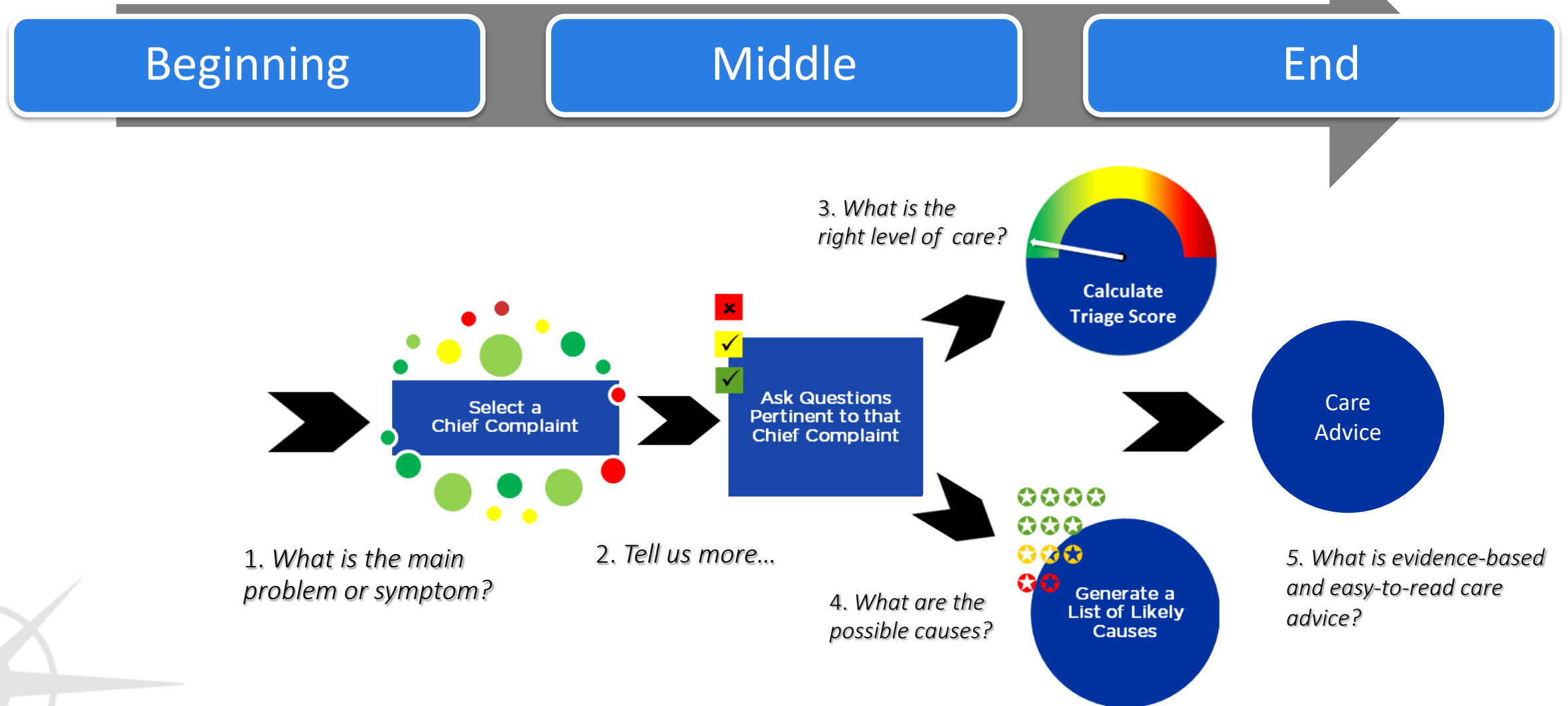
And... International Client Partners (e.g., Global Excel, Microsoft)

Becoming international.



# Workflow

Building blocks that digitally replicate and support the medical encounter.





# The Medical Encounter

Every medical encounter begins with a chief complaint.



Beginning

Middle

End

Clinical  
Concepts

Coded  
Chief  
Complaints

Clinical  
Concepts

*What is the main  
problem or symptom?*

- Eliciting the patient's presenting complaint is one of the first tasks of health personnel.
- A chief complaint or “**reason for visit**” (RFV) or “**reason for call**” (RFC) should be recorded for each encounter.

## Where are Patient Chief Complaints Found?

Answering service messages

Electronic medical records

Medical kiosks

Patient emails and messages

Search engines

Symptom checker apps

# Coded Chief Complaints

Every medical encounter begins with a chief complaint.



Beginning

Middle

End

Clinical  
Concepts

Coded  
Chief  
Complaints

Clinical  
Concepts

*What is the main  
problem or symptom?*

- **Coded Chief Complaints** is a proprietary clinical vocabulary for capturing and storing the reason for visit.
- 470+ different chief complaints.

**Metadata** for every CCC, including:

- Concept ID
- ICD10-CM, SNOMEDCT
- Acuity
- Type
- System
- Documentation element
- Language

Chief Complaint	Type	System	ICD-10	SNOMED	Acuity (CPI 1-5)	
<u>Agitation</u>	Symptom	Psychiatric and Beh	R45.1	24199005	3	<div></div>
<u>Alcohol Intoxication</u>	Drug - Chemical	Psychiatric and Beh	F10.929	25702006	3	<div></div>
<u>Alcohol Use or Abuse</u>	Disease - Condition	Psychiatric and Beh	Z71.41	15167005	4	<div></div>
<u>Allergic Reaction</u>	Disease - Condition	Allergic and Immuno	T78.40XA	212999007	3	<div></div>
<u>Altered Mental Status</u>	Symptom	Neurological and Sp	R41.82	419284004	2	<div></div>
<u>Amenorrhea</u>	Symptom	Genitourinary and R	N91.2	14302001	4	<div></div>
<u>Angry or Hostile Behavior</u>	Symptom	Psychiatric and Beh	R45.6	248004009	2	<div></div>
<u>Animal Bite</u>	Environment - Exposur	Skin, Hair, Nails, an	W55.81XA	242604003	4	<div></div>
<u>Ankle Crooked or Deformed</u>	Symptom	Musculoskeletal and	M21.869	1504100011910	2	<div></div>
<u>Ankle Injury</u>	Injury - Trauma	Musculoskeletal and	S99.919A	125603006	4	<div></div>
<u>Ankle Pain</u>	Symptom	Musculoskeletal and	M25.579	247373008	4	<div></div>
<u>Ankle Redness (or Rash)</u>	Symptom	Skin, Hair, Nails, an	R21	299452003	4	<div></div>
<u>Ankle Swelling</u>	Symptom	Musculoskeletal and	M25.473	267039000	4	<div></div>
<u>Anorexia</u>	Symptom	Gastrointestinal	R63.0	79890006	4	<div></div>
<u>Anxious or Nervous</u>	Symptom	Psychiatric and Beh	R45.0	424196004	3	<div></div>
<u>Apnea</u>	Symptom	Respiratory	R06.81	1023001	1	<div></div>
<u>Arm Lump (or Mass)</u>	Symptom	Skin, Hair, Nails, an	R22.30	309525008	4	<div></div>
<u>Arm Crooked or Deformed</u>	Symptom	Musculoskeletal and	M21.929	298747001	3	<div></div>
<u>Arm Injury</u>	Injury - Trauma	Musculoskeletal and	S49.92XA	287159005	4	<div></div>
<u>Arm Numbness (or Tingling)</u>	Symptom	Neurological and Sp	R20.2	95673003	2	<div></div>
<u>Arm Pain</u>	Symptom	Musculoskeletal and	M79.603	102556003	4	<div></div>

# Translation & Localization



	Type	System	ICD-10	SNOMED	Acuity (CPI 1-5)
	Symptom	Psychiatric and Beh	R45.1	24199005	3
Alcohol Intoxication	Drug - Chemical	Psychiatric and Beh	F10.929	25702006	3
Alcohol Use or Abuse	Disease - Condition	Psychiatric and Beh	Z71.41	15167005	4
Allergic Reaction	Disease - C				
Altered Mental Status	Symptom				
Amenorrhea	Symptom				
Angry or Hostile Behavior	Symptom				
Animal Bite	Environme				
Ankle Crooked or Deformed	Symptom				
Ankle Injury	Injury - Tra				
Ankle Pain	Symptom				
Ankle Redness (or Rash)	Symptom				
Ankle Swelling	Symptom				
Anorexia	Symptom				
Anxious or Nervous	Symptom				
Apnea	Symptom				
Arm Lump (or Mass)	Symptom				
Arm Crooked or Deformed	Symptom				
Arm Injury	Injury - Tra				
Arm Numbness (or Tingling)	Symptom				
Arm Pain	Symptom				

Chief Complaint	Type	System	ICD-10	SNOMED	Acuity (CPI 1-5)
Dificuldade para engolir	Sintoma	Orelhas, nariz, boca,	R13.10	288939007	3
Dificuldade para respirar (falta de ar)	Sintoma	Respiratório	R06.02	267036007	2
Diminuição do apetite	Sintoma	Gastrointestinal	R63.0	79890006	4
Doença – condição 1 (risco de morte)	Grupo de doenças do	Geral	R69	442452003	1
Doença – condição 2 (risco alto ou emergência)	Grupo de doenças do	Geral	R69	24484000	2
Doença – condição 3 (urgente ou complexa)	Grupo de doenças do	Geral	R69	371924009	3
Doença – condição 4 (baixa urgência ou baixo risco)	Grupo de doenças do	Geral	R69	6736007	4
Doença – condição 5 (não urgente ou informação de	Grupo de doenças do	Geral	R69	255604002	5
Dor ao urinar	Sintoma	Sistema geniturinári	R30.9	49650001	4
Dor de ouvido	Sintoma	Orelhas, nariz, boca,	H92.09	16001004	4
Dor do umbigo	Sintoma	Gastrointestinal	R10.33	88522004	3
Dor durante o sexo	Sintoma	Sistema geniturinári	N94.10	71315007	4
Dor na articulação	Sintoma	Músculo-esquelético	M25.50	57676002	4
Dor na axila	Sintoma	Músculo-esquelético	M79.629	300953009	4
Dor na boca	Sintoma	Orelhas, nariz, boca,	K13.79	102616008	4
Dor na cabeça (dor de cabeça)	Sintoma	Neurológico e verteb	R51	25064002	3
Dor na garganta (garganta inflamada)	Sintoma	Orelhas, nariz, boca,	R07.0	267102003	4
Dor na genitália feminina	Sintoma	Sistema geniturinári	R10.2	162145001	4
Dor na língua	Sintoma	Geral	K14.6	30731004	4
Dor na mandíbula	Sintoma	Geral	R68.84	274667000	4
Dor na mão	Sintoma	Músculo-esquelético	M79.643	53057004	4
Dor na nádega	Sintoma	Músculo-esquelético	R52	279043006	4

# Translation & Localization

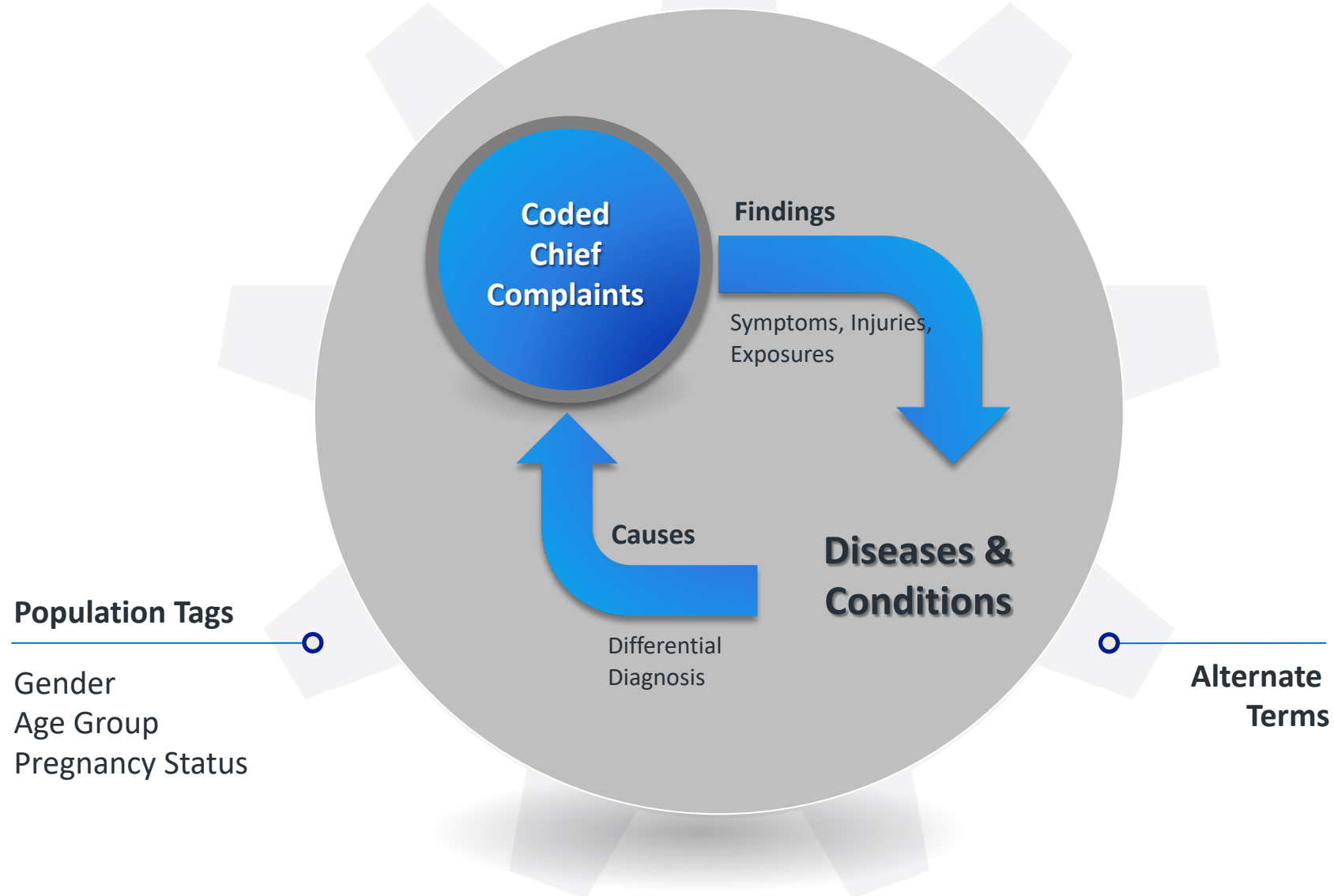
	Type	System	ICD-10	SNOMED	Acuity (CPI 1-5)	
	Symptom	Psychiatric and Beh	R45.1	24199005	3	
Alcohol Intoxication	Drug - Chemical	Psychiatric and Beh	F10.929	25702006	3	
Alcohol Use or Abuse	Disease					
Allergic Reaction	Disease					
Altered Mental Status	Symptom					
Amenorrhea	Symptom					
Angry or Hostile Behavior	Symptom					
Animal Bite	Environmental					
Ankle Crooked or Deformed	Symptom					
Ankle Injury	Injury					
Ankle Pain	Symptom					
Ankle Redness (or Rash)	Symptom					
Ankle Swelling	Symptom					
Anorexia	Symptom					
Anxious or Nervous	Symptom					
Apnea	Symptom					
Arm Lump (or Mass)	Symptom					
Arm Crooked or Deformed	Symptom					
Arm Injury	Injury					
Arm Numbness (or Tingling)	Symptom					
Arm Pain	Symptom					

Chief Complaint	Type	System	ICD-10	SNOMED	Acuity (CPI 1-5)	
Declaración - Muerto al Llegar	Administrativo	General	R99	63238001	3	
Dedo Torcido o Deformado	Lesión - Trauma	Musculoesquel y	M20.001	26517000	3	
Dedos Azules	Síntoma	Cardiovascular	R23.0	162745007	3	
Dedos del Pie Azules	Síntoma	Cardiovascular	R23.0	162746008	3	
Descarga Eléctrica	Lesión - Trauma	General	T75.4XXA	371708003	2	
Desmayo	Síntoma	Cardiovascular	R55	271594007	2	
Diarrea (Heces Seltas)	Síntoma	Gastrointestinal	R19.7	62315008	4	
Diente Flojo o Caído	Síntoma	Oídos, Nariz, Boca,	K08.8	25540007	4	
Dificultad Para Articular Las Palabras o Afasia	Síntoma	Sistema Nervioso y	R47.81	289195008	2	
Dificultad Para Dormir (Insomnio)	Síntoma	Psiquiátrico y Cond	G47.00	193462001	4	
Dificultad Para Respirar	Síntoma	Respiratorio	R06.02	267036007	2	
Dificultad Para Tragar	Síntoma	Oídos, Nariz, Boca,	R13.10	288939007	3	
Disminución del Consumo de Líquidos	Síntoma	Gastrointestinal	R63.8	161844003	3	
Disminución del Deseo Sexual (Baja Libido)	Síntoma	Psiquiátrico y Cond	F52.0	8357008	5	
Dolor Abdominal	Síntoma	Gastrointestinal	R10.9	21522001	3	
Dolor al Orinar	Síntoma	Genitourinario y Re	R30.9	49650001	4	
Dolor de Cabeza	Síntoma	Sistema Nervioso y	R51	25064002	3	
Dolor de Cuello	Síntoma	Sistema Nervioso y	M54.2	81680005	4	
Dolor de Diente / Encía	Síntoma	Oídos, Nariz, Boca,	K08.8	27355003	4	
Dolor de Espalda	Síntoma	Sistema Nervioso y	M54.9	399079008	4	
Dolor de Garganta	Síntoma	Oídos, Nariz, Boca,	R07.0	267102003	4	
Dolor de Muñeca	Síntoma	Musculoesquel y	M25.539	56608008	4	

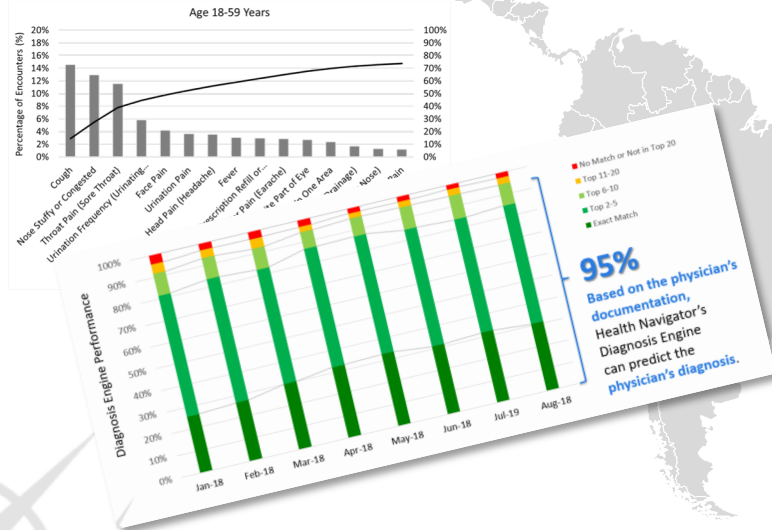
# Integrated Clinical Vocabulary

Essential for building the complex relationships between clinical findings and causes.





## United States



Lyle Berkowitz, MD  
Chief Medical Officer

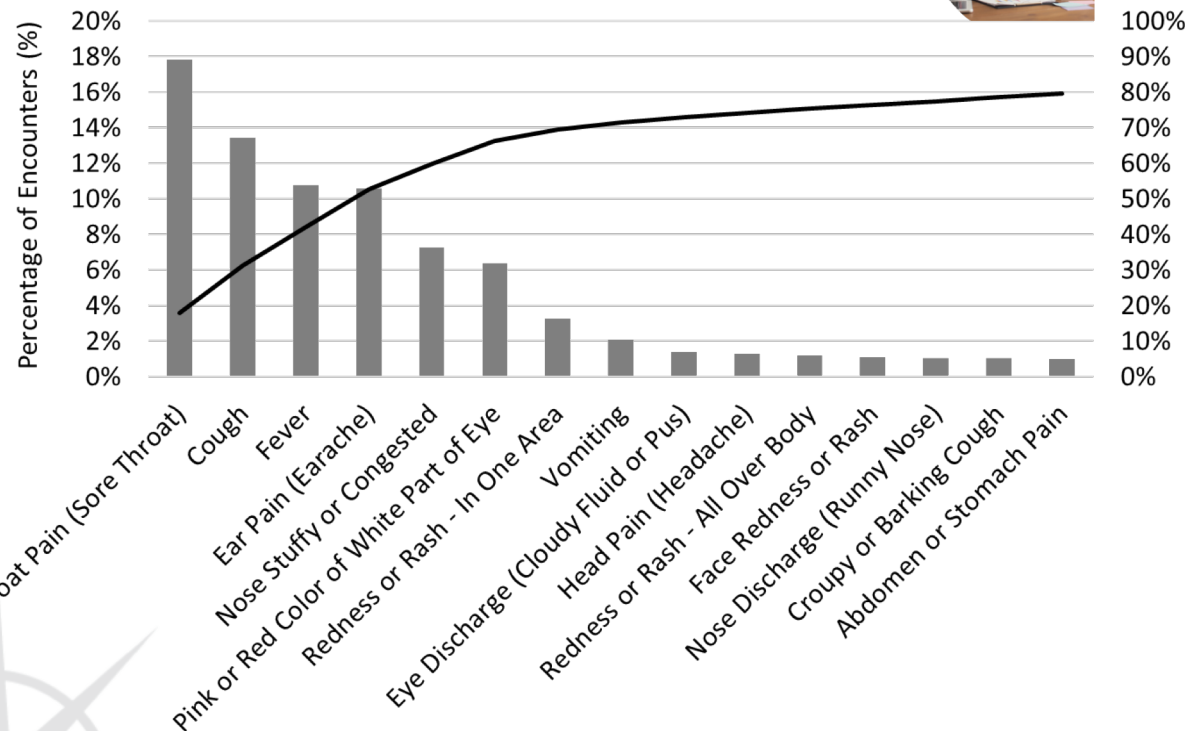


# Understanding the Chief Complaint

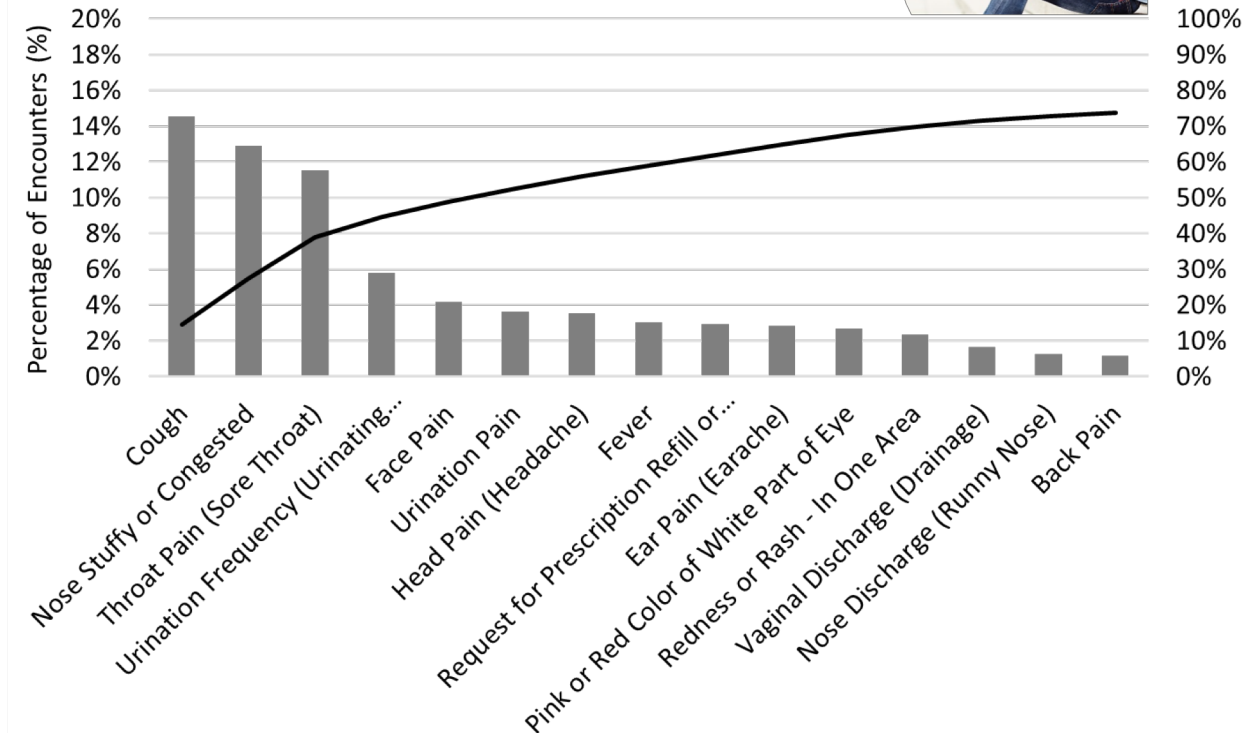
Analysis of 454,000 Telemedicine Records



Age 2-17 Years

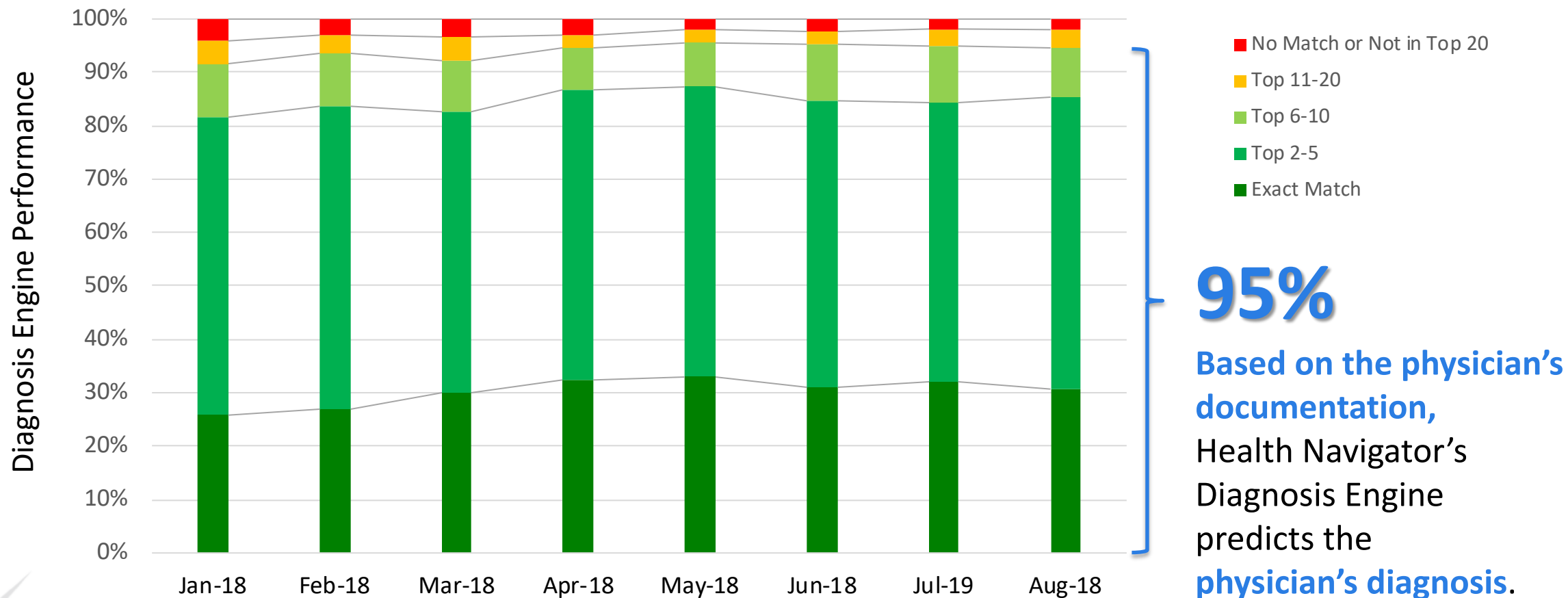


Age 18-59 Years



# Predicting the Diagnosis

Analysis of 12,000 Telemedicine Records || Jan - Aug 2018



Notes: Health Navigator v12.1-12.5. Physician diagnosis present in Health Navigator Top 10

# Lytic

United States



Lytic  
US



**Adeel Malik**

Chief Executive Officer



**Dave Zbarsky**

Chief Technology Officer



**Bilal Naved**

Chief Medical & Strategy  
Officer



**Peter Garber**

Chief Marketing & Design  
Officer

# Lytic

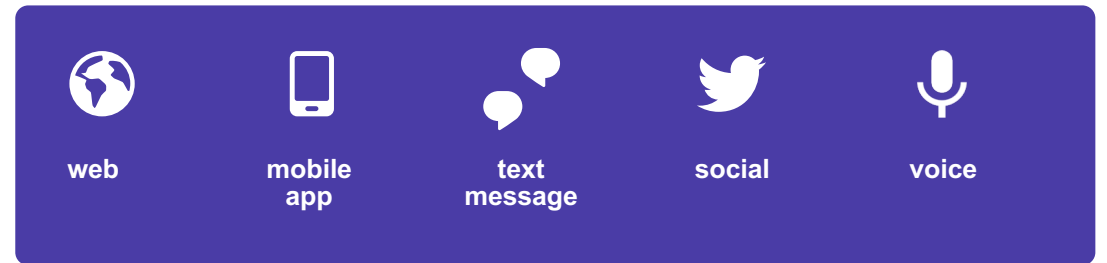
Health Navigator Partner



# Introducing Checkup

A digital home for your healthcare needs with a personalized AI chatbot to check symptoms and give healthy recommendations and reminders

Omni-channel health-bot access via:



Immediate application:

# Primary and urgent care practices

Offer patients iPads in the waiting room and streamline the care encounter by generating templated EMR notes

Interaction Summary

Patient Information

AGE/SEX34 / Male

PATIENT NAMEChristopher Wall

BIRTH12/01/1984

DATE OF SERVICE11-11-2018

TIME00:41:42

Patient Complaint Notes

Chief Complaint: Fever

Chief Complaint:  
Fever

S - Notes:  
Fever and headache

HPI:  
3 days or more of fever. Fever 101° F (38.3° C) or higher. Staying the same. + Throat Pain. + Head Pain (Headache) ; No rash - purple spots or dots. No skin abscess (or boil). No abdomen pain. No chest or rib pain. No flank pain. No mosquito bite. No recent foreign travel. No recent hospitalization. No recent surgery. No exposure to heat / hot weather

Medicines:  
No chemotherapy. No recent immunization (vaccination)

ROS:  
+ Chills. + Cough. + Lymph Node Swelling. + Nose Discharge ; No diarrhea. No muscle aches (myalgia). No redness or rash - widespread. No nausea. No sweating. No shortness of breath. No vomiting. No weight loss

PMH:  
+ Asthma. + Diabetes mellitus ; No cancer. No copd (emphysema). No hiv positive or aids. No organ transplant (e.g., kidney, liver, lung, heart). No urinary catheter (e.g., foley). No weak immune system. No alcohol use or abuse. No bedridden. No drug use or abuse



# The Medical Concierge Group (TMCG)

Uganda



The Medical Concierge Group  
Uganda



**DR. DAVIS MUSINGUZI**  
Founding Partner, Managing  
Director

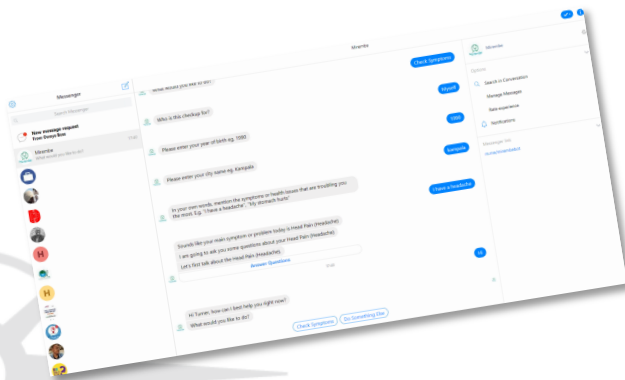


**DR. JOHN MARK BWANIKA**  
Founding Partner, Director  
Research and Clinical Services



**THE MEDICAL  
CONCIERGE GROUP**

**Health Navigator Partner**



# The Medical Concierge Group (TMCg)

Uganda

An illustration of a Black woman with short black hair, wearing a blue headband, glasses, a blue collared shirt, and a white lab coat. She is gesturing with her right hand as if speaking.

I am  
**Mirembe**  
Your Personal  
Health Advisor.

The logo for The Medical Concierge Group, featuring a stylized green and blue circular design with a white 'M' and 'C' inside.

THE MEDICAL CONCIERGE GROUP  
UGANDA | KENYA | NIGERIA

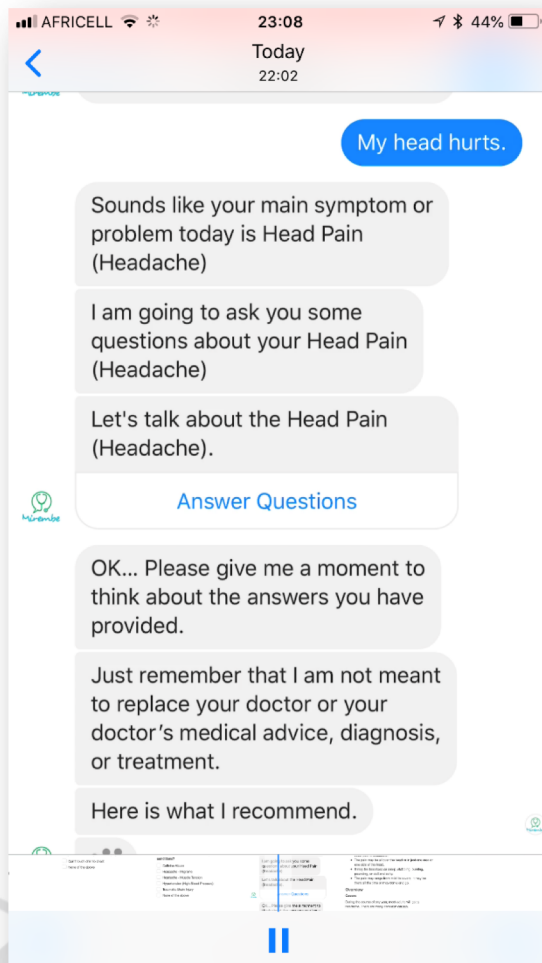


# Mirembe

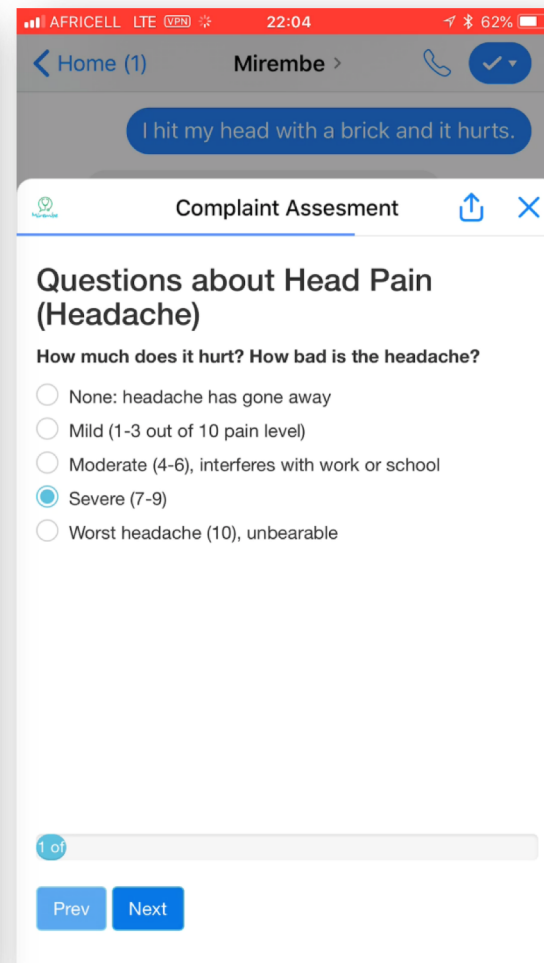
## Facebook Messenger Implementation in Uganda



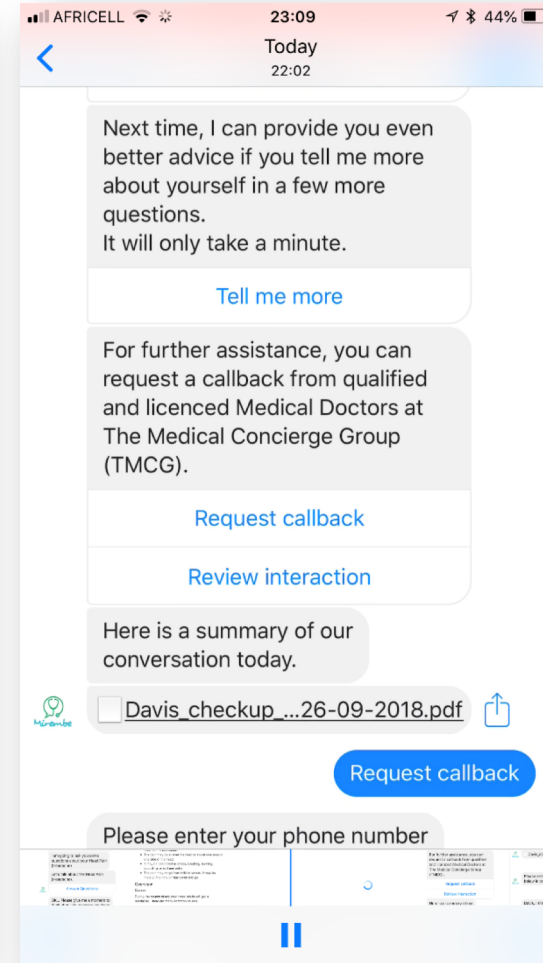
THE MEDICAL  
CONCERGE GROUP



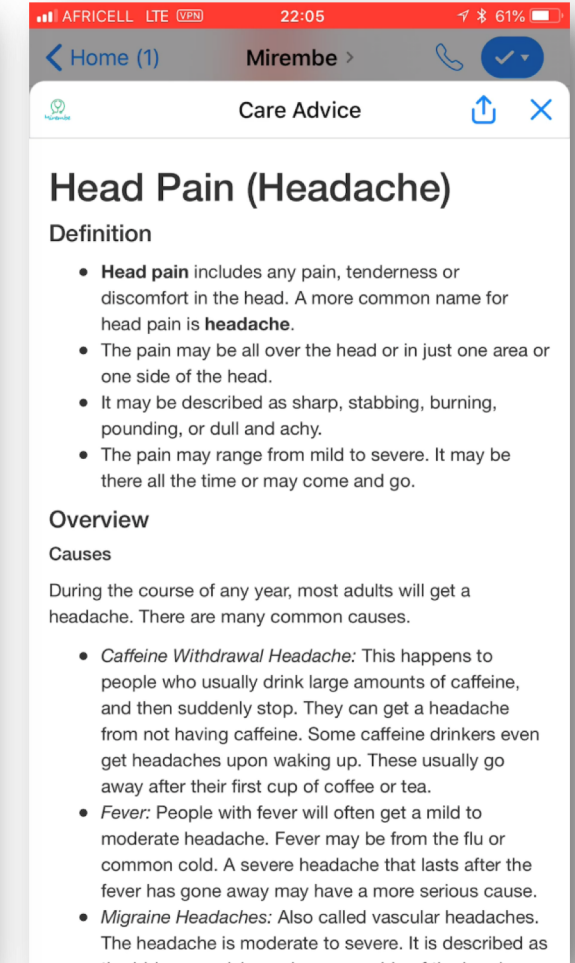
Natural Language Processing



Rapid Medical History



Triage, Access to Doctor



Care Advice and Health Information


# Call Queue

Physician Telemedicine Application, Uganda



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CONCIERGE GROUP






THE MEDICAL CONCIERGE GROUP

Dashboard

New Encounter

Patient Records

New Patient Record



Hi Doctor, Please have a look at these....

Acuity	Patient Name	Presenting Complaint	Time of interaction	Age	Pregnancy Status	Gender	Report File	Status	Details
Red	Turner Nicholas Snr	I have a headache	2018-10-04 09:19:10	23	Not Pregnant	M	<a href="#">Turner_checkup_summary_04-10-2018_09_19.pdf</a>	<input type="checkbox"/>	<a href="#">CALL</a>
Orange	Tyna Mbabazi	Vomiting	2018-09-24 14:39:06	25	Not Pregnant	F	<a href="#">Tyna_checkup_summary_24-09-2018.pdf</a>	<input type="checkbox"/>	<a href="#">CALL</a>
Yellow	Sandra Kabigumira	Urination pain and fever	2018-10-03 18:52:56	25	Pregnant	F	<a href="#">Sandra_checkup_summary_03-10-2018_06_52.pdf</a>	<input type="checkbox"/>	<a href="#">CALL</a>
Green	Patricia Onyutta	Lower abdominal pain.	2018-09-24 14:54:50	29	Not Pregnant	F	<a href="#">Patricia_checkup_summary_24-09-2018.pdf</a>	<input type="checkbox"/>	<a href="#">CALL</a>

List of Patients  
Waiting for  
Telemedicine  
Encounter

Coded for acuity using  
Health Navigator NLP  
engine.



# SOAP Note

Physician Telemedicine Application, Uganda



THE MEDICAL  
CONCERGE GROUP



SOAP Note - Medical Encounter

Subjective - Tell us More

Urination Pain

Cough

Other Symptoms

How bad is the cough?

☐ None: cough has gone away

☐ Mild cough

☒ Moderate nonstop cough interferes with school or work [A]

☐ Severe: nonstop cough and can't sleep

< BACK

NEXT >

Patient Bio

Name

Mutumba Sowod

TMC ID

TMCID 0507

Age

46

Gender

Female

Pregnancy Status

Pregnant

Subjective Info

Presenting Complaint

I feel pain while urinating and I have a running nose and cough

Primary Complaint

Urination Pain

Other Complaints

Cough

Nose Discharge

## SOAP Note – Subjective Area

The patient's **symptoms** automatically populate the physician telemedicine record.

Soap Note - Assessment

Diagnosis

Top Causes

Emergencies

All Causes

Top Causes

Causes	Likelihood	ICD10 Code
Cystitis	95%	N30.90
Urinary Tract Infection (UTI)	94%	N39.0
Pyelonephritis (Kidney Infection)	88%	N12
Urethritis (Inflamed or Infected Urethra)	88%	N34.2
Sexually Transmitted Infection (STI)	81%	A64
Cancer - Vulva	71%	C51.9
Cystitis - Chronic Interstitial	71%	N30.10
Ureteral Reflux (Backflow of Urine from Bladder)	71%	N13.70
Urethritis - Nongonococcal	71%	N34.1

Triage

You should see or talk to your doctor today.

Assessment Note

Doctor|

## SOAP Note – Assessment Area

Show possible **causes** (diagnoses) to provide decision and coding support.

# TytoCare

Israel, United States



**TytoCare**  
**Israel, United States**



Dedi Gilad  
CEO & Co-Founder



Ophir Lotan  
Vice President, Product



**Health Navigator Partner**



# SOAP Note

## Physician Telemedicine Application

A screenshot of the tytocare telemedicine application interface. The screen displays a series of prompts for the user to describe their symptoms. The first prompt asks "Describe the reason for your visit" with a text input field containing "I have been". The second prompt asks "How long have you been experiencing this?" with radio button options: "A minute or longer", "An hour or longer", "A day or longer", "A week or longer", and "A month or longer". The third prompt asks "What is your main symptom?" with a list of symptoms: "Fever", "Headache", "Cough", "Running Nose", and "Stomach ache". The "Fever" option is selected. The fourth prompt asks "Can you describe what the skin feels like?" with radio button options: "No", "Purple of deep red spots colored spots and bruises", "Skin Boil", and "Skin sore or ulcers". The "No" option is selected.

Use **NLP** to determine patient's reason for visit.

Use **Rapid Medical History** to capture important information to send to telemedicine provider.

Recommend **best devices** to use for symptoms.

Prompt and guide user.

Perform and capture **exam** information.

Send **Chief Complaint, Rapid Medical History, and Exam** results to telemedicine provider.

# Macadamian

Canada



**Macadamian  
Canada**



m acadamian

**Health Navigator Alexa Skill**

Powered by Macadamian



Fred Boulanger  
Chief Executive Officer



Timon LeDain  
Director of IoT

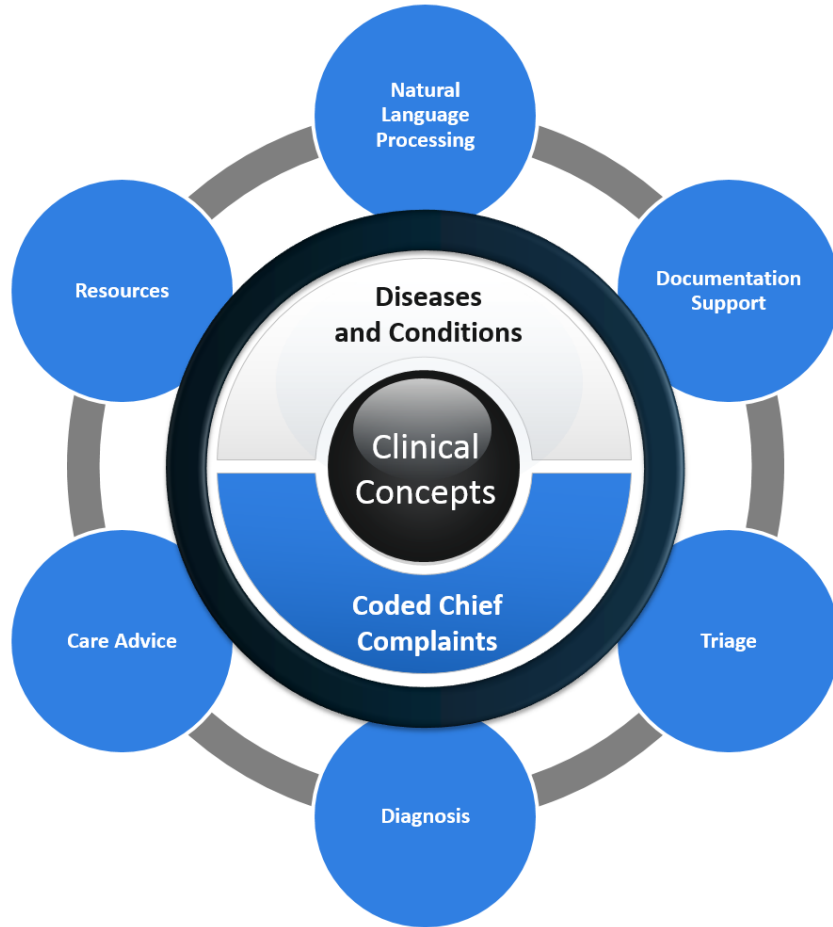
m acadamian

**Health Navigator Development Partner**



# Health Navigator

How is the clinical content delivered?



Encrypted Microsoft SQL Server database;  
hosted on Microsoft Azure.

Content



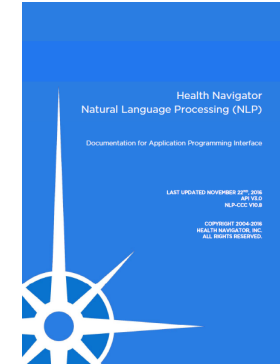
Delivery



Support



API



API employs RESTful web services. API returns JSON  
or XML depending on the client's requested format.  
Detailed API user guide documentation.



Your  
Application.



Sobre você



O que há de errado?



Conte-nos mais



Possíveis causas



Prontuário

## Conte-nos mais



Diarreia (fezes moles, evacu...

Dor no abdômen ou estômago

Outros sintomas

View API Call



Você pode descrever mais?

Sim Não

☐☐

Diarreia aquosa

Você está com dor em alguma dessas áreas?

Sim Não

☐☐

Dor no estômago - constante e perdurando por mais de 2 horas

Algum destes é verdadeiro?

Sim Não

☐☐

Viagem recente ao exterior

☐☐

Hospitalização recente

Você tem algum destes sintomas?

Sim Não

☐☐

Tontura (zozzo - tonto)

☐☐

Bebendo menos líquidos

☐☐

Boca seca

☐☐

Febre

☐☐

Febre durando mais de 3 dias

☐☐

Fezes - cor preta

Masculino

26 anos (Adulto)

Queixa principal primária

Diarreia (fezes moles, evac...

Queixa(s) principal(is) secundária(s)

Dor no abdômen ou estôm...

# Health Navigator

Clinical content for digital health and telemedicine, hosted on Microsoft Azure.



## Clinical Vocabulary

Medical Coding, Metadata, Plain Language



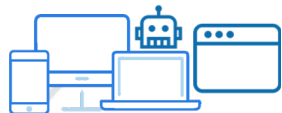
## Natural Language Processing

NLP



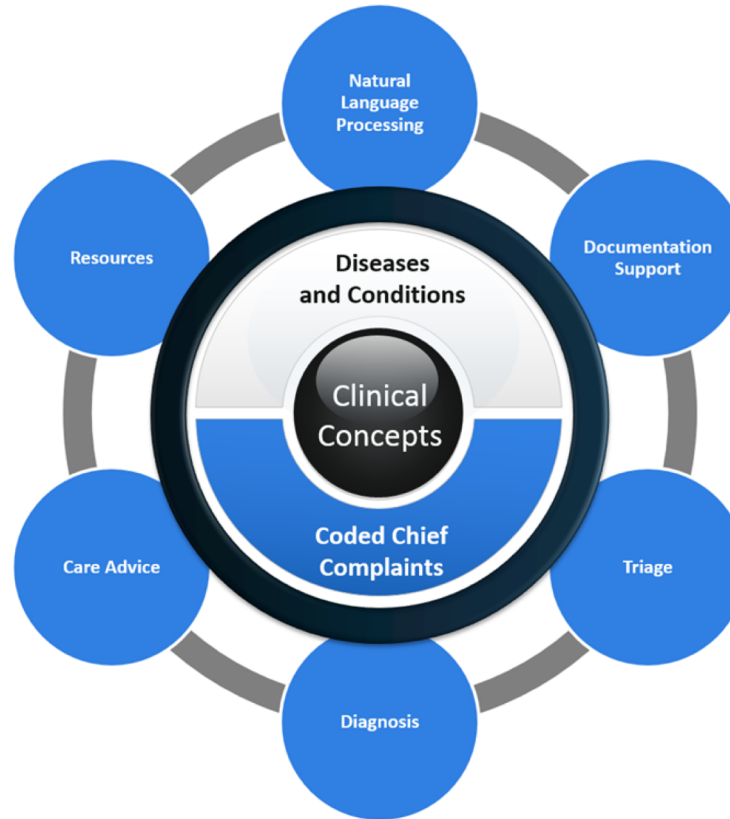
## Decision Support

Triage and Diagnosis Engines



## Omni-channel

Mobile Phone, Web, Health bots



## Health Navigator

Setting the standard for quality, across multiple channels and the continuum of care, improving the patient and provider experience, from the presenting complaint to the final diagnosis and care advice.



## Application Programming Interface

API: RESTful Web Service



## Documentation Support

Checklists for Patients and Doctors



## Multi-Lingual

US and UK English, Arabic, French, German, Spanish, Hindi, Chinese



## Quality and Credibility

20+ Years Experience in Clinical Content



# The End



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