



# Health Cards to Assist Decision Making in Consumer Health Search

Oral Presentations - Patient-centered Informatics

S47

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#AMIA2019

# Disclosure



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I have no relevant relationships with commercial interests to disclose.

# Learning Objectives

After participating in this session, the learner should be better able to:

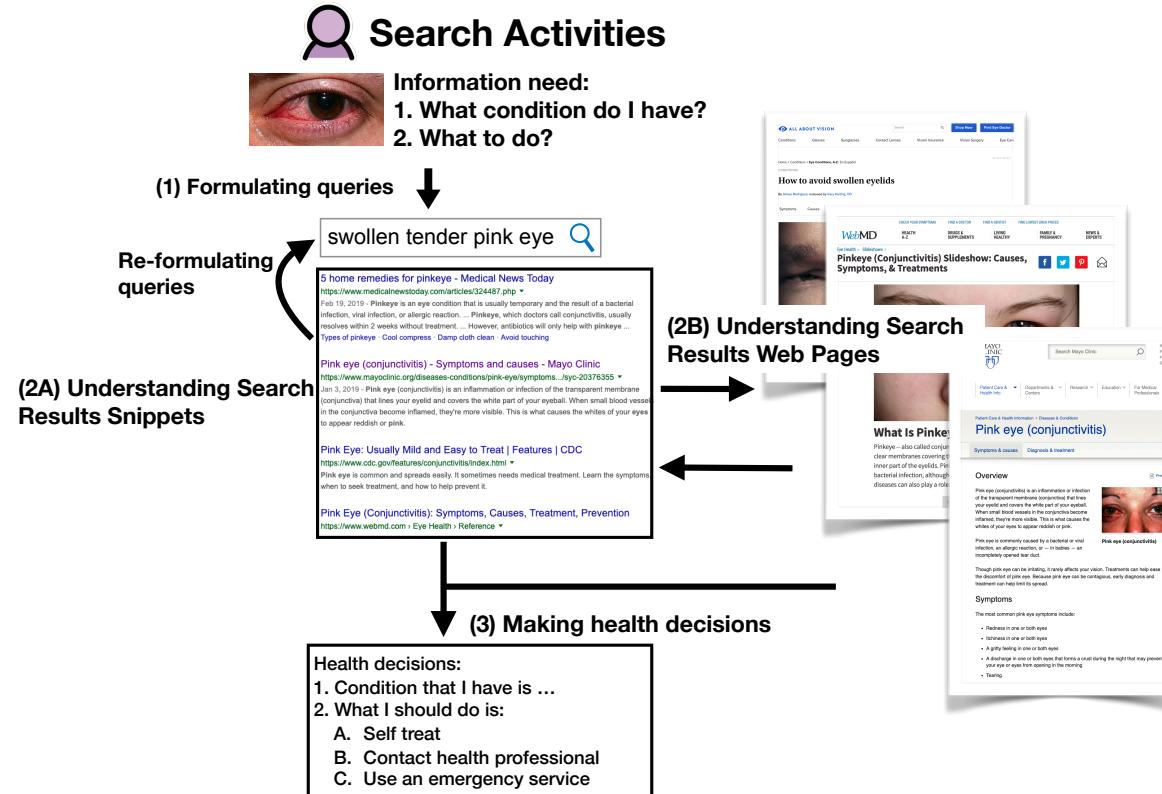
- learn challenges and possible solutions in **assisting** consumer health search users in making **health decisions by searching** from search engines.
- understand the concept of health cards and how **health cards influence decision making** in consumer health search.

# Consumer Health Search (CHS)



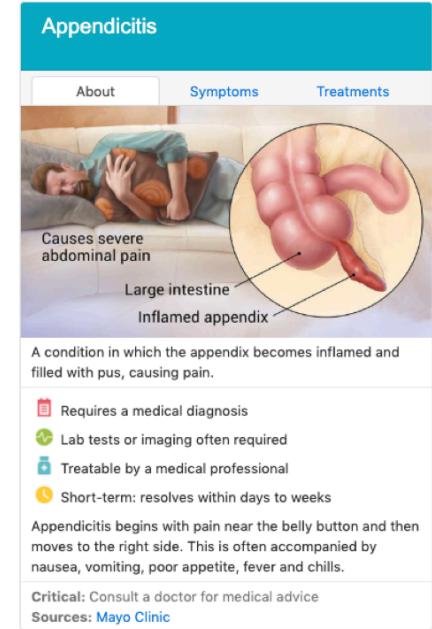
- CHS: **people searching for health advice online.**
  - 59% of U.S. adults has searched online for health information [Fox & Duggan, 2013].
  - 7% of Google searches are health related ~ 70,000 health queries/minute [Murphy, 2019].
- Search results strongly **bias people's** health decisions [Pogacar, 2017; White, 2009].
- People **struggle to understand** health search results and **fail to make correct health decisions** [Alpay, 2009; Kobayashi & Ishizaki, 2019].
- 59% of self-diagnosers decided **NOT to confirm their condition with a health professional** [Fox & Duggan, 2013].

# Search Activities



# Health Card for CHS

- Entity cards have been used by commercial search engines to present **coherent, easy to understand and trustworthy** information [Radlinski, 2015].
- The appearance of a health card is triggered by queries that **contain a health condition name or its aliases**.
- We investigate **the benefits of health cards for broader search tasks** - beyond just more information about a health condition.



Health card images and information are courtesy of Google.

# Search Task

For a health scenario, make the following two decisions:

1. What is the **most possible condition for the scenario?**
2. What to do / level of urgency ?
  - a) Use emergency service
  - b) Contact a health professional
  - c) Self treat

## Sample scenario:

**Scenario:** Your 12-year-old daughter had a sudden severe abdominal pain with nausea, vomiting, and diarrhea. Her body temperature is 40C.

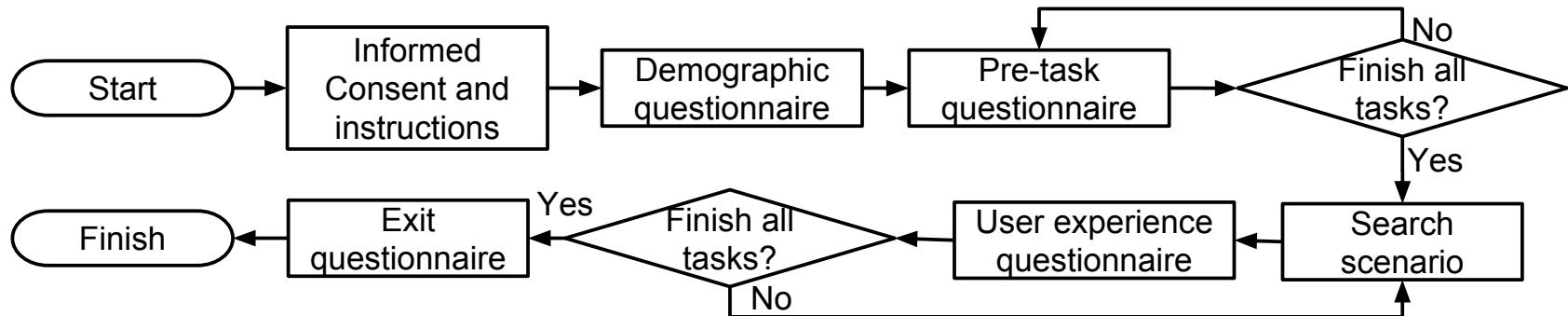
**Correct Diagnosis:** Appendicitis

**Correct Urgency Level:** Emergency

[Semigran et al., 2015]

# Methods: User Study

- 8 health search tasks X 64 Participants = 512 Data Points
- Search interfaces:
  - Correct VS Incorrect Cards
  - Single VS. Multiple Cards



# The Four Search Interfaces

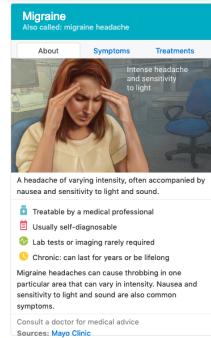
## Single-Card

With a Correct Card



## Multi-Cards

No Correct Card



Migraine	Meningitis	Encephalitis	High blood pressure
A single card for Migraine, showing a woman with a headache and a brain diagram. Text: 'Also called: migraine headache', 'About', 'Symptoms' (Intense headache and sensitivity to light), 'Treatments'. Below: 'A headache of varying intensity, often accompanied by nausea and sensitivity to light and sound.' Bullets: 'Treatable by a medical professional', 'Usually self-diagnosable', 'Lab tests or imaging rarely required', 'Chronic: can last for years or be lifelong'. Bottom: 'Consult a doctor for medical advice' and 'Sources: Mayo Clinic'.	A single card for Meningitis, showing a brain diagram. Text: 'About', 'Symptoms' (Severe headache and stiff neck), 'Treatments'. Below: 'Inflammation of brain and spinal cord membranes, typically caused by an infection.' Bullets: 'Treatable by a medical professional', 'Spreads by airborne droplets', 'Requires a medical diagnosis', 'Short-term: resolves within days to weeks'. Bottom: 'Critical: Consult a doctor for medical advice' and 'Sources: Mayo Clinic'.	A single card for Encephalitis, showing a brain diagram. Text: 'About', 'Symptoms' (Inflamed brain), 'Treatments'. Below: 'Inflammation of the brain, often due to infection.' Bullets: 'Treatable by a medical professional', 'Spreads by animals or insects', 'Requires a medical diagnosis', 'Short-term: resolves within days to weeks'. Bottom: 'May cause no symptoms or mild flu-like symptoms. Severe cases can be life-threatening. Immediate medical attention is needed for symptoms such as confusion, hallucinations, seizures, weakness and loss of sensation.' and 'Critical: Consult a doctor for medical advice' and 'Sources: Mayo Clinic'.	A single card for High blood pressure, showing a man taking a blood pressure reading. Text: 'About', 'Symptoms' (Measuring blood pressure), 'Treatments'. Below: 'A condition in which the force of the blood against the artery walls is too high.' Bullets: 'Treatable by a medical professional', 'Requires a medical diagnosis', 'Lab tests or imaging not required', 'Chronic: can last for years or be lifelong'. Bottom: 'High blood pressure often has no symptoms. Over time, if untreated, it can cause health conditions, such as heart disease and stroke.' and 'Critical: Consult a doctor for medical advice' and 'Sources: Mayo Clinic'.

Migraine	Encephalitis	High blood pressure	Pink eye
A single card for Migraine, showing a woman with a headache and a brain diagram. Text: 'Also called: migraine headache', 'About', 'Symptoms' (Intense headache and sensitivity to light), 'Treatments'. Below: 'A headache of varying intensity, often accompanied by nausea and sensitivity to light and sound.' Bullets: 'Treatable by a medical professional', 'Usually self-diagnosable', 'Lab tests or imaging rarely required', 'Chronic: can last for years or be lifelong'. Bottom: 'Consult a doctor for medical advice' and 'Sources: Mayo Clinic'.	A single card for Encephalitis, showing a brain diagram. Text: 'Also called: inflammation of the brain', 'About', 'Symptoms' (Inflamed brain), 'Treatments'. Below: 'Inflammation of the brain, often due to infection.' Bullets: 'Treatable by a medical professional', 'Spreads by animals or insects', 'Requires a medical diagnosis', 'Short-term: resolves within days to weeks'. Bottom: 'May cause no symptoms or mild flu-like symptoms. Severe cases can be life-threatening. Immediate medical attention is needed for symptoms such as confusion, hallucinations, seizures, weakness and loss of sensation.' and 'Critical: Consult a doctor for medical advice' and 'Sources: Mayo Clinic'.	A single card for High blood pressure, showing a man taking a blood pressure reading. Text: 'Also called: HBP, hypertension', 'About', 'Symptoms' (Measuring blood pressure), 'Treatments'. Below: 'A condition in which the force of the blood against the artery walls is too high.' Bullets: 'Treatable by a medical professional', 'Requires a medical diagnosis', 'Lab tests or imaging not required', 'Chronic: can last for years or be lifelong'. Bottom: 'High blood pressure often has no symptoms. Over time, if untreated, it can cause health conditions, such as heart disease and stroke.' and 'Critical: Consult a doctor for medical advice' and 'Sources: Mayo Clinic'.	A single card for Pink eye (conjunctivitis), showing an eye and a diagram. Text: 'Also called: conjunctivitis', 'About', 'Symptoms' (Eye with conjunctivitis), 'Treatments'. Below: 'Inflammation or infection of the outer membrane of the eyeball and the inner eyelid.' Bullets: 'Spreads easily', 'Treatable by a medical professional', 'Usually self-diagnosable', 'Short-term: resolves within days to weeks'. Bottom: 'Symptoms include redness, itching and tearing of the eyes. It can also lead to discharge or crusting around the eyes.' and 'Critical: Consult a doctor for medical advice' and 'Sources: Mayo Clinic'.

# Why Showing Multi-cards?



- People submitted **underspecified queries** which often make **difficult** (if possible at all) **to determine** the single **correct health card** to present.
- **Presenting possible health conditions** side-by-side **enables** people to perform **differential diagnosis**.

# Search Interface with Multi-Cards

**Scenario 7 of 8:**  
Your 12-year-old daughter had a sudden severe abdominal pain with nausea, vomiting, and diarrhea. Her body temperature is 40°C.

**Tasks:**  
1. Copy and paste the most possible health condition for this scenario.  
  
2. What would you do now?  
 Use an Emergency service. This includes calling 000 or immediately going to an hospital Emergency.  
 Contact an health professional. This includes make an appointment with a GP, a home doctor, or call a nurse helpline.  
 Self treat. This includes buying an over the counter medicine/drug, use an home-remedy, or performing activities to mitigate the condition.  
  
3. How confident are you with your answers?  

Very NOT Confident	NOT Confident	Neutral	Confident	Very Confident
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4. You consider the health cards shown in this scenario as:  

All NOT Relevant	Some are Relevant	All Relevant
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All are Difficult to Understand	Some are Easy to Understand	All are Easy to Understand
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All are NOT Trustworthy	Some are Trustworthy	All are Trustworthy
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**Submit**

child stomach ache vomiting diarrhea temperature

Matched Conditions

**Sepsis**  
Also called: septicemia

About      Symptoms      Treatments



Bacteria infect bloodstream

A life-threatening complication of an infection.

- Requires a medical diagnosis
- Lab tests or imaging always required
- Treatable by a medical professional
- Short-term: resolves within days to weeks

Symptoms include fever, difficulty breathing, low blood pressure, fast heart rate and mental confusion.

Critical: Consult a doctor for medical advice

Sources: Mayo Clinic

**Stomach flu**  
Also called: gastroenteritis

About      Symptoms      Treatments



Stomach  
Intestines

An intestinal infection marked by diarrhea, cramps, nausea, vomiting and fever.

- Spreads easily
- Usually self-treatable
- Usually self-diagnosable
- Short-term: resolves within days to weeks

Diarrhea, cramps, nausea, vomiting and low-grade fever are common symptoms.

Consult a doctor for medical advice

Sources: Mayo Clinic

**Flu**  
Also called: influenza

About      Symptoms      Treatments



Fever and muscle aches

A common viral infection that can be deadly, especially in high-risk groups.

- Spreads easily
- Usually self-treatable
- Usually self-diagnosable
- Short-term: resolves within days to weeks

Symptoms include fever, chills, muscle aches, cough, congestion, runny nose, headaches and fatigue.

Consult a doctor for medical advice

Sources: Mayo Clinic

**Appendicitis**

About      Symptoms      Treatments



Causes severe abdominal pain

Large intestine

Inflamed appendix

A condition in which the appendix becomes inflamed and filled with pus, causing pain.

- Requires a medical diagnosis
- Lab tests or imaging often required
- Treatable by a medical professional
- Short-term: resolves within days to weeks

Appendicitis begins with pain near the belly button and then moves to the right side. This is often accompanied by nausea, vomiting, poor appetite, fever and chills.

Critical: Consult a doctor for medical advice

Sources: Mayo Clinic

About 1,750,000 results

## Why Is My Child Throwing Up With No Fever? Nausea and ...

<https://www.webmd.com/children/guide/child-throw-up-no-fever>

Usually, your child will also have nausea, watery diarrhea, and stomach pain. It's possible for food poisoning to cause fever, but it's common for it to cause throwing up with no fever, too.

## Diarrhea, Fever, Nausea or vomiting and Stomach cramps ...

<https://symptomchecker.webmd.com/multiple-symptoms/symptoms=diarrhea%7Cfever%7Cnausea-or-vomiting%7C...>

Diarrhea, Fever, Nausea or vomiting and Stomach cramps. WebMD Symptom Checker helps you find the most common medical conditions indicated by the symptoms diarrhea, fever, nausea or vomiting and stomach cramps including Gastroenteritis, Food poisoning, and Irritable bowel syndrome.

## What are the Causes of Stomach Ache and Fever?

<https://www.wisegeek.com/what-are-the-causes-of-stomach-ache-and-fever.htm>

When a person has a stomach ache and fever, one of the most likely causes of his symptoms is a stomach flu. Despite the misleading name, this condition is not related to influenza, but is caused by a virus that leads to such symptoms as pain, fever, diarrhea, nausea, and vomiting .

## Viral Gastroenteritis (Stomach Flu): Symptoms and Treatment

<https://www.healthline.com/health/viral-gastroenteritis>

Symptoms can last from 1 to 10 days, including diarrhea, vomiting, and fever. Here are some self-care tips and home remedies for relief. Viral gastroenteritis, also known as the stomach flu, is an ...

# Search Interface: Scenario and Tasks

**Scenario 7 of 8:**

Your 12-year-old daughter had a sudden severe abdominal pain with nausea, vomiting, and diarrhea. Her body temperature is 40C.

**Tasks:**

1. Copy and paste the most possible health condition for this scenario.
2. What would you do now?
  - Use an Emergency service. This includes calling 000 or immediately going to an hospital Emergency.
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**Submit**

Did stomach ache vomiting diarrhea temperature

Search Conditions

**Sepsis**  
Also called: septicemia

About Symptoms Treatments

Bacteria infect bloodstream

life-threatening complication of an infection.

- Requires a medical diagnosis
- Lab tests or imaging always required
- Treatable by a medical professional
- Short-term: resolves within days to weeks

symptoms include fever, difficulty breathing, low blood pressure, fast heart rate and mental confusion.

Critical: Consult a doctor for medical advice

Sources: Mayo Clinic

**Stomach flu**  
Also called: gastroenteritis

About Symptoms Treatments

Stomach Intestines

An intestinal infection marked by diarrhea, cramps, nausea, vomiting and fever.

- Spreads easily
- Usually self-treatable
- Usually self-diagnosable
- Short-term: resolves within days to weeks

Diarrhea, cramps, nausea, vomiting and low-grade fever are common symptoms.

Consult a doctor for medical advice

Sources: Mayo Clinic

**Flu**  
Also called: influenza

About Symptoms Treatments

Fever and muscle aches

A common viral infection that can be deadly, especially in high-risk groups.

- Spreads easily
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- Short-term: resolves within days to weeks

Symptoms include fever, chills, muscle aches, cough, congestion, runny nose, headaches and fatigue.

Consult a doctor for medical advice

Sources: Mayo Clinic

**Appendicitis**

About Symptoms Treatments

Causes severe abdominal pain

Large intestine Inflamed appendix

A condition in which the appendix becomes inflamed and filled with pus, causing pain.

- Requires a medical diagnosis
- Lab tests or imaging often required
- Treatable by a medical professional
- Short-term: resolves within days to weeks

Appendicitis begins with pain near the belly button and then moves to the right side. This is often accompanied by nausea, vomiting, poor appetite, fever and chills.

Critical: Consult a doctor for medical advice

Sources: Mayo Clinic

1,780,000 results

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# Search Interface: Multi-Cards

**Scenario 7 of 8:**

Your 12-year-old daughter had a sudden severe abdominal pain with nausea, vomiting, and diarrhea. Her body temperature is 40°C.

**Tasks:**

- Copy and paste the most possible health condition for this scenario

**2. What would you do now?**

- Use an Emergency service. This includes calling 000 or immediately going to an hospital Emergency.
- Contact an health professional. This includes make an appointment with a GP, a home doctor, or call a nurse helpline.
- Self treat. This includes buying an over the counter medicine/drug, use an home-remedy, or performing activities to mitigate the condition.

**3. How confident are you with your answers?**

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**Submit**

child stomach ache vomiting diarrhea temperature

**Matched Conditions**

Sepsis	Also called: septicemia
<a href="#">About</a> <a href="#">Symptoms</a> <a href="#">Treatments</a>	
<p><b>Bacteria infect bloodstream</b></p> <p>A life-threatening complication of an infection.</p> <ul style="list-style-type: none"> <li><span style="color: orange;">●</span> Requires a medical diagnosis</li> <li><span style="color: green;">●</span> Lab tests or imaging always required</li> <li><span style="color: blue;">●</span> Treatable by a medical professional</li> <li><span style="color: yellow;">●</span> Short-term: resolves within days to weeks</li> </ul> <p>Symptoms include fever, difficulty breathing, low blood pressure, fast heart rate and mental confusion.</p> <p>Critical: Consult a doctor for medical advice</p> <p>Sources: <a href="#">Mayo Clinic</a></p>	

Stomach flu	Also called: gastroenteritis
<a href="#">About</a> <a href="#">Symptoms</a> <a href="#">Treatments</a>	
<p><b>Stomach</b> <b>Intestines</b></p> <p>An intestinal infection marked by diarrhoea, cramps, nausea, vomiting and fever.</p> <ul style="list-style-type: none"> <li><span style="color: orange;">●</span> Spreads easily</li> <li><span style="color: green;">●</span> Lab tests or imaging often required</li> <li><span style="color: blue;">●</span> Usually self-treatable</li> <li><span style="color: yellow;">●</span> Usually self-diagnosable</li> </ul> <p>Diarrhoea, cramps, nausea, vomiting and low-grade fever are common symptoms.</p> <p>Short-term: resolves within days to weeks</p> <p>Symptoms include fever, chills, muscle aches, cough, congestion, runny nose, headaches and fatigue.</p> <p>Consult a doctor for medical advice</p> <p>Sources: <a href="#">Mayo Clinic</a></p>	

Flu	Also called: influenza
<a href="#">About</a> <a href="#">Symptoms</a> <a href="#">Treatments</a>	
<p><b>Fever and muscle aches</b></p> <p>A common viral infection that can be deadly, especially in high-risk groups.</p> <ul style="list-style-type: none"> <li><span style="color: orange;">●</span> Spreads easily</li> <li><span style="color: green;">●</span> Lab tests or imaging often required</li> <li><span style="color: blue;">●</span> Usually self-treatable</li> <li><span style="color: yellow;">●</span> Usually self-diagnosable</li> </ul> <p>Short-term: resolves within days to weeks</p> <p>Symptoms include fever, chills, muscle aches, cough, congestion, runny nose, headaches and fatigue.</p> <p>Consult a doctor for medical advice</p> <p>Sources: <a href="#">Mayo Clinic</a></p>	

Appendicitis	
<a href="#">About</a> <a href="#">Symptoms</a> <a href="#">Treatments</a>	
<p><b>Causes severe abdominal pain</b></p> <p>Large intestine</p> <p>Inflamed appendix</p> <p>A condition in which the appendix becomes inflamed and filled with pus, causing pain.</p> <ul style="list-style-type: none"> <li><span style="color: orange;">●</span> Requires a medical diagnosis</li> <li><span style="color: green;">●</span> Lab tests or imaging often required</li> <li><span style="color: blue;">●</span> Treatable by a medical professional</li> <li><span style="color: yellow;">●</span> Short-term: resolves within days to weeks</li> </ul> <p>Appendicitis begins with pain near the belly button and then moves to the right side. This is often accompanied by nausea, vomiting, poor appetite, fever and chills.</p> <p>Critical: Consult a doctor for medical advice</p> <p>Sources: <a href="#">Mayo Clinic</a></p>	

Why Is My Child Throwing Up With No Fever? Nausea and ...  
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Usually, your child will also have nausea, watery diarrhea, and stomach pain. It's possible for food poisoning to cause fever, but it's common for it to cause throwing up with no fever, too.

Diarhea, Fever, Nausea or vomiting and Stomach cramps ...  
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# Search Interface: Snippet List

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**Submit**

child stomach ache vomiting diarrhea temperature

Matched Conditions

**Sepsis**  
Also called: septicemia

About    Symptoms    Treatments



A life-threatening complication of an infection.

- Requires a medical diagnosis
- Lab tests or imaging always required
- Treatable by a medical professional
- Short-term: resolves within days to weeks

Symptoms include fever, difficulty breathing, low blood pressure, fast heart rate and mental confusion.

Critical: Consult a doctor for medical advice

Sources: Mayo Clinic

**Stomach flu**  
Also called: gastroenteritis

About    Symptoms    Treatments



An intestinal infection marked by diarrhea, cramps, nausea, vomiting and fever.

- Spreads easily
- Usually self-treatable
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Diarrhea, cramps, nausea, vomiting and low-grade fever are common symptoms.

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**Flu**  
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About    Symptoms    Treatments



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**Appendicitis**

About    Symptoms    Treatments



A condition in which the appendix becomes inflamed and filled with pus, causing pain.

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Critical: Consult a doctor for medical advice

About 1,750,000 results

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# Impact of Health Cards on Search Behavior

49% of search session **time** was spent to interact with the **Single-Card** interface.

migraine fever neck stiffness

About 3,390,000 results

**Migraines and Neck Pain in Muscles and Nerves | Symptoms**  
https://migraine.com/migraine-symptoms/migraine-fever-neck-pain/7/neck-headache/7/fever-neck-throat/7/cold-n...  
Some people living with migraine report neck pain during migraine attacks. Warning: A stiff neck can be a sign of a more serious or potentially life-threatening condition. Seek immediate medical assistance if you experience stiff neck along with fever and headache.

**Fever, Headache, Sore throat and Stiff neck: Common ...**  
https://www.webmd.com/migraine/conditions-common-migraine-fever-neck-headache/7/fever-neck-throat/7/cold-n...  
Fever, Headache, Sore throat and Stiff neck. WebMD Symptom Checker helps you find the most common medical conditions indicated by the symptoms fever, headache, sore throat and stiff neck including: Vomiting, Pharyngitis, Acute sinusitis, and Aseptic meningitis (adult).

**Stiff Neck and Headache - healthkey.com**  
https://www.healthkey.com/stiff-neck-headache  
Moderate to severe headache and stiff neck - Encephalitis, migraine, sinus headache Extreme headache and stiff neck - Trigeminal neuralgia, meningitis, ... The virus causing meningitis spreads easily and quickly in unhygienic areas. Muscle spasms, fever, headache, sore throat, behavioral changes, stiff neck are symptoms of viral meningitis.

**Why Neck Pain Is Frequently Related to Migraines - Upper ...**  
https://www.cervicalawareness.com/migraine-pain-related-migraines/  
Neck pain is a common migraine symptom, and good reason. But before we get to that, let's take a look at some research in Italy that clearly connects. ... These misalignments can also damage nerves and soft tissue, thereby causing pain and stiffness. Even for patients who do not have migraines, the tissue damage can still cause pain.

**Case Study: Headache, neck stiffness, and fever - The ...**  
https://www.clinicaladvisor.com/clinical-challenge/case-of-headache-stiff-neck-and-fever/article/696...  
A 65-year-old man with a history of hypertension and migraines is sent by his primary care provider to the ED for a spinal tap to rule out meningitis. ... Headache, neck stiffness, and fever.

**Migraine Headaches, Nausea, and Vomiting - WebMD**  
https://www.webmd.com/migraines-headaches/headaches-migraines-and-nausea  
A severe headache that causes nausea and extreme sensitivity to light may sound like a migraine. But if you also have a stiff neck, with or without a fever, it could be meningitis, which requires ...

**Infections That Cause Headaches and a Fever**  
https://www.verywellhealth.com/infections-that-cause-headache-and-fever-1719431  
A brain abscess is a rare, but potentially life-threatening condition, in which infected fluid collects in the brain. Symptoms of a brain abscess can resemble that of meningitis or encephalitis and include: fever, headache, neck stiffness, neurological dysfunction, and confusion.

**Case Study: Headache, neck stiffness, and fever - The ...**  
https://www.clinicaladvisor.com/clinical-challenge/case-of-headache-stiff-neck-and-fever/article/696...  
A 55-year-old man with a history of hypertension and migraines is sent by his primary care provider to the ED for a spinal tap to rule out meningitis. ... Case Study: Headache, neck stiffness ...

**I got headaches but no fever my neck stiff so am I ...**  
https://answers.yahoo.com/question/index?qid=2010010304418AA0w8p  
I got headaches but no fever my neck stiff so am I? I got headache and stiff neck and very giddyxD. Follow ... Migraine- One sided, more common in females, Sensitivity to light, pain behind one eye, throbbing, brought on by bright lights, chocolate, cheese, red wine or menstrual cycle. ... Stiff Neck And Fever. Sources(...)

**Stiff neck? Blinding headache? HELPP!!? | Yahoo Answers**  
https://answers.yahoo.com/question/index?qid=20070930182129AA3yvT6  
Last night I felt the worst because I was vomiting, had violent chills and a fever. Should I... show more For the past four days I have had a horrible headache. My head pounds and it gets worse with lights. ... COULD STILL BE A MIGRAINE BUT WITH A STIFF NECK AND THE OTHER SYMPTOMS YOU NEED TO GO TO THE E.R. RIGHT NOW AND BE CHECKED ...

82% of search session **time** was spent to interact with the **Multi-Cards** interface.

migraine fever neck stiffness

Matched Conditions

**Migraine**  
About Symptoms Treatments

**Meningitis**  
About Symptoms Treatments

**Meningitis**  
About Symptoms Treatments

**Encephalitis**  
About Symptoms Treatments

**High blood pressure**  
About Symptoms Treatments

A heatmap showing user interaction patterns across the search results pages. The 'Multi-Cards' interface shows significantly more interaction (green highlights) on the condition cards themselves compared to the 'Single-Card' interface.

# Measurements

1. Selected as a source of information



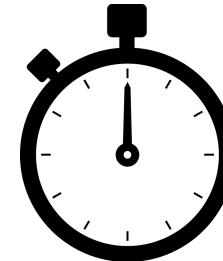
4. Reduce the **effort** to complete a task



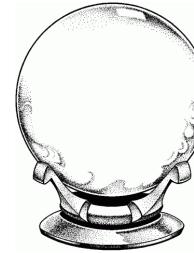
2. Lead to more **correct** decisions



3. Reduce **time** to complete a task



5. Increase rate of **Good abandonment\***



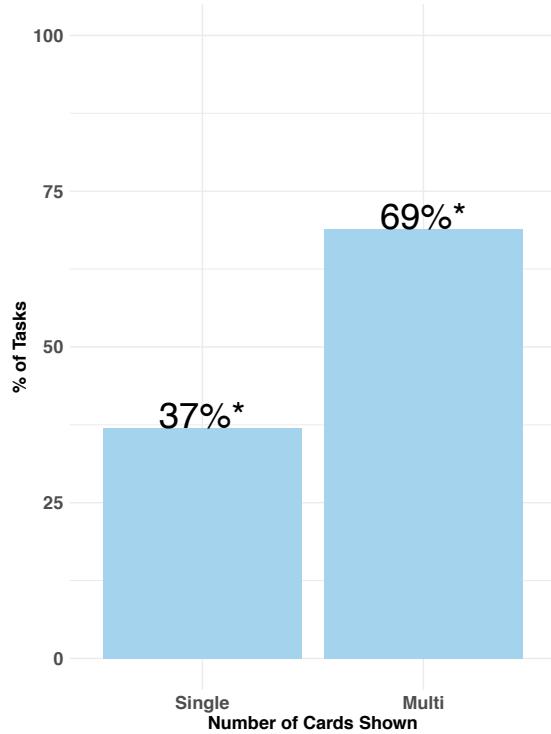
6. Improve **confidence** on decisions



\* Good abandonment is when people manage to complete a task without clicking on the search results.

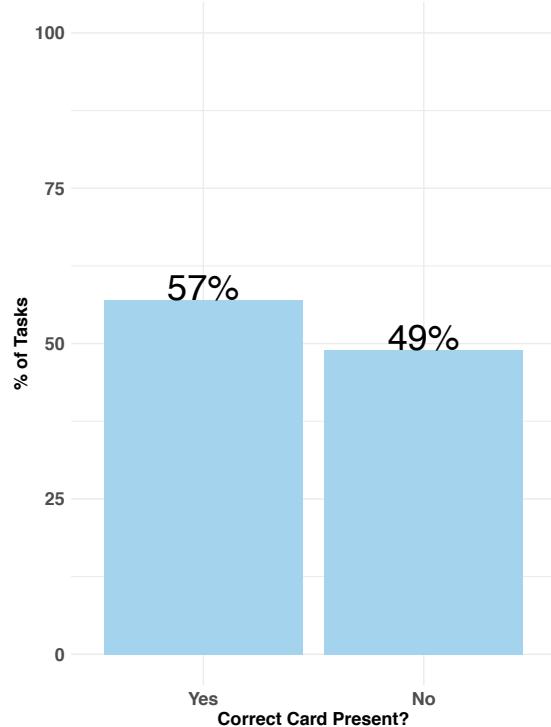
# Are Health Cards Selected as a Source of Information? (1)

People **selected information from multi-cards significantly more frequent than from single-card.**



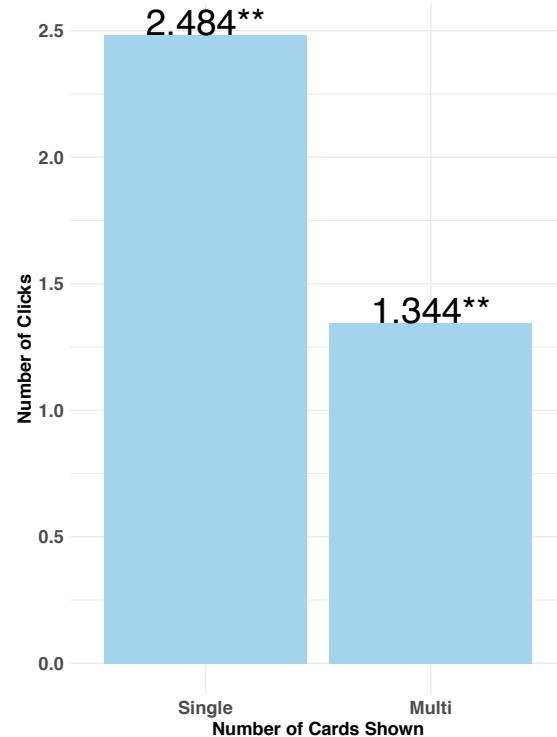
# Are Health Cards Selected as a Source of Information? (2)

People **select** from health cards **regardless** the correctness of health cards.



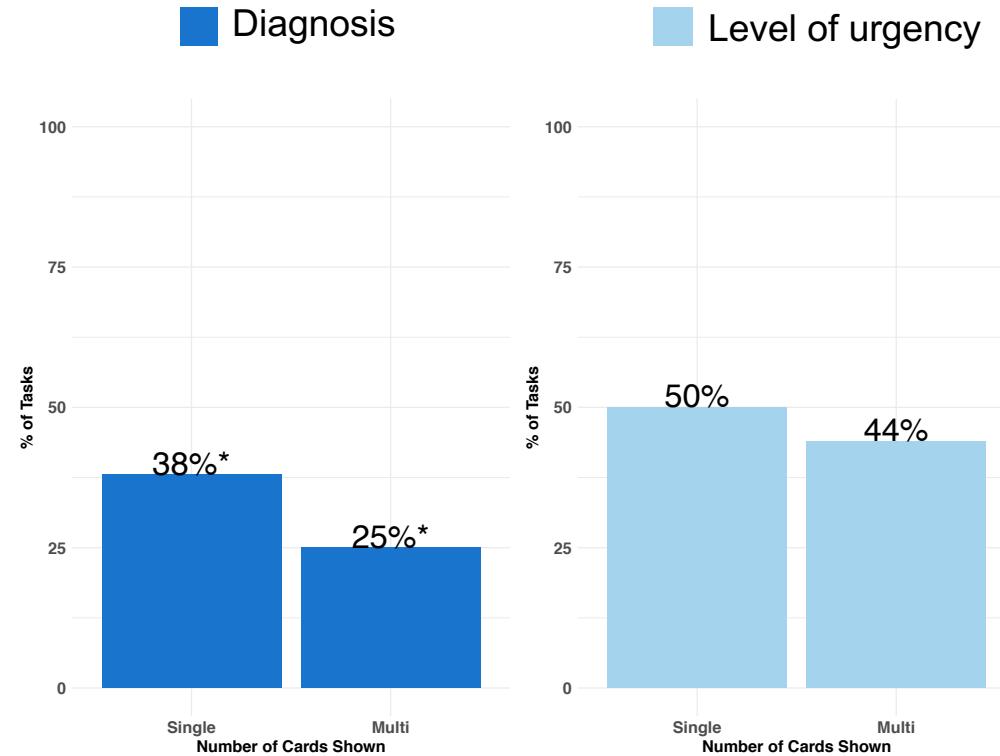
# Does Presenting Health Cards Reduce Effort to Complete a Task?

- **Effort is** translated as the **number of clicks** required to complete a task.
- The **multi-cards** interface enables people to make health decisions with **significantly less effort** than the single card interface.



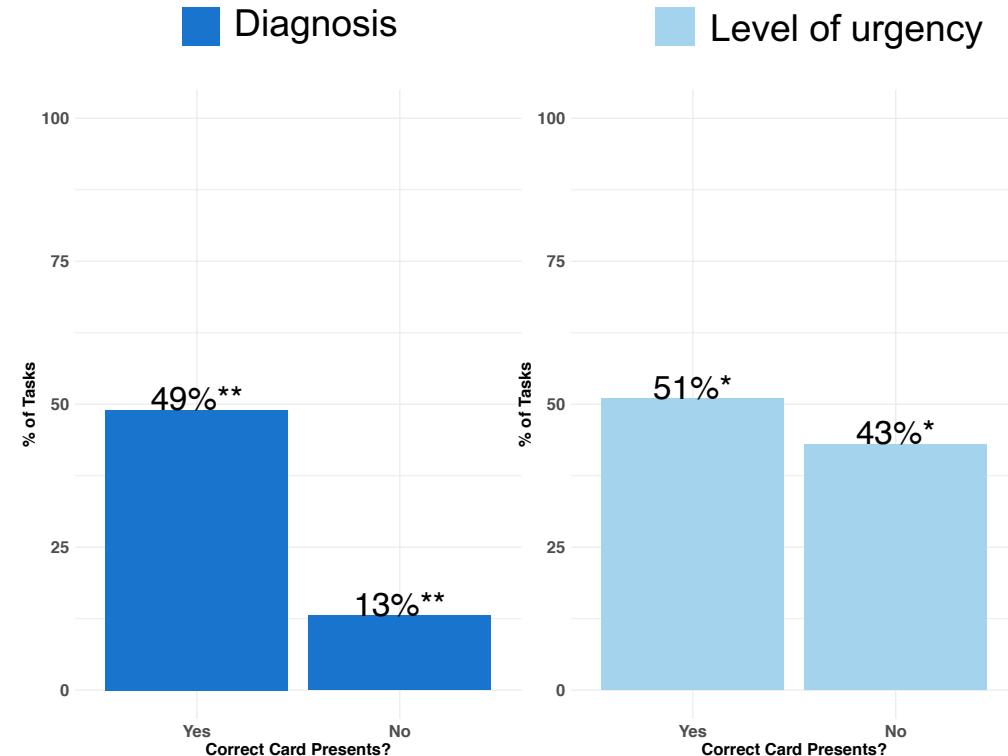
# Does Presenting Health Cards Improve the Number of Correct Decisions? (1)

**Single-card** interface leads to a significantly **higher number of correct diagnosis** than multi-cards interface.

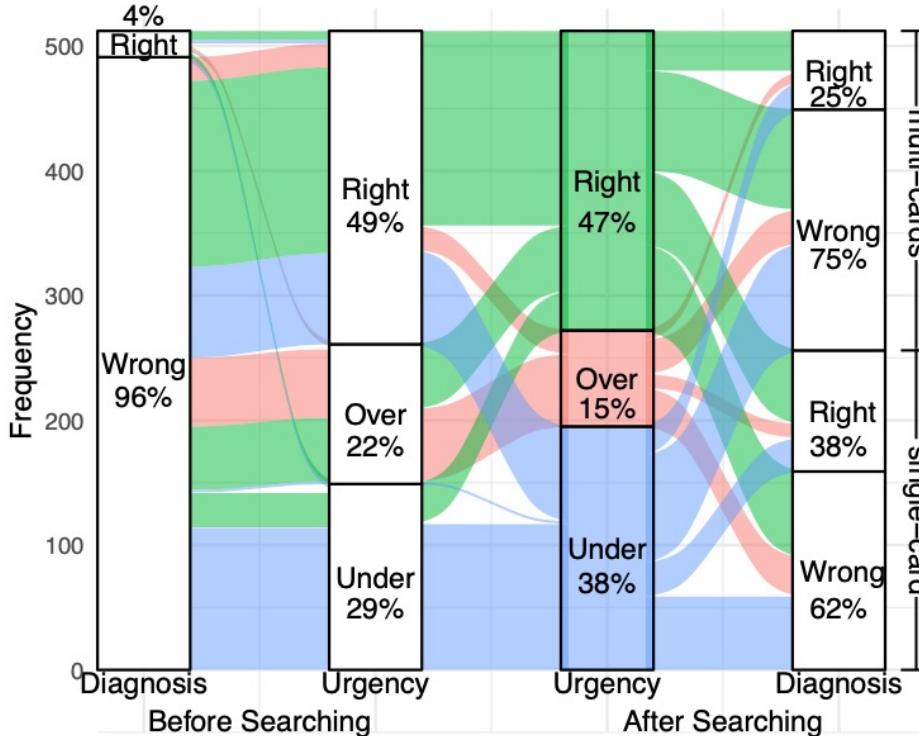


# Is Presenting Health Cards Improves the Number of Correct Decisions? (2)

- The **correctness of decisions** is **dependent** to the correctness of the **presented health card**.
- This is inline with findings from a previous study by Pogacar et al. in 2017.



# Correctness of Decisions Before and After Search



- **Search activities** lead to significant **increase of correct diagnosis**.
- **Search activities** did **NOT** lead to **better level of urgency correctness**.
- **43% of correct diagnosis had an incorrect level of urgency** (73% of them were underestimated).

# Was It Us?



## Before

### Self-treat

**Stye**  
Also called: Sty

[About](#) [Symptoms](#) [Treatments](#)



A red, painful lump near the edge of the eyelid that may look like a boil or pimple.

Usually self-treatable  
Usually self-diagnosable  
Lab tests or imaging rarely required  
Short-term: resolves within days to weeks

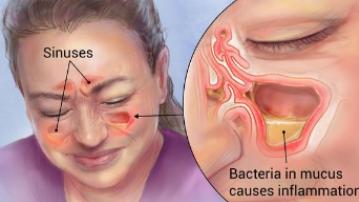
Styes are often filled with pus. Sometimes a stye can form on the inner part of the eyelid.

Consult a doctor for medical advice  
Sources: [Mayo Clinic](#)

### Seek Medical Attention

**Sinusitis**  
Also called: sinus infection

[About](#) [Symptoms](#) [Treatments](#)



A condition in which the cavities around the nasal passages become inflamed.

Treatable by a medical professional  
Usually self-diagnosable  
Lab tests or imaging rarely required  
Short-term: resolves within days to weeks

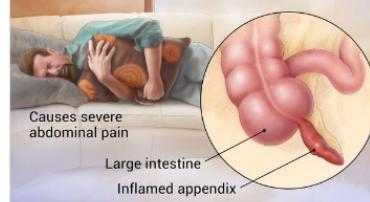
Symptoms include headache, facial pain, runny nose and nasal congestion.

Consult a doctor for medical advice  
Sources: [Mayo Clinic](#)

### Emergency

**Appendicitis**

[About](#) [Symptoms](#) [Treatments](#)



A condition in which the appendix becomes inflamed and filled with pus, causing pain.

Requires a medical diagnosis  
Lab tests or imaging often required  
Treatable by a medical professional  
Short-term: resolves within days to weeks

Critical: Consult a doctor for medical advice  
Sources: [Mayo Clinic](#)

## Now

### Emergency

**Appendicitis**

[ABOUT](#) [SYMPTOMS](#) [TREATMENTS](#)



Causes severe abdominal pain  
Large intestine  
Inflamed appendix  
Source

A condition in which the appendix becomes inflamed and filled with pus, causing pain.

Requires a medical diagnosis  
Lab tests or imaging often required  
Treatable by a medical professional  
Short-term: resolves within days to weeks  
Critical: needs emergency care

The appendix is a pouch on the colon that has no known purpose. Appendicitis begins with pain near the belly button and then moves to the right side. This is often accompanied by nausea, vomiting, poor appetite, fever and chills. Appendicitis is usually treated with surgery and antibiotics. If untreated, the appendix can rupture and cause an abscess or systemic infection (sepsis).

Consult a doctor for medical advice  
Sources: Mayo Clinic and others. Learn more

# Implications

- People **struggle** to **infer the level of urgency** based on search results. In fact, people tend to **underestimate urgency** across search interfaces.
- This is problematic as making the **correct diagnosis** is **not as important as** identifying the **correct level of urgency**.

Diagnosis	Urgency Level	Risk
Correct	Under-estimated	Harm well-being
Correct	Over-estimated	Waste medical resources
Incorrect	Correct	None to minimum

- **Future work** needs to better assist people in **deciding the urgency level** of their perceived condition.

# Thank you!

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