Medical Diagnostic Systems
Previous Attempts at Artificial Intelligence in Medicine

- **Mycin- Stanford**
  - Doctoral dissertation of Edward Shortliffe designed to identify bacterial etiology in patients with sepsis and meningitis and to recommend antibiotics
  - Had simple inference engine and knowledge base of 600 rules
  - Proposed acceptable therapy in 69% of cases which was better than most ID experts
  - Never actually used in practice largely due to lack of access and time for physician entry >30 minutes

- **Caduceus** – similar inference engine to Mycin and based on Harry Pope from U of Pittsburgh’s interviews with Dr. Jack Myers with database of up to 1,000 diseases
Previous Attempts at Artificial Intelligence in Medicine

- Internist I and II – Covered 70-80% of possible diagnoses in internal medicine, also based on Jack Myers’ expertise
- Worked best on only single disease
- Long training and unwieldy interface took 30 to 90 minutes to interact with system
- Was succeeded by “Quick Medical Reference” which was discontinued ten years ago and evolved into more of a reference system than diagnostic system
- Each differential diagnosis includes links to origin evidence to provide meaningful use of EMR’s and supports adoption of evidence based medicine/practice
Medical Diagnostic Systems

- Dxplain used structured knowledge similar to Internetist I, but added hierarchical lexicon of findings
- Iliad system developed in ‘90s added probabilistic reasoning
  - Each disease had associated a priori probability of disease in population for which it was assigned
Diagnostic Systems using Unstructured Knowledge

- ISABEL uses information retrieval software developed by “Autonomy”
- First CONSULT allows search of medical books, journals, and guidelines by chief complaints and age group
- PEPID DDX is diagnosis generator
Diagnosis Systems Using Clinical Rules

- Acute cardiac ischemia time insensitive predictive instrument uses ECG features and clinical information to predict probability of ischemia and is incorporated into heart monitor/defibrillator
- CaseWalker system uses four item questionnaire to diagnose major depressive disorder
- PKC advisor provides guidance on 98 patient problems such as abdominal pain and vomiting
Reasons Current Diagnostic Systems Aren’t Widely Used

- They aren’t integrated into day to day operations and workflow of health organizations and patient information is scattered in outpatient clinic visits and hospital visits and their primary provider and specialists
- Entry of patient data is difficult – requires too much manual entry of information
- They aren’t focused enough on recommendations for next steps for follow up
- Unable to interact with practitioner for missing information to increase confidence and more definitive diagnosis
- Have difficulty staying up to date
Watson as Diagnostician
Patient has red eye with pain, inflammation, blurred vision, floating spots and sensitivity to light.

What condition has red eye, pain, inflammation, blurred vision, floating spots and sensitivity to light?
Google Search

red eye, pain, inflammation, blurred vision, floating spots, sensitivity to light

Search

About 54,700 results (0.33 seconds)

Everything

Eye Diseases Pictures Slideshow: Recognize These Common Eye...
www.medicinenet.com > home > eyesight center > eyesight az list
Aug 3, 2011 – Blepharitis is an inflammation of the eyelids. ... Symptoms of a corneal ulcer include red eyes, pain, feeling like something is in ... Floaters are deposits of condensation that cause people to see floating spots. ... redness and irritation, blurred vision, eye pain, increased sensitivity to light, and floating spots ...

Eye Problems – FamilyDoctor.org
familydoctor.org/familydoctor/en/health-tools/.../eye-problems.html
Eye pain or redness and changes in your vision may be signs of a problem that ... of spots and strings floating in your field of vision; flashes of light in 1 or both eyes; ... Your symptoms may be a sign of a serious inflammatory condition called ... Are your eyes red or sensitive to light, are you experiencing eye pain, and do you ...

Cataract Surgery Complications
www.cataractfreemedia.org/cataracts/complications.htm
Treatment is commonly anti-inflammatory eye drops or tablets. ... Symptoms include pain, red eye, and/or severe and rapid decrease of vision, redness of the eye, blurred vision, sensitivity to light (photophobia), dark floating spots within the ...

Eye Health Guide - Eye Diseases, Eye Problems and Eye Conditions
www.allaboutvision.com/conditions
Itchy, red, swollen, tearing eyes may mean eye allergies. ... Flashes of light and floating spots are classic warning signs of a detached retina – get them ... Painful inflammation of the uvea causes light sensitivity, floaters and blurred vision ...

Getting A Regular Eye Exam From An Ophthalmologist Is Important...
www.bayridgeeyes.com/ophthalmologist.shtml
Floating spots are alarming when they first appear and an eye exam by an ... people who have had eye surgery, eye injuries or serious eye inflammatory conditions. ... The sudden development of a red eye can be due to a variety of causes, some of them tearing, foreign body sensation, eye pain, light sensitivity, or blurry vision ...

Dr. Kenneth Sparks - Uveitis
www.laretinasurgeon.com/uveitis.aspx
Uveitis refers to the inflammation of the uvea, the middle layer of the eye. It also may ...

https://www.google.com/search?q=red+eye,+pain,+inflammation,+blurre...
Patient has red eye with pain, inflammation, blurred vision, floating spots and sensitivity to light.

What condition has red eye, pain, inflammation, blurred vision, floating spots and sensitivity to light?

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uveitis</td>
<td>91%</td>
</tr>
<tr>
<td>Iritis</td>
<td>48%</td>
</tr>
<tr>
<td>Keratitis</td>
<td>29%</td>
</tr>
<tr>
<td>Anterior Uveitis</td>
<td>16%</td>
</tr>
<tr>
<td>Photophobia</td>
<td>13%</td>
</tr>
</tbody>
</table>
History of Present Illness

The patient has a confirmed case of uveitis.

Question

What disease or condition can cause uveitis in a patient?

Answer

<table>
<thead>
<tr>
<th>Disease</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behcet's Disease</td>
<td>45%</td>
</tr>
<tr>
<td>Sarcoidosis</td>
<td>32%</td>
</tr>
<tr>
<td>Ankylosing Spondylitis</td>
<td>30%</td>
</tr>
<tr>
<td>Arthritis</td>
<td>13%</td>
</tr>
<tr>
<td>Iritis</td>
<td>11%</td>
</tr>
</tbody>
</table>
What disease or condition can cause uveitis in a patient?

Uveitis and Vision | preventblindness.org
www.preventblindness.org/uveitis
Uveitis patient resources - information on uveitis treatment

www.uveitis.org | A Guide to Ocular Inflammatory Disease
www.uveitis.org/kids/OIDGuide.htm
That is, no infection or associated systemic illness can be identified at the time of the ... Certain cancers can cause ocular inflammatory disease, such as lymphoma, lung ... Usually, when an eye problem is suspected, a patient is first sent to a ...

American Uveitis Society: FREQUENTLY ASKED QUESTIONS
www.uveitissociety.org/pages/faq.html
Jump to Can Uveitis cause me to go blind?: Can Uveitis cause one to go blind? Back to Top. Uveitis is not a single disease and therefore it is not possible to make ... cooperative patients, few individuals with uveitis should suffer such ...

Uveitis
Uveitis refers to a group of inflammatory conditions that occur in the eye. Often uveitis reflects diseases that are developing elsewhere in the body. Sometimes uveitis is ... Infection (germs, bacteria and viruses) can also cause inflammation. In uveitis ... in chronic uveitis, patients complain of dull aches and/or blurring of vision; ...

Uveitis and Other Eye Conditions in Rheumatology Patients - HSS
www.hss.edu/conditions/uveitis-and-other-eye-conditions-in-rheuma ...
Sep 25, 2002 — Uveitis and Other Eye Conditions in Rheumatology Patients - HSS. ... Dr. Schwartzman: I think Lyme disease can clearly cause uveitis. It is one ...

For UVEITIS - BACKGROUND INFORMATION • Uveitis is the fourth ...
www.lyxbio.com/Uveitis%20Background.pdf
File Format: PDF/Adobe Acrobat - Quick View
Patients is 39 and, if left untreated, uveitis can cause irreversible sight loss in just three years. • Uveitis is an autoimmune disease involving the eye. It is often ...

Uveitis Evaluation and Treatment
emedicine.medscape.com/article/1209123-overview
Oct 10, 2011 — For many years, uveitis was considered a single disease entity; therefore, the ... Patients with uveitis can present with some of the most challenging Conditions causing uveitis, in addition, are a heterogeneous group of
The patient has a confirmed case of uveitis.

She reports a family history of arthritis.

On physical examination a circular rash is observed. She complains of fever and headache.

What disease or condition can cause uveitis in a patient with circular rash, fever, headache, and family history of arthritis?

<table>
<thead>
<tr>
<th>Disease/Medical Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyme Disease</td>
<td>62%</td>
</tr>
<tr>
<td>Systemic Lupus Erythematosus</td>
<td>17%</td>
</tr>
<tr>
<td>Juvenile Rheumatoid Arthritis</td>
<td>12%</td>
</tr>
<tr>
<td>Erythema Migrans</td>
<td>7%</td>
</tr>
<tr>
<td>Rocky Mountain Spotted Fever</td>
<td>6%</td>
</tr>
</tbody>
</table>
Google Search: Uveitis, Arthritis, Circular Rash, Headache

Search
About 52,100 results (0.25 seconds)

Watson and healthcare
www.ibm.com/developerworks/industry/library/find ... index.html?ca... - 47
Apr 12, 2011 – Question: This disease can cause uveitis in a patient with family history of arthritis presenting circular rash, fever, and headache. Answer: 76% ... - 47

Arthritis of the Eves
www.invista.com/Health/Common Ailments/Arthritis - 47
Uveitis Arthritis is usually thought of as a disease of the joints, only and rarely thought of... including headaches, injures, infections (as tuberculosis, herpes, or syphilis),... numbness or weakness, vitilgo (patches of depigmentation), skin rashes,... The iris is the circular, colored part of the eye behind the cornea, which also... - 47

Lyme Disease Clinical Presentation - Johns Hopkins Arthritis Center
www.hopkins-arthritis.org/Arthritis Info/Lyme Disease - 47
Johns Hopkins Arthritis Center Johns Hopkins Medicine... This rash begins as a small red papule at the site of a tick bite, generally 3-30 days after exposure... Headache 40-50%... It was previously thought that all target-shaped rashes (i.e., circular-shaped with red... the eye (e.g., follicular conjunctivitis, keratitis, and rarely uveitis or white)... - 47

Behcet's Syndrome (Behcet's Disease) Causes, Diagnosis...
www.medicinenet.com - 47
by Dr. William Shiel
2 days ago – A reddish, scaly rash often located over the surfaces of the elbows, knees, scalp, and... Managing Osteoarthritis Pain: Coping with Arthritis... The inflammation of the area of the eye that is around the pupil is called uveitis... (meninges) include headaches, neck stiffness, and is often associated with fever... - 47

Q&A Behcet's Disease
www.niams.nih.gov/Health_Info/Behcets_Disease/ - 47
In some people, the disease also results in arthritis (swollen, painful, stiff joints), skin problems, and... Meningitis can cause fever, a stiff neck, and headaches... - 47

Vasculitis Symptoms - General Help - Vasculitis.ca
www.vasculitis.ca/vasculitis symptoms/.../vasculitis symptoms.html - 47
People with meningencephalitis may have fever, headache, stiff neck, and difficulty... Other symptoms include rashes, arthritis, conjunctivitis or uveitis... - 47

Syphilis: Sexually Transmitted Diseases (STD): Merck Manual...
www.merckmanuals.com/professional/infectious.../syphilis.html - 47
Lyme Disease

**Present Illness**

**Family History**

**Finding**

**Demographics**

**Finding - Evidence Sources**

**Textbook:** For people who live in areas where Lyme disease most often occurs in the United States along the Atlantic coast, the Midwest, and parts of Oregon and California, the circular rash can be a sign of Lyme disease, especially when it appears during the summer months.

**Journal:** For the initial systemic Lyme disease, on the other hand, the symptoms include fatigue, pains in the joint and muscle, mild fever, headache, drowsiness and swollen lymph glands. For the majority of people, once a tick has bitten its human host, a slow growing circular rash called erythema migrans appears around the site of the bite.

**Web Site:** One of the early symptoms of Lyme disease is development of a circular rash, known as erythema migrans (EM). This rash is seen in about 70-80% of infected people and it starts within duration of three days to one month.
The patient has Lyme disease. The treatment plan is antibiotics.

What antibiotics are prescribed for treating Lyme disease?

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doxycycline</td>
<td>97%</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>68%</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>30%</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>29%</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>29%</td>
</tr>
</tbody>
</table>
The patient has **Lyme disease**. The treatment plan is antibiotics.

The patient is **pregnant**. She has a **penicillin allergy**.

**Question**

What is the recommended antibiotic prescription for Lyme disease in a woman during pregnancy with penicillin allergy?

**Answer**

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefuroxime</td>
<td>95%</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>17%</td>
</tr>
<tr>
<td>Lyme Disease Vaccines</td>
<td>7%</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>6%</td>
</tr>
<tr>
<td>Steere</td>
<td>5%</td>
</tr>
</tbody>
</table>
User Information Design for Decision Support

Evidence Profile: Diagnosis

**Uveitis**  91%
**Iritis**  48%
**Keratitis**  42%

**Factors**
- SYMPTOMS
  - Red eye
  - Eye pain
  - Eye inflammation
  - Blurred vision
  - Floating spots
  - Sensitivity to light
- FAMILY HISTORY
  - Arthritis
- ALLERGIES
  - Penicillin
- DEMOGRAPHICS
  - 34 years old
  - Female

Sources and Factors for Uveitis Symptoms

**Sources**

- **Textbook**
  - *Uveitis* specifically refers to inflammation of the middle layer of the eye, termed the "uvea" but in common usage may refer to any inflammatory process involving the interior of the eye.

- **Website**
  - *Uveitis* usually develops quickly and generally affects only one eye. Signs and symptoms may include any or all of the following, pain in the eye or brow region, worsened eye pain when exposed to bright light, and reddened eye, especially adjacent to the iris.

- **Medical Journal**
  - The most common form of uveitis is anterior uveitis, which involves inflammation in the front part of the eye. It is often called iritis because it usually only affects the iris, the colored part of the eye.

**Factors**

- **Textbook**
  - *Uveitis* is often marked by moderate to intense pain and usually involves impaired eyesight.
My Involvement in Helping to Train Dr. Watson

- Initial research and grant to help educate Watson in medical domain
- Could Watson software for Jeopardy! be successfully ported into the medical domain?
  - Began discussing challenge associated with NEJM Clinico-Pathological Conference
  - Talked about books and journals and other sources that could augment the general knowledge built into the Jeopardy! playing software
E-mails and interviews from all over the world:

- Most were incredibly impressed with potential for medicine and opportunities for the future
- Some however:
  - SKYNET and end of world as we know it
  - Pre-medical students speculating that it really doesn’t make sense to attend medical school any more
  - Physicians writing blogs predicting that they would be replaced by the computer within a short period of time
Want 3 components similar to medical students education

- Book knowledge
- Sim Human Model
- Experiential learning from actual EMR
Book Learning

- Textbook, journal, and Internet resource knowledge.
  Quiz materials
- Like medical student this alone not enough don’t want to make hypochondriac
Advancing Deep Q/A’s Medical Knowledge

- Continue to develop medical knowledge database
  - Harrison’s
  - Merck
  - Current Medical Diagnosis and Treatment
  - American College of Physicians Medicine
  - Stein’s Internal Medicine
  - medical Knowledge Self Assessment Program
  - NLM’s Clinical Question Repository
Use New England Journal of Medicine 130 CPC cases and quiz material
  Additional CPC cases at U of Maryland
Begin developing interactive capability to develop hypotheses and refine them depending on the answer to those questions
Develop a tool that allows for physician feedback to the system for various hypotheses so community can interact and teach Watson
SIM Human

- SIM Human model of physiology – work done at the University of Maryland School of Medicine and UMBC by Dr. Bruce Jarrell and colleagues
- Want to have understanding from model of physiology
- Work has been done to create simulations of disease processes and then observe how it affects other physiology in the body
Clinical/Hospital “Experience”

- Consumption of electronic medical record which is largely just paper represented digitally, cannot search for “rash” for example
- Access to records at U of Maryland and VA but also larger repositories from the VA in de-identified manner
Electronic Medical Record Challenges and Limitations

- Epic system at the University of Maryland
- VA’s VISTA System
- University of Maryland EPIC system
  - EMR
    - Electronic version of paper records
    - Review large number of discharge summaries
    - Review progress notes and structured and unstructured additional information from EMR
IBM and VA Team Review of EMR

- Patient EMR such as VA’s highly publicized and praised VISTA revealed numerous challenges
Despite the fact that virtually 100% of patient information is available in the electronic EMR with records going back more than 15 years

- Not possible to search for a term within or among patient records such as “rash”
- Majority of data is unstructured and in free text format
- Much of the text in progress notes and other types of notes is highly redundant since interns and residents and attending physicians typically cut and paste information from lab and radiology and other studies and other notes
- Information is entered with abbreviations that are not consistent and misspellings
Patient Problem List

- Patient problem list has no “sheriff” and each physician is free to add “problems” but very few delete them for “problems” that are temporary
- The problem lists themselves often have contradictory information
Medical Domain Adaptation

- 5000 questions from American College of Physicians Doctor’s Dilemma competition

- E.g.
  - The syndrome characterized by joint pain, abdominal pain, palpable purpura, and a nephritic sediment
    - Henoch-Schonlein Purpura
  - Familial adenomatous polyposis is caused by mutations of this gene: APC gene
  - Syndrome characterized by narrowing of the extrahepatic bile duct from mechanical compression by a gallstone impacted in the cystic duct: Mirizzi’s Syndrome
3 Areas of Adaptation for Deep QA

- **Content**
  - Organizing domain content for hypothesis and evidence generation such as textbooks, dictionaries, clinical guidelines, research articles
  - Tradeoff between reliability and recency
- **Training**
  - Adding data in the form of sample training questions and correct answers from the target domain so system can learn appropriate weights for its components when estimating answer confidence
- **Functional**
  - Adding new question analysis, candidate generation, and hypothesis evidencing analytics specialized for the domain
Content Adaptation

- Text content is converted into XML format used as input for indexing
- Text analyzed for medical concepts and semantic types using Unified Medical Language System terminology to provide for structured query based lookup
- “Corpus expansion technique” used by DeepQA searches web for similar passages given description of symptoms for example and generates pseudo documents from web search results
Medical Content Sources for Watson Include

- ACP (American College of Physicians) Medicine
- Merck Manual of Diagnosis and Therapy
- PIER (collection of guidelines and evidence summaries)
- MKSAP (Medical Knowledge Self Assessment Program study guide from ACP)
- Journals and Textbooks
Training Adaptation: 188 Unseen ACP Doctor’s Dilemma Questions

Precision: % of questions correct for top answer when chooses
to answer
Despite all of the advances in computer technology we are arguably still at the paper stage of research as far as ability to discover and combine important data:

- Research data including those associated with major medical journals and clinical trials are typically created for a single purpose and beyond a one or two manuscripts, remain largely locked up or inaccessible.
- Even when the data are made accessible, they are typically associated with limited access through a proprietary Internet portal or even by requesting data on a hard drive.
- Often requires submission of a research plan and data and then a considerable wait for permission to use the data which is often not granted.
Alzheimer’s Disease Neuroimaging Initiative

Excellent example of patient data and associated images with great sharing model

However requires access through their own portal and requires permission from ADNI Data Sharing and Publications Committee
As an NCI funded Consortium, the Pediatric Brain Tumor Consortium (PBTC) is required to make research data available to other investigators for use in research projects.

An investigator who wishes to use individual patient data from one or more of the Consortium's completed and published studies must submit in writing:

- Description of the research project
- Specific data requested
- List of investigators involved with the project
- Affiliated research institutions
- Copy of the requesting investigator's CV must also be provided.

The submitted research proposal and CV shall be distributed to the PBTC Steering Committee for review.

Once approved, the responsible investigator will be required to complete a Material and Data Transfer Agreement as part of the conditions for data release.

Requests for data will only be considered once the primary study analyses have been published.
Institutional Database
General Practice Research Database

**Archived News**

Select a Topic:

Please select

---

**LSHTM Pharmacoepidemiology Course**

London School of Hygiene and Tropical Medicine in collaboration with GPRD are running a short course entitled ‘Practical Pharmacoepidemiology’ from Monday 12th to Thursday 15th September 2011. The course is designed for students with a basic grounding in epidemiological methods and concepts and/or some prior knowledge of pharmacoepidemiology.

For further details and to apply please click here.

**User Group Meeting Update**

Dear Colleague

This year’s GPRD User Group Meeting is scheduled for the 18th of August 2011 and will be held in Chicago to follow on from the 27th International Conference on Pharmacoepidemiology and Therapeutic Risk Management.

These meetings give GPRD users the chance to learn about key developments with the database as well as current research projects. This meeting will also provide users the opportunity to meet with members of GPRD’s research team and engage in discussions with other users.

Please register your interest if you wish to attend, give a presentation or lead a discussion group by contacting

jenny.campbell@gprd.com
Institutional Database: VA’s Corporate Data Warehouse Vinci
Disease Specific Databases
Alzheimer’s, Parkinson’s, Schizophrenia

Disease-specific databases:
AlzGene, PDGene, SzGene

Lars Bertram, MD
Assistant Professor of Neurology (HMS)
Assistant in Genetics (MGH)

Genetics and Aging Research Unit
MassGeneral Institute for Neurodegenerative Diseases
Massachusetts General Hospital
Harvard Medical School
Cornucopia of Sources of Data for Dr. Watson

- University hospital databases
- Large medical system e.g. Kaiser Permanente data warehouse
- Insurance databases such as WellPoint
- State level databases
At best, freely sharable databases are accessed using their own idiosyncratic web portal.

Currently no index of databases or their content.

No standards exist to describe how databases can “advertise” their content and availability (free or business model) and their data provenance and sources and peer review, etc.

Would be wonderful project for AMIA or NLM to investigate the creation of an XML standard for describing the content of databases.

This will be critical to the continuing success of the Dr. Watson project in my opinion.
Medical Guidelines

- Medical guidelines are increasingly being put into machine intelligible form although this is not an easy process
- Incorporating these into Watson software could serve multiple purposes including health surveillance, could factor into diagnostic decision making, and could be an early implementation of the Watson technology
The transition to the 3rd year of medical school begins a new phase in education from theoretical to empirical.

Medical students are exposed for the first time to the wards and of course, importantly, to one of their major jobs for the next few years:

- Maintenance and review of patient charts, nowadays the Electronic Medical Record.
Introducing Dr. Watson to the Electronic Medical Record

![Vista CPRS](image)

**Active Problems**
- Diabetes mellitus
- Coronary Artery Disease
- Angina
- Copd
- Congestive Heart Fail

**Allergies / Adverse Reactions**
- Strawberries
- Chocolate
- Tylenol

**Postings**
- Crisis Note: Dec 05, 97
- Allergies
- Advance Directive: Mar 18, 98

**Active Medications**
- Halcinonide 0.1% Cream 60gm
- Fluoxetine (prozac) 20mg Cap
- Tetracycline 250mg Cap
- Calcium Lactate 325mg C.T.
- Isosorbide Dinitrate 40mg S.A. Tab

**Clinical Reminders**
- Influenza Immunization: Oct 07, 97
- Pneumovax: Apr 22, 98
- Fecal Occult Blood Test: Apr 22, 98
- Problem Drinking Screen: Apr 22, 98
- Flexisigmoidoscopy: Apr 22, 98

**Lab Results - Past 30 Days**
- Prothrombin Time Blood
- Plasma Routine-Not For S
- Glucose Blood Serum Routine-Not For Sat,Sun,Holi
- Cbc,Plt,Diff Blood Routine-Not For Sat,Sun,Holi

**Vitals**
- T: 99
- P: 82
- R: 20
- BP: 138/76
- WT: 219

**Appointments / Visits / Admissions**
- Rainbow I (primary Care) visited: Apr 09
- Rainbow I (primary Care) visited: Apr 02
- Rainbow I (primary Care) visited: Mar 30
- Rainbow I (primary Care) visited: Mar 29
- Rainbow I (primary Care) visited: Mar 18
Despite the tremendous strides we have made toward an electronic medical record, we are really just at the 1.0 stage and arguably most current EMR systems really represent just a digital form of paper.

The Watson development team was really surprised when we reviewed the EMR at how primitive it was, even in 2011.

- Lack of ability to search for terms within a patient’s record
- Lack of ability to search across patient records
- Lack of ability to perform basic statistics or have access to basic decision support tools in EMR
The diagnosis of a specific type of pneumonia, for example, can be made according to patient signs and symptoms using journal articles and textbooks. But it can also be made more reliably by a system such as Watson by also mining the local EMR database as to what diagnoses have been made over the past few days, weeks, months, etc. locally.
EMR

- It can then be further refined by not necessarily being constrained to tentative diagnoses that have been made but the microbiology/pathology proven causes of pneumonia.
- The EMR provides empirical data about the association of these signs and symptoms with diagnoses and the means to verify what was found by lab tests etc.
EMR Challenges

- Challenges mining EMR
  - Unstructured free text with abbreviations, variable terms (e.g. MRI terminology)
  - Difficulty in having Watson technology analyze large databases such as VA’s EMR due to PHI concerns and need to stay within the firewall
  - Watson needs to incorporate the concept of changing signs and symptoms in a patient over time which creates added dimension to diagnosis of a single patient presentation
  - Challenge is the fragmentation of electronic medical records by multiple hospitals, clinics, outpatient settings, etc.
EMR Opportunities

- Watson can gain empirical knowledge of vast numbers of physicians and patients in a way that would not be possible for any single practitioner.
- Watson could use EMR to perform research and discovery in healthcare such as unanticipated drug responses and interactions and factors impacting patient response to therapy.
- Watson can be impetus to medical community for the development of more structured EMR in a more friendly machine readable format.
PHR’s will enable Watson to get all information in one place when patients centralize and take control of their own electronic health records.

Patients will be able to control level of access to their information.