Module 4: Social Media Analytics for Healthcare

What is Social Media?

Digital word of mouth

"A group of Internet-based applications that build on the ideological and technological foundations of Web , and that allow the creation and exchange of **user-generated content**."

Electronic communication through which users create online communities to share information, ideas, personal messages, and other content.

Major Social Media Sites and Uses

- **Facebook:** "I ate." (social networking)
- **Youtube:** "Look at this eat!" (video)
- **Twitter:** "I need to eat." (microblog)
- **Linkedin:** "I am good at eating." (business networking)
- **Foursquare:** "This is where I eat." (location)
- Fluid and constantly changing based on new technology, websites, etc. All have mobile apps.

Glossary of Social Media Terms:
http://www.socialbrite.org/sharing-center/glossary/

Personal vs Professional

- Physician use social media for **personal** reasons at the same rate as general public (Pew)
- uses of Social media for **professional** reasons

Major Social Media Sites #s

- Facebook:
- YouTube:
- Twitter:
- LinkedIn:
- Google+:
- Pinterest:
- Any many more….

Privacy Settings Issues

- **Facebook** – set privacy levels, if you know how
- **YouTube** – set some privacy, usually open, allow or block comments
- **Twitter** – set privacy, lock tweets for friends only, block people
- **Google+** -- put people in circles, set privacy within circles

"We need to be as professional on the Web as we are face-to-face with a patient, and we always need to be aware of HIPAA rules. When you use any form of social media, ask yourself before you hit the send button: if I were in a crowded hospital elevator and I said aloud what I just wrote for a social media network, would that be OK? If the answer no, don't post it!" Kevin Pho

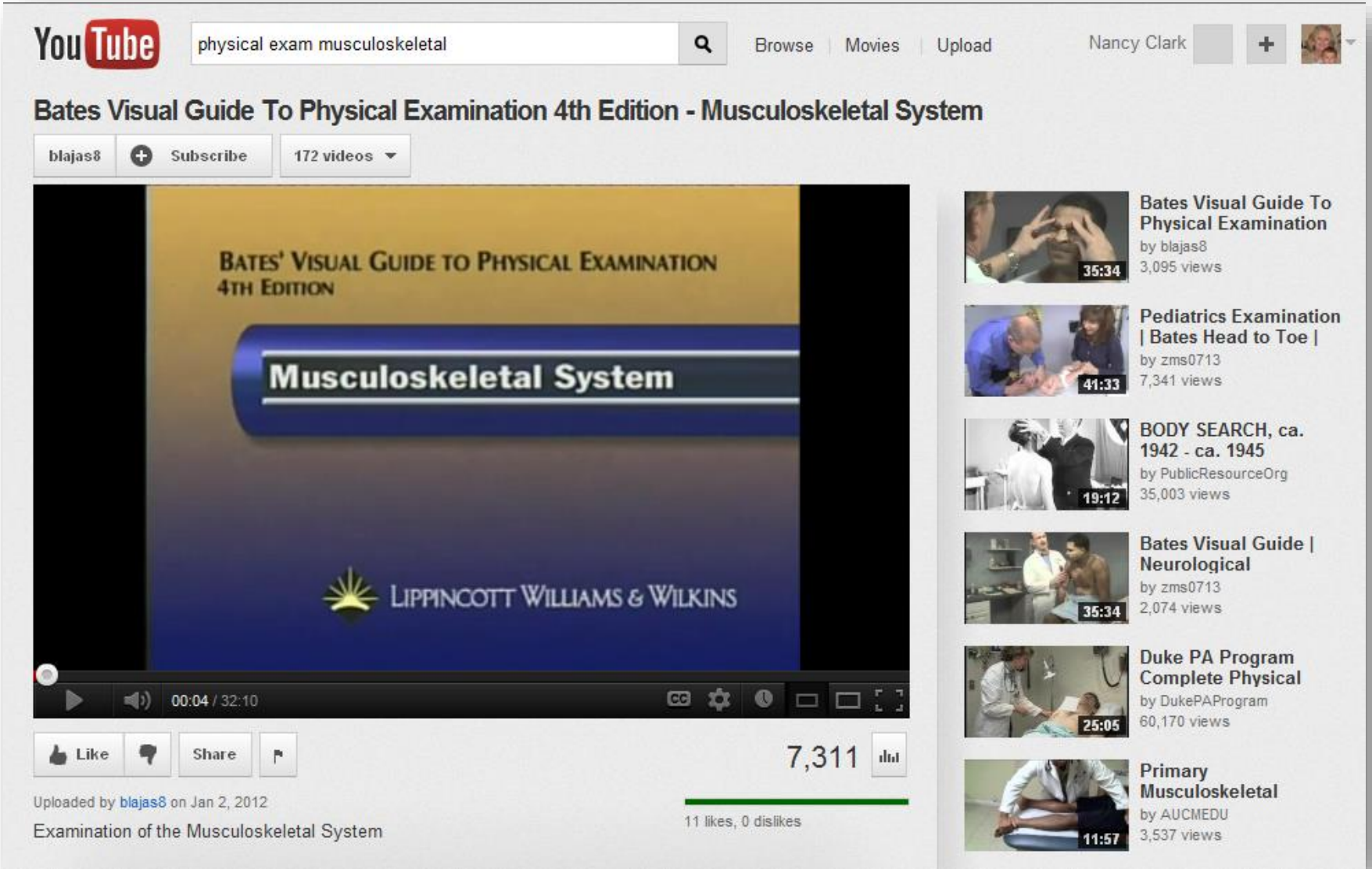
Facebook

SHARE

YouTube

8

http://www.youtube.com/fsumedmedia



Twitter


twitter
FSU Medicine
@FSUCoM
At the Florida State University College of Medicine, we're interested
producing doctors who are caring practitioners of both the art and
science of medicine.
Tallahassee, FL http://www.med.fsu.edu
Stay in touch with FSU Medicine
Join Twitter today
Full name
Email
Password
Sign up
Tweets
Following
Followers
Tweets
FSU DigiTech @FSU
@FSUCoM Great wor
be exhibited at DigiTe
Retweeted by FSU Me
FSU Medicine @FSUCoM 24 Mar
One of our 4th year students just designed a medical app! Learn more about it: t.co/Ff9EqmXL & download it now t.co/TKRigZ1O
View app
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Check out some pictures from #MatchDayFSU #MatchDay2012! t.co/JOCurVPs
FSU Medicine @FSUCoM 22 Mar

AT&T 3G 5:27 PM 100%
Dr. Mehmet Oz @DrOz 55m
If you have back pain, take a look at this: droz.me/AlpERT See my top tips for relief.
FSU Medicine @FSUCoM 2h
We are hoping to change that RT@kennylinafp: The Doctor Is Out: Young Talent Is Turning Away From Primary Care bit.ly/yG1qqF
FSU Medicine @FSUCoM 5h
Have to admit, that last tweet was scary to type! Class of 2020, wow.
FSU Medicine @FSUCoM 5h
Hope to see some of you as a members of @FSUCOM class of 2020! RT @FSUAdmissions Congratulations to all of our newly
Home
Connect
Discover
Me

The Anatomy of a Tweet

"Tweet" Members send and read text-based posts of up to 140 characters (Tweet, *n* or *v*)

The Anatomy of a Tweet

- "#“ Hashtag. Group posts by topic or type – words or phrases prefixed with a "#" sign. *#obesity #Medicine #healthcare #HCSM #Health20 #meded #mHealth* http://www.symplur.com/healthcare-hashtags/
- "@" sign followed by a username is used for mentioning or replying to other users *@MD_chat @HarvardHealth*
- “**Retweet**“ To repost a message from another Twitter user, and share it with one's own followers, the retweet function is symbolized by "RT" in the message.
- **URL shortener – bit.ly tinyurl.com** bit.ly/JQKt9L
- **Tweet Chats:** scheduled chats about a subject.

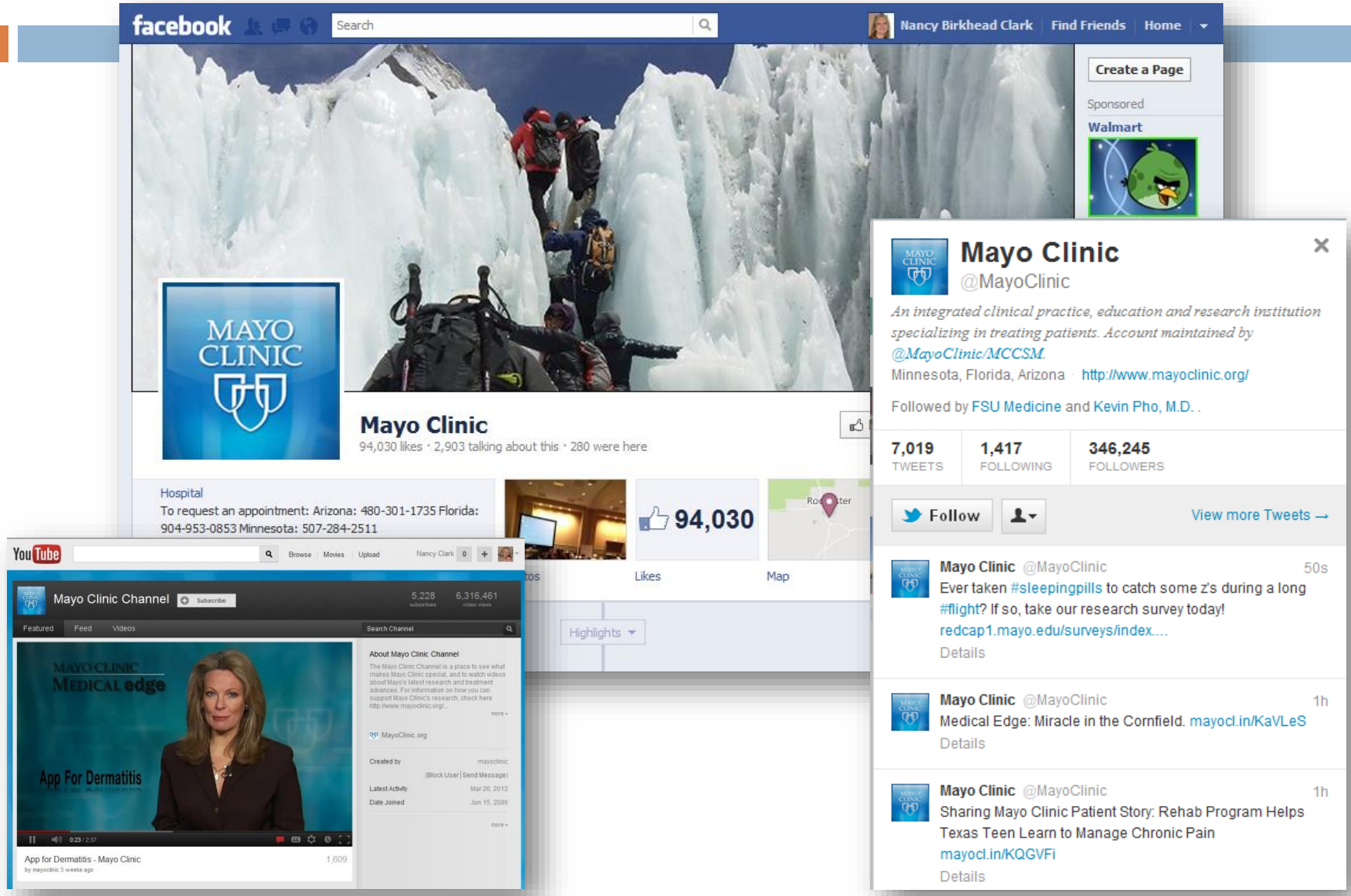
Live Tweet Surgery

The UCLA Functional and Movement Disorders P
Brain Stimulation Surgery to Cease Tremors

Physician's Guide to Getting Started on Twitter

http://www.slideshare.net/bestdoctors/a-physicians-guide-to-twitter-12776591

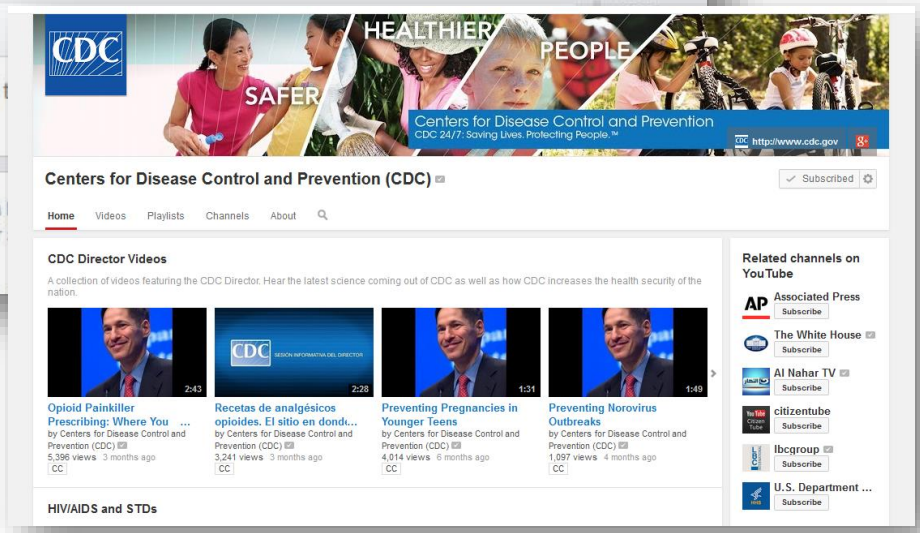
Healthcare Institutions on #HCSM



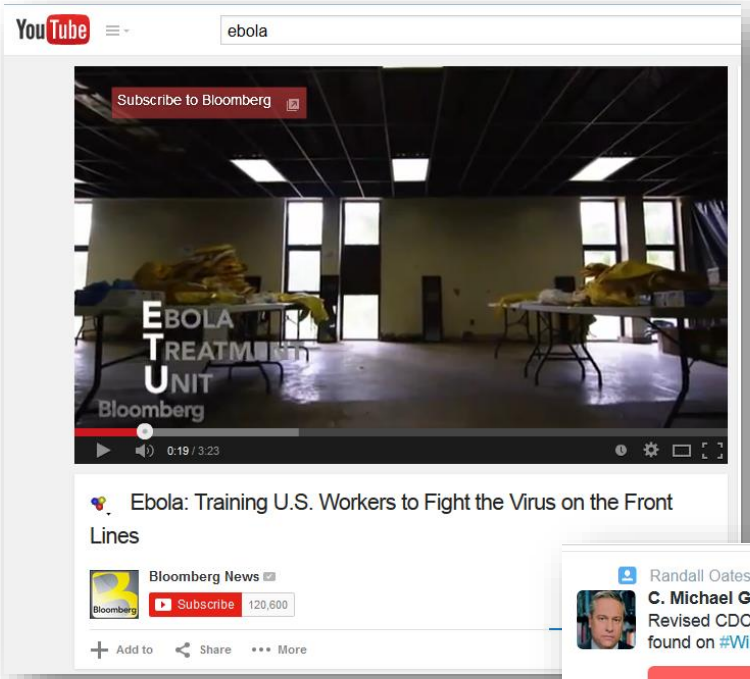
Major Associations on #HCSM

Journals on #HCSM

Government Agencies on #HCSM



#Ebola on #HCSM



Youtube

Twitter

Facebook

LinkedIn

LinkedIn Account Type: Basic | Upgrade

Nancy Clark Add Connections

Home Profile Contacts Groups Jobs Inbox 4 Companies News More

People Search... Advanced

Attn: Female Directors - Apply to the Worldwide Who's Who network for Successful Women.

Share an update

Attach a link Share

LinkedIn Today: See all Top Headlines for You

Expert: Millions of jobs will "reshore" back to U.S.

When Choosing a Job, Culture Matters

via blogs.hbr.org

Why Your Company Needs A Chief Collaboration Officer

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Lee McMillian is now connected to Philip Payne, Associate Professor and Chair, Department of Biomedical Informatics at The Ohio State University Medical Center

Send a message • 1 hour ago

Corey Fleming, RRT, MHA, FACHE is now connected to Cynthia S. Perez, Intern at Ernst & Young, Nini Perry,MBA, RN, Director of Quality & Risk Management at Behavioral Centers of America (CCH) and Andrea Gwyn, Assistant Administrator at HCA

People You May Know

Curtis Stine, Professor and Associate Chair at Flordia State

Connect

Val Glenda Marchesoni, --

Connect

Kenneth Higgins, Sr. Medical Informatics Trainer at Florida State

Connect

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Add + About Nancy

Farris Timimi

Medical Director, Mayo Clinic Center for Social Media; Program Director, Heart Failure/Transplant Cardiology Fellowship; Cardiologist; Physician; Doctor; Father; Husband. Twitter: @FarrisTimimi

Rochester, MN

Repins from

Susie Shephard

39 Boards 318 Pins 2 Likes Activity Unfollow All 95 followers 29 following

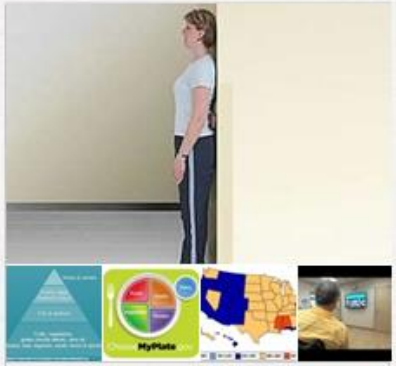
Healthy Recipes
55 pins

Follow

Pediatrics
10 pins

Follow

Health and Wellness
20 pins



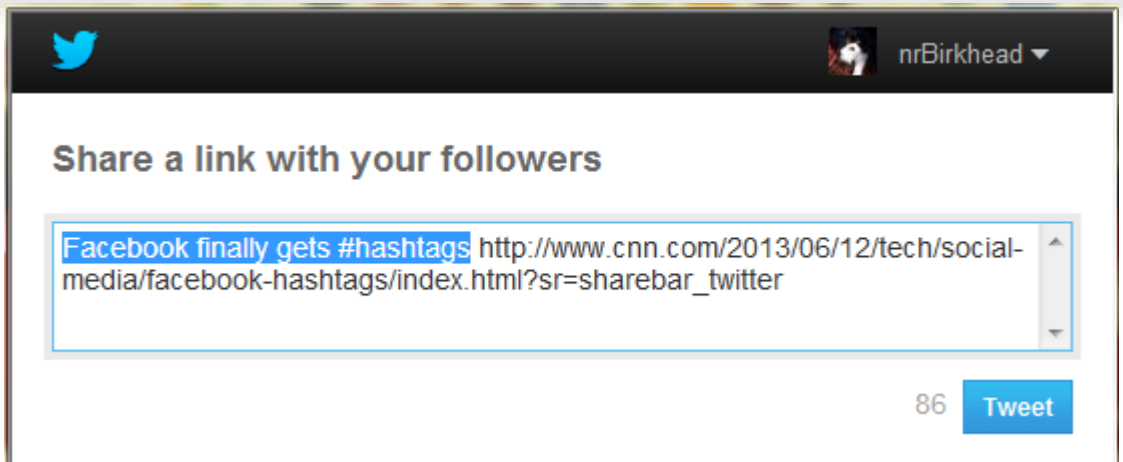
Follow

Health Care Social Media
7 pins

Follow

Sharing

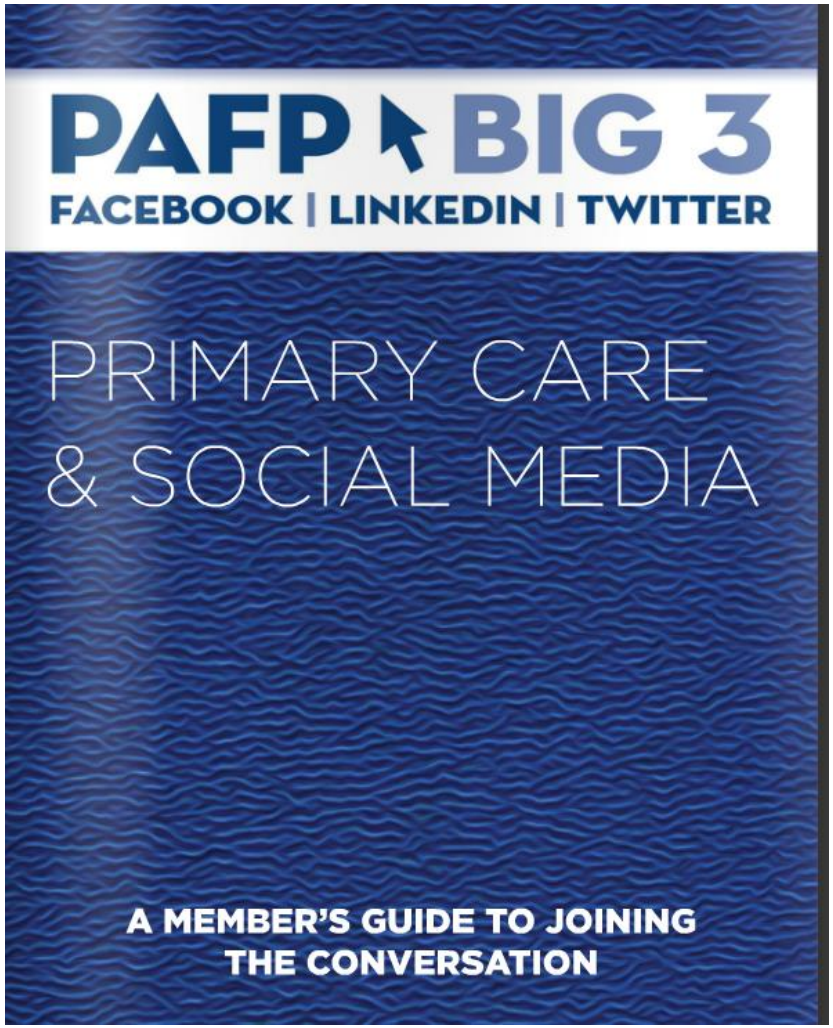
- "Thank you for sharing" …or not



Physician's Guide to Using FB, Twitter, LI

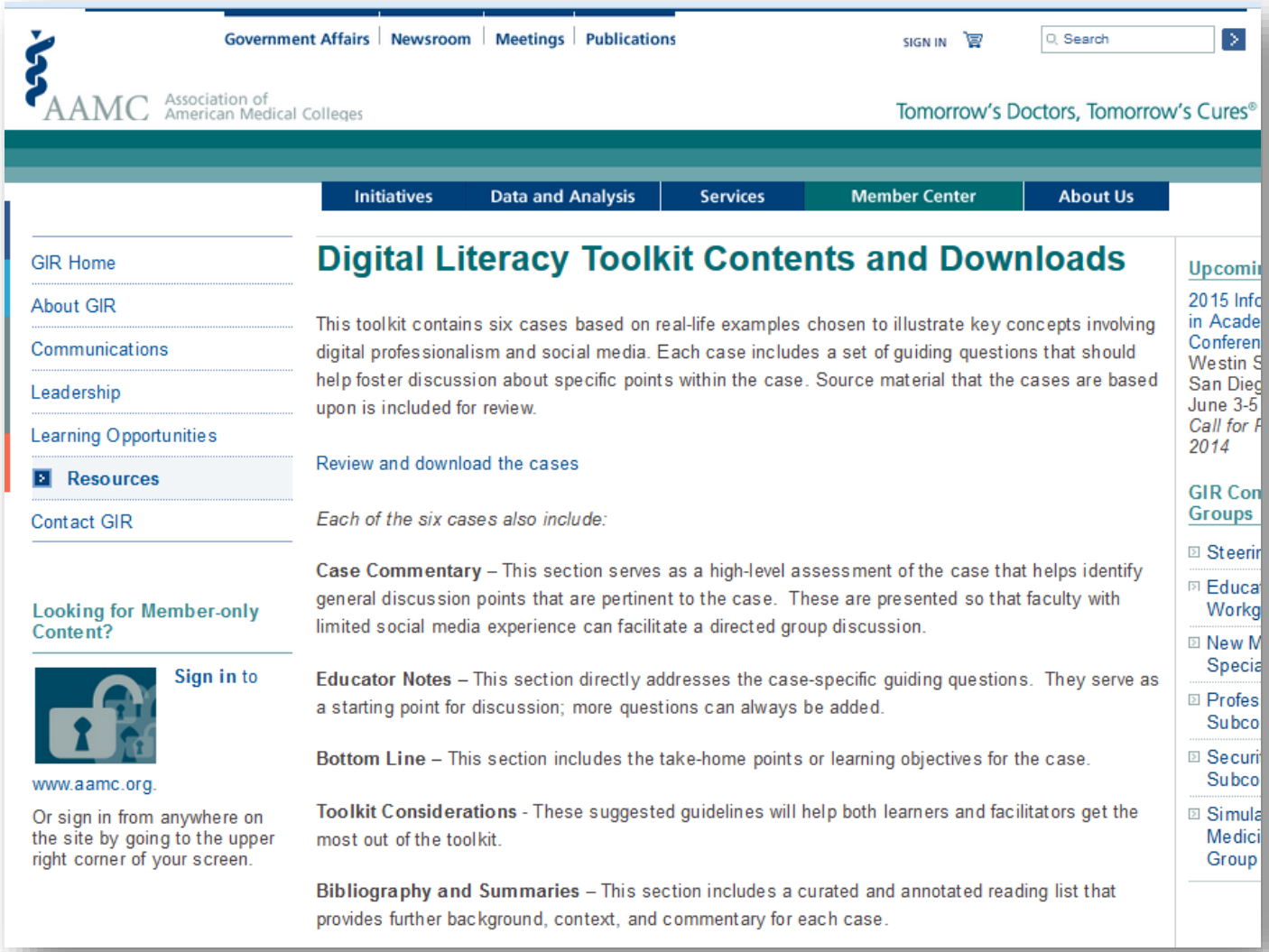
- Pennsylvania Academy of Family Physicians
- Guide to Social Media
- Advanced Guide now available. Includes setting up a Blog at Wordpress.com

http://bit.ly/1yDwklv



AAMC Digital Literacy Initiative

https://www.aamc.org/members/gir/resources/359492/digitalliteracytoolkit.html



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Digital Literacy Toolkit Contents and Downloads

This toolkit contains six cases based on real-life examples chosen to illustrate key concepts involving digital professionalism and social media. Each case includes a set of guiding questions that should help foster discussion about specific points within the case. Source material that the cases are based upon is included for review.

Review and download the cases

Each of the six cases also include:

Case Commentary – This section serves as a high-level assessment of the case that helps identify general discussion points that are pertinent to the case. These are presented so that faculty with limited social media experience can facilitate a directed group discussion.

Educator Notes – This section directly addresses the case-specific guiding questions. They serve as a starting point for discussion; more questions can always be added.

Bottom Line – This section includes the take-home points or learning objectives for the case.

Toolkit Considerations - These suggested guidelines will help both learners and facilitators get the most out of the toolkit.

Bibliography and Summaries – This section includes a curated and annotated reading list that provides further background, context, and commentary for each case.

Patient Medical Use of Social Media

- Social Media(SM) is the new word-of-mouth for picking a doctor
- Find a local doctor, read and write reviews of doctors
- Find health information
- Find support groups for chronic disease and other health issues

Social Media and Informal Support Groups

- Chronic Disease support groups
  - Awareness, support, education
  - Community of bloggers
- Lifestyle and health maintenance support
  - Diet plans, track exercise …
- Caregiver social support groups
  - Caregivers for elderly, family members with chronic disease

Diabetes, as an Example

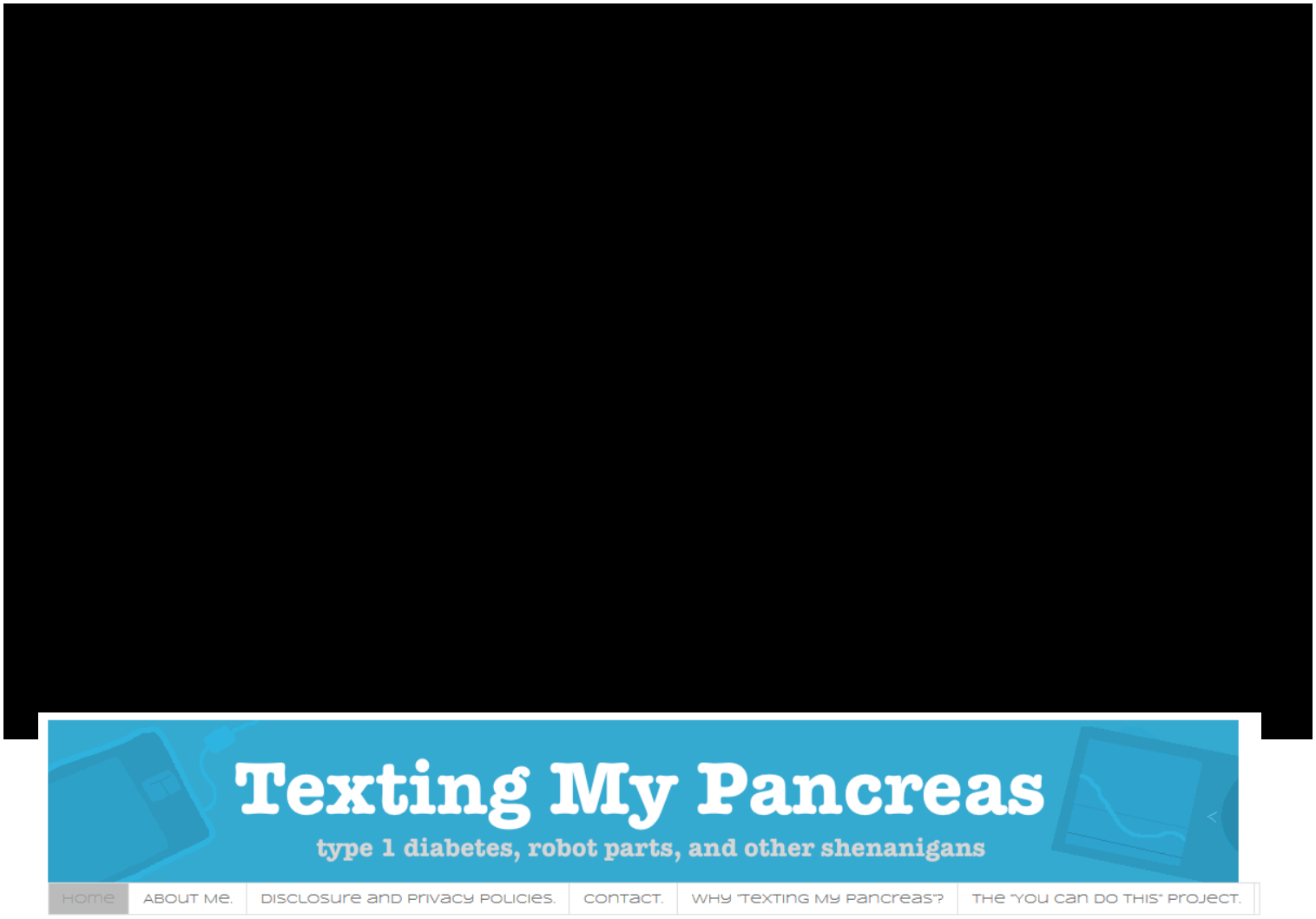
Social Media for Chronic disease

- Awareness
- Support
- Education

Diabetes Hands Foundation. http://www.tudiabetes.org

The Power of an Online Community of Patients

https://www.youtube.com/watch?v=HwiIZ8TnZJw



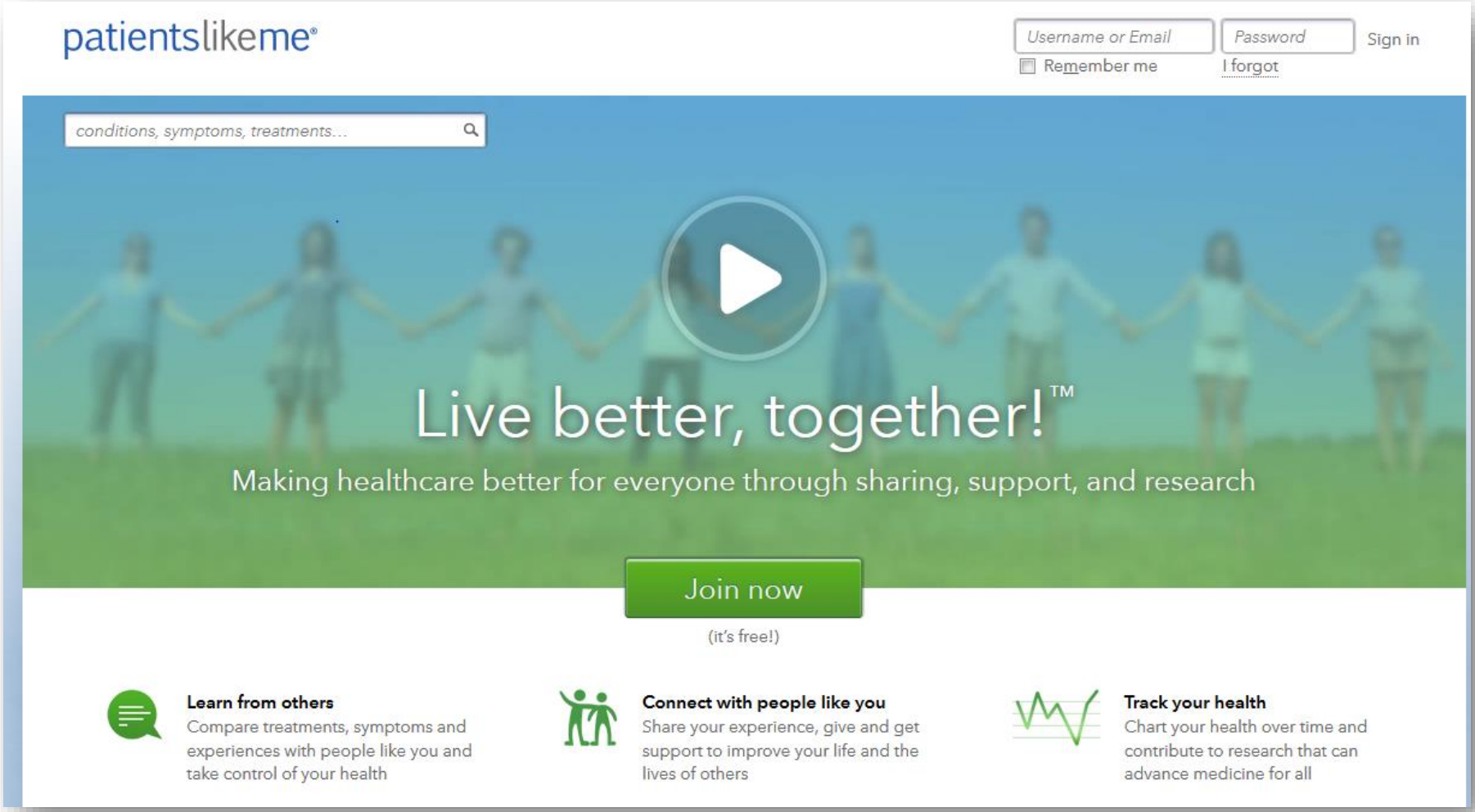
Peer-to-peer Healthcare

- One in four internet users living with high blood pressure, diabetes, heart conditions, lung conditions, cancer, or some other chronic ailment (23%) say they have gone online to find others with similar health concerns.
- By contrast, 15% of internet users who report no chronic conditions have sought such help online.

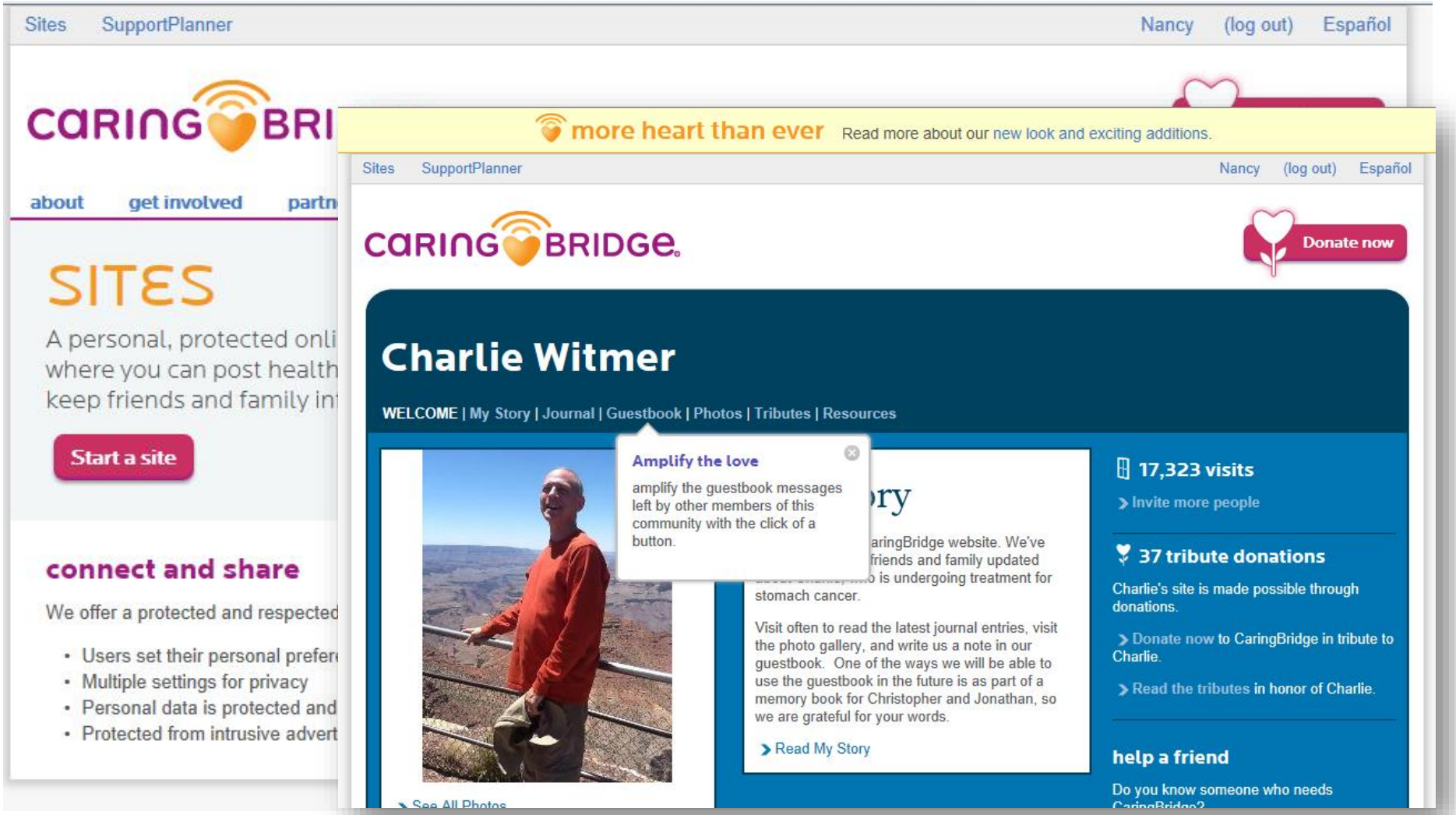
Fox, Suzannah. Peer-to-peer Healthcare. Pew Internet Survey Results.
http://pewinternet.org/Reports/2011/P2PHealthcare.aspx

https://www.youtube.com/user/PatientsLikeMe2008

Patients Like Me



Grief and Community Support



How to Find Communities

- Google a condition and “community”, “Blog” etc.
- Go to a major social media site and search on a disease/condition
- Use a site that curates healthcare social networking sites like www.webicina.com by specialty and condition

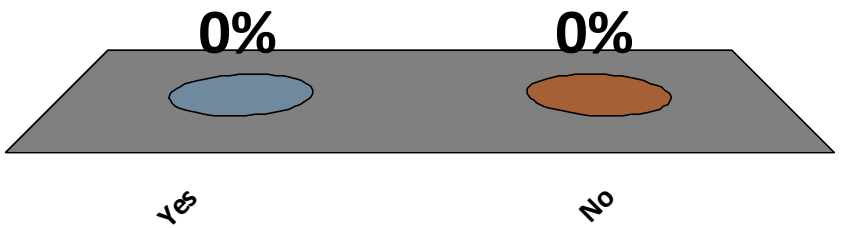
Health Information Online

- 80% of internet users gather health information online (Pew)
- Educate patients to find good information online
- List reliable sites on your clinic web site
- Social media provides physicians opportunities to contribute to good information online
  - In your Twitter posts, FB page, or Blog
  - Recommend sites, good articles, good blogs on topics you see often or questions you answer often

As a patient, have you used social media to address a health question?

A. Yes

B. No



Rheumatoid Arthritis

http://bit.ly/MgNS8t

Search

Pinterest

Add + About Nancy

Health Care Social Media

7 pins

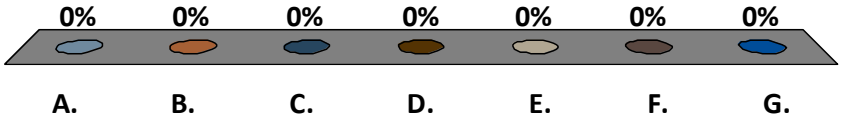
Unfollow

Also from youtube.com

The first patient blogger to attend as a member of the press, Kelly Young advocate for Rheumatology Arthritis patients speaking at the American College of Rheumatology Scientific Meeting. Her mission-Empower RA patients to advocate for improved diagnosis and treatment. In 2009, Kelly created the website, Rheumatoid Arthritis Warrior. Her leadership has earned her a position as an advisory board member on Mayo Clinic's Social Media Health Network.

For which of the following reasons might you recommend a social media site to a patients?

A. Patient education
B. Caregiver support
C. Peer-to-peer support
D. Healthy lifestyle support
E. Find community health resources
F. Other
G. Nothing



Pick up to 6

Manage your Reputation

https://www.youtube.com/watch?v=-XhH1-NMPHI

Your Online Reputation

- Multiple sites contain physician demographics, certifications, credentials, actions…
- Allow patient reviews
  - Physician Experience
  - Ease of scheduling appt.
  - Wait times
  - Staff friendliness
  - Would they recommend to friend

Healthgrades.com
AngiesList.com
Google Plus Local (maps)
Vitals.com
Zocdoc.com
…and many more

Establishing, Managing, and Protecting Your Online Reputation: A Social Media Guide for Physicians and Medical Practices

Patients Share Experiences

- Patient reviews mostly positive……
- Encourage your good patients to post review

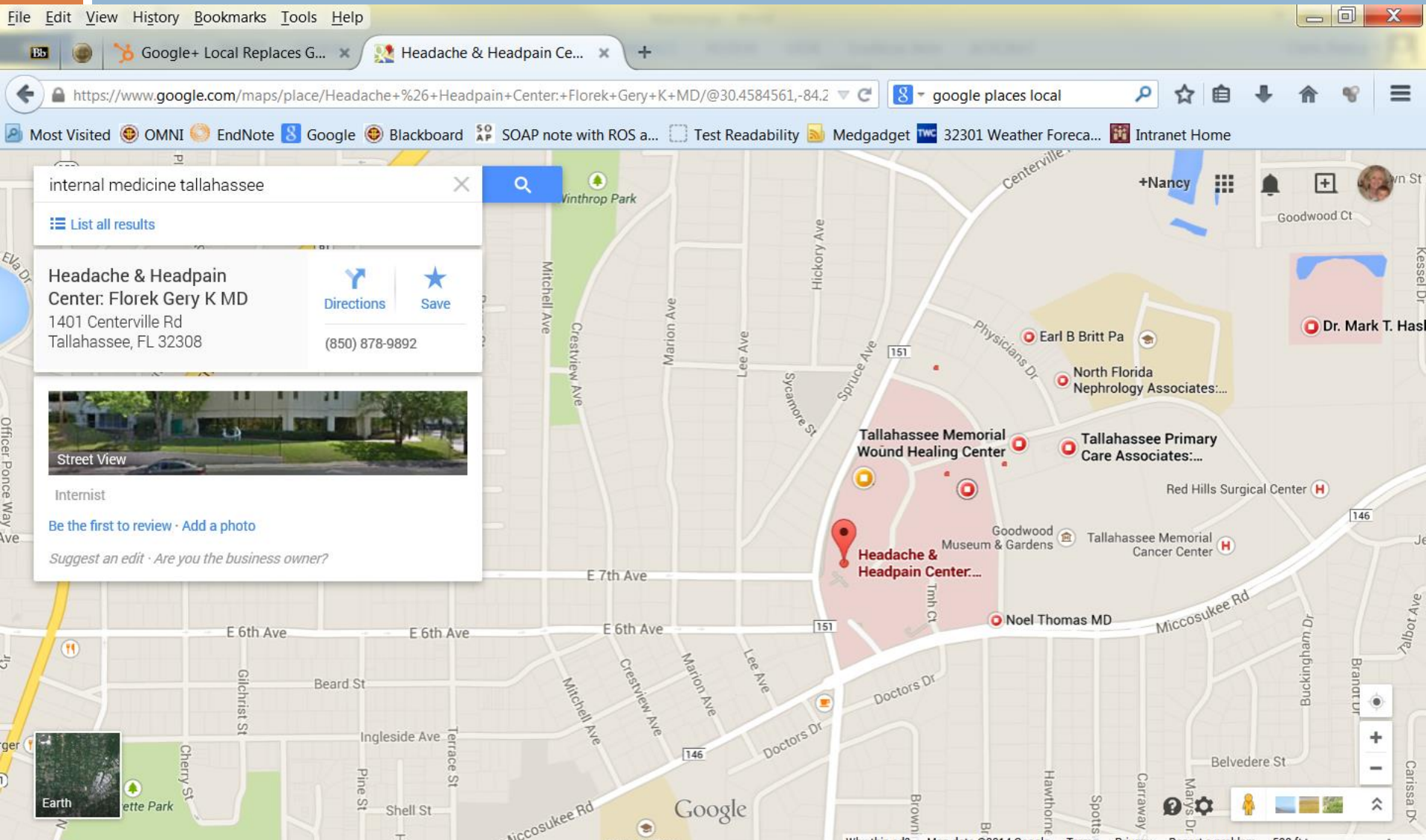
- "You have no control over what other people say about you, but you have total control of the content you create about yourself and your practice."

Dealing with Patient Reviews

- Monitor patient comments about you
- Respond to comments in compassionate, thoughtful way
- Calmly and thoughtfully suggest alternative points of view
- Consider opinions -- not dismiss them as irrelevant/incorrect
- Avoid online confrontation – let administrator contact patient to deal with concerns

Campbell, KR. Doctors: Social media strategies to manage our identity online. August 2012. www.kevinmd.com/blog/2012/08/doctors-social-media-strategies-manage-identity-online.html

Google Plus Local



Manage Your Google Rep

1. **Claim your listing.** Search Google Places by your telephone number, then claim your listing(s). Need Google account (Gmail). Delete duplicate listings. Do not use the same phone number for multiple locations.
2. **Complete your listing**. Fill out profile completely. Add link to website and practice description. Use keywords that relate to practice or specialty. Google Places shows your profile completion rate. 100% most effective.
3. **Update: Reviews in Google+ Local.** No longer anonymous. Good for businesses, bad for healthcare.
4. Google recognizes up to date profile and active participation in listing and uses this when calculating rank.

Hire a Reputation Mgmt Firm

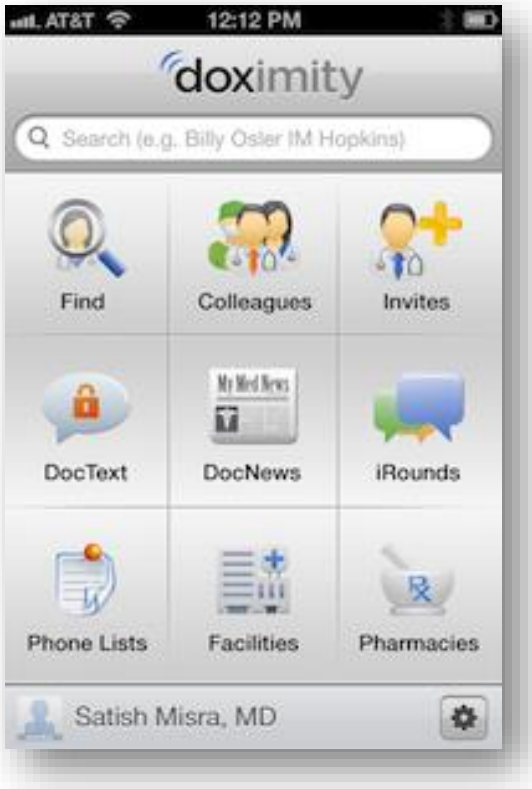
- To insure consistent and factual information about you and your practice
- Remove any unwanted information from online resources
- Suggestions for selecting a firm:
  - Verify their credibility
  - Get a referral
  - Check out their work
  - Know what you are paying for

Physician Use of SM

- Market practice and recruit patients
- Identifying services patients desire
- Connect with other doctors
- Connect with patients
- Keep up to date with health news, technology's impact on health and the delivery of healthcare
- Recruit research subjects

Connecting with other doctors

http://www.youtube.com/watch?v=xL85FlmbI_4



- **doximity.com** The Private Network for Physicians. Med Students. Convenient & HIPAA-compliant. Free for doctors on iPhone, Android and web. Alumni groups. Secure patient information, eFaxing, messaging. Consults. Recruiting.

https://www.youtube.com/watch?v=bEmwyxaY6hw

http://33charts.com/2013/08/12-things-about-doximity.html

Connecting with Patients

- Start with a professional Website
- Use Facebook account for clinic linked to Website
  - Remind patients of Great American Smokeout, flu shots
  - Cosmetics post success stories from patients
- TwitterDoctors.net – doctors who Tweet
  - Share articles, sites, news
  - Tweet while attending conferences
  - Tweet when running late

Incentives

- Patient satisfaction increases
- Support meaningful use efforts: Stage 2
  - Communicating health information to patients, electronic copy of health information upon request
  - View and download relevant information via web-based portal within 36 hrs – use mobile apps?
- Integral aspect of the Patient-Centered Medical Home (PCMH) model
- Standards will need to be developed to do this securely

HCSM and the Patient Centered Medical Home. Ben Miller. March 2012.
http://smhcop.wordpress.com/2011/03/16/hcsm-and-the-patient-centered-medical-home/

Strategies for Putting SM into Practice

- Set up **Google Alerts** for your name
  - http://www.google.com/alerts
- Define your goals
  - Manage online reputation, increase patient load, improve office efficiency, engage patients…
- Establish guidelines
- Determine time commitment
- Define your role, role of staff members
- Determine your message
- Pick a core site for presence
- Hire a communications professional (reputation.com)

Guidelines on Social Media Use

- Federation of State Medical Boards – *Guidelines for Appropriate Use of Social Media…* (April 2012)
  - Connecting with patients - Do Not…interact with current or past patients on **personal** social media. **Professional** only.
  - Connecting with other physicians – secure, HIPAA compliant sites like Doximity.com
  - Privacy/confidentiality – HIPAA – written authorization from patients
  - Disclosure – reveal any conflicts of interest
  - Content
  - Professionalism…

Federation of State Medical Boards. Model policy guidelines for the appropriate use of social media and social networking in medical practice. April 2012.

http://www.fsmb.org/Media/Default/PDF/FSMB/Advocacy/pub-social-media-guidelines.pdf

Social Media in HeALTHCARE

- **Over the duration of a person's life, the detailed information collected by doctors, hospitals, heath insurers and pharmacies, results in a detailed picture of the health of an individual.**
- **On a population scale, this information can be of high value.**
- **Health data allow the reuse of existing data sources for new studies, thereby reducing costs and efforts in data acquisition.**
- **For example, it enables the investigation of adverse drug reactions in certain patient groups.**

Social Media analysis for detection and tracking of Infectious Disease outbreaks.

- Epidemics of **infectious diseases, such as influenza and cholera, are a major public health concern that is difficult to anticipate and model.**
- Seasonal influenza epidemics result in about three to five million cases of severe illnesses and about 250,000 to 500,000 deaths worldwide each year.
- Although **influenza reoccurs each season in regular cycles, geographic location, timing and size of each outbreak varies, complicating the efforts to produce reliable and timely estimates of influenza activity using traditional methods for time series analysis.**
- In general, **health organizations require accurate and timely disease surveillance techniques** in order to respond to the **emerging epidemics by better planning for surges in patient visits, therapeutic supplies** and **public health information dissemination campaigns.**
- Additional **early knowledge of an upward trend in disease prevalence can inform patient capacity preparations and increased efforts to distribute the appropriate vaccine or other treatments,** whereas knowledge of a downward trend can signal the effectiveness of these efforts.

- Public health monitoring has traditionally relied on surveys and aggregating primary data from healthcare providers and pharmacists (e.g., clinical encounters with healthcare professionals, sick leave and drug prescriptions).
- Syndromic surveillance, the monitoring of clinical syndromes that have significant impact on public health, is particularly required for episodic and widespread infections, such as seasonal influenza.
- Many **infectious disease surveillance systems, including those employed by Centers for Disease Control and Prevention (CDC)** in the United States, Public Health Agency of Canada, Infectious Disease Surveillance Center in Japan, **Health Protection Agency in the United Kingdom, Swedish Institute for Infectious Disease Control and the European Influenza Surveillance Scheme** continuously collect virological and clinical reports from designated laboratories and physicians, in a process known as sentinel surveillance.
- For example, CDC operates the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet) and publishes the data col- 312 Healthcare Data Analytics lected and aggregated from it on-line via FluView.1
- **ILINet is one of the most effective disease surveillance systems,** which monitors 2,700 sentinel outpatient health providers and issues weekly reports of the proportion of all visits to those providers that are related to influenza-like illness (ILI) symptoms (temperature 100 degrees Fahrenheit or greater, cough and/or sore throat without any apparent cause).

- Although **survey-based surveillance systems are effective tools in discovering disease outbreaks.**
- they typically incur **high operational costs and temporal lags in reporting the outbreaks,** since an infectious disease case is recorded only after a patient visits a doctor's office and the information about it is sent to the appropriate public health agency.
- In the case of CDC, the **typical lag times for influenza** reporting are **one to two weeks** with even **longer lags for less common diseases.**
- During the **deadly infectious disease outbreaks, such as cholera,** this delay can hinder early epidemiological assessment and result in a greater number of fatalities.
- Previous work **in epidemiology has also shown that the most effective way to fight an epidemic in urban area**s is to quickly confine infected individuals to their homes.
- Since this strategy is effe**ctive only when applied early, it becomes important to be able to detect the outbreaks of infectious diseases in urban areas** as quickly as possible.
- In general, **methods for earlier outbreak detection allow more time to deploy interventions** that can lower the morbidity and mortality resulting from the outbreak.
- Besides longer reporting time lag, **sentinel-based surveillance systems suffer from population bias, since people who do not actively seek treatment or do not respond to surveys are virtually invisible to them, and tend to overreport population groups that are more vulnerable to diseases.**

- By contrast, **social media data are available in near real time and therefore can provide much earlier estimates** of the magnitude and dynamics of an epidemic.

- Social media platforms, **such as Twitter, offer virtually unlimited volumes of publicly available data** and **population sample sizes that exceed those of paper surveys by several orders of magnitude**.

- Finding the **key symptomatic individuals along with other people, who may have already contracted the disease,** can also be done more effectively and in a timely manner by leveraging online social network data.

- Furthermore, **geographical metadata in the form of the coordinates** associated with some of the **social media posts** can play an important role in monitoring the impact and **the geographical spread of an epidemic.**

- In this section, an extensive overview of the recently **proposed methods for detection and tracking of infectious disease outbreaks** based only on the analysis of the signals from social media

Social Media analysis for detection and tracking of Infectious Disease outbreaks

- 1 Outbreak Detection
- 1.1 Using Search Query and Website Access Logs
- 1.2 Using Twitter and Blogs
- 2.2 Analyzing and Tracking Outbreaks
- 2.3 Syndromic Surveillance Systems Based on Social Media

1 Outbreak Detection

- Outbreak Detection Experiments with unconventional methods using preclinical "health information seeking" for syndromic surveillance have been conducted before the advent of Web 2.0 and social media.
- For example, several surveillance systems have been introduced in the past to **monitor indirect signals of influenza activity, such as the volume of calls to telephone health advisory lines , over-the-counter drug sales and school absenteeism** rates.
- The emergence and rapid widespread adoption of online services, **such as search engines and social media platforms like Twitter and Facebook,** presented an opportunity for nearly real-time Internet-based **surveillance for disease outbreaks based only on the analysis of the data from these services.**
- This led to the emergence of a new area of research at the intersection of computer science and public health known as "infodemiology" or "information epidemiology".
- Infodemiology is an umbrella term for methods that study the determinants and distribution of health information for public health purposes and are aiming at:

- • developing methodologies and measures to understand patterns and trends for general public health research;

- • identifying disease outbreaks based on the analysis of these trends;
- • studying and quantifying knowledge translation gaps;
- • understanding the predictive value of search and content generation behavior for syndromic surveillance and early detection of emerging diseases.
- As a result, several lines of recent work have focused on developing new methods to detect outbreaks of infectious diseases using the data from different types of online services, such as query logs, microblogs and blogs.

http://www.cdc.gov/flu/weekly/

1.1 Using Search Query and Website Access Logs

- An increasing number of people around the world are **using the Internet to seek and disseminate health-related information.**
- People **search for health information for a variety of reasons: concerns about themselves, their family or friends.**
- According to the National Library of Medicine, an estimated **113 million people in the United States use the Internet to find health-related information with up to 8 million people searching for health-related information on a typical day.**
- About **90 million American adults are believed to search for online information about specific diseases or medical problems each year,** making the Web search a unique source of information about health trends and major events, such as epidemics.
- Therefore, an **interesting research question** from both computer science and public health perspective **is whether tracking health information-seeking behavior of people over time can be used to monitor public health in general and for syndromic surveillance, in particular.**

- The general idea behind the proposed methods for monitoring public health **based on the analysis of query logs of search engines is that the interest of a general public in a certain public health topic can be approximated by the search query activity related to this topic.**

- Therefore, **health information-seeking behavior can be captured and transformed into indicators of disease activity.** Since some search **query data also carries geographical information (generally based on the IP address of the computer, from which a particular query was issued), it may also be possible to detect simple geo-spatial patterns.**

- The **researchers** explored **whether an automated analysis of trends** in Internet searches **could be useful for predicting the outbreaks of infectious diseases,** such as influenza.

- They created a **Google advertisement campaign, in which the advertisements were triggered by the influenza-related search terms and experimented with different multivariate models to predict the number of ILI cases** based on the advertisement campaign statistics.
- It was found out that the **number of clicks on online advertisements has the highest correlation with traditional surveillance measures.**

- It was also observed that the **weekly number of flu-related advertisement clicks has even higher correlation with ILI reports from sentinel physicians** for the following week, suggesting systematic mining of search engine logs could be a valuable addition to traditional surveillance methods for those conditions, when the patients consult the Internet before visiting a physician.

- A joint study by CDC and Yahoo! suggested that **Internet searches for specific cancers correlate with their estimated incidence, mortality and the volume of related news coverage .** They concluded that **media coverage appears to play a powerful role in prompting online searches for cancer information.**

1.2 Using Twitter and Blogs

- The emergence and rapid increase in popularity of **Twitter5 opened up a new research direction in Internet-based disease surveillance.**
- Twitter is a **social networking and microblogging platform that enables users to create the posts limited to 140 characters** and **share them either with the general public or only with a specific group of people designated as "followers."**
- Although the Twitter stream consists **largely of useless chatter, self-promotion messages and user-to-user conversations that are only of interest to the parties involved,** due to the sheer volume of tweets, it contains **enough useful information for any task.**
- For example, **Twitter data has been used to measure political opinions , national sentiment, public anxiety related to stock prices and to monitor the impact of earthquakes.**
- The advantages of **Twitter-based approaches for disease outbreak detection over the ones that are based on search query and access logs** are twofold.

- First, although Twitter messages are fairly short, they are still more descriptive and provide more contextual information than search engine queries.
- Second, Twitter profiles often contain rich meta-data associated with the users (e.g., their geographical location, gender, age and social network), enabling more sophisticated detailed analysis.

- Twitter also has an advantage over other social media services in that it offers a larger volume of mostly publicly available messages.
- In particular, as of January 2014, Twitter is estimated to have over 600 million active registered users worldwide, who create 58 million microblog posts every day. Frequent updates and public data availability open up opportunities for near real-time, demographically and geographically focused disease surveillance.
- The work of authors was one of the first to use Twitter for infectious disease surveillance.
- In particular, they used the dataset consisting of 48 million tweets collected over a period of two months, which covers the timespan between the first time when the news about H1N1 (or Swine Flu) virus first broke out and until the H1N1 pandemic was declared by the World Health Organization on May 11, 2009.
- They used the data from Hubdub,6 an on-line prediction market, to model the public belief that H1N1 will become a pandemic using support vector machine (SVM) regression. Their analysis resulted in two major conclusions.
- The first conclusion is that simple bi-gram features extracted from the content of Twitter messages within historical contexts of different granularity (1 day, 3 days, 1 week, entire history) can accurately predict health-related beliefs and expectations of the general public.

3http://www.vardguiden.se 4http://www.healthlink.com
5http://www.twitter.com Social Media Analytics for Healthcare 315 and

- The second conclusion is that combining the features based on the content of Twitter messages and with the ones derived from the Hubdub data results in a more accurate prediction model than the one that relies on the prediction markets data alone.
- The authors have demonstrated the potential of Twitter outbreak detection by collecting and characterizing over 135,000 posts pertaining to H1N1 over a period of one week.

- The other researchers identified influenza related Twitter posts by applying simple and multiple logistic regression-based document classifiers using the occurrence of predefined keywords such as “flu,” “cough,” “sore throat” and “headache” as features to a dataset of over 500,000 posts spanning 10 weeks.
- In a multiple regression model, each keyword had a different weight, whereas in a simple regression model all keywords had the same weights.
- Then calculated the Pearson correlation coefficient between the log-odds of a fraction of influenza-related messages in the overall daily volume of Twitter posts and the log-odds of a fraction of all outpatient visits with ILI-related symptoms reported by the CDC
- Although multiple regression outperformed simple regression, he found that multiple regression began to overfit when too many keywords were used. The best model in his study achieved the correlation coefficient of 0.78 with CDC statistics.
- Similar methodology were applied to estimate alcohol sales from the volume of tweets related to drinking and found that the most accurate model is the one, which relies only the keyword “drunk.”

2.2 Analyzing and Tracking Outbreaks

- Analyzing and Tracking Outbreaks Besides near real-time surveillance through detection of self-reported cases of infectious diseases**, social media analysis can also be used to analyze and track the spread of a pandemic.**
- The **lack of timely data** and **limited understanding of the emergence of global epidemics** from **day-to-day interpersonal interactions** makes **monitoring and forecasting** the global spread of infectious diseases **very difficult.**
- Previous research in computational epidemiology has mostly concentrated **on coarse-grained statistical analysis of populations, often using synthetic data.**
- Although social media-based surveillance methods can **effectively perform passive monitoring and produce coarse, aggregate statistics, such as the expected number of people afflicted by flu in a city or a state, their prediction capabilities are severely limited by the low resolution of the aggregate approach.**
- Therefore**, another line of work focused on developing new techniques** to provide a detailed explanation of the mechanisms **underlying infectious disease transmission and, given a pandemic, to predict how rapidly and where it will spread.**

- The **bottom-up approaches proposed consist of two stages and take into account fine-grained interactions between individuals.**
- In the **first stage, a classifier is applied to detect sick individuals based on the content of their tweets.**

- In the **second stage, physical interactions between sick and healthy people are estimated** via their online activities and the large-scale impact of these interactions on public health is predicted.
- In particular, a **method proposed to accurately predict the prevalence of an infectious disease in a geographical region** (e.g., a city) by **modeling fine-grained behavior and interactions of the residents in that region with the outside world.**
- In the **first stage of their method, individuals are classified as either healthy or symptomatic based on the content of their tweets using SVM.**
- In the **second stage, classification results for individual users are aggregated into two probabilistic variables capturing the flux of healthy and sick travelers as well as their physical interactions within predefined geographical locations** based on using the GPS coordinates of their tweets and publicly available airline travel statistics to track geographical movements of people.
- They **estimated that the first variable, which corresponds to the expectation of the number of sick users on a given day in a given geographical region** has the correlation coefficients of 0.8 with the CDC statistics and 0.87 with Google Flu Trends.
- Additionally, **they found that using only travel statistics in the regression model** explains 56% of the variance in Google Flu Trends, while adding the expected number of sick travelers to the model explains 73% of the variance. Including the second variable, which models the number of physical interactions as a function of people traveling to the same airport at the same time, explains an additional 5% of the variance.

- Some researchers focused on the **fine-grained analysis of the spread of infectious diseases** and studied **how it is influenced by geographical co-location, social ties and interpersonal interactions**. In their method, **two individuals are considered to be co-located, if they visited the same 100 by 100 meter area within the same time window.**
- To identify the tweets indicating that their author was infected by flu at the time of posting, they **proposed a cascading process of training an SVM classifier working only with bag-of-words** features (unigrams, bigrams and trigrams).
- Optimized to overcome an imbalance between positive and negative samples and maximize the area under the ROC curve (i.e., to consistently have both high precision and recall).
- After identifying the tweets likely posted by the infected people, **they used the GPS coordinates of these tweets and the Twitter friendships of their author**s (in their **work Twitter friendship is defined as two users, who follow each other**) to quantify the effect of geographical co-locations and social ties on disease transmission.
-

- In both cases, **they observed strong exponential dependencies:** in case of co-locations, between probable physical encounters with sick individuals and ensuing sickness and in case of social ties, between the number of sick friends and the probability of getting sick.
- **For example,** they established that having 40 encounters with sick individuals within 1 hour or having 10 sick friends on a given day makes one ill with a 20% probability on the next day. At the same time, the number of friends in any health state (i.e., the size of a person's friends list) has no impact on that person's health status.

- **Further the researchers proposed a model, which in addition to predicting whether an individual will fall ill can predict when exactly that will happen.**

- **Their method simultaneously captures the effect of collocations as well as their duration on disease transmission and the delay between contagion and the onset of symptoms.**

- **After applying SVM to detect individuals afflicted by flu based on the content of their posts,** they used **a dynamic conditional random field (CRF) model to predict an individual's health status in the future using the 7-day prior history of co-location events,** the **number of unique sick individuals encountered and the number of sick Twitter friends of this individual as features.**

- They observed that **the performance of CRF is significantly enhanced by including the features that are not only based on the health status of Twitter friends,** but also on the estimated encounters with already sick, symptomatic individuals, including non-friends. Moreover, when using social ties and co-locations individually, CRF performs inconsistently when making predictions into the future.

- By contrast, **when considering friendships and co-locations jointly, along with using the Viterbi algorithm to infer the most likely sequence of a person's health states over time,** performance of the CRF improves and stabilizes, achieving up to 0.94 precision and 0.18 recall.

- The authors explained the low recall by the fact that **about 80% of infections occur without any evidence in social media.** They concluded that although many **complex events and interactions take place "behind the scenes" and are not directly recorded in social media,** they can still exhibit themselves in the activity of a sample of people we can observe.

- For example, **although Twitter friendships themselves do not cause or even facilitate the spread of an infection,** they can be proxies and indicators of a complex set of phenomena that may not be directly accessible.
- For example, **friends often eat out together, meet in classes, share items and travel together.**
- While most of these events are never explicitly mentioned online, they are crucial from the disease transmission perspective.
- These results can have direct and immediate implications for public health.
- For example, **a person predicted to be at high risk of contracting flu could be specifically encouraged to get a flu vaccination.**
- Additionally, recommendations can be made regarding the places that pose a high risk of getting infected.
- Finally, the proposed models are not limited only to the healthcare domain. Similar approaches can be used to model and predict the transmission of political ideas, purchasing preferences and many other complex behavioral phenomena.

2.3 Syndromic Surveillance Systems Based on Social Media

- Many of the techniques that we overviewed in this section have been implemented in **existing online syndromic surveillance systems.**
- InSTEDD's **Riff8 is an open source online platform for detection, prediction and response to health-related events (such as disease outbreaks) and humanitarian disasters.**
- Riff **synthesizes information about public health-related events from a variety of sources (e.g., news, social media, blogs) and visualizes them on a map to assist public health authorities with investigation and response.**
- HealthMap9 is a **system that monitors global media sources such as news wires and Web sites to provide a comprehensive view of ongoing disease activity around the world.**
- http://instedd.org/technologies/riff
- http://www.healthmap.org

(HealthMap Contd..)

- **It combines automated, around-the-clock data collection and processing with expert review and analysis.** Visitors to the site could filter reports according to the suspected or confirmed cases of deaths from a disease and select a time interval to show its spread.
- All reports are **entered into the HealthMap system along with their geographic location, allowing for easy tracking of both regional and global spread of infectious diseases.**
- During the **2009 H1N1 pandemic, HealthMap created an interactive map to provide information about disease outbreaks around the world using information from both informal sources** (e.g., news media, mailing lists and contributions from individual users) and formal announcements (primarily from the World Health Organization, the Centers for Disease Control and Prevention and the Public Health Agency of Canada).
- The **researchers analyzed the geographical pattern for the spread of H1N1 and observed that the countries that are international travel hubs** (e.g., France and the United Kingdom) reported flu infections earlier than the countries with less international traffic (e.g., Eastern European nations).

- They also **found that the countries with a high Gross Domestic Product per capita tended to have shorter time lags between the issue dates of reports** of suspected and confirmed cases of H1N1 influenza infection.
- Systems like **HealthMap allow anyone with a mobile phone to get involved in responding to a epidemic or humanitarian crisis** by contributing relevant information.

- As an example, during the **2010 Haitian earthquake and cholera outbreak, HealthMap allowed the individuals affected by this crisis to post information about their lost relatives and track the disease activity in their communities.**
- **FluNearYou10** is an **online system that integrates different types of data (weekly surveys completed by volunteers, CDC Flu Activity data and Google Flu Trends ILI data)** to visualize the current and retrospective flu activity in the United States and Canada.
- It is a joint project between HealthMap, the American Public Health Association, Skoll Global Threats Fund and Boston Children's Hospital.
- **Crowdbreaks11** is **a surveillance system that automatically collects the disease-related tweets, determines their location and visualizes them on a map.**
- It **employs a machine learning algorithm to assess whether a given tweet contains a reported case of a disease.**
- **Crowdbreaks** uses **crowdsourcing to generate the labeled training data for this algorithm by asking the site visitors to answer simple questions about randomly selected tweets.**
- **This system is based on the idea that social media data are not only provided by the crowd, but can also be assessed and curated by the crowd for their relevance to the issue at hand.**

Analysis of Social Media Use in Healthcare

- **Communication between patients and clinicians** is at the heart of healthcare.
- The emergence of **new social media resources such as social networks**, **instant messaging platforms and video chats** has the potential to completely change the way doctors and patients interact.
- Researcher points out that using social media in health education **"is about changing the locus of control to the patient**" and **altering the relationships between care givers and care receivers, in which patient portals**,
- **EHR platforms, blogs and microblogs** won't merely substitute for **many one-on-one encounters with providers**, **but will also allow for deeper doctor-patient relationships**.
- Besides **helping to establish better doctor-patient relationships**, leveraging **social media in healthcare has the following benefits**:

Benefits of Social Media in Healthcare

- Social media platforms can make it **easier for severely ill patients who are home-bound or bed-bound to regularly communicate with their providers**;

since **written communication may take less energy/effort than phone calls** and **can be paused if the patient needs to take a break during the communication to rest;**

- • Such **platforms can narrow the information gap between providers and patients** and **make patients more engaged in their healthcare management and decision making**;

- • **Communications via social media would also be beneficial for patients who are seeing experts located in different parts of the state or even country** for their health conditions

- The **public health community** is also **considering how social media can be used to spread health information**,
- Applications includes **health education and promotions**, as well as **larger scale scenarios**, in which **patients can "friend" their doctors and constantly share health information with them and receive advice**.

- **Social Media as a Source of Public Health Information**
- **Analysis of Data from Online Doctor and Patient Communities**

Social Media as a Source of Public Health Information

- **Personal health data has been traditionally considered as private**. However, with the **emergence of collaboratively generated content platforms** dedicated specifically to healthcare, that **view started to change**.
- While **health information systems vary in complexity and purpose**, the **predominant model is that of a central repository for all health information generated within clinical contexts(health history, diagnoses, allergies, current treatments)** that is **kept securely for view only by patients and their healthcare providers.**
- And while there is a **growing demand by patients for access to their own health data**, **little is known about how other people with similar medical concerns can**
- Social Media Analytics for Healthcare **effectively use these data, if they are made available to them.**
- **A medical informatics working group asserted that the ideal personal health record is more than just a static repository for patient data.**
- It should **combine data, knowledge and software tools** to **help patients become active participants in their own care.**

- **Framing online patient interaction around sharing personal health information** resulted in the emergence of healthcare-related Web 2.0 communities,
- Where, the **members exchange their knowledge and experience, educating each other**.
- **This way patients can be viewed as individual data stores**, which if **linked together with online social networks**, can **become part of a global, dynamic and shared healthcare knowledge repository**.
- The **popularity of social media resources can be leveraged to disseminate health information** and conduct interventions.
- For example, in the dermatology community, the Sulzberger Institute for Dermatologic Education is sponsoring an Internet contest for the best video promoting sun safe behavior.

- Other examples include Twitter groups dedicated to certain medical conditions
- e.g., a group for mothers of children with attention deficit disorder, YouTube videos on **tobacco cessation** and **human papillomavirus vaccination campaigns.**
- Researchers analyzed the **pros and cons** of using **social media to spread public health information** to young adults and concluded that
- the **pros include low cost and rapid transmission**,
- while the **cons include blind authorship, lack of source citation and frequent presentation of opinions as facts**.
- Researchers studied experiences, expectations and strategies of 84 healthcare organizations in using social media for external communication.
-

- In particular, they **studied the activity, popularity and presence of these organizations** on Facebook, Twitter, LinkedIn, YouTube, Google+, and Pinterest as well as blogs and
- found that different **social media platforms are not equally utilized and that the activity of organization on these platforms differs by their specific area.**
- It was found **that health organizations generally have a Facebook and/or Twitter account, however, other social media platforms, such as Google+, blogs and YouTube are hardly used at all.**
- In addition, **health organizations most commonly use social media to spread information about themselves.**
- Interviews with the **employees of those organizations responsible for social media relations** indicated that there is a need for "**closed platforms**," in which the members have different levels of access to the content.
- Such platforms will be **more suitable for private and sensitive information, which is common in the healthcare industry**.
- As **behavioral interventions** are becoming increasingly important in public health, the potential of using **social media to study dissemination of health behaviors, sentiments and rumors** among very large populations is unparalleled.

- Other researchers assessed the spread of vaccination sentiments from person to person during the unfolding of the H1N1 pandemic and

- They found that anti-vaccination sentiments could be reliably assessed across time and that those sentiments tend to cluster in certain parts of online social networks.

- Their analysis also indicated that negative sentiments spread more effectively than positive ones.

- They also identified strong positive correlation between anti-vaccination sentiments and CDC estimates of H1N1 vaccination rates (i.e., vaccination coverage was higher in the regions with more positive sentiments).

Analysis of Data from Online Doctor and Patient Communities

- **Fast and easy access to online health information** resulted in **patients relying on social media and the Internet more frequently than their physicians** as a source of health information.
- In particular, researchers conducted an extensive study of social media use by Generation Y, people **with low socioeconomic status and chronically ill populations.**
- **Emerging healthcare-related social media platforms** also play an **increasing role in online health searches**.
- In many cases, **people prefer to turn to social media groups, discussion forums and patient communities** to express and **discuss their fears and concerns for several reasons**.
- The **patients either** may not feel **comfortable disclosing their fears to providers** or **may wish to find other individuals in similar situation**, **who will listen to them, provide support and address their everyday issues** and **fears that healthcare providers may not realize**.

- This particularly **applies to the issues** that are traditionally related to **stigma, ridicule and rejection in a society**.
- **Social interaction through computer-mediated communication services resembles face-to-face interactions**, but **offers greater anonymity and intimacy**, which in turn **results in higher levels of trust**.
- **Both patients and doctors** naturally **seek to meet and interact with a community of other patients and doctors** either to **share their knowledg and experience or to receive support and advice**.
- This type of dynamic online communication (called Health 2.0, by analogy with Web 2.0) now offers **patients a unique opportunity to learn about their illness and gain support and knowledge from others** with similar experiences.
- As a result, **online patient communities can be used as a source of clinica data and patients' insights** on the functioning of different aspects of the healthcare system.

- **These platforms are based on two assumptions**.

- **First**, **given appropriate tools**, **patients** will be able to **interpret and learn from their own and others' health data**.

- **Second**, **sharing personal health data and collaboratively reviewing and critiquing it** will enhance the **utility of the data for each contributor**.

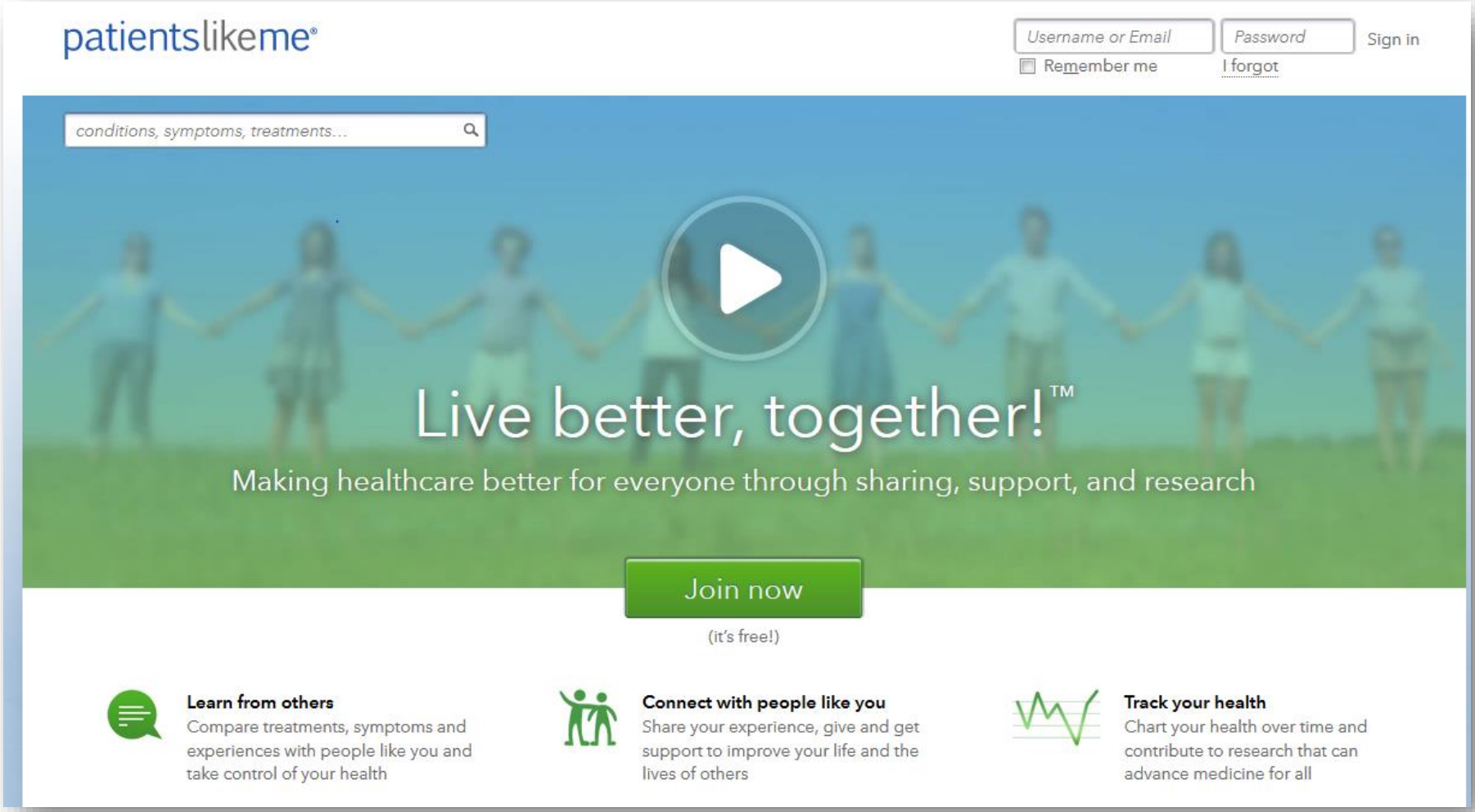
- A list of popular on-line patient communities is provided in Table (Popular Online Patient Communities) next slide.

TABLE 9.1: Popular Online Patient Communities

Community	Description	Website
PatientsLikeMe	Online community for patients to share their experiences and progress or to get input from others, who suffer from the same condition	`www.patientslikeme.com`
MedHelp	Online patient community that partners with hospitals and medical research institutions to deliver on-line discussion boards on a variety of healthcare topics	`www.medhelp.org`
DailyStrength	Social networking platform centered on support groups, where users provide one another with emotional support by discussing their struggles and successes with each other	`www.dailystrength.org`
Inspire	Patient community organized around support groups related to medical conditions that are represented as a hierarchy	`www.inspire.com`
MediGuard	Patient and consumer network that helps patients to track their medications and exchange information with others	`www.mediguard.org`

https://www.youtube.com/user/PatientsLikeMe2008

Patients Like Me



- PatientsLikeMe is an **online platform built to support information exchange between the patients with life-changing diseases**, which is organized around patient communities designated for specific conditions.

- PatientsLikeMe has more than **20 disease communities formed by more than 50,000 patients** that **anonymously share treatment options, symptoms, progression and outcome data for complex diseases**.
- To **make health information more accessible**, this Web site provides **visualization tools that help the patients understand** and **share information about their health status.**
- **Upon joining the site**, **patients enter a combination of structured and unstructured information about their health status and history.**
- It is **then processed and represented as a set of graphical displays on their profiles:**

- a personal picture, **an autobiographical statement**, **a diagram that maps a functional impairment** to specific areas of the body, a diagnosis history and a series of charts.

- The “**nugget” summary diagram displays the current function score as a color code mapped onto the affected areas**

- of the body as well as the number of years with the disease,

- an **iconic representation of the equipment currently used**, and - - stars indicating the level of participation on the site.

- **Each member can also see a graphical representation of their own and others’ health status**, **treatments and symptoms over time** and **can view reports of aggregated data**.
- The site includes an **interactive report for each treatment,medication and intervention that patients add to the system**.
- Such **reports include dosages taken, time on treatment, evaluations of treatment, including perceived efficacy, side effects** and **burden**.
- **Members can locate other patients in similar circumstances** and with shared medical experiences using the forum, private messages and comments they post on one another’s profiles.

- They found that discussions on the site fall into three major categories:
- Targeted questions to other patients with relevant experience, proffering personally acquired disease-management knowledge or coping strategies, and forming and solidifying relationships based on shared health concerns.
- Online patient networks open up new ways of testing treatments and can speed up patient recruitment into clinical trials for new drugs.
- Recent studies have also demonstrated that using online patient network data in clinical studies can accelerate discoveries related to complex conditions such as Parkinson's disease, amyotrophic lateral sclerosis (ALS) and rheumatoid arthritis.
- These platforms can also be used to identify shifts in patients' perceptions and behaviors in response to public health policies.
- Many disease-specific groups have arisen on Facebook, representing important sources of information, support and engagement for patients with chronic diseases.
- It was identified the 15 largest groups focused on diabetes management and evaluated a sample of discussions within them.

- They found that Facebook diabetes communities contain a plurality of participants, including patients, their family members, advertisers and researchers, with divergent interests and modes of communication.
- They use Facebook to share personal clinical information, request disease-specific guidance and feedback and receive emotional support. They also found that users posted individual concerns about possible adverse effects of medications and diet supplements in an attempt to see if their own experiences correlated with those of others.
- Furthermore, nearly a quarter of all the posts shared sensitive aspects of diabetes management unlikely to be revealed in doctor–patient interactions.
- Many blogging and Twitter communities are also dedicated to specific health conditions.
- Researchers studied dietdiaries.com, the community of bloggers focused on weight management, and compared the effectiveness of two approaches for the task of predicting weight loss from natural language use in blogs.
- The first approach is based on manually categorizing blog posts based on the degree of weight loss or gain reported in them and then using standard multinomial Na¨ıve Bayes textual classifier with bag-of-words features to classify them into those categories.
- The second approach is based on the detailed linguistic analysis of blog posts leveraging linguistic inquiry and word count (LIWC) categories.
- In this method, textual feature vectors are mapped into linguistic categories that are known to be associated with psychological constructs.

- The proposed method first computes correlations between LIWC categories and weight change and then uses linear regression to predict the percent of body weight change based on the distribution of LIWC categories, which have statistically significant correlations with weight change.

- The researchers observed that the LIWC-based regression approach generally outperformed the Na¨ıve Bayes-based classification approach.
- In particular, they found that using more sadness-related words and fewer food ingestion related words is a statistically significant predictor of weight loss, whereas the percent of body weight change was unrelated to the usage of positive emotion words (e.g., “awesome,” “happy”), health words (e.g., “nausea,” “sick”) or social words (e.g., “friend,” “hug”).
- These results was that sharing negative emotions is a more successful strategy in blogging about weight loss than simply keeping a food intake diary.
- The other researchers studied communication about childhood obesity on Twitter using descriptive statistics and exponential random graph modeling to examine the content of tweets, characteristics of users tweeting about childhood obesity and the types of Twitter followers receiving tweets about childhood obesity.

- They concluded that Twitter may provide an important channel for reaching traditionally difficult-to-reach populations, including lower income, Hispanic, and non-Hispanic Black groups facing significantly higher rates of childhood obesity than their higher income and non-HispanicWhite counterparts.

- Several researchers also focused on studying the content and social network structure of online communities for smoking cessation.
- Some rsearchers analyzed the content of the posts on StopSmokingCenter.net, an online social support network moderated by trained program health educators, as well as characteristics of the users who created them.
- They found that the majority of posters were female and that the most common theme of the posts was seeking support or advice with quitting.
- However, only 15% of the new members made at least one post on the support group boards and an even smaller fraction of users were active and consistent posters, suggesting that otherself-quit programaspects (e.g., developing a strong sense of community)might bemore appealing to the participants.

- Additional analysis revealed that 50% the the first-time posts were made relatively quickly (within three hours after joining the site).
- In their first posts, members most frequently conveyed that they were seeking support and advice. Replies to the first posts from other support group members were also quick, with 25% of the first posts receiving a reply within 12 minutes and 50% within 29 minutes.
- Responses were even faster for the posts from the members that were actively seeking support, revealing that the support group board did function to provide members with an immediate source of support not available with most traditional interventions.
- Network analysis techniques were used to identify structural and functional characteristics of
- QuitNet,15 one of the largest and most popular continuously operating online communities focused on smoking cessation. They found that the members in the strongly and densely connected cores of QuitNet's social network are mostly older females (over 40 years old), that have been active and abstinent community members for more than a year.
- +

- In a recent study , social media was also used to study a new drug, methoxetamine.
- Also they identified and compared the level of different types of social support (informational, emotional and instrumental) across three different types of computer-mediatedcommunication tools (discussion forums, personal journals and notes) on the MedHelp alcoholism support community and found that the patients use these communication tools for different purposes.
- Forum users are more likely to seek and provide informational support, while journals and notes are primarily used to express higher levels of emotional support.
- Similar qualitative content analyses of posts on online communities for health conditions such as irritable bowel syndrome , Huntington's disease and HIV [have been conducted and identified that all five subtypes of social support (emotional, informational, esteem and social network) are evident in the posts, with informational and emotional support being offered most frequently.
- The researchers also studied the characteristics of the young lesbian, gay and bisexual population on Twitter and proposed several methods for effective peer-driven information diffusion and preventive care, specifically focusing on suicide prevention.

- Besides patient communities, there is also a growing number of online communities for healthcare professionals, which foster and facilitate the exchange of information, insights and knowledge about current medical practices, treatments and medications and generate epidemiological and clinical data that were previously dispersed between the physicians' charts, EMRs and clinical histories.
- A list of popular online platforms dedicated to healthcare professionals is presented in Table (next slide).
- Sermo is the largest such community with over 200,000 registered licensed MDs and DOs.
- Data- Genno is a Web portal for healthcare professionals and researchers along with patients and their relatives to exchange information about rare genetic and complex diseases. It provides a database with sample and disease information along with the images for each sign or symptom, a search engine for differential diagnosis and features for information exchange between healthcare professionals.
- It has been designed to bridge the gap between healthcare professionals, scientists, genetic counselors, nurses and patients by combining clinical, genetic and genomic information for specific diseases.
- eMERGE is an NIH-funded collaborative project linking medical records data with genomic data.
- It is a community-based social network for health professionals that combines traditional drug discovery covery informatics with Web 2.0 platforms and strong privacy is believed to be the key to facilitate richer collaborations between healthcare professionals with the same interests

TABLE 9.2: Popular Online Communities for Doctors and Clinical Researchers

Community	Description	Website
DataGenno	Interactive database containing molecular and clinical genetic information from diseases targeted to healthcare professionals, research scientists, and patients	`www.datagenno.com`
eMERGE	The Electronic Medical Records and Genomics (eMERGE) network combines DNA repositories with electronic medical record systems for large-scale genetic research	`emerge.mc.vanderbilt.edu`
Sermo	Online network for physicians with panel discussions about specific topics	`www.sermo.com`
Ozmosis	Provides several solutions for physicians to share their knowledge and clinical experiences with each other	`www.ozmosis.com`