

Conflicts of Interests Disclosure

- AAO Foundation – Hoskins Center for Quality and Safety
- NAEVR / AEVR
- Centers for Disease Control and Prevention
- American Glaucoma Society
- American University Professors of Ophthalmology
- Consultant /Research
 - Alcon Research Institute
 - Kellogg Foundation
 - National Eye Institute
 - University of Michigan
- Intellectual property
 - Statins for glaucoma
 - EMR decision support and data entry

“Big Data” and What Improved Care and Outcomes Might Look Like in the Future



Paul P. Lee, MD, JD
University of Michigan
Kellogg Eye Center

35th Annual Symposium
Southern California
Permanent Medical
Group

“Big Data” Presentations

- What Big Data is Teaching Us in Ophthalmology
Bobek Modjtahedi, MD
- Artificial Intelligence in Healthcare
Moses Wintner, PhD

“Big Data” – Foundational Element of the Future

- **“In this data-rich world, your competitive advantage is your ability to transport, collect, store, organize, mine, visualize, and machine learn against data. This ‘computational knowledge extraction’ lies at the heart of 21st century discovery.”**

–Ed Lazowska
Bill & Melinda Gates Professor at the University of Washington
Co-Chair, PCAST NITRD Subcommittee

E-mail responding to Athey-Glotzer U-Michigan Cyberinfrastructure Report; 2008

New Market Entrants

- New sites of care
 - CVS Minute Clinics
 - Online apps
 - Community centers / places
 - Housing areas
 - Workplaces
- Industry giants
 - Amazon
 - Microsoft
 - Apple
 - Alphabet (Google)



What is our “Goal” ?

Prevent (and restore) vision loss in patients and populations

Themes for Discussion

- History of achievement creates optimism for future
- “Big Data” will help us address many of our current challenges in our profession
- Using new advances such as “big data” wisely will strengthen our sense of being professionals once again

Innovation in Eye Care

- 1968
 - Coke bottle glasses after cataract surgery
 - No refractive surgery
 - Pilocarpine and full thickness surgery for glaucoma
 - Open sky vitrectomy and buckles for retinal detachment
 - No therapy for AMD
- 2018
 - Femtosecond laser cataract surgery with no glasses
 - Custom refractive surgery
 - Multiple glaucoma surgery options with understanding of how they work
 - Sutureless and endoscopic surgery, with rescue of detached retina
 - Anti-VEGF therapies
 - Gene and stem cell regeneration of function

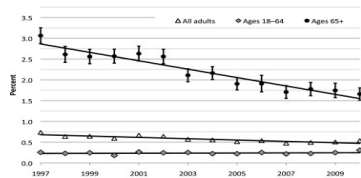


Figure 2. Prevalence of activity-limiting visual impairment among adults in the United States, age-adjusted by age group, 1997–2010.

Trends in Self-reported Visual Impairment in the United States: 1984 to 2010

<http://dx.doi.org/10.1016/j.ophtha.2012.04.016>

Ophthalmology, Volume 119, Issue 10, 2012, 2028–2032

Angelo P. Tanna, H. Stephen Kaye

NEON Cataract Outcomes Registry

Lum F, et al, Initial Two Years of Experience with the AAO NEON Cataract Surgery Database, Ophthalmology 2000

Lum F, et al, The Development and Demise of a Cataract Surgery Database, Jt Comm J Qual Improv 2002

- Started in January 2006 with Earl Steinberg, Johns Hopkins, PORT PI
- 249 ophthalmologists submitted data
- 7626 patients pre-op data
- 3342 post-op data (44%)
- Over 5 years (to 3/2001), 17,876 patients, with complete data on 9937 (56%)
- 93% with 20/40 or better
- 89% improved on VF-14
- 92% improved symptoms
- “...technically feasible”
- “...willing to spend time required to participate...”
- “...NEON was discontinued because of a lack of participation and demand by members or 3rd parties...”

Themes for Discussion

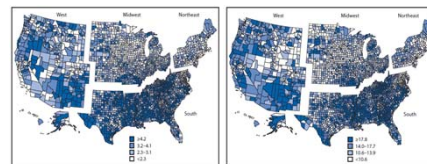
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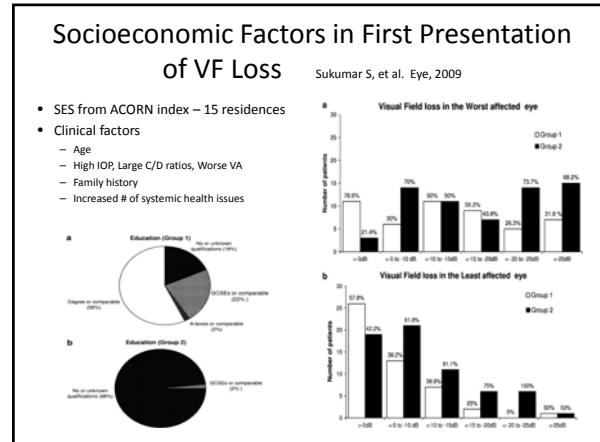
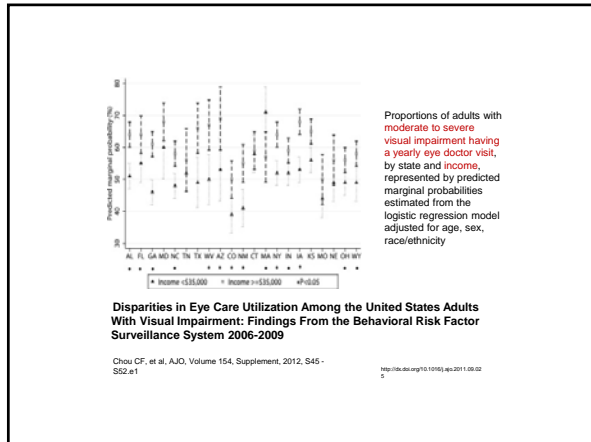
Geographic Disparity (by County) of Poverty and Vision Loss

Kirtland KA, et al, MMWR, 2015

Percentages ≥ 18 with severe vision loss (blind or serious difficulty seeing even with glasses)

Percentages ≥ 18 with family income below poverty

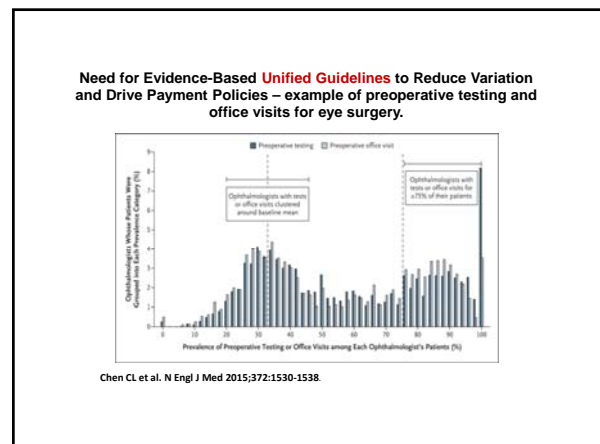
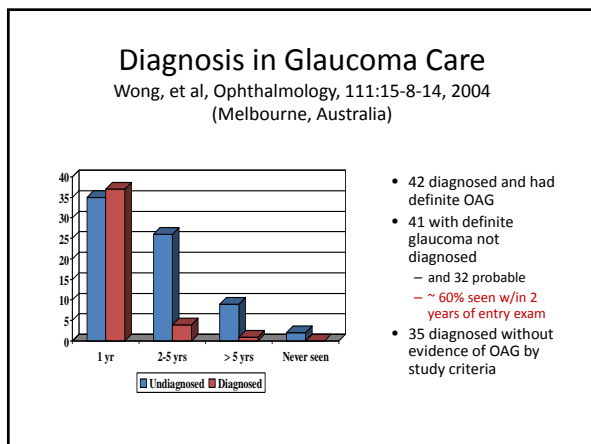


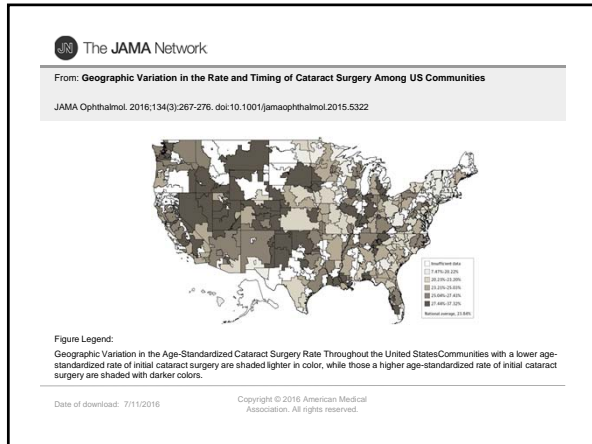


Challenges and Opportunities in Ophthalmic Safety and Quality

- IOM / NASEM reports
 - Quality
 - Safety
 - Diagnostic Error
- Royal College approaches

- ### History taking among Glaucoma Specialists – Open-ended Vignettes (pre-EMR)
- Family history of glaucoma 93 %
 - Review of pertinent records 57 %
 - Known medication intolerance 57 %
 - Time of last use of medications 1 %
 - Assessment of vision – ADLS 0 %





Health and Health Care in 2032: RWJ Foundation / Institute for Alternative Futures, 2012

- 4 scenarios for next 20 years for USA
- Culture of health
- Big data, big health gains
- Slow reform, better health
- Health if you can get it

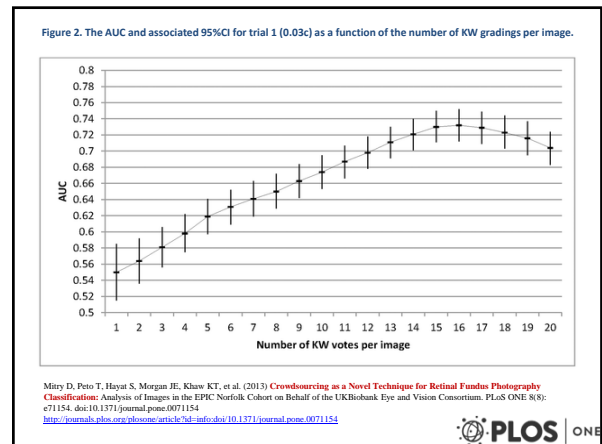
Big Data = Big Gains in Health RWJ Foundation / Institute for Alternative Futures, 2012

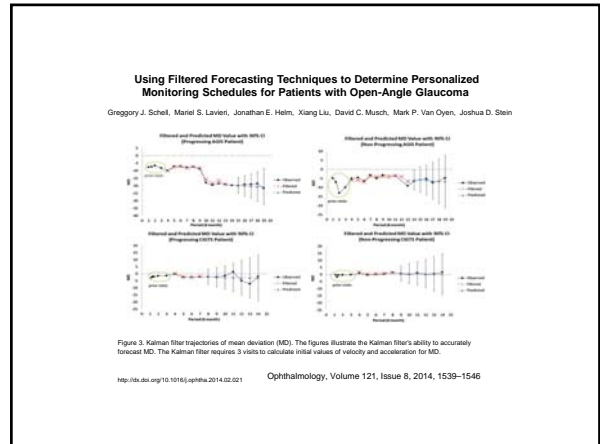
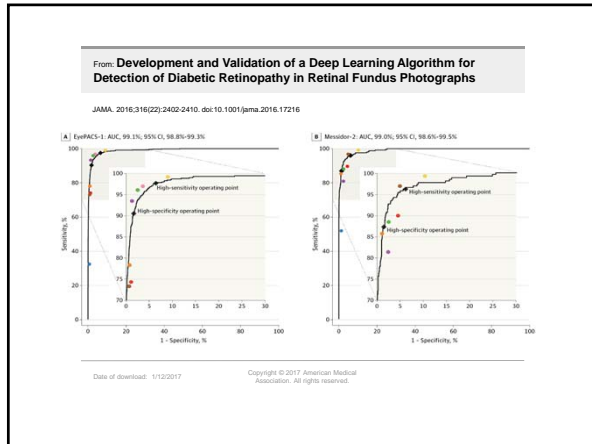
Integrating Eye Health Systems and Public Health Systems

- Partners in Work
 - Eye care specialists
 - Primary care providers
 - Schools
 - Public health departments
 - Social welfare departments
 - FQHC's
 - NGO's
 - Others

Social Networks Influence on Health

- WIRED, Issue 17.10, Sept 2009
- People cluster around happy people / joyful expressions
- Weight loss
- Smoking cessation
- Duke SON research projects on online social networks to change health behaviors





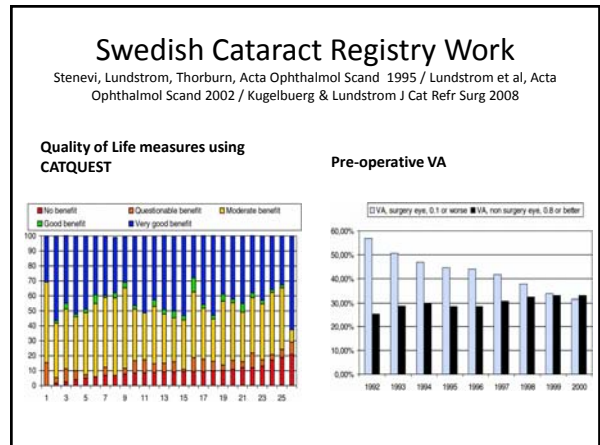
Value of IRIS Registry
Courtesy of Flora Lum, MD, AAO

Evaluate your own data

- Benchmark your outcomes against your practice colleagues or national averages

Manage your patients at a population level

- Look at a specific group of patients based on conditions, risk factors, demographics or outcomes
- Identify trends and track interventions
- Answer specific clinical questions



Patient Safety: Potential Wrong IOL

- Time period: 2013-2014
- Cataract surgery procedures: 857,738
- 66986: IOL exchange:
 - 412 occurred within 90 days or .05%
 - 1136 occurred within 1 year or .13%

Courtesy, William L. Rich, III, MD

Myopic CNV - Conclusions

- First study to describe practice patterns for myopic CNV using a registry
- IRIS Registry as tool:
 - Understand practice patterns
 - Identify areas of unmet need
 - Validate results of ophthalmic clinical trials in real world setting
- Willis J et al. Treatment patterns for Myopic Choroidal Neovascularization in the United States: Analysis of the IRIS Registry. Ophthalmology 2017 [E pub ahead of print]

Courtesy of Flora Lum, MD

Endophthalmitis after Anti-VEGF

Anti-VEGF Agents	Injections	Unique Patients	Endophthalmitis at 30 days	Rates (30 days)
Bevacizumab	490,799	95,651	391	0.080%
Ranibizumab	295,025	44,868	212	0.072%
Aflibercept	298,482	34,372	202	0.068%

Courtesy of Flora Lum, MD

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Health Care Interaction

- (2) Interaction
- (1) Patient ----- (3) Provider
- (4) Who pays for visit services
- (5) Structure of delivery system
- (6) Who finances overall system
- (7) Overall societal context

1. What is the Role of a Physician ?

- Human relationships
- Personal to patient and physician
- Instruments
- Algorithms
- Data integration / Analysis
- Point of care systems
- Leverage technology
- Communities / Networks
- Relationships

Integrated System with Practitioners Performing What They Do Best (Rao GN, Barrie Jones Lecture, Eye, 2015)

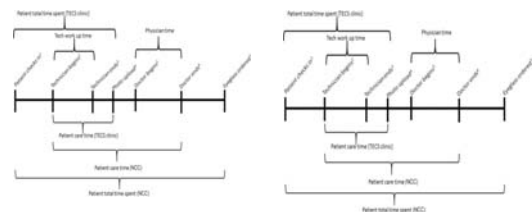
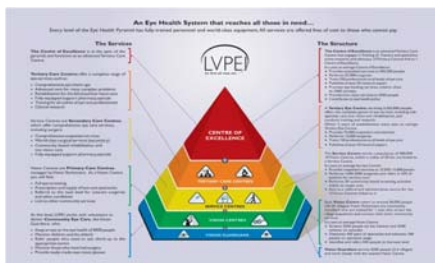


Figure 3. Distribution of eye care resources in the "pyramid model"

April Y. Maa, Barbara Wojciechowski, Kelly J. Hunt, Clara Dismuke, Jason Shyu, Rabeea Janjua, Xiaojin Lu, Charles M. Medert, Mary G. Lynch

Early Experience with Technology-Based Eye Care Services (TECS) : A Novel Ophthalmologic Telemedicine Initiative

Ophthalmology, 2017

<http://dx.doi.org/10.1016/j.ophtha.2016.11.037>

2. What Expectations do Patients Have for the Patient Visit ?

Dawn & Lee, Archives, 2003

- Communication
 - honesty (1);
 - diagnosis and prognosis (2);
 - clear language (3);
 - listening and addressing concerns (6)
- Interpersonal manner
 - empathy (5);
 - personal connection (7)

3. What are Important Patient Perspectives ?



Figure 3. A, A word cloud showing the occurrence of descriptors of glaucomatous vision loss

David P. Crabb, Nicholas D. Smith, Fiona C. Glen, Robyn Burton, David F. Garway-Heath



How Does Glaucoma Look? : Patient Perception of Visual Field Loss

Ophthalmology, Volume 120, Issue 6, 2013, 1120-1126

Patient-Reported Outcomes

Listening to the Patients—The Laser-Assisted In Situ Keratomileus Quality of Life Collaboration Project

Several years ago, the US Food and Drug Administration (FDA) became aware that some patients were experiencing debilitating glare and night symptoms affecting their quality of life following laser-assisted in situ keratomileus (LASIK). The FDA convened a team to compare the information assessed following the intervention. The FDA approved use, post-market data to the scientific evidence upon which the FDA issued its approved indications for patients' good. The patient and pre-market data showed that more than 90% of patients were satisfied with their outcome. However, some patients were dissatisfied. While all FDA approved LASIKs undergo extensive technical and clinical data evaluation prior to approval, the impact of the symptoms on the patients' daily lives was not previously collected or reported to FDA by the health care community or manufacturers.

JAMA Ophthalmology 2017 FDA involved

Additional Joint FDA Projects
Glaucoma
Potentially others

Key Component: Measuring What Patients and Families Want

Scott Wallace, PhD – Public Director, ABO

- **Capability** – patient-centered outcomes, functioning, ability to use system for life activities
- **Comfort** – complications, side effects, morbidity
- **Calm** – anxiety, worry, depression, patient experience (“how are YOU doing” vs “how are WE doing” in many patient satisfaction questions)

What are Potential Outcomes

Adapted from Lee P, J of Glauc, 1995; Vitale S, 2009; S Wallace 2017

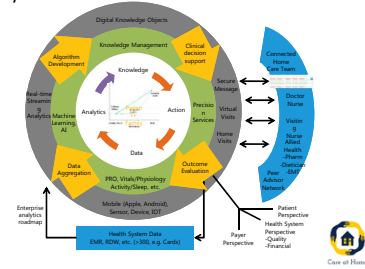
	Organ	System	Person
• Clinician	IOP / RNFL	Visual Acuity	Task Performance Contrast Sensitivity
• Person	Symptoms	Vision Function “Capability”	Health Perceptions “Comfort” / “Calm”
• Payor	Costs of care	Cost-effective	Satisfaction
• Society	Surveillance	Utilities	Disability

Address What Patients Are Worried About: Entry Health Perceptions in CIGTS

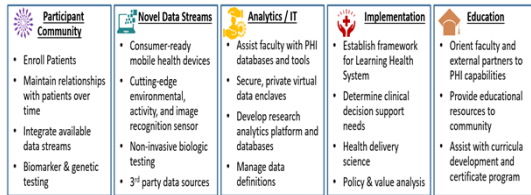
Janz, et al. Ophthalmology, 2001

- Stressed about glaucoma ~ 30 %
- Interferes emotional state ~ 40 %
- **Worried about blindness** ~ 50 %

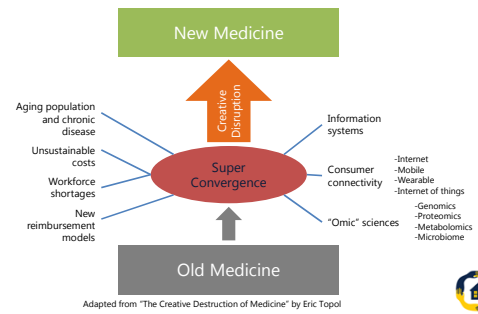
4. How do We Continue to Do Better and Drive a Learning Health Care System ?



Precision Health Platform – Case Example of Michigan



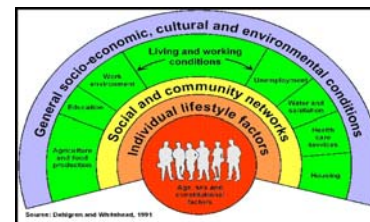
The Creative Disruption of Medicine



UK Biobank (UKBB) Cumberland PM, et al, PLOS One, 2015

- World's largest single resource for study of health and disease
- Recruited 502,682 adults between ages 40 and 69
 - Recruited between 2006 and 2009
 - All registered with UK National Health Service
 - Live within 25 miles of one of 22 study assessment centers
- At 6 recruitment centers, 117,279 had enhanced eye examination, starting in 2009
- Included ethnicity / highest education / housing status / use of glasses or contacts / common eye conditions and age / ever had eye surgery / illnesses / handedness

5. How do We Do Better for Populations as well as Individuals ?



Greater Sources of Patient Data – 2018

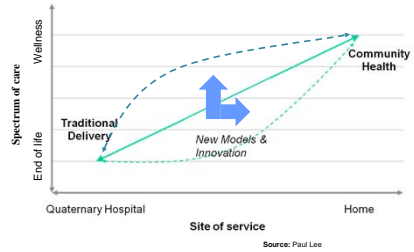
Already Used Widely

- Office chart – paper
- Office chart – electronic
- Data registry of specified data elements
- Claims databases
- Patient surveys
- Company data
- Census bureau

Uses Starting to Grow - Person

- Google / Facebook / Twitter / others
- DMV / other government
- Surveillance camera – public and private
- Smartphone GPS / Apps
- Proteomics / Genomics
- Wearable sensors / data capture devices
- To be invented ...

Changing Where We get Care



Revitalized Importance of the Doctor-Patient Relationship

- Reconnect to the patient and their loved ones as people
- Reinvigorate the sense of meaning to what we do
- Restore a greater level of joy of being a physician

- Increases resiliency
- Reduces burnout
- Improves outcomes