Prepare for Change: Disruptive Technologies and Trends in Ophthalmic Practice

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Financial Disclosures

Robert Wiggins, MD MHA: OMIC Board of Directors
Linda Harrison, PhD: Director OMIC Risk Management
Disruptive Technology

*Definition:* A **disruptive technology** is one that displaces an established **technology** and shakes up the industry or a ground-breaking product that creates a completely new industry.

*Source:* [https://whatis.techtarget.com/definition/disruptive-technology](https://whatis.techtarget.com/definition/disruptive-technology)
Disruptions Affect All Industries
Entertainment

vs

NETFLIX

Transportation
Retail

VS

amazon
Other technology disrupters

• The PC displaced the typewriter
• Personal computing disrupted the TV industry
• Email displaced letter writing and the postal industry
• Cell phones disrupted the telecom industry
• Smartphones replaced cell phones and personal digital assistants (PDAs), calculators, and GPS devices
• Cloud computing displaced many in-house hosted services
• And on and on...
Disruptive Technology and Eyecare Delivery

1. EHRs-scribes, assistants, and throughput
2. Part B drugs-models of administration (e.g. PA’s, APN’s)
3. Online glasses, contact lenses, refractions, and exams
4. Artificial intelligence, application-based examination selfies and disease diagnosis and monitoring
Themes

• High cost of US healthcare without commensurate quality.
• EHRs have been widely adopted.
• Advanced practice providers may provide some care more efficiently.
• New technology may be vastly disruptive.

“According to Darwin’s Origin of Species, it is not the most intellectual of the species that survives; it is not the strongest that survives; but the species that survives is the one that is able best to adapt and adjust to the changing environment in which it finds itself.”

-Leon Megginson, LSU Professor of Management, 1963
EHRs-Scribes, Assistants, and Throughput
Team-Based Care

The Electronic Health Record
The Good Old Days
And Today

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**Matrix Sizes**

- **19x19 Matrix**
- **22x17 Matrix**
EHR Risk: Loss of patient rapport and efficiency

- Doctors using EHR spent 1/3 of time looking at computer screen during patient visits.
  --*Int. Journ. Medical Informatics*

- Patients rated doctors lower when they looked at a computer screen a lot during the exam.
  --*JAMA Internal Medicine*

- Patient volume per provider dropped 16.9% over 4 years after implementation of EHR.
  --*BMC Health Serv Res*

Source: *Is Your Doctor Getting Too Much Screen Time?* WSJ Dec 14, 2015
The Expanding Role of the Ophthalmic Assistant
A Key to Clinic Efficiency

- Increase in workload compared to paper-more time to train
- Increased data input
- Assuring quality data entered
- Keyboard proficiency
- Posting charges
- Appointment scheduling

Recruit, Train, Retain: Critical competency!
Ongoing Training: Daily!
Scribes/Techs

- Assist with clerical aspects of the exam
- Prepare the EHR for the next encounter
- Record exam findings and imaging interpretations
- Document diagnoses and plans
- Monitor schedules and flow

- Benefits: efficiency
- Cross-training of technicians and scribes; scribing makes for better technicians
- Downsides: time spent on training, risk of data entry error, increased payroll; keyboard skills important
Scribes

Throughput/Productivity: “Back of the Envelope”

- MD time on documentation/day: 120 minutes
- MD time per patient encounter: 16 minutes
- Scribe can document 80 of 120 minutes
- 80/16 = 5 additional patients/day
- 5 x $200/encounter = $1000 revenue per day
- Cost of tech/scribe per day = (8 hrs/day x $18/hr) + 20% pay (benefits) = $173
- **Net revenue of $827/day**
Confirmed by an Academic Study

- Revenue: Net increase of $429/half day (add’l 2.15 patients per half day)
- Records closed 8.9 days earlier (11.7 days vs. 2.8 days)
- Statistically significant improvement in provider satisfaction (2.2/5 w/o scribes vs. 4.7/5 with scribes)

Implementation of Medical Scribes in an Academic Urology Practice: An Analysis of Productivity, Revenue, and Satisfaction-UNC-Chapel Hill, World Journal of Urology, 2018
Workflow Benefits from Posting of Charges/Appt. Scheduling by Techs/Scribes

Transportation, Waiting, Motion, Overprocessing, and Inventory: Gone!

The Future
Part B Drugs: Models of Administration (PA’s and APN’s)
Cost of Healthcare by Country: US vs. UK

Health Care Cost as % of GDP

Per Capita Health Care Spending by Country
Intravitreal Injections of Anti-VEGF Agents: US vs. UK

**United Kingdom**

- Rapid increase in demand for intravitreal injections (IVT)
- Shortage of ophthalmologists (reduced training positions)
- NHS Lothian (Scotland) performed a prospective study of IVT by nurses
Results

• 11,893 injections given (2008-13) of which 10,006 given by NPs
• Complications: incidence of 0.04% endophthalmitis (vs. 0.05% in MARINA and 0.1% in ANCHOR studies)
• No lens injury or RD
• 100% patient satisfaction with service received by nurse
• Preference: 4% Doctor; 15% Nurse; 81% Either

References

• A safety audit of the First 10,000 intravitreal ranibizumab injections performed by nurse practitioners. *Eye (2014)*
• Introduction of a nurse-led intravitreal injection service in ophthalmology. *British Journal of Nursing (2017)*
And a study from Denmark showed... 

- NPs gave a total of 5817 intravitreal injections without on-site supervision (though now a supervising physician is readily available)
- No serious adverse events (no endophthalmitis or RD’s)
- Patients satisfied and none refused a nurse-delivered injection

Evidence-Based Practice Activity

You treat patients with intravitreal anti-VEGF agents for AMD and diabetic retinopathy.

Questions to ask Yourself

• Is there a better way of doing this?
• Is it safe and effective?
• Is it more efficient/cost-effective?
• Is it ethical?
• What will my patients think about it?
• Is it legal?
• How would this model be covered by my professional liability carrier?
• What are other implications of this model?
Online Glasses, Contacts, and Refraction: “Oh My!”: Dorothy 2018
1-800-CONTACTS

Express Exam
Renew your Rx

Contact lens prescription expired? Renew it online in 15 minutes.

No dilation or puffs of air required.
Try our innovative new vision exam for a quick, painless Rx renewal — only $19.99!

Qualify

18 to 55 years old
Healthy eyes

Get Started

Skip the trip to the doctor's office
An ophthalmologist licensed in your state will review your exam results and send your prescription to you within a business day.

On line Glasses and Contact Lens Sales

• In 2017 about 8 million pairs of glasses sold on line (4.2% of total spectacle Rx’s)

• Another nearly 8 million people ordered CL’s on line/mail order (about 18.9% of CL wearers)

Buying Glasses Online Will Become The Norm -- Growth Will Explode Once Eye Exams Go Digital

Forbes-April 24, 2018

**Ample Room for Disruption**

1. High margins on eyewear
2. Emergence of online distribution channels
3. Long wait time for custom eyewear (schedule appt., length of exam, time to order and wait for glasses)
4. New technology (3D printing and online exams)

- Current market dominated by Luxottica-Essilor

**Disruptors**

- Zenni Optical: complete single vision lenses/frames average $40 but start at $6.95
- Warby Parker: $40 online exam + $95 (least expense frame/lenses) + 5 frame trial
- Opternative: Online eye exam with spectacle Rx: $50; including CL Rx: $60
Disruptive Innovation
Clayton Christensen: The Innovator’s Dilemma 1997
Disruptive Innovation

Incumbents' Comments About New Technology

• “This telephone has too many shortcomings to be seriously considered as a means of communication.”-Western Union, 1876
• “Who wants to hear actors talk?”-H.M. Warner of Warner Bros., 1927
• “There is no reason for any individual to have a computer in his home.” Ken Olsen, President Digital Equipment Corporation, 1977
Eyeque App: Zenni Optical

As low as $50 for Exam, Spectacle Lenses and Frames
Inexpensive=Disruptive!
DigitalOptometrics Plans National Expansion

• Remote eye exam company will expand from northeastern US to nationwide in 2019
• Promotes comprehensive eye exams rather than refractions only
• Patient completes health history form on tablet
• Technician takes photos of anterior and posterior segments and measures IOP
• Refraction performed remotely by optometrist
• Walk-ins welcome; exam takes 30 minutes
Healthcare Apps

The digital revolution arrives to healthcare.
Other examination selfie apps: rationale for use

- A visit-based care delivery model has dominated healthcare for centuries
- Devices/Apps are able to transmit information to the healthcare provider
- Coupled with multi-disciplinary care teams, this approach can help address a shortage of physicians
- Engages the patient and family as important members of the healthcare team
Selfies and Health Records Apps

Home Visual Field Monitoring for Glaucoma

Can Home Monitoring Allow Earlier Detection of Rapid Visual Field Progression in Glaucoma?

Andrew J. Anderson, PhD,1 Phillip A. Bedgood, PhD,1 Yu Xiang George Kong, PhD,2 Keith R. Martin, FRCOphth,3 Algis J. Vingrys, PhD4

Conclusions: Detecting rapid visual field progression may be improved using a home-monitoring strategy, even when compliance is imperfect. The cost-benefit of such an approach is yet to be demonstrated, however. Ophthalmology 2017;124:1735-1742 © 2017 by the American Academy of Ophthalmology
Home IOP Monitoring for Glaucoma

Save IOP measurements to your computer and send to your physician.

Question: Who in the practice is going to review this data and how will it be incorporated in the EHR?
Home Monitoring for Wet AMD - ForeseeHome

3 minutes per eye per day – it’s that simple

How ForeseeHome works to preserve your vision

1. You take a simple, daily test to check for tiny changes in your vision.
2. Monthly reports are sent directly to your doctor’s office. Testing results are available to your eye doctor 24/7 on the Netal Vision portal.
3. If a change in test scores is detected, your doctor is alerted so an appointment can be scheduled.

$0 for the majority of Medicare patients.

Patients without supplemental insurance can expect to pay no more than $15 per month.
DIY OCT

A hand-held OCT is under development for home monitoring of patients with retinal disease.

*The Ophthalmologist*; June 2018
What Can AI* Do Now?

• Some input data (A) is used to quickly generate a simple response (B)

• A photo tagger will require tens to hundreds of thousands of pictures (A) to tell you if there are people in them (B)

• A speech recognition system requires tens of thousands of hours of audio (A) together with transcripts (B)

*AI = Artificial Intelligence=Prediction Machines
Deep Learning

A branch of AI inspired by the mechanics of the human brain

1. Uses layers of training
2. Requires lots of data
3. Makes use of graphics processing chips developed for video games

Source: Deep Learning will Radically Change the Ways we Interact with Technology Singh, HBR, January 30, 2017
Diagnosis and Management of Disease

Artificial Intelligence*

• FDA Permits Marketing of IDx-DR for Automated Detection of Diabetic Retinopathy in Primary Care

• IDx-DR becomes the first autonomous, AI-based diagnostic system authorized for marketing by the FDA

• April 12, 2018

ACO Measure 41:

Documentation in primary care MD record of examination by ophthalmologist or optometrist within past 12 months

Local Results

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<tr>
<th>Year</th>
<th>2015</th>
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<tr>
<td>Result</td>
<td>43.4%</td>
<td>48.5%</td>
<td>46.1%</td>
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*AI: “Prediction Machines”
AI alone now making the diagnosis
Conditions under evaluation for AI applications

Screening

• Vision threatening DR: Sensitivity 100%; Specificity 91.1%

• Referable AMD: intermediate or large drusen, geographic atrophy, or neovascular disease; Sensitivity 93.2%; Specificity 88.7%

• Referable Glaucoma: c/d>0.8, focal thinning of rim, disc hemorrhage; Sensitivity 96.4%; Specificity 87.2%

Follow up and Management

• AMD: Use of OCT to assess treatment outcome

• AMD: Use of OCT to predict visual outcome

• Glaucoma: Use of OCT, visual fields, and fundus photos to diagnose and manage glaucoma
3D OCT and Screening for Retinal Disease

Source: Nature Medicine, vol 24, September 2018
The Economics of Machine Intelligence

When the cost of prediction through AI falls precipitously. . .

1. We will start using AI to perform tasks where we currently didn’t.
2. The value of human judgment will rise.

The Simple Economics of Machine Intelligence
Agrawal, Gans, and Goldfarb
HBR November 17, 2016
Are Robots Coming for Our Jobs?

- Roles will be redesigned in our practices.
- Where do machines vs. humans do a better job?
- Reinvent processes to make use of both types of talent.
- Best organizations will use technology to enhance and transform processes.
When should we start innovating?
Thinking About Innovation

1. Define what you’d like to change. Areas ripe for disruption are those that have remained the same for a long time.
2. Eliminate your customer pain points.
3. Redefine your market size for your products and services.
4. Reduce complexity.
5. Reduce costs.
6. Embrace smart technology.
How Do You Innovate?

**Key Steps**
1. What do you want to do?
2. How are you going to do it?
3. List 4 reasons it won’t work.
4. List 12 ways it might work.
5. Challenge your idea.

Should we add/take away something? Why wouldn’t customers like it? Is it financially viable? Is it simple?

6. List 4 reasons it will work.

**Key Ingredients**
- Make it a big challenge.
- Dedicate time to innovation.
- Extreme focus.
- Create constraints: small teams, small budgets.
- Work quickly.
Get Employees on Board with Change

• Clearly tell them reason for change.
• Communicate the positive effects.
• Tell Them How They Benefit.

Don’t Just Tell Employees Organizational Changes are Coming—Explain Why; Morgan Galbreath, HBR Oct 5, 2018

“Get Your Kicks-On Route 66”
Creating a Culture for Innovation and Change

• Tolerance for failure
• Willingness to experiment
• Psychologically safe
• Collaboration

• But no tolerance for incompetence
• But highly disciplined
• But brutally candid
• But with individual accountability

Source: The Hard Truth About Innovative Cultures; by Gary Pisano; HBR; Jan-Feb 2019
Conclusions

1. The move to value-based payments combined with rapid advances in technology are creating a perfect storm for disruptions in the delivery of eyecare.

2. New technology will cause eye care team member duties to evolve.

3. Innovate and change or risk the fate of many previously successful companies.
Medico-legal Implications of New Technology

Linda Harrison, PhD
Director OMIC Risk Management
Medico-Legal Issues of the EHR

• Impact on patient rapport
• Carry forward
• Templates, macros, drop down menus
• Patient data mismatch
• Patient portal
• Interoperability
• The EHR in litigation
Patients and the Google/Amazon Effect

• 20% of Google searches are healthcare-related
  o Does Google know more about your patient than you do?

• Patient to Alexa: "I have a red eye; what should I do?"
  o Suggest ordering drops from Amazon?
  o Will Alexa tell you to contact your physician?
  o Not HIPAA compliant

• Expectations and Misinformation

• Continuity of Care
THE ECRI
TOP HEALTH TECHNOLOGY
HAZARD FOR 2019

Hackers can exploit remote access to systems, disrupting healthcare operations.
Risks of Adaptation: Providers

“In China…authorities in one province are requiring primary care patients to see a robot before they can obtain a referral to a doctor.”

Health care disruption: Thinking broadly about regulation and innovation. A POLITICO working group report. By POLITICO STAFF 12/10/2018
Challenges to Adaptation: Staff

- Resistance to change
- Responding to patient expectations
- Learning and Unlearning
  - HOW and WHERE care is delivered
  - New technologies
  - New workflows
- Ongoing training and adaptation
- Burnout

Time to Adapt