Novel Delivery Systems for Occupational Medicine: Response to a Global Health Worker Shortage

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I declare no financial conflict of interest,
but....
Disclaimers

• I am a Baby boomer.
  • Not a millennial.
  • A reporter, not an expert.

• My content is already out of date.
  • Simply through knowledge explosion

• Meant to be provocative, not prescriptive
  • Qualitative, not quantitative assessment
  • Predictions are extremely multi-factorial.
    • No crystal ball
    • Just possibilities

• I will end with recommendations to ensure our best future.
Uniqueness of Occupational Health

• Relatively new field of medicine: ~100 years
  • all due respect to Ramazzini 300 years ago
  • Thus, science-based

• Target is a population, not an organ system.

• More cognitive than technical but reliant on technical fields

• Practice is subject to government regulation.
  • Worker compensation rules
  • Medical surveillance for occupational disease (OSHA, CDC, state regulations)
  • Causation of disease (presumptive for most public safety workers)

• Focus is on prevention and population health.
National Threats to Medicine
(Including Occupational Medicine)

• Fiscal constraints
  • Escalating costs
  • Who pays?
  • And for what? (not going there....)

• Medicine not keeping pace with technology, lagging behind
  • Telecommunications
  • Finance
  • Airlines
  • Retail
  • Even agriculture
Global Threats to Medicine
(Including Occupational Medicine)

• Increased demand for health workers worldwide
  • Global Strategy on Human Resources for Health: Workforce 2030 (WHO, 2016)
    • 43.5 million health workers in 2013, projected need of 67.3 million in 2030
    • Consider health workers an investment
    • Recommend leveraging technology
  • High Commission of Health Employment and Economic Growth (UN, 2016): 40 million new health sector jobs needed by 2030
  • U.S. Census Bureau: by 2030, 20% of population 65 or older.

• Shortage of providers, particularly physicians and nurses
  • In 2006, projected shortage of 4.3 million health workers (The WHO World Health Report 2006)
  • Now, projected shortage of 18 million health workers by 2030
  • Obstacles to growth:
    • Bottlenecks in the pipeline
    • Burnout/retirement in an ageing population
  • U.S. Census Bureau: by 2030, # of potential caregivers aged 45 to 64 will rapidly decline.
Perfect storm or opportunity for novel delivery systems?

• Right procedures?
• Right personnel?
• Right timing?

• Efficiencies to be gained?
Predicting the Future of Occupational Medicine

• ACOEM House of Delegates, November 2017

• Survey of members of the International Occupational Medicine Society Collaborative (IOMSC) in 2015
ACOEM House of Delegates November 2017:
Occupational Medicine in 2037

- Burnout/pipeline issues
- Maintaining integrity of OM
  - Competition with other specialties
  - Competition with other providers within OM (mid-levels, RNs)
- Shifts in organized labor and governmental regulation (less of each)
- Automation in the workforce
  - Driverless trucks
  - Pilotless airliners
  - Drone deliveries
- Focus on healthy workforce: long-term commitment of employers
- Leveraging complex cognitive skills **not amenable to automation**
  - Functional assessment (cognitive and physical)
  - Causation analysis
  - Negotiation skills
2015 IOMSC Projections
22 of 30 countries responded to survey, representing 26% of world population, 1.18 billion workers

The future of OM in your country? (20 of 22 optimistic)
- Major changes in technology over next 10 years
- Increasing focus on mental health and work/life balance
- Better return-to-work policies
- Greater attention to primary vs. secondary prevention
- Increasing demand for OM specialists

- Threats
  - Economic crises
  - Ageing workforce
2015 IOMSC Projections

How will emerging technology impact occupational medicine?

- Improved training (tele-health, webinars, etc.)
- Telemedicine (Virtual/digital medicine) will broaden scope/reach
- Safer workplaces
- Better record-keeping/use of data

- Threats
  - New occupational hazards
  - Ethics of genetic information impacting job selection
So, I ask again:

“Perfect storm or opportunity for a positive paradigm shift in delivery of occupational health?”
Relevant Advances in Technology

Definition of Terms

• Internet of Things (IoT)
  • Wearables
  • Remote monitoring

• Big Data
  • Bioinformatics
  • Precision medicine

• Artificial Intelligence
  • Machine learning
  • Clinical decision support
  • Natural language processing

• Robotics

• Block Chain Technology
Definitions:
Internet of Things (IoT)

- **Machine-to-machine communication:** wired, near field (NFC), Bluetooth, WiFi, ? microwave, ? radio waves, ? laser
  - Manage inventory, maintenance, updates, obsolescence
  - Internet of Medical Things (IoMT)
    - IV pumps
    - Cardiac monitors, etc.

- **Wearables**
Definitions:
Internet of Things

• Remote monitoring
  • Body temperature
  • Heart rate
  • Respiratory rate
  • Blood pressure
  • Skin moisture
  • Range of motion
  • Steps
  • Voice/video recording
Definitions:

Big Data

• Analogy: Word transformed to Xcel/Access
• Bioinformatics
  "We don't have a shortage of data. We don't have a shortage of dashboards. We have plenty of tools. What we don't have is plenty of time to analyze all of that data. Prescriptive analytics are what the healthcare industry needs to move the needle."  Steve Hess, CIO at UCHealth, Colorado
• Precision medicine
  Medical decisions, practices, and/or products being tailored to the individual patient in the context of a patient’s genetic content or other molecular or cellular analysis. Wikipedia
• 2017 Health Leaders Media Analytics in Healthcare Survey:
  Only 14% of respondents’ organizations use artificial intelligence capability.
Definitions

• **Artificial intelligence (AI):** ability of a computer to complete tasks in a manner typically associated with a rational human being.  
  Jennifer Bresnick, Health IT Analytics, 7 Oct 17

• **Machine learning (ML):** algorithms making accurate predictions about future outcomes through pattern recognition, rule-based logic, and reinforcement techniques to strengthen good outcomes and eliminate bad ones.  
  Jennifer Bresnick, Health IT Analytics, 7 Oct 17
  
  Example: Compare a pathology slide to a library of slides to identify cancer.

• **Clinical decision support (CDS):** links [clinical] observations with health knowledge to influence health choices by clinicians for improved health care.  
  Robert Hayward of the Centre for Health Evidence
  
  Example: Creating a prioritized differential diagnosis

• **Natural Language Processing (NLP):** automation of time-consuming, complex processes for efficiency and accuracy.  
  Optum 360, June 2018
  
  Example: review EHR for relevant data to ensure clinical documentation is complete for accurate coding.

  “Virtual doctor better at diagnosing illness than humans,” London Times, June 28, 2018

AI Summit San Francisco, September 19-20, 2018, Palace of Fine Arts: 4,000 attendees
Definitions:
Robotics
FIRST Robotics Competition
La Crosse, Wisconsin, April 2018

• Annual competitions, worldwide
  • Remotely controlled robots
  • Up to 120 pounds each
  • Multiple functions
  • 3-minute competition

• 25 + years
• ~3,500 teams

• Focus
  • Technology
  • Teamwork
  • Gracious professionalism
  • Mentored student ingenuity
Definitions:
Block Chain Technology

- Decentralized database that keeps records from different sources organized, updated and synchronized in real-time
- Analogy: knitted sweater
- Initial application: monetary currency (Bitcoin is one of 1,000+ cryptocurrencies.)
- Future applications:
  - Personal ID cards
  - Manage IoT
  - **Health records**
    - Estonia, Dubai
    - Optum/Humana/Multiplan/Quest
- Trump Summit on 8/13/18: Amazon, Microsoft and Google agree to collaborate to remove health data barriers — block chain? *(WSJ)*
Reduced “clicks”: one-time login, then scan badges
  • Less annoyance
  • 20 to 140 less logins per day
  • 6 to 20 minutes saved per day

Voice recognition software for EHR entry
  • 50% reduction in time to complete & close encounters
  • Up to 8 hours saved per week
  • 30 to 40% of users, 100 more/week

Pilot program of virtual scribes (robotic assistants)
Applications to Occupational Health & Safety
Virtual Medicine, eMedicine

• Virtual visit (asynchronous) vs. traditional visit (synchronous)
  (Unpublished study by Jacob Spirer, MA, from April 2017 at free worksite clinic in La Crosse, Wisconsin)
  • 304 employees had both types: 118 participated (39%), 49% under age 35
  • Employees’ perceived time spent
    • virtual: 84% < 15 minutes, 61% < 10 minutes
    • traditional: 84% over 30 minutes
  • Perceived quality of care
    • Virtual: 83% best or OK
    • Traditional: 95% best or OK
  • Perceived accuracy of diagnosis
    • Virtual: 84%
    • Traditional: 97%
  • Provider perception of visits per hour
    • Virtual: 8
    • Traditional: 4
Applications to Occupational Health & Safety
Virtual Medicine, eMedicine
(Take-home slide)

• Virtual visit vs. traditional visit (continued)
  • Employee preference: 55% virtual
  • Provider preference: All four chose traditional
  • Cost per visit:
    • Virtual: $45
    • Traditional: $200
  • Overall cost:
    • Virtual has twice the throughput at 23% less cost/visit.
    • Thus, 87% savings over traditional visit for selected cases.
• Value
  • Employee perspective (Preference/dollar): clearly virtual
  • Provider perspective (Quality/dollar): less clear
Applications to Occupational Health & Safety
Virtual Medicine, eMedicine

• **Remote appointments** *(Telemedicine)*
  • Gaining in acceptance by payers, providers, and patients (IoT, wearables)
  • Synchronous or asynchronous
  • Applied by Veterans Hospital Administration over a decade ago

• **Group appointments**, remote or in person
  • In person concept for decades
  • Team approach: prescriber and group facilitator
  • Concerns about confidentiality but
  • More social support amongst employees with similar issues
  • Throughput: about 10 patients per hour
Applications to Occupational Health & Safety
Potpourri

• **Cloud-based references and EHR** (block chain)
• **Person to person payments** (block chain: no bank, no insurer)
• **Modern learning theory** to train and retain (improve pipeline, stem tide of losses)
  • Just in time learning: essentials up front, modules and pop-ups in progress
  • Optimal delivery methods: seeing, hearing, touching, simulating
• **Improved engineering/administrative controls**
  • Example: Healthcare industry (integration of worker and patient safety)
    • Patient handling (technique, equipment, patient selection tools)
    • Violence management (biologic monitoring, proper staffing, humane controls)
    • Bloodborne pathogen exposures (safety devices, prophylactic Rx)
Applications to Occupational Health & Safety

My Personal Dream

• More precise occupational research (Big Data)
  • Optimal surveillance exams
    • Most effective interval
    • Most effective components
    • Really needed at all?
  • Proper restrictions in workplace
    • Just enough to protect worker without contributing to presenteeism
    • Proper duration with appropriate progression back to full duty
    • Optimal determination of plateau of healing/“permanency”
    • Draft disability rating from data in electronic health record
Applications to Occupational Health & Safety

IoT in Action

• Remote monitoring
  • Physiological (done since ‘60s in space program)
  • Environmental: radiation, O2, CO2, ambient temp/humidity

• Robotics/AI/drones
  • To protect workers: Inspection/repair in confined space/at elevation or in hazardous environments
  • To aid healthcare workers: Clinical assistant/scribe (robot)
    • Transcription during clinical visit
    • Create a differential diagnosis (Clinical Decision Support)
    • Order tests/set up appointments
    • Assist with procedures
  • Realistic example: Driverless car/taxi/truck/airplane
Chart 2. Fatal occupational injuries by major event, 2015-16

- Violence and other injuries by persons or animals: 866 (2016), 703 (2015)
- Contact with objects and equipment: 761 (2016), 722 (2015)
Impact on Top Causes of Occupational Fatality

- Transportation incidents: 703
- Violence and other injuries by persons or animals: 866
- Falls, slips, trips: 800
- Contact with objects and equipment: 722
- Exposure to harmful substances or environments: 518
- Fires and explosions: 121

Total fatalities: 2038
Visualize an Office Visit in 2038
(Close your eyes and dream)

- Self-scheduling
- Pre-visit data collection/analysis
- AV recording of entire visit for documentation
  - Clinical decision support (CDS) suggests diagnoses, treatments
  - CDS projects possibilities (guidelines, differential, treatments) to provider
    - Helmet visor/glasses
    - Wall-mounted screen
  - AI assistant extracts data to input to EHR, performs order entry, e.g., Rx
- Real-time EHR development and utilization review/approval
- Immediate transmission of status/restrictions to employer
- Remote monitoring of injured employees progress
Visualize an Office Visit in 2038
Efficiencies and Savings

• Time spent face to face
  • reduced duration & frequency
  • increased quality
• Real-time scheduling, ordering, pre-authorization
• Reduced ancillary staff
• Precise recording of encounter
• Auto-populated medical record/forms
• Direct financial transaction, no middlemen
Could the New Paradigm Require Fewer Occupational Health Providers?

• Use of mid-level providers, paraprofessionals
• Use of AI, robotics, and remote monitoring
• Elimination of need for an entire class of examinations: drivers & pilots
• Fewer work injuries/illnesses to treat
• Reduced complexity/frequency of medical monitoring, if any
• Shift from
  • secondary prevention, e.g., medical monitoring, with its heavy reliance on medical professionals
  to
  • primary prevention (nutrition, exercise, better engineering/admin controls) performed by non-medical personnel
Thus, with fewer injured/ill workers and more efficient delivery of care, will we really have a shortfall of health workers in the next generation? I think we have reason to hope not.

However,....
Issues that Threaten a Novel Tech-Based Occupational Health Model

- **Practical limitations**
  - Batteries/charging/connectivity
  - Internet/cell tower access
  - Updates, slow systems, lock-ups: Control-Alt-Delete
  - Equipment breakdown
  - System inadequacies: IBM’s Watson

- **AI in complex situations**: driverless cars – who lives or dies?

- **Privacy/security**
  - Clumsy firewalls: Accessing devices through dual authentication (speed issue)
  - Impact of cyberattacks/hacking (not a matter of if but when)
Batteries/charging/connectivity
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Issues that Threaten a Novel Tech-Based Occupational Health Model

• **Global disaster**
  - Financial collapse
  - War
  - Pandemic

• **Worker engagement/acceptance**
  - Gallup Survey of 142 countries in 2016:
    - US: **32%** engaged, 16% actively disengaged
    - Worldwide: **13%** engaged, 24% actively disengaged
    - Little change since 2000
    - Blame on populism and **disruptive technology**
  - Forbes finds better numbers in USA (well over 50% engaged at work) but admits it could be better.
A call for global collaboration on pandemics
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Issues that Threaten a Novel, Tech-Based Occupational Health Model

No impact on the **informal economy** (over half of all workers worldwide)
Informal Sector = No Occupational Protection
Recommendations Moving Forward

• **Less byzantine licensing laws and reimbursement codes**
  - Physician licensing compact (imperfect solution)
  - Codes for functional assessment and cognitive services, in general
  - In 2019, CMS unbundling of Code 99091 in Jan 2017: remote patient monitoring

• **Disaster preparation through collaboration** (government, science, industry)
  - Protect human capital and infrastructure
  - “Game-changing,” universal influenza vaccine

• **Better medicine**
  - Globalization of evidence-based guidelines
  - Value-based medicine vs. volume-based medicine
  - Quote from benefits manager: “Why would I trust you with my healthy workers...”
As of February, 2018

States offering expedited medical licenses to qualified physicians
Recommendations Moving Forward

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  • Physician licensing compact (imperfect solution)
  • Codes for functional assessment and cognitive services, in general (work of ACOEM Task Force on Function)

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Hope for a new influenza vaccine
La Crosse Tribune, 22 Jan 2018

A century later: The echoes of a pandemic
January 22, 2018

100 years after the influenza pandemic ravaged the globe, scientists seek a super-shot.

WASHINGTON — The descriptions are haunting. Some patients felt fine in the morning and were dead by night. Faces turned blue as paleliters eventually stopped working. Bodies collapsed and died.

A century after one of history’s most catastrophic outbreaks, scientists are rethinking how to guard against another such surfer. This 1918 influenza, which killed tens of millions as it swept the globe, is a reminder of how deadly a pandemic can be.

There’s no way to predict when or where a strain of the deadly flu virus could trigger another pandemic. But modern medicine tells us how it might happen.

In this October 1918 photo made available by the Library of Congress, St. Louis Red Cross Motor Corps personnel leave their camp near an ambulance in preparation for combat against the influenza pandemic.

‘Killing zone’

In this October 1918 photo made available by the Library of Congress, St. Louis Red Cross Motor Corps personnel leave their camp near an ambulance in preparation for combat against the influenza pandemic.

The 1918 flu pandemic is still a mystery. Scientists don’t know how the virus spread or how it adapted to fit in with normal human biology. They are trying different strategies to stop future pandemics.

In New York, researchers at Mount Sinai School of Medicine have been studying ‘sentinel’ viruses — the first to enter the human body — to better understand how they might change.

Influenza and tuberculosis are two pandemics that have shaped the United States. Last summer, when researchers began searching for a vaccine against the flu, they were met with resistance.

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Evidence-Based Guidelines

ACOEM’s Occupational Medicine Practice Guidelines (1997)

SOM’s Occupational Health: the Global Evidence and Value (2018)
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• **Low-tech applications** for developing countries

• **Integration of health & safety** in the workplace

• **Clear roles** for OH professionals: MD/DO, PA/NP, DC, COHN, OHW, IH, etc.

• **Sound ethics**
  - **Firewalls** between science, policy, and industry, e.g., influenza vaccine development
  - **Guidelines** on when to replace people with machines
  - **Strict privacy rules** on data, ironclad security
  - **Proper use of genetic data**. Avoid pitfalls of eugenics.
ACOEM GUIDANCE

Integrating Health and Safety in the Workplace

How Closely Aligning Health and Safety Strategies Can Yield Measurable Benefits


Objectives: To better understand how integrating health and safety strategies in the workplace has evolved and establish a replicable, scalable frame

work for advancing the concept with a system of health and safety metrics, modeled after the Dow Jones Sustainability Index. Methods: Seven leading national and international programs aimed at creating a culture of health and safety in the workplace were compared and contrasted. Results: A list of forty variables was selected, making it clear there is a wide variety of approaches to integration of health and safety in the workplace. Conclusion: Depending on how well developed the culture of health and safety is within a company, there are unique routes to operationalize and institutionalize the integration of health and safety strategies to achieve measurable benefits to enhance the overall health and well-being of workers, their families, and the community.

Coeviding with these advances in safety was the rise of a workplace wellness movement in the United States, driven in part by rising health care costs.1 As costs increased, employers began to introduce "worksite health promotion" programs on a large scale in an effort to keep their employees healthier and thus reduce total health-related costs (medical/pharmacy costs and absenteeism/presenteeism costs).

Early workplace wellness programs consisted of health screenings, smoking cessation, weight-loss education, and on-site exercise offerings, including corporate fitness centers. Over time, these programs evolved into much more personalized efforts, which
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ACOEM Vision Statement
(approved by BOD, 3 Feb 2018)

ACOEM is the pre-eminent physician-led organization that champions the health of workers, safety of workplaces, & quality of environments.
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Conclusion

• **Occupational health**
  • A unique discipline
  • Ripe for a quantum leap in its delivery model

• **Technology**
  • Advancing rapidly
  • Limitless possibilities

• If technology is applied properly, **efficiencies will result**.
  • OH services will have greater value.
  • Perceived shortfall in health workers may be premature.

• **Significant impediments** to implementation do exist.

• Proper strategic planning and collaboration: **Make the dream come true**.