Health Informatics and the Covid-19 Pandemic

Challenges, Opportunities, Lessons learnt and the path ahead.

Dr Venugopal Mudgundi, MD
Dr Balazs Zsenits, MD
<table>
<thead>
<tr>
<th>Country</th>
<th>Total Cases</th>
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*Note: Taiwan is a disputed territory with claims from both China and Taiwan itself.*
6 MILLION COVID-19 DEATHS — A TIMELINE

JANUARY 2020
First death from COVID-19, reported in Wuhan, China.

JANUARY 2021
The U.S. continued to top COVID-19 death counts, but experts were hopeful the rollout of vaccines will help reduce mortality numbers.

JULY 2021
India accounted for almost a quarter of COVID-19 deaths during this period, driven by the delta variant. Later analyses said the total number was likely much higher, with one estimate putting the death toll at 3 million.

MARCH 2022
Several countries have started easing COVID-19 restrictions. But WHO officials continue to advise caution. While trends show COVID-19 cases are declining, they warn the pandemic is not yet over.

SEPTEMBER 2020
The U.S. topped total COVID-19 deaths during this period, reaching over 200,000.

APRIL 2021
Uneven distribution of vaccines left several low- and middle-income countries with little to no access to doses.

NOVEMBER 2021
Official data showed the African region, excluding Egypt, had less than 150,000 deaths. But deaths in 13 countries had doubled since July, raising calls for more vaccine access as only 3% of the region’s population was fully vaccinated.
Pandemic history and Covid-19

Throughout history, as humans spread across the world, infectious diseases have been a constant companion. Even in this modern era, outbreaks are nearly constant.

Here are some of history's most deadly pandemics, from the Antonine Plague to COVID-19.
Challenges Presented by Covid-19 Pandemic

- Access to healthcare
- Rapidly changing clinical landscape
- Unpredictable waves of resource utilization
- Resource Constraints
Access to Healthcare

- Fear of exposure to the virus
- Quarantine requirements
- Resource reallocation
- Healthcare workforce shortages
Access to Healthcare

Percent change in visits from baseline

![Graph showing percent change in visits from baseline](image)

Note: Data are presented as a percentage change in the number of visits in a given week from the baseline week 6 (Week 10, or March 1–7, 2020). "Typical year" data from 2016 to 2019 were also calculated as a percentage change from the baseline week — week 10 — in those years. Data are equally weighted across the four years.

Source: Aleeve Mehrotra et al., The Impact of COVID-19 on Outpatient Visits in 2020: Visits Remained Stable, Despite a Late Surge in Cases (Commonwealth Fund, Feb. 2021). [https://doi.org/10.5007/01bfk-k4](https://doi.org/10.5007/01bfk-k4)
For Patients:

Less interference with daily life

No exposure to potentially contagious patients

Greater convenience

Greater privacy

A better overall healthcare experience
For healthcare providers:

Greater revenue potential

A more streamlined workflow

Increased patient engagement

Ultimately, telemedicine presents an opportunity to increase the quality of healthcare and clinical services
Telemedicine drawbacks and challenges

Certain types of clinical services cannot be provided remotely

Telemedicine requires training

A potential reduction in in-person visits

Regulations, reimbursement, and state policies are complex
Changing landscape of virtual care
Access to Healthcare – Telemedicine /Telehealth

Note: Data are presented as a percentage: the number of telemedicine visits in a given week is the numerator, while the number of visits in the baseline week (March 1–7) is the denominator. Telemedicine includes both telephone and video visits.

Remote Patient Monitoring

- Allows clinicians monitor or gather data remotely
- Many symptoms and conditions that can be tracked
- Use of some devices may require training
- As technology advances, more devices, workflows and use-cases are being added.
- Uptake has been driven by need to keep patients out of hospital
- Willingness from payers to let clinicians bill for Remote Physiological Monitoring
Remote Patient Monitoring – Potential benefits

• Reduced hospitalizations

• Shorter hospital stays if the patient can be discharged with a remote monitoring device to use at home

• Fewer visits to the emergency room

• Better health outcomes for patients in rural areas

• Better preventative management for chronic conditions

• Minimize risk of exposure for healthcare providers
Remote Patient Monitoring – Predicted uptake

High growth in the Asia Pacific market is attributed to the increasing geriatric population and chronic illness, improving healthcare infrastructure, rapid economic growth, and the rising standards of living.

Rising geriatric population and the growing need to expand healthcare access, cost benefits of telehealth and remote patient monitoring, benefits of RPM to reduce the burden on medical resources, advancements in telecommunications, and increasing investments in telehealth and RPM are the major factors driving the market growth.

The role and impact of AI in remote patient monitoring and the high utility of RPM in combating infectious diseases & epidemics are factors expected to offer significant growth opportunities for players operating in this market.

The remote patient monitoring market in North America is projected to reach USD XX Billion by 2027, growing at a CAGR of XX% during the forecast period (2022-2027).

The Asia Pacific market is projected to register the highest CAGR of XX% during the forecast period.

Global Remote Patient Monitoring Market Trend

- 2022-e: USD 53.6 Billion
- 2027-p: USD 175.2 Billion

CAGR of 26.7%
Managing patients who need an inpatient level of care in their homes.

Mostly driven by need to keep patients out of resource constrained hospitals.

Improvements in health technology space with availability of remote monitoring equipment, and ability to provide mobile acute care services at home.

Pandemic driven CMS and private insurance approvals for several hospitals to provide HaH with Diagnosis-related Group (DRG) reimbursements.
How does hospital-level care in a patient’s home compare with usual care in the hospital?

91 patients with acute medical conditions warranting hospitalization

- clinician visits
- remote monitoring
- video communication
- lab testing
- IV medications

length of stay: 4.5 days
sedentary: 12% of day
30-day readmission: 7%
lab orders: 3 per admission

$ Adjusted mean cost 38% [24%, 49%] lower with home hospital

length of stay: 3.8 days
sedentary: 23% of day
30-day readmission: 23%
lab orders: 15 per admission

Hospital at Home - The Evidence
Hospital at Home - The Evidence

• home patients had better experiences with their care team

• more experiences promoting healing such as better sleep and physical activity

• better experiences with systems factors such as the admission processes
Hospital at Home - The Potential

- Reduce healthcare costs
- Better patient outcomes
- Better patient and care-giver satisfaction
- Comparable mortality and morbidity between HaH model and traditional inpatient model
Up to $265 billion worth of care services currently being delivered in clinics, facilities, and physicians’ offices could shift to the home by 2025.

Medicare spend for care that could be performed at home, by 2025:

- $180–$265 billion increase
- 3–4x increase over the current spend at home

<table>
<thead>
<tr>
<th>Capabilities</th>
<th>Capabilities exist but need to become a comprehensive offering</th>
<th>Some capabilities exist, but others need to be further developed</th>
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<td>Acute care</td>
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<td>Outpatient-specialist consults</td>
<td>Infusions</td>
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<td>Emergency or urgent care</td>
<td>Dialysis</td>
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<tr>
<td>Outpatient mental-health/behavioral-health visits</td>
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1 Based on 2018 Medicare claims data (Medicare Limited Data Set), NHE-projected Medicare annual growth rates, and results of external physician survey to understand what percentage of care being delivered in an office or facility today could be provided at home.

Hospital at Home - The Impetus
Factors that could affect adoption of HaH

- Developing guidelines and standardized work-flows
- Identify and establish specific use-cases
- Develop evidence to support similar or better outcomes
- Economic viability
- Substantial investment will be needed in
  1. Technology acquisition
  2. Infrastructure development
  3. Training
  4. Research
Rapidly Changing Clinical landscape

Definitions necessitating workflow modifications

Rapidly evolving evidence

Treatment guidelines and protocols

Dynamic policy changes

Reporting regulations
Rapidly Changing Clinical Landscape - solutions

- HI/IT Operational structure modifications
- New governance to prioritize projects
- New processes to implement rapid changes
- Invest in training of staff
- Close collaboration with EMR partners and other vendors
Unpredictable waves of resource utilization

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<th>Waves of resource utilization</th>
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<tr>
<td>Challenge predicting timing of these waves</td>
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<td>Challenge predicting peaks and troughs of resource utilization</td>
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<td>Unpredictable waves of resource utilization – Role of HI</td>
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<tr>
<td>----------------------------------------------------------</td>
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<tr>
<td>Robust data analytics</td>
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<tr>
<td>Dashboards and Data Visualization</td>
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<tr>
<td>Harnessing artificial intelligence for resource reallocation</td>
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</table>
Resource Utilization - What AI has to offer

AI at patient level:

1. Predicting length of stay
2. Predicting need for hospitalization/ICU admissions
3. Predicting diagnoses or poor outcomes (falls, deterioration, sepsis)
AI at population level

- Identify populations that may need higher healthcare resource utilization
- Predict populations at high-risk of ED visits/Inpatient admissions
- Identify patients at high risk of chronic diseases
AI in Healthcare administration

- Models that predict nurse-staffing on units
- AI based models for automated Utilization and Review management
- AI based models for auditing user access
- Models to identify services and medications that require prior authorizations
Artificial Intelligence and Medicine

**Fig. 1: Number of medical A.I. studies by year from 2010 to 2020; and by medical specialties.**

From: A short guide for medical professionals in the era of artificial intelligence

Artificial Intelligence and Medicine
AI in Health Systems – the road ahead

- Quantity and Quality of Data
- Models need to be validated for a system locally
- Robust governance to implement models
- Continued monitoring to detect drift due to changing circumstances.
- Engagement and acceptance from end-users including clinicians
Digital Health – challenges ahead and a word of caution

• Potential to create a digital divide
• Conscious effort to eliminate bias and outcome disparities
• Supportive policies, robust governance and regulation
• Need for more research to establish and support some of these tools with high-quality evidence
• Investment in Data analytics and interoperability
• Legal issues and liability
• Developing trust amongst clinicians, patients and other stakeholders
Overview of COVID-19 Related Work at RRH
What Worked in Wave 1

• Incident Command
  • Provided structure, expertise, and decision platform
  • Facilitated complex teamwork with singular focus

• Successful transitioning to
  • Telemedicine (technical, volume, satisfaction),
  • Telework (logistics, technology, leadership, efficiency),
  • Multiple new clinical processes (policies, EMR builds, training, messaging),
  • Supporting new operational challenges (PPE, tents, redeployment, occ med)...
How May Wave 2 Differ?

• Must be prepared for longer and more severe incident
  • More patients, nationwide emergency, financial and political instability
  • Financial restrictions, supply constraints (including IT), deferrals from Wave 1
• May coincide with non-deferrable major initiatives
  • Strategic projects: SCCCC, LTACH, SLHS groundwork
  • HI/IT projects: CI Fellowship, AIP projects, Epic double-QU
  • Regulatory challenges (21CCA) or expiring waivers (contract, HIPAA, liability)
• On the plus side: we have more lead time
  • Benefits from Wave 1 work and experience
  • Operational structure, incident training, planning
Surge Management

What worked in Wave 1

- Tent/drive-through locations for testing
- Hospital surge phases 1-2
  - IT work completed (300+ beds)
  - Addressing hardware, software, predicted need for future build
- St. Mary Hospital
  - Surge – LTACH transition
- Ventilator management tools
  - Ventilator association with EMR
  - Ventilator allocation tool (SOFA based)

Work for Wave 2

- LTC surge plan
  - Create plan and spreadsheet (similar to IP) to define each surge unit, capture their specific needs, a global timeline with predicted capacity
- Update the IP surge plan
  - Decide on new phases and timeline
  - Fully update the planning spreadsheet (verify bed count, IT readiness, timing, potential new units e.g. COVID-ICU?)
- Projects scoped to consider surge
  - PPID, BCA hardening
- Ventilator management
  - Ventilator integration with EMR
  - Community-based ventilator allocation?
### Surge Plan Overview - Updates

#### UMMC

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<tr>
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<th>Phase Color</th>
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<th>Description of Unit</th>
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#### Surge Stage RGH Hospital COVID+ Flu Census

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<th>Surge Stage</th>
<th>RGH</th>
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<th>NWCH</th>
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<td>9</td>
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#### Surge Stage: Set up a Field Hospital

1. A new field hospital is planned to support the surge location.

#### Surge Stage: Staffing to support the surge location

1. Additional staffing is required to handle the increased workload.

---

* -- Note: Details and requirements for each stage may vary based on specific needs and circumstances. Additional information and updates may be provided as needed.*
Telemedicine

**What worked in Wave 1**
- Ambulatory Telemed transition
  - Good volume retention
  - Education with high satisfaction
- Technical requirements
  - MyCare, Zoom, Skype
  - Phone lines, internet volume
  - Licenses (Citrix, Duo, VPN)
- Additional MyCare updates
  - Branded App / communication
  - Sign-up and utilization increased
  - eCheck-in and other touchless tools
- Home monitoring with Datos

**Work for Wave 2**
- Inpatient
  - Tele-ICU and LTACH eICU
  - Bedside communication with families
- Engaging patients through the care continuum and communication
  - Touchless visits (MyCare tools, isolation kiosk, expanded eSignature)
  - Emmi education expansion
- Enhanced tele-visits
  - Tyto care (remote exam)
  - Improved connection (CAL)
  - eVisits (asynchronous)
  - Explore AI tools?
Telemedicine Transition

• Telemedicine volume increased by 1600% in a matter of weeks
• Professional service volume dropped in March and April, but RRH had 29.4% better RVU retention than regional average (Epic data)
• Successful education, high level of patient satisfaction
• Transition to minimal touch office visit
Clinical COVID EMR Builds

What worked in Wave 1

• Numerous testing related builds with
  • Built-in decision support and
  • Reporting
• COVID alerts, episodes and registries
  • Assess-Track-Monitor Care Connect suite
• Interoperability (ECLRS)
• Employee-EMR COVID tracking tools
  • Data sharing with Workday
• Created disaster navigator
  • For simplified documentation during mass casualty / emergency

Work for Wave 2

• New clinical content as science, practice & context change
  • Testing and treatment
  • Alerting and isolation (e.g. resolved)
  • Vaccine and/or immunity
• Anticipate additional regulatory and resource-related changes
  • Affecting care beyond COVID-19 (flu, disaster plan)
• Advance Care Planning expansion
  • MOLST by APP, workflow, billing
• Research and data sharing tools
  • RedCAP, Vestige, Epic Cosmos
Other Relevant IT Builds

What worked in Wave 1
- Dashboards and internal reports
  - Indications, control charts, predictions,
- RFC submission tool updated
  - Immediate review of COVID requests
- Regulatory reporting (HHS...)
- Visitation management Epic build
  - Best practice highlight – further work
- Daily Pass (updated, other users)
- Mobile technology
  - PowerMic Mobile, Haiku to RN leaders

Work for Wave 2
- Hospital visitor management system
- New predictive analytics
  - Deterioration index
  - Forecasted house census
- Mobile EMR technology
  - Dictation to Haiku, voice assist
- Tighter Workday-Epic integration for workforce management
- Workforce analytics (reallocation)
- EMR build for Mutual Aid Plan?
- Inpatient Hospice Epic SIDER
RFC Volumes: Total and COVID-19

Monthly total RFC volume:
2019-2020 reviews and builds
March/April ‘20 busiest (160%)

Monthly COVID-19 RFC volume:
2020 reviews and builds
Very fast approval/build rate
Training

What worked in Wave 1
• New “Supervised eLearning”
  • eLearnings alone were insufficient
  • Added remote live sessions (didactic + exercises) with very high satisfaction.
  • Now also as on-demand Zoom video
  • Same is available to nursing and allied health staff (HI/IT training collaboration)
• Redeployment training & support (922-HELP #9)
• Telemedicine training & support (#7)
  • User training re platforms and Epic tools
  • Patient education (Emmi video)
• Training COVID specific EMR processes

Work for Wave 2
• Redeployment reactivation
• Back-fill training
  • To cover redeployed roles
• Ongoing training of evolving practices
  • Vent allocation (SOFA) training
• Graduated learning series
  • Bundled videos on more detailed topics
  • Customization guides (pdf) with embedded videos
Feedback on New Training

Instructor-led presentation was well organized and easy to follow

Participant exercises and/or scenarios improved my understanding of the content

Comments – an example:  “After the learning session, I really felt comfortable with using EPIC. The presentations were very clear and concise that made it easier to understand. Completing the learning tasks within the testing environment really helped me acquaint myself with EPIC”
Resource Management

What worked in Wave 1
• Hardware for tent & early surge stages
• HI/IT operational structure
  • Deployed for daily RFC review and builds
  • Took over roles from consultants
  • Scaled down workforce
• Work from home
  • Policy, technology, process (e.g. interviews)
  • Leadership (metrics, training for support)
• Collaboration with vendors
  • Unbilled Epic build resources / analysts
  • Free Epic modules and developments (travel screen, PA, Cosmos, AVS, HHS)
  • Nuance: additional free dictation licenses

Work for Wave 2
• HI/IT workforce need: agile leadership and team capacity to meet above challenges
  • Working with PRC/LRC, identify key positions to reopen and fill
  • HI medical team (fellowship program, restructure existing roles)
• IT hardware / equipment
  • Identify additional surge needs
  • Long-term telework model
  • Lead time (e.g. laptops 12 weeks)
  • Reuse equipment due to shortage
• Updated RFC submission & tracking
  • Ongoing project for prioritization, transparency, throughput and predictability
Wave 1 IS&T Equipment

Teleworker Equipment
- Deployed 176 laptops (5 returned). No monitors were officially deployed, some were taken and used at home (approved by manager, not IS&T).
- The deployed laptops are non-standard laptops (non-standard models or older out of date models).

Deployed for Hospital Surge (no equipment has been returned to stores)

<table>
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<tr>
<th>Location</th>
<th>WOW</th>
<th>Cerner Bridge Printers</th>
<th>Med Scanners</th>
<th>Label Printers</th>
<th>Wristband Printers</th>
<th>Document Scanners</th>
<th>AIOS</th>
<th>BCAs</th>
<th>Laptops</th>
<th>MFD (Printers)</th>
<th>Monitors</th>
<th>Non-Powered Carts</th>
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Available Stock Purchased for COVID But Not Deployed

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<tr>
<th>Available Stock (COVID)</th>
<th>WOW</th>
<th>Cerner Bridge Printers</th>
<th>Med Scanners</th>
<th>Label Printers</th>
<th>Wristband Printers</th>
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<th>MFD (Printers)</th>
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Working Remotely: Technical Issues

• Phone system capacity (1200 max concurrent calls for Skype)
• Citrix remote licenses (20-times jump)
• Internet traffic
• VPN
• Duo licenses
Incident Command Processes

What worked in Wave 1
- Data driven decisions – reporting
- Expert input available via SICC
- Communication on updates (toolkit + KBs, Strides, HI-Priority)
- Partnered for projects (LTC HCW testing, Visitor tracking, surge plan)
- Successful coordination some complex builds (COVID test ordering)
- Expedited hundreds of COVID RFCs
  - Immediate review (same day)
  - Effective processing (160%)
  - Efficient (fast) builds

Work for Wave 2
- Decision process
  - Requests coordinated with stakeholders and subject matter experts prior to RFC/CRQ
  - SICC leadership team and IC in charge, system-wide acceptance of SICC decisions
- Requested changes are consistently managed as projects
  - Defined roles (sponsor, manager, stakeholders, SMEs, resources) and personnel
  - Well-coordinated tasks with transparent timelines, and status
- SICC project managers and CI/ITPMO collaboration and mutual updates
Questions?