31 October

Australian Securities Exchange
Exchange Centre
20 Bridge Street
Sydney NSW 2000

Alcidion to Present at The Health Informatics New Zealand Conference

Alcidion Group Limited (ASX:ALC) today announced that it will present at The Health Informatics New Zealand Conference in Rotorua on the 1st November 2017.

Chairman and CEO Mr. Ray Blight and Executive Director and Chief Medical Officer (CMO), Adjunct Professor Malcolm Pradhan will present on behalf of Alcidion. Updating the group on the latest developments within the company as a listed company.

Event Details

Adelaide Event

Date: Wednesday 1st November 2017
Alcidion presenting at 8:00 am (New Zealand time)

Venue: Energy Events Centre
Queens Drive
Rotorua 3010, New Zealand

A copy of the presentation in included as an Appendix to this announcement.

ENDS

For further information, please contact:

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About Alcidion

Alcidion Group Limited (ASX:**ALC**) is a publically listed, innovative health informatics company that specializes in clinical products that improve productivity, safety and efficiency. Alcidion's solutions target key problems for Emergency Rooms, Inpatient Services and Outpatient Departments and are built upon a next generation health informatics platform, which incorporates an intelligent EMR, Clinical Decision Support Engine, Data Integration Capability, Smartforms, Terminology Support and Standards Based Web Services.

Alcidion's focus is on delivering solutions that enable high performance healthcare and which assist clinicians by minimising key clinical risks, tracking patient progress through journeys and improving quality and safety of patient care.

www.alcidion.com

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Real Time CDS & Predictive Analytics

Ray Blight, Chairman and CEO

Malcolm Pradhan, Chief Medical Officer

Alcidion

We passionately believe that clinicians and executives
must have fast, easy to use intelligence,
to make better patient and service decisions

We breath life into patient data with smart software
to create real-time intelligence for better decisions,
plus better clinical and business outcomes

About Alcidion

- Founded by Ray Blight and Malcolm Pradhan in 2000
- Listed on ASX in February 2106
- Advanced health informatics platform
- Primarily **clinical decision** focused (CDS), plus:
  - High performance logistics/workflow (Patient Flow)
  - Performance metrics (businesis and clincal)
  - Business efficiency (Revenue, cost reduction)
  - Patient safety (Avoidable Errors)
- Now with predictive analytics

The Miya Platform

An Enterprise Health Informatics Platform

- Harvests and continuously monitors patient data
- Applies “smarts” to data (AI, algorithms, knowledge bases)
  - Identifies presence (or emergence) of clinical risk
  - Builds clinical intelligence and pushes to the clinician
- Pushes guidance on best practice risk mitigation
- Captures decisions and monitors completion

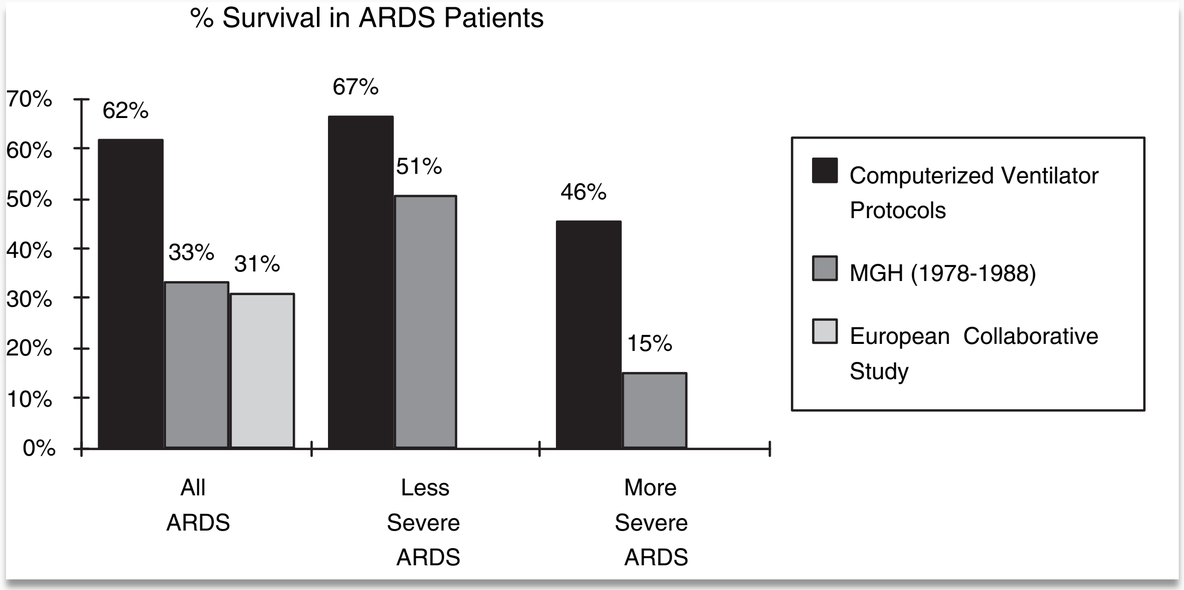
Supports/Turbocharges Applications

- Alcidion’s application s and products
- Customer apps and third party apps

The Promise of CDS

- Expert level clinical performance since the 1970's in specialized areas
- By early 2000's strong evidence of benefit
- Main centres of CDS & EHR
  - Regenstrief Institute, Indianapolis
  - Columbia-Presbyterian MC, NY
  - Beth Israel Hospital, Boston
  - LDS Hospital, Salt Lake City
  - VA Hospitals

- Alerting
- Ordering guidelines
- Management guidelines
- Diagnostic CDS



Henderson et al. Proc Annu Symp Comp Appl Med Care 1989;13:588–592

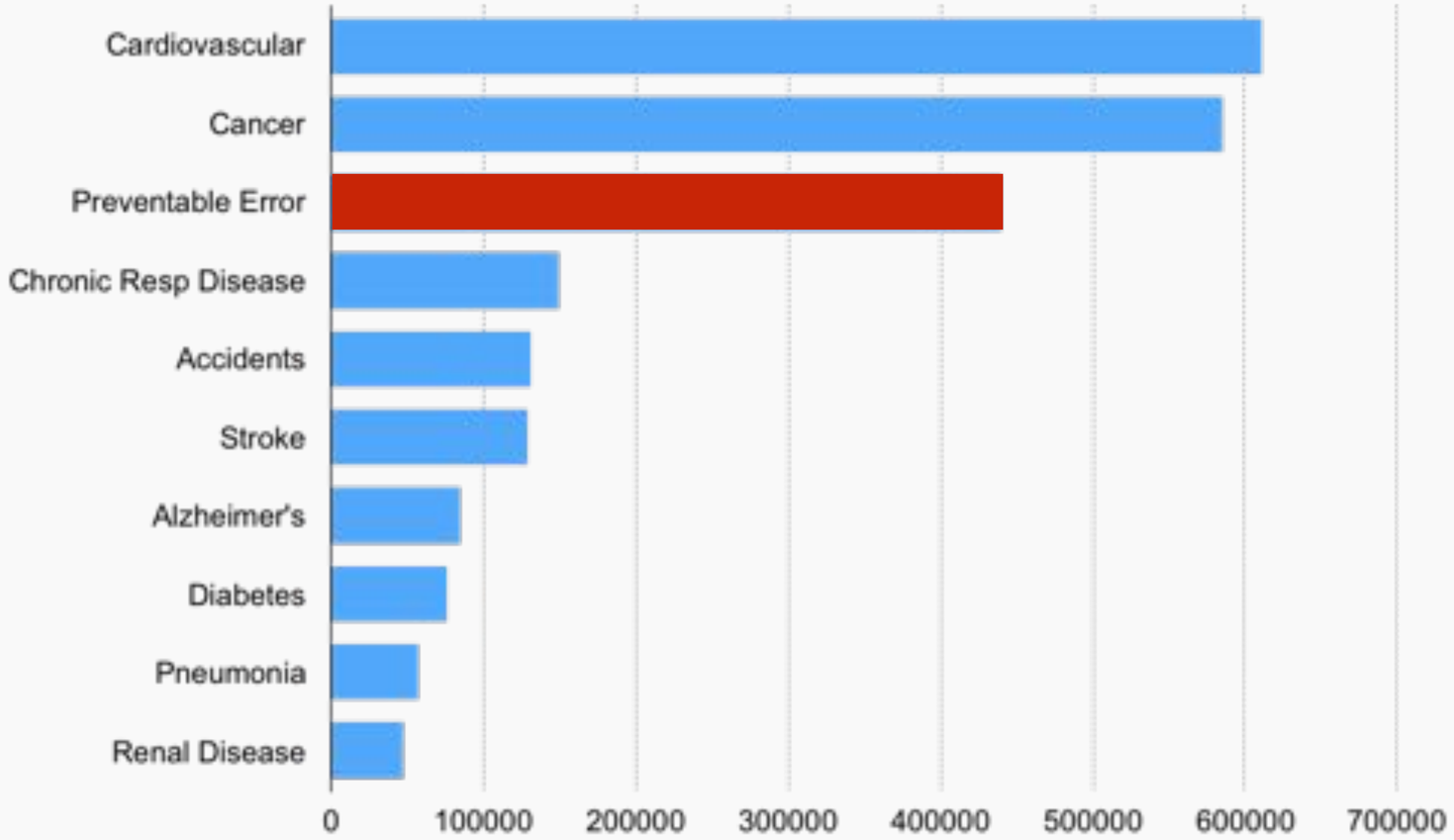
Drivers for EMRs

- Large scale EMR investments
  - Productivity? Safety? Outcomes? CDS?

HIMSS EMRAM

Stage	Cumulative Capabilities
7	Medical record fully electronic; HCO able to contribute **CCD as byproduct of EMR**; **Data warehousing** in use
6	**Physician documentation (structured templates), full CDSS (variance & compliance)**, full R-PACS
5	**Closed loop medication administration**
4	**CPOE, CDSS (clinical protocols)**
3	**Clinical documentation (flow sheets)**, **CDSS (error checking)**, PACS available outside Radiology
2	**Clinical Data Repository, Controlled Medical Vocabulary, Clinical Data Support System**
1	Ancillaries– Lab, Rad, Pharmacy

The State of Post-EMR Healthcare



Leading causes of death in the US

Patient harm 10-50%+ of multi-day episodes

Up to 40% of lab results are not seen

30% of AMI patients not on guideline meds

Mis- or late diagnosis in 10%–20% of cases

The Post-HiTech Reality

✓ CPOE was associated with half as many pADEs and medication errors

Syst Rev. 2014 Jun 4; 3:56

"CDSS malfunctions are widespread and often persist for long periods"

J Am Med Inform Assoc 2016; 23:1068–1076

"Across clinical settings, new generation CDSSs integrated with EHRs do not affect mortality and might moderately improve morbidity outcomes"

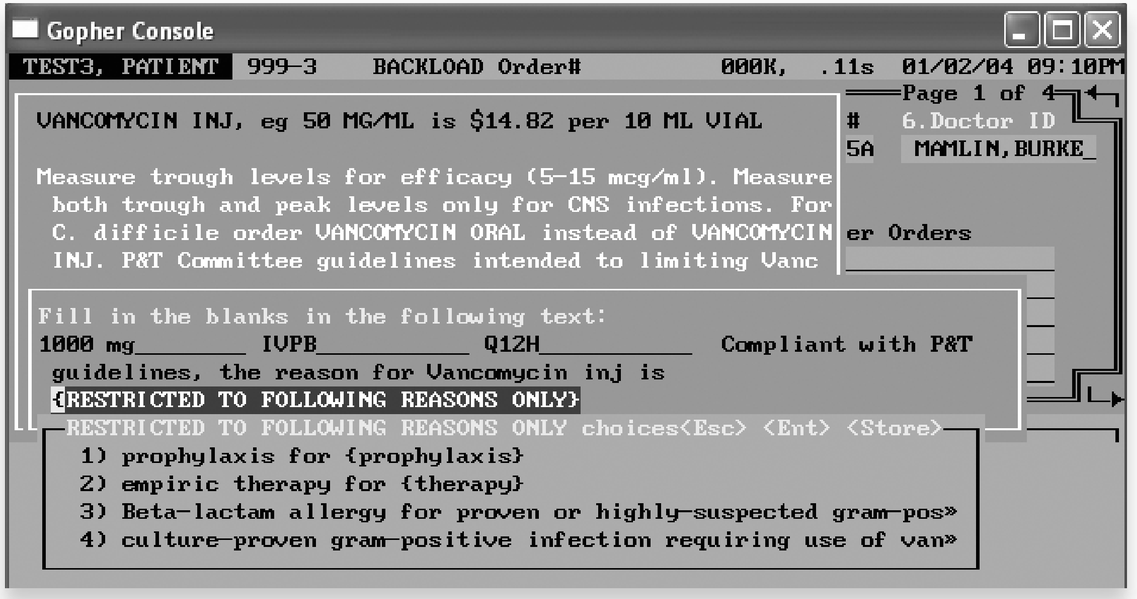
Am J Public Health. 2014. 104:e12–e22

"CDSSs … seem to reach a plateau with respect to their effectiveness when implemented in real-world settings. One could consider that paradigm shifts are required either in the design, the development, or the implementation of CDSSs"

Yearb Med Inform 2014:163-6

Lessons from the 80's–90's

- Workflow is paramount
- Avoid punishing the user with additional obstacles
- Response-times should be sub-second i.e. "blazingly fast"
- Users should be able to override nearly every decision



Berner (ed). Clinical Decision Support Systems Theory and Practice. 2ed. Springer. 2007

Some Lessons for Healthcare IT

Alcidion

make the right thing to do
the easier thing to do

you don’t solve problems
by accident

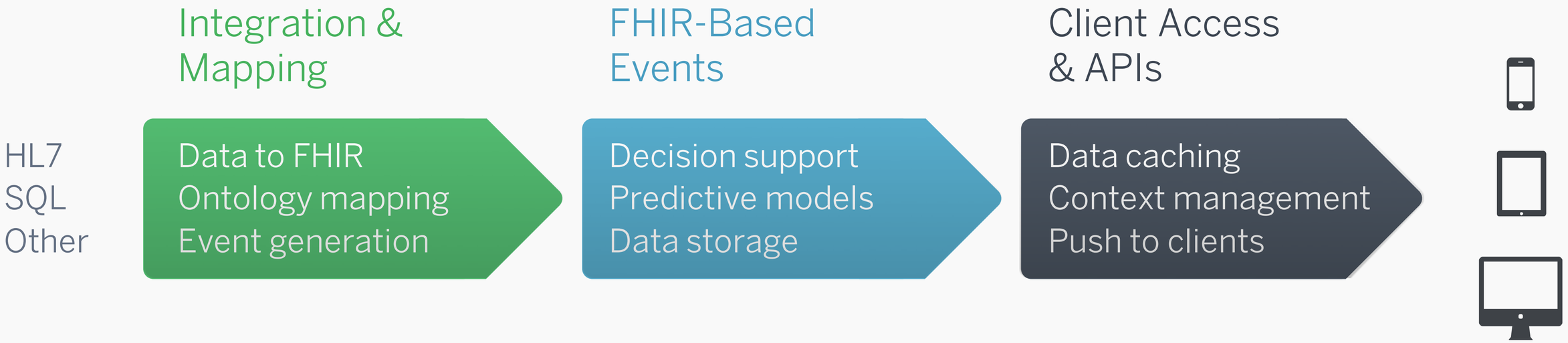
algorithms will drive
healthcare

Alcidion's Approach

- Maximise the value of existing data sources
- Every click (or tap) for the user is pushing a friendship
- Each specialty is a separate business
  - What does a specialist want to know?
- What should they know?
  - Smart infrastructure
  - Predictive
  - CDS
- CDS/Predictive will only be widespread when we can trust it

The Miya Platform

Alcidion

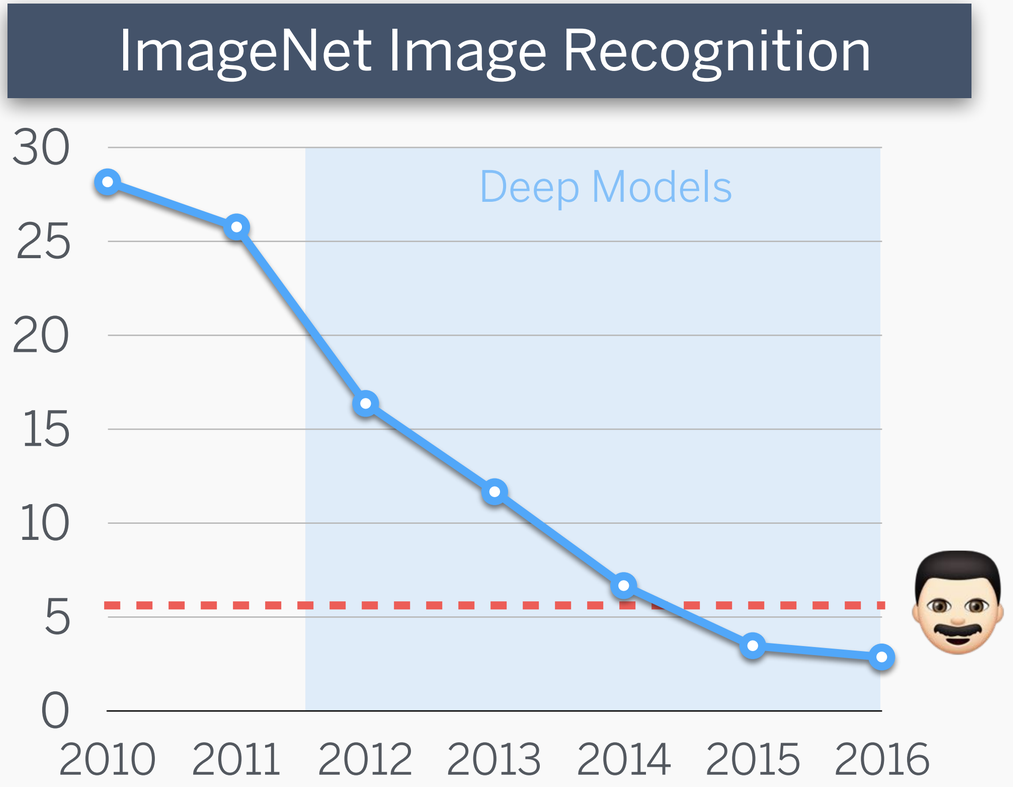


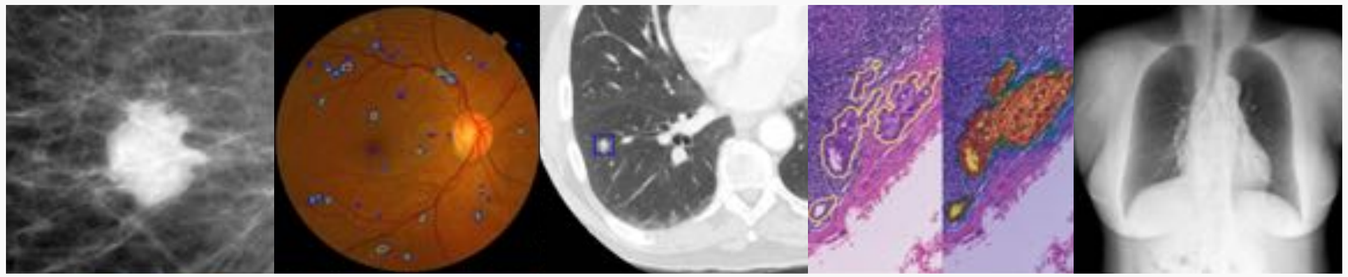
Fewer Technology Barriers

- Recent advances in machine learning and ‘AI’ (expert systems)
- We have very powerful systems for pattern recognition
  - Deep learning/deep networks
- We have systems for uncertainty and rational decision making
  - Bayesian networks, Gaussian processes, etc.
  - Decision theoretic systems

Deep Learning Performance

- Good at perception type problems
- Image recognition is a ‘solved problem’
- State of the art performance
  - Mammographic mass classification
  - Diabetic retinopathy
  - Lung nodule detection on CT
  - Breast cancer metastases detection in lymph nodes
  - Skin lesion classification





Non-Image Performance

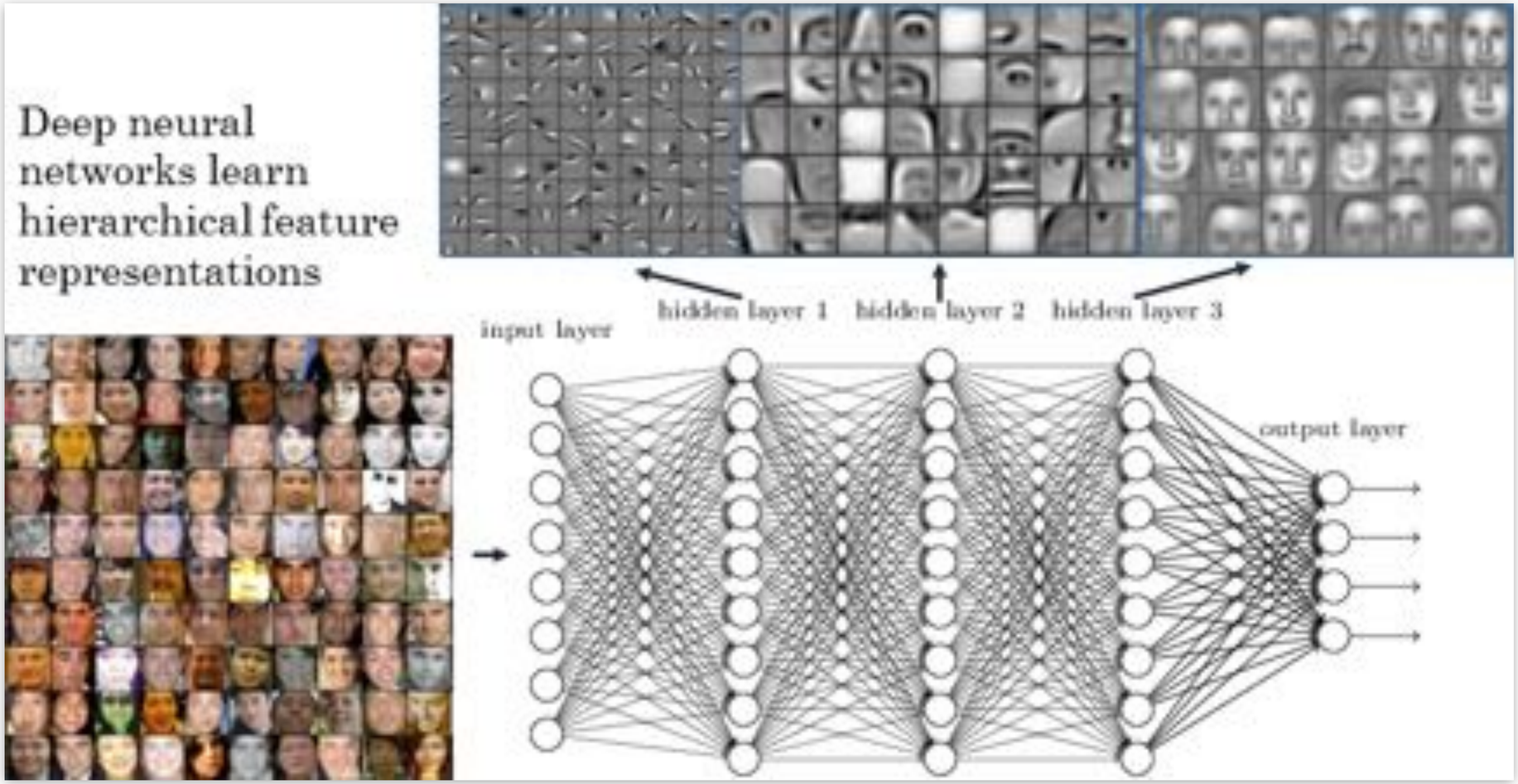
- Prediction of CCF and COPD
- Chronic disease prediction
- Predict suicide risk
- Unplanned readmission after discharge

- Alcidion applications
  - Occupancy prediction
  - Per patient resource utilisation
  - LOS (predicted discharge date)
  - Readmission prediction
  - Clinical risks

What are Deep Networks?

- Deep networks do not ‘understand’ the data they process

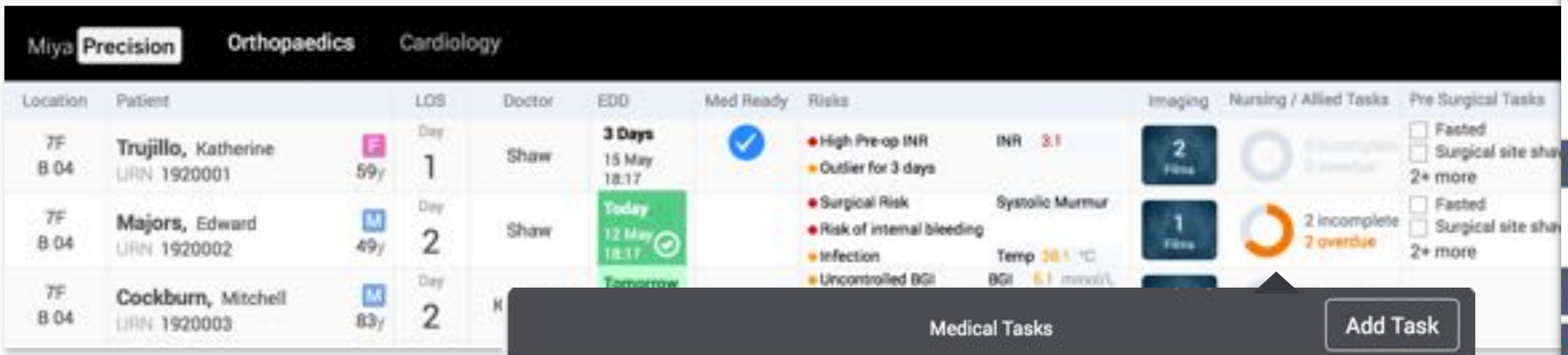
In reality much more deep and complex e.g. 24m nodes, 15b connections

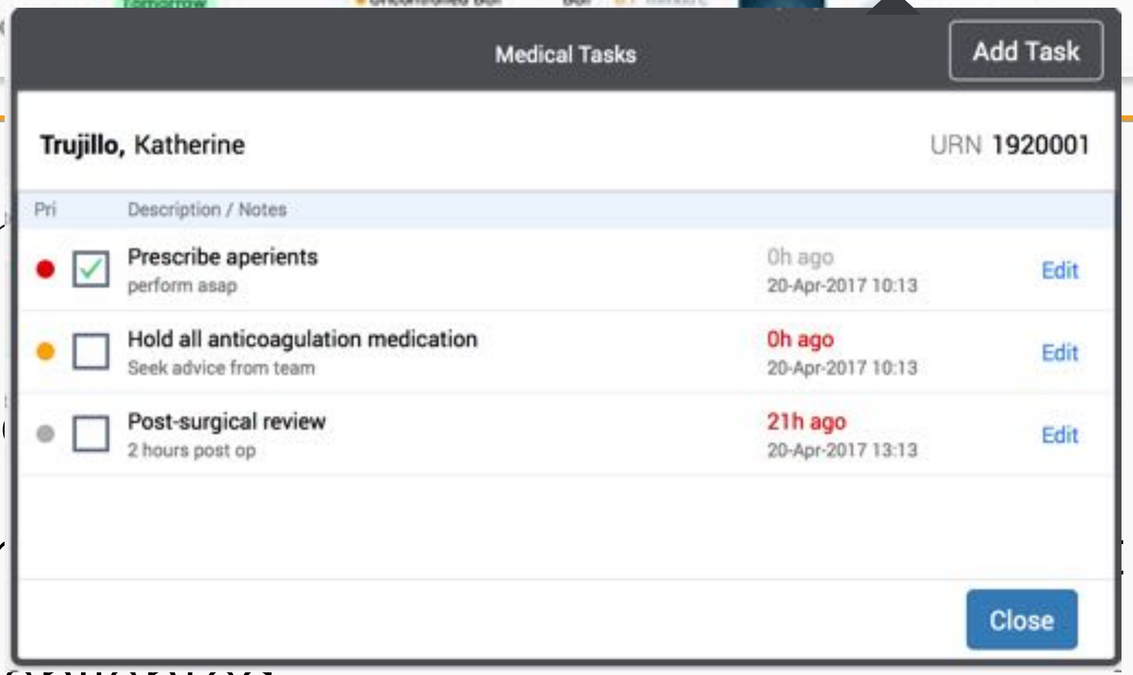


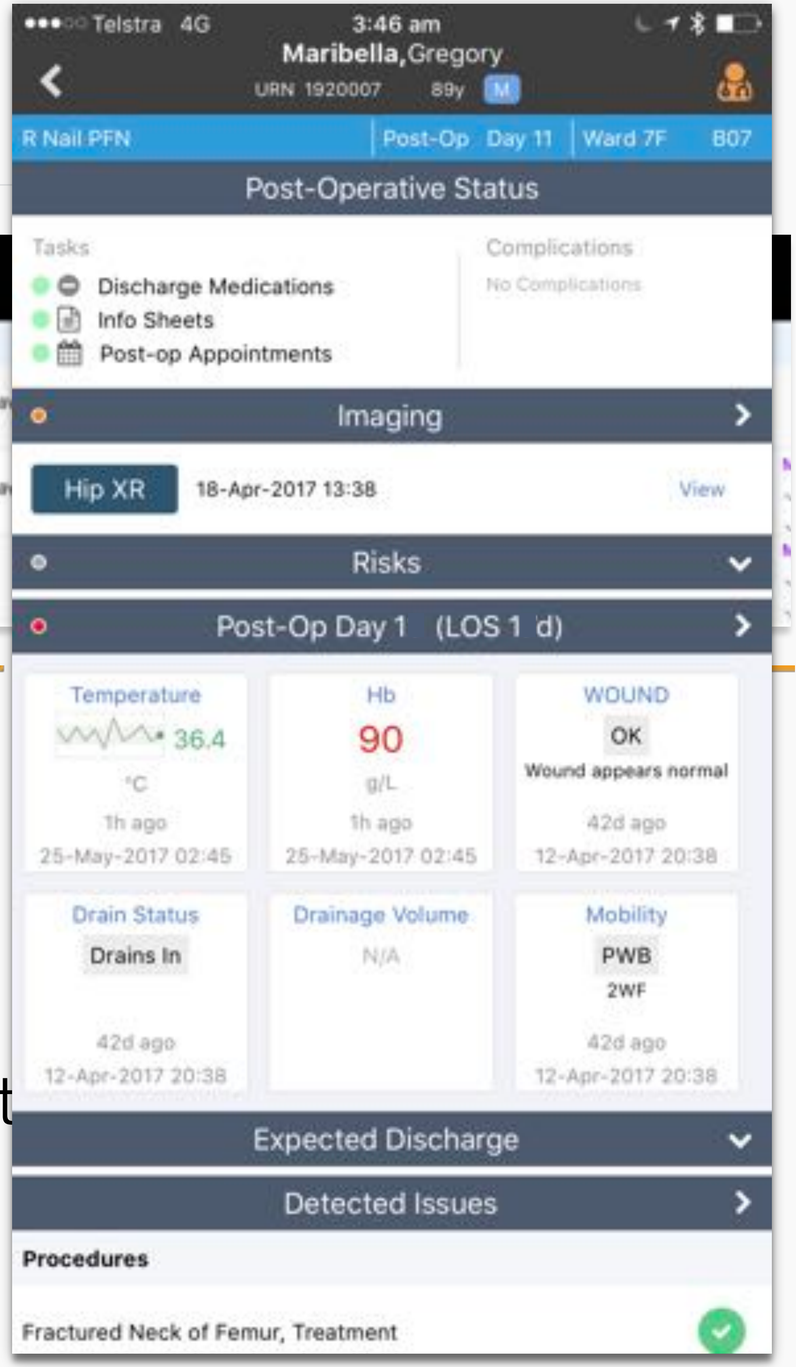
Lee, H. et. al. Convolutional Deep Belief Networks for Scalable Unsupervised Learning of Hierarchical Representations. ICML 09

Technical Challenges for Predictive AI & CDS

- Interoperability – data hiding as a strategy
- Workflow integration
  - Many systems are not designed for integrated CDS and Predictive Analytics
  - Testing new models of care, enabled by algorithms, is hard
- Deep models can be brittle
  - Confidently incorrect
- Representing complex clinical data to neural networks
- Lack of outcome data
  - Successful ML is supervised needing outcome data
  - Implies capturing the right data, in the right way (structured data)
  - Most data in EMRs is free text







1 Specialty cor

- Login time 1 se
- Important infor list
- Clinical risks highlighted

Patient Flow Examples

- ED admission prediction
  - Probability of inpatient admission
  - Most likely unit
  - Based on previous history, lab orders, lab results
- ED occupancy
- Hospital occupancy
- Resource prediction
- State of art performance using deep learning

Real-Time Safety Monitoring

- Safety has been a post-hoc assessment of harm → real-time risk
- Monitoring for commission and omission errors
- Using data to determine conditions for each patient → level of complexity
- Real-time contextual risk & complication detection → early warnings
- Highlight complexity and exposed risks
  - How many patients with INR > 5 right now
  - Who on an aminoglycoside antibiotic not monitored for levels & renal function
- Financial drivers through Hospital Acquired Complications

Miya Metrics
RSH
Safety & Quality
Nanelle Nurse
Cardiology Risk Profile
By Risk Category
Antimicrobial Stewardship
Cardiac Guideline Compliance
Coagulation
Renal Function
By Patient
Endocrinology Risk Profile
Cardio-thoracic Surgery Risk Profile
General Surgery Risk Profile
Medical Oncology Risk Profile
Nephrology Risk Profile
Neurosurgery Risk Profile
Paediatric Medicine Risk Profile
Respiratory Medicine Risk Profile
Orthopaedic Surgery Risk Profile
High Risk, Low Complexity Cardiology Patients
Ward
Patient
Risks
SD Bagdatos, Martin 74 yo Antimicrobial Stewardship + 1 other View
SD Mulligan, Jose 63 yo Antimicrobial Stewardship View
SF Hamilton, Mary 63 yo Renal Function View
SD Grey, Michael 74 yo Renal Function View
SD Wu, Aaron 63 yo Renal Function View
SF Rogers, Amelia 63 yo Coagulation View
SF Hamilton, Mary 63 yo Coagulation View
SD Grey, Michael 74 yo Coagulation View
SD Wu, Aaron 63 yo Coagulation View

Patient Complexity

- Patient complexity is important
- Understanding LOS, expected discharge
- Planning care within and in the community
- Appropriate reimbursement through ABF
- EMR data is largely free text with little structured data
- Problem lists not routinely and consistently updated
- Daily complications in nursing/allied health notes

Natural Language Processing (NLP)

Alcidion

- Significant improvements in non-health areas
  - Sentiment analysis
  - Product mentions
  - Support request routing
- Non-health NLP based on large volumes of tagged data
- Challenges for health care NLP
  - Concept detection
  - Disambiguation
  - Negation detection

Alcidion's Deep Learning Negation Detection

- Original note with concepts detected

  While on the surface, this woman has suffered a [CVA], the [CT] brain [imaging] as well as the clinical picture are not congruent with one another. One would always have to exclude the possibility of a [brain_tumour].

Alcidion's Deep Learning Negation Detection

- Original note with concepts detected

> While on the surface, this woman has suffered a [CVA], the [CT] brain [imaging] as well as the clinical picture are not congruent with one another. One would always have to exclude the possibility of a [brain_tumour].

- Negation detection

Pos/Neg Indicator	CUI	Concept Term	Category	Original String
pos	C0040405	X-Ray Computed Tomography	Diagnostic Procedure	CT
pos	C0079595	Imaging Techniques	Diagnostic Procedure	imaging
neg	C0038454	Cerebrovascular accident	Disease or Syndrome	CVA
neg	C0006118	Brain Neoplasms	Neoplastic Process	brain tumour

Demo

Summary

- Innovation is essential to building a sustainable healthcare system
- Key factors for innovation
  - Interoperability
  - Workflow improvements
  - Automation
- Predictive analytics, CDS and AI are possible today
- Alcidion has built the Miya Platform as the foundation for real-time predictive analytics and CDS

Q&A