



Better, faster decisions

# Improving ED Flow & Safety with Predictive, Real-Time Technology

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# About Alcidion



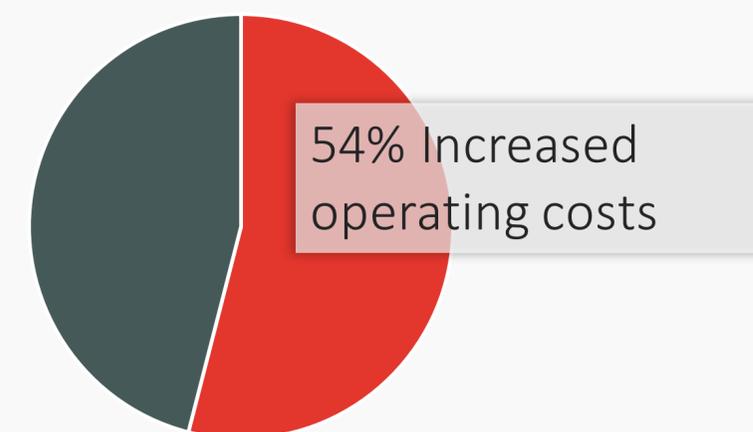
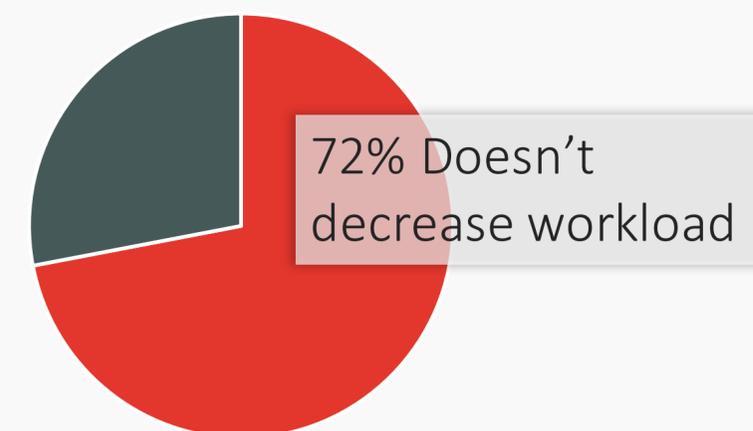
- ASX listed health informatics company based in Adelaide
- Proven track record in innovation
- Customers currently large public hospitals
  - Western Health (Vic)
  - Northern Territory
  - Royal Melbourne
  - Tasmania
  - Midcentral DHB, NZ
- Engagement with Calvary Care



# Challenges of Healthcare IT



- Health IT systems slow down clinicians
  - Not integrated into workflows
  - Lack of focus on clinical productivity
  - Lack of focus on safety
- Lack of interoperability
  - IT vendors 'hide data' to prevent competition
  - Innovation is stifled
- Most data entered in EMRs is unstructured
  - Prevents clinical decision support & automation
  - Prevents machine learning



AMA College of Physician survey on attitudes to EMRs (2014)

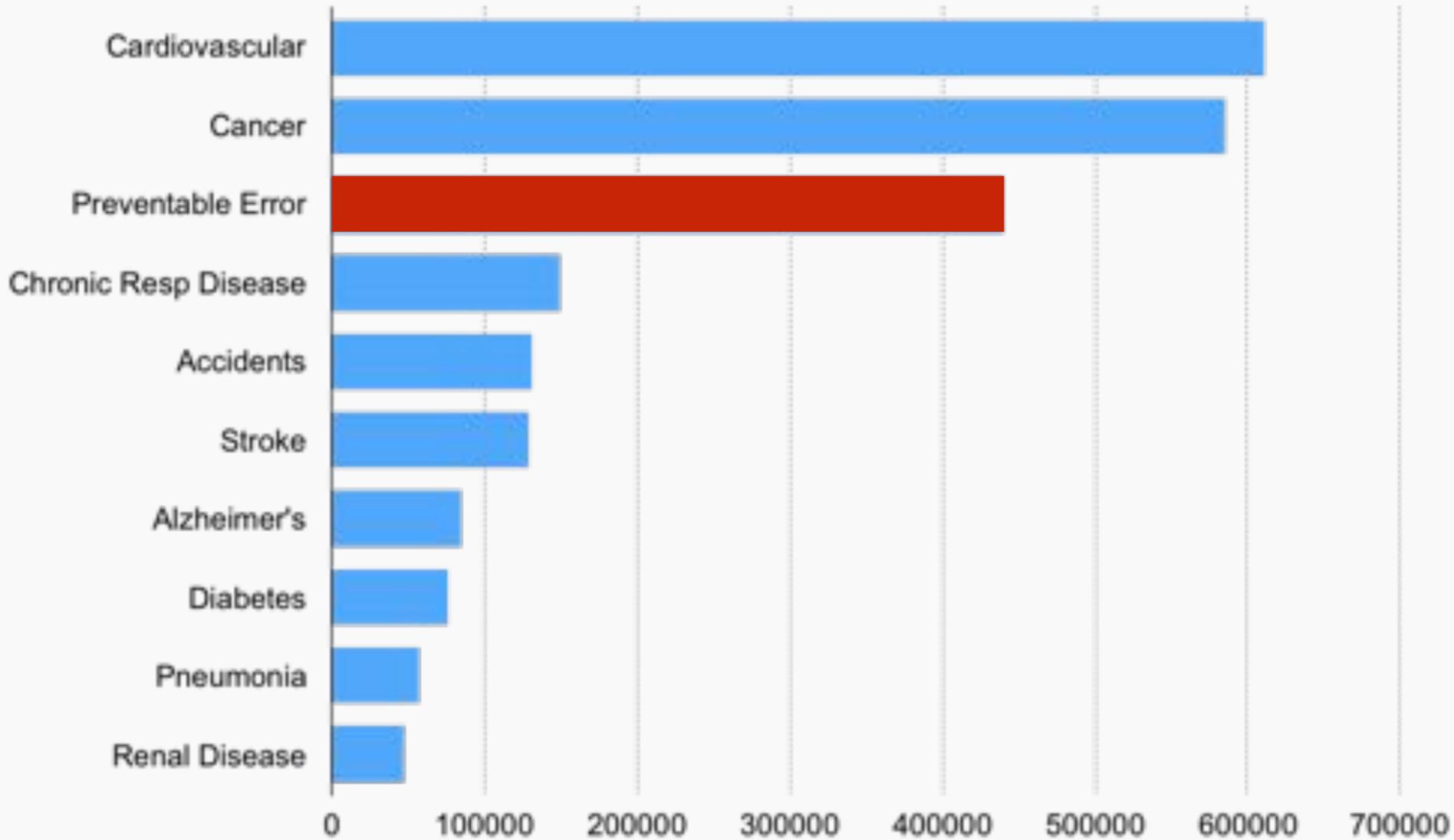
# Paved with Good & Bad Intentions



- By early 2000's strong evidence of clinical benefits of Clinical Decision Support (CDS) integrated into EMRs
- The EMRAM & HiTech Act
- Data hiding as a strategy
- Benefits of CPOE meds
- "CDSs ... seem to reach a plateau with respect to their effectiveness when implemented in real-world settings" Am J Public Health. 2014. 104:e12–e22

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

# The Results



Leading causes of death in the US

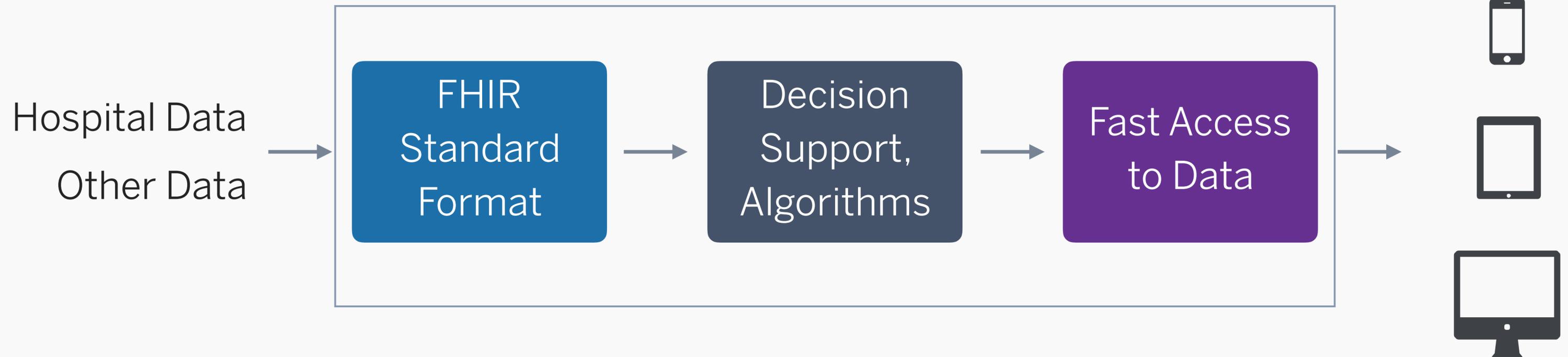
Patient harm 10-50%+ of multi-day episodes

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

# Miya Platform (v5.6)



- Open standards, real-time platform for healthcare decision support and analytics
  - Logistics – Blazingly fast, platform for innovation
  - Clinical risk – Make the right thing to do the easiest thing to do
  - Revenue – Track patient complexity
- In the cloud, on premise

# Miya ED Clinical Risk Management

**Elecs**  
25 min ago

**FBE**  
12 min ago

**Trop**  
18 min ago

**Coag**  
37 min ago

**X-Ray**  
25 min ago

**CRP**  
5 min ago



MIYA

Home, No. 40 Patients Area / Book My View Home

Patient Name	Appointment Time	Status	Buttons
Moreno, Sasha	7:27	OK	DEF, OK, STOP, HOLD
Lynn, Sara	7:30	OK	DEF, OK, STOP, HOLD
Stern, Herbert	8:15	OK	DEF, OK, STOP, HOLD
Davidson, Kenneth	8:20	OK	DEF, OK, STOP, HOLD
Prince, Howard	8:30	OK	DEF, OK, STOP, HOLD
Simon, Jeffrey	8:30	OK	DEF, OK, STOP, HOLD
York, Jordan	7:30	OK	DEF, OK, STOP, HOLD
Farmer, Ashley	7:30	OK	DEF, OK, STOP, HOLD
Berger, Herbert	8:15	OK	DEF, OK, STOP, HOLD
Kim, Kelley	7:30	OK	DEF, OK, STOP, HOLD
DeSantis, Jonathan	8:30	OK	DEF, OK, STOP, HOLD
Rasmussen, Elise	7:15	OK	DEF, OK, STOP, HOLD
Ramirez, Olive	7:30	OK	DEF, OK, STOP, HOLD
Kishner, Erika	7:30	OK	DEF, OK, STOP, HOLD



Area / Bed	Name & Gender	Age	Room	DOB	Results						
Adults 3	Garner, Ellis URN: 1048399 Dr. MIDDLETON	M 29y	3	10-18 hours	EtoH 23:00 09 Apr	Parac 14:58 09 Apr	Bchem 14:58 09 Apr	FBE 14:58 09 Apr			4 of 6 unread
Adults 5	Blackburn, Merrill URN: 282653 Dr. KARPATHAKIS	M 30y	4	5:11 hours							1 of 1 unread
Adults 6	Macias, Arline URN: 975822 Dr.	F 21y	5		XRay 23:38 09 Apr						0 of 1 unread
Adults 9	Garner, Linda URN: 1048696 Dr. MIDDLETON	F 27y	4	4:16 hours	XRay 23:47 09 Apr	XRay 23:30 09 Apr	Ddm 23:30 09 Apr	FBE 21:18 09 Apr	Bchem 21:18 09 Apr	CK 21:18 09 Apr	8 of 9 unread
Adults 11	Rios, Corine URN: 1047742 Dr. KARPATHAKIS	F 55y	4	5:11 hours	Umcr 23:00 09 Apr	FBE 22:57 09 Apr	Bchem 20:07 09 Apr	Amy 20:07 09 Apr	Umcr 20:00 09 Apr	CT 11:37 09 Apr	0 of 10 unread
Adults 20	Schwartz, Debbie URN: 181574 Dr. MIDDLETON	F 51y	4	4:45 hours	Bchem 22:50 09 Apr	FBE 22:50 09 Apr	Umcr 21:40 09 Apr				3 of 3 unread
Adults 21	Vega, Lynnette URN: 709659 Dr.	F 36y	4	5:24 hours	Trop 10:00 09 Apr	XRay 11:42 09 Apr	XRay 12:40 09 Apr	Trop 11:30 09 Apr	FBE 11:30 09 Apr	Bchem 11:30 09 Apr	7 of 7 unread
Adults 22	Rodriguez, Claire URN: 967204 Dr. KARPATHAKIS	F 21y	4	4:56 hours	FBE 10:00 09 Apr	bHCG 10:00 09 Apr	Bchem 10:00 09 Apr				3 of 3 unread
Adults 24	Alvarado, Madelyn URN: 194293 Dr. MIDDLETON	F 41y	2	12:54 hours	CT 17:00 09 Apr	CT 17:01 09 Apr	CRP 12:40 09 Apr	Bchem 12:40 09 Apr	FBE 12:40 09 Apr		4 of 5 unread
Adults 25	Suarez, Junior URN: 923492 Dr. MIDDLETON	M 77y	4	4:04 hours	Umcr 22:00 09 Apr	FBE 22:00 09 Apr	Bchem 22:00 09 Apr				3 of 3 unread
Adults 27	Fuentes, Bridgette URN: 416002 Dr. KARPATHAKIS	F 87y	3	7:12 hours	Bgrou 22:25 09 Apr	CT 21:40 09 Apr	XRay 20:00 09 Apr	Bchem 19:30 09 Apr	Amy 19:30 09 Apr	FBE 19:30 09 Apr	11 of 12 unread
Adults 28	Hensley, Gilda URN: 1026702 Dr. TOVEY	F 78y	5		CT 22:47 09 Apr	XRay 22:41 09 Apr	CT 21:52 09 Apr	XRay 21:01 09 Apr			4 of 4 unread
Adults 33	Rowland, Valerie URN: 480651 Dr. MIDDLETON	F 73y	5		FBE 23:00 09 Apr	Coag 23:00 09 Apr	Coag 23:00 09 Apr	Bchem 23:00 09 Apr	INR 23:00 09 Apr		5 of 5 unread
Adults 34	Payne, Doreen URN: 194529 Dr. MIDDLETON	F 70y	3	11:24 hours	CT 21:54 09 Apr	CT 21:53 09 Apr	XRay 19:01 09 Apr	XRay 19:00 09 Apr	BGas 11:13 09 Apr	Amy 12:40 09 Apr	7 of 8 unread

Filtering by Doctor: Van der Pennen

Reset My View

Bed / Area	Name & Details	Alerts	Triage	Att. Doc.	First Seen	LOS	Orders	Diagnostic Reports
B28 Area A	Bagdatos, Martin URN 972623 29 yo M		1	Van der Pennen	OK	2h 15min	16 Orders 1 Collect	Elecs 10:12 15-Dec LFT 10:26 15-Dec FBE 10:02 15-Dec 5 of 5 unmed
B28 Area A	Bagdatos, Martin URN 972623 29 yo M		2	Van der Pennen	10h 13m	2h 15min	16 Orders 1 Collect	Elecs 10:12 15-Dec LFT 10:26 15-Dec FBE 10:02 15-Dec 5 of 5 unmed
B28 Area A	Bagdatos, Martin URN 972623 29 yo M	Alerts	3	Van der Pennen	OK	2h 15min	16 Orders 1 Collect	Elecs 10:12 15-Dec LFT 10:26 15-Dec FBE 10:02 15-Dec 5 of 5 unmed
B28 Area A	Bagdatos, Martin URN 972623 29 yo M		4	Van der Pennen	OK	2h 15min	16 Orders 1 Collect	Elecs 10:12 15-Dec LFT 10:26 15-Dec FBE 10:02 15-Dec 5 of 5 unmed
B28 Area A	Bagdatos, Martin URN 972623 29 yo M		5	Van der Pennen	OK	2h 15min	16 Orders 1 Collect	Elecs 10:12 15-Dec LFT 10:26 15-Dec FBE 10:02 15-Dec 5 of 5 unmed
B28 Area A	Bagdatos, Martin URN 972623 29 yo M	Alerts	1	Van der Pennen	Doctor 13 min	2h 15min	16 Orders 1 Collect	Elecs 10:12 15-Dec LFT 10:26 15-Dec FBE 10:02 15-Dec 5 of 5 unmed
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Displaying 10 of 36 patients

Results Tracker

Collection List

Discharge Report

▲ Scroll Up

▼ Scroll Down

# Adaptive User Interface



1

Standard configuration for department

2

Stream specific elements

Patient Record

Overview

Admission History

Diagnostic Reports

Patient Details

Overview

Monitors



Hb  
140  
g/L

4 weeks 28-May-17



K+  
5.2  
mmol/L

4 weeks 28-May-17



PO4  
1.1  
mmol/L

4 weeks 28-May-17

Radiology  
7  
Exposures  
Last 12 Months

CHADS2  
3  
5.9% Risk  
20-Apr-2017

Pathology Results Since Admission on 25-May-2017

Report	Abnormalities	Age	Date	
<b>Elects</b> Electrolytes	K+, Na, Cr, AB	1 h 15 min	25-May-2017 08:32	<a href="#">View</a>
<b>FBE</b> Full Blood Exam	Hb, WCC	1 h 15 min	25-May-2017 08:32	<a href="#">View</a>
<b>CRP</b> C Reactive Protein		1 h 25 min	25-May-2017 08:22	<a href="#">View</a>
<b>Elects</b> Electrolytes	K+, Na, Cr, AB	1 h 25 min	25-May-2017 08:22	<a href="#">View</a>
<b>FBE</b> Full Blood Exam	Hb, WCC	1 h 25 min	25-May-2017 08:22	<a href="#">View</a>
<b>CRP</b> C Reactive Protein		1 h 25 min	25-May-2017 08:22	<a href="#">View</a>

12 More Results [View](#)

ED Episode Timeline

Elapsed Time  
1 hr 55 min of 4 hours  
2 hr 5 min remaining

- Admission 1 hr 55 min ago 25-May-2017 07:43
- First Seen 1 hr 2 min ago Dr Fitzpatrick 25-May-2017 08:45
- Nurse Assessment 30 min ago 25-May-2017 09:17
- Medical Assessment
- Discharge

Recent Admissions

Legend Hospital (Inpatient) Admission Emergency Admissions

Click a dot to view the Admission History



Diagnostic Imaging Since Admission on 25-May-2017

Patient Appointments

1-Feb-2016 11:30 am ago  
Admission  
Cardiology  
9 d



# Missed Results Tracking

© 2012

Login

# Miya ED Benefits



- Patient treatment commences an hour earlier, leading to faster recovery
- Redundant test orders are reduced – 5% savings in ED pathology costs
- Critical (abnormal) test results are properly witnessed for follow-on action
  - Without Miya ED around 40% of test ordered are not read
  - 18% of these will be critical
- Miya ED saves ED Heads/Senior Consultants several hours a day
- Care team satisfaction with Miya ED is very high – rated at better than 80% compared to other clinical systems at around 30%

Location	Patient Details	Triage	First Seen	LOS	Attending Doc	Orders / Collect	Recent Panels
Acute A2	<b>Duncan, Annie</b> HRN 667466 34y	2	Seen 52 min / 30m	3hr 7min	Gomez	1 Collect	
EDU EU5	<b>Gates, Geoffrey</b> HRN 606734 47y	2	Seen 5hr 54min / 10m	13hr 18min	Gomez	5 Orders	TROP TROP CL DIFF 9 of 8 unread
Disas... D4	<b>Gilliam, Martha</b> HRN 608061 48y	5	Seen 2hr 37min / 120m	3hr 37min	Gomez	1 Collect	
Wait... AEW	<b>Glass, Brandy</b> HRN 690049 61y	6	120m	8.5 min	Gomez	1 Collect	UEC CL HB CMP 10 of 12 unread
High... HD4	<b>Hess, Duane</b> HRN 619930 43y	2	OK	5hr 17min	Gomez	1 Collect	Chempul BC CXR UEC 12 of 12 unread
EDU EU6	<b>Hicks, Colin</b> HRN 638716 67y	2	OK	10hr	Gomez	1 Collect	UEC CL LFT CMP 16 of 16 unread
EDU EU2	<b>Hubbard, Nadine</b> HRN 701654 62y	2	OK	10hr 23min	Gomez	1 Collect	TROP CTPA CXR GHG 16 of 16 unread
EDU EU7	<b>Hunter, Lavern</b> HRN 709800 65y	4	Seen 89 min / 60m	4hr 57min	Gomez	1 Collect	
High... HD3	<b>Jefferson, Agnes</b> HRN 618533 44y	2	OK	11hr 15min	Gomez	1 Collect	UEC CL LFT CMP 7 of 7 unread
Wait... A2	<b>King, Horacio</b>	4	OK	3hr	Gomez	1 Collect	

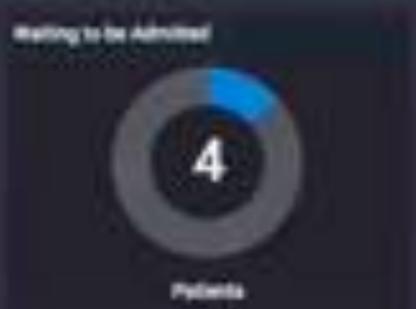
# Real-Time Metrics



New Patients



Current Patients



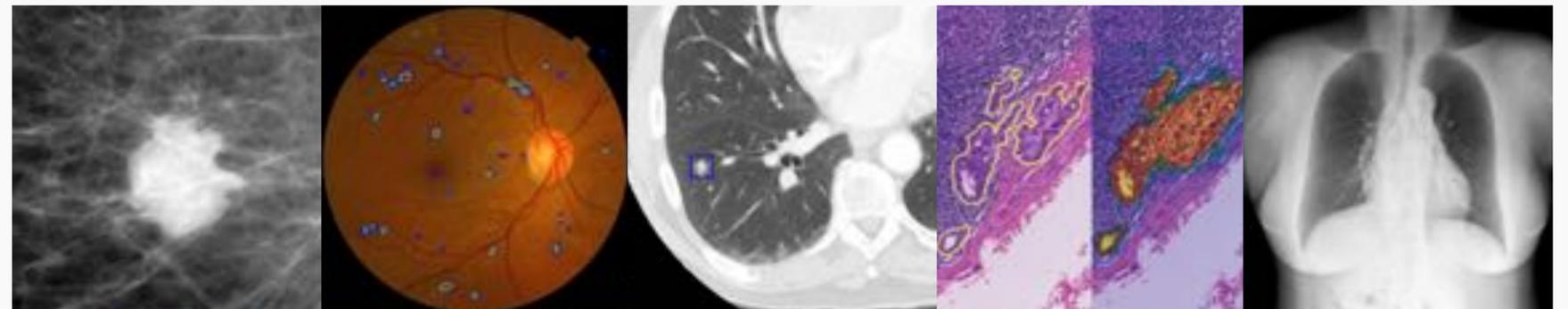
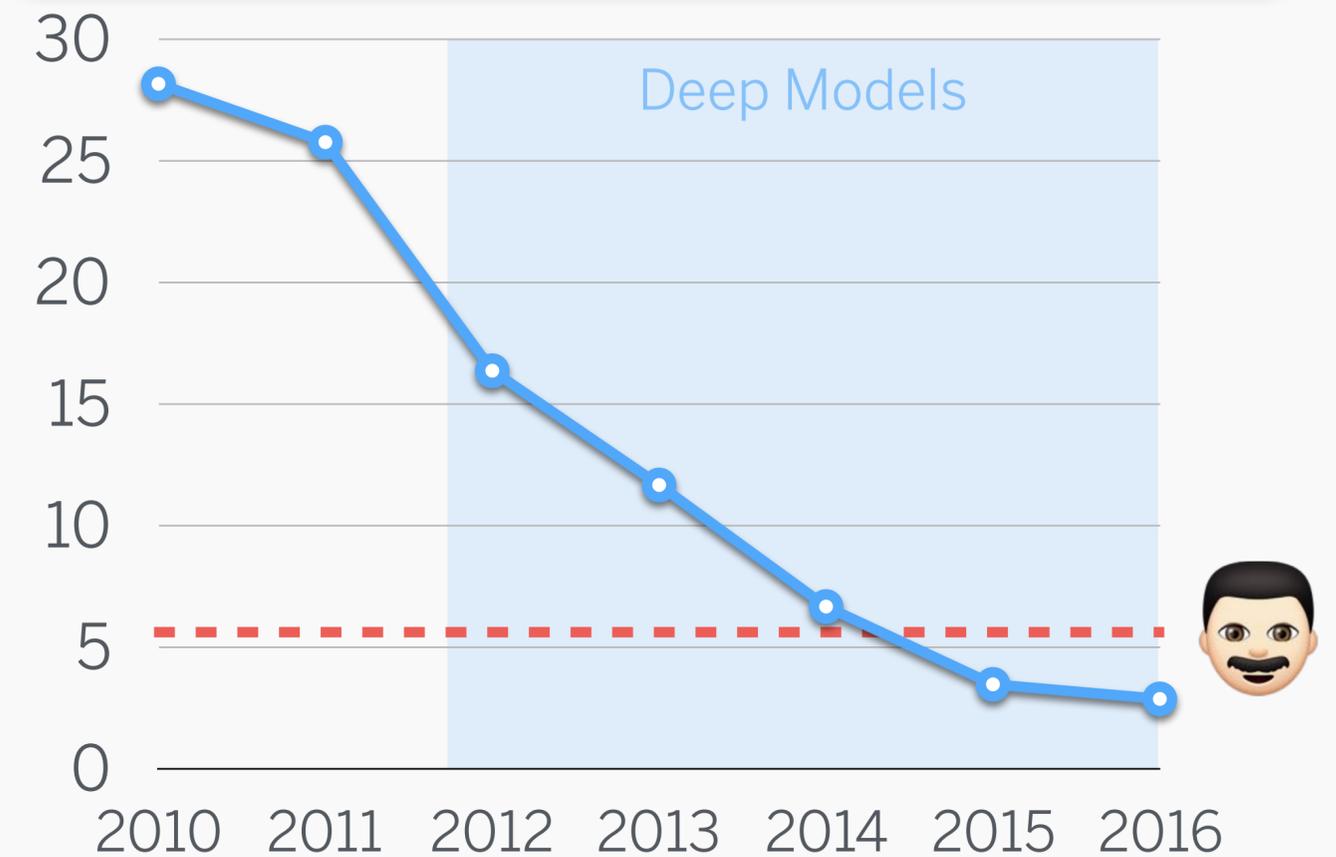
# Predictive Analytics



# Deep Learning Performance

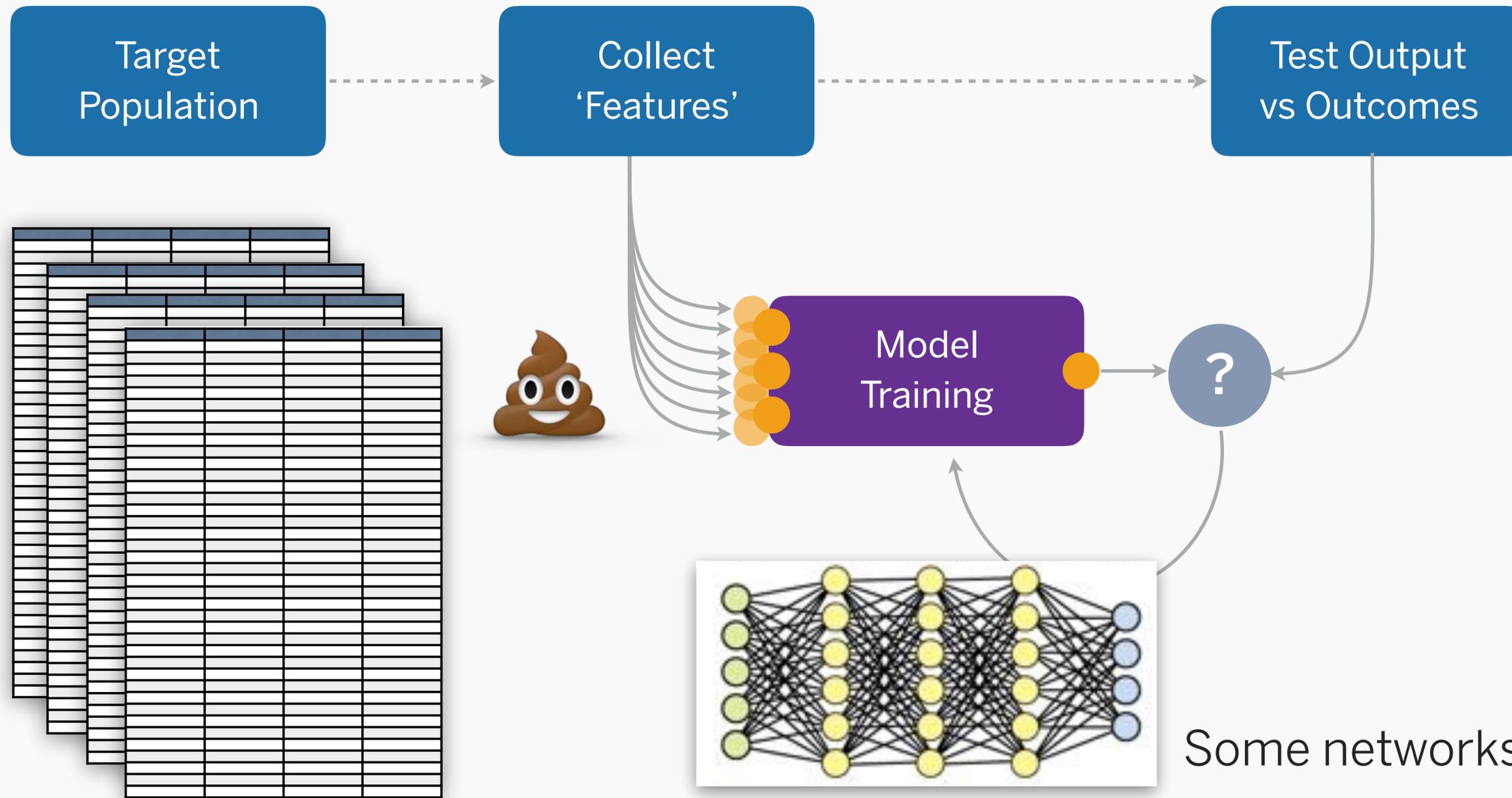
- Good at perception type problems
- Image recognition is a 'solved problem'
- State of the art performance
  - Mammographic mass classification
  - Diabetic retinopathy
  - Lung nodule detection on CT
  - Breast cancer metastases detection in lymph nodes
  - Skin lesion classification

## ImageNet Image Recognition





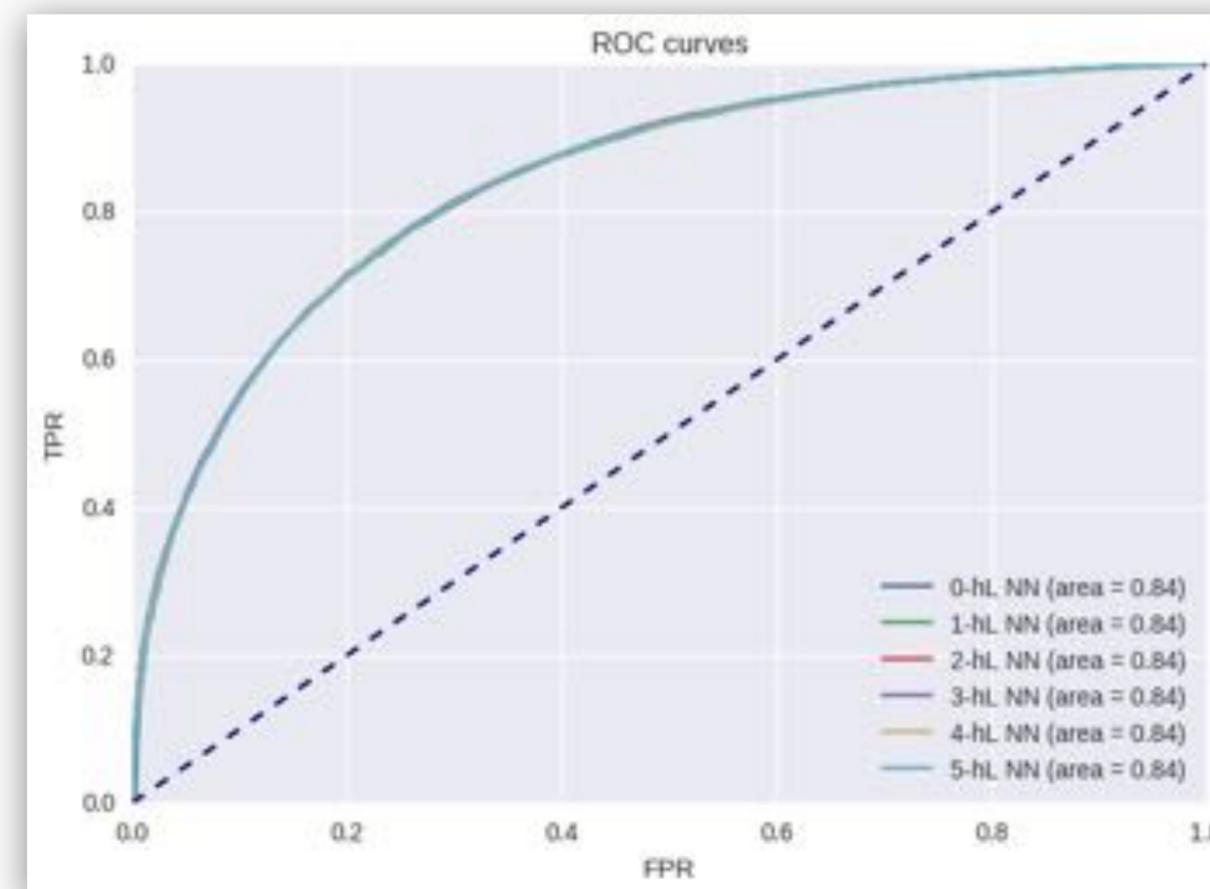
# Training Deep Models



Some networks  $10^{10}$  weights

# Prediction for the ED?

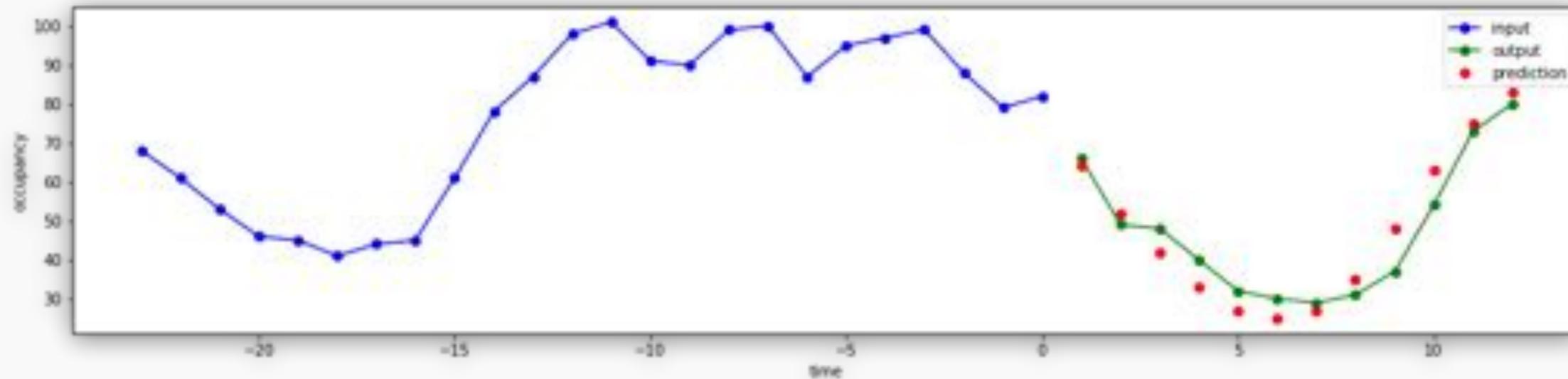
- We can now use more contextual data for prediction
- Per patient prediction of admission & destination
  - Age, triage, presenting problem
  - Previous visits, labs, medications
  - Problem list (or ICD codes)
- ED Occupancy
- Resource utilisation
- Detection of patients ready for discharge



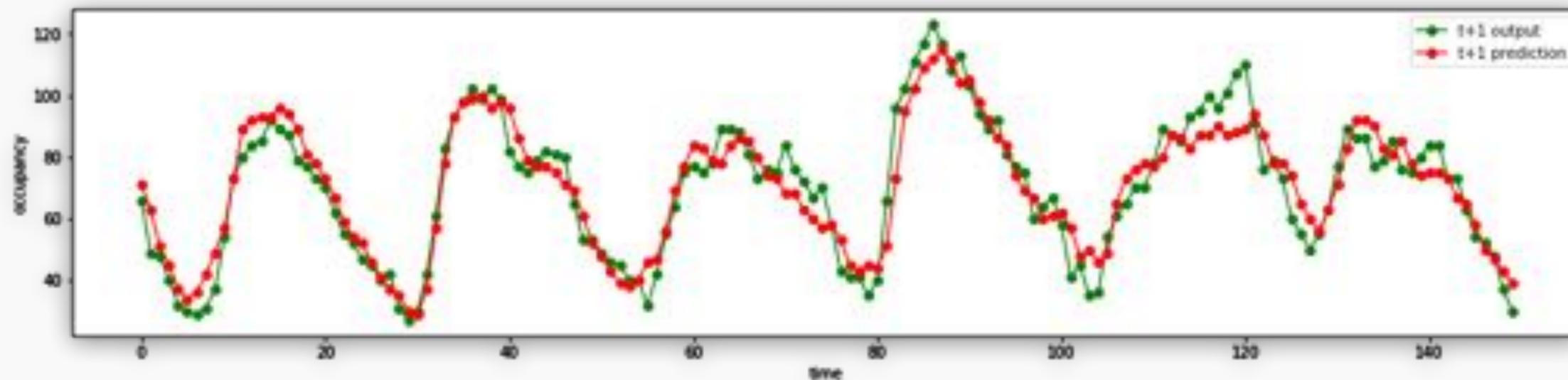
Admission Prediction AUC=0.84

# Occupancy Prediction

- 12 hour occupancy prediction model



- Multiple models (e.g. 1, 3, 6, 12, 24 hour models)



Physician Utilization



Legend: ● Triage 1 ● Triage 2 ● Triage 3 ● Triage 4 ● Triage 5

Chance of ED Block - Next 6 hrs

78%

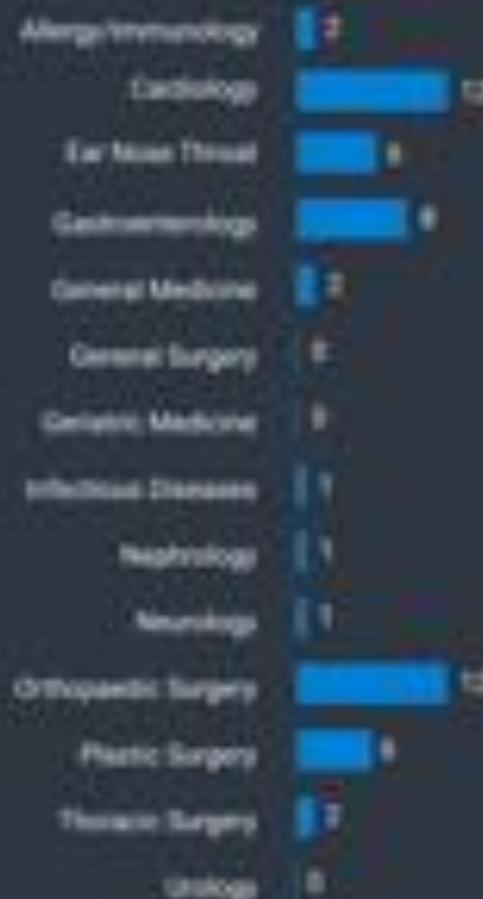
Wasted Minutes Last 24 hrs

258

Wasted Minutes by Specialty Last 24 hrs



Predicted Admissions by Specialty - Current Patients





Better, faster decisions

Thank You