Establishing an ambulatory care service using point-of-care testing diagnostics

ABSTRACT

The use of ambulatory emergency care services in the NHS has been shown to reduce the emergency inpatient burden and enhance the overall patient experience, while demonstrating a cost saving to the NHS. At the James Paget University Hospital point-of-care testing was used as an enabler within an evidence-based lean service redesign to successfully set up a novel unit. A 3-month pilot period, with limited operational times, showed a dramatic improvement in patient flow through the acute medicine pathway, with an equivalent of 59 bed days saved during the pilot period. Further expansion of the unit to a dedicated area with full 7-day opening allowed a continued improvement in performance. This resulted in a mean length of stay of 115 minutes (a 54% reduction from pre-baseline), and just 6.1% of an average of 18.1 daily attendances were converted to full admission. This demonstrated a clinical, operational and financial benefit, allowing improved clinical outcomes.

In recent years the NHS has seen a dramatic rise in the number of inpatients and subsequent bed occupancy levels (McCallum et al, 2010; Bardsley et al, 2013; NHS Elect, 2016). This has resulted in an unprecedented operational challenge to hospitals, especially when combined with the current need for streamlining and generating cost and efficiency savings across all aspects of health care, which results in increased staffing pressures and negatively impacts upon patient experience (Dean, 2013). There is increasing evidence that ambulatory emergency care services can play an instrumental role in reducing the inpatient burden, improving patient management and enhancing the overall patient experience (Bardsley et al, 2013; NHS Elect, 2016).

The ethos of ambulatory emergency care is the identification and management of patients with acute medical conditions who should not require overnight admission (McCallum et al, 2010; Ambulatory Emergency Care Network, 2012). Estimates demonstrate that ambulatory treatable conditions managed through conventional admission streams account for up to £1.42 billion of the national NHS budget per year (The King's Fund, 2012a). A predicted 50% reduction the number of 1- and 2-day admissions could save the NHS an additional £683.8 million (NHS Elect, 2016).

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Organizational context

The James Paget University Hospital is a 484-bedded district general hospital in the east of England. It had previously used a bay within its acute medical unit to provide ambulatory emergency care-style services in conjunction with a specialist nurse-led deep vein thrombosis clinic. The previous service model saw an average of 25.1 patients per month with a mean length of stay of 250 minutes. At an average of less than one patient per day, it was clear that the service was not meeting patient demand or providing associated operational benefits. This presented an opportunity to redesign and implement fundamental work process change to the existing investigation and treatment pathways. The subsequent quality improvement project established a new ambulatory care unit with the specific goals of improving patient flow, outcomes and experience.

Rationale for point-of-care testing

When beginning the process of redesigning ambulatory care pathways, it was considered that using point-of-care testing diagnostics could hold the key to significantly reducing the overall patient length of stay. It is now widely accepted that the reduced specimen turnaround times provided by point-of-care testing can potentially help to reduce the time in which patient clinical review is undertaken, in turn offering improved patient outcomes, increased patient satisfaction and, importantly, a possible reduction in costs (Luppa et al, 2011).

However, when point-of-care testing is provided as a standalone solution, it is often unable to generate desired improvements unless accompanied by system process changes, as laboratory test turnaround times may not be the rate-limiting step in a patient management process (Pearson, 2006). By changing the processes and overall system in which point-of-care testing is used, new approaches to patient management can be engineered, particularly those focussing on patient-centred care, as integrated point-of-care testing devices are well suited to increasing patient involvement in the decision-making process and reducing the patient's perceived sense of waiting (Marshall et al, 2012; DuBois, 2013).

Additionally, the majority of current health systems are based upon pathology testing taking place in a centralized laboratory and are not configured to use point-of-care testing effectively. Thus new innovative processes are needed to change traditional testing methodologies – aligning service delivery and workflow to ensure real-time availability of results to affect patient management (Jani and Peter, 2013).

Consequently, James Paget University Hospital formed a working agreement with Abbott Point-of-Care to provide the i-STAT platform and Emerald CEL-DYN full blood count analyser for an initial 3-month pilot, coupled with service redesign expertise provided by Operasea Ltd – experts in Six Sigma improvement methodology.

Service redesign process

Operasea Ltd helped the Trust-based project team to use quality improvement

AMBULATORY UNIT INVESTIGATION PANEL																
AMBULATORY PATIENTS	Chem 8	INR/PT (iSTAT)	FBC	ABG (iSTAT)	D-dimer	TROP	TFT	G&S	Haematinics	Urine	B/C	BM	ECG	CXR	CT	CLINIC R/V
Anaemia	Y		Y					Y	Y	Y		IF DM	Y			Haem/Gastro/Acute Med
Arrhythmia/AF	Y		Y			bocn	Y					IF DM	Y			Acute Medical
Asthma	Y		Y	Sats <94%						Y	temp >38	IF DM	If tachy	Y		Acute Medical
Cellulitis	Y		Y								Temp >38	If DM				Acute Medical
Chest Pain (Cardiac)	Y		Y	Sats <94%		Y						IF DM	Y	Y		?Chest pain clinic
Chest Pain (Pleuritic)	Y		Y	Sats <94%	Y						Temp >38	IF DM	Y	Y		Acute Medical
COPD	Y		Y	Y						Y	Temp >38	IF DM	Y	Y		BOCN
Diabetic	Y		Y							Y		Y				BOCN/Endocrine
Epilepsy	Y		Y							Y		IF DM	Y		OPA (1ST)	BOCN/Neuro
Headache	Y	Y	Y							Y		IF DM	Y		BOCN/OPA	
Heart Failure	Y		Y									IF DM	Y	Y		HF nurses
LRTI/Pneumonia	Y		Y	Sats <94%							Temp >38	IF DM	Y	Y		BOCN
PE	Y	Y	Y	Y	Y							IF DM	Y	Y	?OPA <48 hrs	Acute Medical
Pleural Effusion	Y	Y	Y									IF DM		Y	OPA	Acute/Resp/Oncol
Syncope	Y		Y	Sats <94%		bocn				Y		IF DM	Y	Y		BOCN
UTI (not confused)	Y	If on warfarin	Y							Y	Temp >38?	IF DM	If tachy			
DVT	Y	Y	Y		Y							IF DM				
Ascitic Drains	Y	Y	Y									IF DM				Gastro/Acute Med

Figure 1. Ambulatory unit investigation matrix. ABG = arterial blood gas; AF = atrial fibrillation; B/C = blood cultures; BM = blood glucose; BOCN = based on clinical need; COPD = chronic obstructive pulmonary disease; CT = computed tomography; CXR = chest X-ray; DM = diabetes mellitus; DVT = deep vein thrombosis; ECG = electrocardiogram; FBC = full blood count; G&S = group and save; INR = international normalized ratio; LRTI = lower respiratory tract infection; OPA = outpatient appointment; PE = pulmonary embolism; PT = prothrombin time; TFT = thyroid function test; TROP = troponin; UTI = urinary tract infection.

methodology (including Lean Six Sigma tools such as project planning, stakeholder salience analysis and process activity mapping) to understand the current system. This process of identifying the current state allowed the team to develop an evidence-based ideal future state to fulfil predicted demand, while also highlighting focus points, such as point-of-care testing, to catalyse this change (Baker et al, 2010). Quality improvement methodology was also used to provide governance for the processes as they were developing, and obtained multiple stakeholder input to identify and resolve potential issues.

Undertaking the ambulatory emergency care redesign in this manner, the team first defined 'value' within the process (reduced length of stay) and then focused on essential goals to achieve this (de Sousa and Carpinetti, 2014). To optimize this process required close interdepartmental collaboration with the emergency department, a conscious breakdown of the traditional emergency floor NHS silo and integration of ambulatory emergency care services into the existing emergency care set-up (accident and emergency and acute medical unit), so complying with national best practice guidance (McCallum et al, 2010). Furthermore, this provided a foundation to meet improvement objectives defined by the Institute of Medicine (2001), stating that all health-care systems should provide patient-centred, timely and efficient care in a safe, effective and equitable manner.

Redesigned ambulatory emergency care pathways within the Trust supported the attainment of these objectives through:

- The use of national guidance to enable early identification of suitable patients, such as those with chest pain, cellulitis or suspected pulmonary emboli (Ala et al, 2012)
- Patient risk stratification through discussion with experienced clinical staff (Hamad and Connolly, 2018)
- Expedited investigations
- Appropriate treatment and discharge planning controlled and defined by condition-specific patient management algorithms and the involvement of senior decision makers (consultant, registrar or nurse practitioner) at the first point of patient clinical contact (Royal College of Physicians, 2007; NHS Elect, 2016).

Work processes were specifically designed to integrate the role of nurse practitioners as the key staff group within the unit to provide strong leadership and accurate, early patient assessments (Carter, 2014).

This project resulted in the identification of 18 commonly occurring ambulatory care unit suitable conditions and a modelled demand of 20 attendances to the unit per day, with the expectation of discharging 90% of this cohort. A condition-specific matrix (*Figure 1*) was developed to ensure that standardized care pathways were used.

Pilot results

During the initial 3-month pilot, the newly developed ambulatory care unit model (operational on weekdays only between 08:00 and 18:30) demonstrated dramatic

Table 1. James Paget University Hospital ambulatory care unit pilot performance data

	Total no of patients	Average no of patients seen per day	Mean length of stay (min)	Conversion rate*
Month 1	101	5.1	127	11.9%
Month 2	143	6.5	161	14.7%
Month 3	181	9.1	150	18.2%

** the conversion rate is the percentage of attendances that were converted to a full hospital admission with a hospital length of stay of at least 1 day*

Table 2. James Paget University Hospital ambulatory care unit full year data

	Total no of patients	Average no of patients seen per day	Mean length of stay (min)	Conversion rate*
January	498	17.2	107	7.4%
February	446	15.4	117	7.6%
March	367	12.7	115	10.1%
April	317	13.2	112	6.0%
May	352	16.0	115	5.7%
June	475	19.0	116	6.3%
July	587	20.2	102	4.6%
August	541	19.3	110	4.6%
September	491	18.9	113	5.1%
October	636	20.5	131	7.2%
November	626	20.9	116	5.3%
December	678	21.9	122	4.7%
Average	501	18.1	115	6.1%

** the conversion rate is the percentage of attendances that were converted to a full hospital admission with a hospital length of stay of at least 1 day*

improvements in patient flow through the acute medical unit, despite an overall 7.6% year-on-year increase in Trust medical admission activity. The process change reduced the length of stay from 1.04 to 0.8 bed days within the acute medical unit, despite only 26.1% of patients being managed through the ambulatory care unit. The mean length of stay for this patient cohort reduced by 40.8% from an established baseline of 250 minutes (*Table 1*). As expected, an 8.2% increase in the number of same-day discharges was seen (zero length of stay admissions) in the acute medical unit, with an associated decrease of 8.9% in 1-, 2- and 3-day length of stay patient admissions – equating to 59 saved bed days during the pilot period. The findings of the pilot were essential in producing a successful business case to establish and develop the service, while demonstrating the importance of scaling up performance gradually to allow staff to become comfortable with the novel working practices.

Service expansion

Following on from the success of the pilot period a permanent ambulatory care unit service was achieved through a successful business case which demonstrated clinical, operational and financial benefits, the latter equating to £1.098 million per annum. The business case enabled enhanced staffing levels, extended 7-day working hours, and an expanded point-of-care testing test cluster including the Abbott i-Stat (electrolytes and blood gasses), Sysmex XN-450 (full blood count), and Radiometer AQT 90 Flex (D-dimer). Whole year data are demonstrated in *Table 2*.

Table 2 demonstrates both scalable and sustainable improvements afforded by the ambulatory care unit model, resulting in a mean length of stay of 115 minutes with an initial clinical review within 13 minutes, a conversion rate (% admissions) of 6.1% and an average of 18.1 patients seen per day, alongside a reduction of 54.0% in length of stay from the pre-pilot baseline. In addition to the operational performance enhancement illustrated, the unit demonstrated improvement in patient 30-day mortality outcomes – from 4.5% of all patients seen through the previous service, this dropped to 0.7% for all attendances seen through the new service.

While this example shows how a quality improvement approach can demonstrate significant improvements within the acute service it was not without some obstacles. The removal of the ambulatory patient cohort from the normal admission stream lead to an overall higher acuity of patients within the acute medical unit and as such lead to a slight reorganizing of nursing staff for the acute medical unit. There was difficulty with some overall buy in across the trust with the unit's space being used as part of the bed base at times, particularly during high pressure periods. This was overcome using physical barriers to beds being put into the unit. The use of novel governance procedures within the unit led to some difficulty integrating with the existing trust documents, which unfortunately led to some duplication while the two sets of documents were amalgamated.

Conclusions

The overall changes to process and adoption of the ambulatory model (Bardsley et al, 2013), along with integration of point-of-care testing and evidence-based lean service redesign, has allowed the James Paget University Hospital to provide emergency medical patients with efficient, high quality care, while creating additional hospital capacity by seeing, treating and discharging patients on the same day. By increasing both staff and patient engagement, this project has demonstrated the ability to improve clinical outcomes and patient experience (The King's Fund, 2012b). This has resulted in a reduced

length of stay for this patient cohort and, in turn, created additional hospital bed capacity through a process optimized system designed to support safe discharge and appropriate follow-up. This is underpinned by rapid assessment through senior decision makers at the first point of clinical contact and timely diagnostic results. **BJHM**

Conflict of interest: Mr P Weihser has received honoraria for undertaking international speaking engagements for Abbott Point-of-Care and Bayer; Dr D Giles has received honoraria for undertaking speaking engagements for Bayer.

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KEY POINTS

- Process-based service redesign using point-of-care testing as an enabler can deliver clinical, financial and operational benefits.
- Expedited diagnostics coupled with early senior clinical decision maker review enables a reduction in length of stay across the emergency floor.
- A multidisciplinary project team and adherence to quality improvement methodology were essential.
- This data-driven approach is key to demonstrating this project's success.