



# CareCosting

Presents Plixology®

## Supply and Demand foundation paper

A value-based healthcare approach to Emergency Care

Seb Kerr / Neil Milner



*"if you want something new you have to  
stop doing something old"*

Peter Drucker

[www.carecosting.co.uk](http://www.carecosting.co.uk)

## Supply and Demand foundation paper

### A value-based healthcare approach to Emergency Care

Seb Kerr / Neil Milner

#### The problem

We need to meet patient demand, reduce waiting times and reduce hospital admissions but we have no more money to spend.

#### Background

This problem is common the world over and Emergency Departments in the UK are under more pressure than ever before. A reduction in real-time funding over the last ten years has seen staff burnout, longer waiting times and a service firefighting every day to cope with the demand on the service.

With less accessibility to Primary care services such as GPs, Emergency Departments are overwhelmed with more and increasingly complex demands.

However, in modelling terms, the PLICS approach to understand Accident and Emergency (A&E) services has delivered no tangible benefit in helping to address this problem.



#### History of Patient Level Information and Costing System (PLICS)

All UK hospitals are required to submit detailed costs at the patient level, by resource and activity, on an annual basis to the UK regulator. This is the largest collection of detailed patient costs in the world. An average hospital submission is many millions of rows of data. This submission includes each A&E attendance. You would expect with all this data this problem could be addressed. Unfortunately, this is not the case and there are a number of key reasons why this does not deliver the value that is needed.

#### The PLICS model is primarily required to track a tariff

The key objective of the submission is to inform a tariff mechanism for payment. All attendances are clinically coded and grouped into a HRG (Healthcare Resource Group).

These HRGs form the basis for payment and within A&E there are less than ten HRGs that form the basis for such payments.

Also, price and cost are two quite different things, and price has no bearing on the cost of providing healthcare

Because of this the PLICS "rules" for costing are overly simplified.

With this in mind, the nationally defined PLICS rules indicate that A&E cost should be traced to patients based on treatment time. While superficially this makes some sense and appears to follow Time Driven ABC principles, it obscures the opportunity to solve the problem.

#### The drivers of cost in PLICS only focus on patient demand

With treatment time and the number of patients forming the basis for understanding cost, there are only two levers the hospital can pull to appear to improve their performance, namely by either;

- Seeing more patients and reducing average treatment minute unit cost of the resources used OR
- Increasing the amount of time spent treating each patient, effectively increasing the number of demand minutes and therefore reducing their unit cost per minute.

**Neither of these help with productivity  
or improve the patient experience!**

# Understanding the problem

## Cost has to be balanced with non-cost metrics

PLICS focusses on cost and not information. By simply looking at the cost effect this presents no context by which it can be understood. The Information side of PLICS should be about bringing in non-cost metrics to provide further understanding and to help address the problem.

## More data and detail does not always mean a better model

PLICS delivers on data and detail, yet this wealth of data delivers little of value to a hospital that wishes to improve performance and deliver better patient care. PLICS therefore becomes yet another data liability for the Hospital already drowning in regulatory and operational data reporting needs.

## The cost is seen as being "spent" by the patient

The hospital spends money on employing resources to meet the patient demand. Cost at the patient level is merely the effect of these resourcing decisions.

## Focus is on the patient attendance and not the patient

As the tariff payment for A&E is based on attendances, the focus of the PLICS submission is on each attendance and not the patient. So the P of PLICS is actually an A for attendance.

## The PLICS model does not reflect causality

At the root of all of these shortcomings is one aspect; the PLICS model is not based on causal principles and is therefore limited in its use at best, and is misleading at worst. Essentially the PLICS model is not a digital twin of what physically happens in the A&E department.

## Plixology

Understanding Supply AND Demand In order to understand causality, it is imperative that both resource supply and patient demand are understood in sufficient, actionable detail.

This data is already available and can be understood at a level where it can be used to effect tangible change and start to help to solve the problem. Especially as the hospital can control and influence supply more than demand.

In PLICS the term "cost driver" is overly simplified as it typically focuses on patient demand. Whilst in many cases reducing the time each activity takes is a good thing, this isn't always the case and particularly in healthcare this can lead to a reduction in quality, put more pressure on healthcare professionals, and ultimately lead to significantly more cost and patient demand being generated further down the line. In reality, there are supply drivers and demand drivers, or in ABC terms, resource drivers and activity drivers.

## Operational variation versus clinical variation.

Considerable research and analysis focusses on removing clinical variation. Clinical variation often focusses on homogenising care and identifying variances in clinical practice. For example, why for the same condition were more tests requested for Patient A versus Patient B?

Healthcare is complex and doctors and nurses are some of the most skilled professionals on the planet because of this. While pressure to reduce clinical variation may yield some benefits it can over-simplify healthcare and devalue the operational decisions that these immensely talented people have to make.

The good news is that focussing on operational variation has the potential to help improve performance and patient care and begin to solve the problem. With the wealth of data now available we can begin to understand and identify operational variation and the benefits this can reveal.



## Costing Supply & Demand presents Opportunity

Traditional PLICS gives one perspective of cost allocation.

As already discussed, in PLICS the basis for allocating cost based purely on patient demand presents one perspective and this, of itself limits the operational benefits that a hospital can gain from PLICS, as is illustrated below.

Figure A shows the current limitations of costing based on patient demand only. Figure B demonstrates how, by bringing in resource supply and expanding the patient demand data to include these resources, the opportunities for operational improvement begin to present themselves.

Demand		
Total Cost		
Patient		
	A	B
Total Treatment mins	120	45
Cost Per Minute	£6.06	£6.06
Cost	£727	£273

Figure A

Supply				Opportunity		
Nurse				Hour		
Total Cost = £1,000						
	1	2	3	16:00 – 17:00	17:00 – 18:00	
Start Date Time	1 <sup>st</sup> Jan 16:00:00	1 <sup>st</sup> Jan 16:00:00	1 <sup>st</sup> Jan 17:00:00			
End Date Time	1 <sup>st</sup> Jan 18:00:00	1 <sup>st</sup> Jan 18:00:00	1 <sup>st</sup> Jan 18:00:00			
Total Supply Mins	120	120	60	Supply Minutes	120	180
Cost	£400	£400	£200	Supply Cost Per Minute	£3.33	£3.33
				Supply Cost	£400	£600
				Utilisation	50%	83%
				Opportunity to Explore	£200	£102
				Demand Cost	£400	£600
				Demand Cost Per Minute	£6.66	£4.00
				Demand Minutes	60	150



Demand		
Patient		
A	B	
1 <sup>st</sup> Jan 16:00:00	1 <sup>st</sup> Jan 17:00:00	Start Date Time
1 <sup>st</sup> Jan 18:00:00	1 <sup>st</sup> Jan 17:45:00	End Date Time
120	45	Total Treatment mins
1	2	Nurses Present
120	90	Total Nurse mins
£640	£360	Cost
100	20	Wait Minutes
N	Y	Admission

Figure B

In practice, operational variation occurs hour by hour, day by day.

By costing supply and demand, causality begins to be reflected, leading to the potential for action and change.

# Identifying the opportunity

## Understanding Supply & Demand — Practical Example

In this simple example we focus on one resource, Nursing in A&E, and one activity, Treat Patients in A&E.

### Step 1 – Understand Supply

The general ledger helps us to identify the total spend on A&E Nursing in the period. Using the HR roster, we are able to see who worked when. Using this data we can see the actual supply minutes available and their cost, for each hour of each day

### Step 2 – Understand Patient Demand

Demand is made up of the following three components which form the basis of understanding the patient demand for the A&E service

- Attendances** - How many attendances were treated and for which patients? This defines the universe of patients demanding treatment from A&E in a given period.
- How long did the treatment take?** - The longer a patient was treated, the more demand they placed on the A&E service – The same as the recommended approach for costing A&E attendances
- How many nurses were present at each treatment?** – Acuity of care is not considered in the national PLICS approach, yet it has a huge bearing on demand. A cut finger may take time to be treated by a single nurse, whilst a patient requiring resuscitation may be stabilised quickly but require an army of resources to make this happen

$$A * B * C = \text{Patient Demand}$$

We also know the start and end date and time of each treatment so we can begin to understand the aggregate patient demand each hour of the day

### Step 3 – Understand utilisation

By understanding supply and demand each hour of the day we can begin to understand and identify where the opportunity is for change

### What are the results?

#### Supply

Supply minutes: 23.6m

Cost per supply minute: 56p

#### Demand

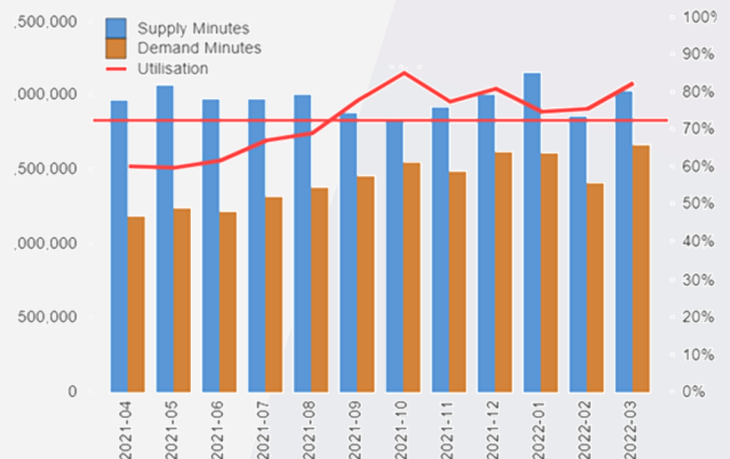
Demand minutes: 17.1m

Av. cost per demand minute: 77p

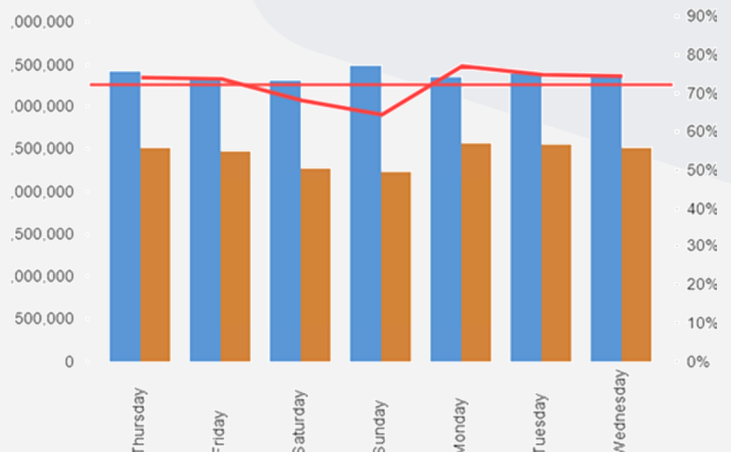
Utilisation: 72.4%

Opportunity to explore: £3.68m (28%)

### Supply and demand minutes by calendar month

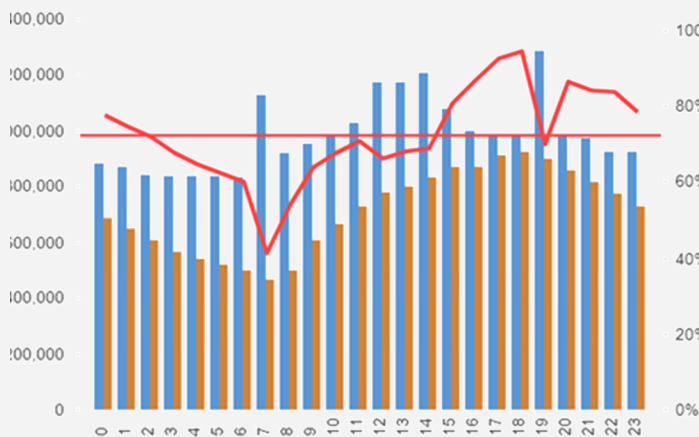


As demand increases, pressure on the service increases as demand outpaces supply



## Supply & Demand by Hour

In the example below, A&E services are under pressure from 4pm onwards with two spikes at 7 am and 7pm indicate when staff shifts change. One occurring at the quietest time for the department, and the other occurring nearly at the peak of demand.



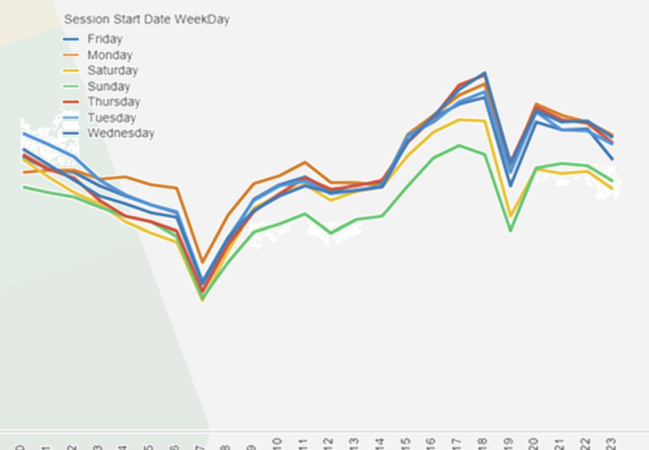
Each of these data points are also fully costed. Where utilisation is low, the effect of this is increased costs for patients treated in that hour. Where utilisation is high the reverse is presented.

This also indicates pressure on the service is high at different points in the day.

***“The closer you come to the capacity of a resource the greater the damage is done by a disruption”***

Source: Eliyahu M. Goldratt

With such high levels of demand and inconsistent supply levels, the chances for disruption become higher when A&E is at its busiest. The utilisation chart is also consistent over each day of the week.

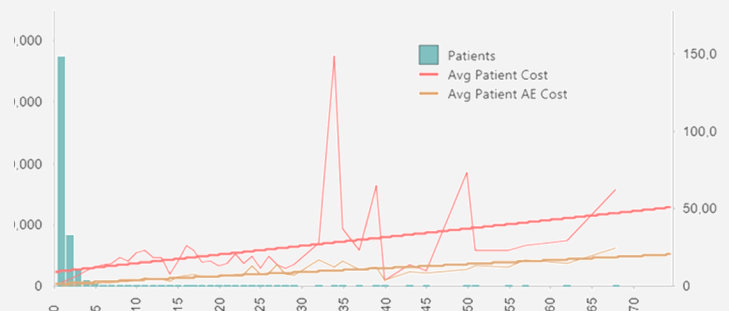


**Actions:** This approach begins to give insight that can be acted upon with a chance to improve both productivity and patient care. By changing resource levels utilisation can be smoothed out and Patient demand for medical resourced used more effectively.

Using such data to inform future staffing patterns offers a real opportunity to reduce operational variation without impacting negatively the care given to patients. Opportunities are here however: efficient use of resources.

In the next example, A&E attendances are plotted based on the patient, and the number of attendances within a one year period. The majority of patients treated by the hospital do not attend A&E (62.5%) and a further 27.7% use A&E only once in the year.

However, there is a significant “tail” of patients that uses A&E services on a regular basis. What we also observe is both an increase in A&E costs (as you would expect the more attendances, the more cost) but also a considerable increase in cost across the whole hospital to care for these patients.



### In Summary

Understanding Healthcare is a complex task, but logical causal modelling at the patient level has the ability to shine new light on improve hospital productivity and improving healthcare for all.

The approach we have described is not for the faint hearted, with thousands of resource drivers and millions of activity drivers across a complex organisation such as an NHS hospital.

However, the benefits of such analysis have the potential to far exceed its related cost, turning existing PLICS data from a data liability into a true data asset.

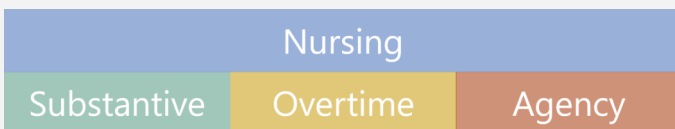
## Next Steps

More work is needed to further understand Nursing within Accident & emergency Departments

This is the first step on the journey to understanding A&E Nursing, and the cause and effect of supply decisions on cost. However, the following key areas will be explored further as a part of the next case study.

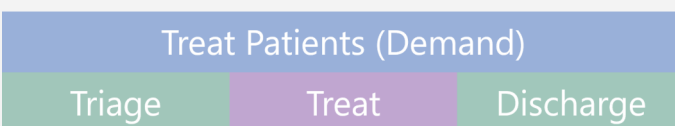
**Understanding Supply further:** Currently Supply is all Nursing in A&E – This effectively gives us the same cost per supply minute across the year

However, nursing supply is made up of a mix of resources. Substantive staff at different bands employed by the hospital, overtime worked, bank and agency staff.



By understanding the staff mix per hour, a cost differential can be observed which also highlights key areas where the hospital has to rely on more expensive variable resources to meet patient demand.

**Understanding patient demand further:** Demand is currently being understood in the context of one activity. By understanding how time is spent managing the flow of patients through A&E by hour, a greater understanding of the dynamics of patient demand can be better understood.



**Improving waiting times:** Currently patient demand shows when patients are treated. However, if we want to reduce waiting times we also need to look at when that demand presented itself. By offsetting each patients' treatment time to when they first presented to A&E and when staff were available to meet this demand, patients can be treated more quickly and the pressure on the A&E service minimised.

**Understanding admissions:** By identifying which attendances led to admission, we will be able to better understand if pressure on the system is a contributing factor that leads to such admissions. However, targets, measures and decisions are too often made in a siloed way that may improve performance in one area but cause a larger problem to be managed later downstream; an issue to be avoided by seeing the bigger picture.

**Understand the true drivers of cost:** staff satisfaction, absence rates and sickness rates Staff welfare and work satisfaction have a huge bearing on the running of a hospital and it is vital to understand these measures in conjunction with cost and utilisation.



Staff are the healthcare systems most precious resource. Change should not negatively impact staff. A&E is one of the highest pressure work environments in the world, with life and death decisions made on a daily basis. It is the responsibility of all support functions within a hospital to support those on the front-line in caring for patients.

By aligning supply and demand more closely, and ensuring safe levels of staff are in place to meet the demand, some pressure can be removed.

**Managing Demand:** whilst more difficult to do, the opportunity to reduce patient demand for A&E services and consider more appropriate ways to care for patients can now be better understood and inform actionable insights.

Finally, although the study focusses on A&E the use of these techniques are equally possible throughout the Hospital, Outpatients, Theatres, Wards etc will all benefit from this approach.

## Contact CareCosting to claim your **FREE** Plixology Canvas

The Plixology Canvas is a strategic management tool offered free by CareCosting that provides a visual framework for describing, designing, and analysing a trusts Costing function.

The canvas consists of six building blocks that represent the key elements of a Costing department.

Using the Plixology Canvas, Trusts evaluate their Costing function, improve it's performance, and optimize their services. It defines the value proposition, targets focus areas, and aligns resources and activities for optimal efficiency.



### Why you need a plixology canvas

- The Plixology Canvas provides a quick overview of the PLICS model and is devoid of the unnecessary details compared to the traditional business plan.
- The visual format of the Plixology Canvas enhances accessibility and can be understood by anyone.
- It's easy to edit and it can be easily shared with employees and stakeholders.
- It clarifies how different aspects of PLICS are related to each other.
- You can use a Plixology Canvas template to guide an ideas session on defining your PLICS status & strategy.

*"The Christie would like to express our appreciation for the work completed by CareCosting in creating the Plixology Canvas for our organization. This tailored assessment, along with the accompanying Excel toolkit, has been incredibly valuable."*

*CareCosting's expertise in understanding our unique needs and challenges has enabled us to gain valuable insights into our cost management strategy. The tools have provided us with a roadmap to prioritise roll out, focus communication, and improve resource allocation. Thanks to CareCosting, we are better equipped to make informed decisions and deliver high-quality information to our stakeholders while managing expectation effectively."*



**The Christie**  
NHS Foundation Trust

Gavin Rush  
Head of Costing  
The Christie NHS Foundation Trust

In addition to the standard report and the excel tool kit the first 5 enquiries to quote this foundation paper will also receive a free canvas session and tailored report based on it's findings.

seb.kerr@carecosting.co.uk  
07736 827967

neil.milner@carecosting.co.uk  
07506 733093