Essential Action 2:
Capacity and Flow Realignment

BASIC BUILDING BLOCKS

GENERAL GUIDANCE DOCUMENT

6 ESSENTIAL ACTIONS
Unscheduled Care

Healthier Scotland
Scottish Government

BASIC BUILDING BLOCKS

GENERAL GUIDANCE DOCUMENT

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1. 6 Essential Actions to Improving Unscheduled Care

Background

The 6 Essential Actions to Improving Unscheduled Care Improvement Programme was launched in May 2015. In consultation, 6 Essential Actions were identified as being fundamental to improving patient care, safety and experience for the unscheduled care pathways.

The Six Essential Actions

1. **Clinically Focussed and Empowered Hospital Management**
2. **Capacity and Patient Flow Realignment**
3. **Patient Rather than Bed Management**
4. **Medical and Surgical Processes arranged for Optimal Care**
5. **Targeted 7 Day Services**
6. **Ensuring Patients are Cared for in their Own Home**

The aim of the programme is safe, person centred, effective care delivered to every patient, every time without unnecessary waits, delays and duplication

Essential Action 2: Capacity Management and Patient Flow Realignment establishes and then utilises appropriate performance management and trend data to ensure that the correct resources are applied at the right time, right place and in the right format. This essential action includes Basic Building Blocks, Bed Management Toolkit, Workforce Capacity Toolkit and alignment with Guided Patient Flow Analysis.

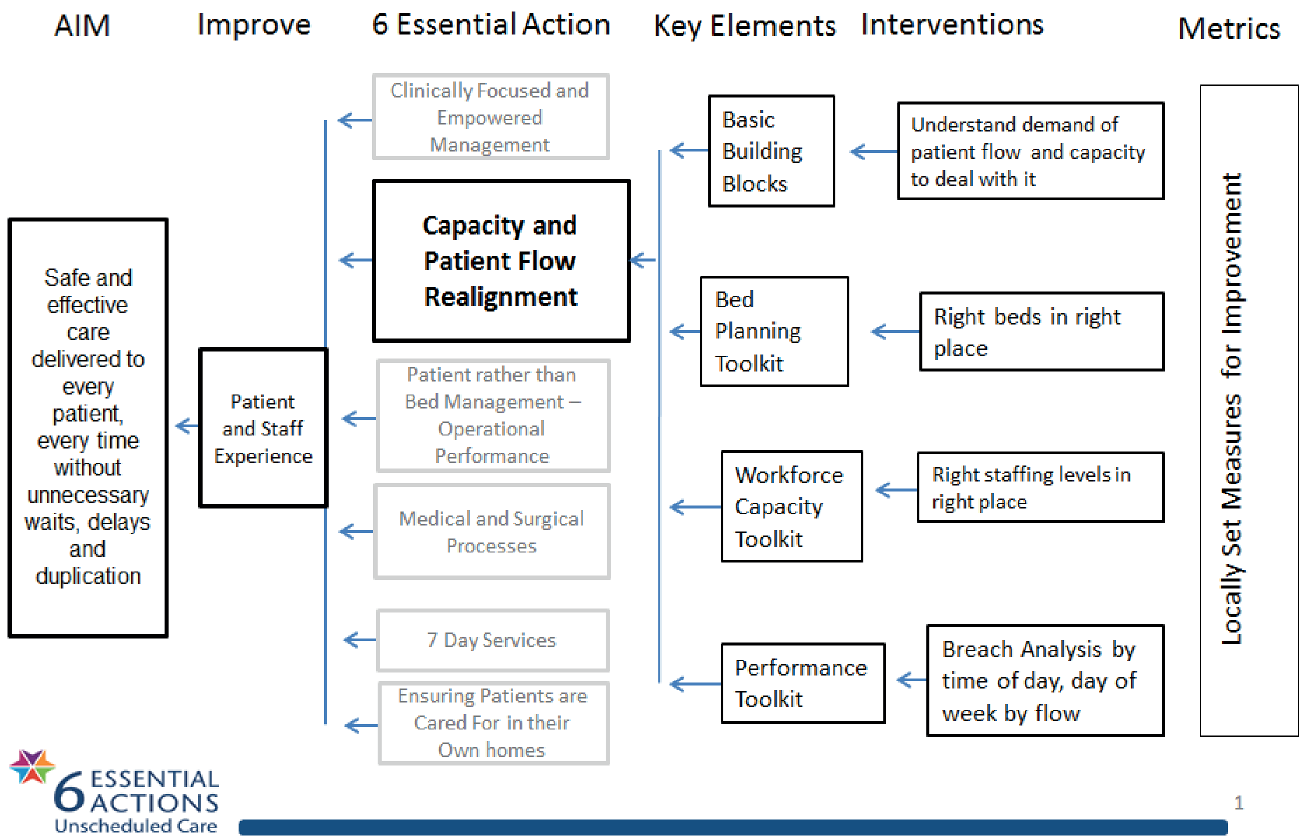


Fig 1.

Purpose

This guidance introduces you to the toolkit for developing **Basic Building Blocks** as the key action within Essential Action 2: Capacity Management and Patient Flow Realignment.

This toolkit offers a systematic approach to developing a Basic Building Block and supports understanding of capacity, demand and patient flow analysis through a hospital site. Developing the Basic Building Blocks will initially give an overview of the site footprint and a basic understanding of patient flow. As you progress through the Basic Building Blocks you develop a deeper understanding of how each sector of demand impacts on the next to cultivate a whole system analysis of capacity and demand.

This toolkit can be used to understand the impact of service redesign and transformation. When fully complete the Basic Building Blocks will allow you to simulate innovations to measure the impact and inform test of change, it will identify measures that will determine if the change has been successful and will offer analysis for development of business case for change.

SUMMARY

The Basic Building Blocks methodology is a systematic approach to the demand and capacity analysis of existing patient pathways.

By using this methodology sites will gain:

- detailed understanding of the existing unscheduled care pathways
- meaningful data which improves understanding of demand at each stage of the patients pathway
- knowledge of demand to support realistic capacity planning to improve the quality of care and patient outcomes
- improved understanding of the cause-and-effect relationships in the system
- support management to identify the numbers associated with a ‘functioning system’
- fuller engagement in utilising data for modelling transformation and service redesign and potential impacts
- in depth analysis to support business case for change

2. Developing the Basic Footprint of Hospital Flow

The first step of the Basic Building Blocks is to understand the current capacity and pathway of patient flow in the hospital site and any support services that ensure patients are cared for in their own home. This may also include additional pathways which reduce admission such as ambulatory care, short stay and clinical decision units.

The footprint diagram (Fig 2.) summarises the emergency patient pathway within an acute hospital, requiring input and care from numerous clinical staff groups and departments/wards. Understanding demand profiles and aligning appropriate capacity at each stage of the patient's pathway is vital to ensure we understand the complexity of patient flow and how it is managed.

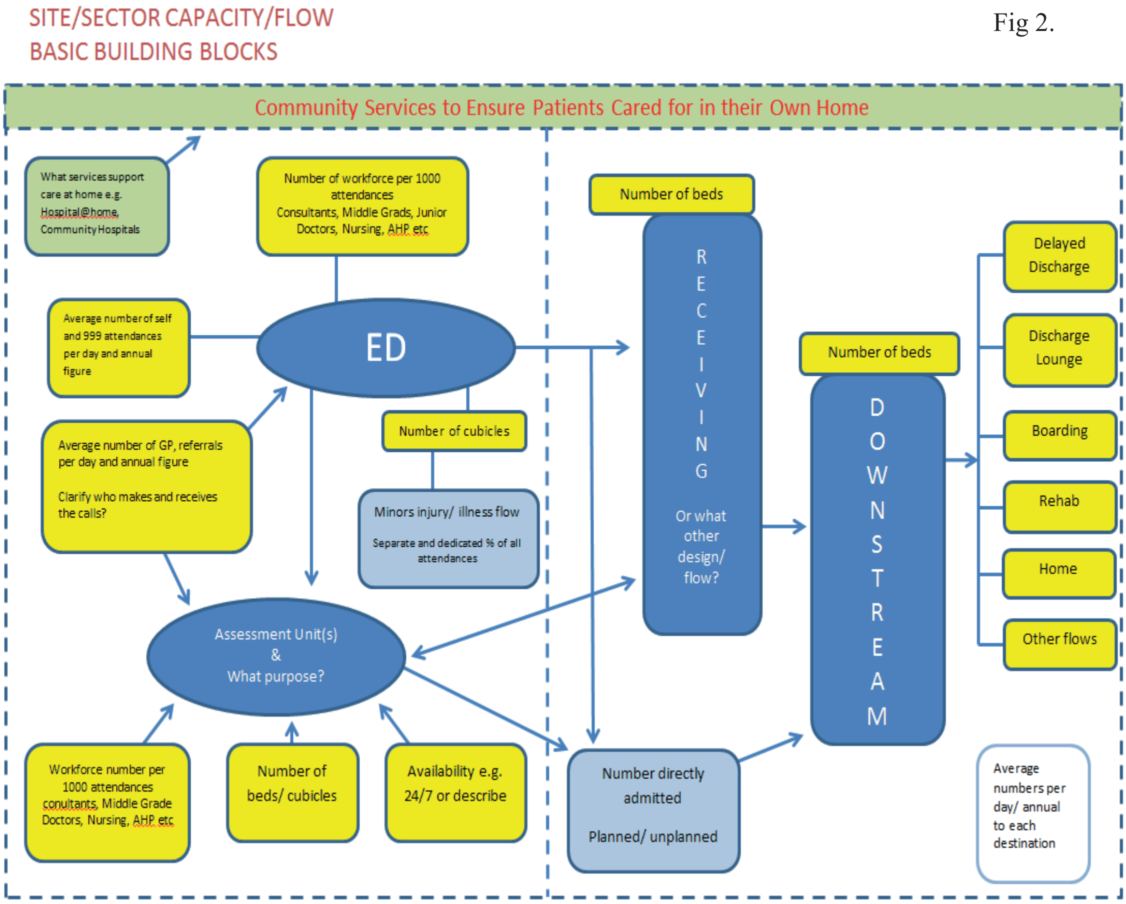
Before launching into data analysis it is valuable to invest time in the preparation of your footprint diagram (Fig 2.), and process mapping your patient's pathways (Fig 3).

Engaging with clinical teams, managers and data analysts is vital at this point to ensure that the complexity of your system is clearly described and broken down into relevant pathways and staging posts. The initial footprint diagram (Fig 2.), and the pathways process maps (Fig 3.) act as an important visual guide for the system and will support the operational team in recognising the key staging posts along the route and the relationship these have within the whole system Basic Building Block information that is produced. The format of the analysis will mirror the process maps reinforcing the link between information and operational management decision-making.

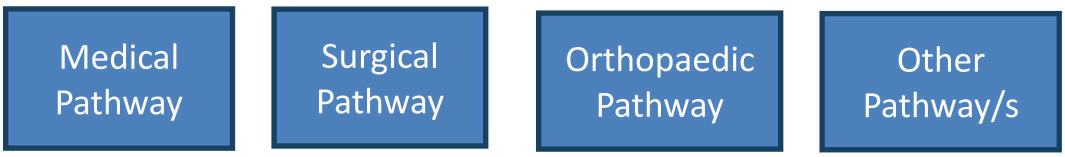
Process Mapping is used to develop a 'map' of a process within a system. It will help you to map the whole patient journey or diagnostic pathway with a range of people who represent the different roles involved. Process mapping can be used to help a team understand where the problems are and identify areas for improvement.
http://www.qihub.scot.nhs.uk/knowledge-centre/quality-improvement-tools/process-mapping.aspx

Stage 1:
The development of an initial footprint which provides a high level summary of the emergency patient pathways within the Acute Hospital

Fig 2.

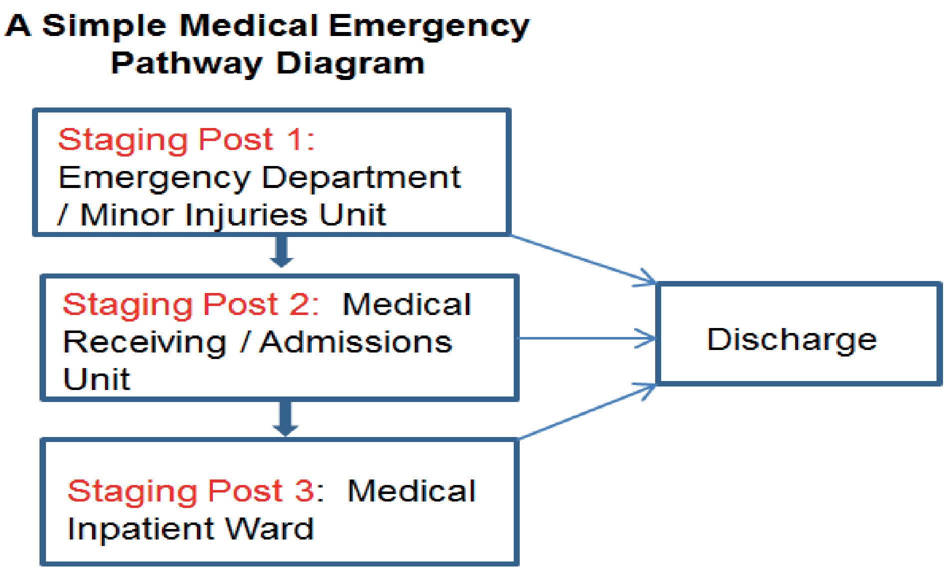


Stage 2:
Identify individual patient pathways within the initial footprint of your hospital



Stage 3:
Process map each individual pathway, identifying all staging posts. An example of a simple medical pathway map is given.

Fig 3.



The Basic Building Blocks is a bottom-up systematic approach to the generation of a demand and capacity analysis report for each staging post within each defined pathway, together creating a demand and capacity summary for the entire pathway. Once each pathway is complete, the resulting suite of reports, together create an over view of demand and capacity within the entire emergency pathway.

The hospital management team can use these reports to create a greater understanding of the hospital system by combining operational knowledge of the existing patient pathways with the 'meaningful data' within the reports. This data will numerically describe demand and capacity at each stage of the pathways, assist in identification of bottlenecks and improve understanding of the cause-and-effect relationships in the system, which can help managers identify the numbers associated with a 'functioning system'.

3. Emergency Department Profiling

The Emergency Department is often a common staging post, appearing as the 1st point of contact for many emergency pathway patients.

As an identified staging post within your basic footprint and pathways you then need to understand the profile of the unscheduled flow though this unit.

There are 4 key areas of analysis for an Emergency Department (ED).

a) Current performance
b) Demand
c) Length of stay
d) Occupancy profiling

a) Understanding Current Performance

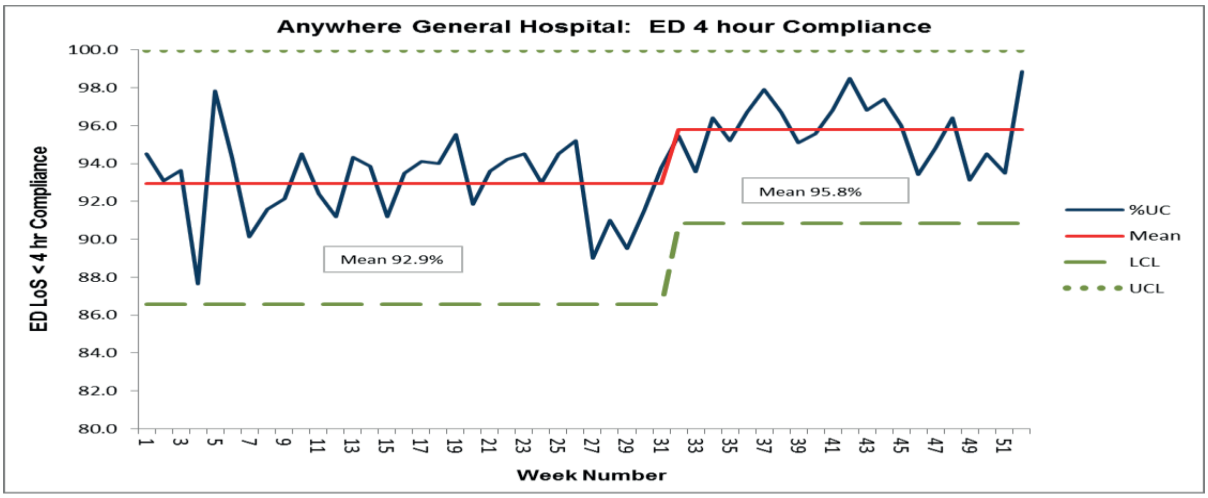
Emergency Access Standard

Weekly monitoring of performance against the Emergency Access Standard for ED should be undertaken routinely. Using statistical process control allows identification of standard variation as opposed to special cause variation. Upper and lower control limits should be re-calculated once a known change to the system has taken place and sufficient data points have been recorded. Recalculation of the Upper Control Limit (UCL) and Lower Control Limit (LCL) is important as this will indicate the current level of variation in the system. Reduced variation will equate to improved flow.

For further information on Statistical Process Control please see:
http://www.qihub.scot.nhs.uk/knowledge-centre/quality-improvement-tools/statistical-process-control.aspx

Operational and Improvement Managers can use this type of chart to track and monitor improvements and changes to the system, with increasing variation or spikes or dips in performance being examined to determine cause.

Fig 4.



Performance by Flow and Day of Week

Analysing Emergency Department data by flow group and day of week is useful to identify the flow group/s with lower performance and average daily performance against the Emergency Access Standard.

For flow group definitions please see:
http://www.ndc.scot.nhs.uk/Dictionary-A-Z/Definitions/index.asp?Search=P&ID=385&Title=Patient%20Flow

Examples of useful analysis are provided in Fig 5.

Anywhere General Hospital Performance by Flow Group Weeks 1 - 52	
Flow Group 1	97.80%
Flow Group 2	96.10%
Flow Group 3	91.20%
Flow Group 4	87.30%

Anywhere General Hospital Performance by Day of Week Weeks 1 - 52	
Monday	87.30%
Tuesday	86.90%
Wednesday	93.50%
Thursday	95.90%
Friday	97.50%
Saturday	96.10%
Sunday	93.10%

Fig 5.

In this example admitted flow groups (3&4) are the lowest performing. Further analysis of the recorded 'reason for breach' codes by flow groups should be undertaken to ascertain the key reasons for patients staying in excess of 4 hours.

It is useful to monitor flow group performance on a weekly basis, particularly during period of improvement work or re-design. Operational and Improvement Managers can use this data to identify the specific flow groups or individual days of the week where performance is lower. Further analysis of these identified days or flow groups can then be undertaken to understand the cause, is it due to patient numbers, staffing levels, changes of practice?

Using the Performance Toolkit will give this information by time of the day and day of the week. This analysis is useful when comparing one week to another to identify where trends emerge and show indications of where further analysis is required using the above method and support information for improvement of waits delays and bottlenecks.

Performance Toolkit
https://performancetoolkit.blob.core.windows.net/doc/toolkithelp.html

Other Useful Measures of Emergency Department Flow

Consider the other data items that are currently collected by your site and how these are used for performance or improvement purposes.

Key Quality indicators for the ED include journey point measures such as:

- time to 1st assessment
- time to 1st assessment by triage category
- time to cubicle etc.

These internal ED indicators are key to the review of the flow of patients within the Emergency Department.

Tables and charts generated to show the 'effect' on flow within patient journeys across each staging post. The example provided in Fig 6. is the 'Saturday' chart of a suite of analysis prepared to examine the average time to first assessment within the Emergency Department by hour by day of the week. In this chart a clear spike in average time to 1st assessment on the Saturday evening is identified. This profile would warrant further analysis of the underlying data and combined with operational knowledge will identify and understand what has caused this increase. Common causes may be due to volume of patients, increased acuity of patients, changes in medical and nurse staffing levels, or a combination of reasons.

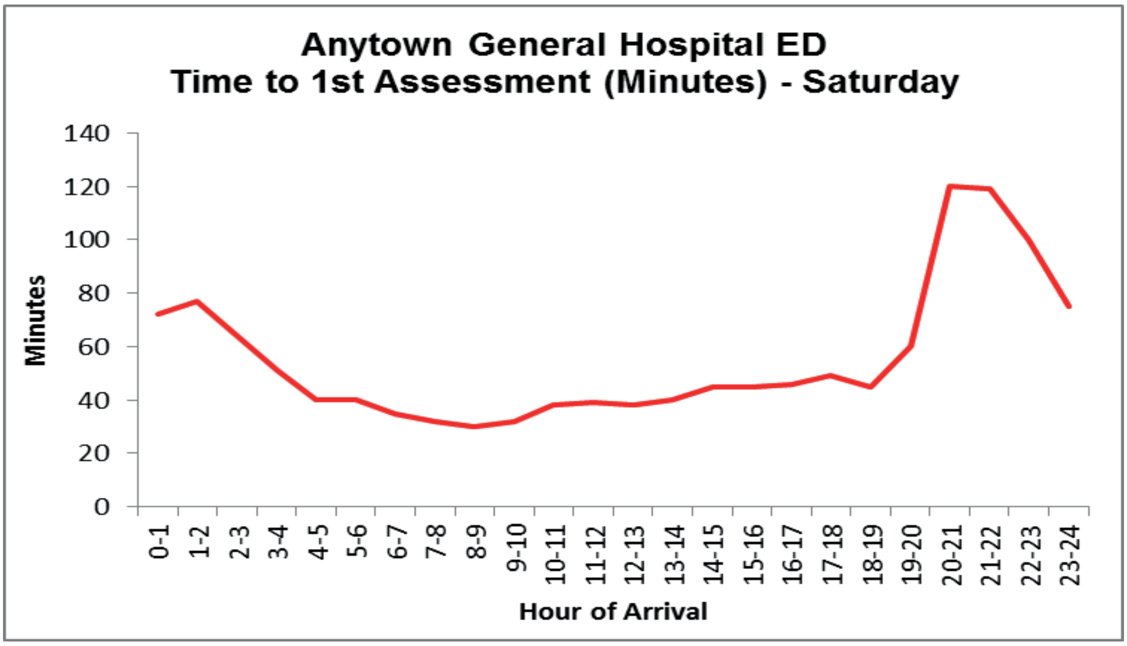


Fig 6.

The aim of this detailed analysis is to understand what causes delay to most patients most of the time.

b) Emergency Department Demand Profiling

Understanding the profile of demand is key to managing on a day to day basis. Such information will feed into daily Hospital Safety Huddles and contribute to determining daily prediction of attendance and admission. It supports the planning of services and resources.

The profiling chart in Fig 7. displays box plots which summarise the key statistics relating to Emergency Department attendances numbers per weekday, based on a 12 month dataset. By using a boxplots to display this information average numbers are determined but also includes more detailed information about the range of attendances per day. This includes minimum and maximum numbers recorded and the 85th percentile average number of attendances.

Daily Profiling
Hospital: Anytown General Hospital
Analysis: ED Attendances by Day (Apr 14 – Mar 15)

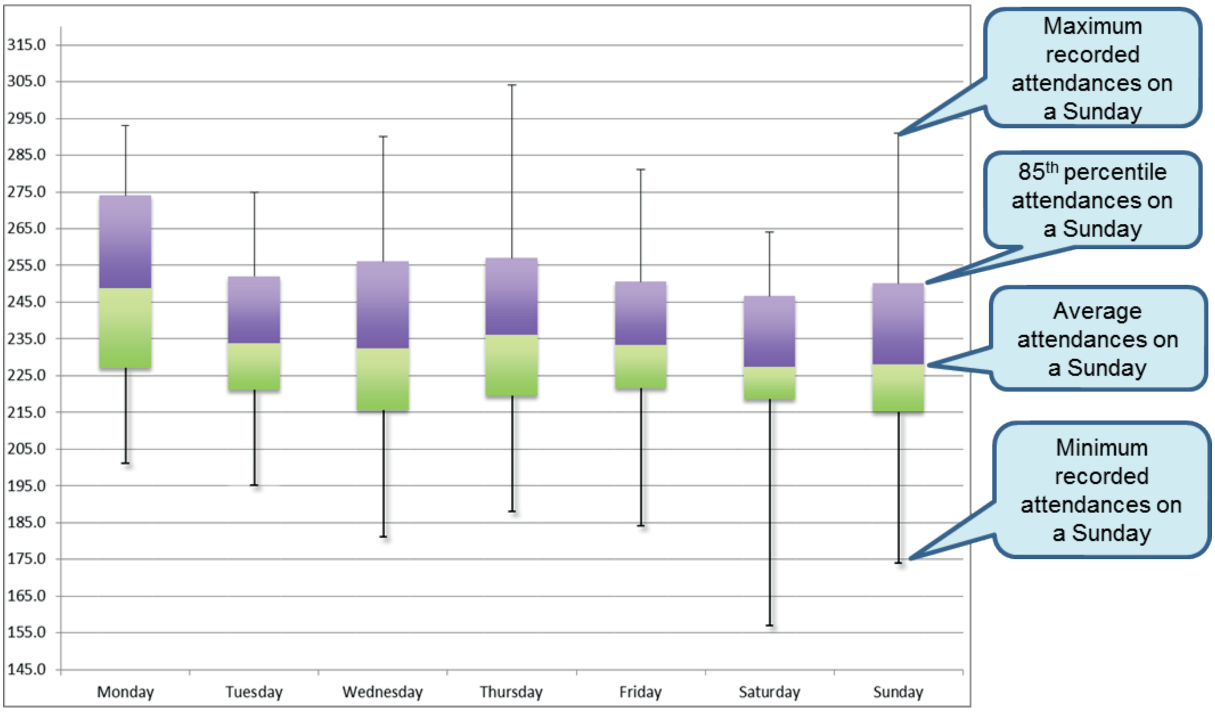


Fig 7.

Summary Statistics							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minimum	201.0	195.0	181.0	188.0	184.0	157.0	174.0
25th percentile	227.0	221.0	215.5	219.5	221.5	218.5	215.0
Average (Mean)	248.7	233.8	232.4	235.9	233.4	227.3	228.1
85th percentile	274.0	252.0	256.0	257.0	250.5	246.5	250.0
Maximum	293.0	275.0	290.0	304.0	281.0	264.0	291.0
Median	253.0	236.0	233.0	234.0	238.0	227.0	230.0

Fig 8.

Understanding the Summary Statistics (Fig 7&8.)

85th percentile: For effective capacity planning it is recommended that the upper quartile used is 85%. i.e. You plan capacity to meet demand 85% of the time. In this example the 85th percentile value on a Sunday is 250 attendances. This means that clinicians and managers can have confidence that on 85% of Sunday's there will be 250 or less Emergency Department attendances.

Average (mean): This statistic is often the most frequently used and as a result is well understood. It is useful to understand average demand levels throughout the week however basing capacity planning on these values should be done with caution, as you are in effect planning capacity to meet demand only 50% of the time. It can however be useful when looking at underlying trends over periods of time. Very often changes in attendance levels or monitoring of system re-design is done by looking at changes to the average attendance levels over a time period.

Maximum and Minimum: Simply the maximum and minimum values recorded throughout the data period for the day. This is useful to understand the full range of the daily attendances and can be further reviewed by using the underlying dataset to identify exact dates of these occurrences. Very often these will be a result of 'special cause' variation, for example post public holidays, specific events. It is always worthwhile to identify these days and examine underlying causes. This can often aid future 'surge' planning.

Using the Summary Statistics

Using a chart, such as the boxplot, can be useful to understand trends and changes in attendance numbers over time. These charts can be produced on a monthly or quarterly basis, and the outputs reviewed to identify changes in patterns, or volume. This type of chart is a good method of keeping track of inter-week variation in attendance levels, as it allows the quick identification of the 'highest' attendance days, not only providing the average numbers, but the range of attendances for that given day of the week. This type of information is very useful when reviewing available capacity, including medical and nurse staffing levels.

Emergency Department Arrival Patterns

Analysis of arrival patterns per hour are essential within the Emergency Department to support effective capacity planning. Capacity includes cubicle space, equipment and staffing resource. In the charts below (Fig 9&10.) the average weekday arrival pattern is compared to the weekend. One noticeable difference is the higher attendance levels from 10.00 pm - midnight at the weekend.

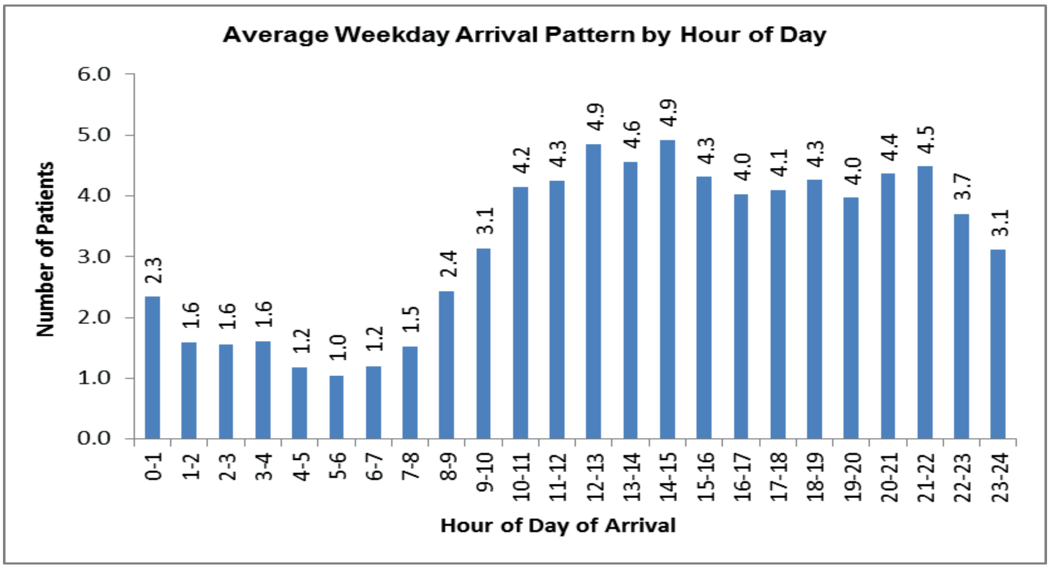


Fig 9.

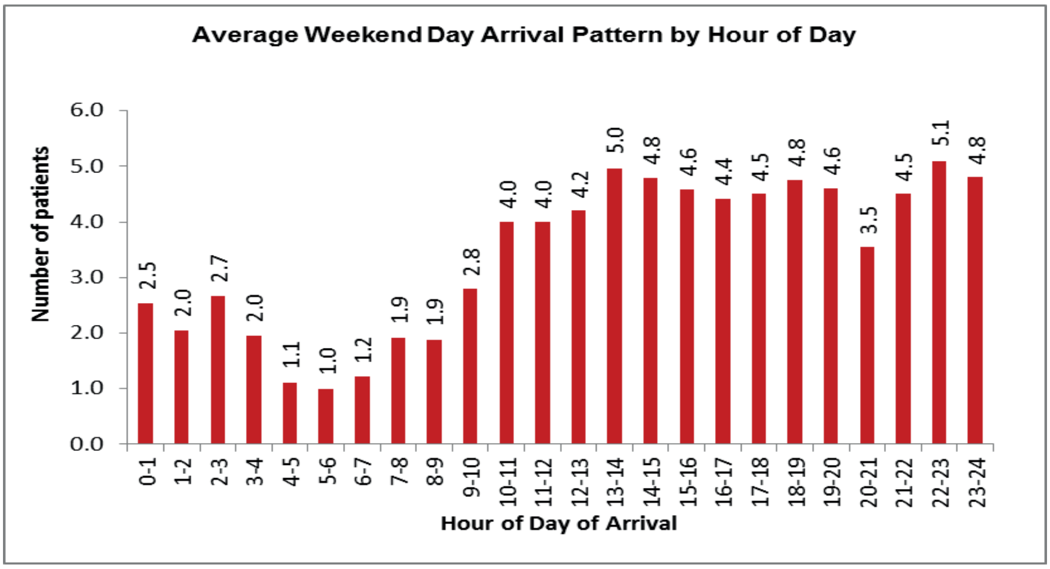


Fig 10.

In addition to weekday and weekend arrival profiling, individual daily arrival patterns can be useful. Understanding the total Emergency Department attendances anticipated per day and the arrival pattern supports resource planning. This information, supplemented by analysis on patient acuity, usually done via triage category, can inform decision making regarding the required medical and nurse staffing resource required to meet the anticipated demand at key points in the week.

Emergency Department Average Arrivals versus Departures Profiling

Ideally to maintain balance, the number of arrivals would match the number of departures, per hour. Redressing the balance is crucial to improvement across the whole system and is supported by work across the other Essential Actions, such as EA3 – Daily Dynamic Discharge.

In the graphs below (Fig 11.), a full year of data (for weekdays, Monday to Friday) has been analysed, with the average numbers of arrivals versus the average number of departures per hour displayed.

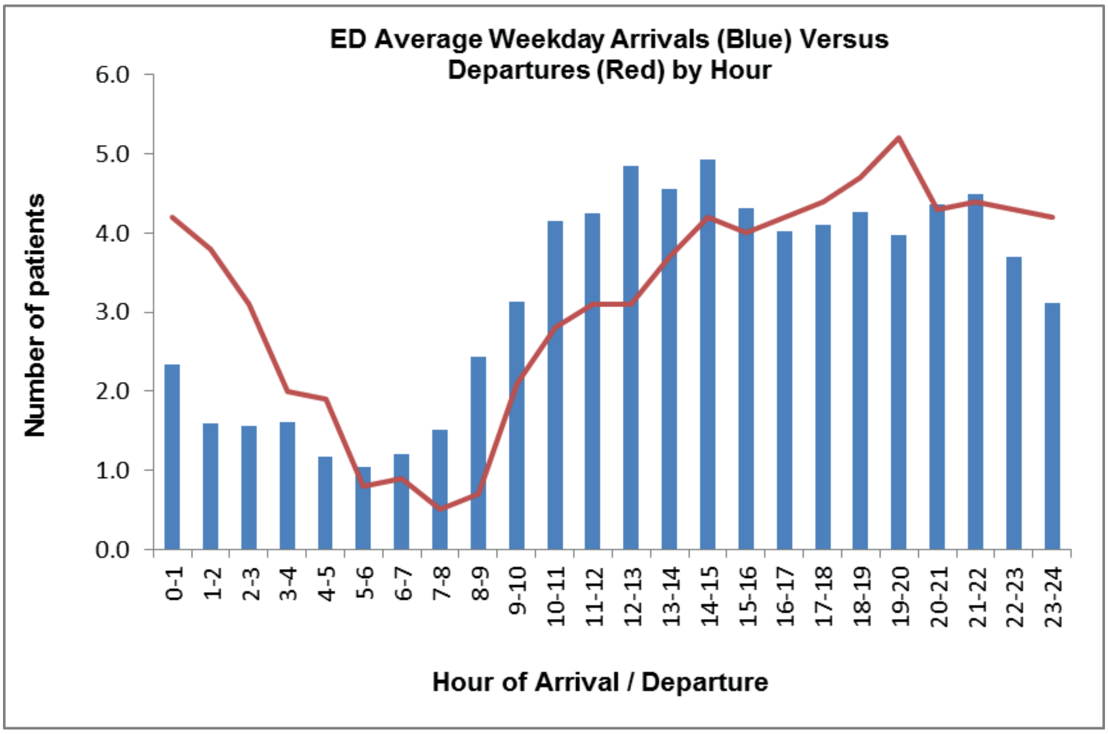


Fig 11.

The resulting pattern of arrival numbers versus departures for this Emergency Department is quite common. Through the night the number of arrivals reduces whilst the departure rate is higher as the department slowly starts manage demand and either admit, discharge or transfer patients. From 7 am the average hourly arrivals start to increase, with the number of arrivals exceeding departures until late afternoon. As a result the occupancy of the department will rise significantly during this time period.

When reviewing these graphs, it is important to look for interesting changes in departure or arrival rates, and explore the potential reasons for these. For example in the graph (Fig 11.) shown you will note that throughout the year, on weekdays, the departure rate spikes up between 1900-2000 hours. Recognising where anomalies present leads to further investigation of cause and effect.

One possible explanation may be nursing shift handover time, with a ‘push’ to ensure those patients ready for discharge or admission are completed before handover.

Some improvement activities on completing todays work in hours has proven beneficial in improving this balance profile

It may also be beneficial to create these charts by day of the week, often this can reveal subtle intra week variations which may be attributable to capacity (in terms of physical space or staffing levels), on specific days and times.

Emergency Department Admission and Discharge Rates

Weekly emergency department admission and discharge rates should be prepared to provide a baseline of current system outcomes. These statistics should then be continuously monitored utilising Statistical Process Control (SPC) charts (Fig 12&13). These charts should be routinely updated and monitored to pick up any developing trends.

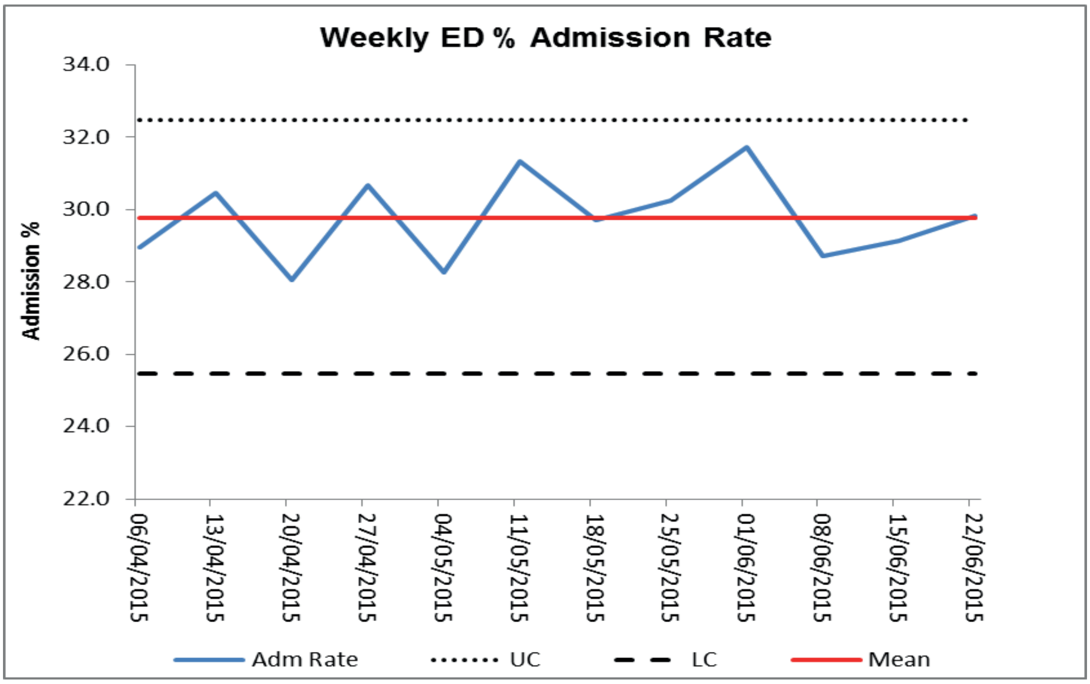


Fig 12

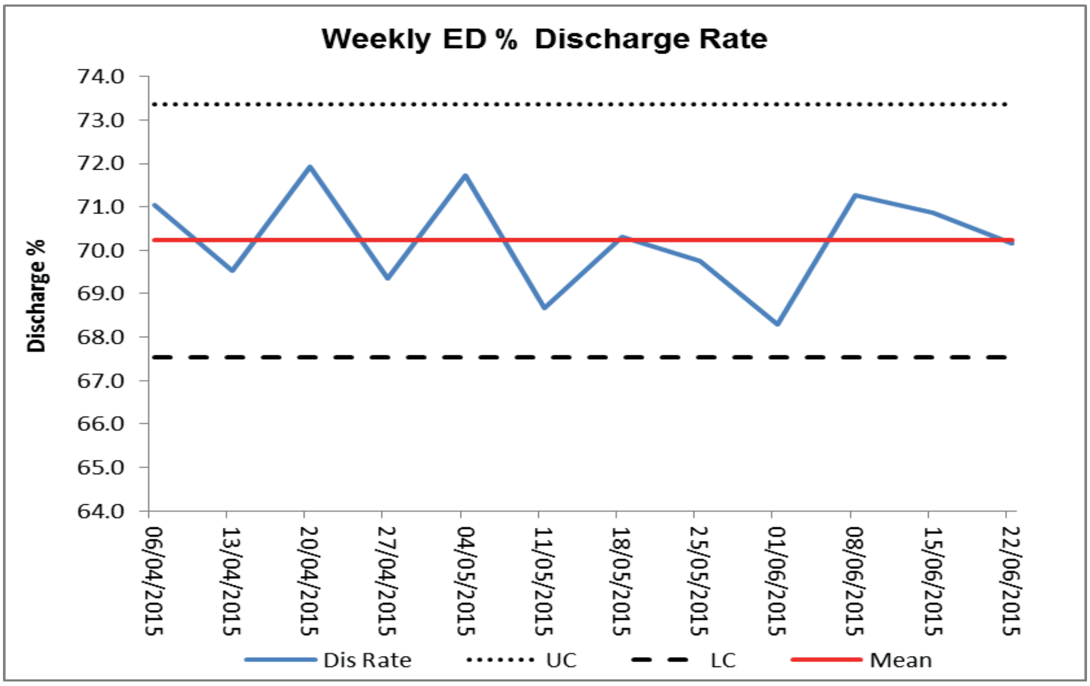


Fig 13

Admission and discharge rates should be reviewed on a day of week basis to identify variations. If as specific day is identified as having a high admission rate it is worthy of further examination to establish cause, such as staffing resource levels on specific days. Similar consideration should be given to weekly average admission numbers, again where increases are noted further investigation of cause should be undertaken to determine cause and identify if internal factors or an external factors, such as increasing incidence of influenza within the community or bad weather with snow and ice etc. This is information for improvement and can identify relevant test of change to minimise variation and reduce resultant delays.

c) Emergency Department Average Length of Stay

Length of Stay is an important metric to monitor within an Emergency Department. An increasing length of stay often drives increasing occupancy levels and capacity pressures within the department. There are a number of ways to monitor length of stay. The aim of monitoring is to allow the identification of increased variation, or longer lengths of stay. Length of stay by week (to identify any trends), and by day (to identify inter-week variations), and also by flow group are useful metrics.

The simple chart below (Fig 14) graphs the average length of stay by week, over a 12 week period and shows the weekly variation.

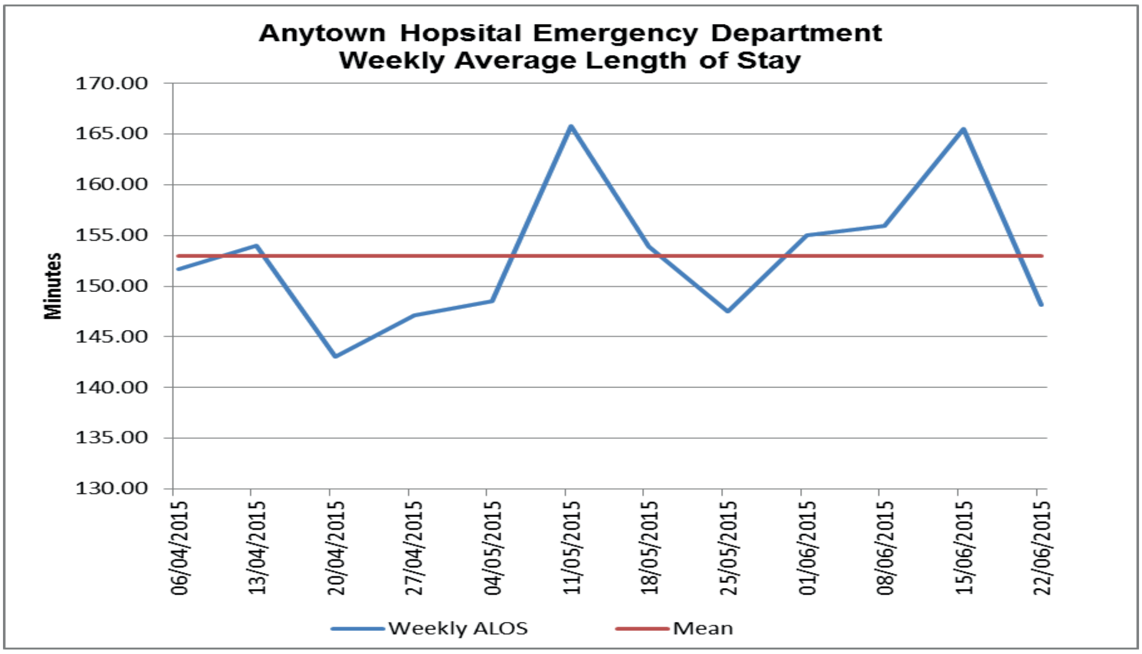


Fig 14.

Day of the Week

Further analysis of the same dataset allows you to 'drill down' to identify length of stay variations by day of week, and then flow group.

The chart below (Fig 15) provides the average length of stay by day of the week, from the 12 weeks dataset. It is evident that for 6 of the 7 days the average length of stay is in the range of 153-158 minutes however on a Wednesday length of stay is significantly lower at 138 minutes on average. This variation is worthy of further investigation to understand if this is due to external factors such as reduced attendances which is out with control or improved internal factors such as increased staffing, availability of diagnostics, which if in place would support improvements across the other days of the week.

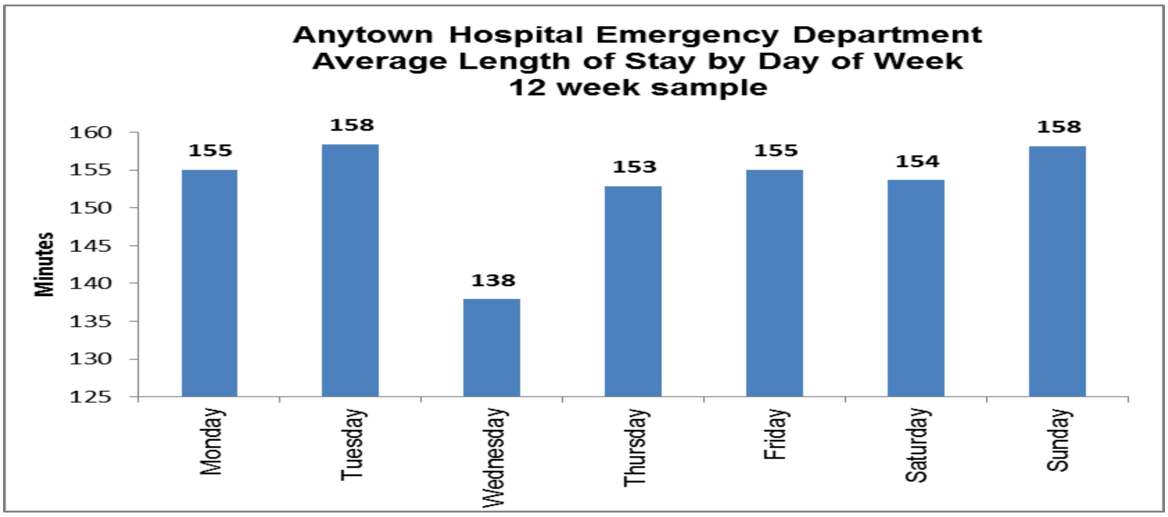


Fig 15.

The following table (Fig 16.) provides the average length of stay by flow group. The variation in ED length of stay on these 4 cohorts of patients is evident showing Flow 3 patients have on average the highest length of stay at 230.14 minutes. This type of information is useful in understanding what cohorts of patients are driving the overall average length of stay within the Emergency Department.

ED Average Length of Stay by Flow Group (12 week dataset)	
Flow 1	89.5 minutes
Flow 2	166.3 minutes
Flow 3	230.14 minutes
Flow 4	168.3 minutes
Overall	**153.1 minutes**

Fig 16.

Reducing average length of stay within ED will improve patient flow, decrease occupancy and alleviate the pressure of over-crowding. The data should be used to provide the current baseline metrics but also to identify variation between days or patient cohorts, to identify opportunities for improvement.

d) Emergency Department Occupancy

The occupancy of the unit per hour, per day is important. Many of the other factors we analyse such as attendance numbers and length of stay are the variables which create the occupancy level. A unit's "fullness" significantly impacts on its ability to meet the demand placed on it. High / over occupancy leads to backlogs, poor flow and reduced quality of care for patients. An analysis of occupancy of an Emergency Department over a one week period is shown below. The following table (Fig 17) provides analysis that can and should be generated for longer periods to identify patterns and trends.

Anytown General Hospital Emergency Department (4 resuscitation cuubicles, 16 majors cubicles and 6 minors cubicles - total 26 cubicles)																												
		Number of Patients within the Emergency Department On Each Hour of the Day																								Average Occupancy Over 24 hours	Average Occupancy 11am-11pm	Maximum Patient Number
Date	Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23			
01/08/2014	Fri	18	11	10	9	9	8	5	1	5	7	15	18	24	24	23	20	21	22	21	17	18	22	20	22	15.4	20.9	24
02/08/2014	Sat	15	15	9	6	8	4	6	5	5	3	6	16	21	17	22	22	25	23	21	18	11	13	18	18	13.6	18.8	25
03/08/2014	Sun	15	12	9	9	12	11	8	7	7	10	16	22	34	40	48	40	41	35	34	38	26	31	33	28	23.6	34.6	48
04/08/2014	Mon	27	17	18	14	14	13	14	12	14	14	17	25	29	30	33	36	34	27	32	25	22	23	17	16	21.8	26.8	36
05/08/2014	Tue	18	13	14	14	8	7	6	6	7	10	12	11	18	17	24	28	29	23	25	28	30	29	29	27	18.0	24.5	30
06/08/2014	Wed	21	17	14	13	12	13	13	11	9	10	12	25	17	25	24	21	26	21	22	15	13	22	22	29	17.8	21.7	29
07/08/2014	Thu	24	20	18	14	12	6	5	5	4	4	8	20	30	33	30	32	24	28	19	20	20	28	35	33	19.7	27.1	35
08/08/2014	Fri	26	21	15	7	6	3	2	1	0	2	5	19	22	28	22	17	17	16	16	18	15	16	18	13	13.5	18.2	28

Fig 17.

Using the Occupancy Table

The occupancy table provides a raw count of the number of patients within the department per hour of the day. In the 7 day sample provided (Fig 17) the pattern of occupancy across the days and hours within this Emergency Department becomes clear. It is busy at midnight, clearing overnight resulting in generally low numbers at 08.00 am. From 08.00 am occupancy starts to rise, continuing throughout the afternoon and into the evening.

The data within the table can be used to analyse specific days for example in Fig 17 it is evident it is evident that the department remained busy throughout the early hours of Monday. By using occupancy analysis, over a longer time period, it is possible to compare the profile for a number of Mondays. This will confirm if the trend identified on this individual Monday was unusual or is the Sunday nightshift into Monday morning always busy.

The occupancy numbers generated are the 'effect' of patient's numbers and length of stay. High attendances or increasing length of stay will all contribute to increasing occupancy. Although high levels of occupancy usually exhibit a high correlation with lower performance against the 4 hour Emergency Access Standard, the numbers themselves do not fully describe the pressure or 'busy-ness' of a department. Other factors can significantly impact occupancy levels, such as patient acuity.

Where periods of high occupancy have been identified, to establish the cause it is important to review other data for the same time period, such as patient numbers by triage category by hour, and staffing profiles etc. This will ensure that all the contributing factors are considered and will create a fuller picture of the 'pressure' within the Emergency Department. This information will help focus improvement by identifying the peak 'pressure' times within the department.

The occupancy template used to generate these figures has been distributed to Board's Data Analysts, following a workshop in December 2015. This tool can be used, not only to generate the initial baseline of occupancy levels in the Emergency Department, but is useful for monitoring the impact on improvement work over a period of time.

4. Inpatient Staging Post Profiling

Inpatient Units which form part of an emergency patient's pathway will require baseline analysis and profiling. It is recommended that receiving or admission units are individually profiled, however when you are analysing downstream general wards it is possible to group these together. It is advisable to profile specialist units individually such as Coronary Care Units, Intensive Care Unit, and Medical High Dependency Unit etc.

For each inpatient staging post there are 3 key areas of analysis:

a) demand profiling
b) length of stay profiling
c) occupancy

This information will aid operational management in optimising flow through the ward/unit.

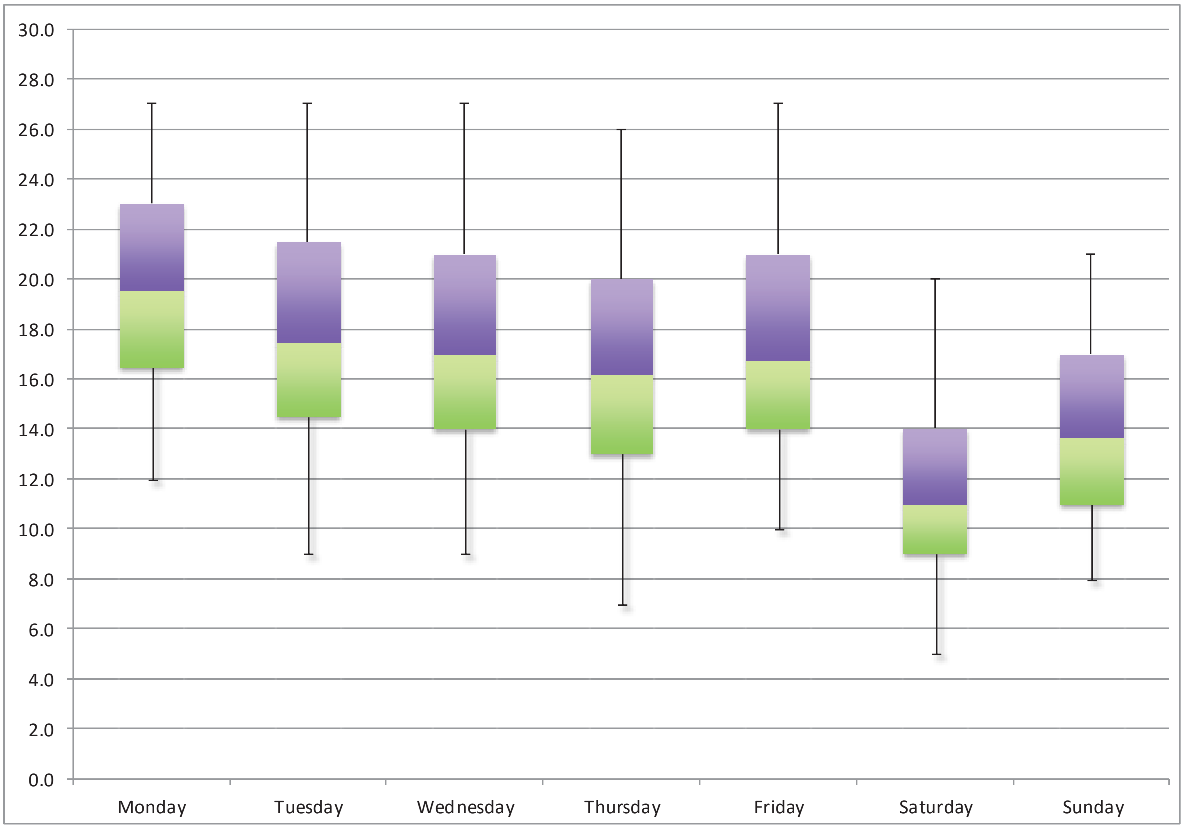
a) Demand Profiling

The profiling boxplot chart on the following page (Fig 18) summarises the key statistics relating to a sample inpatient unit's admissions, based on a 12 month dataset. Boxplot analysis is useful as it provides information on the admission demand per day, derived from previous data. In this case a full 12 months has been analysed, but it can be useful to generate these charts on a quarterly or even monthly basis to identify seasonal variations. The statistics generated provide an understanding of the inter-week variation in admission numbers to a unit, and provide an 'expected' level of admissions to facilitate capacity planning. Although the 'average' admission number is often used the optimal measure for capacity planning is considered the 85th percentile level of anticipated demand.

> By planning systems to the 85th percentile of admissions we are building a system that will be resilient enough to cope with all but the most extreme levels of demand. At ward level we can reduce variation and improve flow in a number of ways, such as, by smoothing discharge more evenly over the day, ensuring discharge tasks are completely in a timely manner, or by pulling patients from upstream rather than waiting for work to be pushed on the ward.

The summary statistics generated in the boxplot graph and table on the following page (Fig 18) are the same as those previously prepared for the Emergency Department. Guidance on interpretation can be found on page 13.

Hospital: Anywhere General Hospital
Analysis: Admissions to the Medical Receiving Unit (MRU) - 27 July '14 - 28 June '15



Summary Statistics							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minimum	12.0	9.0	9.0	7.0	10.0	5.0	8.0
25th percentile	16.5	14.5	14.0	13.0	14.0	9.0	11.0
Average (Mean)	**19.5**	**17.5**	**17.0**	**16.2**	**16.7**	**11.0**	**13.6**
85th percentile	**23.0**	**21.5**	**21.0**	**20.0**	**21.0**	**14.0**	**17.0**
Maximum	27.0	27.0	27.0	26.0	27.0	20.0	21.0
Median	20.0	17.0	17.0	17.0	16.0	11.0	15.0

Fig 18.

In Fig 18, the daily admissions to a 20 bedded Medical Receiving Unit have been analysed. The admission profile of this unit is similar to many receiving/admission units:

- Monday is the busiest day for admissions, with on average anticipated 19.5 admissions and with 23 anticipated at the 85th percentile.
- You will see that the average daily anticipated admission numbers reduce slight mid-week, increase on Friday and then reduce through the weekend.

The identification and understanding of intra-week variation is very important as it informs capacity planning and the development of local strategies to cope with the 'expected' higher levels of admissions on certain days.

Inpatient Admissions and Discharges

Balancing the demand for admission with bed capacity, in the right place at the right time can be challenging. The first steps of analysis to support the alignment of demand and capacity requires some baseline analysis of your current inpatient wards.

The initial stage of analysis involves the generation of current admissions numbers per hour of the day, per day of the week. This analysis provides a set of daily admission profiles by hour which represents how your current inpatient wards services the demand for admission. This must be distinguished from the actual demand for admission, which can be derived from the time when the decision to admit the patient was made, or a patient became ready for transfer and the bed request was made.

The following example takes you through the analysis generated for the 20 bedded medical receiving unit in Anytown Hospital. A full year of data (2015/16) was analysed. In this example the analysis generated is for Monday's. To complete a full review of capacity and demand this analysis will be required for each day.

The baseline average admission profile on a Monday is shown in Fig 19. This chart represents the average number of patients admitted per hour on a Monday. It represents the current system.

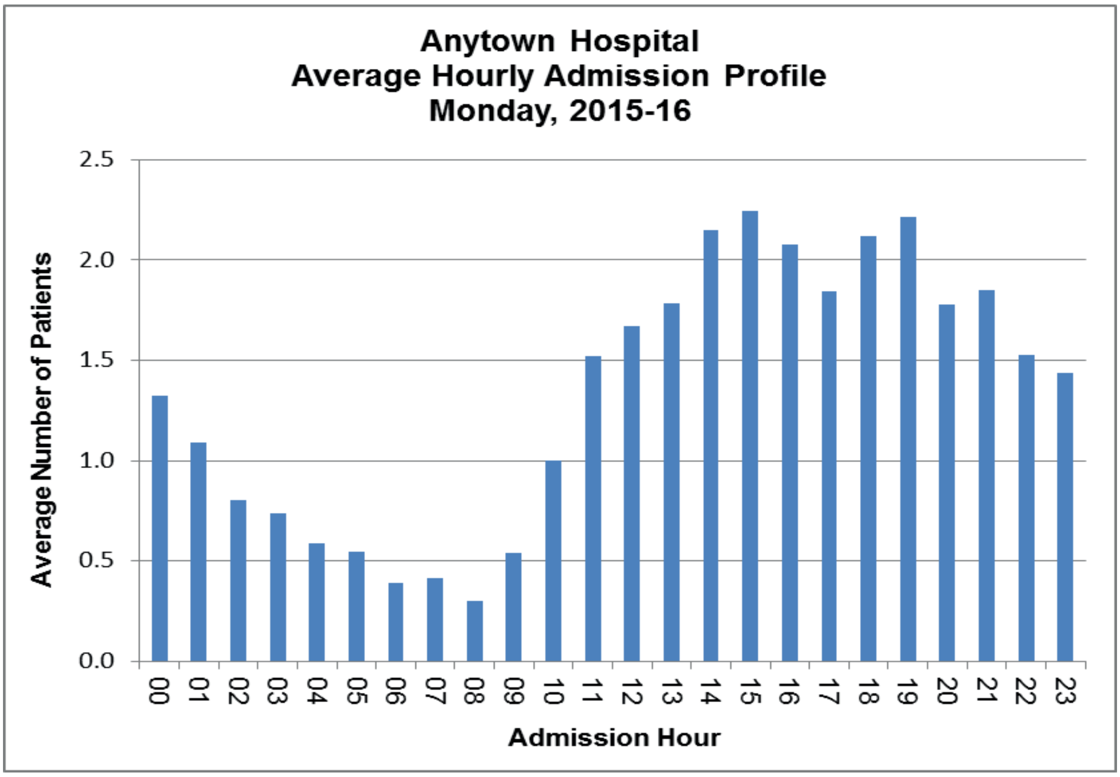


Fig 19.

In Fig 19. the current hourly admission pattern is shown, however the next stage is to identify what it should be. To prepare this chart requires data on the 'decision to admit' time for each patient or the 'bed request' time. If this information is not readily available electronically a prospective audit can be carried out to gather this dataset.

In Anytown Hospital, data relating to decision to admit time is available from the electronic system. A chart (Fig 20) can be generated indicating what the admission profile on a Monday should look like if patients are admitted within 30 minutes of a bed request or decision to admit.

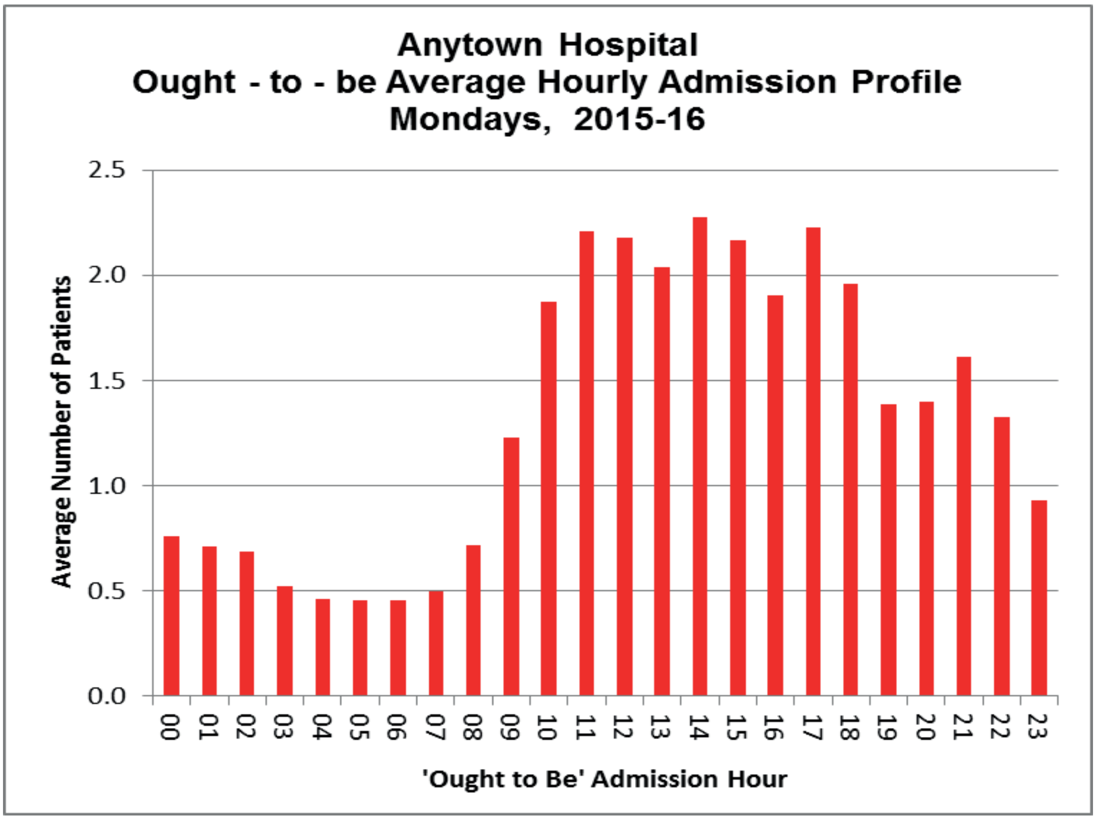


Fig 20.

The current admission profile can now be compared to the 'ought to be' profile. Ideally, to minimise patient delay, the 2 datasets should 'match'.

From a comparator graph (Fig 21) a misalignment between the actual admission demand (the ought-to-be hourly profile), and the current system is evident. It is apparent in this case that the actual demand for admission is earlier in the day than the capacity created and delivered by the current system. As a result in the evening period, the system 'catches up' with the demands of the day.

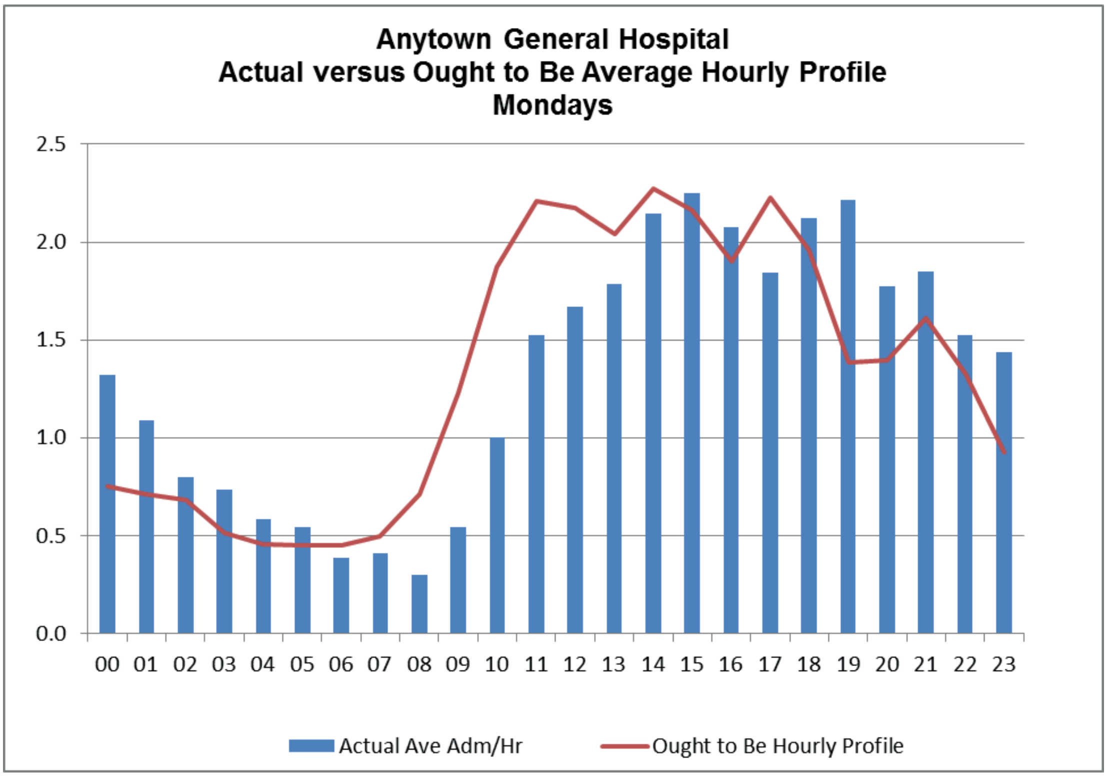


Fig 21.

This misalignment is common occurrence and is often driven by the discharge profiles within the inpatient wards. In Anytown Hospital the number of morning discharges is low, with the majority of patients being discharged and transferred out in the afternoon and into the evening (Fig 22). This discharge pattern does not meet the demands for admission and results in patient delays and poor flow through the afternoon period.

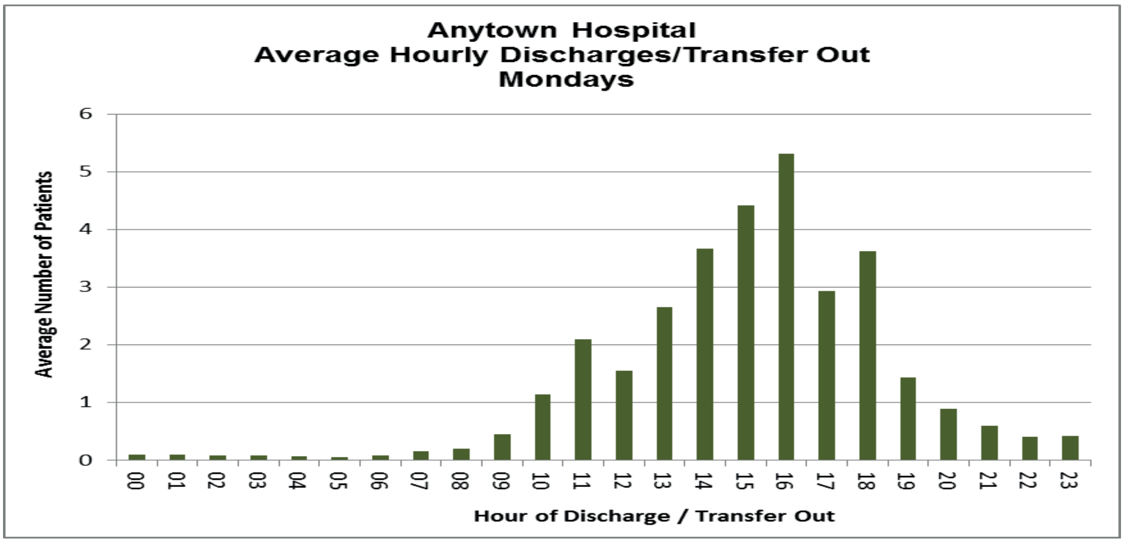


Fig 22.

This type of admission demand analysis can identify two types of capacity and demand misalignment, either a shortfall overall capacity or the time when capacity becomes available. When a shortfall in overall bed capacity is the cause you will see frequent and sustained boarding of patients to other specialty wards from admission. However the common cause of the misalignment is due to the hour of the day when capacity is created versus the hourly demand, as is the case in this example hospital. Once a mismatch is identified further analysis is required to identify the cause to inform improvements and test of change required.

There are a few further charts that are useful to determine some metrics for daily inpatient discharges. By using the same dataset, a cumulative discharge profile can be produced.

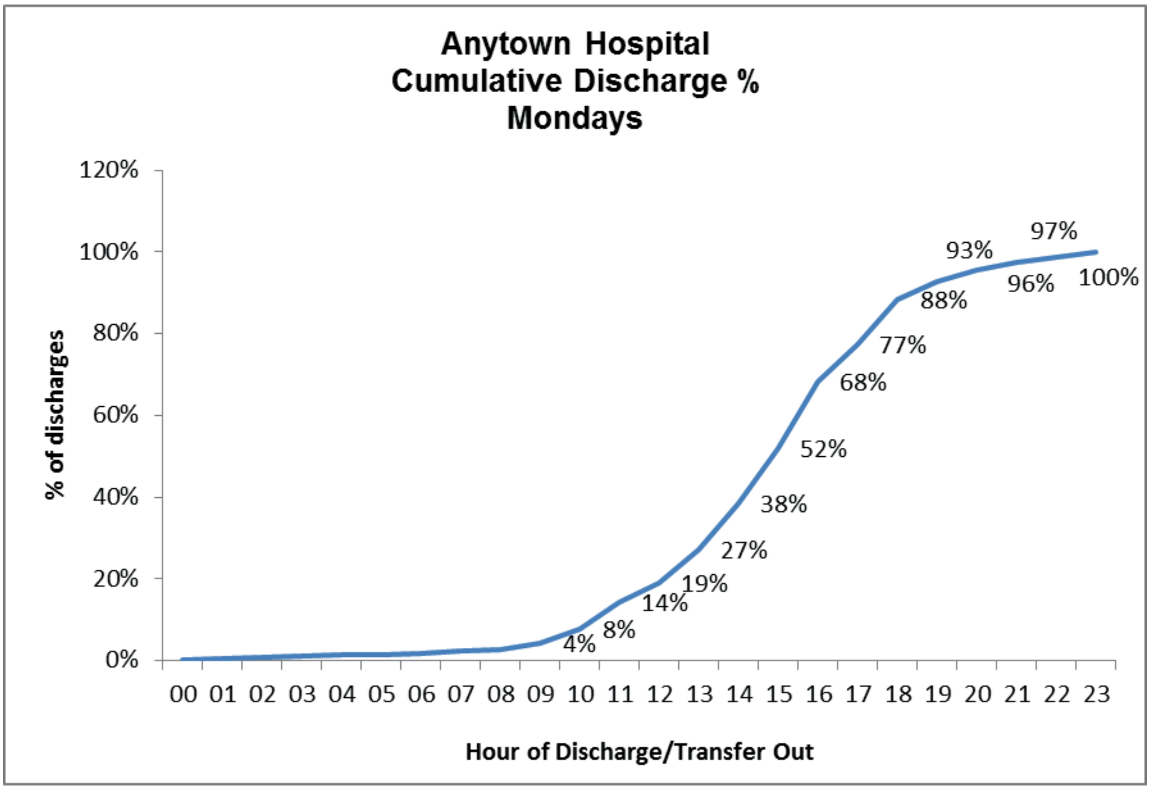


Fig.23.

Fig 23. shows that this unit achieves 19% of anticipated discharges or transfers by 1 p.m.

From the ‘ought to be’ demand levels for this unit, the percentage of admissions which ‘ought to be admitted’ from midnight to 1 p.m. is 40.1%.

This analysis can be used to highlight misalignment in capacity and demand, at specific hours in the day. In this specific example the data has provided a clear focus for improvement, focusing on earlier discharge.

b) Length of Stay Profiling

An initial analysis of length of stay analysis within each inpatient unit using retrospective data should be prepared. This information provides a baseline of the unit's current performance. It is useful to analyse length of stay by day of arrival and by month (to check for seasonality). Examples are provided below (Fig 24) using the dataset from Anytown General Hospital MRU.

The overall average length of stay within the MRU (12 months dataset) was 21.4 hours. This average length of stay by day of arrival is summarised below.

Summary Statistics							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25th percentile	6.5	6.5	6.8	7.1	6.0	8.3	8.1
Average (Mean)	**19.8**	**20.7**	**20.0**	**20.1**	**23.0**	**24.7**	**21.3**
85th percentile	**34.9**	**38.4**	**35.0**	**31.6**	**46.6**	**46.7**	**37.9**
Maximum	127.5	145.8	149.4	142.8	176.6	149.5	144.0

Fig 24.

From these summary statistics a number of interesting features can be identified;

- Each day there are a number of patients who are admitted into this unit and discharged immediately - in this case investigation revealed a small number of patients each day who are instantly re-directed to an ambulatory care unit.
- The 25th percentile shows that 25% of the patients admitted are discharged or transferred within 6.5 hours on a Monday, 8.3 hours on a Saturday etc. Understanding the patient groups who remain within an inpatient unit for a short time period is worth further consideration. Depending on the type and purpose of the unit this may be normal but in some cases it may indicate that there is a group of patients whose care may be suited to an alternative service (for example ambulatory care). Remember that all these summary statistics have the individual patient episodes behind them therefore your data analyst will be able to extract specific patient cohorts for more detailed review.
- The average length of stay is relatively consistent Monday -Thursday, but you will note a rise for those being admitted at the weekend. This is mirrored in the rise in the 85th percentile average length of stay for those being admitted on Friday and Saturday. Further examination of this cohort is worthwhile to understand the causes of this weekend effect.
- The maximum length of stay recorded by day is extremely high for a unit that aims for a 24 hour stay. Again it is useful to prepare further analysis of the long staying cohort to understand causes e.g. clinical, lack of bed availability for transfer, lack of single rooms etc.

A baseline review of monthly average length of stay is beneficial to ascertain seasonal variation. You will note there is a clear variation in the winter and summer periods in this chart. (Fig 26)

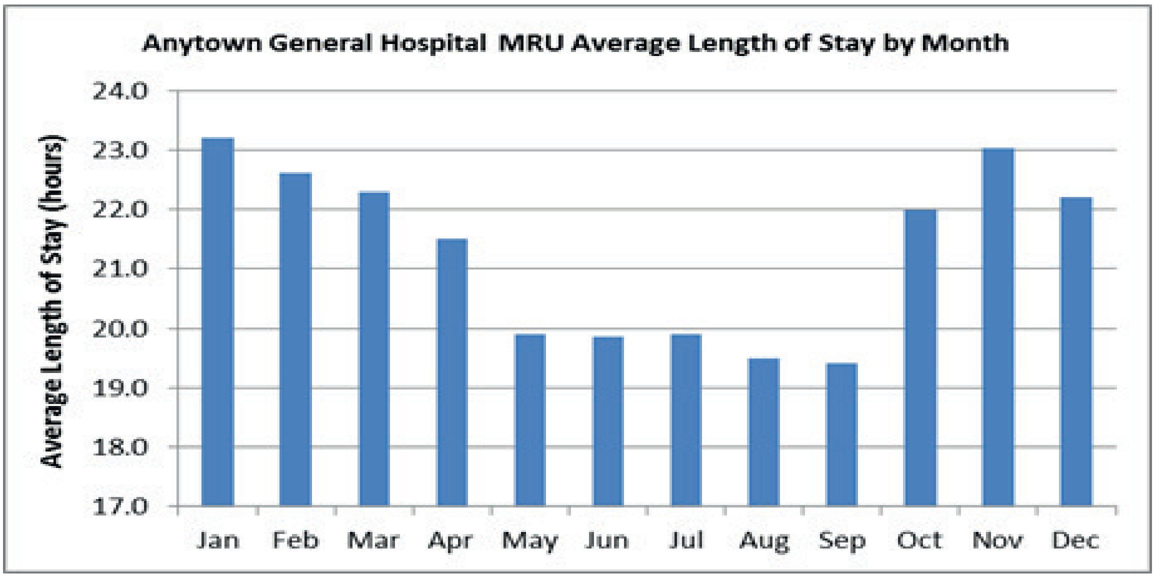


Fig 26.

A further useful graph for displaying the length of stay within an inpatient unit is shown below (Fig 27.).

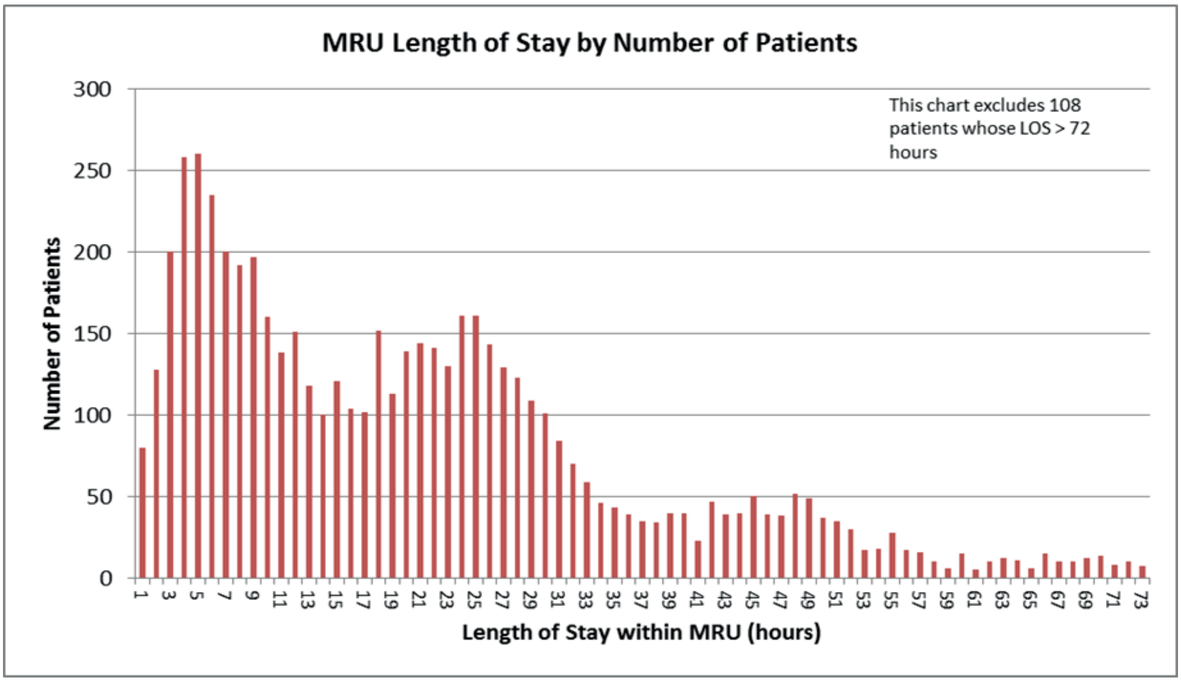


Fig 27

This graph displays the total number of patients by each hourly length of stay. Two peaks are evident at 4-5 hours and 25-26 hours. This chart can be useful to identify the range of length of stay within an inpatient unit.

Very often this range can be linked to different cohorts of patients, those with single issue conditions with a short admission to more complex patients who require an extended period of care, and often have rehabilitation requirements. It is beneficial to look at average length of stay by outcome (discharge or transfer to another ward/unit). Further local internal audit can help provide more detailed information on what drives the unit length of stay such as; clinical reasons, delays to diagnostics, or transfer and transport issues

A unit's length of stay should be continuously monitored utilising SPC charts. These charts should be routinely updated and reviewed to pick up any developing trends, and any occurrence of special cause variation which should be examined. In addition these charts can be used to monitor the impact of any re-design or improvement work

c) Occupancy Profiling

Understanding an inpatient unit's occupancy per hour per day is important as the level of "fullness" significantly impacts on its ability to meet the demand for beds placed on it. Often downstream inpatient ward run at high occupancy and operate on a one out / one in basis throughout the day. However in receiving or inpatient admission units, high occupancy throughout the day often leads to backlogs, poor flow and 'bed waits' for patients.

An analysis of occupancy of a 20 bedded Medical Receiving Unit over a seven day period (in the summer) is shown in Fig 28. This type of analysis can and should be generated over longer periods, particularly if seasonal variation is evident.

Anywhere General Hospital MEDICAL RECEIVING UNIT (MRU) Occupancy Profile																										Average Daily Occupancy (24hrs)	Maximum Recorded patient number
		Number of Patients Within the Medical Receiving Unit (20 beds) on each hour																									
Date		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
07/07/2014	**Mon**	18	18	19	19	19	17	18	18	**18**	18	19	18	17	17	17	19	20	20	20	18	19	20	21	21	19	21
08/07/2014	**Tue**	14	14	14	15	15	15	17	17	**17**	18	19	19	17	18	19	19	21	22	22	17	13	14	15	15	17	22
09/07/2014	**Wed**	20	20	20	20	20	20	20	20	**20**	20	21	20	17	18	20	20	23	23	23	19	16	16	17	18	20	23
10/07/2014	**Thu**	15	15	15	16	17	18	18	18	**18**	19	19	15	17	15	16	16	12	12	12	10	11	13	14	15	15	19
11/07/2014	**Fri**	15	15	16	15	15	16	16	17	**17**	17	18	18	17	18	19	19	16	16	16	13	11	12	9	9	15	19
12/07/2014	**Sat**	15	13	13	14	15	15	16	16	**16**	16	16	16	18	18	19	20	18	18	18	18	16	12	12	12	16	20
13/07/2014	**Sun**	16	16	15	15	15	13	13	13	**14**	14	14	15	15	14	16	18	19	19	19	19	19	19	17	17	16	19

Fig 28

From this analysis you will note that even in the summer period the unit has periods of very high occupancy and at times is over-occupied. The use of the occupancy template is advised to support improvement. The data can be analysed by day of week, or by month, to identify particular periods of high occupancy. When high occupancy periods are identified further analysis or audit can help to determine cause, which may be due to a number of factors including medical and nurse staffing levels, portering resources etc. The template can also be used to assess the impact of improvement work.

5. Whole System ‘Ought to Be’ Numbers

With a complex system it can be difficult to ascertain what the ‘ought to be’ numbers should be for the different component parts to optimise flow. One simple technique that can be used is to split the hospital system into 3 component parts, the front door (ED), inpatient receiving / assessment areas and downstream wards.

This analysis describes the whole hospital by using two x nine number grids.

The metrics of ‘how many’, ‘how long’ and ‘how full’ are calculated for each area of the hospital, for 2 specific cohorts, the top 25% of days in terms of performance against the 4 hour Emergency Access Standard and for the lowest performing 25% of days against the 4 hour Emergency Access Standard. The results for Anytown General Hospital are shown in the grids below (Fig 29).

Anytown General Hospital
91 Lower Quartile days and 91 upper Quartile days

91 LQ days: **91.3%** compliance

	A&E	Assessment	Wards
How many?	131 attendances	21.7 admissions	72 admissions
How long?	148 minutes	24.8 hours	3.8 days
How full?	13.2 patients	21.8 patients	279 patients

91 UQ days: **99.0%** compliance

	A&E	Assessment	Wards
How many?	125 attendances	19.0 admissions	65 admissions
How long?	116 minutes	24.4 hours	3.7 days
How full?	10.1 patients	20.2 patients	271 patients

Fig 29

These two grids (Fig 29) provide key flow metrics associated with each area of the hospital at 99% compliance for the ‘ought to be numbers’ and alternatively when EAS compliance is lower at 91.3%.

When there is good compliance with EAS the number of ED attendances at Anytown General Hospital are slightly lower and the average length of stay is 32 minutes lower resulting in a lower occupancy. The GP assessment and admissions ward and the downstream wards follow a similar pattern with slightly lower admission numbers, similar length of stays, and a slightly reduced occupancy. Small differences in each component part of the system combine to have a significant impact on the Emergency Access Standard performance.

These grids confirm the importance of optimising flow at each stage of the hospital system by demonstrating even a slight increase in occupancy or length of stay downstream can impact on the whole system.

6. Using Simulation to Support Improvement

The tools developed to support the generation of Basic Building Blocks analysis, such as the occupancy template can also be used for simulation modelling. Once the area for further investigation has been identified in the Basic Building Block the same tools can be used to test the impact of proposed test of change and service redesign.

The occupancy template can be used to measure the potential reduction in ED occupancy, if patients suitable for ambulatory care were directed to this new unit from triage. The template can also be used to ascertain the daily and hourly occupancy of this new unit, and hence provide information on the number of cubicles / chairs /staffing resource required.

This process has been tested out at a busy Emergency Department where the Basic Building Blocks identified an issue with over occupancy from 11 a.m – 8 p.m.

Further analysis of length of stay and flow group presentations suggested an alternative pathways would be useful. The analysis tools were utilised to simulate this change and measure the impact statistically before any changes were made to actual patient flow. An Ambulatory Care Unit appeared to be a solution. By presenting the analytical modelling within the business case operational and managerial engagement and ownership can be generated and service redesign and transformation developed at pace based on modelling scenarios. It is important to follow this modelling up along the way of the test of change and continue to monitor impact on flow as often practical issues can change the dynamics. This must be a joint initiative of data and operational input.

7. Next Steps

The National Team are available to offer support and guidance on the use of the Basic Building Blocks Methodology.

We welcome regular feedback from sites in terms of progress or any issues being experienced, and we also welcome examples of different types of analysis your specific site may have developed and found beneficial which can be shared.

Full guidance and case study examples can be found on the website along with further information on a series of master classes and implementation support events to be agreed.

Full details can be found at the 6 Essential Actions to Improving Unscheduled Care webpage
http://www.qihub.scot.nhs.uk/UnscheduledCare.aspx

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