

## Insight report

# The weekly pulse

An analysis of hospital activity by day of the week

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# The weekly pulse:

## An analysis of hospital activity day day of the week

Hospitals may be a 24/7 service but just like a supermarket there are peaks and troughs in activity throughout the week. It is widely acknowledged that the number of operations, other procedures and diagnostic tests vary from day to day. However, the extent of this variation and how the working week compares with the weekend is rarely reviewed in totality.

### Introduction

CHKS has over 20 years' experience in the analysis of hospital data. We decided that given the unprecedented financial pressures facing NHS acute trusts, an analysis of activity across the week would highlight variation and help trusts understand where efficiency improvements might be made.

Recent reports have focussed on mortality rates, which were shown to be higher at the weekend, but there are a number of other ways to look at the data and the detail offers interesting insight into this variation.

Hospitals provide a wide range of services that can be split between outpatients and ward-based activity – consisting of emergencies (including A&E), maternity and elective treatment. Then there are support services such as theatres and diagnostics.

We focused our attention on a number of specific areas: emergency patients; elective patients; maternity and births; procedures and diagnostics. Our researchers looked at HES data, which covers acute hospital trusts in England. All analysis is based upon Hospital Episode Statistics (HES) data for the calendar year 2011. All charts by day of the week have been adjusted for the effects of Bank Holidays as this is when activity levels are at least as low, and sometimes lower, than those of the weekend.

### Executive summary

Our analysis has revealed a discernible pattern in hospital activity. We found that across emergency patients; elective patients; maternity and births; procedures and diagnostics there was significantly lower activity at the weekend.

The analysis prompts us to ask the question which services should be provided at the weekend which in terms of the supermarket analogy is the range of products provided at an "in town", a "standard supermarket", or a "superstore". There are already examples of change in the way services are provided. The survival rate for ruptured aortic aneurysms is much higher if repaired by a vascular surgeon rather than a general/on take surgeon. This has led to the clustering of hospitals for weekend emergency cover rota. There maybe scope for further change along these lines.

Much of what we have found has been highlighted before but by pulling it together we have been able to present a more complete picture of what happens during the week and at the weekend.

Clearly there is no average hospital and it is likely that hospital will cover an increasingly wide range of activities, but there is enough significance in our findings to warrant further investigation by every acute trust.

### Outpatients

Chart 1 shows how few outpatient appointments are offered at weekends with the busiest days being Monday and Tuesday. One issue of significance that should not be forgotten is how this impacts on the issue of car parking.

With the national volume going from fourteen million appointments in the week to less than half a million at the weekend this represents many vacant parking spaces.

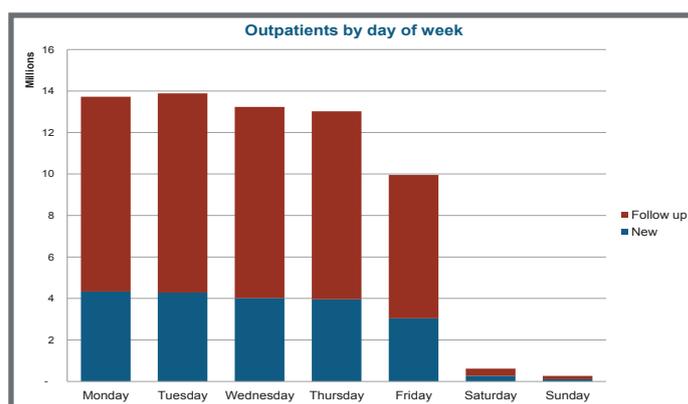


Chart 1: Outpatients by day of the week

### Total ward-based activity

The scale of the difference between the weekend and weekdays is further highlighted by looking at the total of ward-based activity (i.e. excluding outpatients and diagnostics).

Chart 2 shows that the volume of activity occurring on Sunday is about one third of that occurring on Monday.

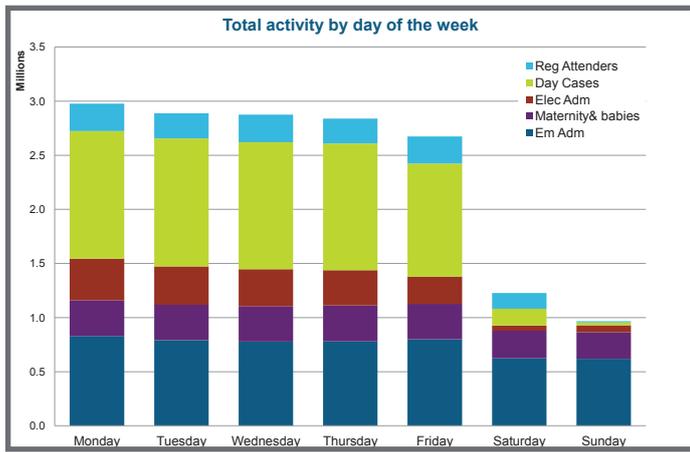


Chart 2: Total activity by day of the week

## Emergency patients

There are two main elements to our analysis. These are: time of day of arrival and the day of week of arrival. Our analysis also takes into consideration the different types of emergency patient. There are not only differences between the specialties to which emergency patients can be admitted but more crucially between short and longer stay emergencies.

The reality is that over 50 per cent of all emergency admissions in England are now diagnosed, treated and discharged either on the same day as admission, called zero length of stay, or discharged on the following day. This group form the cohort of activity that is also referred to as urgent care.

HES data does not include a time of admission. Therefore our analysis was based on patients who are admitted from A&E. CHKS researchers used the discharge time from A&E as the admission time for the hospital episode. Admissions from A&E are about three quarters of all emergency admissions although this varies from hospital to hospital according to where they have their "front door".

Chart 3 shows total admissions with the time of day for the highest and lowest activity. The highest volume occurs on Monday and the peak time is consistent for every day at 15:00 hours. This is at least partially an effect of a GP seeing the patient in morning, sending them to hospital and then the patient being admitted up to four hours later. The trough is also consistent across all days of the week at 07:00 hours.

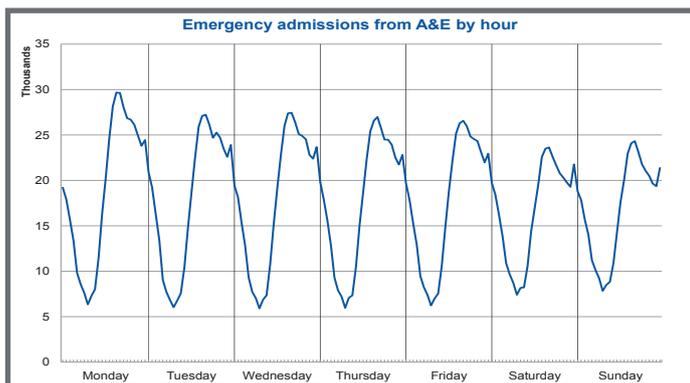


Chart 3: Emergency admissions from A&E by hour

We analysed the proportion of emergency admissions that were short stay. Short stay admissions show a dip in the small hours of the morning then rise again from around 09:00. Chart 4 below shows the percentage of admissions discharged within zero or one day as a percentage of total admissions for the day.

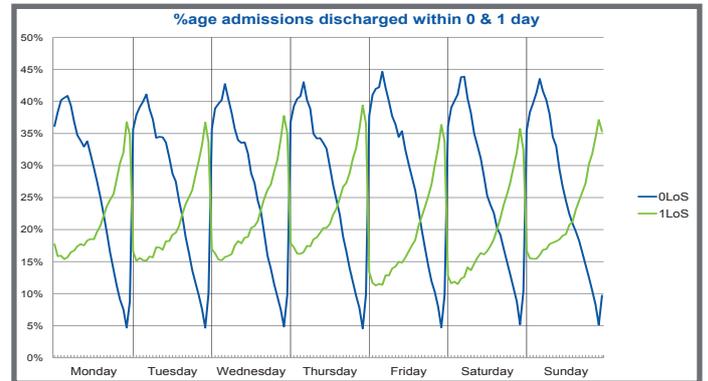


Chart 4: Percentage of admissions discharged within 0 & 1 day

This reveals the extent to which short stay emergencies are affected by what time the patient arrives in hospital. Not surprisingly the earlier in the day you are admitted, the more likely it is that you will be discharged on the same day.

Similarly the later you are admitted, the more likely it is that you will stay in overnight and be discharged the following day. The crossover point is at around 15:00 every day when the proportion of patients discharged is the same for both zero length of stay and one day length of stay.

The hour-by-hour analysis reveals that 15:00 is an important point in the day. In terms of cost management, trusts looking to reduce the number of patients staying in overnight might consider ensuring patients are seen by this time. It is also interesting to note that the highest proportion of patients with a zero length of stay occurs on Friday.

The suggestion is that this reflects the desire to keep patients out of hospital over the weekend (previous analysis has shown that this desire not to admit has a big impact on Christmas Eve<sup>1</sup>).

The next step was to look at the number of emergency admissions by the day of the week (See Chart 5). This shows the activity at the weekend is at least 20 per cent lower than during the rest of the week. The proportion of zero length of stay patients is highest on Friday. The theory that this is a result of deliberate attempt to keep patients out of hospital over the weekend is given further credibility by the fact that the proportion of patients with a one day length of stay is highest on Thursday.

<sup>1</sup> <http://www.hsj.co.uk/resource-centre/data-briefing-what-affects-same-day-discharge-rates/3449.article>

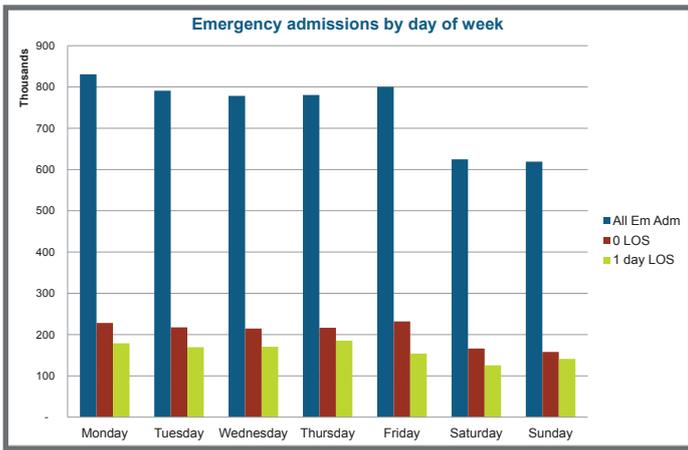


Chart 5: Emergency admissions by day of week

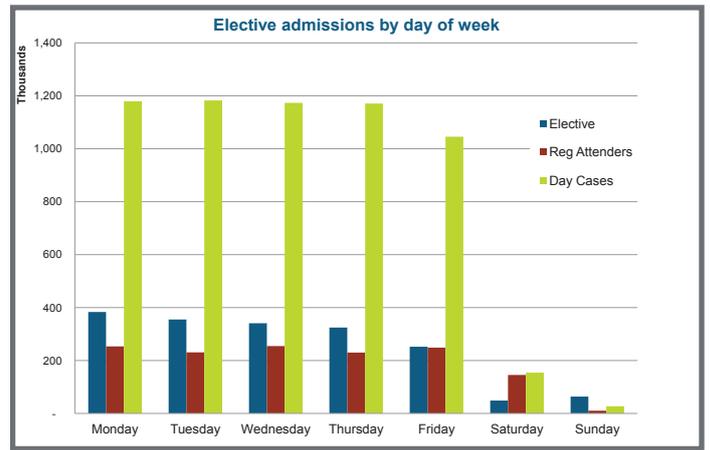


Chart 7: Elective admissions by day of week

Whilst admissions are important the overall flow cannot be fully appreciated without looking at how discharges vary as well. Chart 6 shows a relatively equal number of discharges across the week with a peak on Friday – possibly to get people home for the weekend, but also because there will be fewer senior decision makers around to discharge at the weekend. There is a significant drop in discharges at the weekend for emergency admissions and if this is compared with the admissions in round numbers there are 800,000 admissions on weekdays and about 600,000 at the weekend with only 500,000 or less, discharges at the weekend.

Chart 8 shows there is a steady rise in discharges across weekdays. Hospitals have admitted most patients at the beginning of the week and then discharge them steadily before the weekend. There is a slightly different pattern here from the one we see for emergencies. However, there is still a sizeable volume of patients who are discharged on Saturday – a day when it is easier for rule-led, or nurse-led discharging.

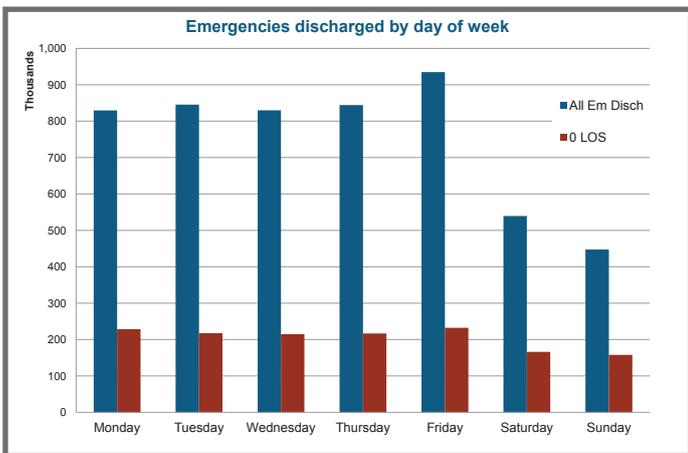


Chart 6: Emergencies discharged by day of week

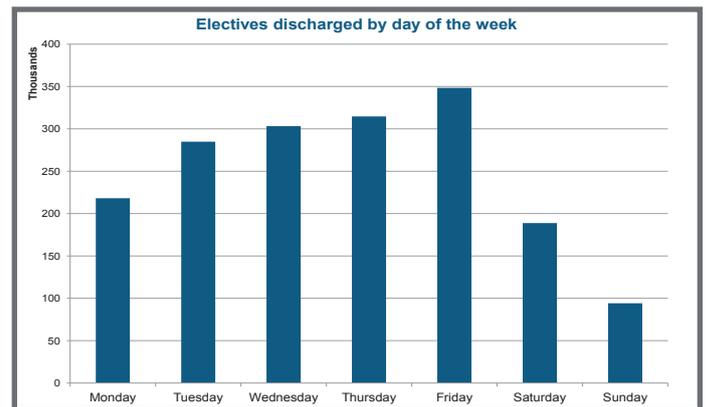


Chart 8: Electives discharged by day of week

## Elective patients

Chart 7 shows Monday is the day with the highest percentage of elective admissions. We have already seen this is same day the number of emergency admissions is at its highest. This explains why many trusts experience bed shortages on Mondays. Some of the very low weekend activity would appear to be the result of 'waiting list initiatives' in NHS hospitals, rather than any routine pattern of work. Sunday admissions are often patients who are pre-admitted for procedures on Monday

The chart also reveals that the highest proportion of regular attenders (often for treatment like dialysis) is on Monday, Wednesday and Friday as a three-day-in-a-week cycle. Tuesday, Thursday, Saturday is another cycle which therefore leaves little activity on a Sunday.

Chart 9 shows the overall relationship between emergency and elective admissions and discharges. This chart is more detailed but simply uses the difference in the number of admissions and discharges on the same day – how the bedstock is managed. The two types of care are complete opposites until they reach a shared maximum (for excess discharges over admissions) on Friday.

**“...the highest number of elective admissions are on a Monday, when there are also the highest number of emergency admissions...”**

What can be seen is that the highest number of elective admissions are on a Monday, when there are also the highest number of emergency admissions and the lowest levels of discharge from the preceding day. So it is not surprising this makes Monday the worst day for bed management in many hospitals.

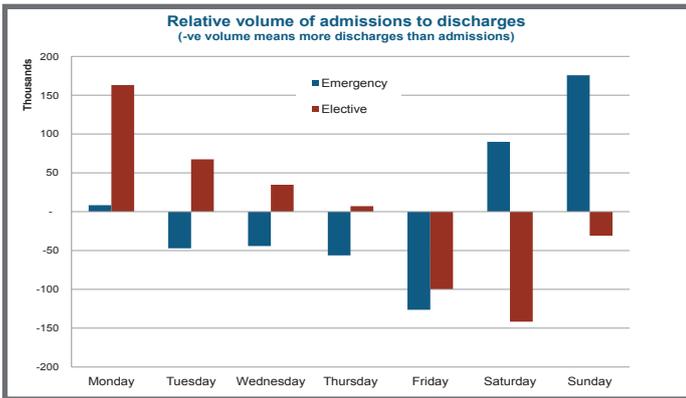
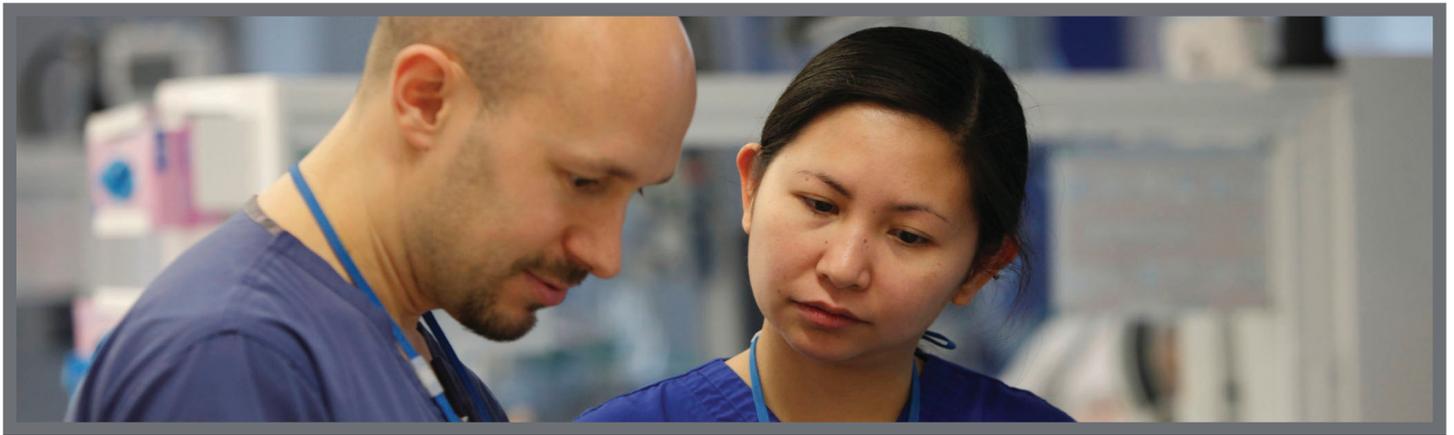


Chart 9: Relative volume of admissions to discharges

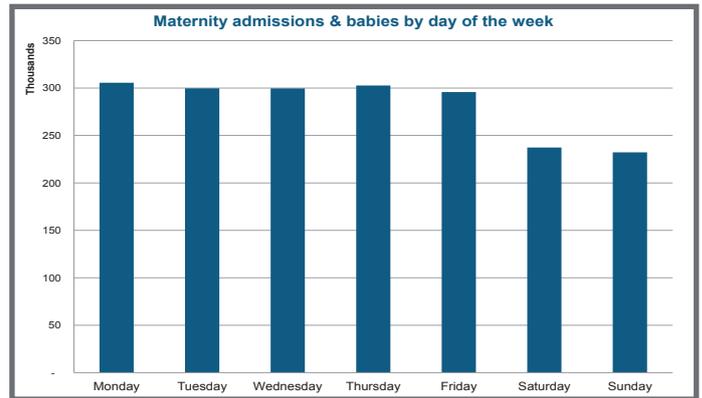


Chart 10: Maternity admissions & babies by day of the week

## Maternity and births by day of the week

For a new birth there are two events recorded in the hospital statistics: maternity admission and the arrival of the new born child. Given this is a natural event a flat pattern of activity might be expected by day of the week but Chart 10 shows this is not so.

**“... to get a better understanding of the pattern we looked at the different types of delivery and the answer is clearly found by looking at elective caesareans...”**

We checked to see whether this was an artefact of maternity admissions by looking at just new births and found the same pattern in Chart 11.

In order to get a better understanding of the pattern we looked at the different types of delivery and the answer is clearly found by looking at elective caesareans.

Chart 12 shows that the number of elective caesareans is significantly reduced at the weekend.

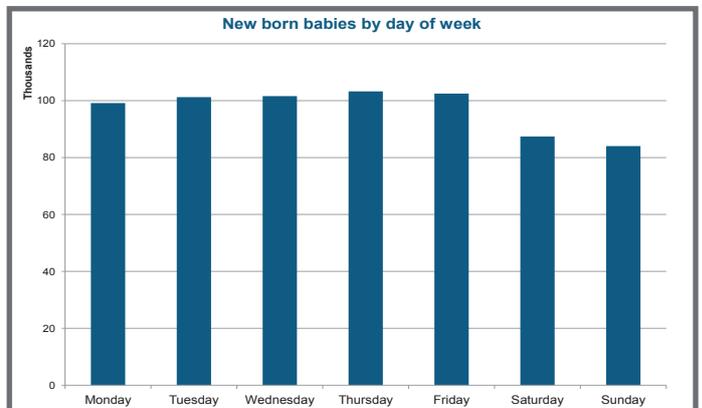


Chart 11: New born babies by day of the week

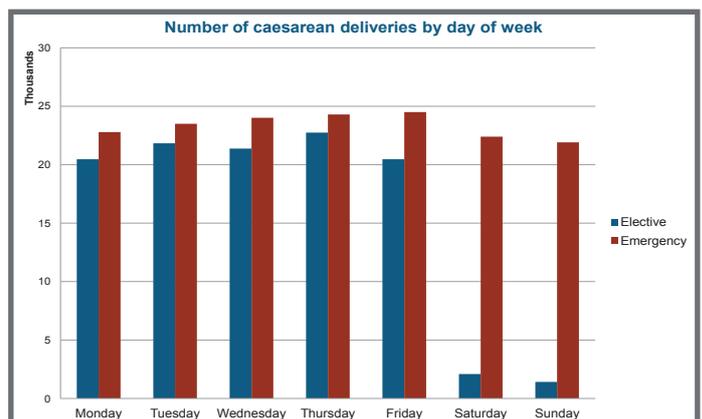


Chart 12: Number of caesarean deliveries by day of the week

## Procedures by day of the week

One of the ways to look at theatre usage is to count of the number of procedures that are being carried out. Whilst this is not completely accurate (some procedures are carried out in other settings and it does not reflect the different time between different procedures) it is a useful guide.

Chart 13 reveals a significant fall in the number of procedures at the weekend. Even the emergency procedure volume is lower at the weekend – which implies patients are being pushed into the following week.

An analysis of the type of procedure on a Sunday shows they are mainly orthopaedic and eye-related (which overlaps with the previous observation on electives that this looks like a 'waiting list initiative' activity).

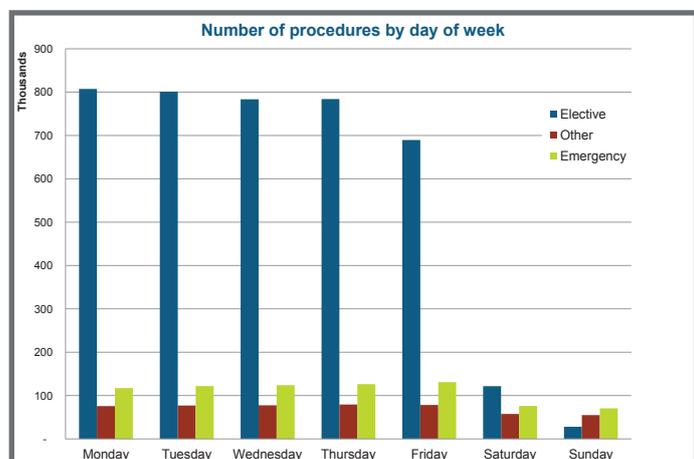


Chart 13: Number of procedures by day of the week

## Diagnostics by day of the week

Our researchers found that emergency admissions are 78 per cent of the weekday average. For diagnostics, the equivalent figure is 35 per cent (see Chart 14). This clearly demonstrates that patients admitted at the weekend (and potentially on a Friday) are not getting diagnostic tests as quickly as those admitted during the week.

Table 1 shows further analysis at the level of diagnostic procedure with the twelve most common procedures carried out on a Sunday and their relative proportion to a normal weekday.

The only one which exceeds the overall drop in patient volumes is diagnostic imaging of central nervous system – most probably due to the requirement for the scanning of strokes within 24 hours. For some other common tests it is clear that most hospitals do not provide them on a Sunday.

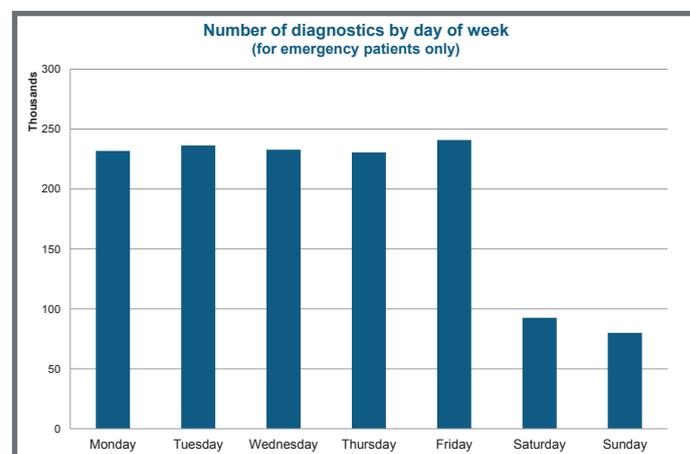


Chart 14: Number of diagnostics by day of week (for emergency patients only)

	Sunday	Average weekday		Sunday as a percentage of average weekday
Code	No of diagnostic procedures	No of diagnostic procedures	Description	
U05	41,986	83,467	Diagnostic imaging of central nervous system	50
U21	23,446	70,857	Diagnostic imaging procedures	33
U20	5,324	36,934	Diagnostic echocardiography	14
U35	2,153	7,217	Other diagnostic imaging of vascular system	30
U07	950	5,365	Diagnostic imaging of chest	18
U54	1,461	5,146	Rehabilitation for other disorders	28
U08	1,398	4,035	Diagnostic imaging of abdomen	35
U13	893	3,171	Diagnostic imaging of musculoskeletal system	28
U16	209	2,894	Diagnostic imaging of hepatobiliary system	7
U11	528	2,626	Diagnostic imaging of vascular system	20
U50	417	1,877	Rehabilitation for musculoskeletal disorders	22
U09	324	1,621	Diagnostic imaging of pelvis	20

Table 1

## Summary

Hospitals may be open 24 hours, seven days a week but the demand on their services and the services they provide are not uniform across the week and there are not well-matched. This summary is based on the average hospital but there are many smaller hospitals where there will be different issues when it comes to providing good staffing cover across the whole period of out-of-hours (which includes the evening and night time as well as weekends).

## Medical emergencies

The largest volume of activity currently occurring at the weekend in hospitals is accounted for by medical emergency admissions. In recent years the admission process and management of this group has seen significant change. In 2007 the Royal College of Physicians published its report by the Acute Medicine Taskforce<sup>2</sup> which identified the need for a consultant physician presence in the medical admissions area, or acute medical unit (AMU). Two further reports have examined both the extent to which the recommendations have been acted on<sup>3</sup>, and the impact that differences in staffing are having<sup>4</sup>.

The main findings were that the vast majority have an established AMU, with a recognised clinical lead and operational policies in place. In addition most have an Early Warning Score (EWS) system in place and most have access to a critical care outreach service usually linked to the EWS system. In 70 per cent of sites, the acute physicians take first line responsibility for acute admissions.

However, consultant patterns of working still reflect 'consultant of the day' rather than the recommended 'consultant of several days'. The report found that in around half of hospitals, the first consultant on-call still undertakes other routine clinics or procedures while managing the acute take. It also found that in many hospitals, AMU patients are not routinely reviewed twice per day by a consultant and only a small minority of acute physicians work at weekends.

The report then analysed staffing patterns against quality measures (using HES data) and demonstrated that significant quality improvements were found from having better patterns. In particular they found:

- hospitals in which admitting consultants have no other fixed clinical commitments while on acute take had a lower adjusted case fatality rate
- where the admitting consultant was present for more than four hours, seven days per week they had a lower 28 day readmission rate

- hospitals with two or more AMU ward rounds per day on weekdays AND admitting consultants worked blocks of more than one day had a lower adjusted case fatality rate.

The findings clearly support the move for better deployment of acute physician consultants at the weekend. However they will still need access to good diagnostic facilities for this to represent a similar quality of care across the week. This is also only of benefit if consultants are already commitment free when managing the take. Patients admitted at the weekend may be getting faster access to a senior decision maker if the weekday consultant is committed elsewhere.

Getting the pattern of provision right for this group starts with ensuring that the weekday services are optimised. The focus then needs to be on what cover is provided at weekends. The key issue here is the availability of commitment free acute physicians to manage the take.

## Support services

It is still going to be a suboptimal service if senior decision makers are present on the wards but cannot get access to appropriate diagnostics as required. Therefore getting services right for medical emergencies is the key.

## Surgical emergencies

Surgical emergencies are a smaller proportion of the emergencies that arrive at a hospital. In the current financial climate the question is whether every hospital needs to have a full range of surgical specialty consultants on call for every weekend and one or more theatres staffed and available. The use of network models, such as that previously described for vascular surgery, needs to be given wider consideration to the extent that some hospitals either close fully for surgical emergencies or take part in a shared rota.

## Weekend mortality

It would be wrong to conclude this paper without any mention of the issue of weekend mortality. Whilst this has been widely covered, CHKS analysis has come up with much smaller differences in weekend mortality compared with mortality during the week. Our research has found a 3 per cent difference between weekdays and weekends (see Chart 15).

There are a number of reasons for this and the most likely is the exclusion of zero length of stay emergency admissions and daycase electives from our mortality model. The key point is that a 3 per cent difference is much less than the overall variation between organisations and this should be looked at first.

The other point that is made very clearly by the data is that you need to look at hospitals individually – once you do this the patterns can be very different as can be seen from Chart 16. We can see that whilst mortality is always an indicator to be taken seriously, the drive for improving services at the weekend should be focussed on other issues first.

2 <http://bookshop.rcplondon.ac.uk/contents/pub235-b42eb97d-209b-4ecd-9127-ef95cc21c819.pdf>

3 [http://www.rcplondon.ac.uk/sites/default/files/consultant-input-into-acute-medical-admissions-management-oct-2010\\_0.pdf](http://www.rcplondon.ac.uk/sites/default/files/consultant-input-into-acute-medical-admissions-management-oct-2010_0.pdf)

4 <http://www.rcplondon.ac.uk/sites/default/files/an-evaluation-of-consultant-input-into-acute-medical-admissions-management-in-england-2012.pdf>

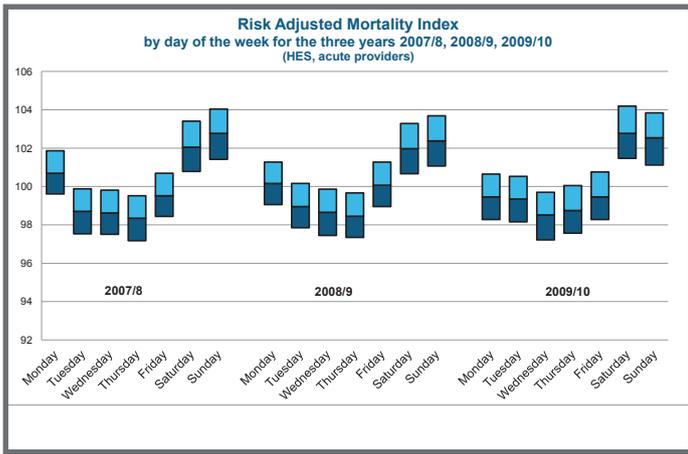


Chart 15: Risk Adjusted Mortality Index by day of week for the three years 2007/8, 2008/9 & 2009/10 (HES, acute providers)

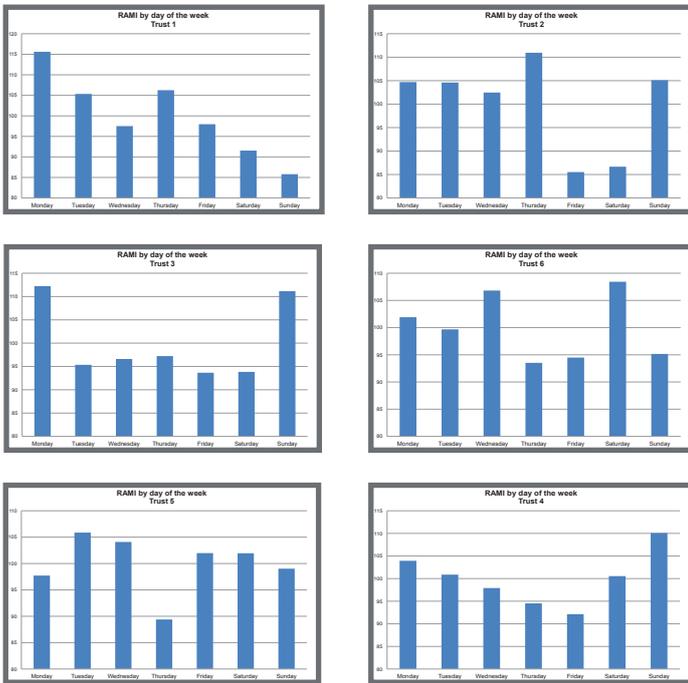


Chart 16: RAMI by day of the week for six trusts – all have Monday as the first day on the left

## Conclusion

Our analysis of hospital activity throughout the week shows that there is considerable variation between weekday and the weekend for elective admissions, elective discharges, elective caesareans, most procedures and diagnostics.

With unprecedented pressure to reduce costs hospitals are going to have to consider how they can operate effectively across the week to iron out these variations.