Performing or not performing: what's in a target?

Abstract

This paper analyses how providers have coped with the 4-hour target over the past 7 years. To do this, we use publically available data from NHS digital to track how long patients remain in A&E departments and their "attendance disposal method." Using this tool, we compared two A&E departments with similar arrival patterns and age profiles and that perform equally well against the target in a specific year. However, these hospitals exhibit very different underlying behaviour. Over 7 years, both exhibit a general increase in length of stay, increasing number of patients being admitted in the 20 minutes preceding the 4-hour target, and rising numbers of patients that breach the target. Despite the two hospitals having similar input profiles there is a 12 percentage point difference in the number of patients who leave the A&E department in the last 20 minutes. This operational information is not visible simply by monitoring the single existing metric. We conclude that the 4-hour target in isolation is an inadequate measure and we reflect on the difference between selecting measures for policy-level review, and for operational management. A link to download the graphs for each A&E in England is available.

Introduction

In 2004 the NHS Plan introduced a target that 98% of patients attending a hospital accident and emergency department (A&E) should be seen, treated and discharged within 4 hours of arrival.[1, 2] In 2010 the target was revised to 95% and this remains a key measure of hospital performance. A set of balanced indicators[3] that incorporated, amongst other metrics, unplanned re-attendance rates, the number of patients that left without being seen, and the times to initial assessment and treatment, were proposed and adopted for local use but not adopted as national targets. At one level, the 4-hour target has been an amazing success, improving the delays in care prevalent in the 1990s and setting a uniform expectation of service for millions of patients in the UK. It has also been important in driving research into the mechanics of urgent care provision and the connection between urgent care facilities and the wider care systems. On the other hand, more than a decade after its introduction, the measure has proved far from sustainable, and many A&Es continue to breach the relaxed target and overall performance against the measure continues to deteriorate. Monitor, now part of NHS Improvement, reviewed the decline in meeting the 4-hour target over the winter of 2014/15 as compared to the previous winter.[4] They concluded that the increase in the numbers of patients that were admitted from A&E, the bed occupancy of downstream wards, and the increase in the number of arrivals by ambulance had all been contributing factors.

Since A&Es are a 'barometer' of the whole health care system, it is important to understand what is happening in the A&E, which is difficult if the sole focus of measurement is around a single point, namely four hours. While a threshold value is easy to understand and report on, there is a danger that we simply focus on 'above' or 'below' the threshold, and do not take into account the context in which results occur. This has two aspects – what conditions contributed to meeting, or failing to meet, the target and whether the clinical response, quite apart from the target, was appropriate or not. Some of this context is available, though not generally reported upon alongside the 4-hour target, in the form of the method of 'disposal' that records whether a patient was admitted, discharged, or referred following their A&E visit.

A consultant physician summed up these aspects as follows: *"The huge failing in the 4hr target, in my opinion, was that the only outcome valued was 'The Patient Out of the A&E at 4hrs'."* (private

communication, email dated 05/08/16). In an effort to meet the target one strategy has resulted in the emergence of the Medical Assessment Unit (MAU) into which urgent care patients may be transferred rapidly for up to 48 hours, during which time they receive focused care. Ideally, the patient leaves the hospital after that and the time spent in the MAU does not contribute to the patient's length of stay in the A&E department. However, while admitting a patient to an MAU may 'stop the clock' as far as the 4-hour target is concerned, it may not represent a significant improvement in the quality of care or redesign of the service or reduction in A&E hospital workload. Various strategies have been introduced, some are beneficial for patients but others aim to improve the target alone. They include re-prioritising patients, but not in order of their clinical need, putting the most senior consultant as the first decision-maker that the patient encounters, and even data manipulation.[6-9] While there is undoubtedly evidence of rounding times down, this is not to suggest that staff are deliberately misrepresenting reality or providing poorer levels of care. Sometimes records are filled in retrospectively, for instance, once the rush is over.

We contend that a single target, such as 4 hours, is a poor measure for operations management,[5] offering limited insight into what is happening and being open to 'gaming'. Moreover, when a single target is highly performance managed then it can produce perverse effects such as an increase in financial deficit in order to meet the target. Even as a monitoring measure, the 4 hour wait target may not be 'helpful' if it is linked to a policy of punishment or reward – especially if there is evidence that the metric is not differentiating between high and poor performance. If operational managers are to be subject to a simple threshold measure to determine whether their performance is satisfactory, then they will require more sophisticated measures to see beyond the simple threshold. It is important that they understand what pressures may be building up, even behind a track record of apparent, consistent, success. The aim of these more sophisticated measures would be to help achieve improved patient flow evenly across the four hours rather than the present target which is shown to incentivise discharges in the last 20 minutes before the 4 hour mark.

In this paper we present publicly available data in such a way as to reveal trends that are not visible when simply considering the 4-hour target. We select two hospitals whose 4-hour performance is similar, and then look behind the headline metric. Our contribution is to provide the means for operational managers to more closely analyse the data around the 4-hour target, by generating graphs and visualising trends over the 7-year period. We hope that this will provide insights and offer more in the way of diagnosis and prognosis of A&E performance.

A new metric for A&Es would require a broader debate and probably the collection of more data, which is beyond the scope of this paper. However, by looking at the data over the past 7 years and by using different visualisation techniques, we identify new trends from the existing data. We hope to use this to guide thinking on appropriate and useful measures for the future.

Method

For this analysis we used the publically available HES data (Accident and Emergency Attendances in England - provider level analysis) from 2008/09 until the most recently published data (2014/15)[a]. Prior to publication, the data is extensively 'cleaned' by NHS digital analysts to prevent any patient identification resulting in some records being suppressed, when it is not possible to guarantee anonymity (typically when fewer than 5 cases are concerned). Each year's data can be downloaded as a separate spreadsheet file from the NHS Digital website (http://content.digital.nhs.uk/), covering

---

[a] From January 2017, the data file (for 2015-2016) will be called Hospital Accident & Emergency Activity and therefore may vary in terms of content reported.

April-March for each (financial) year, although each year's data does not become publically available until the following January. Each downloadable spreadsheet also contains 10 tables detailing one aspect of A&E performance listed by provider (e.g. Number of A&E attendances by hour of arrival for each provider). In addition the "Output" tab can display a comparison of up to 3 different trusts or areas (depending on the year selected) and, where available, the previous years' data is also displayed in tables (though not graphically). While this is interesting, we have taken a longer-term view that it is more informative to look how a single A&E performance has changed over time, and to combine the available data to provide a more in-depth understanding of what aspects of the A&E performance have altered.

We downloaded 7-years' worth of provider-level A&E data amalgamating four of the tables (Number of A&E attendances by hour of arrival, Number of A&E attendances by duration, Number of A&E attendances and method of discharge by duration and Average length of stay by hour of arrival) to provide a longitudinal view of an individual trust's performance. We developed a spreadsheet tool that allows the user to select an individual trust or area from a drop-down list and display the information around the 4-hour target associated with the selection over a 7-year period.

As Trusts combine and change their names over time, a lookup table containing the three letter code for each trust over the 7-year period was developed. When Trusts combine a new code may be generated, and old codes become redundant, and therefore not all trusts will have 7-years' worth of data. The tool then uses the three letter code from the lookup table to identify the data associated with that Trust. The data, for all the years available, is then displayed graphically showing how the profile of discharges has changed over the available period, supporting a far more intuitive understanding of the changes than can be provided by tables alone. Any 'missing' or 'supressed' data is labelled as 'missing' (as it is not always easy to identify when data has been suppressed or is missing).

When is the same performance not the same performance?

To explore how this spreadsheet can provide insight, we selected two trusts (Hospital A and Hospital B) based on the fact that they have a similar age and arrival profile, and reported a similar percentage of breaches (4.68% and 4.49%, respectively) against a 4-hour target of 95% (see Figure 1), for the year 2014-15 despite Hospital A having ~37% more patients in total (148,999 v 108,698).

While these hospitals appear to be performing similarly if we consider only the percentage of breaching the 4-hour target, if we compare the percentage of patients that spend between 3 hours 40 minutes and 4 hours in the A&E we observe a noticeable difference: Hospital A - 20.83% v Hospital B - 8.56%. This discrepancy is immediately obvious if we plot the profile of patients leaving the A&E in each case in 10 minute intervals, averaged over the year (Figure 2). There is a peak where 15.82% of patients are discharged in the last 10 minutes of the 4-hour target at Hospital A, which is absent in the case of Hospital B. What is interesting is that prior to 3:20 in the A&E, the length of stay profiles are very similar, with <1% variation between the two data sets.

It is in cases such as this, that the 4-hour target in isolation may be misleading, and more importantly, looking at a single year in isolation may mean that we are missing trends that could provide insight into systemic problems. By comparing the two hospitals over 7 years (Figure 3), we see that for 4 of the years (2010-11, 2011-12, 2012-13, and 2014-15) the hospitals perform similarly, but that they behave very differently in 2013-14.

We then break this information down further and consider the percentages of those leaving A&E in the first 2 hours (i.e. those who were processed and left the department quickly), those who left in

the last 20 minutes (i.e. those that potentially were rushed through to meet the target) and those that breached the 4-hour target. These categories on their own tell us nothing about the patient's condition when they presented or the appropriateness of the care they received, but we can identify trends over 7 years that offer insight into the operational aspects of the department.

Figure 4 shows the discharge profiles for Hospital A over the 7-year period. The percentage of patients discharged within the first 2 hours (blue) dropped from 31.3% in 08-09 to 21.5% in 12-13, while those discharged in the last 20 minutes (orange), or over 4 hours (grey) generally rose steadily during the same period. Since 12-13 this has reversed significantly with 41.7% patients being discharged in the first 2 hours, and 4.68% breaching the 4-hour target in 14-15. Figure 5 shows the same information for Hospital B. In 08-09 57% were being discharged in the first 2 hours, which declined to 32.8% in 12-13 before rising again to the 48.2% in 14-15. This was mirrored by a rise, and subsequent fall (after 12-13) in the numbers discharged in the last 20 minutes or over 4 hours.

Critically, while these two hospitals report very similar percentage of patients breaching the target for 4 of the 7 years (10-11, 11-12, 12-13, and 14-15, Hospital A ranged from 2.65%-5.17%, and Hospital B ranged from 2.0%-5.32%), if we compare the percentages of patients discharged at distinct stages throughout the 4-hour period we see that the A&E in each case is responding very differently. Both hospitals had their worst A&E performance over the first two hours of A&E stay in 2012-13, and both recovered somewhat in the next 2 years. Simply looking at the 4-hour target does not give us this information.

The reasons for the way the two A&Es behaved are not evident from the data but this approach furnishes material for a discussion; information that is completely lost when considering the 4 hour target alone.

Breaking the information down further on length of stay in A&E and "attendance disposal method" reveals other interesting information. Figure 6 and Figure 7 show the same data as in Figure 4 and Figure 5 respectively, but now the discharge destination is also revealed.

If we consider the Hospital A data (Figure 6), the percentage of patients that are admitted into hospital in the first two hours in any year is very low (between 0.92% and 1.68% - the blue area of the first of the three bars in each year). The percentage of patients admitted in the last 20 minutes before the target time (blue area in the middle bars) is noticeable higher (between 9.25% and 13.48%), and finally the percentage of patients admitted after 4 hours (blue area in 3rd bar) ranges from 1.59% to 5.63%. This shows that very few people are admitted in the first 2 hours, but of those that are still in the A&E after 3:40 hours, 53.68% (range 47.86%-60.68%) are admitted (or 15.09% of all patients are admitted after 3:40 hours). The raw numbers do not explain why this may be the case but it could be an example of the effect of encouraging staff to adhere to the 4-hour target effectively encouraging them to 'admit to decide'.

Additionally, the data shows that the percentage of patients that leave A&E in the first 2 hours, to GP follow-up (brown areas in 1st bars) has risen approximately 4-fold from 6.61% in 08-09 to 26.13% in 2014-15. Conversely the percentage of patients leaving in the first 2 hours that have no follow up (grey areas of 1st bars) has decreased by about half, from 17.11% to 8.01% over the same period. For clarity this information is summarised in Table 1.

	Admitted			Discharged GP follow up			Discharged No follow up		
Discharged in	First 2 hours	Last 20 mins	Over 4 hours	First 2 hours	Last 20 mins	Over 4 hours	First 2 hours	Last 20 mins	Over 4 hours
08-09	1.54%	12.01%	2.74%	6.61%	1.91%	0.50%	17.11%	3.98%	1.30%
09-10	1.50%	13.35%	1.77%	9.67%	5.47%	0.94%	7.13%	2.70%	0.52%
10-11	1.68%	13.48%	1.59%	10.20%	6.72%	0.51%	6.73%	3.52%	0.26%

11-12	1.14%	12.60%	2.85%	11.14%	6.89%	0.68%	6.84%	3.46%	0.30%
12-13	1.04%	12.56%	3.13%	10.49%	8.35%	1.12%	5.63%	3.02%	0.44%
13-14	0.92%	9.25%	5.63%	15.74%	7.60%	2.49%	6.54%	2.15%	0.62%
14-15	0.92%	11.66%	3.06%	26.13%	6.28%	1.03%	8.01%	1.42%	0.17%

Table 1 Percentages of patients discharged in timespan by destination (Hospital A)

Figure 7 shows the data for Hospital B broken down by discharge destination. In this data we can see that the in 08-09 the percentage of patients admitted in the first 2 hours (1st bar) is comparable with the percentage admitted between 3:40 and 4:00 (2nd bar), but over the years the percentage admitted in the first 2 hours has steadily dropped, while the percentage admitted in the last 20 minutes has risen to a maximum in 12-13, before dropping back to the 08-09 level (see Table 2). Meanwhile 59.12% of patients still in A&E after 3:40 hours will be admitted.

	Admitted			Discharged GP follow up			Discharged No follow up		
Discharged in	First 2 hours	Last 20 mins	Over 4 hours	First 2 hours	Last 20 mins	Over 4 hours	First 2 hours	Last 20 mins	Over 4 hours
08-09	5.65%	4.58%	0.93%	10.15%	0.80%	0.23%	31.13%	0.82%	0.21%
09-10	5.75%	3.76%	0.82%	9.19%	0.72%	0.26%	31.97%	0.71%	Missing data
10-11	4.68%	4.62%	0.94%	10.30%	1.19%	0.36%	23.06%	1.17%	0.35%
11-12	4.42%	6.11%	1.92%	7.88%	1.57%	0.59%	22.31%	1.60%	0.51%
12-13	3.78%	8.02%	3.04%	5.43%	2.79%	0.93%	16.20%	2.30%	0.57%
13-14	1.94%	6.86%	1.98%	5.37%	1.96%	0.59%	15.92%	1.35%	0.21%
14-15	2.59%	4.43%	2.83%	7.82%	1.39%	0.62%	30.35%	1.80%	0.45%

Table 2 Percentages of patients discharged in timespan by destination (Hospital B)

It is also interesting to note how the length of stay profile differs for those patient who are not admitted to the hospital and those who are, and how this has changed over the years. Figure 8 shows the length of stay for admitted and non-admitted patients for All England for 13-14. The graph shows a distinct peak at 4 hours for admitted patients, but a much flatter profile for discharged patients. The profile is similar for all years and the majority of A&Es, and as a general rule the peak in admitted patients becomes more pronounced with each passing year.

Discussion

We acknowledge that targets can improve performance, and the 4 hour target has driven enormous improvement in A&E provision, as well as standardising service expectations for patients across England. Moreover, the problems that led to its introduction are no longer the issues that they were, and the 4 hour wait is one of the shortest standards in the world. Our contention is that a determination to avoid 4-hour breaches only makes sense if one is also monitoring other parts of the profile: we have suggested those leaving within 2 hours and those leaving in the last 20 minutes.

We demonstrate that simply monitoring compliance with the 4-hour target at the 95% level will fail to reveal much about the underlying behaviour of the A&E by selecting two departments that look very similar from the perspective of the 4-hour target in one isolated year, but that behave differently away from the four hour limit, and from year to year. Our analysis of A&E data over 7 years bears out this analysis and reveals further trends, including the pincer movement between fewer people leaving A&E in the first two hours and more leaving in the last 20 minutes, that frequently results in more breaches.

The purpose of this paper is not to propose a formula that combines the 4-hour, the 2-hour and the 20-minute flows, but to show what insight can be gain from graphing the trends. We are aware that any such measure would depend upon how patients were classified. At this stage we are content to present the trends and raise the question for discussion.

This approach also provides basis for a richer discussion between clinicians and managers. It would be tempting to try to understand these trends in clinical terms, such as changing patient mix or flu patterns. However, they might be explicable purely in terms of operational strategies adopted by hospitals and the changing policies to which they have been subjected. We note that A&E is affected by the performance of other areas of the hospital (for instance, the effectiveness of the wards in discharging patients and thus creating capacity for new admissions) and the wider health systems, funding changes or commissioning strategies, and that this information is not contained within the dataset. We present the graphs specifically so that this clinic-operational management discussion can occur in each care setting, taking into account the contextual information that may have affected a particular year's performance against the target. This evidence may inform that discussion, it cannot pre-empt it.

So, firstly, a focus on two hours highlights efforts to move more patients through quickly. Raising the numbers of those leaving A&E within 2 hours would have a double impact of lessening the pressure at 4 hours and of lowering the congestion in the meantime. It is possible that a 2-hour internal focus would require further data to be collected and a refinement of the understanding of the pathways within the A&E, but it is less subject to gaming, since a few minutes either way around 2 hours is unlikely to be critical, while the effort to move more people through within the two hours would yield tangible benefits.

We note, for instance, that Hospital A had a fourfold increase over the seven years in the number of patients leaving the A&E within 2 hours to GP follow-up. While the reason for this is unknown, this may indicate difficulties in obtaining a GP appointments and raises complicated issues around GP access, decisions to admit patients versus treatment as out-patients or in primary care, as well as between clinicians and hospital managers. It may also indicate changes in how some subgroups are managed e.g. the use of "see and treat" for minor injuries or the use of a GP stream within A&E.

Secondly, we have focused on the last 20 minutes of the allowed stay. As A&Es are monitored on their compliance with the target this interval is characterised by a lack of thinking time and may also be associated with patients ending up on inappropriate wards (so-called outliers). Exception-management is always difficult and getting good decisions under extreme time pressure can be challenging. Therefore, strategies that either ensure that late-leavers have an automatic route to the next stage or that there are as few of them as possible, would be another clear operational benefit.

Finally, this approach focuses on trends and not on points in time. This is important within the A&E itself, where trends enable one to predict and therefore to respond ahead of breaches, and in the institution, where near-real feedback of trends can support much closer operational management.

Limitations of the tool include that the data does not become publically available until the January following the end of the previous financial year, and therefore is too late to act upon when pressures build. In addition, some of the data has been supressed – particularly in smaller A&Es, which can affect the how the profiles appear on the graphs. However hospitals collect this data themselves, so could use live data and visualise their performance in this way.

In summary, we have provided a tool that allows analysis of A&Es performance over a 7-year period using publically available data. This analysis looks behind the 4-hour target to analyse how length of stay and method of disposal have changed over time providing deeper insight into performance, providing hospital managers and clinicians the opportunity to explore potential strategies to improve flow within the department.

A summary pdf of graphs for A&Es in England may be downloaded from:
www.cumberland-initiative.org/tools/

References

[1] Secretary of State for Health. *NHS plan: A plan for investment, A plan for reform.* HMSO, 2000

[2] The Kings Fund. *Urgent and Emergency Care: A review for NHS South of England.* 2013

[3] Department of Health: Urgent & Emergency Care. *A&E Clinical Quality Indicators Data Definitions.* 2010

[4] Monitor. *A&E delays: Why did patients wait longer last winter?* Monitor, 2015

[5] Cooke MW. Intelligent use of indicators and targets to improve emergency care. *Emerg. Med. J.* 2013;31:5-6. (doi:10.1136/emermed-2013-202391).

[6] Wang Z, Eatock J, McClean S, Liu D, Liu X, Young T. Modeling Throughput of Emergency Departments via Time Series: An Expectation Maximization Algorithm. *ACM Trans. Manage. Inf. Syst.* 2013;4:1-16. (doi:10.1145/2544105).

[7] Locker TE, Mason SM. Are these emergency department performance data real? *Emerg. Med. J.* 2006;23:558-59.

[8] Mayhew L, Smith D. Using queuing theory to analyse the Government's 4-h completion time target in Accident and Emergency departments. *Health Care Manag. Sci.* 2008;11:11-21. (doi:10.1007/s10729-007-9033-8).

[9] British Medical Association. *Emergency Medicine - Report of national survey of emergency medicine.* BMA, 2007