

In Conversation With... Paul Aylin, MBChB

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Editor's note: *Professor Aylin is Professor of Epidemiology and Public Health at Imperial College London, where he is also Co-Director of the Dr. Foster Unit. His research is internationally recognized for using routine data to identify disparities in quality and patient safety. We spoke with him about the weekend effect in health care—the observation that patients admitted to the hospital over the weekend often have worse outcomes than those admitted during the week.*

Dr. Robert M. Wachter: One particular quality issue you've studied, which has had a huge impact in policy implications, is the weekend effect. What got you interested in that in the first place, and then how did you approach it?

Mr. Paul Aylin: What got me interested in it was my experience as a trainee my first few years working in hospital. I was always aware that during weekends the hospital is quite a different place than what it is during weekdays. It seemed to be more difficult to order tests, x-rays, and CT scans. In one hospital I worked at, the microbiologist had to come in to deal with your blood culture. So, you were encouraged not to do blood cultures on the weekend. That was 25 years ago or more, but those kinds of practices still go on. While my interest arose out of my own experience, everyone has some experience of relatives, often elderly relatives, who had received less than optimal care that appears related to the fact that they came in on a Friday night and then weren't seen by a consultant until Monday morning.

Then, in discussion with Derek Bell (a professor of acute care at Imperial), we decided to see if we could replicate a [seminal paper](#) by Chaim Bell published in the *New England Journal of Medicine*. This study looked at nearly 4 million admissions in Canada. Bell found a significant weekend effect. Overall, a nearly 30% increase in the risk of death if you were admitted on the weekend compared to weekday. We decided to use our large resource of administrative data and look at this in England. We looked at 4 million emergency admissions in the United Kingdom, and we looked at 50 different diagnosis groups as well as all emergency admissions. We adjusted for age, sex, economic deprivation, comorbidities, and the admitting diagnosis. After looking at these 4 million admissions, we found that the odds of death was about 10% higher in patients admitted at the weekend compared to those patients admitted during a weekday.

Interestingly, when we tried to publish our findings in the *BMJ*, the paper was rejected because it wasn't thought to be of interest. At that time (in 2007), the academic community and the medical community seemed to generally acknowledge that the weekend effect was a fact of life and nothing more needed to be done on it. We [published](#) in *Quality and Safety in Health Care* in 2009; the study received huge amounts of press coverage. Although academics and doctors at the time accepted that there was a weekend effect, it would seem to be news to the public.

But one criticism of looking at administrative data, and particularly emergency patients, is that patients are simply sicker when they're admitted on the weekend. Yet, we didn't find any evidence of that looking at our data. Looking at the age mix and the numbers of comorbidities and other indicators that are proxies for how ill patients are, we couldn't see any differences in the weekend/weekday admissions. But that issue of residual confounding, uncorrected for differences in case mix, still was a possibility.

In our [next paper](#), we tried to get around that by looking at planned admissions. We knew that there were very few elective procedures in England carried out at the weekend. Our hypothesis was that if the weekend effect was really a quality or safety issue, then we might expect to see the effect in patients who have their operation on a Friday, then stay over on the weekend. The reason for picking planned admissions was that we didn't expect the mix of patients to change very much from day to day during the week. So you would get the same kinds of operations on a Monday as you would expect on a Friday. We looked at 3 years of data and all operating room procedures carried out in English public hospitals. We excluded day cases. And we looked at the kinds of operations that were carried out from day to day, and there was no difference in the complexity of procedures carried out between a Monday and a Friday. When we looked at the odds of 30-day postoperative death, we found that as your operation approached the weekend your risk or your odds of death gradually increased, until on a Friday you had around about a 40% higher odds of death compared to patients who had had their operation on a Monday.

This was a large percentage of a very low risk. The risk of death in elective surgery is thankfully pretty low, a fraction of a percent. But it was quite a striking picture. We also looked at patients who had their procedures on a weekend. Although in the UK it's a very small proportion of planned procedures, the risk of death in patients who had their procedure at the weekend was about 80% higher than patients having their operation on a Monday.

RW: Wow.

PA: In fact, procedures carried out on the weekend seemed to be slightly less risky, slightly less complex, slightly more routine—hip and knee replacement—type things. So that was quite striking. Again, the paper got a lot of publicity and some criticism and some useful suggestions. One of the rapid responses that came up on the *BMJ* suggested that if it's a postoperative effect, if it's the first 48 hours of care following a procedure, then you might expect the patients who have their operations on a Sunday would have a lower risk of death than those who have their operations on a Saturday. Because of the small numbers, we had only grouped the weekends in one block. But when we split the data from Saturday and Sunday, we did in fact find that patients who had their procedure on a Sunday had a lower risk of death than those patients who had their operation on a Saturday. This, we hypothesize, is because of the bulk of their postoperative period is then experienced on a Monday or a Tuesday in those Sunday operations.

Another suggestion was that maybe it's just that on a Friday you get a different mix of doctors doing the operations. I'm told that if you start your first consultant post in a hospital as a surgeon, you almost invariably get the Friday afternoon theater list because that's the least popular one to do. But we were able to look at proxies for experience there. It did look like there was a slightly higher percentage of more junior consultants operating on a Friday compared to a Monday. And a slightly smaller proportion of more senior consultants operating on a Friday compared to a Monday. But our results were pretty much unchanged by taking that into account. We thought, if it's a real quality of care issue, maybe we would see effects in indicators other than death. We've always picked death before as an indicator because (a) it's quite easy to diagnose, and (b) it's generally pretty well recorded on administrative data. So it's used as a marker for quality. But it is interesting to look at other aspects of care and see if you also find differences there.

In the [next paper](#), we looked at about 90,000 stroke admissions in England over one year. We looked at a range of indicators: outcomes other than death, whether they were likely to develop an aspiration pneumonia, and (as a proxy for a good recovery) the proportion of patients who were discharged back to their usual place of residence. But we also looked at some process measures. We looked at the proportion of patients who could expect to get a brain scan on the day of admission, and the proportion of patients who received thrombolysis. Interestingly, we found that if you were admitted with a stroke at the weekend in England in 2009, you would be less likely to get a same day brain scan. You would be less likely to receive thrombolysis. You'd be more likely to develop an aspiration pneumonia. You have a higher risk of death. And you'd be less likely to be discharged back to your usual place of residence. Five out of the six indicators that we looked at seemed to indicate poorer quality outcomes and processes at the weekend compared to weekdays.

RW: I imagine in doing these studies you confirmed what your suspicion was from your family and personal experience. It sounds like it made a bigger splash than you anticipated, and that policymakers noticed as well. What has been the response and what do you think about it?

PA: We've only published four or five papers in this field, and there are literally hundreds of papers on the weekend effect and on variations in outcomes by day. But certainly in the UK our work seems to have received high levels of media coverage. There have been some policy effects as a result of not only the scientific work, but also the public interest, in that the NHS is trying to move toward a 7/7 working pattern. The policy move seems to be more around emergency care and also care for patients in hospital as opposed to 7/7 provision of elective care. Overall, the public is very supportive of this. What's interesting is some of the political moves to try to encourage more 7/7 working.

The big thing in the news in the UK recently has been around junior doctor contracts. Essentially, junior doctors are being asked to work not necessarily more hours but certainly more weekends. And there have been strikes over this new contract. The politics has added a lot of toxicity to the scientific debates, in that if you look at the responses to our first few papers, there was very little interest from doctors and clinicians and academics. But our most [recent paper](#), on obstetric care, unfortunately happened to come out about a week before a big industrial action was planned by junior doctors. We were inundated with rapid responses from angry junior doctors questioning our results. There were social media campaigns designed to discredit researchers in this field. It seems to have rather clouded the scientific search for the truth. Is the weekend

effect a real effect? I happen to think it is a real effect and it's not accounted for by case mix or other biases or confounders. But the politics has made it more difficult, I think, to stick your head up above the parapet and talk about these research findings. It's been an interesting personal journey for me.

RW: I'll bet it has. You've learned about the way the politics work.

PA: You learn about how science works in society. The interpretation of evidence seems to work along the lines that you see you want to believe, a phenomenon known as confirmation bias. You realize that science isn't a cold, critical appraisal of the facts. It also has emotions and politics and all sorts of things wrapped up in it. Which I knew before, but this research has just confirmed that. It's been very interesting.

RW: You were doing big data before that was fashionable. So how does this work change today, given the proliferation of electronic health records and the new capacity of computers to crunch big data?

PA: Well, it's blurring this distinction between clinical data and administrative data. It opens up a whole new potential. In a way, primary care in the UK is well ahead of hospitals in terms of electronic health records. They've had them for decades. Practically 100% of primary care practices are now computerized. That is a very rich source of information. We're beginning to use some of that data linked to hospital data to learn more about the patient journey from the first primary care consultation up to the procedure in hospital. So, that is allowing us to look at more of the patient experience within the health care system.

I'm also very interested in not just surveillance at a hospital level, consultant level, or GP level, but also using real-time data to assist in monitoring patients. We've done a little bit of work around failure to rescue as an indicator. The increase in the amount of real-time observation data is a potential tool to identify patients who might be deteriorating more quickly. At our local hospital, we now have electronic nursing observation data. It seems that we can start to use either more traditional statistical methods to look at changes in those observations or start to begin to use some of the algorithms and techniques involved in artificial intelligence to pick out patterns in deteriorating patients. The richness and the volume of data is going to allow us to do much more interesting things.