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INVITED COMMENTARY

The weekend effect and workforce in kidney transplantation

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The two-day weekend has its origin in religious observation over millennia and labor rights dating to the industrial age. The two-day weekend in medicine is much younger; only a few decades ago, the weekend did not begin until Saturday afternoon for many physicians.

The observation of a "weekend effect" dates to the 1970s but has only come under scrutiny over the last two decades [1,2]. The effect is an association of increased mortality with hospital admission on weekends (Saturday and Sunday) versus a weekday, carrying an approximately 15% greater risk of mortality. The effect has been identified in both medical and surgical disease. Putative causes include health system characteristics—reduced weekend staffing and clinical experience, and restriction of specialized diagnostics and therapeutics on weekends; and patient characteristics—greater severity of illness and comorbidities in those admitted during the weekend (however, there are analyses showing persistence of a weekend effect after adjustment for patient severity). The effect and its magnitude remain controversial and its cause(s) unclear, but it has been an impetus for a change to consistent staffing and services over the entire seven-day week in at least one national healthcare system, the U.K. National Health Service, with the expectation that the consistency would reduce avoidable deaths.

As the weekend effect has been shown in the setting of emergent surgery (and elective surgery on Friday), deceased donor transplantation, an urgent surgery, has been examined for the effect. Recent studies of large cohorts over long time periods, 1994–2010 and 2003–2014, in United States [3] and U.K. [4] national transplant databases, respectively, showed no association between day of the week and outcomes of transplantation as measured by patient and graft survival, delayed graft function, and acute rejection. Median hospital length of stay was a day shorter (six versus seven) in weekend transplant recipients in the U.S. study, and there was no difference in risk of rehospitalization within the first year in weekend recipients in the U.K. study. Proposed explanations for the lack of a weekend effect were (i) kidney transplant candidates are clinically stable when called for transplant surgery; (ii) transplant programs are in tertiary medical centers; (iii) transplant teams are specialized; and, (iv) transplant care follows standardized protocols [3]. However, selection bias in organ acceptance during the weekend, declining marginal kidneys, could mask an effect [4].

A subsequent retrospective study of the weekend effect over a recent eight-year period, 2007–2014, at a single center in Germany provided closer examination of immediate and short-term outcomes of weekend

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deceased donor kidney transplantation [5]. Addressing the possibility of a masking of the weekend effect through selection bias in organ acceptance, no difference in organ decline rate and donor quality (fraction of donors with KDPI > 85%) between weekend and weekday transplants was seen. Mirroring the large database studies, there was no effect on patient and graft survival at three years, delayed graft function (24%), acute rejection in the first year (~20%), and hospital length of stay (18 days). Additionally, the estimated glomerular filtration rate (eGFR) at one year was equivalent to those who underwent weekday transplantation (50 ml/min/1.73 m^2). However, there was a greater frequency of surgical complications requiring reoperation or intervention in those who underwent weekend surgery, 37 versus 28%. Hemorrhagic complications (hematoma or bleeding that required intervention or blood transfusion) were most common, followed by ureteral and wound complications. The weekend surgical team's schedule, often filled with many surgeries and little sleep, was proposed as a possible explanation for the increased number of weekend transplant surgical complications. The authors recommended general awareness of the weekend effect, appropriate staffing, and an attempt to reduce the workload of transplant teams on weekends.

An ANZDAT database study of another large cohort over a long period, 1994–2012, was prompted by the above report and published in this journal last year [6]. It aimed to determine whether there was a weekend effect in those with vascular disease undergoing kidney transplantation. Congruent with prior studies, there was no impact of weekend transplantation on patient and graft survival. However, in those with vascular disease (coronary, cerebrovascular, or peripheral vascular disease) or its risk factors (diabetes and smoking) transplanted on the weekend, there appeared to be a higher risk of graft loss to vascular complications (renal artery or vein thrombosis, renal artery stenosis, hemorrhage, and cortical necrosis) within 90 days, with the majority of the failures occurring within seven days.

The aim of the retrospective study in this issue [7] was to evaluate whether a weekend effect was evident in a cohort of over 6600 deceased donor recipients transplanted during the 48 hours of Saturday and Sunday in seven centers across France during a recent 12-year period (2005–2017). Similar to the above studies, 30% were transplanted on the weekend, with a range of 28 to 34% across the seven centers. There was no center effect with regard to outcomes. With a median follow-up of four years, weekend transplantation showed no difference in patient or graft survival at 10 years (~55%), and no difference in risk of acute rejection at one year (20%), urological complications at 30 days (~8.5%), and one-year eGFR (~50 ml/min/1.73 m^2). In contrast to the single-center study in Germany and the ANZDAT database study, there was a lesser frequency of vascular complications (primarily bleeding from the surgical site requiring transfusion or surgical intervention, followed by arterial dysfunction requiring surgical repair or angioplasty, and partial or complete arterial or venous thrombosis) at 30 days in the weekend group, 13.3 versus 16.2%, HR 0.79 (0.68-0.92), adjusted for cold ischemia time (mean of ~ 18 h overall). Similar to the study in Germany, there was no evidence of masking of the weekend effect because of weekend organ acceptance behavior. The authors suggest that the lesser vascular complications in the weekend transplants could be a consequence of the practice in France that weekend transplants are done by senior rather than junior surgeons, for greater efficiency.

The sum of these reports shows no weekend effect on the primary outcomes of kidney transplantation, patient, and graft survival. Nonetheless, the findings of increased early complications are troublesome. While the cause of these usually technical complications is unexplained, overwork and fatigue of the weekend surgical team must be considered. Transplant surgeons work long hours. In a survey of U.S. surgeons in 14 subspecialties a decade ago, transplant surgeons reported working an average of 69 hours per week, with an average of 4.3 nights per week on call [8]. Despite the high workload and its consequences (depression, burnout, lower quality of life, and work/home conflict), they reported a high level of career satisfaction. An earlier survey reported an average leisure time of 4.5 days per month [9]. Strikingly, 83% of those who participated in that survey reported inadequate time to recovery from a night transplant. A more recent U.S. abdominal transplant surgery workforce study reported an average of 11.6 nights per month on call [10]. Importantly, 25% of the surveyed transplant centers considered themselves understaffed and were interested in recruiting mid-level not junior surgeons. Workload and inadequate surgeon staffing have been invoked as factors in the weekend effect evident in the discard rate of weekend deceased donor kidneys in the United States [11], which appears to be more than double that in France [12].

The absence of a weekend effect on survival outcome of deceased donor kidney transplantation should reassure recipients who undergo weekend transplantation

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and candidates awaiting transplantation. Transplant surgeons are to be commended for their dedication, diligence, and stamina. Nonetheless, there is a limit to human endurance, and it may be showing in technical error. Concession to this limit should guide the design and staffing of transplant programs, for surgeon and program well-being, and the betterment of those with end-stage kidney disease worldwide [13].

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