“I stood at the head of the bed holding the screaming 2-year-old as gently as possible. As I held him, his bedside nurse spent 20 minutes milking blood from his heel to obtain the necessary tacrolimus level. The patient had received a living donor kidney transplant 7 days before, and his tacrolimus level had clotted both of the previous days. Our team needed this information to appropriately dose the immunosuppressive agent that would prevent rejection in his new kidney. Unfortunately, high levels of the same medication could also cause kidney injury. His mother muffled sobs as she tried to comfort him, and his father stormed out of the room with tears streaming down his angry face. As I held the child, I envisioned this same scene unfolding with every transplant patient for whom I had cared for over the course of my first year of fellowship on every day that I had ordered a tacrolimus level. After all of that trauma, the blood specimen clotted, and we were again left without the necessary information to make a sound clinical decision. His family later told me they would not allow another heel stick to be done on their son.”

There has to be a better way. This mantra reverberates in the minds of trainees throughout medical school, residency, and fellowship as they try to understand why certain decisions are made, how specific processes became standard work, and why these processes vary so greatly between institutions. When faced with inefficient, unsafe, or low-value care, we often fail to question or take action to find and implement a better way. Trainees face an intimidating culture of hierarchy, which often hinders their drive to speak up about patient safety issues or raise questions about a process. This environment can also limit their desire to challenge the system and make improvements. We are called to be good stewards of health care resources, and we simultaneously strive to improve the patient experience, improve the health of populations, and reduce costs. As I reflected on the experience described here and considered my obligation to improve care, I reviewed the current process in place for monitoring tacrolimus levels for kidney transplant patients admitted to the nephrology floor in my institution.

All pediatric solid organ transplant recipients take a regimen of immunosuppressive medications to prevent transplant rejection. Most of these regimens include a potent immunosuppressive medication with a narrow therapeutic window and concentration levels that are highly variable, both between patients and within individual patients. The side effects of tacrolimus are concentration dependent and numerous; they include nephrotoxicity, neurotoxicity, hypertension, infection, glucose intolerance, liver dysfunction, and lymphoproliferative disease.
Given the narrow therapeutic window of tacrolimus, it is crucial to monitor drug levels closely with a 12-hour trough level obtained before the next medication dose. In pediatric kidney transplant recipients, the serum concentration dose–response relationship between tacrolimus and nephrotoxicity makes adequate drug level monitoring especially important.5

The process for monitoring tacrolimus levels in our kidney transplant patients included a finger stick or heel stick blood draw performed by the bedside nurse and ordered just before the morning dose of tacrolimus to ensure an accurate 12-hour trough level. In addition, 86% of these patients underwent a separate venipuncture laboratory draw at a different time for their routine daily laboratory tests. Although most providers consider venipuncture and other needle sticks to be routine, these procedures are significant sources of pain that could have lasting psychological effects on both pediatric patients and their parents.6 Shockingly, −20% of the tacrolimus levels drawn in this way were reported as “clotted” or “insufficient quantity,” making the finger or heel stick laboratory draw performed on these patients not only redundant but clinically useless. In fact, this practice was potentially harmful. The patient described in the opening had a doubling of his creatinine concentration in the face of a high tacrolimus level that we were unable to detect for several days as a result of the clotted samples. Although this test is clearly essential for patient care, the process used in our institution to obtain the test specimen was harmful, wasteful, and of low value.

In baseline data collected over a 10-month period, we found that 24 (20%) of the 123 tacrolimus levels drawn were unsuccessful. This scenario equates to the following: −8 hours of wasted time during which nurses could have been performing other patient care duties; almost an ounce of wasted patient blood; wasted supplies (including lancet, lavender top tube, Vacutainer blood collection tube, alcohol swabs, gauze, and hot packs); and $7200 spent on a laboratory test that yielded no usable result. Of the 123 episodes of care over the baseline period, the patients in 104 of these encounters (86%) suffered 2 needle sticks. The dissatisfaction by patients, families, and providers cannot be quantified. The low quality and high cost make this a low-value process for an essential test.

Does any of this matter? It should matter to us as health care professionals and responsible stewards of health care resources. As I delved into the details of this process and performed a root cause analysis, it became increasingly apparent that we were providing low-value care to some of our most vulnerable patients. The value ratio did not add up.7 In fact, this process did not meet any of the Institute of Medicine’s 6 aims for improving health care (the numerator in the value ratio), and the underlying cost of the process was high in terms of both wasted resources and patient and family distress (the denominator).78 This process was neither safe nor effective, as evidenced by the risk of nephrotoxicity and acute kidney injury in the setting of unavailable tacrolimus-level data to guide subsequent dose adjustments. It was certainly not patient centered, as most patients suffered a painful heel or finger stick regardless of age plus an additional venipuncture blood draw at a different time, which led to patient and family dissatisfaction. No part of the process was timely or efficient. The bedside nursing staff would often spend >20 to 30 minutes of wasted time trying to obtain the tacrolimus level. This process took them away from other patient care duties and often resulted in late administration of the morning tacrolimus dose. It also cannot be minimized that each patient whose blood specimen clotted or was of insufficient quantity provided precious blood that was wasted. Finally, the process was not equitable. Solid organ transplant teams on other floors were able to use an 8:00 AM phlebotomy service to obtain all blood work with a single venipuncture blood draw while a change in the nephrology floor phlebotomy schedule 5 years ago made an 8 AM phlebotomy blood draw impossible.

In response to the confirmed provision of low-value care in the kidney transplant population admitted to the nephrology floor, we have undertaken a quality improvement effort to enhance the quality of care provided, the reliability of care, and the patient and family experience. We have the opportunity to eliminate this example of “not value-added care” and to reduce waste.9 This effort would not be possible without the collaboration of individuals across the hospital, including the nephrology department, the transplant team, the floor nursing staff, and the phlebotomy service. By exploring how we can improve this process and sharing those findings, a discussion began that has led to a committed effort to truly affect patient care and the patient experience in a meaningful way. Previously, each team of individuals operated in a siloed environment, and no one knew there was a problem. We have crossed disciplines to understand the challenges in each
department that previously precluded a solution, and we have found a better way. As of February 2014, all kidney transplant patients have blood for all of their daily laboratory tests, including their tacrolimus level, drawn by the phlebotomy service reliably between 6:50 and 7:50 AM. This approach requires communication between the residents, floor nurses, and phlebotomy (all of whom truly own this process) to ensure that patients receive 1 phlebotomy laboratory draw for all their laboratory tests at the appropriate time. Since February, 255 tacrolimus levels have been drawn on 45 unique patients, and 100% have been successful, with no clotted or insufficient quantity specimens. In addition, we have successfully avoided 247 heel or finger sticks, which is a 77% reduction. Ultimately, our efforts have decreased the number of painful blood draws in each patient, improved the number of useful tacrolimus levels as well as the reliability of tacrolimus drug dosing, and increased the satisfaction of every member of the team (including the patients, families, and providers).

Successful health care improvement necessitates interdisciplinary collaboration; and it could begin with you.

As trainees, we deliver health care on the front lines and find ourselves in a unique position to identify low-value care. We also have the responsibility to do something about it. We are the next generation of health care providers and the future on which an improved health care system will depend. As a fellow trainee, I challenge you to ask the question, find the facts, and start the conversation of how we can provide better care to the patients we serve.

REFERENCES