Overwhelming numbers, frequency of uninsured dialysis patients in public hospital emergency rooms may have a solution

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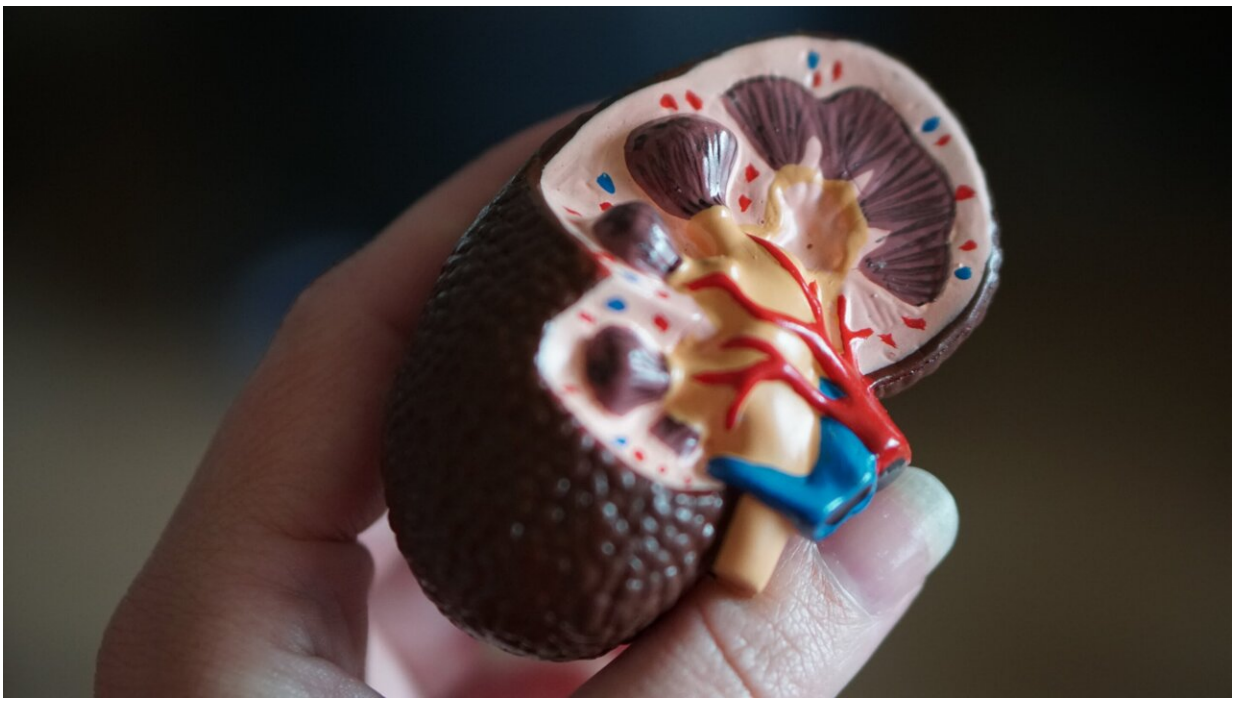

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Screening protocols to determine who qualifies for "compassionate dialysis" in hospitals with high numbers of uninsured patients are driving an unintended consequence, an SMU analysis has found. The protocols are putting too much strain on the emergency room, as measured by how

long ER patients are waiting to be seen and other metrics.

It has been estimated that the number of patients needing compassionate dialysis could make up 2 to 5 percent of the overall ER population in some public hospitals. Yet, these patients have been ultimately responsible for 20 to 30 percent of the total ER visits because of the frequency of their visits, previous studies have shown.

"The burden on the ER in these 'safety-net hospitals' is so disproportionate, it is naive to focus on relief to the acute dialysis unit alone," said Sila Çetinkaya, chair of Operations Research and Engineering Management in SMU's (Southern Methodist University's) Lyle School of Engineering. "ER is always a pain point for any hospital."

Çetinkaya's research team has investigated possible solutions to the problem—including congestion mitigation via modifying the screening threshold, scheduling treated ER patients to come back for more treatment at a set time and adjusting the screening threshold in response to the available capacity in the dialysis unit at different times of the day.

Compassionate dialysis is required by law of publicly-funded county hospitals when uninsured patients, including a large number of undocumented immigrants, need, but cannot pay for, dialysis to treat end-stage kidney disease—known as emergent dialysis. But before providing that dialysis a skilled nurse and a nephrologist in the emergency room must evaluate whether that patient has life-threatening conditions, currently based on a series of medical criteria laid out in the hospital's screening protocol.

County governments set the policy and hospitals rarely get a say in what the screening protocol rules will be for their emergency room.

Çetinkaya, said policy makers should use SMU's high-level analysis to

look at several metrics at their safety-net hospital to see if the screening protocol they've put in place is helping or hurting the hospital and its patients.

SMU's research team quantified the impact of the screening protocol for compassionate dialysis by developing what is known as a stylized queueing model, which was based on patient flow observations and interviews with medical experts at Parkland Memorial Hospital. This model allowed SMU to calculate the waiting times, queue length and many other factors for a typical safety-net hospital's emergency room and its acute dialysis unit, if different scenarios took place.

For example, they looked at the impact on overcrowding in both the ER and the dialysis unit if patients seeking dialysis were rejected at a certain rate with the intent of relieving congestion, but then ultimately those patients returned to the ER when they were sicker.

They determined that if the probability of patients getting rejected from the dialysis unit went from 0.15 to 0.20 when they arrived at the ER, the ER waiting time could increase by 44 percent. That translates to all ER patients having to wait almost two extra hours to be seen by a doctor. The wait time for the dialysis unit only decreased by 10 percent or 24 minutes, in exchange for this burden on the ER.

However, the research team also found that there are instances where screening protocols can be useful.

"The key is keeping the number of patients who are rejected for emergent dialysis low and under control," Çetinkaya said. "Our model gives policy makers a blueprint for how they can use screening protocols effectively, if they're going to have them in place."

The research was supported by the SMU Lyle School of Engineering

Seed Funding Program in collaboration with SMU Cox School Business and Parkland Memorial Hospital. A study on the findings has been published in the journal Service Science, the flagship INFORMS-sponsored journal that focuses on service operations including healthcare applications.

The medical issue

If a person's kidneys cannot fulfill their role of ridding the body of toxins, they become dependent on dialysis or the person requires a kidney transplant to live. For patients with end-stage renal disease (ESRD), the standard of care is to give at least three dialysis treatments per week to remove toxins and fluids.

Undocumented immigrants in the United States are ineligible for federal assistance with this disease from Medicare, Medicaid or insurance from the Affordable Care Act exchanges. So if undocumented immigrants don't have another way to pay for standard dialysis, safety-net hospitals are usually their only option. Other uninsured people who qualify for Medicare or Medicaid also seek compassionate dialysis for a variety of reasons such as an inability to file paperwork or having a mental disorder.

"There are patients like this all over the nation coming to publicly-funded county hospitals just like Dallas Parkland, so the problem is widespread," Çetinkaya said. Under the 1986 federal Emergency Medical Treatment and Labor Act, publicly-funded hospitals are required to give emergent dialysis care, regardless of a patient's ability to pay for it.

Because it happens inconsistently, compassionate dialysis does not sufficiently remove toxins and fluids from the body and contributes to progressive deterioration in patient health over time. So the odds are

very high that these patients will be recurrent arrivals to the ER.

This practice can also be staggeringly expensive. A study done by Baylor College of Medicine found the total cost of care for a year of scheduled dialysis was $77,000 compared to $280,000 for emergent dialysis due to emergency room visits, frequent hospital admissions, and prolonged stays.

Çetinkaya started to look into the issue in 2016 after she observed the overcrowded waiting room in Parkland's old emergency room and was told the reason was partly because of patients needing compassionate dialysis. At the time, she had been visiting the hospital with Dr. Bob Hendler, former senior vice president and associate chief medical officer at Parkland.

She worked with Olga Bountali and Vishal Ahuja to create a stylized queueing model of the compassionate dialysis process. Bountali, now an assistant professor of operations management at the University of Toronto, was a postdoctoral fellow in Çetinkaya's SMU Lyle School department when this research was done. Ahuja is an assistant professor of information technology and operations management (ITOM) in SMU's Cox School of Business.

All three SMU researchers have held courtesy appointments with University of Texas Southwestern Medical Center.

Queuing theory is a branch of mathematics that studies and models the act of waiting in lines. To create one, the SMU research team first established a flowchart for what would happen if a patient was approved for getting emergency dialysis and what would happen if he was denied. This flowchart had four points of interest: the ER, where patients are evaluated based on the screening protocol for dialysis; the dialysis unit; a virtual holding place for patients who were rejected from getting

dialysis; and another virtual place for patients who had just completed dialysis treatment.

The team then created a mathematical model and obtained analytical and numerical results to analyze how unpredictable, irregular variables affected both the ER and the dialysis unit. The SMU research team analyzed 864 problem instances, looking at variables such as patient revisit patterns, percentage of patients who received treatment, treatment times and the number of nurses and dialysis machines available.

Possible solutions to the problem

One potential strategy for improving efficiency at the hospital calls for having dialysis patients receiving emergency ER treatment return to the ER for a follow-up treatment at a specific time, according to results published in a second SMU study in the journal IISE Transactions on Healthcare Systems Engineering. Since these treated patients would already be identified as in need of emergent dialysis, not having to screen these patients a second time would eliminate a delay in further treatment. It also meant reducing the wait time in the ER for all patients.

Collaborating with Çetinkaya and Bountali for this second study was SMU Ph.D. student Farnaz Nourbakhsh, whose simulation model allowed the research team to investigate further possible solutions to the issue. For instance, they found that adjusting the screening protocol for compassionate dialysis patients in response to the number of nurses available in the dialysis unit at three different times of the day resulted in lower ER wait times and less delay for dialysis treatment.

More information: Farnaz Nourbakhsh et al, Innovative Use of Operational Tools to Improve Care Delivery for the Uninsured ESRD Patients and to Inform Healthcare Policy-Makers, *IISE Transactions on Healthcare Systems Engineering* (2022). DOI:

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