

## Kidney Care Desert Analysis

### Chronic Kidney Disease and End-Stage Renal Disease in the United States

- End-Stage Renal Disease (ESRD) is one of the most pressing health problems in the United States today.
- ESRD, defined as an irreversible late state of chronic kidney disease (CKD), where the kidneys can no longer maintain a life-sustaining rate of blood filtration (1), affects 786,000 Americans as of 2022 with an additional 26 million other Americans suffering from CKD, many unknowingly (2).
- It has grown at a prodigious rate in the last 30 years, in lockstep with the explosive growth of two other chronic conditions which are tightly correlated with it, Diabetes Mellitus Type 2 and Obesity. It's estimated that by 2030 it will affect over 1.3 million Americans (3).
- ESRD contributes to significant morbidity and mortality in our nation. The life expectancy of a patient with ESRD is severely curtailed as a loss of kidney function has widespread effects throughout the body.
- Even with early dialysis intervention, an estimated 20-50% of ESRD patients die within 2 years (1).
- Chronic anemia, osteoporosis and immune dysfunction are all effects of the chronic sub-optimal renal clearance that is the hallmark of ESRD and are all independently related to high morbidity and mortality among these patients (4) (5) (6)
- These widespread clinical effects continue to cost the American taxpayer a significant amount of money and resources every year. Yearly expenditures on dialysis patients costs on average \$90,600 per patient, with overall Medicare expenses related to the treatment of ESRD totaling \$35.9 billion in 2017, or about 7.2% of total Medicare claims (7)
- Dialysis patients are also often considered disabled under the law considering the burden of treatment that keeps most ESRD patients from full time employment. This lack of participation in the labor market further contributes to the overall cost of this disease on the American public.

### Dialysis: Types, Costs, Comparisons and Barriers

- Dialysis is the process in which artificial devices are used to replace the blood filtering function of the kidneys. There are two main types of dialysis: hemodialysis and peritoneal dialysis
- Hemodialysis usually occurs at specialized centers termed “dialysis centers”. Patients are connected to dialysis machines and over the course of 3-4 hours, have their entire blood volume filtered. This needs to happen three times a week on average on an ongoing, chronic basis.

- Advantages of hemodialysis:
  - Performed at a specialized center with trained clinical professionals at hand to monitor patients while the dialysis process progresses.
- Disadvantages of hemodialysis:
  - High cost: office overhead, clinical staff salary and equipment adds to high average costs.
  - The patient must get to the facility which can be hard to do without reliable transportation. Failure to obtain transportation to and from dialysis centers fuels increased ED utilization for emergency dialysis on these patients after many missed sessions and increased blood toxicity
  - The time burden of chronic hemodialysis use also subtracts from the productivity of patients who cannot hold a full-time job due to the demanding hours of the weekly sessions.
- Peritoneal dialysis, often also termed “home dialysis”, involves filling the peritoneal cavity of the ESRD sufferer with a dialyzable fluid, which clears the blood of toxins through osmosis, when left in the cavity during a period of time.
- The main advantage of peritoneal dialysis is its portable nature allowing the patient to dialyze at home and to continue living a fairly normal life otherwise. A dramatic decrease in cost compared to hemodialysis is also present.
- The main disadvantage of peritoneal dialysis is the degree to which the patient must be trained to properly perform this daily ritual and the consequences that arise from improper practice.

### **End Stage Renal Disease: Inequity in Outcomes and Distribution**

- ESRD is not equitably distributed in the American population with poorer patients and patients of color suffering disproportionately
- As with multiple sectors of American healthcare, treatment of ESRD is not equitably distributed: Primary care, which has been identified as the principal factor in avoiding the conversion of chronic renal insufficiency into ESRD, is not equitably distributed and this has been known for decades (primary care shortage areas)
- Dialysis treatment centers cluster as well, creating vast areas where dialysis care is either nonexistent or hard to reach.
- Peritoneal dialysis would be an appropriate replacement of hemodialysis in these dialysis deserts, but as established earlier, their dependence on pharmaceutical services and supply chains still translates into barriers of treatment.
- Beyond the ballooning costs and increased morbidity and mortality of ESRD in the American population, the inequitable distribution of ESRD treatment resources has several deleterious effects onto our society:

- Increased mortality:
  - It goes without saying that decreased accessibility to life saving modalities such as dialysis treatments increase overall mortality from ESRD and its associated effects on the human body.
  - This mortality will also reflect the social economic and racial inequities present in the inequitable distribution of these resources.
- Increased costs
  - Decreased treatment will lead to more complications and more illnesses, which will lead to more costs to the taxpayer.
- Increased use of emergency and hospital services:
  - Missed dialysis appointments, usually due to difficulties in transport to a nearby facility, is a common ED admission complaint.
  - The greater the barriers to accessing dialysis centers, such are present in dialysis center deserts, the greater the numbers of ESRD patients we will see reporting to local EDs and hospitals in need of costly, emergency care.

## WHAT HSR.health PROVIDES

HSR.health is an innovation-first healthcare technology firm and the leading provider of health-focused geospatial data analytics. Our AI-enabled, geospatial platform curates data globally and provides actionable health risk data analytics to healthcare industry professionals, NGO's, and government entities.

Our Dialysis Desert analysis identifies multiple locations in the United States where ESRD care resources are severely deficient and may constitute a significant barrier to care for millions of Americans. This analysis, part of our wider Care Desert series, is a first and important step in increasing the awareness of our policy makers to this often, under publicized problem. HSR.health hopes to lead the way in revealing how our geography can contribute to both health problems and likewise, health solutions.

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