

Measuring the association of switching patients from hemodialysis to expanded hemodialysis, with hospitalizations, medication use, costs, and patient utility.

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Background

- An innovation called expanded hemodialysis (HDx) - using the Medium Cut-Off membrane **Theranova** - allows for improved removal of molecules with a size of 25 kDa and above, including larger uremic toxins in comparison with conventional high flux hemodialysis (HD). (1)
- Early clinical evidence suggests that using HDx has the potential to improve patient outcomes and quality of life. (2)

Objectives

- To provide an initial assessment of the impact of switching patients to HDx on hospitalizations, hospital days, medication use, hospitalization and drug related costs, and patient utilities.

Methods

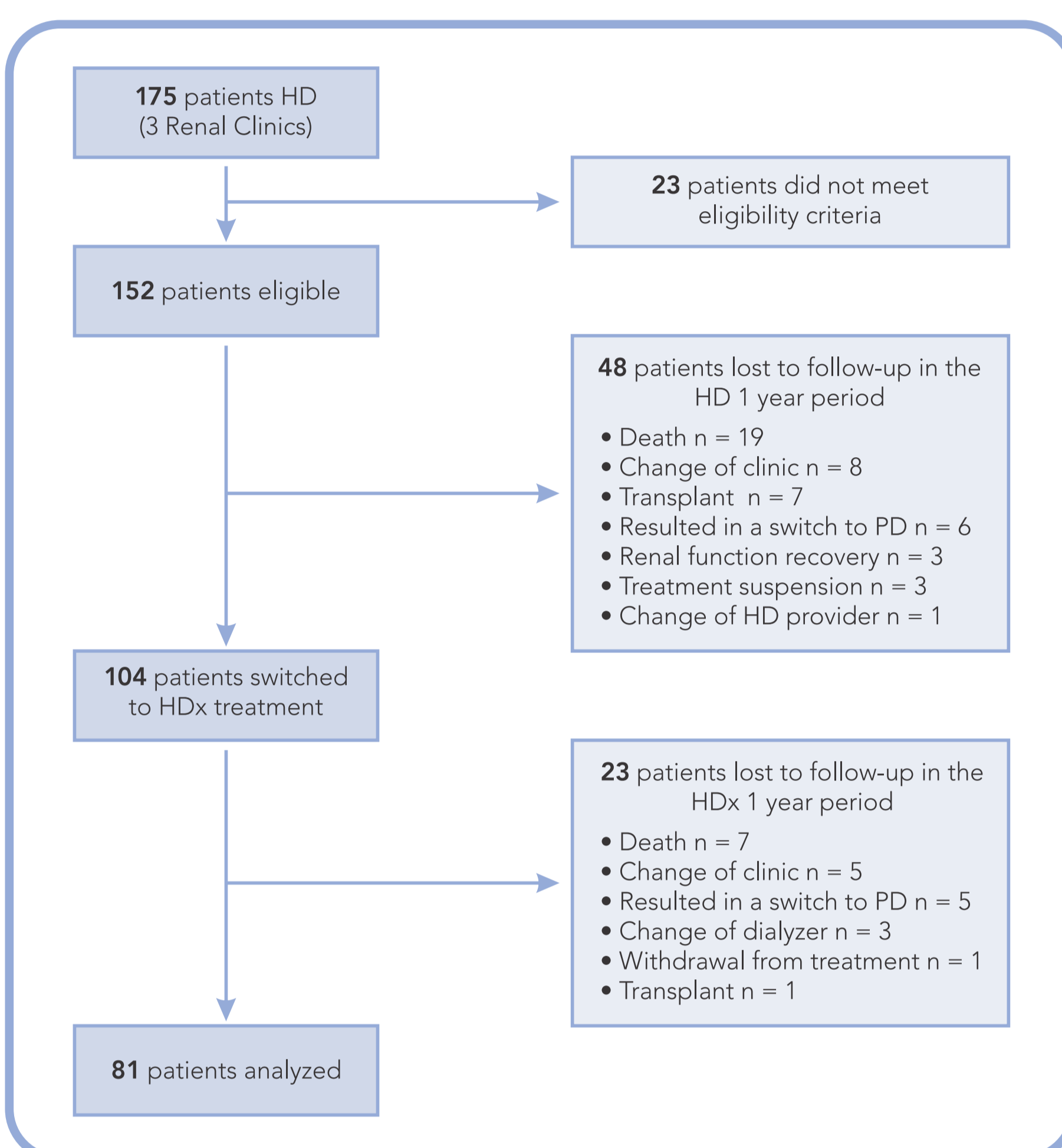


Figure 1: Flowchart, inclusion / exclusion criteria

The data for this before and after retrospective analysis came from the Renal Therapy Services (RTS) medical records database in Colombia. All of the patients included switched from HD to HDx and had at least a year of data on HD and HDx (see inclusion/exclusion criteria in figure 1). For these patients, it was possible to capture clinical and demographic covariates; annual counts of hospitalizations, total length of stay, use of medications, and quality of life as measured by the KDQoL-36 and the KDQoL-SF at the start of HDx, and 1 year after HDx.

Hospital days were monetized based on a Colombian cost study in dialysis (3). Drug costs were also estimated based on published prices in Colombia (4,5). The hospital and drug related cost estimates were then converted to US dollars (3,338.27 Pesos per US dollar). To examine patient utility associated with the treatment change, published algorithms were used to convert the KDQOL results into EQ-5D utility scores (6,7).

Generalized linear models were used to examine the univariate relationship between HDx and hospitalizations, hospital days, the proportion of patients taking ESA, iron, insulin, and hypertension related medications, and measures of dosing of those medications. In the univariate analyses, the functional form was selected based on the best fit with the data as measured by the Akaike Information Criteria (AIC) score. All analyses were performed using Stata version 13. In addition, annual cost estimates for a patient on HD and HDx were calculated along with percent changes across time.

Results

Of 175 patients in the three clinics with complete data and that had switched all their patients to HDx, 23 did not meet the eligibility criteria, 48 were lost to follow-up while receiving HD and 23 were lost to follow-up while receiving HDx (See Figure 1). At baseline, the 81 patients included in the study had an average age of 61.1 years, 64.2% were male, 98.8% were from urban areas, 98.8% had an education level of high school or less, and 80.2% had a middle or low socioeconomic status. In addition, the patients on average had been on dialysis for 6.23 years, 25.9% of them had a modified Charlson comorbidity index of 3 or greater.

Table 1: Hospitalizations, Medication Utilization, and Patient Utilities at Baseline and with HDx (N = 81)

Outcome	HD Mean (SE)	HDx Mean (SE)
Yearly Hospitalization Rate	0.75 (0.129)	0.73 (0.129)
Yearly Hospitalization Days	5.84 (1.066)	4.47 (1.066) a
Proportion Using ESA	0.85 (0.0395)	0.88 (0.366)
Dosage Per Patient Per Year of ESA (IU)	181,318 (15,024)	168,124 (15,024) a
Proportion of Patients using Iron	0.81 (0.432)	0.78 (0.046)
Dosage Per Patient Per Year of Iron (mg)	959 (101)	759 (101)a
Proportion of Patients Using Insulin	0.35 (0.528)	0.35 (0.528)
Dosage Per Patient Per Year of Insulin (IU)	5,383 (1,067)	3,434 (1,067) a
Proportion using Hypertension Medications	0.78 (0.046)	0.74 (0.049)
No. Tablets Patient Per Year of Hypertension Medications	1,183 (108)	731 (108) a
KDQOL-36 based EQ-5D Utility Score	0.70 (0.026)	0.72 (0.026)
SF-12 based EQ-5D Utility Score	0.83 (0.015)	0.83 (0.015)

a) Statistically significant difference (P value < .05) found in corresponding univariate GLM analysis of outcome on HDx
 IU = International units
 mg = milligrams
 ESA = Eritropoiesis stimulating agents

Table 2: Annual hospitalization and medication costs (USD)

Annual Per Patient Cost Category	Average Annual Costs with HD	Average Annual Costs with HDx	Percent Change HDx v. HD
Hospitalizations	\$1,822	\$1,394	-23.9%
ESA	\$385	\$357	-7.27%
Iron	\$4.32	\$3.42	-20.83%
Insulin	\$242	\$163	-32.64%
Antihypertensives	\$189	\$132	-30.16%

Conclusions

HDx has shown promise as an important advancement in dialysis-related care and this analysis has provided evidence that HDx was statistically significantly related to reduced hospitalization days and lower doses of medications in a real-world setting. Further, the cost valuation of hospitalizations and medications was suggestive of a potential savings related with HDx (USD \$593 per patient per year in Colombia). In addition, the results on utility projections provided initial evidence that HDx was not negatively associated with EQ-5D utility scores for patients over time. Future research should examine more rigorously the potential of HDx to be considered as a dominant treatment.

There are limitations to consider in interpreting the results as the analyses rely on a before and after design in a single provider. Time trends in medication use and hospitalizations may confound the treatment effect. Future work should incorporate cohorts of control patients that remain on HD during the same time period. Generalizing the results to other settings should be done with care, especially for costs and utility scores. This analysis has focused solely on estimating the impact of HDx in reducing cost of hospitalizations and medications. In this sense, the potential cost savings/cost-avoidances of this technology will depend on the dynamics of prices and the contracting models for these therapies over time.

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