Optimizing referral to a renal care management program through use of a predictive model for transition to dialysis in a Medicare Advantage population

Dong Y,[1] Hines H,[1] Haugh G,[1] Cockrell M,[2] Prewitt T,[2] Gopal V[1]

1. Clinical Analytics, Humana Inc., Louisville, KY; 2. Clinical Best Practices, Humana Inc., Louisville, KY

Background

Advanced chronic kidney disease (CKD) requires coordinated renal care management, particularly around the time of transition to dialysis. Individuals who are likely to progress to dialysis are typically identified by laboratory values reflecting kidney function, such as the estimated glomerular filtration rate (eGFR).[1] However, timely selection of candidates for renal care management is hampered because of the frequent lack of relevant lab test results. Predictive analytics may provide a more efficient way of identifying individuals likely to transition to dialysis.[1-2]

Objective

To measure the clinical impact of using a predictive model to select individuals at high risk of transitioning to dialysis for referral to renal care management

Methods

Predictive Model Development:

- The model was created from administrative medical, pharmacy, and laboratory data, as well as matched consumer data who met the following criteria:
  - Medicare Advantage coverage
  - CKD diagnosis or eGFR < 30 mL/min/1.73 m^2 within the previous 12 months
  - Not currently in hospice care
  - No dialysis within the previous 12 months
- Over 1000 variables in 5 categories (demographic, clinical, behavioral, medication, and dialysis-specific) were considered as potential predictors of transition to dialysis in the next 12 months (see Figure 1).
- The final model includes 100 variables, with an area under the receiver operating characteristics curve (AUC-ROC) of 0.934.
- Neural Network was selected as the modeling methodology.

Study Design: Prospective cohort study

Data Source:

- Administrative claims data from Humana Inc., a health care company insuring over 2.8 million Medicare Advantage members around the time of the study [4]

Inclusion Criteria:

- Individuals with Medicare Advantage coverage at time of referral
- Referred to the renal care management service between March and October 2014 using dialysis predictive model risk scores (risk scores in the top 2%) or standard criteria (e.g., eGFR <20mL/min/1.73 m^2 or nurse referral)

Exclusion Criteria:

- ≥ 2 dialysis claims within the 120 days prior to referral
- Advanced clinical management under a plan-sponsored program other than the renal care management provider

Outcomes:

- Annualized rate of transition to dialysis
  - Rate defined as number of individuals who transitioned to dialysis divided by the total person-years since referral
  - Dialysis transition defined as ≥ 2 dialysis claims after referral
  - Time to dialysis defined as days from referral to transition
- Renal care management enrollment rate defined as number of enrollees divided by number of referrals
- Continuation rate defined as proportion of enrollees continuing in program at the end of the study evaluation period

Statistical Analyses: Outcomes were assessed at a maximum of 11 months from time of referral, using claims that were processed as of February 28, 2015 for services performed as of January 31, 2015. The following statistical tests were used:

- For annualized transition to dialysis and time to dialysis: unpaired t-tests
- For program enrollment and continuation: chi square tests

Results

Figure 1. Development of the Dialysis Predictive Model

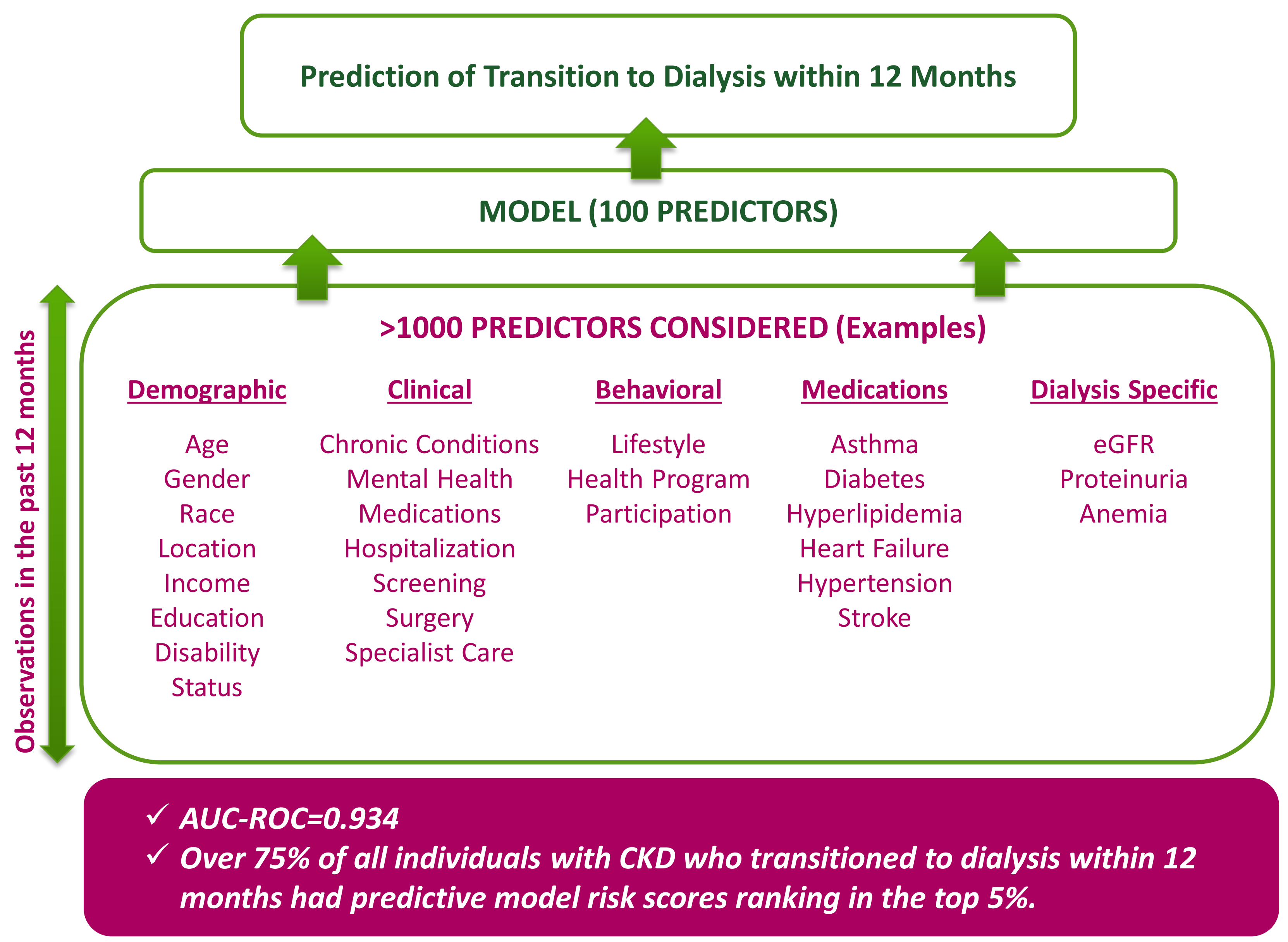
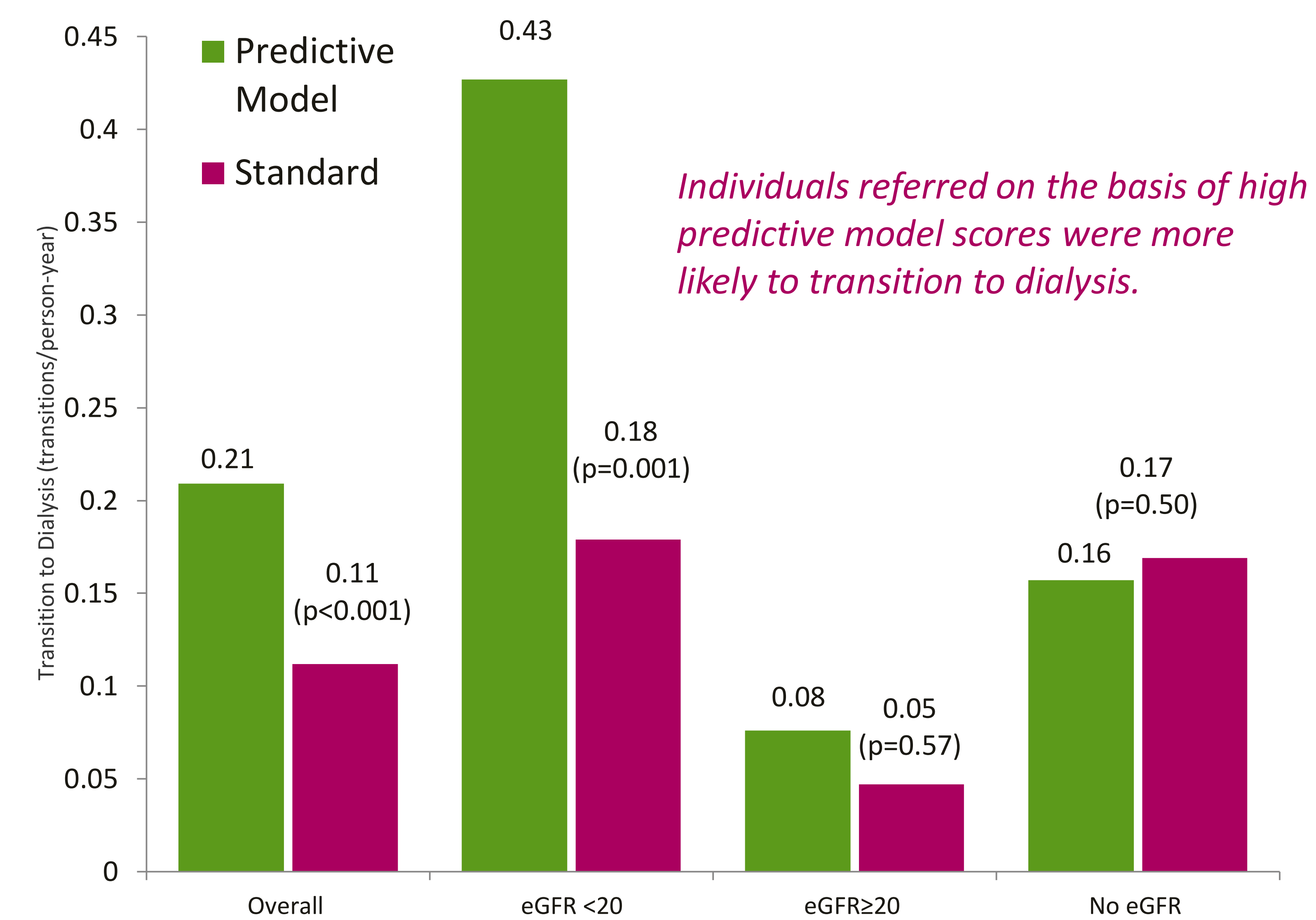


Table 1. Participant Characteristics

Measure	Predictive Model	Standard	P Value
	Referral Group		
N	947	7,607	-
Age in years, mean ± SD	71 ± 11	75 ± 10	p<0.001
Female, n (%)	435 (46)	4342 (57)	p<0.001
Caucasian, n (%)	644 (68)	5167 (68)	Non-significant
Predictive model score*, mean ± SD	181 ± 19	108 ± 44	p<0.001
Charlson Comorbidity Index, mean ± SD	8.7 ± 3.5	7.2 ± 3.4	p<0.05
Geographic Region, n (%)			
Northeast	20 (2)	66 (1)	p<0.05
Midwest	228 (24)	1587 (21)	
South	623 (66)	5312 (70)	
West	75 (8)	635 (8)	
eGFR†			
eGFR, mean ± SD	17.5 ± 6.2	24.9 ± 14.1	p<0.001
eGFR < 20, n (%)	202 (21)	2702 (36)	p<0.001
eGFR ≥ 20, n (%)	146 (15)	3786 (50)	p<0.001
eGFR not available, n (%)	599 (63)	1119 (15)	p<0.001

*Maximum Dialysis Predictive Model score, 245
†Reported in mL/min/1.73 m^2
SD, standard deviation; eGFR, estimated glomerular filtration rate

Figure 2. Annualized Rate of Transition to Dialysis



*At mean follow-up of 262 days for Predictive Model referrals and 208 days for Standard Referrals (p<0.05 for difference)

Figure 3. Time to Dialysis

Referral using the predictive model was associated with a longer time until dialysis: 4 months (120 days) for Predictive Model versus 3 months (92 days, p<0.001) for Standard referral.

Table 2. Enrollment and Retention

Outcome	Predictive Model	Standard	P Value
Program enrollment	35%	37%	0.103
Continuation in program at study end	70%	68%	0.489

No differences in program enrollment or retention were observed.

Conclusions

- By using a wide range of data sources and advanced modeling techniques, the dialysis predictive model was able to effectively identify members for referrals to renal care management.
- The individuals identified by predictive model had a higher dialysis transition rate and longer interval to transition.
- Similar enrollment and retention were observed in individuals referred by the predictive model and traditional means.

Implications

- The predictive model may allow more time for intervention due to earlier identification.
- The predictive model scores may also be used to prioritize referrals from various referrals sources, enabling more focused intervention.

Limitations

- A longer term study may be needed to further evaluate the clinical outcomes of individuals referred by the dialysis predictive model
- Since individuals were not randomized to referral method, results might reflect unmeasured confounders that are related to transition to dialysis and differed between the two groups. However, the robustness of the results and the number of factors taken into account by the predictive model suggest this risk is small.
- This study is subject to limitations common to claims data (e.g., coding errors, missing data, fixed variables).

References

1. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney Inter., Suppl. 2013; 3: 1–150.
2. Polkinghorne KR. Estimated Glomerular Filtration Rate versus Albuminuria in the Assessment of Kidney Function: What's More Important?. Clin Biochem Rev. 2014;35(2):67-73.
3. Humana Press Release, 2014 First Quarter Report. 2014. Available at: http://phx.corporate-ir.net/phoenix.zhtml?c=92913&p=irol-newsArticle&ID=1927984. Accessed September 16, 2015.

Your QR Code will apear here

37th Annual North American Meeting of the Society for Medical Decision Making
St. Louis, MO
October 18-21, 2015

Humana

GCHJG2HEN