Testing a 30-day readmission risk calculator in a veteran population with heart failure: A pilot study

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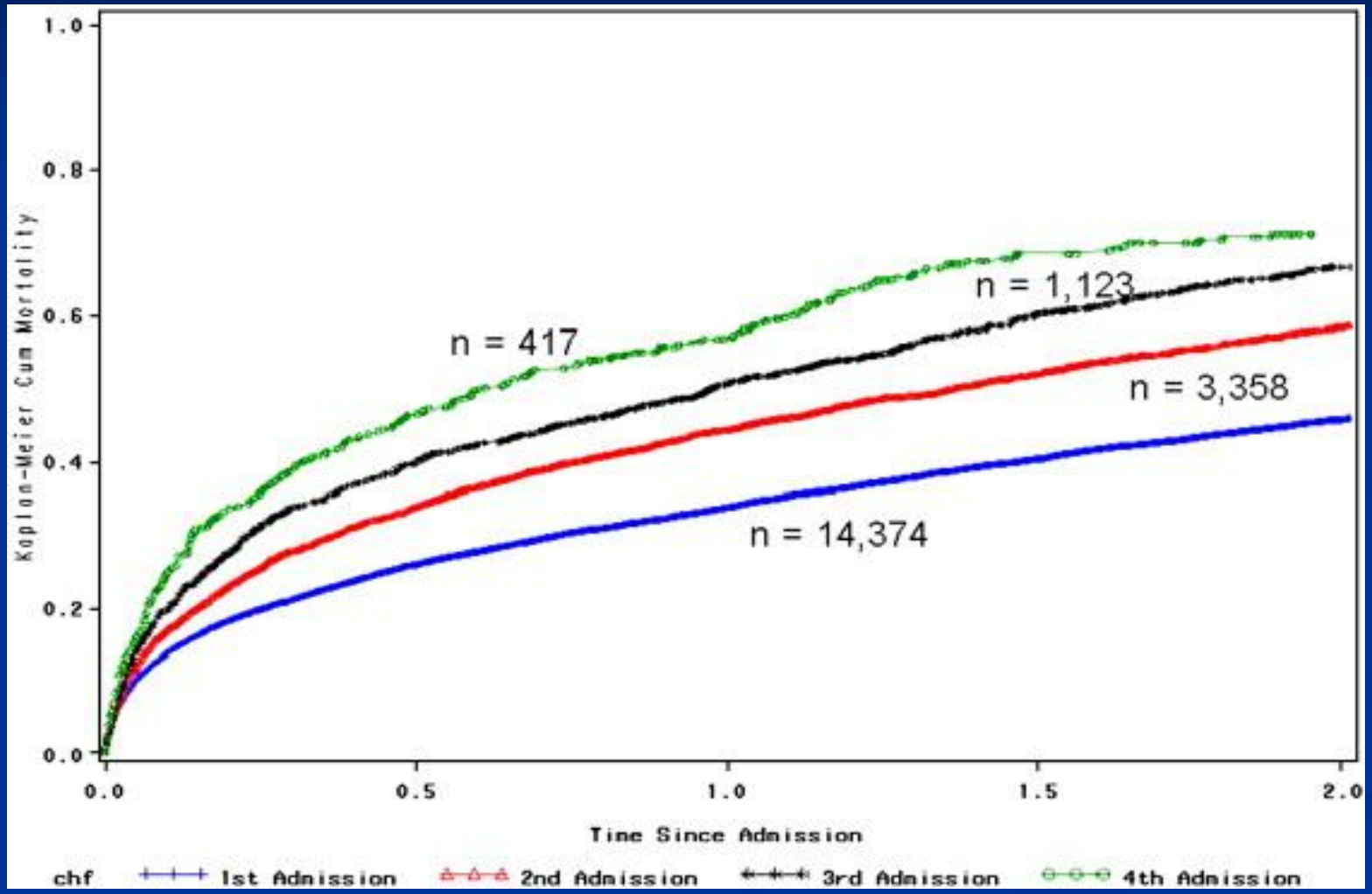
Background

- Heart failure a common, chronic, progressive disease with significant morbidity and mortality.
- Readmission rates are high both in the Medicare population (24.8%- www.hospitalcompare.hhs.gov) and the VA (20.9% - www.hospitalcompare.va.gov).
- Readmission rates are a major focus of QI initiatives internationally as many readmissions thought to be potentially preventable (PPR).

Background

- Readmissions costly, $37.2B for HF care in 2009 with hospital costs the major contributor (Jenks, 2009).
- Quality metric for Medicare and the VA –Hospital Readmission Reduction Program (HRRP)
  - Risk assessment
  - Medicare reimbursement penalties for excessive readmissions.
- Poorer clinical outcomes in readmitted patients

Mortality and HF Admissions



Setoguchi, et al., 2007

Background

- Evidence based programs to reduce readmissions have been reported and generally fall into four categories.
  1. enhanced care and support during transitions;
  2. improved patient education and self-management support;
  3. multidisciplinary team management;
  4. patient-centered care planning at the end of life.
- However, these interventions need to be targeted towards the patients at highest risk for readmission.
- Tools have been derived and validated to help with this prediction.

Purpose Statement

- The purpose of this research project was to test a derived risk calculator for readmission in the VA medical-surgical population in a population admitted with heart failure to predict those patients at high risk for readmission.

Review of the Literature

Use of clinical prediction tools

- Mathematical tools that predict the likelihood of events and allow clinicians make choices about care for patients.
- Two types have been derived and used for HF readmission prediction
  - Hospital comparison
  - Clinical prediction
- Both types have been reviewed in well-conducted Systematic Reviews

Review of the Literature

- Ross (2008). Reviewed 117 HF-specific studies between 1988 and 2007.
  - Many types of studies; not all derived a model
  - Used heterogeneous approaches to model development (if any model); predictors varied amongst the models and no consistent predictors emerged from the review
- Kansagara (2011). Reviewed 26 derived models between 1997 and 2011; not all HF-specific.
  - Reviewed studies using large samples that had been derived and validated.

30 Day Outcomes in Veterans Hospitalized with Heart Failure

- Recent descriptive study of characteristics and predictors of 30 day outcomes in hospitalized veterans with HF (Gannuscio, 2011)
- Sample was noted to be younger, have lower ejection fraction and more often black than in VA as a whole.
- In a univariate model, substance abuse was the strongest predictor of readmission with EF and LOS weaker predictors. In the multivariate model only the presence of substance abuse was a significant predictor with an OR of 5.93., $p < .001$.
- These factors provided some clues about possible predictors for further study.

VA IPEC Readmission Risk Prediction Calculator

Calculation of Modified Risk Score

Patient Demographics (select only one)

- ☐ Age 70 - 80 years
- ☐ Age > 80 years

Hospitalization Information

- ☐ Operative
- ☐ Length of stay 7 days or more

Previous Admission

- ☐ 0 - 180 Days prior

Medications (select only one)

- ☐ 1 - 5
- ☐ 6 - 17
- ☐ More than 17

Lab Values

- ☐ Albumin < =3.2 g/dL
- ☐ 1.5 mg/dL < Creatinine <= 2 mg/dL
- ☐ Creatinine > 2 mg/dL
- ☐ Glucose < 60 mg/dL or Glucose > 180 mg/dL
- ☐ HCT % <= 25 or HCT % >= 55

Primary or Comorbid Diagnosis

- ☐ Anemia
- ☐ Cancer
- ☐ CHF
- ☐ COPD
- ☐ Diabetes
- ☐ Renal Failure

30 Day Readmission Risk Score	**2**
Probability of Readmission	**4.9%**

Tuesday, December 04, 2012

Methods

- Study Design
  - Non-experimental, case-control, descriptive study using a retrospective, chart review to describe characteristics of veterans admitted for heart failure and assess the risk factors for readmission
- Sample & Setting
  - The target population: Veterans at the Washington DC VA Medical Center.
  - Sampling frame identified by query of Veterans Health Information Systems and Technology Architecture (VistA) called CHF ADMISSION Report. N=756 patients
  - Sample for study consisted of 271 unique veterans who had at least one index HF hospitalizations

Methods

- Sample & Setting
  - Inclusion: admission diagnosis of congestive heart failure who had at least one hospital admission between October 1, 2007 and September 30, 2010
  - Exclusion:
    - index admission to the hospital with any other non-heart failure diagnosis,
    - admission for short stay procedures including device implants or generator changes or lead revisions,
    - outpatient procedures including esophagogastroduoedenoscopy, colonoscopy or cystoscopy, or other same day surgery procedures

Procedures

- Baseline data including age, gender, race, ejection fraction, and presence of active substance abuse collected for each veteran by extraction from individual electronic medical records.
- Dichotomous variables in risk calculator collected as well as dichotomous outcome variable of all cause readmission within 30 days.

Variables in IPEC model

At admission	At discharge
Age (only one selected)	Medications (only one selected)
70-80 years	1-5 medications
>80 years	6-17 medications
	>17 medications
Operative admission	LOS ≥ 7 days
Previous admission in last 180 days	
Lab assessment	
Albumin <3.2 mg/dl	
Creatinine <1.5mg/dl &≤ 2.0mg/dl	
Creatinine > 2.0mg/dl	
Glucose <60mg/dl or >180mg/dl	
HCT % <25 or HCT% >55	
Primary or comorbid diagnoses	
Anemia	
Cancer	
CHF	
COPD	
Diabetes	
Renal failure	

Data Analysis

- Data collected were analyzed using SPSS 20.0 (IBM, Inc, Chicago, IL)
- Statistical significance set at $p < .05$
- Nominal-level data were analyzed from a frequency perspective while the ordinal and interval-level data were analyzed using measures of central tendency.
- Analysis of associations between categorical variables was done by conducting Chi-squared test for independence and between continuous variables with Pearson Product-Moment Correlation.

Data Analysis

- Simple logistic regression was used to assess associations between individual predictor variables and the outcome variable of 30-day all cause readmission.
- Multivariate logistic regression model was used to describe 30-day readmission by independent, predictor variables.
- C-statistic was calculated to assess how good the model is in predicting who will be readmitted.

Outcomes

- 271 cases reviewed (each patient represented one case)
- 79 (29%) had at least one readmission
- 22 out of 79 (28%) had >1 readmission. Range 2-11; median 2.5
- Most were male, though no difference in proportion of men readmitted versus women
- Blacks had a higher proportion of readmissions (1 in 3) versus non-blacks (1 in 5) (p=.006)

Risk predictors in the VA IPEC medical- surgical readmission risk model

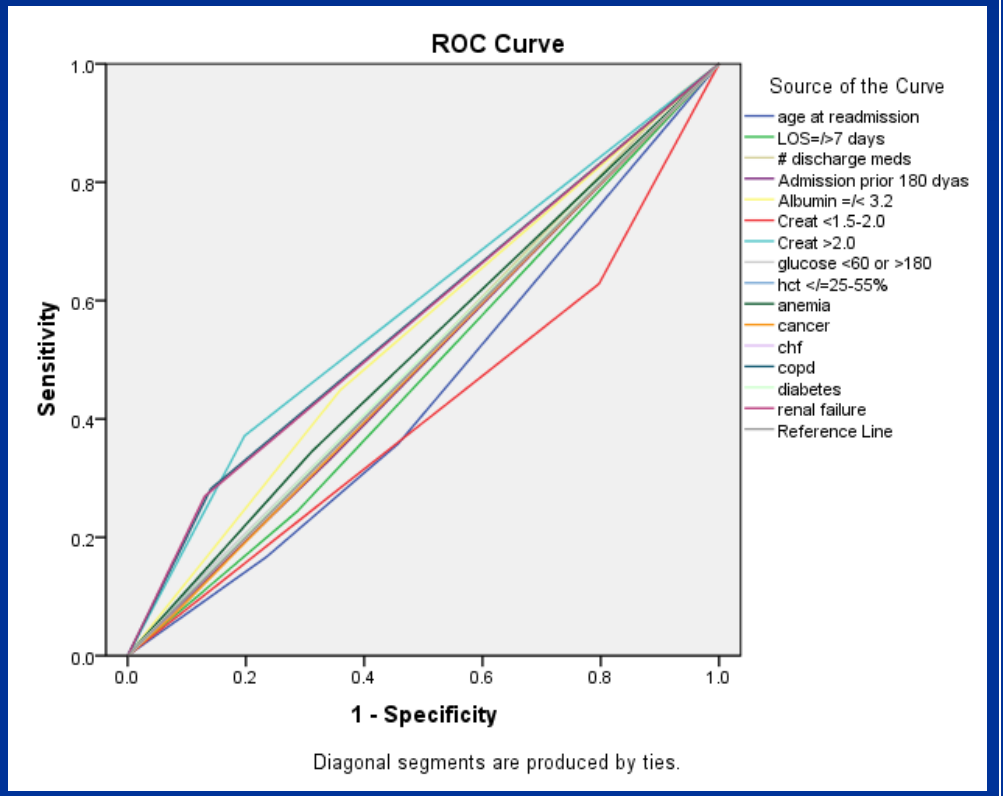
Predictor	All N=272	Readmitted all cause within 30 days N=79	Not readmitted N=193	*p*
Age at admit				.305
< 70 years	153(56.5)	50 (33.3)	103 (66.7)	
70-80 years	60 (22.1)	16 (26.6)	44 (73.4)	
> 80 years	58 (21.4)	13 (22.4)	45 (77.6)	
LOS ≥ 7 days	74 (27.3)	19 (25.6)	55 (74.4)	.440
Medications				.929
1-5	16 (5.9)	4 (25)	13 (75)	
6-17	225 (83)	66 (29.3)	159 (70.7)	
>17	30 (11.1)	8 (26.6)	21 (73.4)	
Admitted prior 6 mo.	92 (33.9)	27 (29.3)	66 (72.7)	.959
Lab at admission				
Albumin	104 (38.4)	36 (45.6)	69 (35.8)	.118
Creatinine	204 (75.3)	50 (63.3)	154 (79.8)	**.003**
Creatinine High	67 (24.7)	29 (36.7)	38 (19.7)	**.003**
Glucose	33 (12.2)	10 (12.7)	23 (11.9)	.877
Hematocrit	3 (1.1)	1 (1.3)	2 (1.0)	.873
Diagnoses				
Anemia	89 (32.8)	28 (35.4)	61 (31.6)	.559
Cancer	20 (7.4)	6 (7.6)	14 (7.3)	.931
CHF	271 (100)	79 (100)	193 (100)	
COPD	49 (18.1)	22 (27.8)	27(14)	**.007**
Diabetes	115 (42.4)	34 (43)	81 (42)	.898
Renal failure	46 (17)	21 (26.6)	25 (13)	**.007**

Relationship between predictors in the VA IPEC Readmission Risk Model and likelihood of readmission within 30 days after heart failure admission

Characteristics	Sample N	Sample %	% Readmit	Unadjusted OR	95% CI	Adjusted OR	95% CI
Age at admit							
< 70 years	153	56.5	32.6	1.00	.39-1.46	.68	.31-1.31
70-80 years	60	22.1	26.6	.39	.29-1.21	.58	.27-1.24
> 80 years	58	21.4	22.4	.15			
LOS ≥ 7 days vs. <7	74	27.3	29.3	.79	.43-1.44	.69	.36-1.32
Labs at index admission							
Albumin <3.2 vs >=3.2	104	38.4	34.6	1.53	.90-2.60	1.46	.82-2.61
Creatinine 1.5-2.0	204	75.3	24.5	.43	.29-.76	.23	.27-1.18
Creatinine >2.0	67	24.7	43.3	2.35*	1.32-4.20	1.94	.85-4.42
Diagnoses at admission							
COPD	49	18.1	44.9	2.36*	1.25-4.47	2.70*	1.35-5.36
Renal failure	46	17	45.7	`2.41*	1.25-4.62	1.62	.63-4.12

Note. Cox & Snell R2 =.076, Hosmer Lemeshow X2(12, n=79) = 21.24, p=.047 C-statistic .52.
* P<.05

Predictive ability of model



Area Under the Curve

Test Result Variable(s)	Area
age at readmission	.446
LOS=/>7 days	.479
# discharge meds	.504
Admission prior 180 days	.495
Albumin =/< 3.2	.545
Creat <1.5-2.0	.416
Creat >2.0	.587
glucose <60 or >180	.504
hct > 5 and <25%	.501
anemia	.517
cancer	.496
chf	.500
copd	.571
diabetes	.503
renal failure	.570

Relationship between predictors in the VA IPEC Readmission Risk Calculator with additional predictors of age, race, EF and substance abuse and likelihood of readmission within 30 days after heart failure admission

Characteristics	*Sample* N	%	*% Readmit*	*Unadjusted OR*	*95% CI*	*Adjusted OR*	*95% CI*
Black	199	73.1	33.7	2.60*	1.31-5.16	2.07*	.97-4.37
Active SA	22	8.1	45.5	2.17	.90-5.26	1.76	.637-4.84
EF				.99	.97-1.00	.99	.97-1.01
Age at admit							
< 70 years	153	56.5	32.6	1.00		1.00	
70-80 years	60	22.1	26.6	.39	.39-1.46	.53	.17-1.63
> 80 years	58	21.4	22.4	.15	.29-1.20	.42	.08-2.04
LOS ≥ 7 days	74	27.3	29.3	.79	.43-1.44	.67	.34-1.30
Albumin <3.2	104	38.4	34.6	.665	.39-1.13	.808	.43-1.52
Creatinine 1.5-2.0	204	75.3	24.5	.43	.24-.76	.54	.23-1.27
Creatinine >2.0	67	24.7	43.3	2.35*	1.32-4.19	1.98	.85-4.63
Diagnoses							
COPD	49	18.1	44.9	2.36*	1.25-4.47	2.70*	1.32-5.52
Renal failure	46	17	45.7	2.41*	. 1.25-4.62	1.56	.61-4.04

Note. Cox & Snell R2 =.124, Hosmer Lemeshow X2=9.148, p=.330. C-statistic .61.
* P<.05

Limitations

- Sample was derived from an electronic clinical report generated in the VA based on principle diagnosis; potential missed coding
- Small sample a limitation
- Single-center study with sample that was slightly younger and more minority than the VA population as a whole which limits generalizability.
- The design of this study is different from the original derivation study

Conclusions

- The VA IPEC Readmission Risk Calculator derived in a medical-surgical population does not predict all-cause 30-day readmission after an index heart failure hospitalization
- Further work needed to derive and validate a clinically useful tool to identify patients at highest risk for readmission after heart failure admission
- Impact of interventions based on risk assessment an open field of investigation.

Questions?