interdisciplinary chronic disease collaboration

Predictors of six-month mortality subsequent to chronic dialysis initiation among an older adult population, and development of a clinical risk prediction tool

James Wick
University of Calgary

CAHSPR – Concurrent Session A4
May 26, 2015

The ICDC is funded by Alberta Innovates Health Solutions - CRIO Team Grants Program

Updated results

Outline

- Background
- Objectives
- Methods & Cohort Formation
- Cohort Characteristics
- Predictors
- Illustration of points system
- Strengths/Limitations

ICDC
interdisciplinary chronic disease collaboration

Background

- Chronic Kidney Disease
  - Reduced kidney function
  - <60% of healthy kidney (estimate glomerular filtration rate)
- End-Stage Renal Disease
  - Severely reduced function (<15%)
  - Kidney Failure

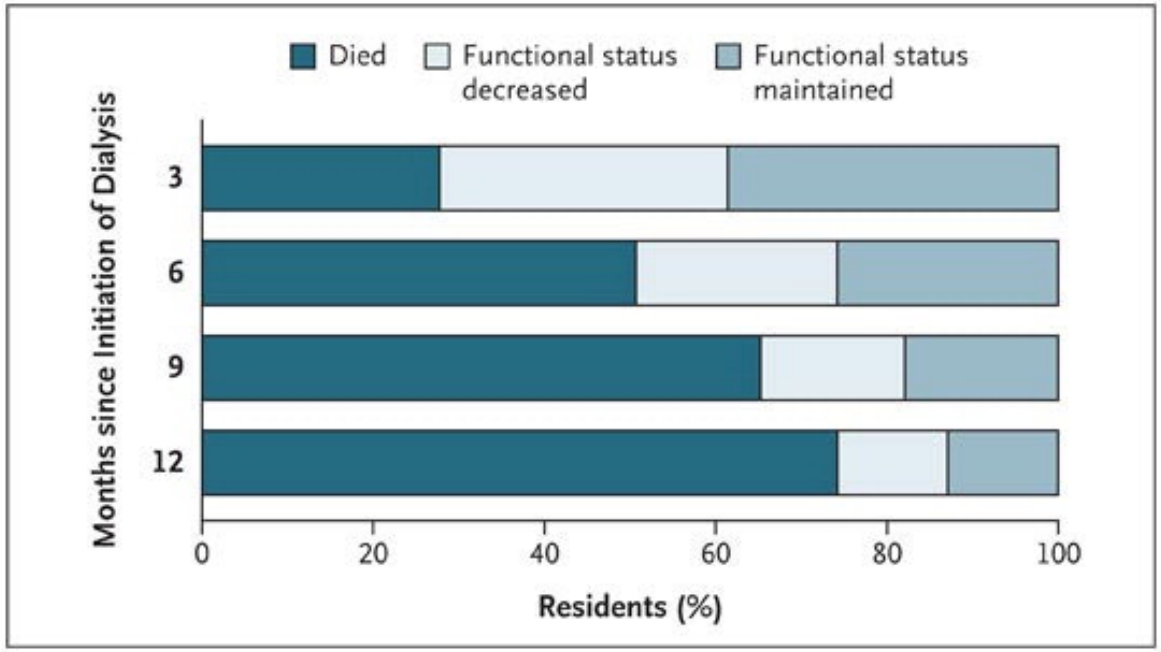
Background

- Treatment of kidney failure
  - Dialysis Initiation
  - Renal Transplant
  - Conservative Care

interdisciplinary chronic disease collaboration

Rationale

- Older Adults (Age 65+)
  - Increasing incidence of chronic dialysis
  - Increased risk of mortality generally, and on dialysis



Survival and Functional Status of nursing home residents after dialysis initiation. From Kurella Tamura et al. 2009

ICDC
interdisciplinary chronic disease collaboration

Objectives

- To determine the **predictors** of **six-month mortality** subsequent to chronic dialysis initiation among an older adult population

- To derive and internally validate a **clinical risk prediction tool** for **six-month mortality** following chronic dialysis initiation in this population.

ICDC
interdisciplinary chronic disease collaboration

Identification of cohort

- Linkage of several data sources (administrative, lab)
- Adults aged ≥ 65 years in Alberta, Canada
- Dialysis initiation based on recording in Northern and Southern Alberta Renal Program (NARP/SARP) databases
- Study Period: May 1, 2003 to March 31, 2012
- Exclusions: prior dialysis or renal transplant

ICDC
interdisciplinary chronic disease collaboration

Population

- n=2,211 Alberta residents age ≥ 65 years old at initiation of chronic dialysis, between May 1, 2003 – March 31, 2012

interdisciplinary chronic disease collaboration

Outcome

- Outcome of interest
  - Mortality within 6 months (182 days) of chronic dialysis initiation (as denoted in Alberta Registry)

- Follow-up end
  - Outmigration
  - Renal Transplant
  - Survival beyond 6 months

interdisciplinary chronic disease collaboration

Potential Predictors

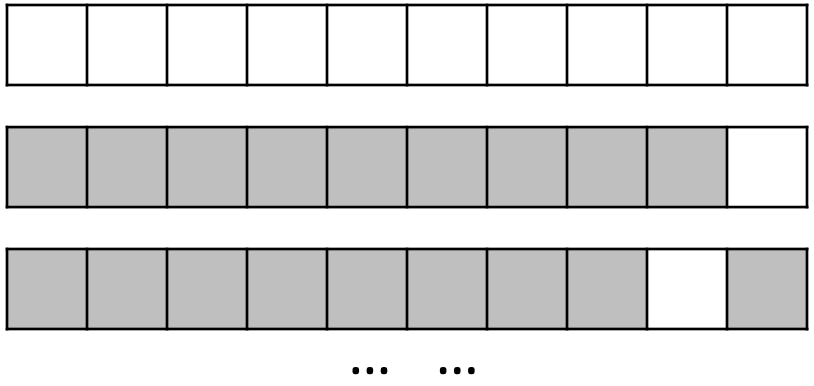
- A total of 62 were available
- 5 categories:
  - Sociodemographic information
  - Comorbid conditions
    - Previously validated algorithms
  - Dialysis-related
  - Health system usage
  - Laboratory

Analysis

- Criteria for inclusion in model selection
- Clinical relevance
  - Discussions with clinical experts
    - Clinical significance
    - Viable mechanism for predictor
- Statistical usefulness
  - Descriptive statistics

Analysis

- Model derivation
  - Logistic Regression
  - Backward elimination
  - 10-fold cross validation run 50 times (500 total models)



  - Combination into (reasonably) stable final model

interdisciplinary chronic disease collaboration

Model Discrimination

- Measured using C-Statistic
- Given two random individuals from study, how often is the one with a higher risk of the outcome the one who had the outcome?

Model Calibration

- How well does the model prediction fit what's actually observed?
  - Split data by (approx.) deciles (0-10th percentile, 11-20 etc.) of risk
  - Observed proportion of deaths vs. expected proportion in each decile

Results

Select cohort characteristics

Characteristics		Overall (n=2,211) %
Age	65-69	26.1
	70-74	25.2
	75-79	24.6
	80+	24.2
Vascular Access	Central Venous Catheter	68.2
	Arteriovenous Fistula/Graft	17.4
	Peritoneal Dialysis Catheter	14.4
Baseline eGFR	0-9.9	60.5
	10-14.9	19.7
	15+	19.8
Proteinuria	Normal	12.3
	Mild	19.3
	Heavy	56.2
	Missing	12.2
Atrial Fibrillation		24.6
Lymphoma		4.0

Select cohort characteristics

Characteristics		Overall (n=2,211) n	Died (n=386) %
Age	Age 65-69	576	15.5
	Age 70-74	557	15.8
	Age 75-79	544	16.7
	Age 80+	534	22.1
Vascular Access	Central Venous Catheter	1508	22.7
	Arteriovenous Fistula/Graft	384	6.0
	Peritoneal Dialysis Catheter	319	6.6
Baseline eGFR	0-9.9	1331	12.3
	10-14.9	434	17.1
	15+	435	31.7
Proteinuria	Normal	271	29.2
	Mild	428	20.1
	Heavy	1244	12.4
	Missing	269	25.3
Atrial Fibrillation		544	28.5
Lymphoma		88	43.2

Fig 1. Significant predictors of 6-mo mortality

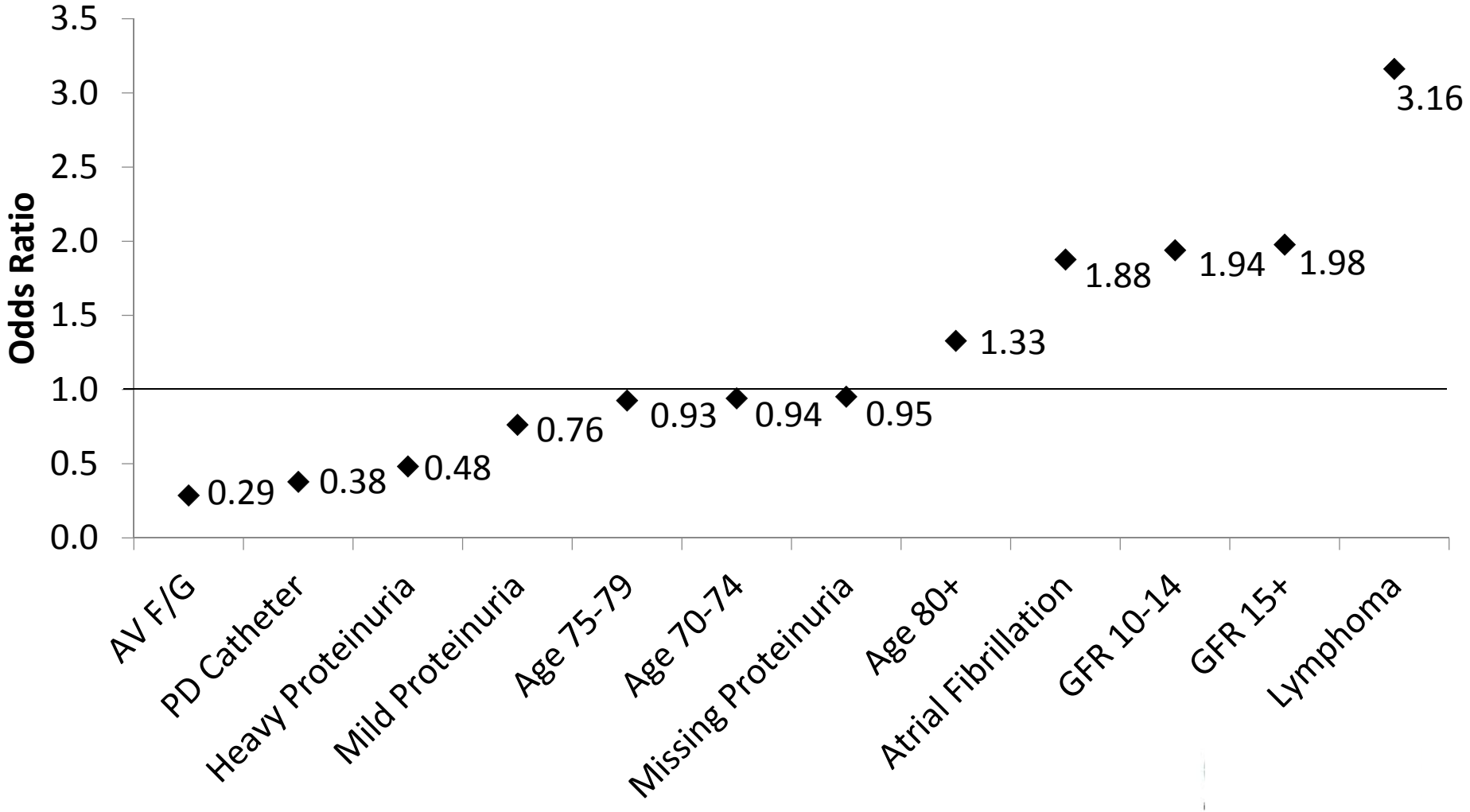
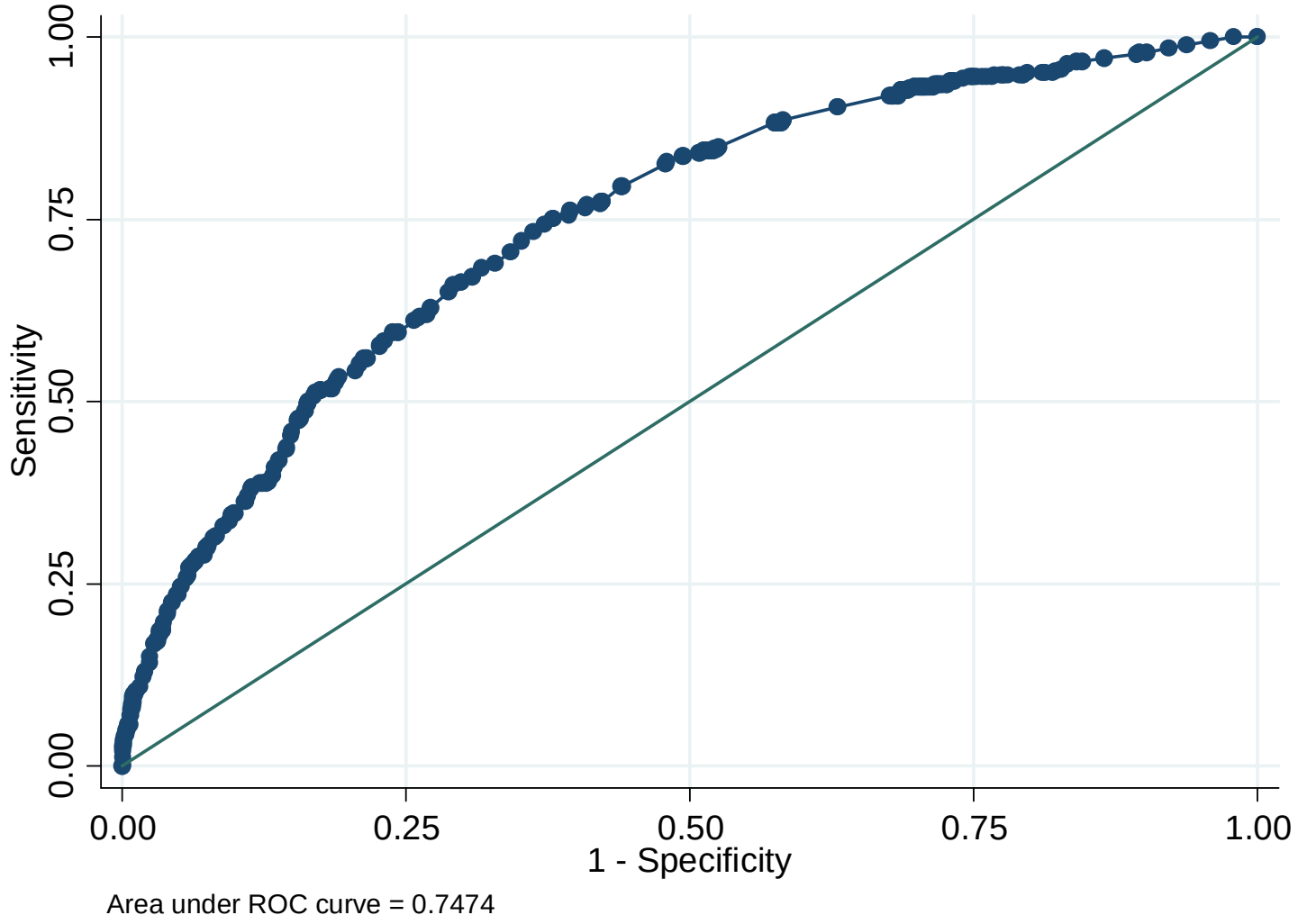


Figure 1. Significant predictors of mortality within six months of chronic dialysis initiation

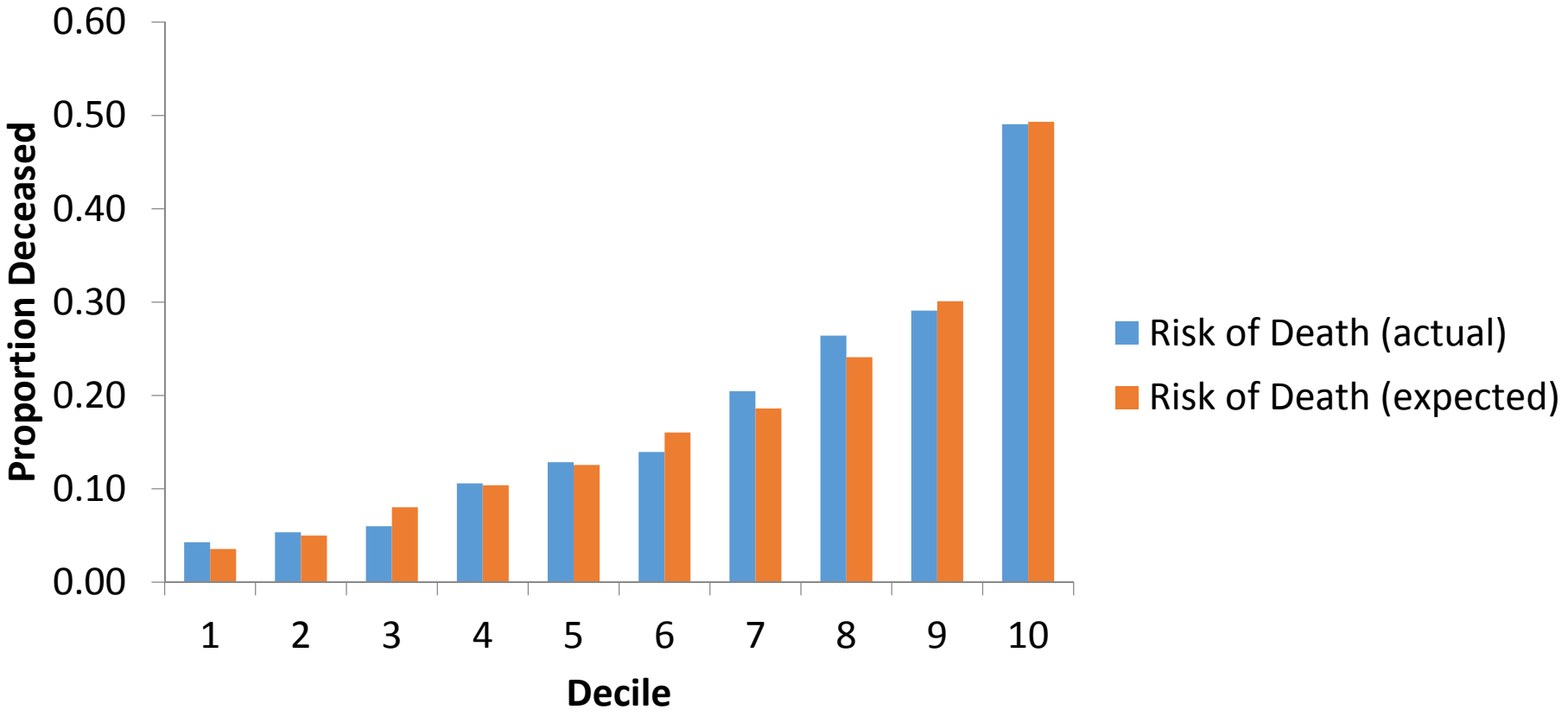
Discrimination/C-Statistic



C=0.7474 (~74.7% of the time; “good” discrimination)

interdisciplinary chronic disease collaboration

Model Calibration



Hosmer-Lemeshow Goodness of Fit=3.85; p=0.87 (well calibrated)

ICDC
interdisciplinary chronic disease collaboration

Points score system

- Assigning points based on risk is more intuitive than calculating regression coefficients.
- Assign each predictor a points score based on it's regression coefficient.
- If an individual has predictor x, score y points for that predictor.
  - E.g. Age 80+ is worth 2 points
- 46-point scale

ICDC
interdisciplinary chronic disease collaboration

Example 1

- 82 year old
- Central-Venous Catheter
- GFR >15
- No proteinuria measurement
- Lymphoma

Category	Points	Example 1
Age 65-69.9	0	
Age 70-74.9	0	
Age 75-79.9	0	
Age 80+	2	2
Central Venous Catheter	7	7
Arteriovenous Fistula/Graft	0	
PD Catheter	1	
GFR < 10	0	
GFR 10-14	2	
GFR 15+	4	4
Missing GFR	23	
Normal Proteinuria	4	
Mild Proteinuria	2	
Heavy Proteinuria	0	
Missing Proteinuria	4	4
Atrial Fibrillation	4	
Lymphoma	7	7
TOTAL	**0 to 46**	**24**

Example 2

- 67 year old
- Arteriovenous Graft
- GFR < 10
- Mild Proteinuria

Category	Points	Example 2
Age 65-69.9	0	0
Age 70-74.9	0	
Age 75-79	0	
Age 80+	2	
Central Venous Catheter	7	
Arteriovenous Fistula/Graft	0	0
PD Catheter	1	
GFR < 10	0	0
GFR 10-14	2	
GFR 15+	4	
Missing GFR	23	
Normal Proteinuria	4	
Mild Proteinuria	2	2
Heavy Proteinuria	0	
Missing Proteinuria	4	
Atrial Fibrillation	4	
Lymphoma	7	
TOTAL	**0 to 46**	**2**

Points

- Example 1: 24 points = ~50-60% risk of mortality
- Example 2: 2 points = ~5% risk of mortality
- ↑points =↑predicted risk of mortality

Strengths & Limitations

- Strengths
  - Well-defined population-based cohort (minimize selection bias)
  - Covers all of Alberta
- Limitations
  - Data in this study are for Alberta patients, potentially limited generalizability to other settings
  - From administrative data, which may result in residual confounding.
  - Not externally validated, would perform worse in another population

interdisciplinary chronic disease collaboration

Acknowledgements

- MSc. Supervisors
  - Dr. Brenda Hemmelgarn
  - Dr. Tanvir Chowdhury Turin
- Additional Co-authors
  - Peter Faris
  - Jennifer MacRae
  - Robert Weaver
- MSc. Support
  - Alberta Innovates Health Solutions Graduate Fellowship

interdisciplinary chronic disease collaboration

Thank you

The ICDC is funded by Alberta Innovates Health Solutions - CRIO Team Grants Program