



# *Sex Differences in Admission to Intensive Care Units: The Role of Social Support Factors*

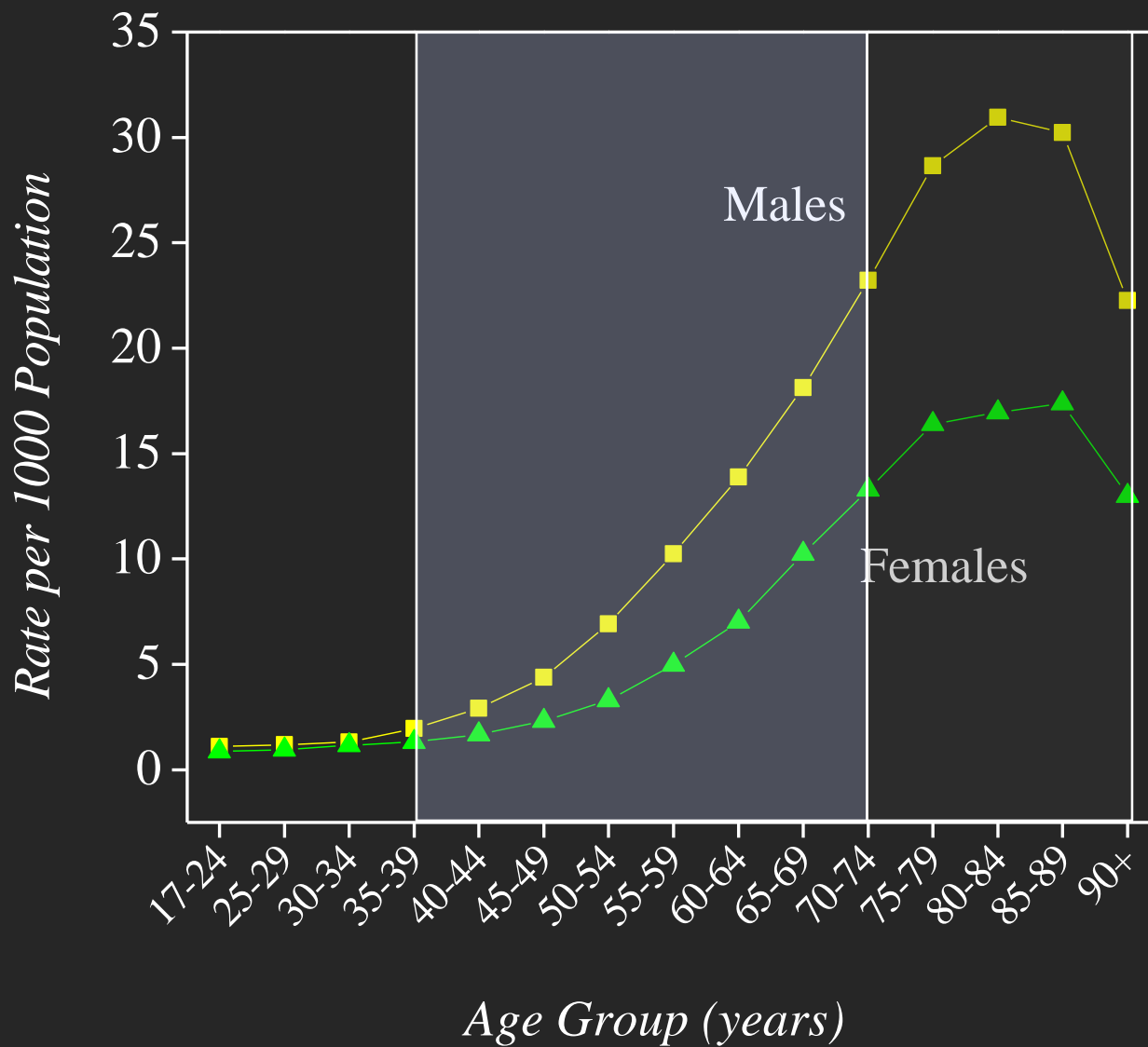
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# Background

- Men outnumber women in ICUs (3:2)
  - this is not accounted for by sex distribution of the population, sex differences in diagnoses, comorbidities, or SES
    - Fowler RA, Sabur N, Juurlink D, et al. *CMAJ* 2007; 177:1513–1519.
    - Valentin A, Jordan B, Lang T, et al. *Crit Care Med* 2003; 31:1901–1907.
    - Romo H, Amaral ACK-B, Vincent J-L. *Arch Intern Med* 2004
    - Dodek, P., et al., More men than women are admitted to 9 intensive care units in British Columbia. *J Crit Care*, 2009. **24**(4): p. 630 e1-8.
    - Garland, A.F., R.; Olafson, K.; Ramsey, C; Yogendran, M.; Chateau, D.; McGowan, K. , 2012, Manitoba Centre for Health Policy: Winnipeg, MB.

# Population-based rates of ICU admissions in Manitoba (average over years 1999-2007)



# Background

- The sex-related differences in ICU admission rates could be related to differences in:
  - propensity towards critical illness
  - 👉 **willingness to seek medical care**
  - access to the portals to hospital care (outpatient care, EMS, ED)
  - admission to hospital (via gatekeepers)
  - 👉 **willingness for aggressive medical care as provided in ICUs**
  - admission to ICU (via gatekeepers)

# Origin of the Idea

- In other health care domains, willingness for medical care has been found to relate to QOL & social supports
- Differences in patients' wishes regarding ICU admission may be related to differences in social support between the sexes, especially in the elderly
- **In regards to ICUs:**
  - Women generally outlive men ⇒
  - More elderly critically ill women are widowed compared to men ⇒ if widowhood reduces willingness to undergo aggressive medical care as provided in ICUs ⇒ It could account for at least some of the male predominance of ICU admission among the elderly

# Background

- Gordon et al (Arch Int Med 1995)
  - 40,820 Adult medical and surgical hospital admissions
  - Nursing home discharges were 2.5 times more common in unmarried than married patients
  - In hospital mortality higher in unmarried patients among surgical population
  - LOS higher for unmarried patients
  - Difference was greater for never married as opposed to widowed or divorced patients
- Manzoli et al (Metanalysis from Social Science and Medicine 2007)
  - Risk of death among elderly widowed (RR 1.11) compared to married
  - Divorced or separated (RR 1.16)
  - Never married (RR 1.11)

# Background

- Iwashyna (Social Science and Medicine 2003)
  - Married people receive different care than unmarried

# Research Questions

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- 1. To identify whether social supports, previous experience with ICU admission, and level of functioning explain the male predominance of ICU admission among people  $\geq 65$  yrs.
- 2. To assess whether after accounting for social supports, experience with ICU admission, and level of functioning, there are differences in post-ICU survival between men and women



# Study Design

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- Parallel analyses on two distinct datasets
  - Manitoba data -- everyone  $\geq 65$  yrs, 2004-2012
  - National (CIHI) data -- those  $\geq 65$  yrs, 2007-2012, limited to the two subsets for which Resident Assessment Instrument (RAI) data exists: (a) homecare clients, (b) nursing home residents
- We have shown that Canadian hospital abstracts (admin data) accurately identify the existence and timing of ICU care ( *Medical Care*. 50:e1-e6,2012)
- In addition, Manitoba administrative data allows for accurate identification of spouses and children

# Study Design – Aim 1

- Among all Manitobans  $\geq 65$  yrs, assess if the male predominance of ICU admission is explained by: (a) widowhood, (b) # and gender of children living in Manitoba, (c) residence in a nursing home, (d) prior personal experience with ICU care, (e) prior spousal experience with ICU care.
- In two subgroups of Canadians  $\geq 65$  yrs for whom the RAI assessment data are available, determine whether the male predominance of ICU admission in these subgroups is explained by sex-related differences in: (i) physical/mental functioning, (ii) measures of social support, and (iii) prior personal experience with ICU care.

# Study Design – Aim 2

- Among all Manitobans  $\geq 65$  yrs who were in ICUs, determine whether post-ICU survival differs for men vs. women, after accounting for: (a) widowhood, (b) # and gender of children living in Manitoba, (c) residence in a nursing home, (d) prior personal experience with ICU care, (e) prior spousal experience with ICU care.
- In two subgroups of Canadians  $\geq 65$  yrs for whom RAI data are available, determine whether post-ICU survival differs for men vs. women, after accounting for: (i) physical/mental functioning, (ii) measures of social support, and (iii) prior personal experience with ICU care.

# Aim 1 – Manitoba data

- Cox regression of time to ICU admission, starting at age 65
- Independent variables:
  - age, **sex**
  - **marital status**
  - **# of sons living in Manitoba; # of daughters living in Manitoba**
  - census-based SES: average household income, % unemployed, % HS graduates
  - comorbidity: Charlson Index, index derived from prescription drugs
  - nursing home residency: patient, spouse
  - prior ICU admission: patient, spouse
  - hospital-days in prior 5 years
  - physician visits in prior 1 year
- Many covariates can change over time -- so include as time-dependent covariates; and allow multiple records per patient

# Analysis: Aim 2

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- Manitoba data: --- has dates of death from provincial vital statistics database, so will do Cox model of time from ICU admission to death (also will do hospital mortality endpoint to compare with CIHI data results)
- For people with multiple ICU admissions, we'll randomly choose just one of them -- to avoid age bias, and interdependence between records

# Results

- Manitoba cohort
  - 250,190 patients, >1.3 million person-yrs
  - 14,662 admitted to an ICU during study period
  - 69,063 deaths
  - Mean age  $72 \pm 8$  years
  - 55% females
  - 395,216 children identified living in Manitoba
    - Cohort size decreased to 117,385

# Baseline Characteristics

Variable	Mean (SD) or percent	Median (IQR)
Hospital days in last 5 yrs		0 (0,5)
Outpatient MD visits in last year		8 (4,14)
Charlson Comorbidity		0 (0,2)
4 <sup>th</sup> level ATC		4 (2,7)
Patient in PCH	3.9%	
In ICU prior to cohort entry	10.5%	
Spouse in ICU prior to cohort entry	7.5%	
Married at cohort entry	57.3%	
Married spouse in PCH at cohort entry	0.67%	
Widowed	16.9%	
Not married	25.93%	

# ICU admissions

Variable	Hazard ratio (95% CI)	P value
Age	1.01 (1.00-1.01)	0.002
Male sex	1.78 (1.70-1.86)	<0.0001
Prior ICU admission	2.21 (2.11-2.32)	<0.0001
Pt lives in PCH	0.32(0.28-0.36)	<0.0001
<b>Widow*</b>	1.16 (1.10-1.22)	<0.0001
<b>Married spouse in PCH*</b>	1.10 (0.90-1.34)	0.35
<b>Not married, not widow*</b>	1.18 (1.12-1.25)	<0.0001
Spouse in ICU prior	1.08 (1.01-1.16)	0.031

\* Reference is married spouse at home

Adjusted Charlson score, SES, number hospital days in last 5 years,

- MD visits in prior year, number of drug categories



# ICU admission including children

Variable	Hazard ratio (95% CI)	P value
Age	1.08 (1.05-1.12)	<0.0001
Male sex	1.81 (1.67-1.96)	<0.0001
Prior ICU admission	2.36 (2.15-2.58)	<0.0001
Pt lives in PCH	0.63 (0.46-0.86)	0.004
<b>Widow*</b>	1.15 (1.05-1.31)	<0.0001
<b>Married spouse in PCH*</b>	1.51 (0.85-2.67)	0.16
<b>Not married, not widow*</b>	1.12 (1.12-1.34)	<0.0001
Spouse in ICU prior	1.16 (1.013-1.34)	0.03
<b>Number of female children</b>	1.02 (0.99-1.06)	0.27
<b>Number of male children</b>	1.02 (0.98-1.06)	0.30

\* Reference is married, spouse at home

Adjusted Charlson score, SES, number hospital days in last 5 years,

● MD visits in prior year, number of drug categories

# Sensitivity analysis

- Excluded cardiac admissions (AMI and surgery)
  - No difference
- Winnipeg ICUs only and rural ICUs
  - No difference
- Second records only amongst those with more than one admission
  - Sex effect goes away

# Conclusions

- Marital status did not explain male predominance in ICU admission rates
- Widows were more likely to be admitted to an ICU than married people
- Number and sex of children did not influence sex differences in ICU admissions
- Pending analysis
  - Stratify by sex or create interaction terms

# Mortality Models

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# Mortality post ICU admission

Variable	Hazard ratio (95% CI)	P value
Age	1.05 (1.05-1.05)	<0.0001
Male sex	1.15 (1.10-1.21)	<0.0001
Prior ICU admission	1.38 (1.31-1.45)	<0.0001
Pt lives in PCH	1.08 (0.96-1.21)	0.21
<b>Widow</b>	1.12 (1.10-1.22)	<0.0001
<b>Married spouse in PCH</b>	0.86 (0.69-1.06)	0.15
<b>Not married, not widow</b>	1.17 (1.10-1.24)	<0.0001
Spouse in ICU prior	1.02 (0.94-1.10)	0.70
APACHE 2	1.06 (1.06-1.07)	<0.0001

Adjusted Charlson score, SES, number hospital days in last 5 years, MD visits in prior year, number of drug categories, GCS, admission time, mechanical ventilation, pressors, dialysis, diagnostic category for admission

# Mortality post ICU admission including children

Variable	Hazard ratio (95% CI)	P value
Age	1.02 (0.99-1.06)	0.21
Male sex	1.02 (0.92-1.14)	0.70
Prior ICU admission	1.36 (1.22-1.53)	<0.0001
Pt lives in PCH	1.48 (0.76-2.88)	0.25
<b>Widow</b>	1.02 (0.87-1.20)	0.77
<b>Married spouse in PCH</b>	1.48 (0.76-2.88)	0.25
<b>Not married, not widow</b>	1.14 (1.01-1.28)	0.03
Spouse in ICU prior	1.16 (0.96-1.34)	0.14
APACHE 2	1.07 (1.06-1.08)	<0.0001
<b>Number of sons</b>	1.02 (0.92-1.14)	0.69
<b>Number of daughters</b>	0.91 (0.82-1.01)	0.07

Also adjusted Charlson score, SES, number hospital days in last 5 years, MD visits in prior year, number of drug categories, GCS, admission time, mechanical ventilation, pressors, dialysis, diagnostic category for admission

# Conclusions

- Widows and unmarried patients have higher HR of dying post ICU admission than married people

# Ongoing Analysis

- CIHI/RAI data portion update
  - analysis has begun by HQP post doctoral fellow
  - Cohort defined
  - Variables defined
  - Soon to begin modeling data for ICU admission



# Future Studies

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- Research program: End-of-life care preferences for elderly men & women
- Planned series of studies to determine the influence of patient, family, social support, and healthcare system factors across the spectrum from intensive to palliative care
- Next step: Mixed methods study surveying people across the phases of life, to understand their wishes regarding intensive and palliative care -- particularly the impact of widowhood, other social supports, SES, chronic illness

# Knowledge Transfer

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- Recruited health care administrators/decision-makers in ON, MB, and BC with responsibility in critical care and elder care
- Goals:
  - go beyond identifying the magnitude and causes of the differences in critical care for men and women
  - develop additional studies, and eventually action plans, to ensure equitable access to ICU care among older, critically ill people

# Our Team

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- University of Manitoba (1° location of Manitoba data analysis)
  - Allan Garland, Clare Ramsey (co-PIs)
  - Malcolm Doupe, Randy Fransoo
- University of Toronto (1° location of CIHI data analysis)
  - Robert Fowler
  - Andrea Hill (postdoctoral trainee)
- University of British Columbia
  - Peter Dodek, Jean Kozak
  - Hubert Wong (statistician)

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