Current Multimorbidity Research from the Health System Performance Research Network

HSPRN Symposium

Caring for people with multiple chronic conditions:

A necessary intervention for Ontario

St Andrew's Centre, Oct 22nd, 2013

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Overview

Agenda:

- Background / Intro
- Empirical study methods
- Results
  - Study 1: Epidemiology
  - Study 2: Hospital use
  - Study 3: Costs
- Summary & Future Research

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Background – MULTI-morbidity is common

- Multimorbidity is highly prevalent and is the norm, particularly for older adults (1-9).
    - The prevalence can reach 98% depending on the settings, data sources and patient's characteristics
- Dramatic increase during the last decades
    - Prevalence of having 3 chronic diseases increased by approximately 60% between 1985 and 2005 in Dutch population and by 300% among those with 4 or more conditions (10)
- Increasing number of people living with multiple chronic diseases will continue
    - Because of successes in health care and decrease in mortality that allows people to survive to more medical conditions, and to live with more than one chronic illness (11-12)

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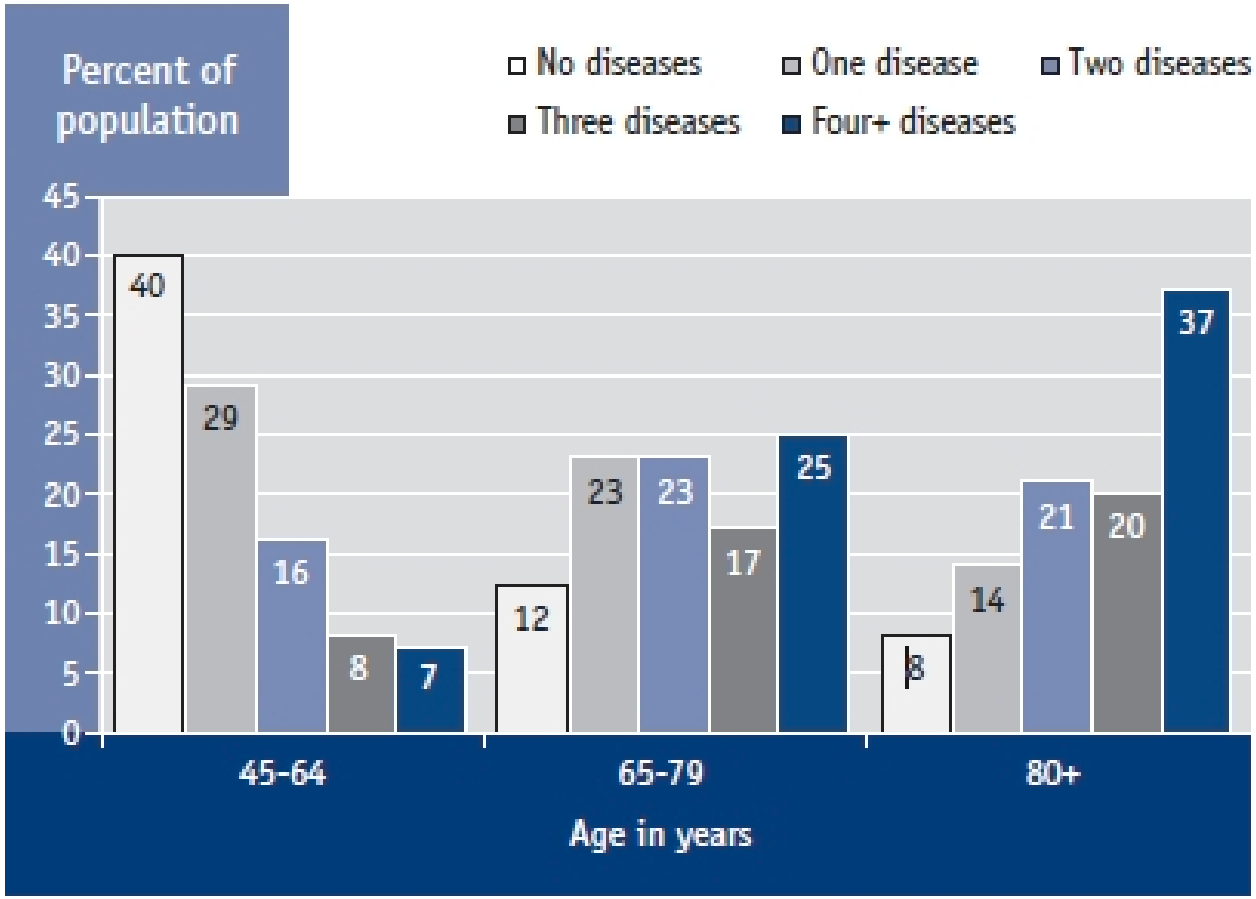
Multi-morbidity is Normal for Older Adults



- Source: The Chief Public Health Officer's Report on the State of Public Health in Canada. 2010 : *Growing Older – Adding Life to Years*

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Background – Burden is High

- High burden of illness among individuals with multimorbidity due to the number and combination of conditions (9, 13, 14).
- Multimorbid patients exhibit lower HRQOL, higher utilization of health care services, increased disability and increased mortality (1, 15-19).
  - High costs resulting from their frequent use of health services and higher health expenditures
  - Multiple chronic conditions accounted for 75% of US health care expenditures in 2001 (20).
  - These patients have more frequent admissions for ambulatory conditions and higher rates of preventable complications (15, 9).
  - The number of prescribed medications also increases in the presence of multimorbidity (21, 6).

Background – Care is Sub-optimal

- Current disease management programs or disease-specific guidelines are not effective for multimorbid patients as they focus on single conditions
  - Higher risk of receiving redundant and duplicative services, inappropriate prescriptions (22), unnecessary hospitalizations (9, 23).
  - Polypharmacy required in multimorbidity can constitute a medical risk, even in presence of optimal treatment for each diagnosis (24-25)

Background: Little Canadian Evidence

- To date most studies have been based on patients enrolled in selected settings.
  - True population-based estimates are not available.
- In Canada, more than half (58%) of all annual health care spending was related to treating people with chronic conditions (26).
  - However, the extent to which this expenditure is attributed to multimorbidity is unknown.
- Similarly, the impact of multimorbidity on outcomes including hospital admissions has not yet been evaluated at the population level in Ontario

Background: Some useful references

Cited literature:

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Research questions

- This research takes advantage of population-based health administrative databases in Ontario, Canada to estimate population-based prevalence of multimorbidity and to explore the costs and outcomes of individuals with multimorbidity.
  - Three main questions are addressed:
    1. What are the prevalence and the characteristics of individuals with multimorbidity in Ontario?
    2. What are the clinical outcomes of individuals with multimorbidity in Ontario?
    3. What are the costs associated with multimorbidity in Ontario?

Methods – Study population

- Ontario residents aged 0-105 as of the index date of the study (April 1, 2009 for most analyses) with one of the following 16 conditions (n=6,639,089):

Cardiac arrhythmia	Osteoporosis
Acute myocardial infarction	Rheumatoid arthritis
Hypertension	Osteo- and other arthritis
Chronic coronary syndrome	Depression
Congestive heart failure	Dementia
Stroke	Cancer
Asthma	Diabetes
Chronic obstructive pulmonary disorder	Renal failure

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Methods - Cohort Definition

- Validated ICES derived chronic disease databases were used to identify prevalent cases of:
  - Acute Myocardial Infarction,
  - Hypertension,
  - Congestive Heart Failure,
  - Asthma,
  - Chronic Obstructive Pulmonary Disorder,
  - and Diabetes

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Methods – Cohort Definition

All other diagnoses:

- One acute care code in an acute care episode (Canadian Institute for Health Information Discharge Abstract Database, CIHI-DAD),
- OR 2 relevant ICD9 codes in OHIP physician billing records
- (OR Cholinesterase Inhibitors recorded in the Ontario Drug Benefit Program, ODB - for Dementia only)

… within 2 years prior to the index date (April 1, 2009)

This is generally the approach of the ICES derived databases.

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Methods – Data Sources

- Additional databases were used for several measures:
  - Patient demographics derived from the **Registered Persons Data Base (RPDB)**
  - Neighborhood income, and components of the Ontario Marginalization Index (Deprivation, Ethnic Concentration, Dependency, Instability) derived from **Statistics Canada Census** data
  - Hospitalizations, Alternate Level of Care (ALC) days based on **CIHI-DAD**
  - ED-visits based on the CIHI National Ambulatory Care Reporting System (**NACRS**)

Methods - Costing

- Costing Analysis based on methods described in HSPRN Report:
  - **Prices** from Management Information System (MIS) and related sources from Ontario Ministry of Health and Long Term Care (MOHLTC) Health Data Branch, OHIP Architected Payment Database
  - Utilization include CIHI DAD, NACRS, Continuing Care Reporting System (CCC & LTC), National Rehabilitation System, Home Care Database, OHIP, Assistive Devices Program, ODB

Methods - Costing

Total alocatable system costs ≈ $30.5 of $42 B health system spending

Health sector costs identified in the administrative data for all of following services:

- Inpatient Acute
- Inpatient Mental Health
- Inpatient Rehabilitation
- Inpatient Complex Continuing Care
- ED visits
- Same Day Surgery
- Oncology and Dialysis outpatient
- Long Term Care Home
- Home Care
- Assistive Devices
- OHIP FFS
- OHIP non-FFS
- OHIP non-physician
- OHIP Laboratory
- Pharmaceuticals (ODB and NDFP)

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Research Study 1:

Prevalence and characteristics of individuals with multimorbidity

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Specific objectives

1. To provide estimates of the prevalence of multimorbidity and evaluate the characteristics of the multimorbid patients;
2. To examine changes in multimorbidity over an 8 year period;
3. To evaluate the most common clusters of co-existing multimorbid conditions.

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Analyses

- Comparison of the prevalence of multimorbidity
  - By year of study (2003 vs. 2009)
  - By patient characteristics
- Assessment of most common diseases clusters
- Study cohort
  - 2003: 5,263,845 individuals
  - 2009: 6,639,089 individuals

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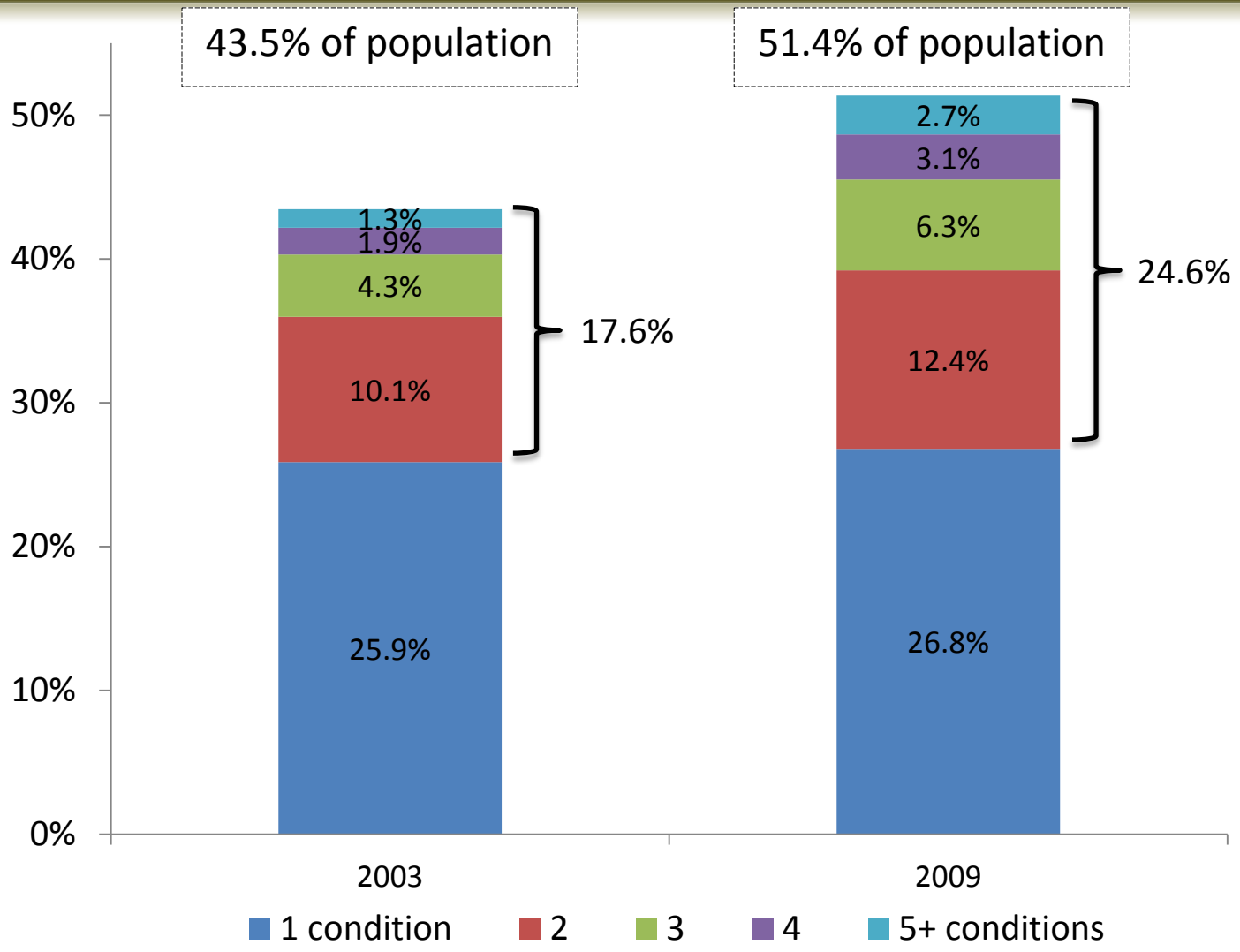
Results

Percent of Ontario population with multimorbidity by year and number of conditions



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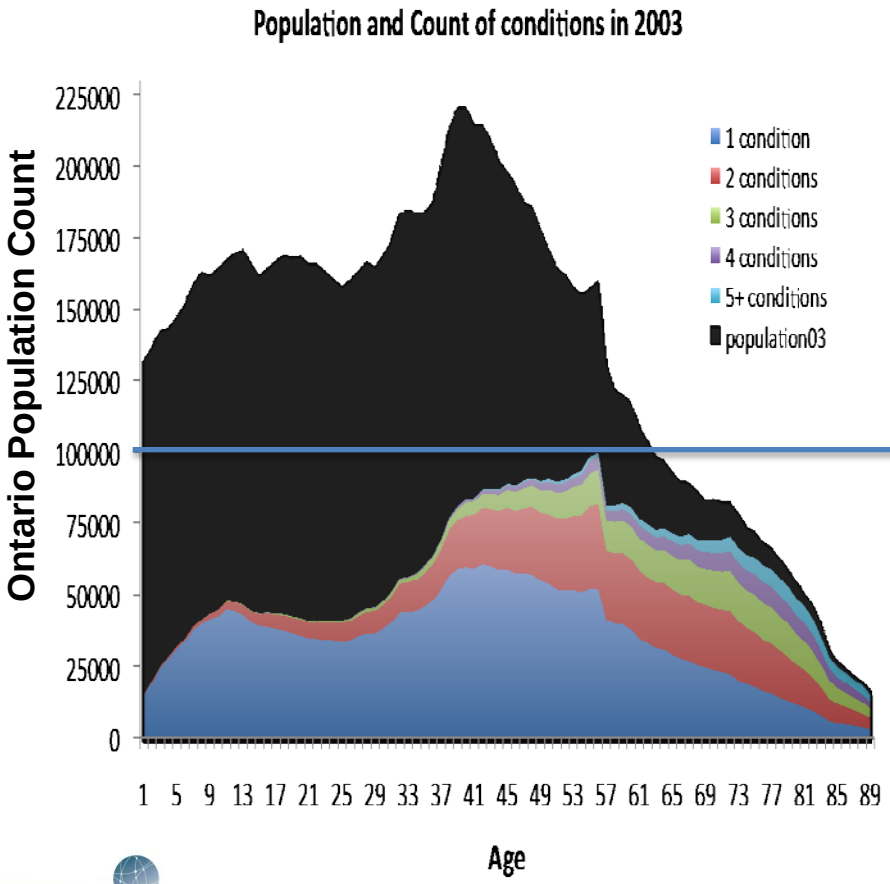
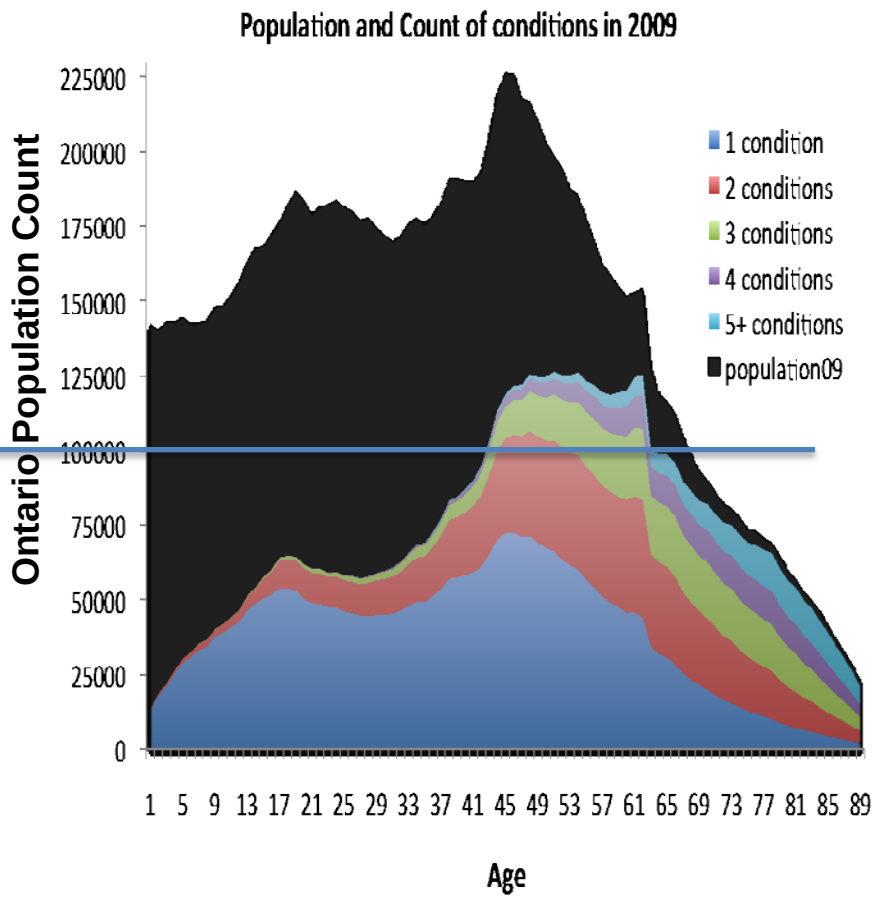
Multimorbidity is increasing across all age groups





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Most Prevalent Conditions and Clusters in 2009

Cohort (n)	Top conditions or clusters	Proportion of cohort in top 5 clusters	Number of conditions or clusters accounting for:	
			50% of cohort	80% of cohort
1 condition (3 464 459)	Asthma (29.2%); Arthritis (24.2%); Hypertension (16.7%); Depression (14.7%); Cancer (6.2%)	91.0%	2	4
2 conditions (1 603 837)	Hypertension & Arthritis (17.5%); Depression & Arthritis (10.0%); Diabetes & Hypertension (9.0%); Asthma & Arthritis (8.8%); Asthma & Depression (6.6%)	52.0%	5	14
3 conditions (816 612)	Diabetes & Hypertension & Arthritis (10.9%); Depression & Hypertension & Arthritis (6.8%); Cancer & Hypertension & Arthritis (5.8%); Coronary Syn. & Hypertension & Arthritis (5.0%); Asthma & Hypertension & Arthritis (4.9%)	33.4%	11	45
4 conditions (406 052)	Coronary Syndrome & Diabetes & Hypertension & Arthritis (5.6%); Depression & Diabetes & Hypertension & Arthritis (4.0%); Asthma & Diabetes & Hypertension & Arthritis (3.8%); Cancer & Diabetes & Hypertension & Arthritis (3.6%); Asthma & Depression & Hypertension & Arthritis (3.2%)	20.1%	30	127
5 conditions (348 129)	Asthma & Depression & Diabetes & Hypertension & Arthritis (1.4%); Cancer & Coronary S & Diabetes & Hypertension & Arthritis (1.3%); Coronary S & Depression & Diabetes & Hypertension & Arthritis (1.2%); CHF & Coronary S & Diabetes & Hypertension & Arthritis (1.1%); Asthma & Coronary S & Diabetes & Hypertension & Arthritis (1.0%)	6.0%	243	2744

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Summary

- **Multimorbidity is highly prevalent in Ontario**
  - 1 in 4 Ontarians have at least 2 of 16 conditions and the prevalence of multimorbidity increases to 75% in people aged 75 years or older.
  - Patient and neighborhood characteristics are associated with multimorbidity

- **While disease prevalence has increased slightly, multimorbidity has increased significantly between 2003 and 2009**
  - 4% increase in the prevalence of single condition
  - 40% increase in the prevalence of multimorbidity

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Summary

- **Multimorbid patients with 3 conditions or more don't have predominant combinations of conditions:**
    - Because of the high crude prevalence, Hypertension & Osteoarthritis are present in most clusters
    - However there were 243 different clusters/combinations of 5 conditions or more that comprised 50% of this population (thousands more for the next 50% of the population)

Research Study 2:

Multimorbidity and hospitalization outcomes over one year

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Specific Objectives

1. To quantify hospital use and related outcomes over one year among a cohort of adults by their degree of multimorbidity.

2. To test whether the association between multimorbidity and hospital use/outcomes was modified by key demographic variables and a measure of primary care contact.

Methods

Main outcome:

- Hospitalization during the year: any, count
- More detail on subset of individuals with ≥ 1 hospitalization

Hospitalization characteristics:

- Length of stay (days)
- Alternate Level of Care designation – days when no longer considered to require acute care but unable to be discharged
- Death at discharge
- 30-day readmission – from any hospitalization; only among those discharged alive

Analyses:

- Age-adjusted hospitalization and death rates stratified by sex
- Descriptive characterization of hospitalizations by age group
- Logistic regression models to test for effect modification

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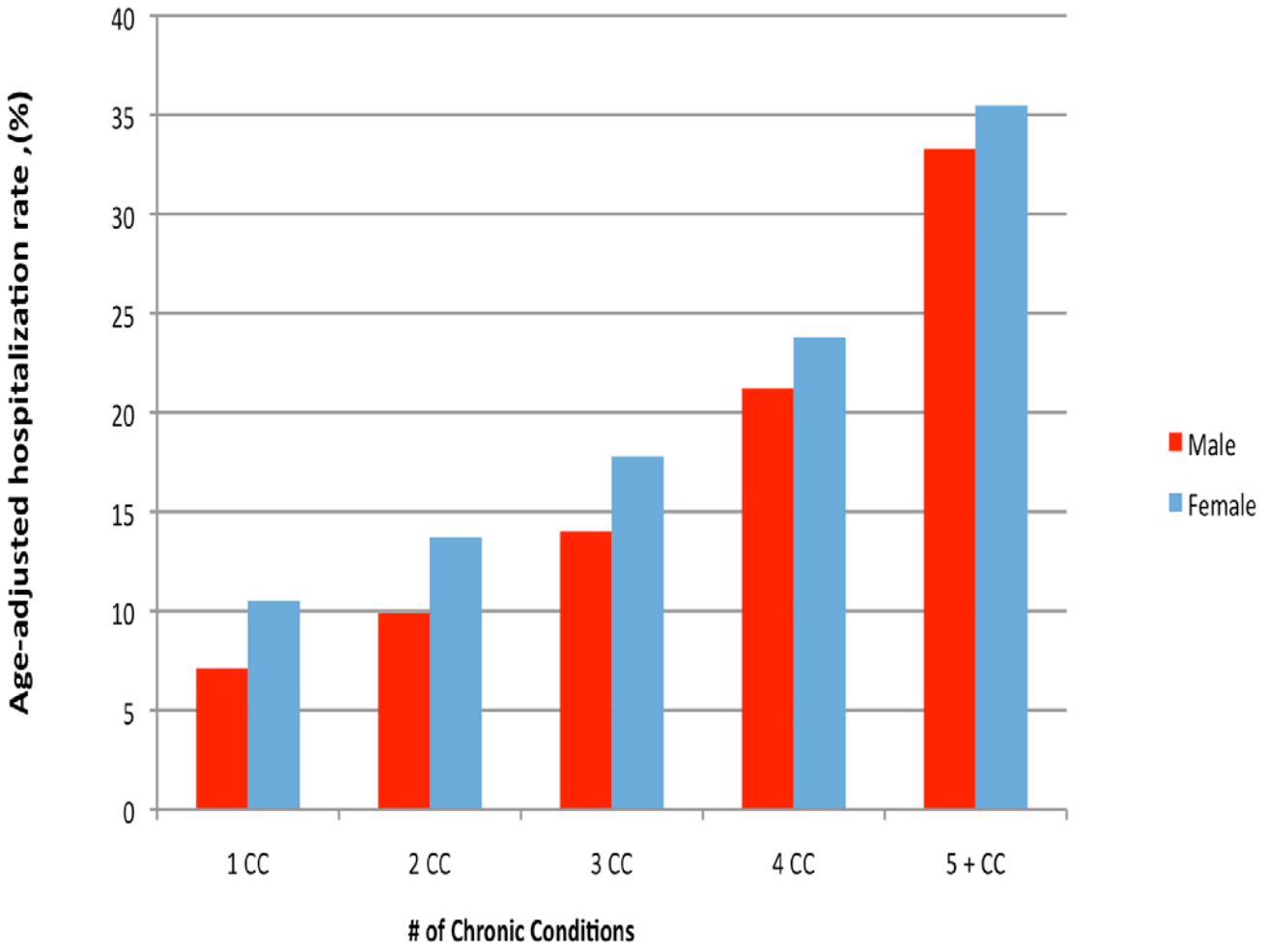
Results

Age-adjusted hospitalization rates over one year



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Hospitalizations and related outcomes over one year

Individuals 65+ years

	1 CC	2 CC	3 CC	4 CC	5CC
Individuals hospitalized, #	44,658	80,191	91,044	77,376	119,880
Proportion with 3+ visits, %	9.8%	11.1%	12.8%	15.1%	21.9%
Median length of stay, days (IQR)	6 (3-13)	6 (3-14)	7 (3-15)	7 (3-18)	10 (4-23)
Any ALC days, %	9.4%	9.7%	10.4%	11.0%	11.3%
Discharge due to death, %	11.8%	12.9%	14.8%	17.4%	25.8%
30-day readmission*, %	12.2%	13.4%	15.1%	17.4%	24.7%

*Among those discharged alive

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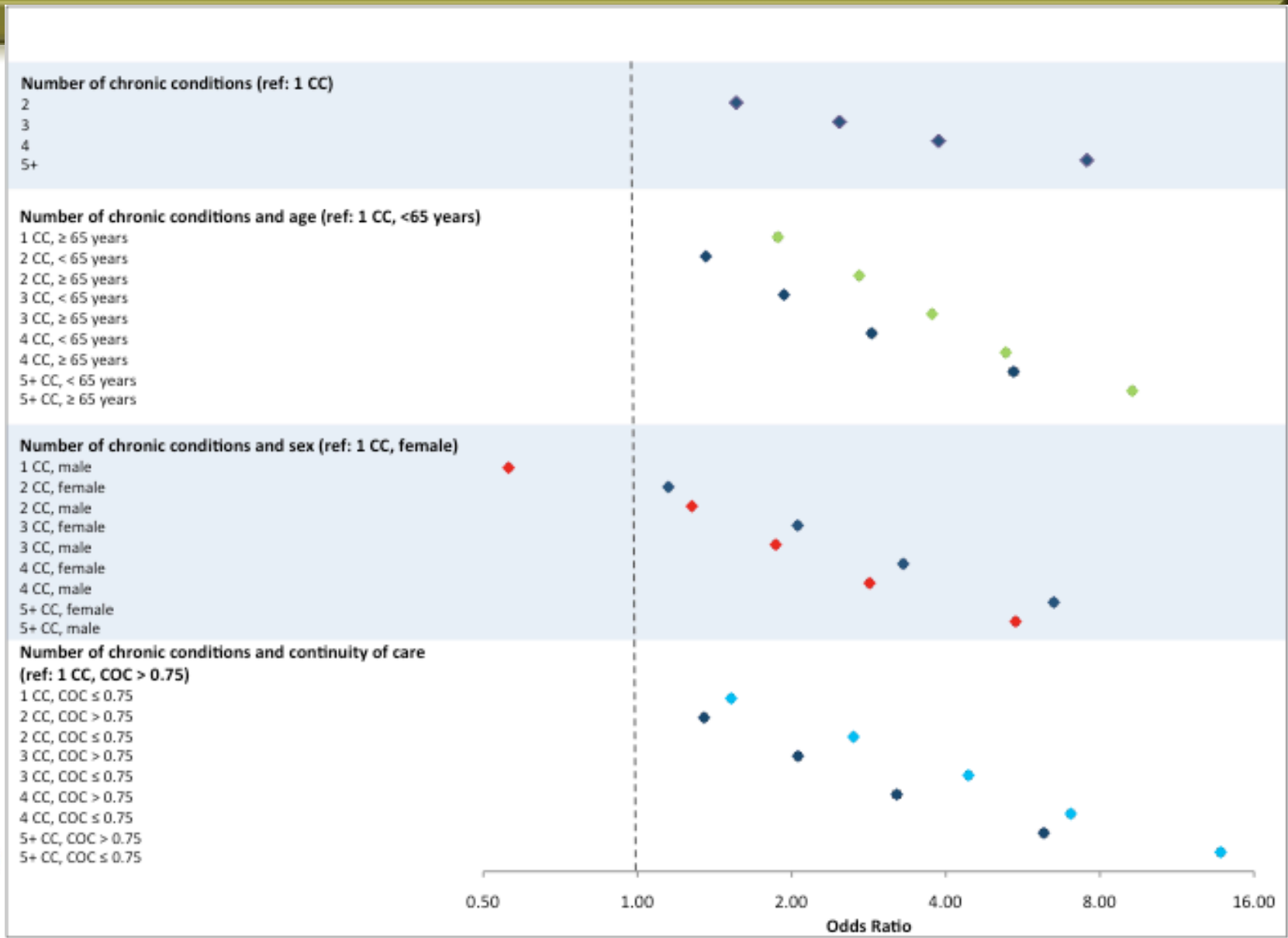
Model 1: Any hospitalization



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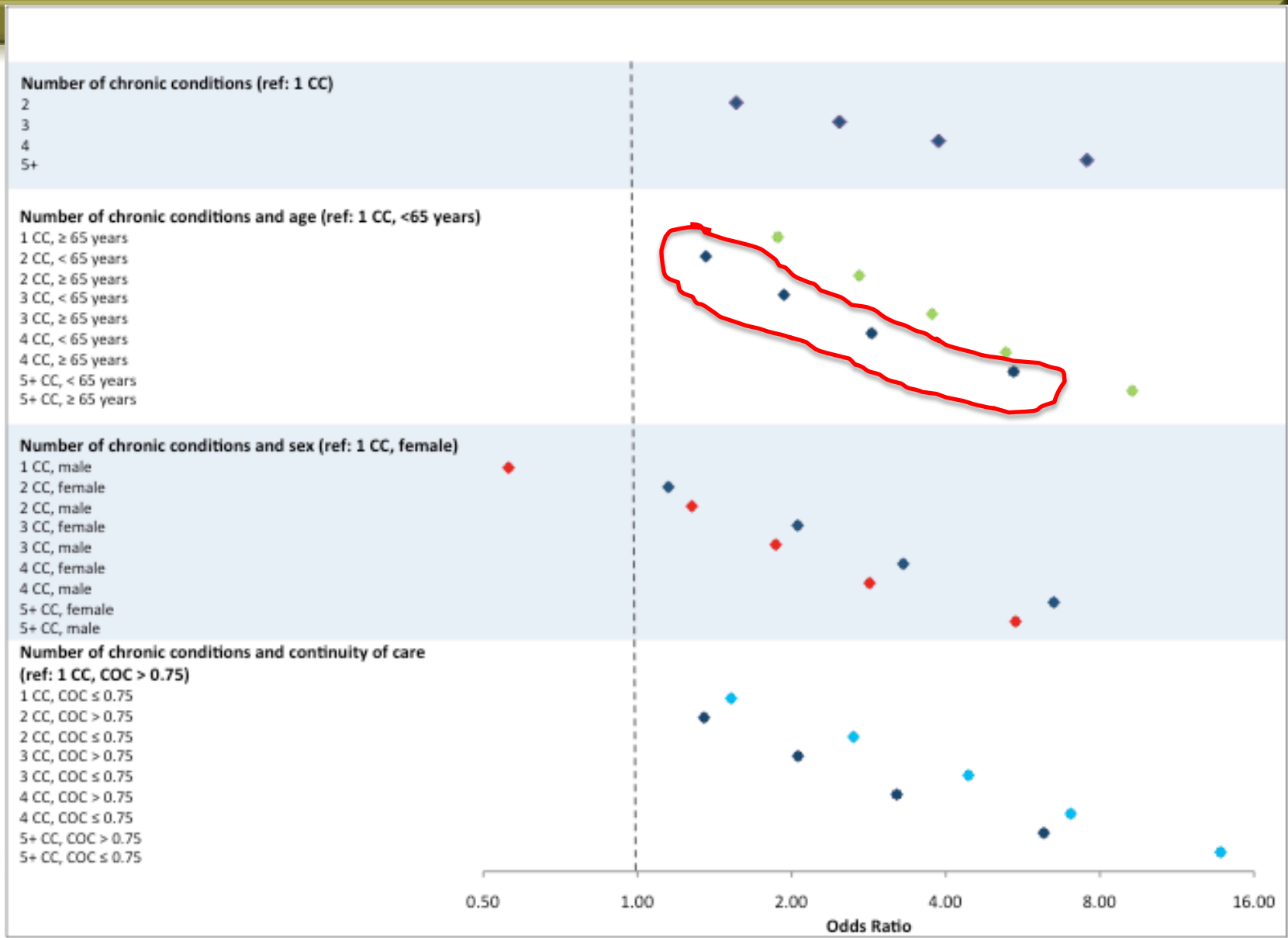

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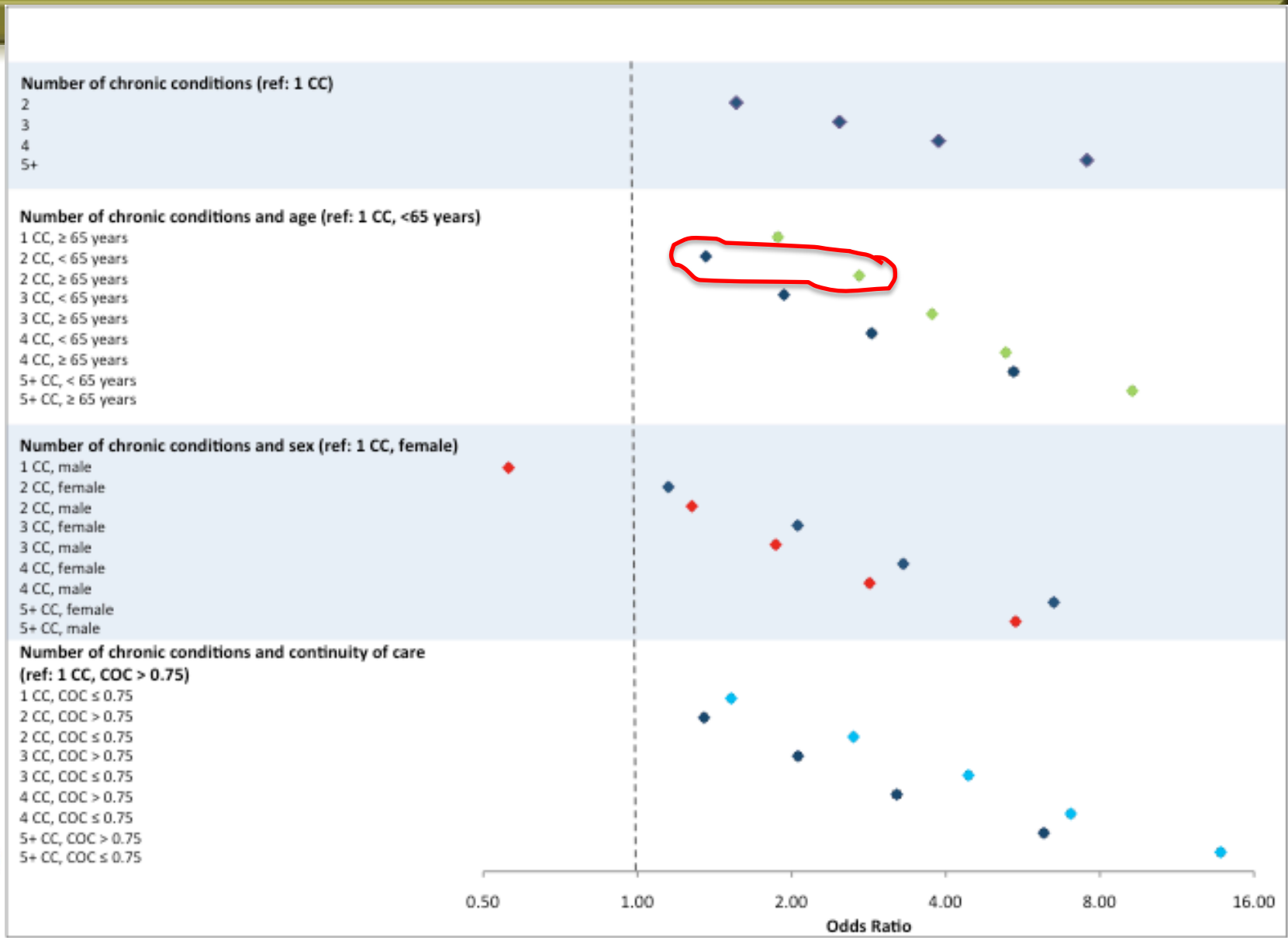

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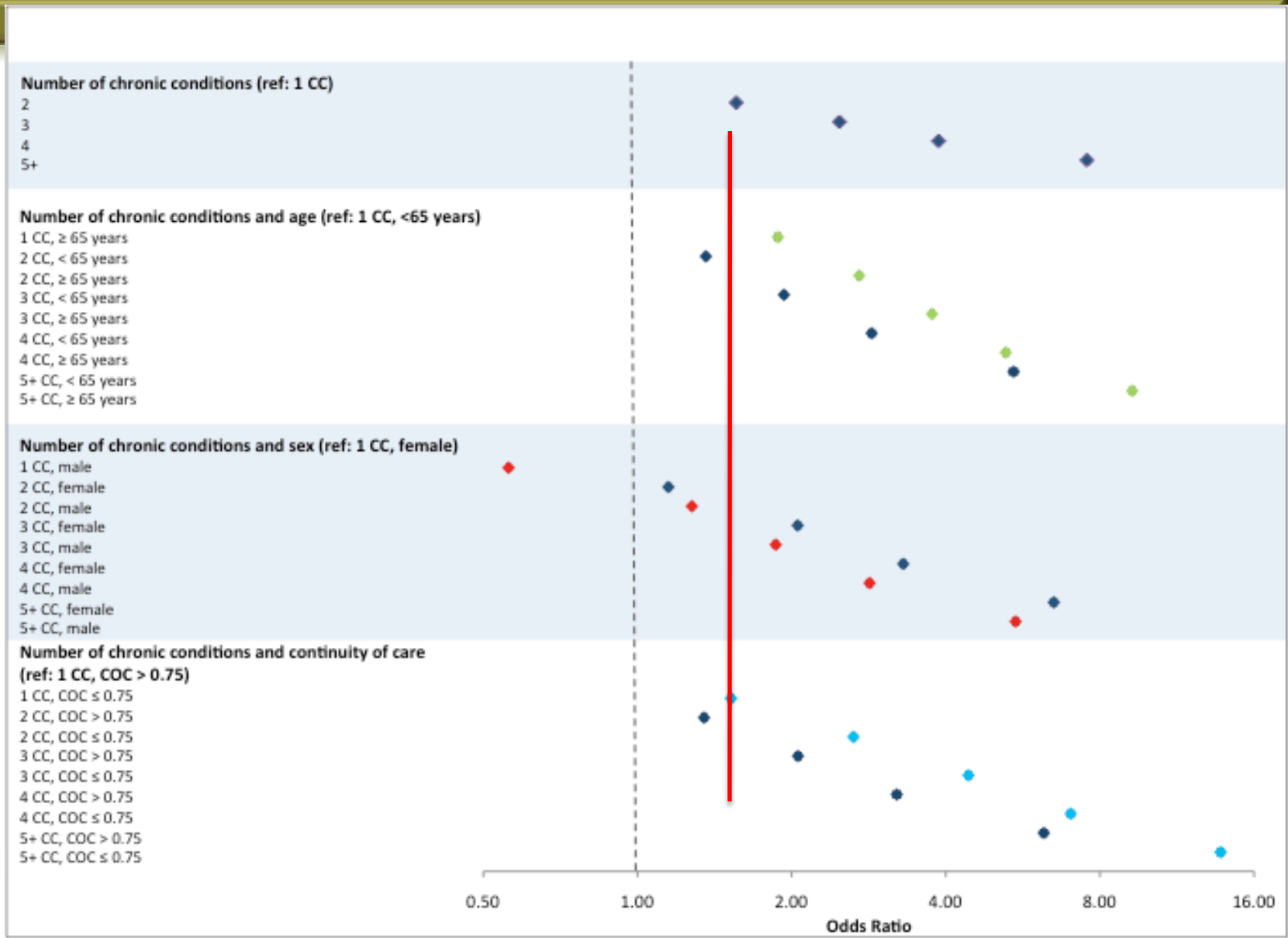
Model 1: Any hospitalization



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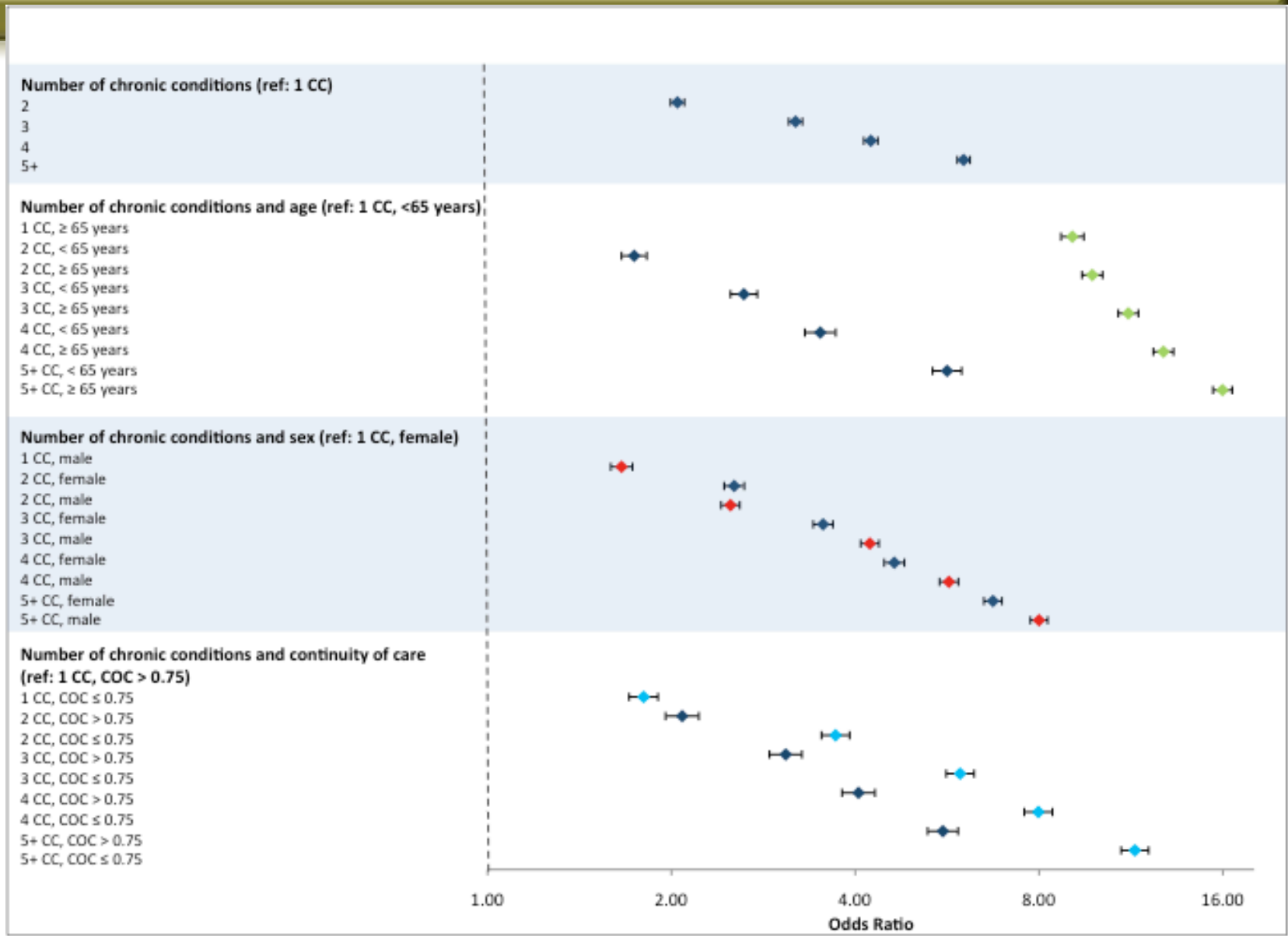
Model 2: Any Alternate Level of Care Days



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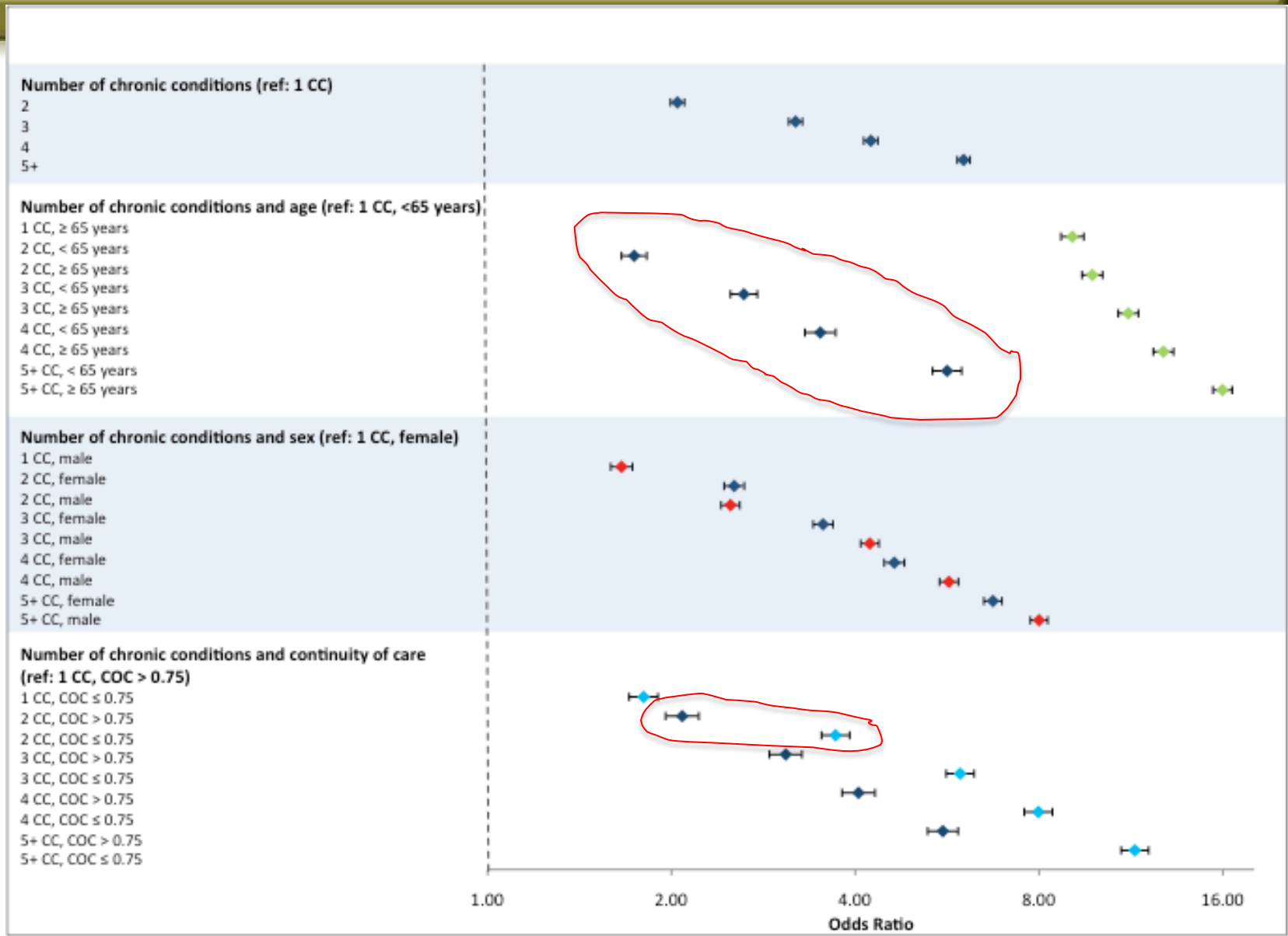

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Summary

- Age-adjusted hospitalization and death rates (not shown) increased with the degree of multimorbidity.
  - Greater increase in hospitalization rates among men as multimorbidity increased.
- Multimorbidity was associated with poorer hospitalization outcomes.
  - Overall proportion readmitted within 30 days more than doubled from 1CC to 5+CC.
- The effect of multimorbidity appears to be moderated by demographic factors and continuity of care.
  - Younger age showed a steeper increases across CC categories.
  - High continuity of primary care appears to counterbalance some of the impact of multimorbidity.

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Research Study 3:

Costs associated with multimorbidity in Ontario's health care system

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Specific Objectives

1. To describe pattern of health care expenditures associated with multimorbidity

2. To estimate incremental cost of multimorbidity in Ontario's population

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Methods

- Perspective of analysis: Ontario government
- Generalized linear models (GLMs) with a log link function by age groups (<65 vs. ≥ 65):
  - **Dependent variable**: total health care costs (2009 $CAD)
  - **Independent variable**: number of medical conditions (1, 2, 3, 4 and 5+ condition (s))
  - Adjusted for sex, primary care model, rurality index, neighborhood factors in quintiles: income, deprivation index, ethnicity concentration, instability, and dependency
- Incremental costs:

$$\hat{C}_2 \text{vs. } \hat{C}_1, \hat{C}_3 \text{ vs.} \hat{C}_2, \hat{C}_4 \text{ vs.} \hat{C}_3, \text{ and } \hat{C}_5 \text{ vs.} \hat{C}_4$$

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Results

Descriptive Statistics

- Total health care costs: $26,454,246,811
  - 86% of (alocatable) Ontario's health care spending in 2009
  - Of these, 79% of total costs ($20,861,738,030) was spent on individuals with multimorbidity
  - Dementia was associated with the highest average costs per capita ($26,722), followed by renal failure ($20,655) and congestive heart failure ($18,906)

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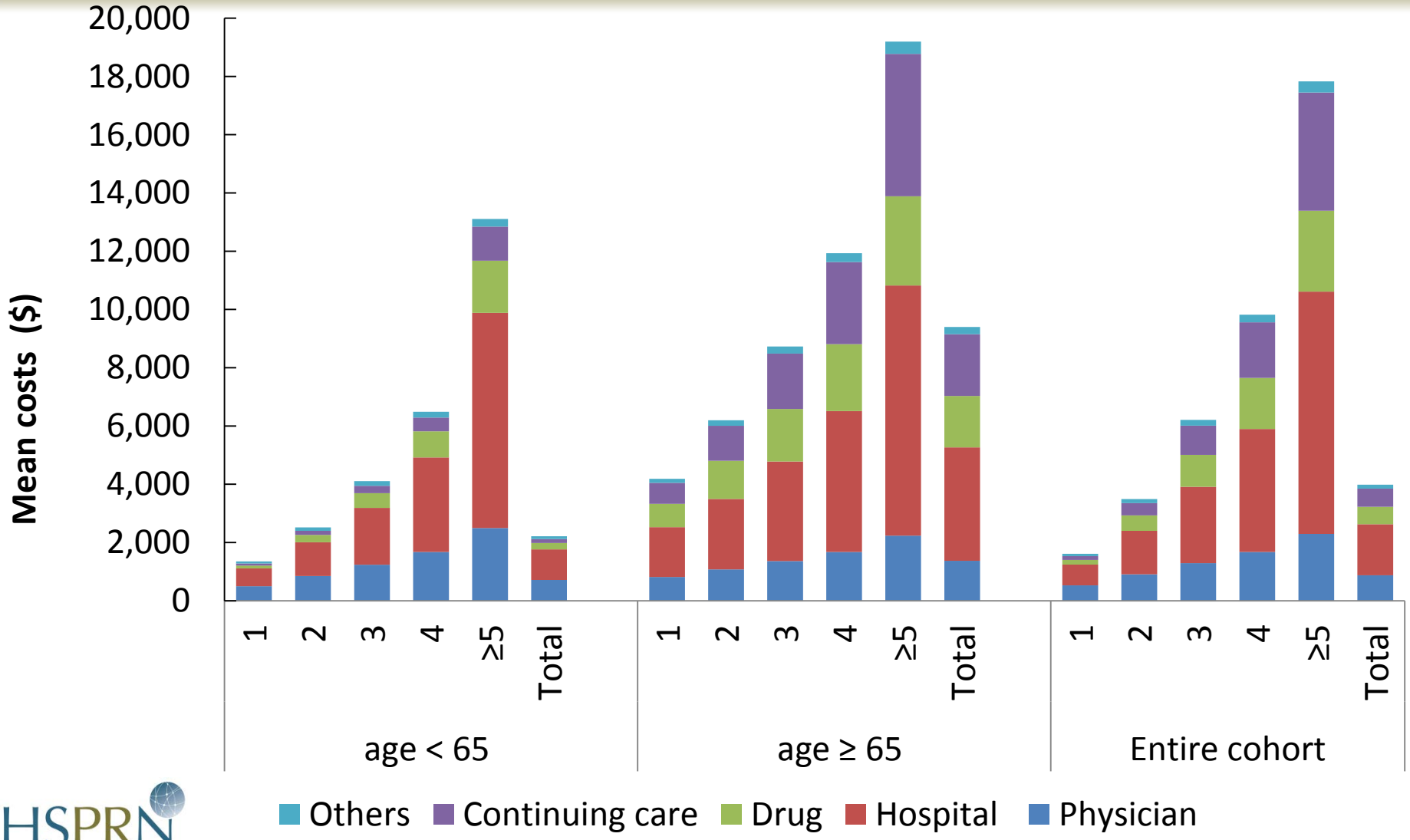
Bivariate Analysis



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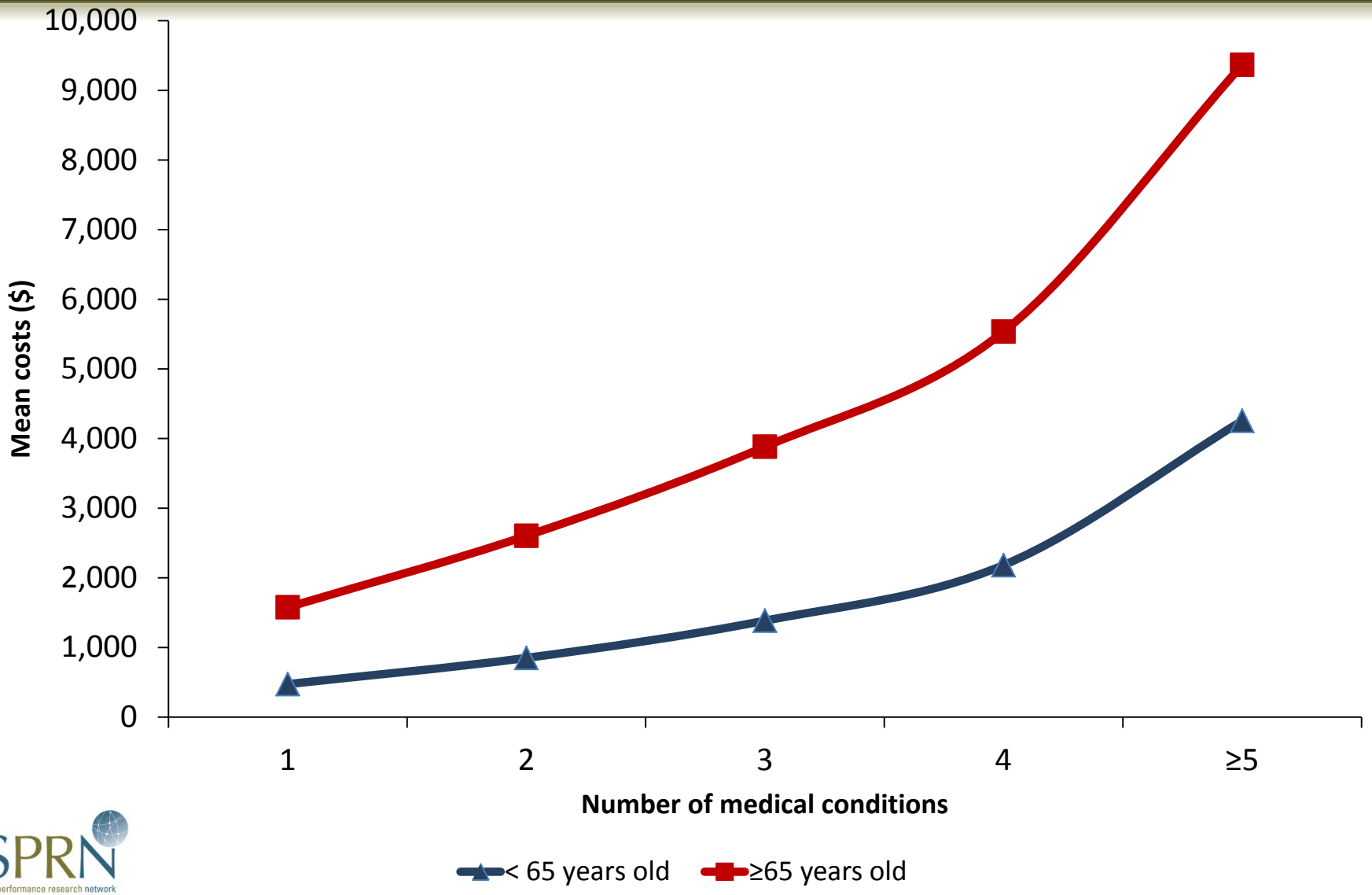
Adjusted Total Health Care Costs



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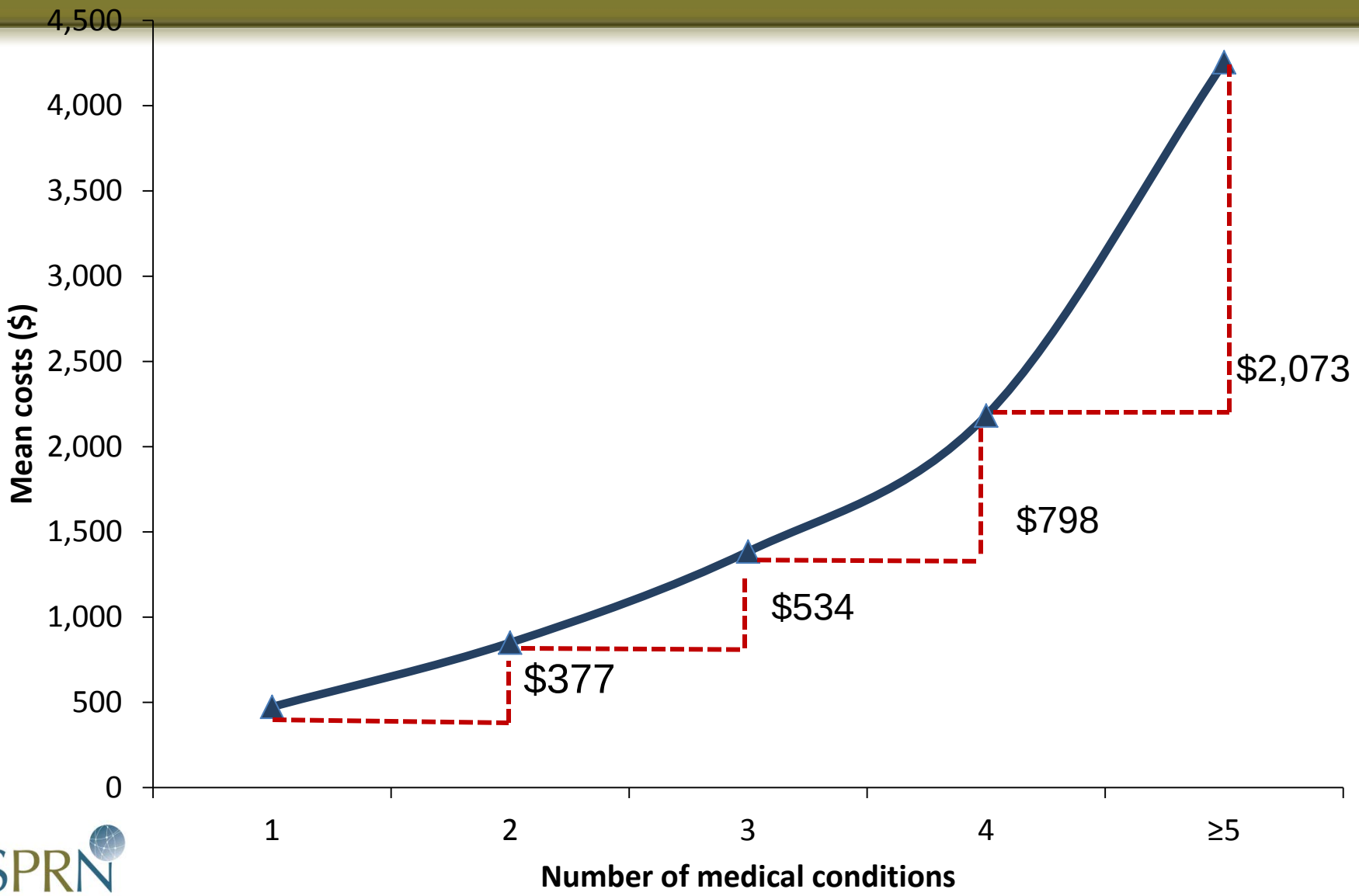
Incremental Total Costs (<65 years)



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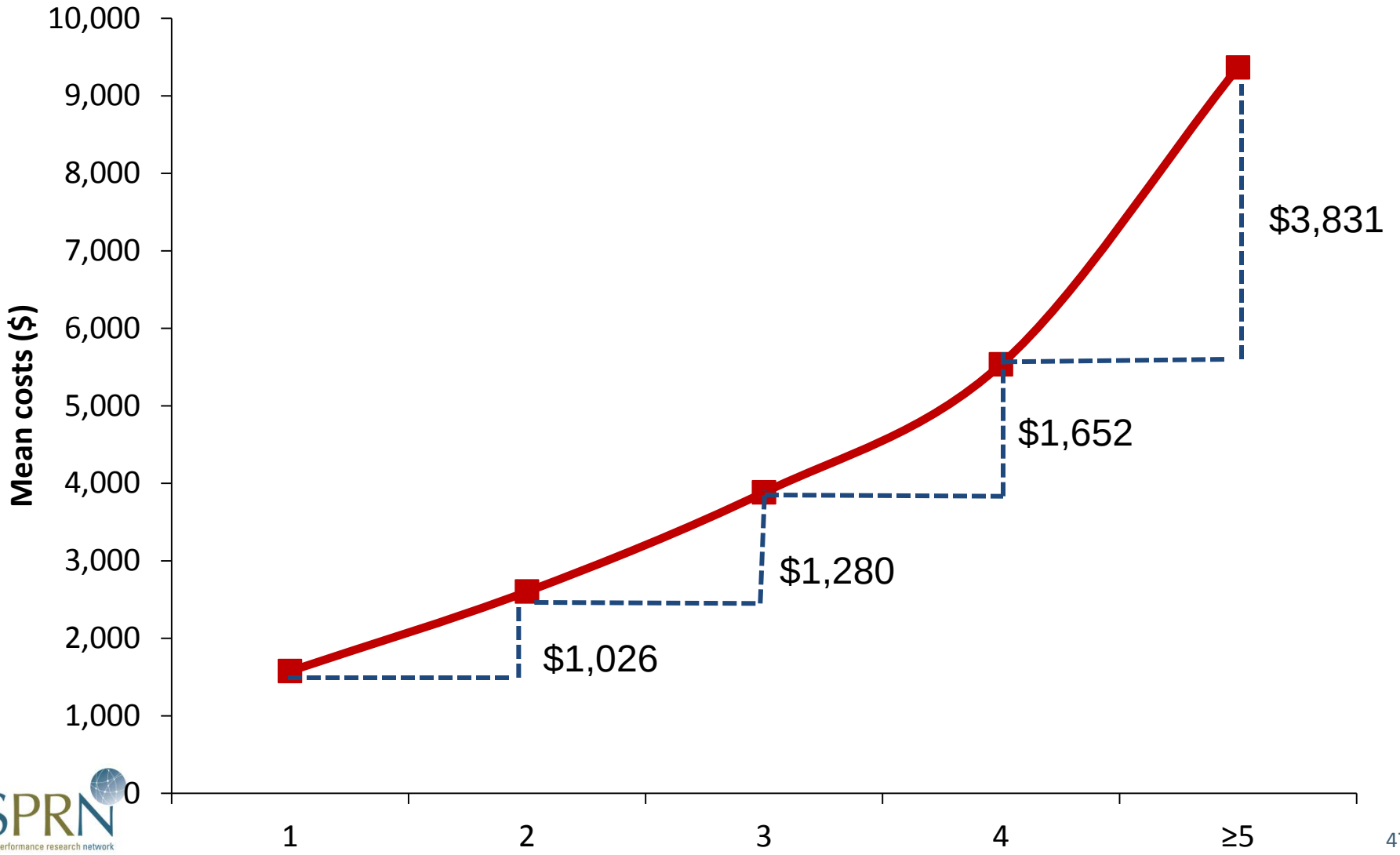
Incremental Total Costs (≥65 years)



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Summary

- Health care costs attributed to multimorbidity are substantial.
  - 42% of all public health care spending in Ontario in 2009 (68% of allocable health care spending)
- Hospital care remains the primary cost driver regardless of age groups.
- Health care costs increased significantly with increasing number of medical condition.

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Program Summary & Future Research

- MULTI-morbidity moreso than chronic disease is escalating rapidly
- Burden is high and escalates exponentially with additional disease
- What we don't know is the extent to which care can be improved…because we don't have good performance measures for multimorbidity
  - Though continuity of care seems to be important
- Our team is now focused on identifying performance measures for multimorbidity

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THANK YOU

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