Improving Diabetes Care for People Experiencing Homelessness:

Using data linkage to identify existing disparities in service use and opportunities for intervention

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Lead investigator: David Campbell

Co-Investigators: Stephen Hwang, Peter Austin, Gillian Booth, Paul Ronksley, Eldon Spackman, Li Bai

Goal of this Presentation

- To highlight existing disparities in diabetes care and explore how service access can be improved for people experiencing homelessness

Introduction

- Diabetes is a complex chronic disease that requires rigorous self-management and consistent follow up care
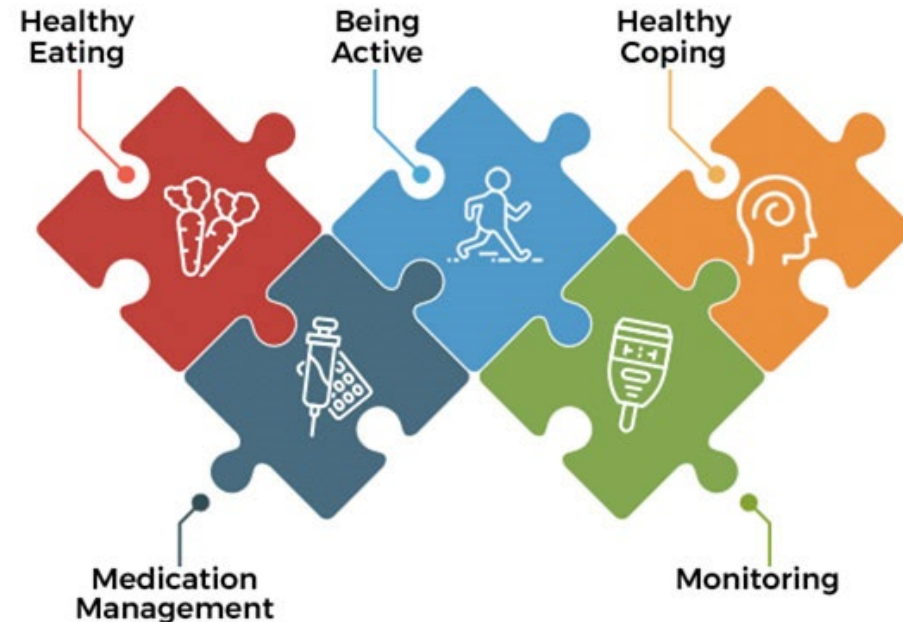
Introduction

- Inadequate diabetes management contributes to suboptimal glycemia and complications such as cardiovascular disease and premature mortality

Navarro-Pérez J et al. Mortality and cardiovascular disease burden of uncontrolled diabetes in a registry-based cohort: the ESCARVAL-risk study. BMC Cardiovasc Disord. 2018;18(1):180.
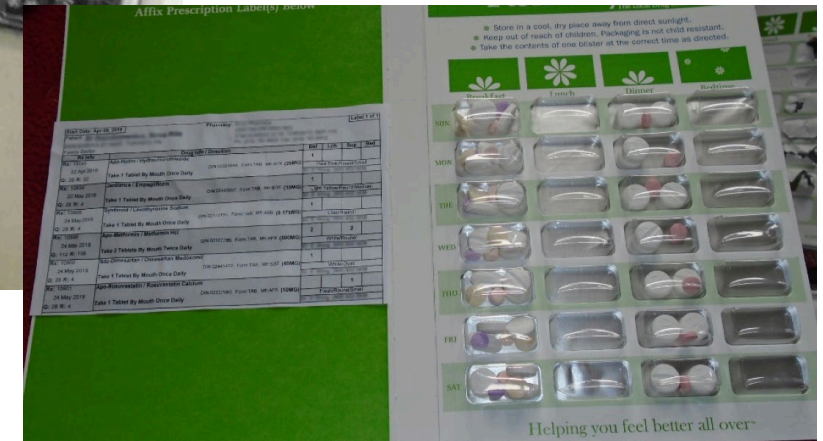
Introduction

Screening recommendations:
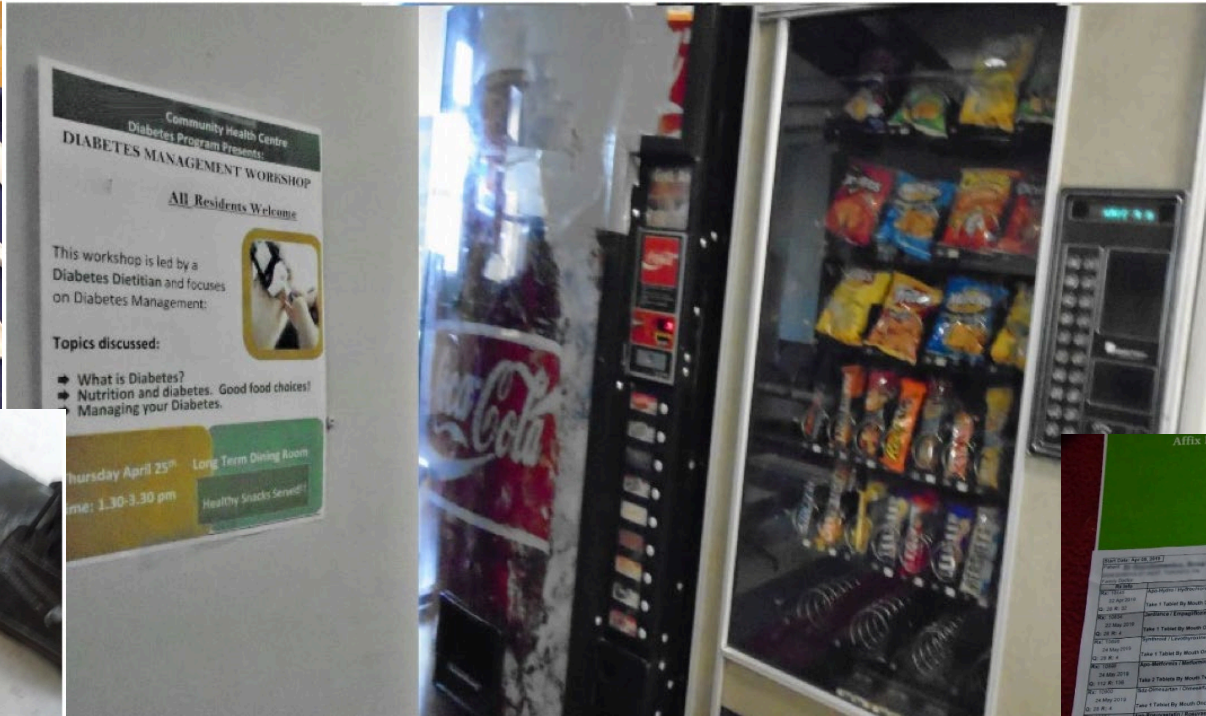
- Glucose blood tests (hemoglobin A1C) every 3-6 months

- Cholesterol tests every 1-3 years

- Kidney function tests every year

- Eye tests every 1-2 years

Diabetes Canada Clinical Practice Guidelines, 2018: https://guidelines.diabetes.ca/cpg/

Introduction

- Homelessness poses unique barriers to diabetes management
  (Grewal et al. 2021)

Grewal EK et al. Using concept mapping to prioritize barriers to diabetes care and self-management for those who experience homelessness. Int J Equity Health. 2021; 20(1):158

Introduction

Campbell, R. B., Larsen, M., DiGiandomenico, A., Davidson, M. A., Booth, G. L., Hwang, S. W., . . . Campbell, D. J. T. (2021). The challenges of managing diabetes while homeless: a qualitative study using photovoice methodology. *Canadian Medical Association Journal, 193*(27), E1034. doi:10.1503/cmaj.202537
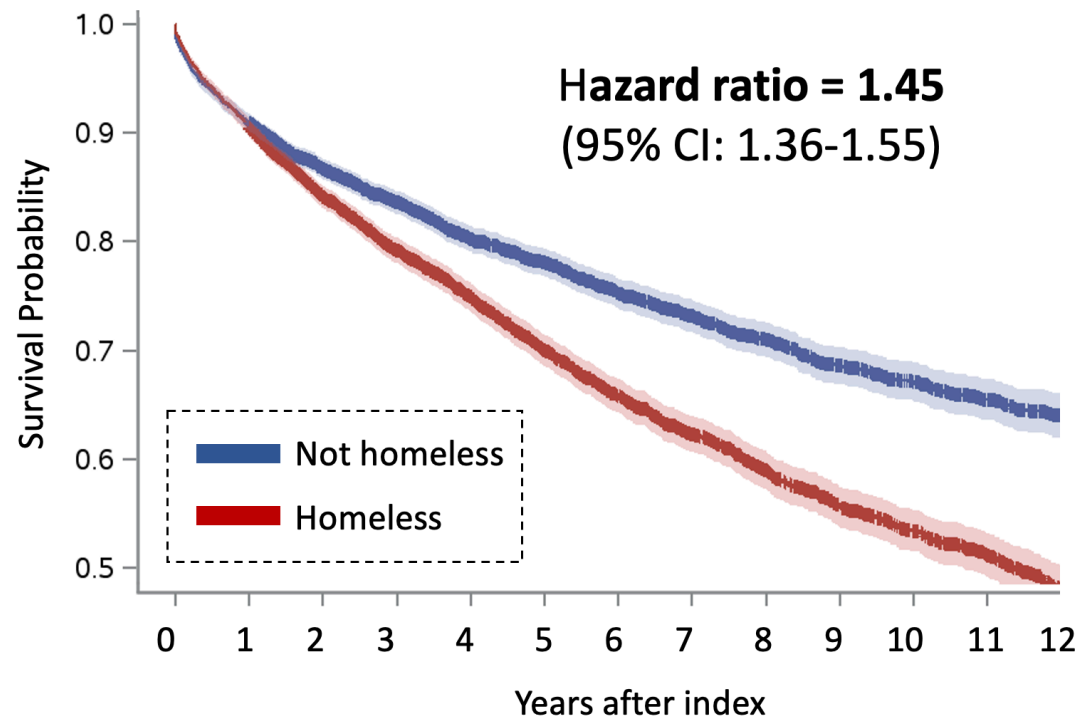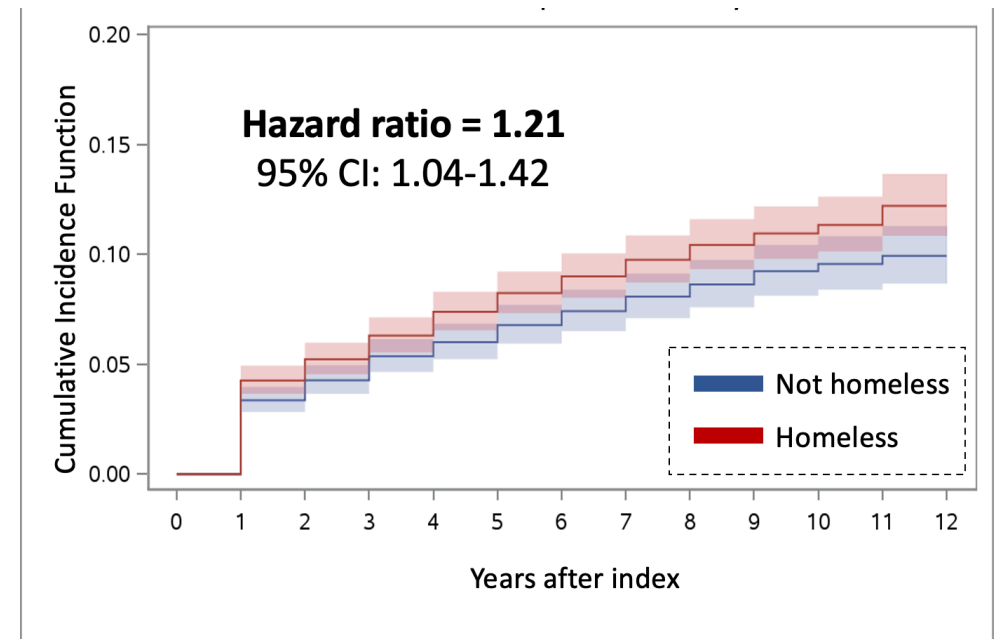
Introduction

- People experiencing homelessness with diabetes have higher instantaneous rate of all-cause mortality compared to non-homeless controls
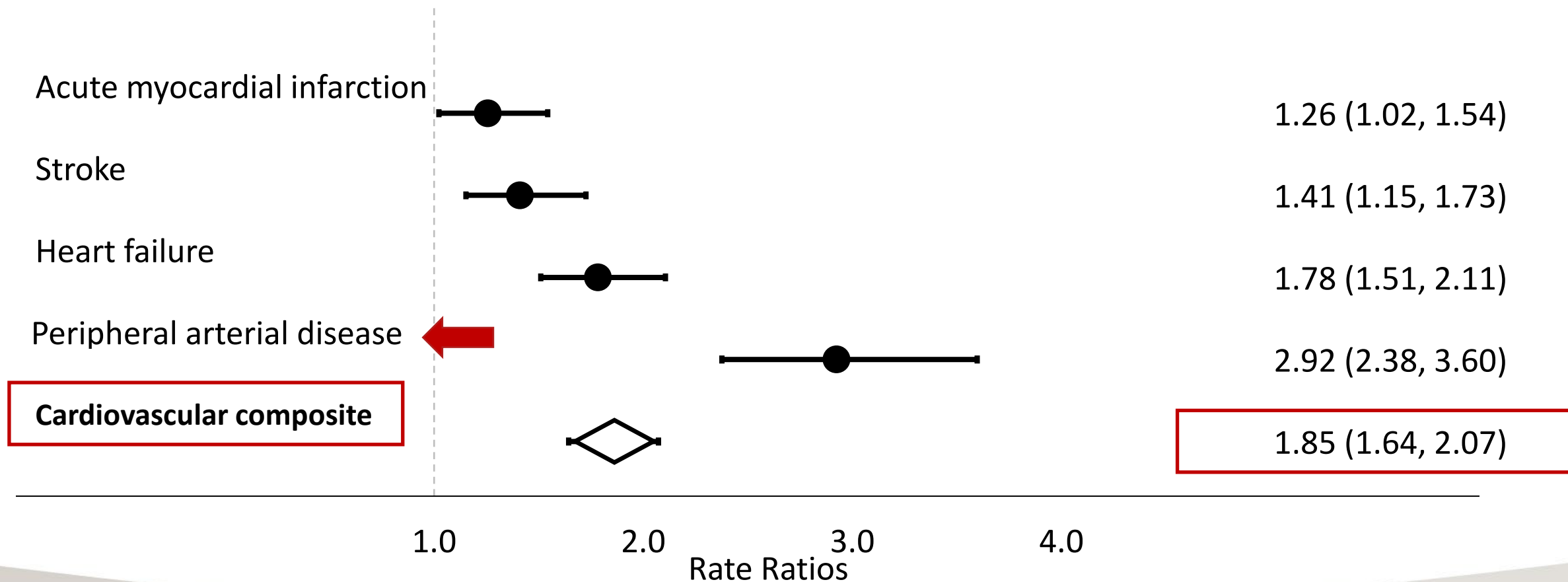

Hazard ratio = 1.45
(95% CI: 1.36-1.55)

Not homeless
Homeless

Cardiovascular-specific mortality

Hazard ratio = 1.21
95% CI: 1.04-1.42
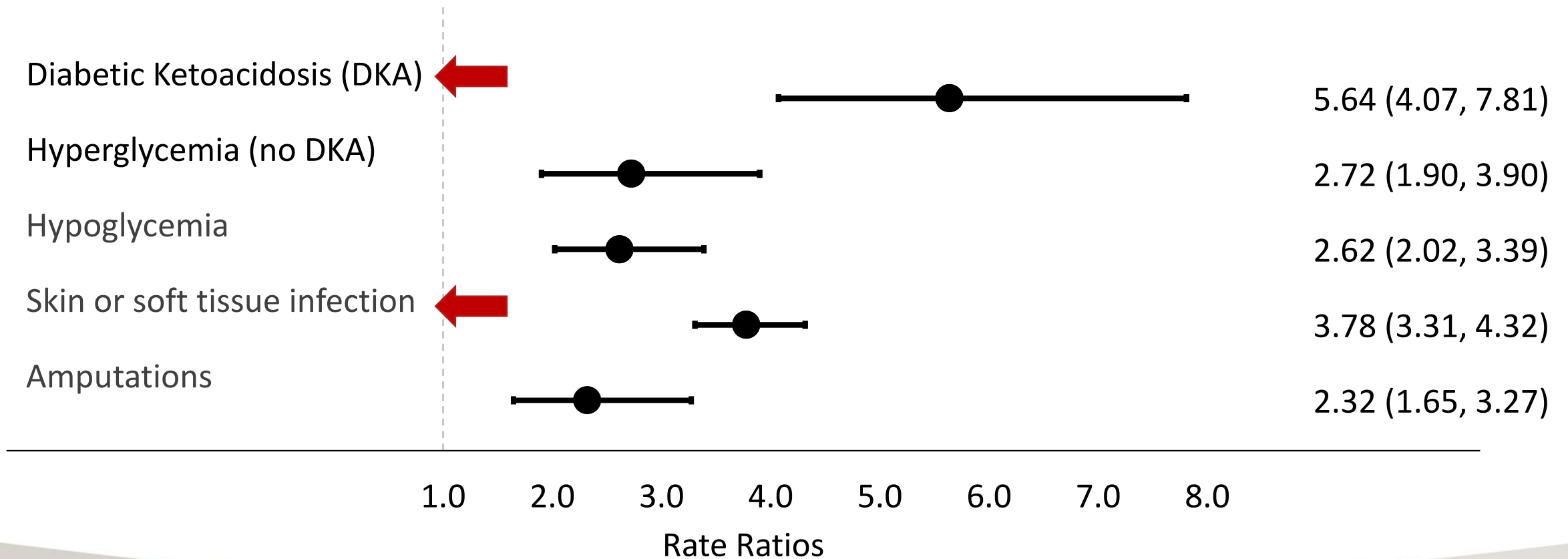
Not homeless
Homeless

Introduction

- People experiencing homelessness with diabetes have higher rates of cardiovascular complications compared to non-homeless controls

Introduction

- People experiencing homelessness with diabetes have higher rates of hospitalization for non-cardiovascular diabetes complications compared to non-homeless controls

Complication	Rate Ratio (95% CI)
Diabetic Ketoacidosis (DKA)	5.64 (4.07, 7.81)
Hyperglycemia (no DKA)	2.72 (1.90, 3.90)
Hypoglycemia	2.62 (2.02, 3.39)
Skin or soft tissue infection	3.78 (3.31, 4.32)
Amputations	2.32 (1.65, 3.27)

Rate Ratios

Summary of past research

Homelessness is associated with worse diabetes outcomes, including premature mortality, cardiovascular complications, and hospitalization for diabetes-related adverse events
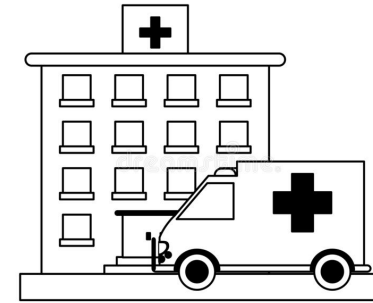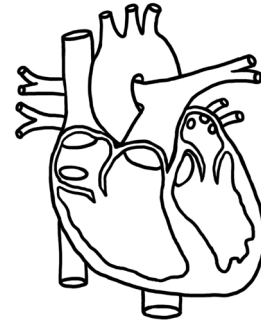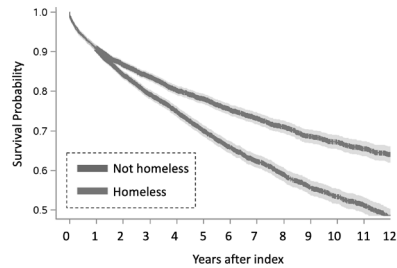
Objective

To quantify the impact of homelessness on diabetes care indicators among patients with diabetes who use hospital services.
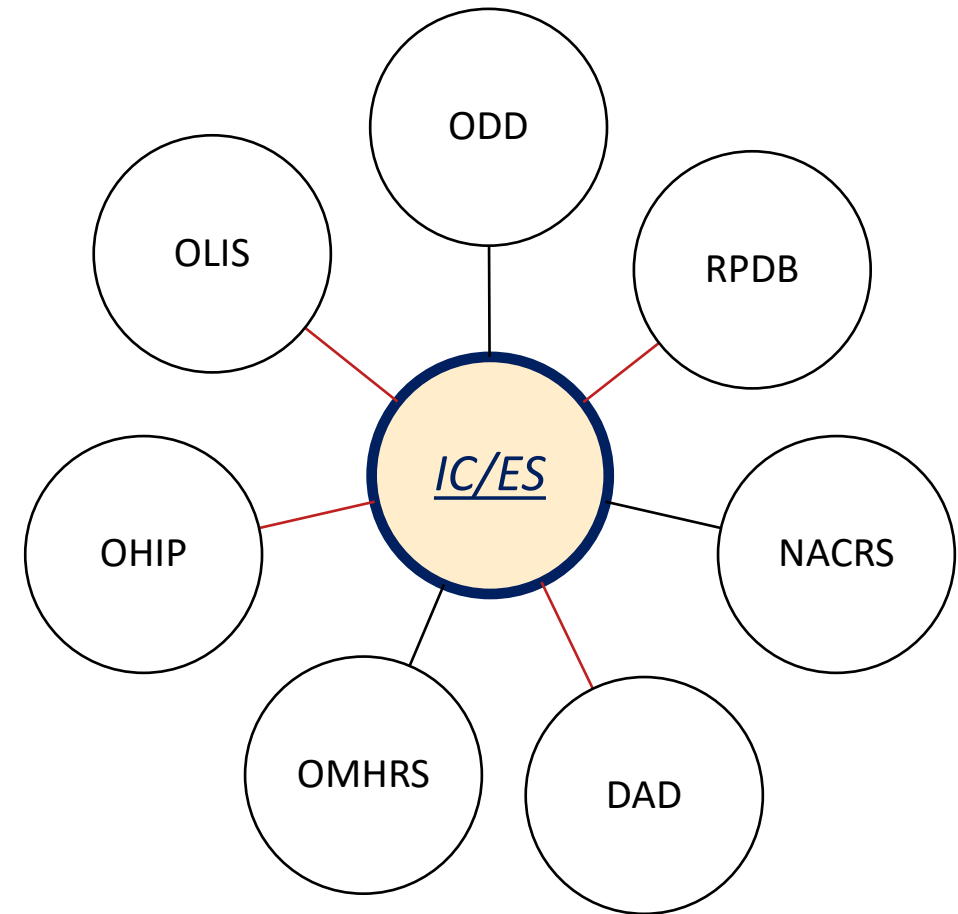
Methods

Study design:

Propensity matched cohort study using population-level administrative healthcare data in Ontario, Canada

Data source: IC/ES databases

A repository of administrative healthcare data in covering all residents eligible for coverage by the Ontario Health Insurance Plan

Data sources: Homeless status

Database	Variable Name	Indicator Value	Description
DAD	HOMELESS	"Y"	Homelessness indicator
	INSTTYPE	"SH"	Institution Type = Supportive Housing
	DX10CODE1 to DX10CODE25	"Z590" or "Z591"	ICD-10 diagnosis codes for "Homelessness" and "Inadequate housing"
	CMGDIAG	"Z590" or "Z591"	ICD-10 diagnosis codes for "Homelessness" and "Inadequate housing"
	PSTLCODE	"XX"	Used to indicate transient/homeless patients
NACRS	DX10CODE1 to DX10CODE10	"Z590" or "Z591"	ICD-10 diagnosis codes for "Homelessness" and "Inadequate housing"
	RESTYPE	"3" or "4"	Residence Type = "Homeless" or "Shelter"
	PSTLCODE	"XX"	Used to indicate transient/homeless patients
OMHRS	PREDX10CODE to PREDX10CODE11	"Z590" or "Z591"	ICD-10 diagnosis codes for "Homelessness" and "Inadequate housing"
	POSTDX10CODE1 to POSTDX10CODE24	"Z590" or "Z591"	ICD-10 diagnosis codes for "Homelessness" and "Inadequate housing"
	PRIOR_RESIDENCE	"6"	Prior residential status = "Homeless (with or without shelter)"
	USUAL_RESIDENCE	"8"	Usual residential status = "Homeless (with or without shelter)"
	ADMITFROM	"8"	Admitted from = "Homeless (with or without shelter)"
	DISCHLIVING	"8"	Living arrangement at discharge = "Homeless (with or without shelter)"
	P5_Retired_2009	"6"	(Variable retired in 2009) Living arrangement = "Homeless (with or without shelter)"
	PSTLCODE	"XX"	Used to indicate transient/homeless patients

Data sources: Cohort creation

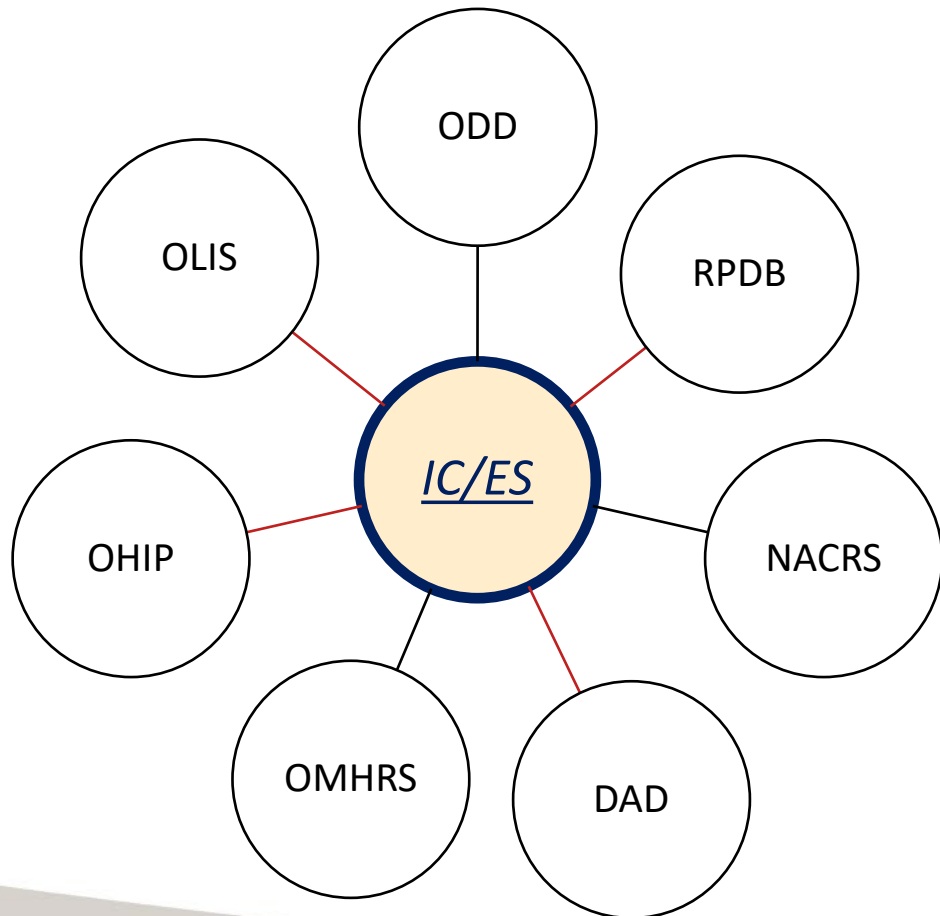"People with diabetes who use hospital services in Ontario, Canada"
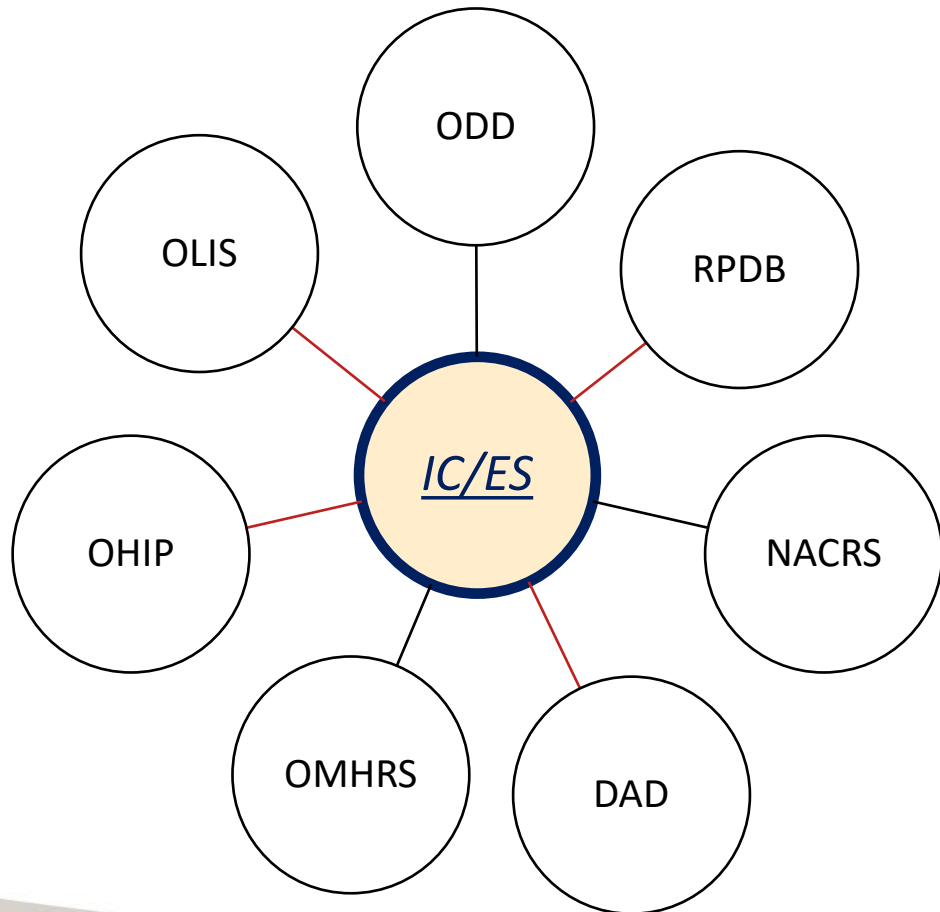
Ontario Diabetes Dataset: provincial registry of patients with diabetes

Registered Persons Database: registry of Ontario residents eligible for the Ontario Health Insurance Plan

Data sources: Cohort creation

"People with diabetes <u>who use hospital services</u> in Ontario, Canada"
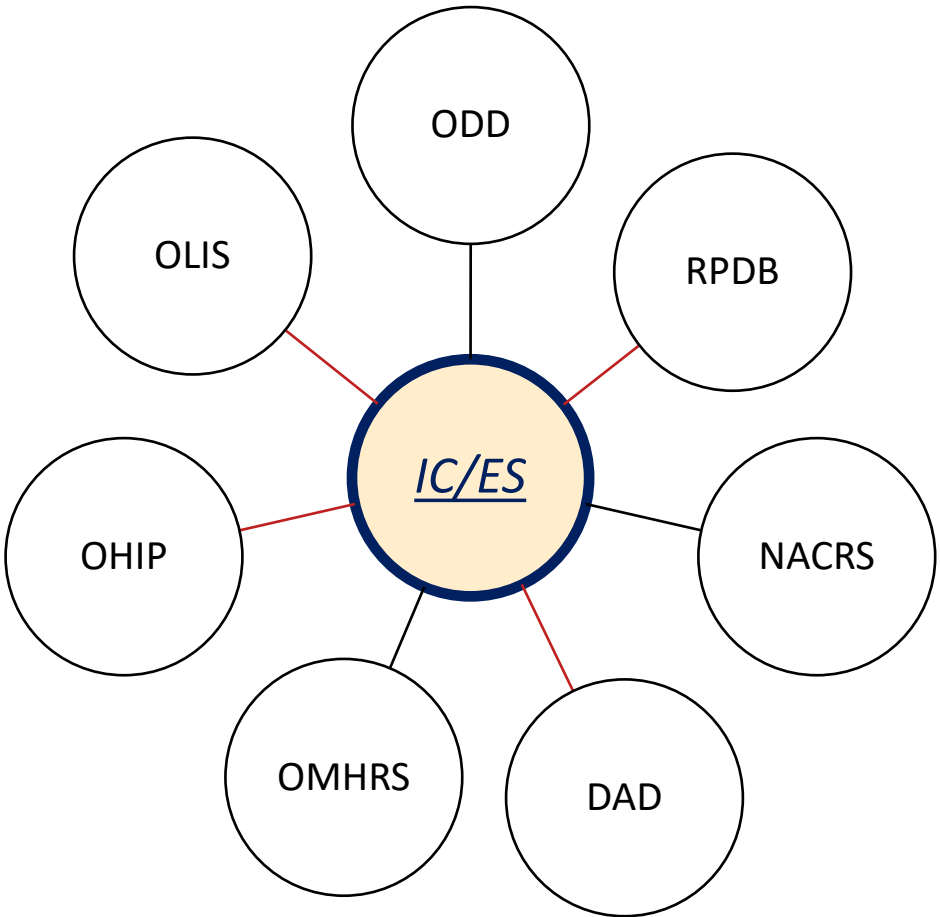

National Ambulatory Care Reporting System: information on emergency department visits

Discharge Abstract Database: information on hospital discharges

Ontario Mental Health Reporting System: information on hospital admissions to designated mental health beds

Data sources: diabetes care indicators

Ontario Health Insurance Plan + ICES Physicians Database:

Ontario Laboratory Information System: labotatory results
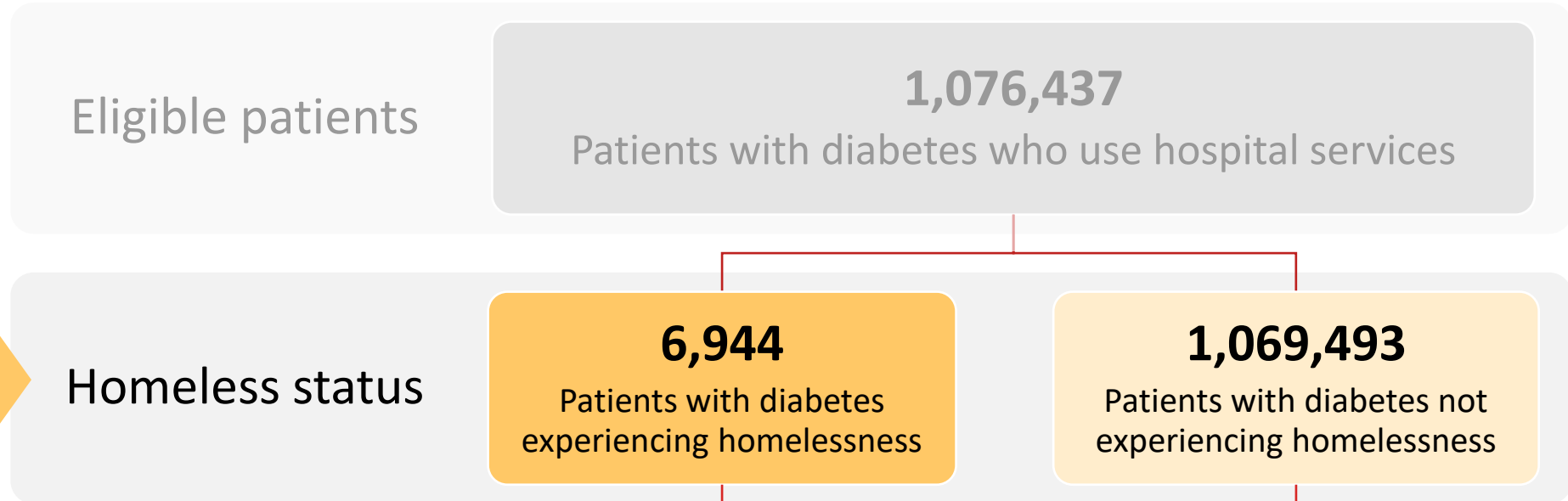
Cohort creation

Eligibility Criteria
* Diagnosed with diabetes
* At least one hospital encounter
* Ontario resident at least 18 years of age

Eligible patients

1,076,437
Patients with diabetes who use hospital services

Cohort creation

Eligible patients

1,076,437
Patients with diabetes who use hospital services

Homeless status:
At least one homeless indicator in NACRS, OMHRS, or DAD between April 2006 and March 2019

Homeless status

6,944
Patients with diabetes experiencing homelessness

1,069,493
Patients with diabetes not experiencing homelessness

Cohort creation

Eligible patients	**1,076,437** Patients with diabetes who use hospital services	

| Homeless status | **6,944** Patients with diabetes experiencing homelessness | **1,069,493** Patients with diabetes not experiencing homelessness |
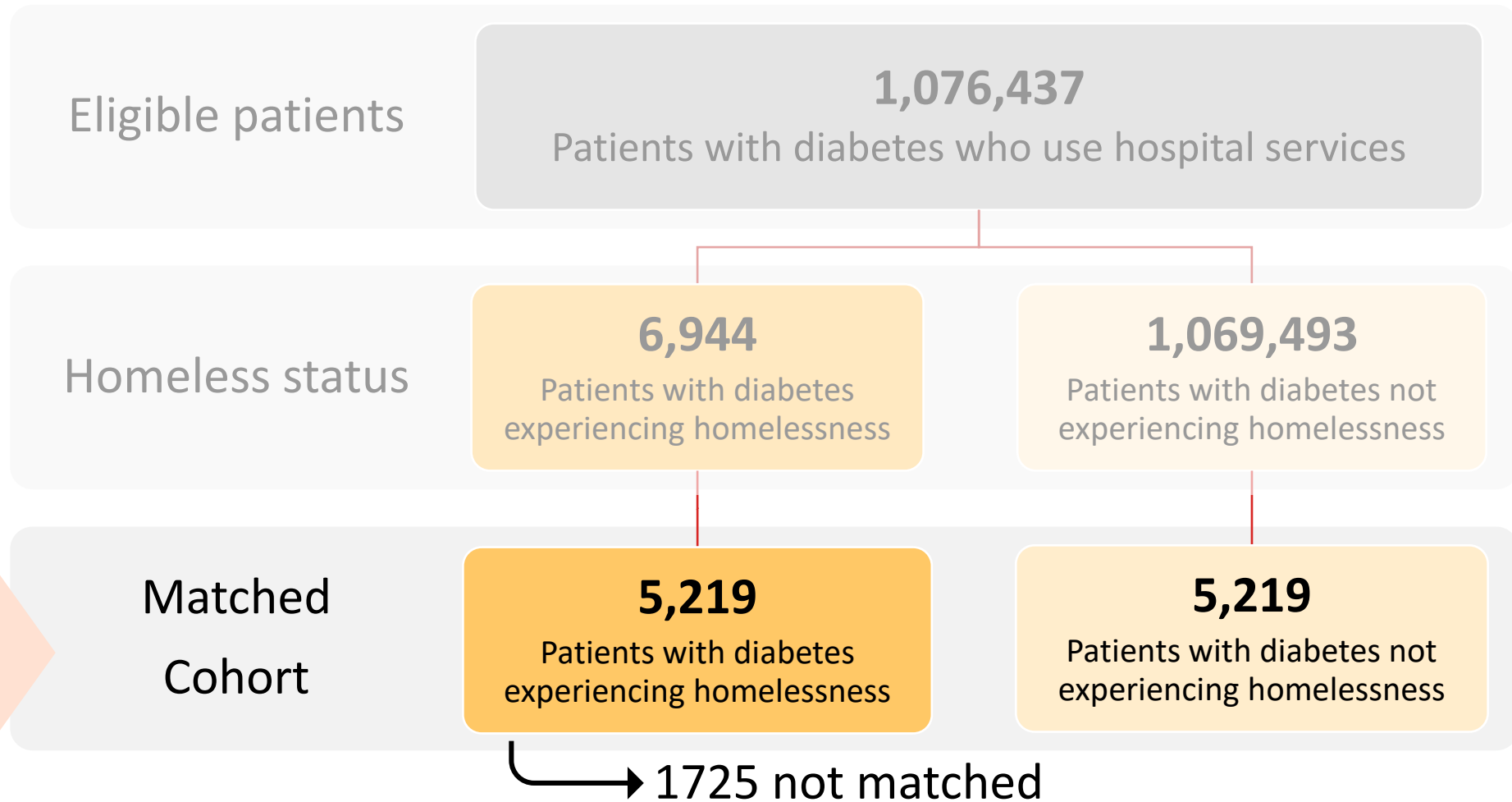
Match criteria
Age, sex, location, mental illness, type & duration of diabetes, comorbidities, past hospital encounters

| Matched Cohort | **5,219** Patients with diabetes experiencing homelessness | **5,219** Patients with diabetes not experiencing homelessness |

1725 not matched

Statistical Analysis

The suitability of the match was examined using *standardized differences,* with a difference greater than 0.1 indicating covariate imbalance.

Count variables:
➢ Rate ratios: Negative binomial regression models with robust standard errors
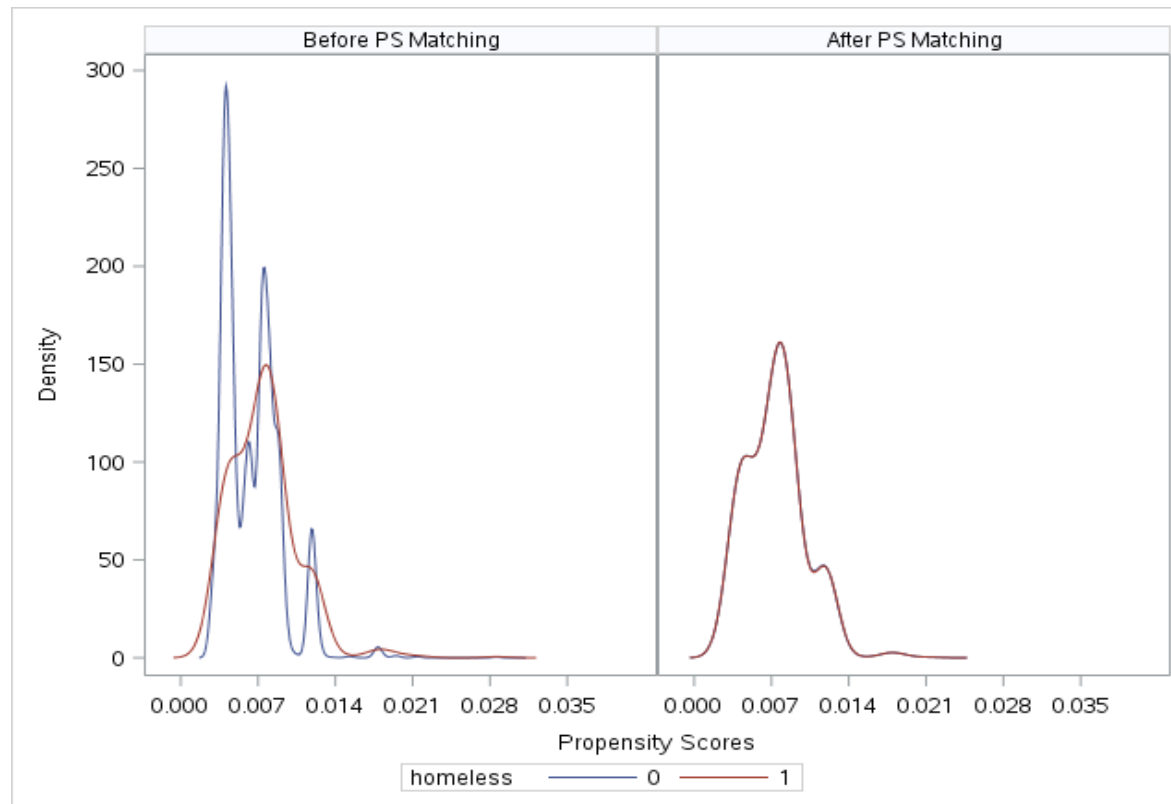
Binary variables:
➢ Proportions, SE
➢ McNemer's test for differences

Results

After matching:

- Age, sex, geographical location, mental illness, type/duration of diabetes, comorbidities, past hospital encounters were balanced across groups

Results: Physician visits

Proportion of people:
first 2 years of
follow up

	Homeless	Non-homeless	
≥ 3 physician visits	98%	98%	
≥ 3 physician visits & 50% of visits with the same primary care provider	13% <	21%	p < 0.001
≥ 1 endocrinologist visit	6% <	12%	p < 0.001

Results: Physician visits

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	Homeless	Non-homeless
≥ 3 physician visits	98%	98%
≥ 3 physician visits & 50% of visits with the same primary care provider	13%	21%
≥ 1 endocrinologist visit	6%	12%

Visits per person year: entire follow up

	Homeless	Non-homeless	
Physician visits (per person year)	18 visits	11 visits	**RR = 1.51** (95%CI: 1.41-1.62)
Diabetes management visit (per person year)	0.3 visits	0.6 visits	**RR = 0.49** (95%CI: 0.46-0.53)
Endocrinologist visits (per person year)	0.1 visits	0.3 visits	**RR = 0.43** (95%CI: 0.38-0.48)

Results: Laboratory Tests

Hemoglobin A1C tests	Homeless	Non-homeless
People with at least 2 A1C tests in first year	25% <	40%
Number of tests (per person year)	1.1 tests	1.5 tests

p < 0.001

RR = 0.69

(95%CI: 0.67-0.72)

Results: Laboratory Tests

Hemoglobin A1C tests	Homeless	Non-homeless
People with at least 2 A1C tests in first year	25%	40%
Number of tests (per person year)	1.1 tests	1.5 tests

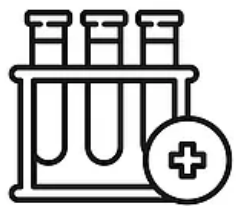| Cholesterol test	Homeless	Non-homeless
People with at least 1 test in first 3 years	70% <	80% $p < 0.001$
Number of tests (per person year)	0.7 tests	1.0 tests

RR = 0.72
(95%CI: 0.70-0.75)

Results: Laboratory Tests

Hemoglobin A1C tests	Homeless	Non-homeless
People with at least 2 A1C tests in first year	25%	40%
Number of tests (per person year)	1.1 tests	1.5 tests
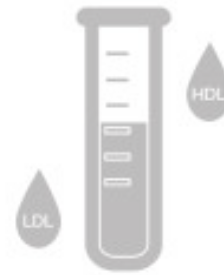
Cholesterol test	Homeless	Non-homeless
People with at least 1 test in first 3 years	70%	80%
Number of tests (per person year)	0.7 tests	1.0 tests

Kidney function blood test	Homeless	Non-homeless
People with at least 1 test in first year	65% <	70%

p < 0.001

Kidney function urine test	Homeless	Non-homeless
People with at least 1 test in first year	23% <	37%

p < 0.001

Results: Eye exams and procedures

Eye exams
(2 year follow up)

Eye exams	Homeless		Non-homeless
At least one eye exam	42%	<	58%

p < 0.001

Eye procedures
(Entire follow up)

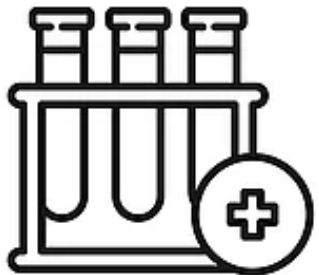| Eye procedures	Homeless	Non-homeless
Intraocular injection procedure	2.3%	2.4%
Vitrectomy surgery	1.3%	1.1%
Laser photocoagulation	2.7%	2.8%

Results in context
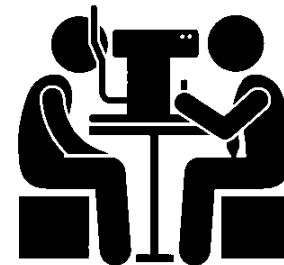
People with a history of homelessness:

- Higher rate of physician visits. BUT…

- Less likely to have continuity of care

- Less likely to have a documented diabetes management visit or diabetes-specialist visit
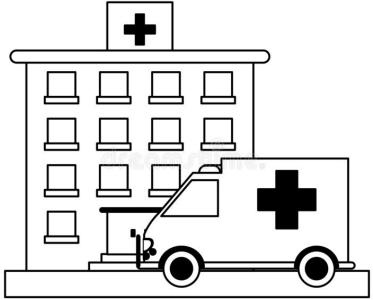
- Less likely to have routine tests for diabetes management

- Less likely to have routine eye exams

Results in context (limitations)

Restricted to people who use hospital services

- Not representative of general homeless population

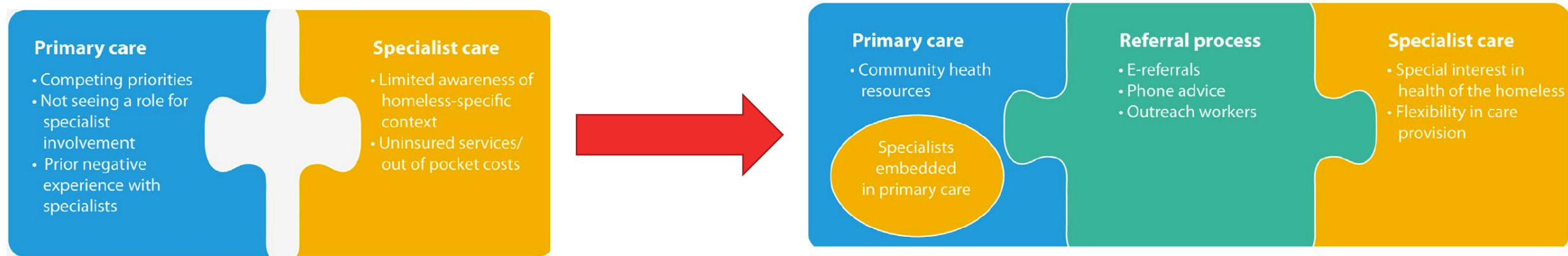Homeless status could not be updated over the follow up period

Administrative health care data is limited by billing codes and documentation
- E.g., OLIS captures completed tests, not ordered tests

Main takeaways

There are disparities in diabetes care for people with a history of homelessness

- Primary care offers an opportunity for intervention
  - Routine follow-up after discharge from hospital
  - Outreach workers to connect primary and specialist care

Image from: McSweeney B, Campbell RB, Grewal EK, Booth GL, Tariq H, Campbell DJT. 2022. Accessing Diabetes Specialty Care for Persons with Lived Experience of Homelessness in Canada: Challenges and Opportunities

Main takeaways

There are disparities in diabetes care for people with a history of homelessness

- Primary care offers an opportunity for intervention
    - Low-barrier diabetes management clinics and point of care testing

Scott, S *et al.* Developing and evaluating a SAFER model to screen for diabetes complications among people experiencing homelessness: a pilot study protocol. *Pilot Feasibility Stud* **8**, 211 (2022).
Image from NIHR: https://www.community.healthcare.mic.nihr.ac.uk/news/assessing-operator-errors-when-using-point-of-care-blood-testing-devices-in-real-clinical-settings

Thank you!