MODULE TEAM PROJECT

Social Determinants of Health Associated with Patient Portal Use in Pediatric Diabetes: A case study

Presented by Nicholas Mitsakakis

June 20, 2024

Data Sciences Institute, University of Toronto

Intro

- Nicholas Mitsakakis, MSc, PhD, P.Stat.
- Senior Biostatistician, Clinical Research Unit, Children's Hospital of Eastern Ontario Research Institute
- Associate Scientist at CHEO RI
- Assistant Professor (Status-Only), Dalla Lana School of Public Health, UofT
- Instructor, MBiotech, Digital Health Technologies, UTM

Objectives

- Discuss how my workplace functions in relation to data science
- Showcase a specific project
- Discuss professional development and ethical aspects

BACKGROUND

Working place

CHEO RESEARCH INSTITUTE
INSTITUT DE RECHERCHE

CLINICAL RESEARCH UNIT

DISCOVERY & EARLY DEVELOPMENT

01

- Formation of research questions
- Grant Applications & Protocols

PLANNING & DESIGN

02

- Sample size calculations
- Clinical Trials, Surveys, Health Economics, Systematic Reviews, Quality Improvement & Program Evaluation
- Patient Engagement

DATA COLLECTION

03

- REDCap design
- Database support
- Big data (ICES, BORN, EPIC)

DATA ANALYSIS

04

- Data management & automated reporting
- Statistical analysis
- Qualitative methods

WRITING & PUBLISHING

05

- Response to reviewers
- Science writing consultation
- Collaborative manuscript writing

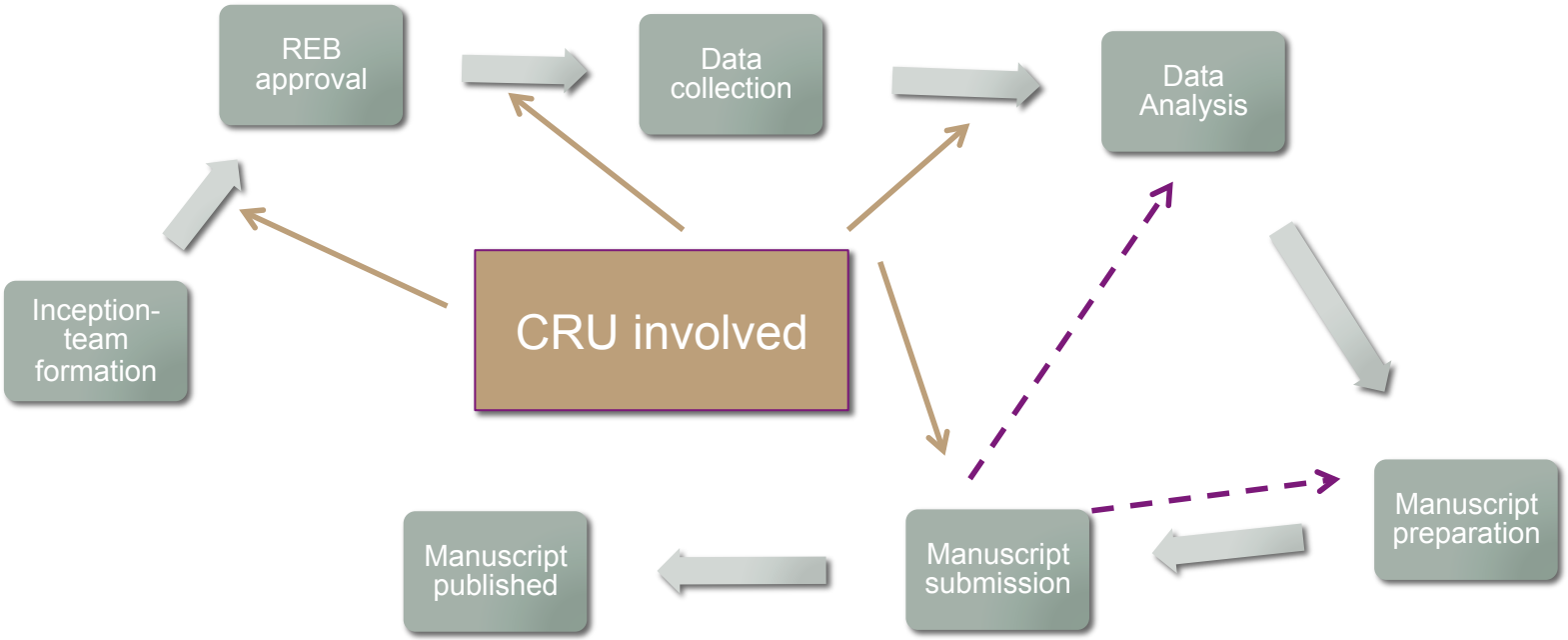
SHARING & IMPACT

06

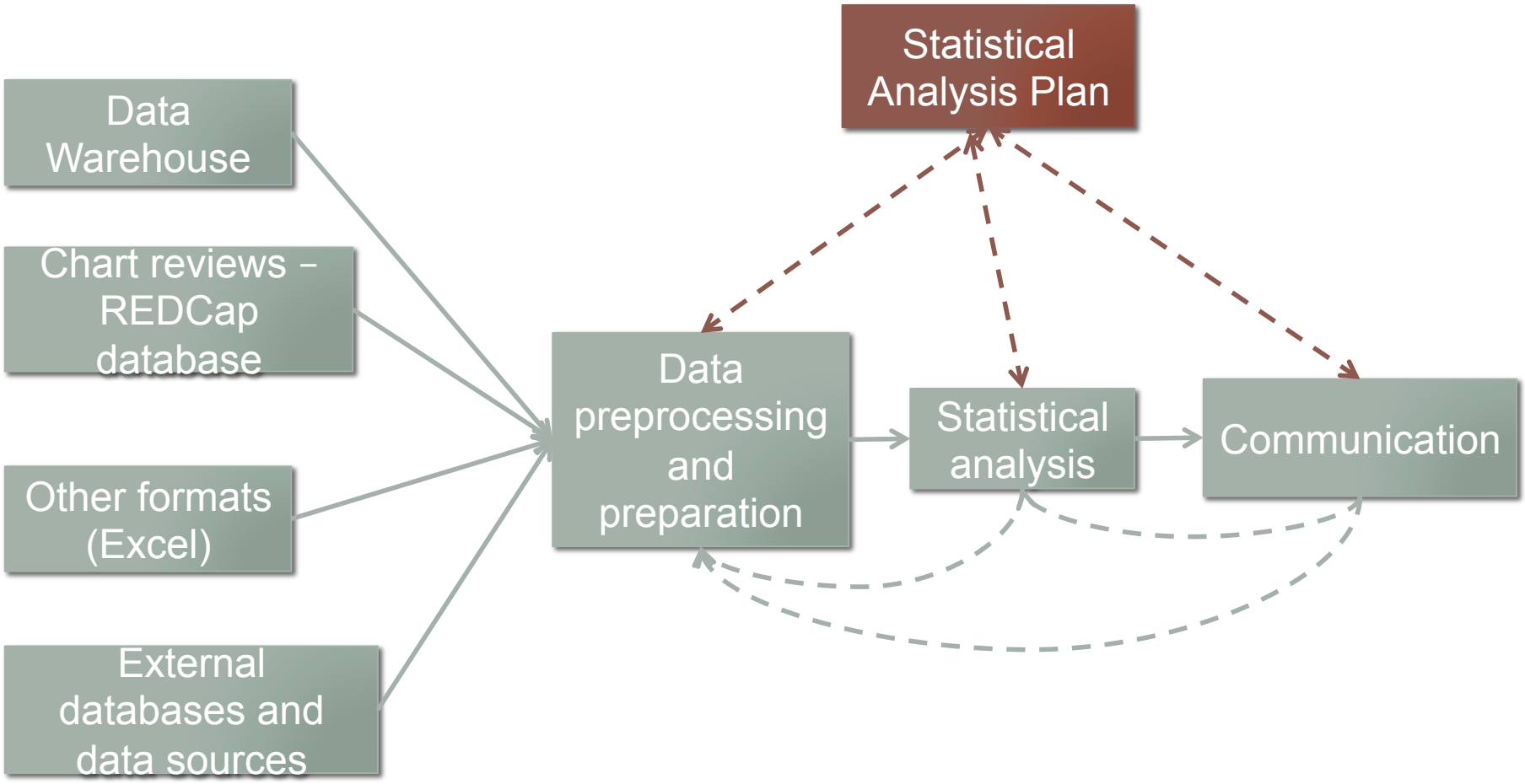
- Educational events
- Medical education research
- Research mentorship
- "How-to" guides

RStudio Workbench Linux server
run.ai

Research study life cycle



Pipeline


Statistical Analysis Plan
Data Warehouse
Chart reviews – REDCap database
Other formats (Excel)
External databases and data sources
Data preprocessing and preparation
Statistical analysis
Communication

CASE STUDY

Can J Diabetes 46 (2022) 586–593

Contents lists available at ScienceDirect

Canadian Journal of Diabetes

journal homepage:
www.canadianjournalofdiabetes.com

Original Research

Social Determinants of Health Associated With Patient Portal Use in Pediatric Diabetes

Rachel Parker MD [a,*]; Ellen B. Goldbloom MD, FRCPC [a,b,c]; Nicholas Mitsakakis MSc, PhD [c]; Ivan Terekhov BComm [c]; Caroline Zuijdwijk MD, FRCPC [a,b,c]

[a] *Department of Pediatrics, University of Ottawa, Ottawa, Ontario, Canada*
[b] *Division of Endocrinology and Metabolism, Children's Hospital of Eastern Ontario, Ottawa, Ontario, Canada*
[c] *Children's Hospital of Eastern Ontario Research Institute, Ottawa, Ontario, Canada*

Study description

- Type 1 Diabetes (T1D)
- Patient portal (Epic MyChart)
- Social Determinants of Health (SDH)

- Diabetes technology use (DTU)

Study objectives

- Primary: To determine if having an **active** MyChart account is associated with SDH
- Secondary: To determine if MyChart **use** is associated with SDH
- Tertiary (exploratory):
  - To assess if the use of diabetes technology is associated with SDH (as measured by ON-Marg)
  - To assess if having an active MyChart account is associated with use of diabetes technology.

METHODS

Ontario Marginalization Index (ON-Marg)

- Deprivation index based on 2016 Canadian census data
- Four dimensions:
  - Material deprivation
    - education, low income, unemployment, lone parent families and dwellings in need of major repair
  - Residential instability
    - household composition, number of persons per dwelling, type of dwelling and proportion of population who moved in the past 5 years
  - Dependency
    - Population >65 and 0-14 years of age, the proportion of the population (>15 years old) not participating in the workforce
  - Ethnic concentration
    - proportion of recent immigrants and those who self-identify as a visible minority
- Scores and quintiles per *dissemination area*
  - DA: smallest area for which data are disseminated

Data

- Patients seen at the CHEO T1D clinic between April 1, 2020 and March 31, 2021
  - Only those residing in Ontario
- Postal Codes -> Dissemination Areas -> ON-Marg
- MyChart Activation Status: Active, Inactive
- MyChart Use: 1+ logins within last year

Data (cont.)

- Age
- Gender
- Use of diabetes technology
  - Diabetes regimen – insulin pump vs injection vs no insulin
  - Use of continuous or flash glucose monitoring (vs. traditional self-monitoring of blood glucose by finger prick)
- A1C (measure of glycemic control)
  - Most recent A1C value prior to April 1, 2021

Statistical Analysis Plan

- Descriptive statistics
- Association between SDH and MyChart activation:
  - Unadjusted, comparing ON-Marg scores between activated and non-activated
    - T-test, Wilcoxon
  - Adjusted, logistic regression, adjusted for covariates
- Association between SDH and MyChart use, and between the use of diabetes technology and the use of MyChart: similar analysis

Data preparation

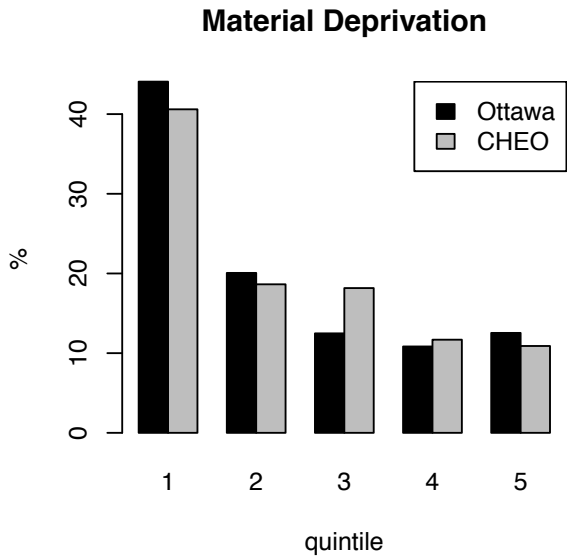
- Accessing and retrieving data from the Data Warehouse
  - Package `DBI` (interface between R and Data Management System)
- Link data with Postal Code Conversion File (PCCF)
  - Use `merge` with Postal code as key
  - Obtain Dissemination Area (DA) for each record
- Link data with ON-Marg Index data
  - Use DA as key
  - Obtain ON-Marg index for each record

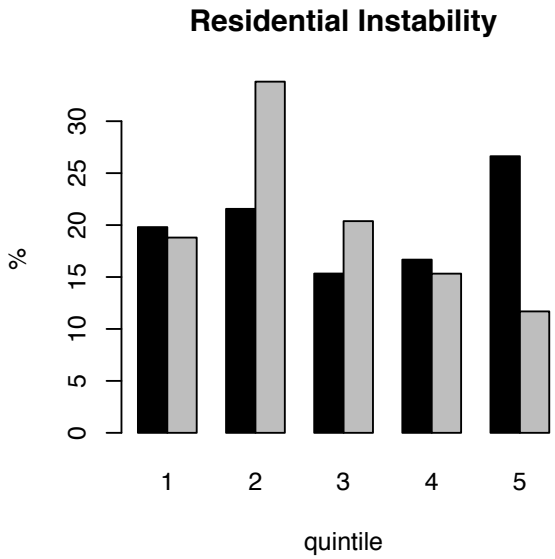
RESULTS

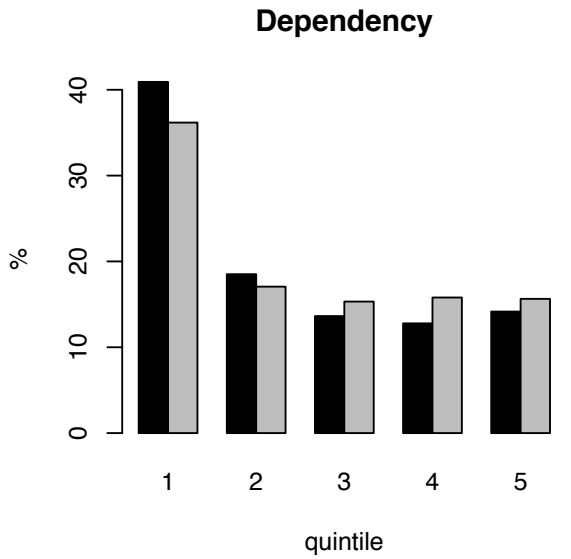
Table 1
Patients' characteristics (N=634)

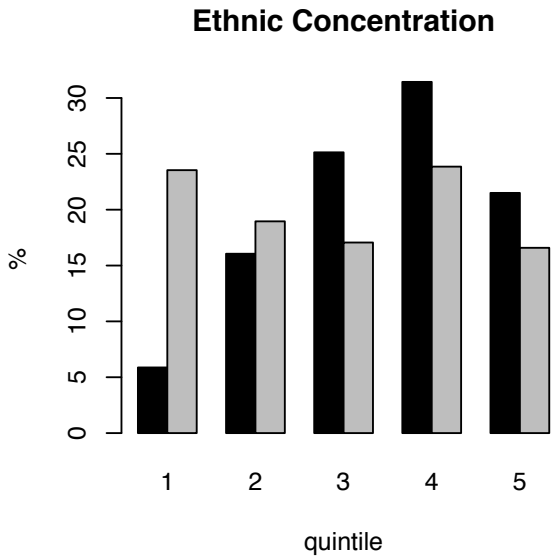
Characteristic	Value
Age (years), mean (SD)	12.77 (3.81)
Sex (male), n (%)	338 (53.3)
Insulin regimen, n (%)	
Insulin pump	284 (44.8)
Injection	346 (54.7)
No insulin	3 (0.5)
CGM (yes), n (%)	500 (82.6)
rtCGM (yes), n (%)	311 (50.7)
isCGM (yes), n (%)	189 (31.9)
A1C (%), mean (SD)	8.43 (1.99)
PP activation status, n (%)	
Active	334 (52.7)
Inactive (previously active)	148 (23.3)
Inactive (never)	137 (21.6)
Inactive (offered)	15 (2.4)
PP use (yes), n (%)	332 (52.4)

A1C, glycated hemoglobin; *CGM*, continuous glucose monitoring; *isCGM*, intermittently scanned continuous glucose monitoring; *PP*, patient portal; *rtCGM*, real-time continuous glucose monitoring.


Material Deprivation
Ottawa
CHEO
%
0
10
20
30
40
1
2
3
4
5
quintile


Residential Instability
%
0
5
10
15
20
25
30
1
2
3
4
5
quintile


Dependency
%
0
10
20
30
40
1
2
3
4
5
quintile


Ethnic Concentration
%
0
5
10
15
20
25
30
1
2
3
4
5
quintile

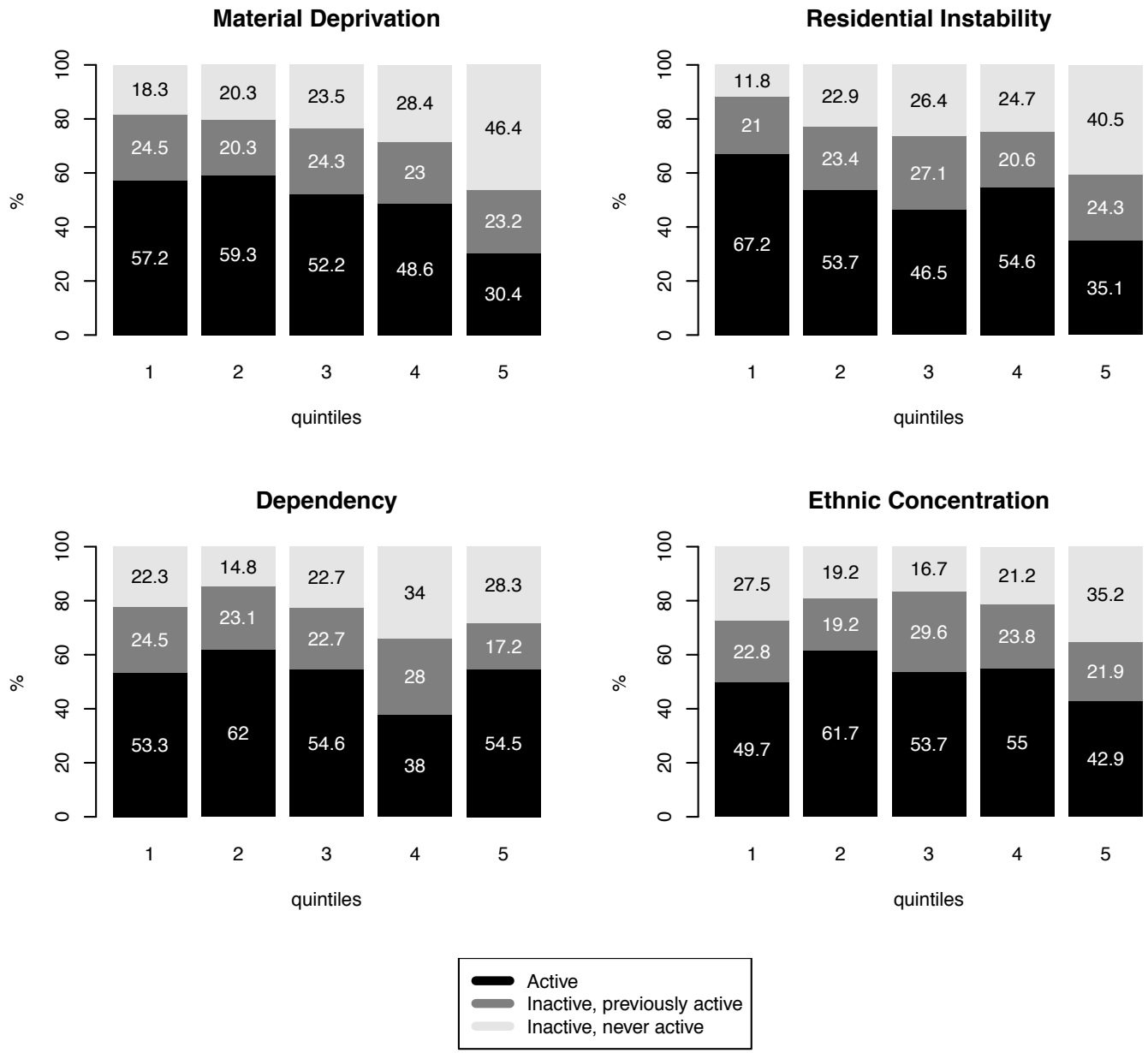

Material Deprivation
18.3
20.3
23.5
28.4
46.4
24.5
20.3
24.3
23
23.2
57.2
59.3
52.2
48.6
30.4
Residential Instability
11.8
22.9
26.4
24.7
40.5
21
23.4
27.1
20.6
24.3
67.2
53.7
46.5
54.6
35.1
Dependency
22.3
14.8
22.7
34
28.3
24.5
23.1
22.7
28
17.2
53.3
62
54.6
38
54.5
Ethnic Concentration
27.5
19.2
16.7
21.2
35.2
22.8
19.2
29.6
23.8
21.9
49.7
61.7
53.7
55
42.9
%
0
20
40
60
80
100
1
2
3
4
5
quintiles
Active
Inactive, previously active
Inactive, never active

Table 2
Association between PP activation status and ON-Marg quintile, adjusted for age, sex and A1C

	Material deprivation		Residential instability		Dependency		Ethnic concentration	
	OR (95% CI)	p Value	OR (95% CI)	p Value	OR (95% CI)	p Value	OR (95% CI)	p Value
Q2	0.92 (0.58–1.45)	0.716	1.66 (1.03–2.70)	0.038	0.68 (0.42–1.45)	0.124	0.64 (0.58–1.45)	0.085
Q3	1.20 (0.76–1.90)	0.435	2.50 (1.48–4.29)	0.001	1.04 (0.64–1.90)	0.872	0.84 (0.76–1.90)	0.518
Q4	1.40 (0.82–2.41)	0.218	1.92 (1.09–3.40)	0.025	1.74 (1.06–2.41)	0.031	0.85 (0.82–2.41)	0.499
Q5	2.91 (1.62–5.36)	<0.001	3.49 (1.86–6.70)	<0.001	0.87 (0.53–1.43)	0.592	1.37 (1.62–5.36)	0.242
Age, years	1.08 (1.03–1.13)	0.001	1.08 (1.03–1.12)	0.001	1.09 (1.02–1.11)	0.004	1.07 (1.02–1.11)	0.004
Sex *, male	1.12 (0.81–1.56)	0.487	1.19 (0.86–1.66)	0.298	1.18 (0.85–1.63)	0.330	1.14 (0.82–1.58)	0.432
A1C, %	1.22 (1.12–1.34)	<0.001	1.23 (1.12–1.35)	<0.001	1.24 (1.14–1.36)	<0.001	1.24 (1.14–1.36)	<0.001

A1C, glycated hemoglobin; *CI*, confidence interval; *OR*, odds ratio; *ON-Marg*, Ontario Marginalization Index; *PP*, patient portal; *Q*, quintile (Q1 [least deprived] was used as the reference quintile).

* Female used as the reference sex.

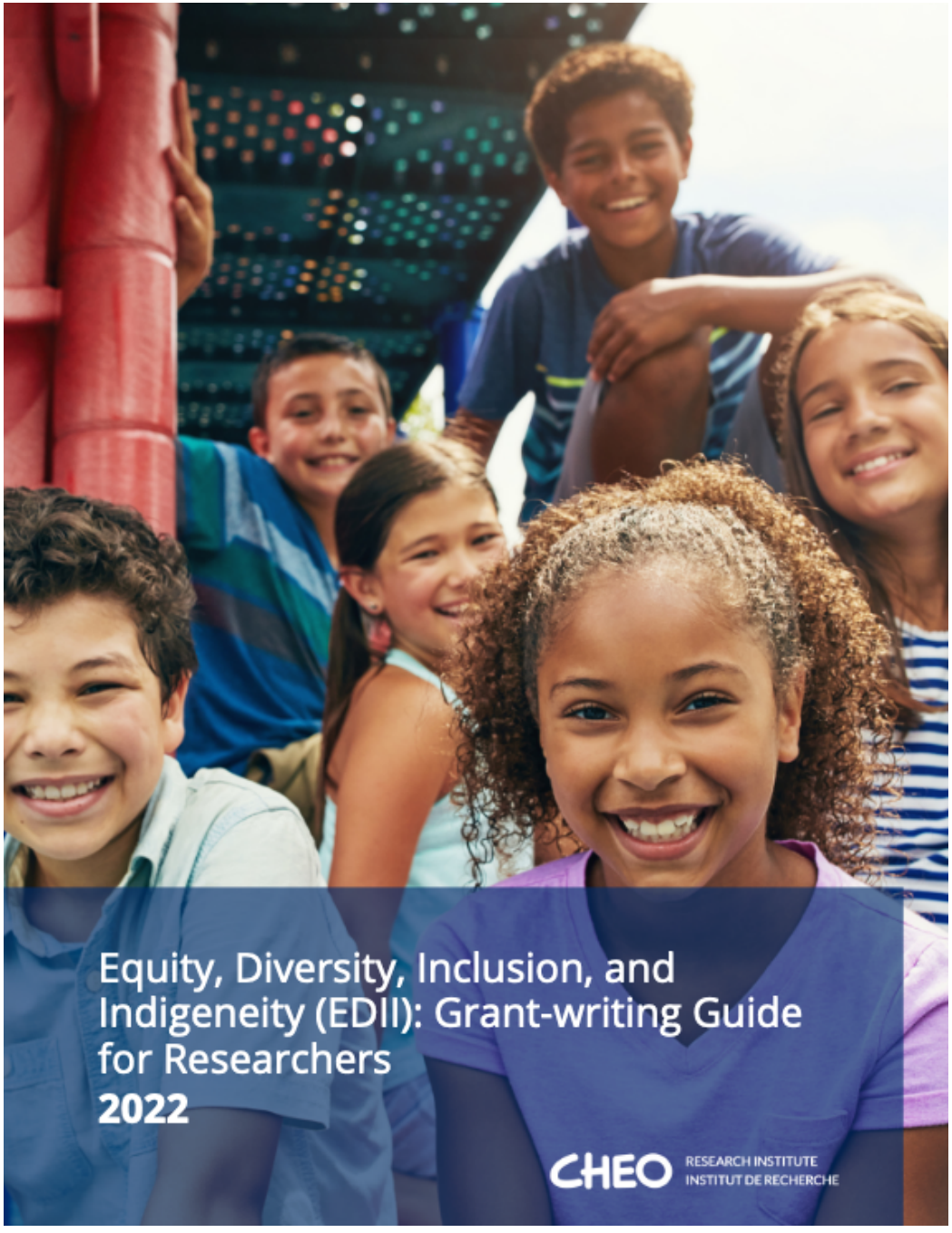
Secondary objectives

- No significant association between DTU and quintile score for any of the 4 dimensions of the ON-Marg (chi-square test)
  - Most of diabetes technology is covered by OHIP
- Significant association between DTU and PP activation status (logistic regression)
  - “those who were not using diabetes technology had a 120% higher odds of being PP inactive compared with those who were using diabetes technology (OR=2.20; 95% CI = 1.40 to 3.49; p=0.001)”
- Note: example of communication

Reproducibility

- R-Markdown
- R- DBMS connection (DBI package)

- Room for improvement
  - Subversion (SVN) for version control


Equity, Diversity, Inclusion, and Indigeneity (EDII): Grant-writing Guide for Researchers
2022
CHEO
RESEARCH INSTITUTE
INSTITUT DE RECHERCHE