

# MODULE 3: R

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

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Presented by Nicholas Mitsakakis

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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 CHEORI
- Adjunct Lecturer, 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

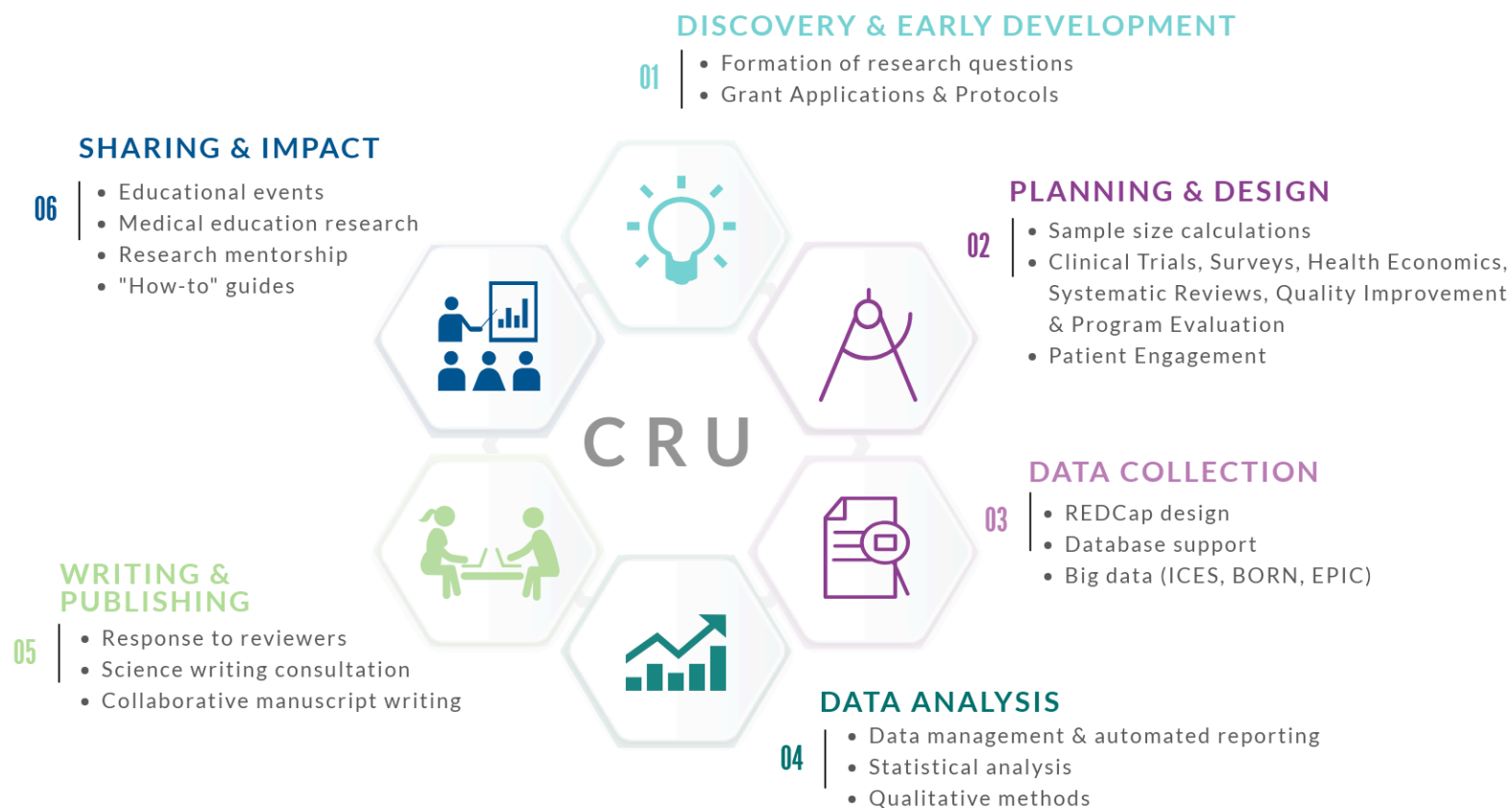
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# Working place



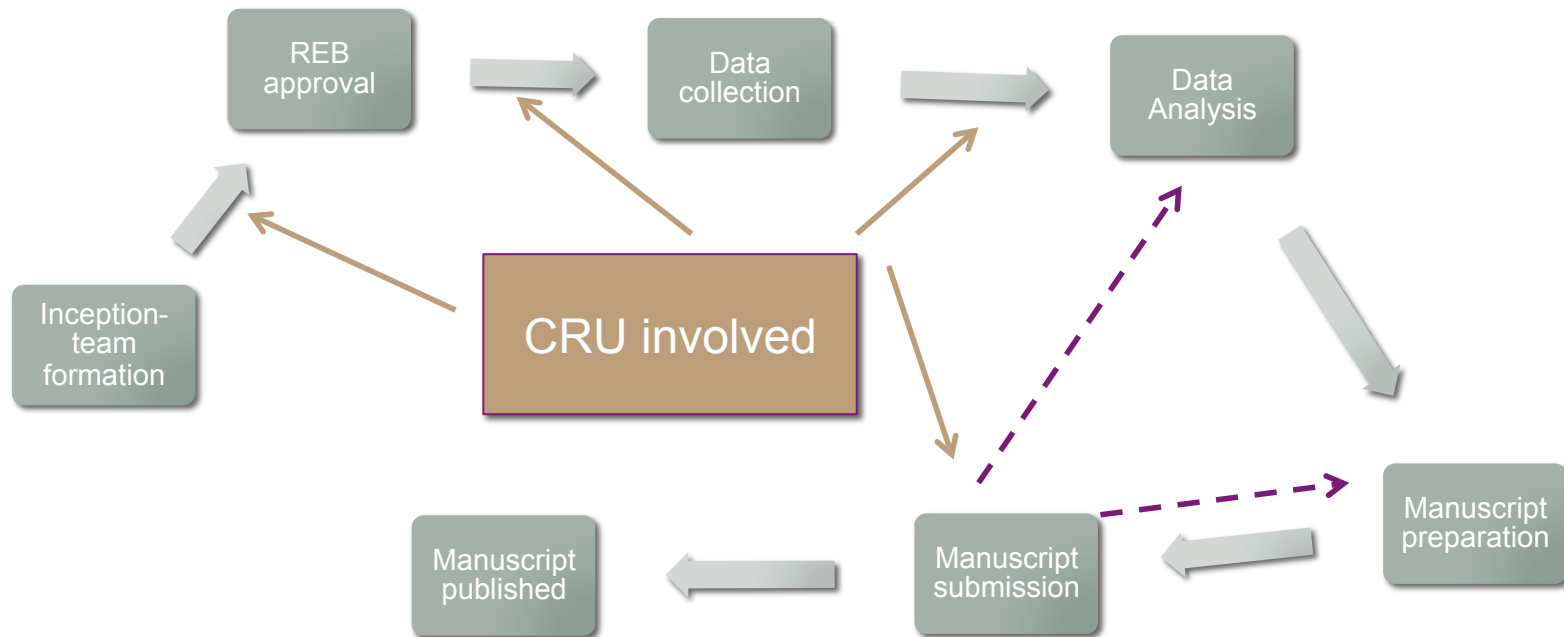
RESEARCH INSTITUTE  
INSTITUT DE RECHERCHE

# CLINICAL RESEARCH UNIT

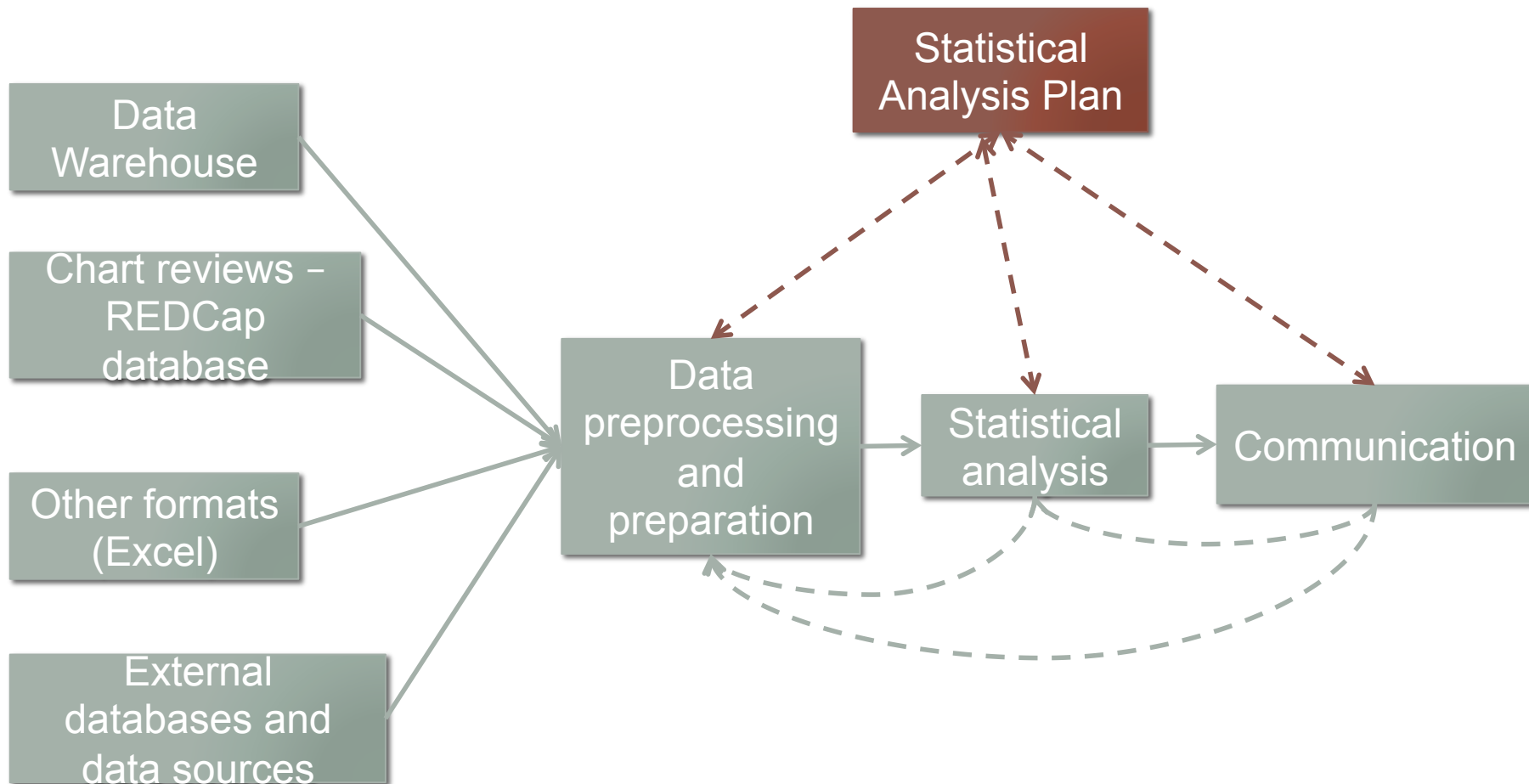


RStudio Workbench Linux server

# Research study life cycle



# Pipeline





# CASE STUDY

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[www.canadianjournalofdiabetes.com](http://www.canadianjournalofdiabetes.com)

**DIABETES  
CANADA**



Original Research

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



Rachel Parker MD<sup>a,\*</sup>; Ellen B. Goldbloom MD, FRCPC<sup>a,b,c</sup>; Nicholas Mitsakakis MSc, PhD<sup>c</sup>;  
Ivan Terekhov BComm<sup>c</sup>; Caroline Zuijdwijk MD, FRCPC<sup>a,b,c</sup>

<sup>a</sup> Department of Pediatrics, University of Ottawa, Ottawa, Ontario, Canada

<sup>b</sup> Division of Endocrinology and Metabolism, Children's Hospital of Eastern Ontario, Ottawa, Ontario, Canada

<sup>c</sup> 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

# 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

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# 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 (offered), Inactive (never offered)
- 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)
- Merge data with **Postal Code Conversion File (PCCF)**
  - Use merge with Postal code as key
  - Obtain Dissemination Area (DA) for each record
- Merge data with **ON-Marg Index** data
  - Use DA as key
  - Obtain ON-Marg index for each record

# RESULTS

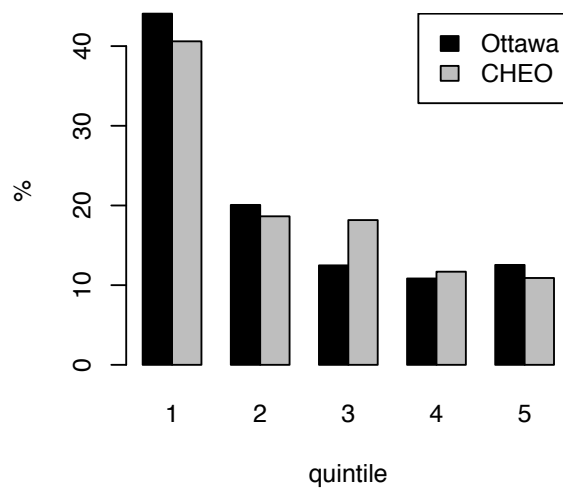
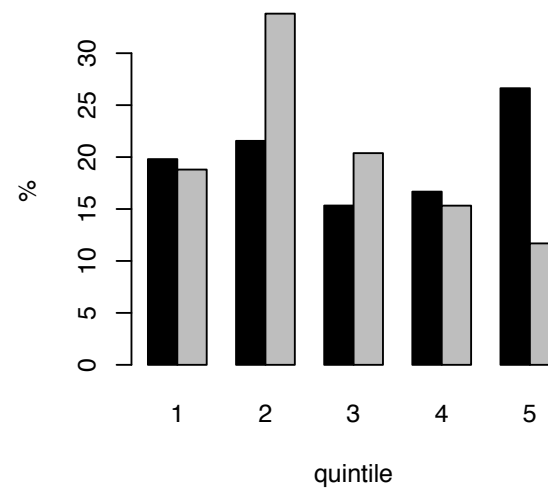
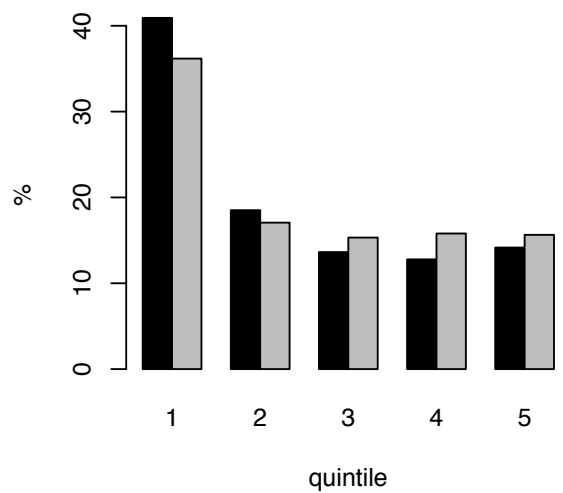
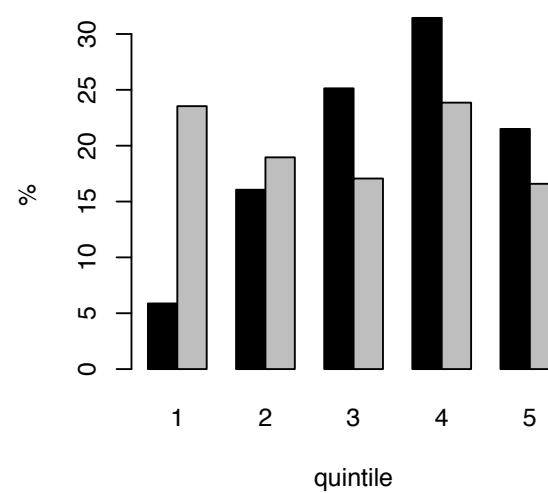
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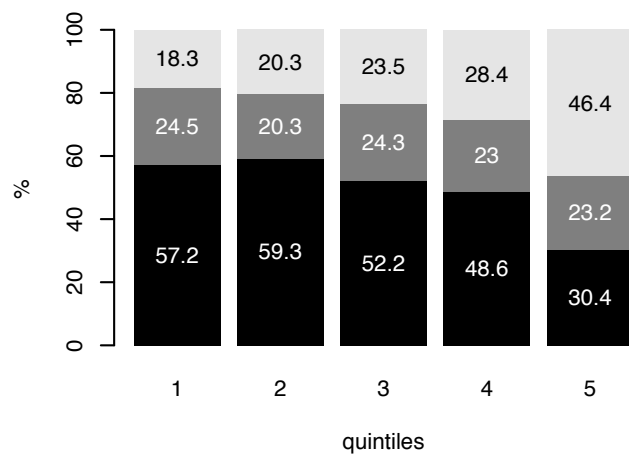
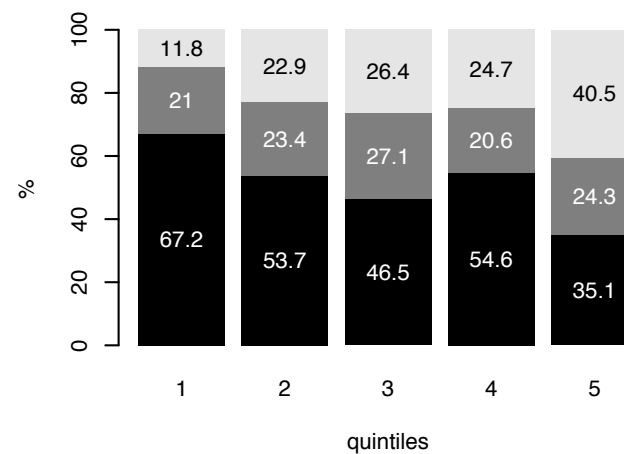
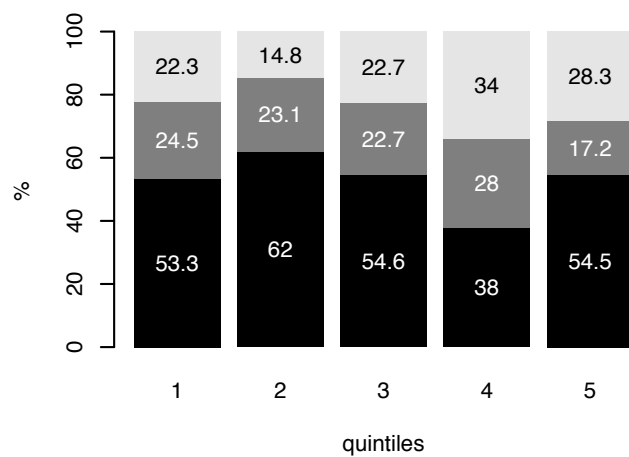
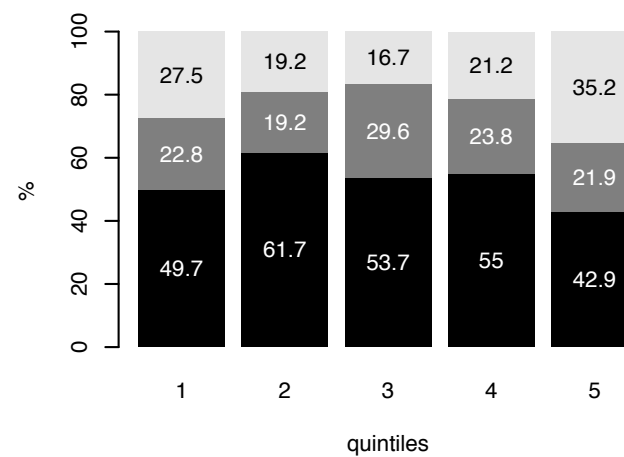
**Table 1**

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****Residential Instability****Dependency****Ethnic Concentration**

**Material Deprivation****Residential Instability****Dependency****Ethnic Concentration**

■ 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	
	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
Q3	1.20 (0.76–1.90)	0.435	2.50 (1.48–4.29)	0.001
Q4	1.40 (0.82–2.41)	0.218	1.92 (1.09–3.40)	0.025
Q5	2.91 (1.62–5.36)	<0.001	3.49 (1.86–6.70)	<0.001
Age, years	1.08 (1.03–1.13)	0.001	1.08 (1.03–1.12)	0.001
Sex *, male	1.12 (0.81–1.56)	0.487	1.19 (0.86–1.66)	0.298
A1C, %	1.22 (1.12–1.34)	<0.001	1.23 (1.12–1.35)	<0.001

Dependency		Ethnic concentration	
OR (95% CI)	p Value	OR (95% CI)	p Value
0.68 (0.42–1.45)	0.124	0.64 (0.58–1.45)	0.085
1.04 (0.64–1.90)	0.872	0.84 (0.76–1.90)	0.518
1.74 (1.06–2.41)	0.031	0.85 (0.82–2.41)	0.499
0.87 (0.53–1.43)	0.592	1.37 (1.62–5.36)	0.242
1.09 (1.02–1.11)	0.004	1.07 (1.02–1.11)	0.004
1.18 (0.85–1.63)	0.330	1.14 (0.82–1.58)	0.432
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.

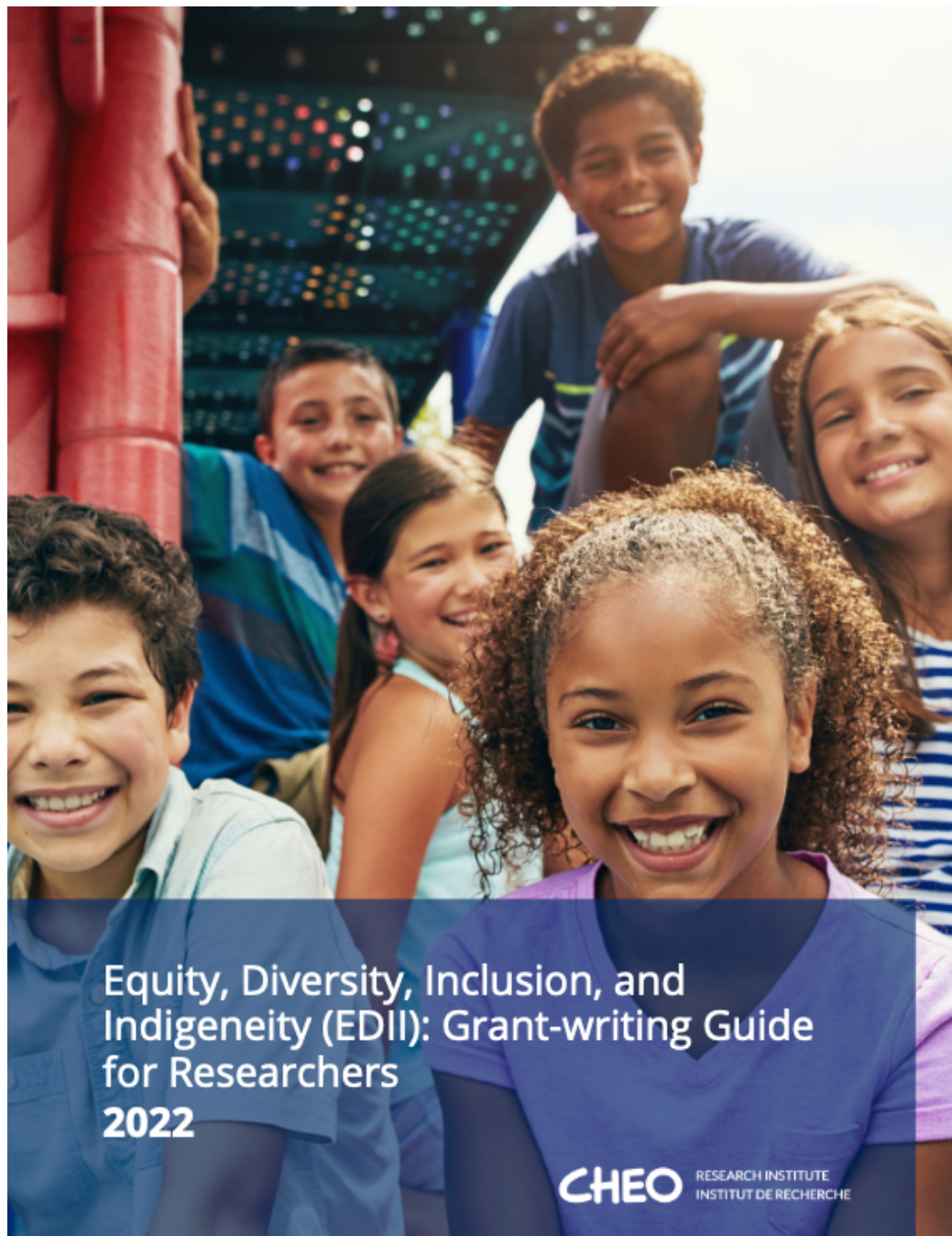
## Secondary objectives

- 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



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**2022**