Examining income inequalities in cancer screening:
A decomposition analysis using administrative data in Ontario, Canada

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BACKGROUND AND OBJECTIVES

Past research has examined the influence of a broad range of determinants including individual characteristics such as age, gender and immigrant status as well as health-system features (i.e.. primary care enrollment) on cancer screening uptake. But the relative contribution of different determinants towards income inequalities in screening uptake is not well understood. The key objectives of this research study are outlined below:

1. Quantify income inequalities in colorectal and cervical cancer screening uptake among adults in Ontario
2. Determine the relative contribution of different determinants towards income inequalities in cancer screening
3. Assess if the same determinants influence inequalities in uptake between colorectal and cervical cancer screening

DATA SOURCES & STUDY POPULATION

Data sources: Canadian Community Health Survey (CCHS), Ontario Health Insurance Plan claims, Registered Persons Database and the Client Agency Program Enrolment database

Study population: Selected from pooled CCHS cycles 2009/10 and 2011/12 and included eligible Ontario residents based on the following criterion:

1) Colorectal cancer - Respondents aged 52-74 (at date of survey response) with no history of colorectal cancer or severe inflammatory bowel disease
2) Cervical cancer screening - Female respondents aged 23-69 (at date of survey response) with no history of cervical/uterine/ovarian cancer or a hysterectomy

MEASURES & ANALYSIS

Determinants of Cancer Screening Uptake:
- Socio-demographic (age, sex etc.), socio-economic (i.e., employment status and home ownership), health status (self-perceived health and ADL impairment etc.) and health system features (primary care enrolment and health admin region)

Outcomes:
- **Colorectal cancer screening**: The proportion of respondents that had a fecal occult blood testing (FOBT) 2 years prior to survey response, a colonoscopy 10 years prior to response, or other investigation (rigid/flexible sigmoidoscopy, single/double contrast barium enema) 5 years prior to response
- **Cervical cancer screening**: The proportion of women that received a (Pap) smear screen 3 years prior to survey response

Analysis:
- A decomposition analysis quantifies the relative contribution of a set of determinants to inequality in a health variable, weighted by the influence of each of those determinants
- For any factor to help explain income inequalities - it must be unequally distributed by income and it must show a partial association with the outcome after controlling for other factors
- Income inequalities in colorectal and cervical cancer screening uptake were examined using a Concentration Index corrected for binary measures (Erreyers-correction)
- A multi-variate probit model with marginal effects was specified to perform the decomposition
- Sensitivity tests were conducted using different reference categories in the multivariable probit model and by performing the decomposition using a logit model approach

RESULTS

Figure 1: Aggregate contributions of determinants of colorectal and cervical cancer screening (%)
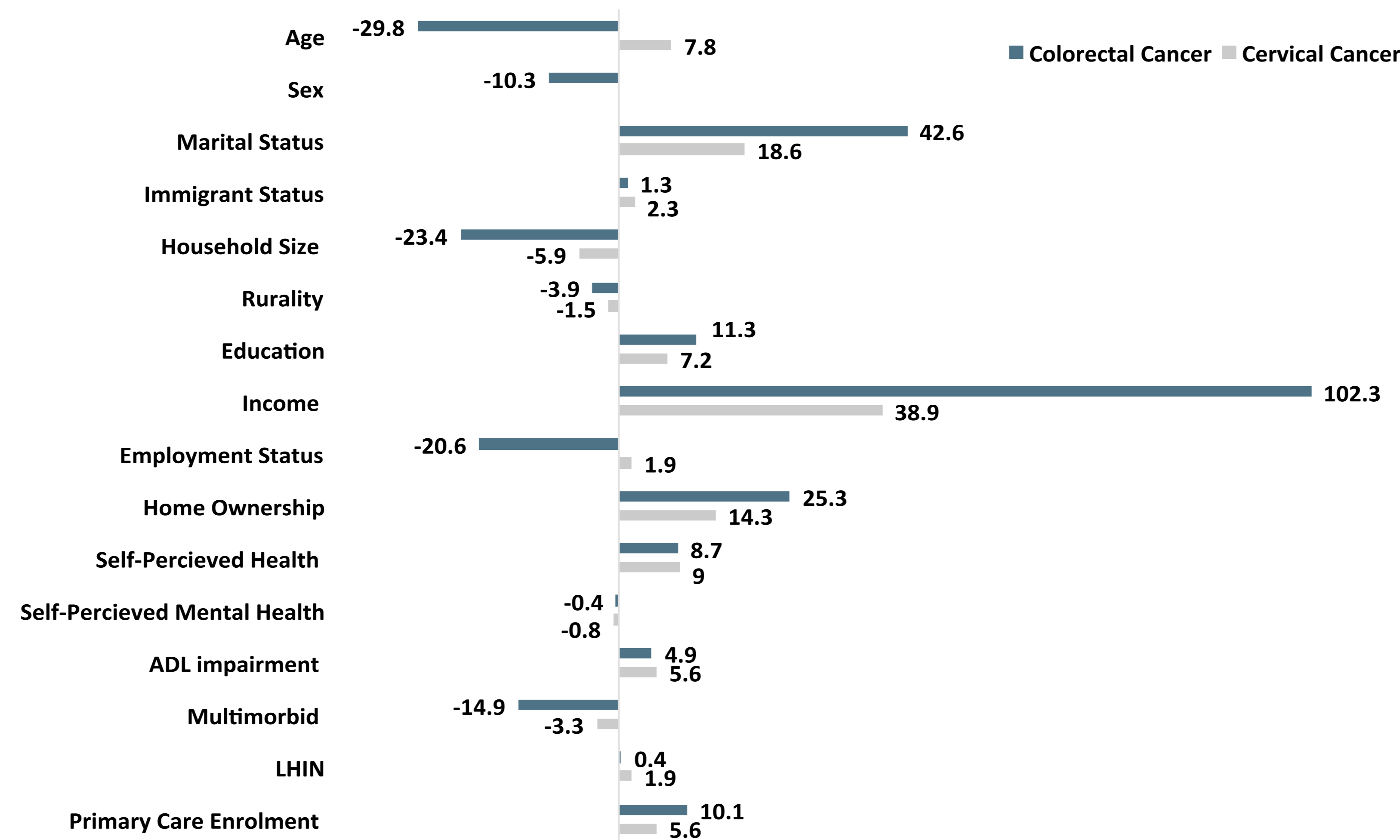

Figure 2: Concentration curves for income inequalities in cancer screening in Ontario
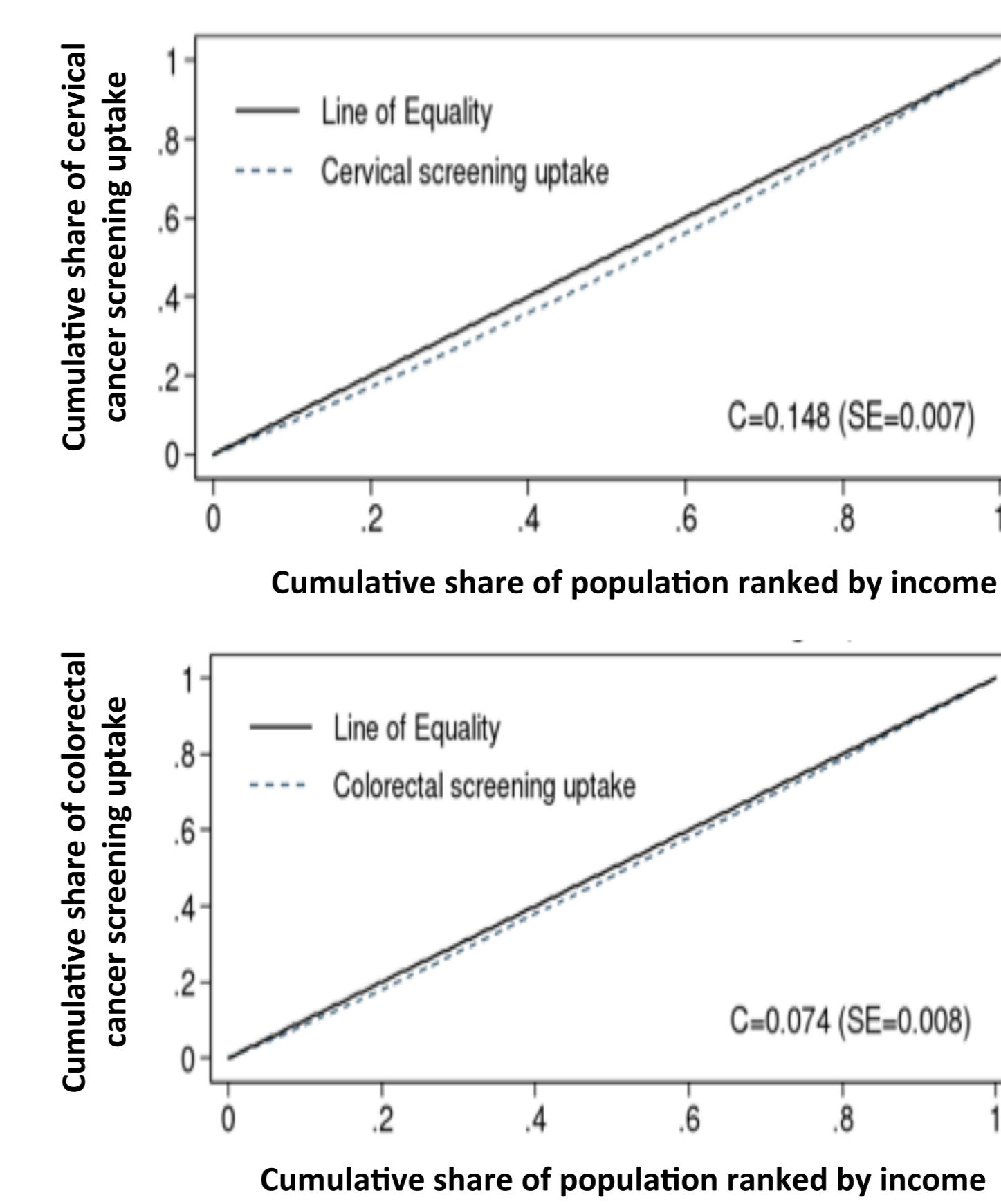

Table 1: Results of decomposition analysis of Erreyegers-corrected concentration index of colorectal and cervical cancer screening

Variable	Description	Cervical Cancer Screening (n=22465)		Colorectal Cancer Screening (n=22358)	
		Marginal Effects (SE)	CErreyegers	Marginal Effects (SE)	CErreyegers
Age	23-29y	[REF]	-	-	-
	30-39y	0.011 (0.012)	0.037	-	-
	40-49y	-0.069 (0.013)*	0.201	-	-
	50-59y	-0.138 (0.013)*	0.262	[REF]	-
	60-69y	-0.224 (0.013)*	-0.324	0.086 (0.008)*	-0.098
	70-74y	-	-	0.119 (0.011)*	-0.486
Sex	Female	-	-	[REF]	-
	Male	-	-	-0.057 (0.007)*	0.188
Marital status	Married or common-law	[REF]	-	[REF]	-
	Divorced/separated/widowed/single	-0.085 (0.01)*	-0.582	-0.09 (0.014)*	-0.613
Immigration status	Born in Canada	[REF]	-	[REF]	-
	Not born in Canada	-0.028 (0.009)*	-0.408	-0.011 (0.009)	-0.238
Household size	1	[REF]	-	[REF]	-
	2	-0.04 (0.011)*	0.349	-0.051 (0.014)*	0.313
	3	-0.025 (0.013)	0.111	-0.087 (0.018)*	0.292
	4	-0.011 (0.015)	0.086	-0.105 (0.027)*	0.194
	5+ persons	-0.019 (0.017)	-0.345	-0.12 (0.028)*	-0.208
Rurality	Urban (RIO 0-9)	[REF]	-	[REF]	-
	Suburban (RIO 10-39)	-0.018 (0.008)*	0.1	-0.031 (0.009)*	0.093
	Rural (RIO>40)	-0.037 (0.011)*	0.159	-0.044 (0.011)*	0.102
Education	Some Post-Secondary Education	[REF]	-	[REF]	-
	No Post-Secondary Education	-0.042 (0.007)*	-0.609	-0.03 (0.007)*	-0.46
Household income	Q1 (Low)	-0.067 (0.013)*	-2.228	-0.099 (0.013)*	-2.074
	Q2	-0.056 (0.011)*	-1.319	-0.074 (0.011)*	-1.195
	Q3	-0.045 (0.01)*	-0.295	-0.057 (0.011)*	-0.192
	Q4	-0.011 (0.01)	0.84	-0.033 (0.01)*	0.844
	Q5 (High)	[REF]	-	[REF]	-
Employment status	Working (last week)	[REF]	-	[REF]	-
	No job (last week)	-0.008 (0.008)	-0.66	0.038 (0.008)*	-0.452
Home ownership	Yes	[REF]	-	[REF]	-
	No	-0.055 (0.009)*	-1.198	-0.058 (0.01)*	-1.132
Self-perceived Health	Excellent/V Good/ Good	[REF]	-	[REF]	-
	Fair	-0.075 (0.012)*	-0.744	-0.027 (0.011)*	-0.582
	Poor	-0.085 (0.019)*	-1.299	-0.038 (0.017)*	-1.06
ADL impairment	No	[REF]	-	[REF]	-
	Yes	-0.064 (0.012)*	-0.806	-0.026 (0.012)*	-0.758
Multi-morbidity	No	[REF]	-	[REF]	-
	Yes	0.043 (0.008)*	-0.321	0.079 (0.007)*	-0.241
Primary care enrolment	Not Enrolled	[REF]	-	[REF]	-
	FHG	0.187 (0.01)*	-0.085	0.221 (0.011)*	-0.078
	FHN	0.19 (0.015)*	0.182	0.232 (0.016)*	0.154
	FHO	0.172 (0.009)*	0.107	0.223 (0.01)*	0.07
	Other	0.15 (0.015)*	-0.069	0.204 (0.015)*	-0.04

Note: Local Health Integration Network was significant for both types of cancer but not included in Table 1 for the purposes of brevity, and self-perceived mental health was not found to be significant for either type of cancer

KEY FINDINGS

- Screening uptake was 61.9% (n=13837) for colorectal cancer and 66.6% (n=14962) for cervical cancer
- Erreygers-corrected C (SE) was 0.074 (0.008) for colorectal cancer screening and 0.148 (0.007) for cervical cancer - screening uptake is concentrated in higher income groups
- Major contributors to income inequalities in colorectal cancer screening included household income (102.3%), marital status (42.6%), home ownership (25.3%), individual education (11.3%) and primary care enrolment (10.1%)
- Age (-29.8%), sex (-10.3%), household size (-23.4%), rurality (-3.9%), employment status (-20.6%) and multi-morbidity (-14.9%) contributed negatively to measured inequality in colorectal cancer screening
- For cervical cancer screening uptake, household income (38.9%), marital status (18.6%) and home ownership (14.3%) were major contributors to measured inequality, though their contributions were less than what was observed for colorectal cancer screening
- The percentage of inequality not explained by the determinants included in the analysis was -3.4% (colorectal) and -1.6% (cervical)

IMPLICATIONS

- Results indicate comparatively greater inequality in screening uptake for cervical cancer
- Marital status, household income and home ownership are major contributors to measured inequality for both colorectal and cervical cancer screening
- Poor or fair ratings of self-perceived health ADL impairment and living in sub-urban or rural areas resulted in a lower likelihood of colorectal and cervical cancer screening
- Having some post-secondary education, being female, married or common-law, primary care enrollment and having two or more chronic conditions increased the likelihood of being screened for both cervical and colorectal cancer
- Findings offer key insights around the relative contribution of various determinants in observed inequalities in cancer screening uptake which could inform future policy interventions and targeted screening efforts

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