

Exploring sex differences in a Canadian Deprivation Index

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Background / Objective

Health is strongly associated with a person's social and economic circumstances. Given that detailed individual socioeconomic data are not routinely collected in health-related administrative databases in Canadian, researchers and academics have developed multi-variable deprivation indices (DI) at small geographic levels. These indices quantify material and social deprivation and can be linked with health data to assign individuals the socioeconomic characteristics of the areas in which they live. DIs can help identify where vulnerable populations are located, and health and social services can be targeted to these areas.

One pan-Canadian DI was developed at the Institut national de santé publique du Québec (INSPQ) and is based on six variables from the Census of Canada, grouped into two domains of deprivation:

- **Material deprivation:** proportion of persons without high school diploma, persons employed, and average pre-tax personal income.
- **Social deprivation:** proportion of persons living alone, single parent families, and persons separated, widowed, or divorced.

Health status may be associated with these component variables in different ways for males and females. Our objective was to investigate potential sex-related differences in the INSPQ DI to enrich this index and its applications in health research and planning.

Methods

Sex-disaggregated Dissemination Area-level (DA) data for all six component indicators for persons 15 years of age or older from the 2006 Census of Canada were obtained from Statistics Canada for the Vancouver, Winnipeg, and Halifax Canadian Census Metropolitan Areas (CMA).

Indicators were calculated, standardized, and transformed using the INSPQ's methodology (Pampalon et al., 2009). Rates of each of the component variables were calculated for males and females in each CMA.

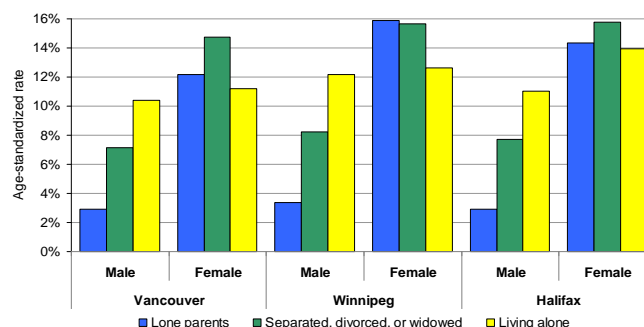
Principal components analysis (PCA) with Varimax rotation was used to replicate the INSPQ methodology for these three CMAs. Three versions of the DI were calculated for each city: one including all residents ("overall" model), one including male residents only, and one including female residents only. Factor scores were grouped into quintiles for each model.

Correlation with the INSPQ factor scores was assessed. PCA results are considered satisfactory if the factor scores explained at least 70% of the total variance, and if analysis variables had high loadings (factor score ≥ 0.40) on one component and near-zero loadings on the other.

Results

In all three CMAs, a larger proportion of females than males were heads of lone-parent households or were separated, divorced, or widowed (Figure 1). Males had higher rates of employment, and their average income was \$12,000-\$15,000 higher than that of females.

Figure 1 Rates of social deprivation variables by sex and CMA



Source: Statistics Canada, 2006 Census of Canada, 20% Sample database.

The INSPQ DI was successfully replicated and the correlation between the scores from our overall model and the INSPQ models was strong ($r=0.83$ to $r=0.94$). The only solution that explained 70% of total variance was the overall model for Winnipeg.

Sex- and CMA-specific results from the PCA are shown in Table 1. Variables significantly associated with each type of deprivation are noted in bold.

Table 1 Rotated factor scores from principal component analysis of the INSPQ DI by sex and CMA

	Vancouver CMA		Winnipeg CMA		Halifax CMA	
	Material	Social	Material	Social	Material	Social
Males						
No high school education	-0.75	-0.01	-0.74	0.05	-0.77	-0.06
Pretax personal income	0.75	-0.30	0.76	-0.31	0.73	-0.38
Employed	0.51	0.02	0.69	-0.08	0.62	-0.03
Separated, widowed, or divorced	-0.05	0.86	-0.06	0.87	-0.17	0.82
Living alone	0.03	0.79	-0.23	0.74	0.01	0.87
Lone parent	-0.09	0.39	-0.08	0.52	-0.37	0.29
Variance explained	23%	27%	28%	28%	28%	28%
	50%		56%		56%	

	Vancouver CMA		Winnipeg CMA		Halifax CMA	
	Material	Social	Material	Social	Material	Social
Females						
No high school education	-0.72	0.08	-0.70	0.15	-0.78	0.17
Pretax personal income	0.78	-0.11	0.81	-0.02	0.81	-0.01
Employed	0.57	0.13	0.70	0.00	0.59	0.11
Separated, widowed, or divorced	-0.04	0.88	-0.16	0.88	-0.13	0.87
Living alone	0.34	0.70	0.00	0.83	0.15	0.81
Lone parent	-0.34	0.64	-0.65	0.47	-0.49	0.58
Variance explained	28%	29%	35%	29%	32%	30%
	57%		63%		62%	

Source: Statistics Canada, 2006 Census of Canada, 20% Sample database.

The only sex-specific model in which all variables had significant loadings on one component and weak loadings on the other was that for males in Winnipeg. With the exception of lone parent households, all variables were significantly associated with the deprivation domain they were intended to measure.

According to the INSPQ model, lone parenthood was thought to reflect social deprivation; however, this variable is associated with both material and social deprivation for females in Winnipeg and Halifax, and with neither form of deprivation for males in Vancouver and Halifax (Table 1, highlighted numbers) in our analyses.

Conclusions and Implications

When disaggregated by sex, females in these three CMAs were more disadvantaged on the material and social measures than males. Despite this relative disadvantage, most variables in the INSPQ DI showed similar associations with material and social deprivation regardless of sex.

The association between lone parent households and deprivation varied by CMA and sex, suggesting this may be a weak indicator for a population-level measure of deprivation. Consequently, identification of deprived areas using this version of the INSPQ DI may be biased.

More generally, these results point to the need for exploration of sex differences beyond age and sex-adjustment for all indicators being considered for multivariable indices.

Work is underway to examine gender differences in and implications of using these component variables to further inform use of this DI to improve health planning.

Reference:

Pampalon R, Hamel D, Gamache P, Raymond G. A deprivation index for health planning in Canada. *Chronic Dis Can.* 2009;29(4):178-91.

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