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## Registration for Deceased Organ and Tissue Donation amongst New Canadians: A Population-Based Cross-sectional Study

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Publication Type: Research Article

Running Title: Li et al., Deceased Organ Donation

Manuscript: 2768 words

Abstract: 250 words

Date: December 1, 2015

## Acknowledgements

This Institute for Clinical Evaluative Sciences (ICES) project was conducted by the Kidney, Dialysis and Transplantation program at the ICES Western site. This study was supported by the Institute for Clinical Evaluative Sciences (ICES), which is funded by an annual grant from the Ontario Ministry of Health and Long-Term Care (MOHLTC). Parts of this material are based on data and information compiled and provided by CIHI. However, the analyses, conclusions, opinions and statements expressed herein are those of the author, and not necessarily those of CIHI. The authors thank Citizenship and Immigration Canada (CIC) for providing access to the databases used in this study. Core funding for ICES Western is provided by the Academic Medical Organization of Southwestern Ontario, the Schulich School of Medicine and Dentistry (SSMD), Western University, and the Lawson Health Research Institute. The ICES Kidney, Dialysis and Transplantation receives programmatic operating grant support from the Canadian Institutes of Health Research. Aspects of this project were conducted in the Lilibeth Caberto Kidney Clinical Research Unit. Mr. Li is a trainee of the Canadian National Transplant Research Program and was supported by a doctoral scholarship from the Kidney Foundation of Canada and the Canadian Institutes of Health Research. Dr. Garg was supported by the Dr. Adam Linton Chair in Kidney Health Analytics, and through an award from the Academic Medical Organization of Southwestern Ontario. Dr. Lam was supported by a KRESCENT New Investigator Award. The opinions, results and conclusions are those of the authors and are independent from the funding sources. No endorsement by these organizations is intended or should be inferred. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

## Disclosures

Dr. Garg received an investigator-initiated grant from Astellas and Roche to support a Canadian Institutes of Health Research study in living kidney donors, and his institution received unrestricted research funding from Pfizer.

## ABSTRACT

**Background:** Canada is a multicultural, developed country with low rates of deceased organ and tissue donation. Immigrants may differ in their registered support for deceased organ donation based on their country of origin.

**Methods:** We used linked administrative databases in the province of Ontario (~12 million residents  $\geq 16$  age) to study the proportion of immigrants and long-term residents registered for deceased organ and tissue donation as of October 2013. We used modified-Poisson regression to identify and quantify predictors of donor registration.

**Results:** Compared to long-term residents ( $n=9,244,570$ ), immigrants as a group ( $n=1,947,646$ ) were much less likely to register for deceased organ and tissue donation (26.5% versus 11.9%). Amongst immigrants, registration was highest in those from the United States, Australia and New Zealand (40%), and lowest in those from Eastern Europe and Central Africa (9%), East Asia and Pacific (8%), and Sub-Saharan Africa (8%). The largest number of unregistered immigrants were from India ( $n=202,567$ ), China ( $n=186,714$ ), and the Philippines ( $n=125,688$ ). Characteristics among the immigrant population associated with a higher likelihood of registration included living in a rural area (population  $<10,000$ ), a residence in Ontario with a lower ethnic concentration, less material deprivation, a higher education, fluency in English, and more years residing in Canada.

**Interpretation:** In Ontario, Canada immigrants are less likely to register for deceased organ donation compared to long-term residents. There is an opportunity to better understand reasons for lower donor registration amongst Canada immigrants, and to create culturally-sensitive materials to build support for deceased organ and tissue donation.

## INTRODUCTION

Canada has one of the lowest organ and tissue donation rates in the developed world.(1) Improving the rates of organ and tissue donation could help save the lives of the thousands of Canadians who suffer from end-stage organ failure. One factor that can influence the family's decision to consent is having knowledge of the potential donor's wishes about organ donation.(2) Canada has an "opt-in" system, where citizens can record their donation wishes through a deceased organ donor registry which can then be used to inform family members in the event of death.(3,4) Increasing the number of registered donors is a key strategy adopted by Canadian organ procurement organizations to improve organ and tissue donation.(3) An important step to increase the registration rate is to identify subpopulations that have lower donor registration rates, and to better understand the reasons for non-registration.

Ethnic minorities have greater concerns regarding organ donation compared to the general population, and these can be culturally-specific.(5) Documented issues include medical mistrust among the African-American and Black population,(5-7) religious uncertainties among North Americans of Islamic Faith,(5-7) donor registries unawareness among Chinese and Indo-Asians Canadians,(8,9) and lack of societal integration among Arab-Americans.(10) In addition, a majority of new immigrants to Canada are from regions with less developed organ donation systems that lack donor registries, such as Asia, Latin America, and the Caribbean.(11) As rates of migration continue to rise in Canada and other countries, identifying immigrant groups with lower donor registration rates and understanding how socio-demographic factors can affect organ and tissue donor registration can inform culturally sensitive donation practice, public education and awareness campaigns.(5,12)

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3 To better inform these issues, we conducted a population-based study in Ontario, Canada to  
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5 determine the deceased organ and tissue donor registration status for over 1 million recent  
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7 immigrants from different countries compared to long-term residents. Our main outcome of  
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9 interest was the proportion of immigrants and long-term residents of Canada (non-immigrants)  
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11 who were registered deceased organ and tissue donors. For recent immigrants, we examined  
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13 characteristics independently associated with registering for deceased organ and tissue donation.  
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15 We also identified the five countries with the largest absolute values of unregistered individuals,  
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17 which represent the populations with the most potential for increasing donor registration rates in  
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19 Ontario. The secondary outcome was whether the registered individual opted to exclude certain  
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21 organs or tissues that they did not wish to donate.  
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## 29 **SUBJECTS AND METHODS**

### 30 *Design and Setting*

31  
32 We conducted a population-based cross-sectional study using linked healthcare databases in  
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34 Ontario, Canada as of October 22, 2013 via unique, encoded identifiers at the Institute for  
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36 Clinical Evaluative Sciences (ICES) according to a pre-specified protocol. Ontario is Canada's  
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38 most populous province (approximately 30% of the Canadian population)(13) with  
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40 approximately 12 million residents  $\geq 16$  years of age, which is the minimum age required to  
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42 register for deceased organ and tissue donation. Ontario's donor registry is an "opt-in"  
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44 affirmative-only registry that only records 'yes' responses. Individuals who choose to register  
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46 can select the option to exclude certain organs or tissues from donation. This study was approved  
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48 by the research ethics boards at Sunnybrook Health Sciences Centre (Toronto, Canada). We used  
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50 published guidelines for observational studies to conduct and report our study (Table S1).(14)  
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### *Data Sources*

We ascertained socio-demographic information and donor registration information from two main administrative databases: The Ontario Registered Persons Database and the Citizenship and Immigration Canada Database.

The Ontario Registered Persons Database contains demographic and donor registration for all residents of the province who have ever been issued an Ontario government issued health card. We derived the individual's income using neighborhood income quintiles (a household size-adjusted measure of income).(15) Marginalization is the "process by which individuals and groups are prevented from fully participating in society".(16) We used Matheson's Canadian Marginalization Index to assign marginalization quintiles based on an individual's area of residence on four components of marginalization: residential instability (measure of turnover in the population), material deprivation (measure of inability to afford consumption goods or services), dependency (a ratio measure of the "dependent" population [i.e. seniors and children] to the "working age" population), and ethnic concentration (a measure consisting of the proportion of recent immigrants and proportion of people who self-identify as a visible minority).(17) This marginalization index was developed using a theoretical framework, derived from census indicators and created by sorting the data into 5 quintiles (1 for least marginalized and 5 for most marginalized).

The Citizenship and Immigration Canada Database contains landing records for every permanent legal immigrant to Canada who arrived from 1985 onwards. We used this database to ascertain immigration status and other migration-related variables. This database has been used previously to examine diabetes and cancer screening among immigrants.(7, 8) The migration-related variables included time since arrival to Canada, immigration visa class (Economic, Family, Refugees, Other), language ability (English, French, Neither or Both), marital status

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3 (Married, Single or Separated, Divorced, Widowed) and level of education at the time of  
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5 immigration. “Economic” immigrants included those sponsored by the province, skilled workers,  
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7 entrepreneurs, and investors. “Family” comprised those of family members of economic  
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9 immigrants and those who arrived through family reunification. “Other” category included all  
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11 other immigrant classes such as live-in caregivers and those who arrived on humanitarian  
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13 grounds.  
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### 20 *Study Population*

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22 We included all permanent residents of Ontario as of October 2013 and classified them as either  
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24 immigrants or long-term residents (i.e. non-immigrants) based on their immigration status within  
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26 the Citizen and Immigration Canada Database. We excluded individuals who did not make at  
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28 least one contact with the healthcare system in the 5 years prior to this date to ensure we only  
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30 included individuals in Ontario.  
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### 36 *Outcomes*

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38 We used each immigrant’s country of birth to categorize them mostly into world region of origin,  
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40 according to the World Bank system: Western Europe, Eastern Europe and Central Asia, Middle  
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42 East and North Africa, Sub-Saharan Africa, East Asia and Pacific, South Asia, Latin America  
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44 and Caribbean, and United States (USA), Australia and New Zealand.(20) Countries that did not  
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46 fit into any of the world region areas were placed in an “Other” category. We chose this grouping  
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48 because we hypothesized that differences in donor registration were primarily due to cultural  
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50 awareness and attitudes.  
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### 57 *Statistical Analyses*

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3 We compared socio-demographic characteristics and the proportion registered between  
4 immigrants and long-term residents using standardized differences, for which a value greater  
5 than 10% indicates a meaningful difference.(21) We used modified-Poisson regression to  
6 estimate the prevalence rate ratio and 95% confidence intervals of organ and tissue donor  
7 registration for immigrants relative to long-term residents.(22) We also used multivariable  
8 modified-Poisson regression to identify variables independently associated with organ donor  
9 registration in immigrants and long-term residents, as well as for the immigrant group only.(22)  
10 We adjusted for variables chosen a-priori based on the findings of previous studies (e.g. age, sex,  
11 income quintile).(23) We used the Wilson-score method to calculate 95% confidence intervals  
12 for proportions. We conducted complete case analysis (without multiple imputation) for the  
13 multivariable analysis because the amount of missing data was very low (less than 1.3% of  
14 individuals were excluded due to missing data). We conducted all analysis with SAS software,  
15 version 9.3 (SAS Institute Incorporated, Cary, North Carolina, USA). Finally, we examined the  
16 consistency of the associative relationships by conducting the analyses stratified by the 5 largest  
17 groups of immigrants who have not yet registered for organ and tissue donation (India, China,  
18 Philippines, Pakistan, and Sri Lanka).  
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## 43 RESULTS

### 44 *Baseline Characteristics*

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46 We identified 1 947 646 immigrant and 9 244 570 long-term residents (i.e. non-immigrants)  
47 (Figure S1). Compared to long-term residents, immigrants were more likely to be slightly  
48 younger (mean age 44.1 vs. 47.3 years), male (52.1% vs. 49.1%), from urban areas (98.7% vs.  
49 90.6%), from lower socio-economic neighborhoods, and higher ethnically-concentrated areas.  
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3 (Table 1). Almost half of all immigrants were from South Asia (24.3%) or East Asia and Pacific  
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5 Region (25.6%).  
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### 10 *Deceased Organ and Tissue Donation Registration*

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12 A total of 231 180 immigrants (11.9% registered; 95% confidence interval [CI] 11.8% to 11.9%)  
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14 were registered for deceased organ and tissue donation, compared to 2 453 116 long-term  
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16 residents (26.5%; 95% CI, 26.5% to 26.6%) (Table 2).  
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20 When we assessed the proportion of immigrants registered for deceased organ donation  
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22 according to the world region of birth, the highest proportion of registered donors were from the  
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24 USA, Australia and New Zealand (40%; 95% CI 39.5% to 40.5%) followed by Western Europe  
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26 (20.6%; 95% CI 20.4% to 20.9%), and Latin American and the Caribbean (15.2%; 95% CI  
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28 15.1% to 15.4%). Less than 10% of immigrants from Eastern Europe and Central Asia (9.4%;  
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30 95% CI 9.2% to 9.5%), East Asia and Pacific (8.4%; 95% CI 8.3% to 8.5%), and Sub-Saharan  
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32 Africa (7.9%; 95% CI 7.7% to 8.0%) were registered.  
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### 39 *Characteristics Associated with Donor Registration*

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41 Among both immigrants and long-term residents, the 30 – 39 year age group had the highest  
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43 donor registration rates (29.2% were registered; adjusted prevalence ratio, PR, 1.96; 95% CI 1.94  
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45 to 1.99; referent 16-19 years) (Table 2). In adjusted analyses, we observed no association  
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47 between income and registration rates. We also found no association between two of the four  
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49 measures of marginalization (instability and dependency) and donor registration (results not  
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51 shown). There was a gradient with ethnic concentration and material deprivation, where  
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53 individuals living in higher ethnically-concentrated areas were less likely to register for deceased  
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3 organ donation. For example, 14.8% of individuals living in the top quintile (5<sup>th</sup> quintile) most  
4 ethnically-concentrated areas were registered compared to 29.2% living in the middle quintile  
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6 (adjusted PR 0.58; 95% CI 0.57 to 0.58; referent was middle quintile) (Table 2).  
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10 Among immigrants, economic immigrants (those selected based on skills), those who had  
11 a university education at landing, and those who spoke both English and French were more likely  
12 to register (Table 3). Separated, divorced, or widowed immigrants were less likely to register  
13 than married immigrants. Immigrants living in Canada for 15 to 20 years were more likely to be  
14 registered compared to those living in Canada for less than four years.  
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22 In Ontario, the top five countries of birth with the highest absolute number of unregistered  
23 immigrants were India (202 548; 13.7%; 95% CI 13.6% to 13.9%), China (186 678; 6.4%; 95%  
24 CI 6.3% to 6.6%), the Philippines (125 686; 8.5%; 95% CI 8.4.% to 8.7%),  
25 Pakistan (95 667; 5.8%; 95% CI 5.7% to 6.0%), and Sri Lanka (72 304; 14.7%; 95% CI 14.5%  
26 to 15.0%) (Table 4). In our five stratified models, we observed effect modification by country of  
27 birth for each examined characteristic, which suggests that each characteristic associates  
28 somewhat differently with donor registration across these five groups. Visually, the following  
29 characteristics were associated with a higher change of donor registration in each of the 5  
30 groups: ages 20 to 49 years (vs. 16 to 19 years), a greater time spent in Canada (vs. < 4 years),  
31 English, and English and French language ability (vs. not able to speak either language), and  
32 economic immigrant (vs. family type immigrant). Except for immigrants born in Pakistan, living  
33 in the highest ethnic concentration area was also associated with lower registration and higher  
34 educational qualifications were associated with higher registration rates.  
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### *Organ and Tissue Donor Exclusion*

During the donor registration process, when given the option to exclude certain organs and tissues from deceased organ donation, 53 473 (23.1%) immigrants and 409 389 (16.7%) long-term residents excluded at least one organ or tissue (Table S2). Registered South Asians donors (N=15 267; 28.8%) were the most likely to exclude an organ and/or tissue. Across all groups, the most commonly excluded organ and/or tissue was skin and eyes (Table S3). Older individuals, men, and those living in rural areas were less likely to exclude an organ and/or tissue. Instability, dependency, and material deprivation showed no clear relationship with higher donor exclusion (results not shown).

## **DISCUSSION**

In this cross-sectional study, we documented that Canadian immigrants had lower organ and tissue registration rates compared to long-term residents. Immigrants born in the USA, Australia and New Zealand region had the highest registration rates. In addition, among immigrants, age 30-39 years, higher education, Canadian language fluency, economic-status immigrant, married/single, and living in less ethnically-concentrated areas were characteristics associated with higher donor registration. These findings highlight the marked differences in donor registration rates across immigrant groups, and inform the development and roll-out of targeted, culturally-sensitive public campaigns to raise awareness about organ and tissue donation.

Our findings are consistent with another study where the immigrant population were less reluctant to register.(24) Similar to López et al's study of Spain immigrants' attitudes towards to donate, our study on actual donor registration rates found that among the immigrant population as a whole, women, people with higher education and higher income were more likely to register for organ donation.(24) López et al. found that immigrants from East Europe and North African

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3 are more reluctant to donate their own organs compared to other immigrant groups, whereas in  
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5 our study, we found that immigrants born in the Sub-Saharan Africa and East Asia & Pacific  
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7 Region were the least likely groups to be registered.(24)  
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10 Many immigrant groups were much less likely to register for organ donation compared to  
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12 long-term residents, but these differences decreased by up to 10% in some cases after adjusting  
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14 for residential ethnic concentration. Further, living in a rural community, higher neighborhood  
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16 income quintile and lower material deprivation was no longer strongly positively associated with  
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18 donor registration after adjustment of ethnic concentration among all Ontario residents. More  
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20 research on other community factors such as volunteerism and civic participation, which may be  
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22 associated with higher donor registration, is needed to help explain these differences.  
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27 Our results may help develop potential strategies to improve organ and tissue donor  
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29 registration rates amongst Canadian immigrants For example, one option may be to provide  
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31 information about organ and tissue donation/donor registration, along with other health related  
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33 information, in orientation packages so that immigrants receive information to better prepare  
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35 them to consider registration when they apply for a health card, which may be the first  
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37 opportunity that they encounter to register. Since Canadian language fluency was associated with  
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39 higher registration rates, it may be important to have information about organ donation in an  
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41 appropriate language at time of immigration. Indeed, many studies have reported that one barrier  
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43 for ethnic minorities is the lack of information about organ donation and the Canadian donor  
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45 registration process.(8,9,25) Immigrants from countries with high donation rates may simply  
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47 need a prompt or immediate opportunity to register in their native language. Others may require  
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49 information that can help address misconceptions about organ donation, their religion's stance on  
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51 organ donation and the need for organs. Given that not all individuals may be ready to register,  
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3 interventions should consider the intermediary steps through which individuals go through  
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5 before donor registration and identify their stage of readiness.(25)  
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8 Our study has a number of strengths. To our knowledge, this is the first study examining  
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10 organ and tissue donor registration rates, rather than expressed support or a positive attitude  
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12 towards donation among immigrants and characteristics associated with registration. A  
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14 systematic review reported that many quantitative studies on this topic lacked methodological  
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16 rigor and did not account for important variables such as age and socio-economic status when  
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18 comparing ethnic groups.(5) Further, most studies focused on specific ethnic or cultural  
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20 collectives such as Hispanics, African Americans, Asians and Arabs, rather than the entire  
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22 immigrant population of a national state.  
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27 Our study does have limitations. First, we had no information on the reasons why many  
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29 immigrants did not register, which is important for the design of educational programs. The low  
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31 organ and donor registration rates in specific immigrant groups may be influenced by many  
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33 factors including knowledge, attitude, and awareness of organ donation that were not measured  
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35 in our study. It may also be possible that the low registration rates may be due to unawareness of  
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37 the registry(8,9) or fear of placing their name in a large database(26) rather than negative attitude  
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39 toward organ donation. Second, the Citizenship and Immigration Canada dataset only contains  
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41 data recorded at time of immigration. More than 50% of our cohort arrived in Canada more than  
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43 10 years ago and certain variables such as education, language ability, and marital status may  
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45 have changed over the years. Despite the limitations in our data, strong differences in registration  
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47 rates among immigrants and long-term residents persisted even after controlling for many socio-  
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49 demographic factors.  
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3 In conclusion, this study documents that Ontarian immigrants register less often for  
4 deceased organ donation compared to long-term residents. There is an opportunity to better  
5 understand the causes for lower donor registration amongst the different immigrant groups. More  
6 research is needed to develop and evaluate culturally-tailored interventions that can build support  
7 for deceased organ and tissue donation.  
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Table 1. Baseline Characteristics of Immigrants and Long-term Residents

Characteristic	Immigrants (n = 1 947 646)	Long-term Residents (n = 9 244 570)	Standardized Differences <sup>a</sup>
<b>Mean age in years, (Standard Deviation)</b>	44.1 (15.5)	47.3 (19.2)	17%
<b>Age</b>			
16 – 19 years	76 073 (3.9%)	599 264 (7.3%)	15%
20 – 29 years	290 314 (14.9%)	1 510 757 (16.7%)	5%
30 – 39 years	419 949 (21.6%)	1 380 229 (13.4%)	22%
40 – 49 years	493 544 (25.3%)	1 498 785 (14.9%)	26%
50 – 59 years	370 569 (19%)	1 657 095 (17.6%)	4%
60 – 69 years	163 899 (8.4%)	1 301 436 (14.3%)	18%
70 – 79 years	86 024 (4.4%)	775 156 (9.1%)	19%
≥ 80 years	47 274 (2.4%)	521 848 (6.7%)	21%
<b>Women</b>	933 639 (47.9%)	4 841 077 (50.9%)	4%
<b>Rural Residence<sup>b</sup></b>	24 848 (1.3%)	869 378 (9.4%)	37%
<b>Income Quintile<sup>c</sup></b>			
First (Lowest)	493 294 (25.4%)	1 231 585 (17.5%)	19%
Second	428 901 (22.1%)	1 314 981 (19.0%)	8%
Third (Middle)	404 293 (20.8%)	1 377 141 (20.2%)	2%
Fourth	368 900 (19.0%)	1 445 641 (21.5%)	6%
Fifth (Highest)	247 307 (12.7%)	1 422 106 (21.8%)	24%
<b>Instability<sup>d</sup></b>			
First (Lowest)	604813 (31.3%)	1 773 816 (25.8%)	12%
Second	350284 (18.1%)	1 426 513 (21.6%)	9%
Third (Middle)	207937 (10.8%)	1 106 656 (16.9%)	18%
Fourth	335781 (17.4%)	1 192 659 (18.0%)	2%
Fifth (Highest)	433725 (22.4%)	1 195 479 (17.7%)	12%
<b>Ethnic Concentration<sup>e</sup></b>			
First (Lowest)	40 269 (2.1%)	872 672 (13.0%)	42%
Second	73 994 (3.8%)	1 111 507 (16.6%)	43%
Third (Middle)	125 735 (6.5%)	1 224 348 (18.3%)	36%
Fourth	294 318 (15.2%)	1 424 500 (21.3%)	16%
Fifth (Highest)	1 398 224 (72.4%)	2 062 096 (30.8%)	91%
<b>Dependency<sup>f</sup></b>			
First (Lowest)	663 665 (34.3%)	1 474 471 (22.0%)	28%
Second	529 973 (27.4%)	1 513 013 (22.6%)	11%
Third (Middle)	335 353 (17.4%)	1 325 099 (19.8%)	6%
Fourth	214 055 (11.1%)	1 162 365 (17.4%)	18%
Fifth (Highest)	189 494 (9.8%)	1 220 175 (18.2%)	24%
<b>Deprivation<sup>g</sup></b>			
First (Lowest)	502 397 (26.0%)	1 761 059 (26.3%)	1%
Second	402 011 (20.8%)	1 562 120 (23.3%)	6%
Third (Middle)	377 933 (19.6%)	1 350 107 (20.2%)	2%
Fourth	331 916 (17.2%)	1 107 409 (16.5%)	2%
Fifth (Highest)	318 283 (16.5%)	914 428 (13.7%)	8%
<b>Country of Birth</b>			
Latin America & Caribbean	269 170 (13.8%)	-	
USA, Australia & New Zealand	38 014 (2.0%)	-	
South Asia	474 101 (24.3%)	-	
East Asia & Pacific	499 533 (25.6%)	-	
Sub-Saharan Africa	115 371 (5.9%)	-	
Middle East & North Africa	181 565 (9.3%)	-	
Eastern Europe & Central Asia	215 856 (11.1%)	-	
Western Europe	153 259 (7.9%)	-	
Other	777 (<0.1%)	-	
<b>Educational Qualification</b>			
University degree or higher	502 234 (25.8%)	-	
Some university	80 655 (4.1%)	-	
Non university qualifications (e.g. college diploma)	277 160 (14.2%)	-	
Secondary or less	923 002 (47.4%)	-	
No education	164 521 (8.4%)	-	

<b>Time Since Arrival in Canada, years</b>			
≥20	512 570 (26.3%)	-	
15-19	379 567 (19.5%)	-	
10-14	453 966 (23.3%)	-	
4-9	518 677 (26.6%)	-	
<4	82 866 (4.3%)	-	
<b>Canadian Language Ability</b>			
English	1 149 609 (59%)	-	
French	16 612 (0.9%)	-	
Both	49 192 (2.5%)	-	
Neither	732 166 (37.6%)	-	
<b>Marital Status</b>			
Married	1 035 265 (53.2%)	-	
Separated, Divorced, Widowed	74 680 (3.8%)	-	
Single	837 396 (43.0%)	-	

<sup>a</sup> Standardized differences compared against long-term residents. Standardized differences greater than 10% represent a meaningful difference between the two groups.

<sup>b</sup> Refers to areas with population less than 10,000.

<sup>c</sup> Categorized into fifths of average neighborhood income.

<sup>d</sup> Measure of the turnover in the population.

<sup>e</sup> Measure of the proportion of recent immigrants and those who self-identify as visible minority.

<sup>f</sup> Measures the size of the “dependent” population [i.e. seniors and children] in relation to the “working age” population who provide social and economic support).

<sup>g</sup> Measure of inability to afford consumption goods or services.

“-“ represents data is not available among long-term residents

**Table 2.** Characteristics Associated with Donor Registration among Immigrants and Long-term Residents (n=11 192 216)

Characteristic	No. Registered (%)	Prevalence Ratio (95% confidence interval)	
		Unadjusted	Adjusted <sup>a</sup>
<b>World Region of Birth</b>			
Long-term residents	2 453 116 (26.5%)	1.00 [Reference]	1.00 [Reference]
<b>Immigrants</b>			
East Asia & Pacific Region	41 752 (8.4%)	0.31 (0.31 to 0.32)	0.39 (0.38 to 0.40)
Eastern Europe & Central Asia	20 222 (9.4%)	0.35 (0.35 to 0.36)	0.38 (0.37 to 0.40)
Latin America & Caribbean	41 006 (15.2%)	0.57 (0.57 to 0.58)	0.68 (0.67 to 0.69)
Middle East & North Africa	19 059 (10.5%)	0.40 (0.39 to 0.40)	0.47 (0.46 to 0.49)
South Asia	53 077 (11.2%)	0.42 (0.42 to 0.43)	0.53 (0.52 to 0.54)
Sub-Saharan Africa	9 080 (7.9%)	0.30 (0.29 to 0.30)	0.35 (0.33 to 0.36)
USA, Australia & New Zealand	15 209 (40.0%)	1.51 (1.49 to 1.53)	1.40 (1.36 to 1.43)
Western Europe	31 637 (20.6%)	0.78 (0.77 to 0.79)	0.79 (0.78 to 0.81)
Other	138 (17.8%)	0.67 (0.58 to 0.78)	1.01 (0.74 to 1.36)
<b>Sex</b>			
Women	1 495 776 (25.9%)	1.00 [Reference]	1.00 [Reference]
Men	1 188 520 (21.9%)	0.85 (0.85 to 0.85)	0.83 (0.83 to 0.83)
<b>Residence</b>			
Urban	2 306 304 (23.2%)	1.00 [Reference]	1.00 [Reference]
Rural <sup>b</sup>	377 992 (29.8%)	1.28 (1.28 to 1.29)	0.97 (0.96 to 0.98)
<b>Age Category</b>			
16 – 19 years	107 575 (15.9%)	1.00 [Reference]	1.00 [Reference]
20 – 29 years	406 873 (22.6%)	1.42 (1.41 to 1.43)	1.45 (1.43 to 1.47)
30 – 39 years	526 486 (29.2%)	1.84 (1.83 to 1.85)	1.96 (1.94 to 1.99)
40 – 49 years	556 450 (27.9%)	1.75 (1.74 to 1.76)	1.85 (1.82 to 1.87)
50 – 59 years	502 942 (24.8%)	1.56 (1.55 to 1.57)	1.54 (1.52 to 1.56)
60 – 69 years	349 575 (23.9%)	1.50 (1.49 to 1.51)	1.41 (1.39 to 1.43)
70 – 79 years	165 279 (19.2%)	1.20 (1.20 to 1.21)	1.11 (1.10 to 1.13)
≥ 80 years	69 116 (12.1%)	0.76 (0.76 to 0.77)	0.69 (0.68 to 0.70)
<b>Income Quintile<sup>c</sup></b>			
First (Lowest)	430 400 (20.4%)	0.86 (0.86 to 0.86)	1.03 (1.02 to 1.04)
Second	491 648 (22.5%)	0.95 (0.95 to 0.95)	1.00 (0.99 to 1.01)
Third (Middle)	537 122 (23.6%)	1.00 [Reference]	1.00 [Reference]
Fourth	588 534 (25.0%)	1.06 (1.05 to 1.06)	1.00 (0.99 to 1.00)
Fifth (Highest)	636 592 (28.1%)	1.19 (1.18 to 1.19)	1.02 (1.01 to 1.02)
<b>Material Deprivation</b>			
First (Lowest)	417 114 (31.6%)	1.08 (1.08 to 1.08)	1.10 (1.10 to 1.11)
Second	524 728 (31.0%)	1.06 (1.06 to 1.06)	1.02 (1.01 to 1.03)
Third (Middle)	548 379 (29.2%)	1.00 [Reference]	1.00 [Reference]
Fourth	582 938 (25.8%)	0.88 (0.88 to 0.89)	1.00 (0.99 to 1.01)
Fifth (Highest)	575 086 (14.8%)	0.50 (0.50 to 0.51)	0.99 (0.98 to 1.01)
<b>Ethnic Concentration<sup>d</sup></b>			
First (Lowest)	417 114 (31.6%)	1.08 (1.08 to 1.08)	1.11 (1.10 to 1.11)
Second	524 728 (31.0%)	1.06 (1.06 to 1.06)	1.07 (1.06 to 1.07)
Third (Middle)	548 379 (29.2%)	1.00 [Reference]	1.00 [Reference]
Fourth	582 938 (25.8%)	0.88 (0.88 to 0.89)	0.89 (0.89 to 0.89)
Fifth (Highest)	575 086 (14.8%)	0.50 (0.50 to 0.51)	0.58 (0.57 to 0.58)

Total immigrants and long-term residents registered were 2 684 296 (24.0%)

<sup>a</sup>Adjusted for World Region of Birth, Sex, Residence, Age Category, Neighborhood Income Quintile, Material Deprivation, and Ethnic Concentration. Adjusted analysis based on a random sample of 20% (n=2 238 443)

<sup>b</sup>Refers to areas with population less than 10 000.

<sup>c</sup>Categorized into fifths of average neighborhood income.

<sup>d</sup>Missing data on ethnic concentration on 145 466 individuals (1.3% missing)

**Table 3.** Characteristics Associated with Donor Registration among Immigrants (n=1 947 646)

Characteristic	No. Registered (%)	Prevalence Ratio (95% confidence interval)	
		Unadjusted	Adjusted <sup>a</sup>
<b>World Region of Birth</b>			
USA, Australia & New Zealand	15 207 (40.0%)	1.00 [Reference]	1.00 [Reference]
East Asia & Pacific	41 748 (8.4%)	0.21 (0.21 to 0.21)	0.28 (0.27 to 0.28)
Eastern Europe & Central Asia	20 216 (9.4%)	0.23 (0.23 to 0.24)	0.28 (0.27 to 0.28)
Latin America & Caribbean	40 985 (15.2%)	0.38 (0.38 to 0.39)	0.51 (0.50 to 0.52)
Middle East & North Africa	19 056 (10.5%)	0.26 (0.26 to 0.27)	0.33 (0.32 to 0.33)
South Asia	53 066 (11.2%)	0.28 (0.28 to 0.28)	0.37 (0.36 to 0.38)
Sub-Saharan Africa	9 078 (7.9%)	0.20 (0.19 to 0.20)	0.26 (0.26 to 0.27)
Western Europe	31 634 (20.6%)	0.52 (0.51 to 0.52)	0.57 (0.56 to 0.58)
Other	138 (17.8%)	0.44 (0.38 to 0.52)	0.58 (0.50 to 0.67)
<b>Sex</b>			
Men	121 402 (12.0%)	0.98 (0.97 to 0.99)	0.93 (0.93 to 0.94)
Women	109 726 (11.8%)	1.00 [Reference]	1.00 [Reference]
<b>Residence</b>			
Urban	224 266 (11.7%)	1.00 [Reference]	1.00 [Reference]
Rural <sup>b</sup>	6 862 (28.3%)	2.43 (2.38 to 2.48)	1.24 (1.21 to 1.26)
<b>Age Category</b>			
16 – 19 years	4 545 (6.0%)	1.00 [Reference]	1.00 [Reference]
20 – 29 years	31 791 (11.0%)	1.83 (1.78 to 1.89)	1.85 (1.8 to 1.91)
30 – 39 years	57 841 (13.8%)	2.31 (2.24 to 2.37)	2.23 (2.16 to 2.3)
40 – 49 years	68 319 (13.8%)	2.32 (2.25 to 2.39)	2.02 (1.95 to 2.08)
50 – 59 years	44 244 (11.9%)	2.00 (1.94 to 2.06)	1.76 (1.7 to 1.82)
60 – 69 years	16 302 (9.9%)	1.66 (1.61 to 1.72)	1.57 (1.52 to 1.63)
70 – 79 years	5 931 (6.9%)	1.15 (1.11 to 1.20)	1.28 (1.23 to 1.33)
≥ 80 years	2 155 (4.6%)	0.76 (0.73 to 0.80)	0.88 (0.84 to 0.93)
<b>Income Quintile<sup>c</sup></b>			
One (Lowest)	43 634 (8.8%)	0.73 (0.72 to 0.74)	0.96 (0.94 to 0.97)
Two	46 543 (10.9%)	0.90 (0.89 to 0.91)	1.00 (0.99 to 1.01)
Three (Middle)	49 520 (12.1%)	1.00 [Reference]	1.00 [Reference]
Fourth	49 308 (13.4%)	1.10 (1.09 to 1.12)	1.09 (1.08 to 1.11)
Fifth (Highest)	42 123 (17%)	1.41 (1.39 to 1.42)	1.02 (1.00 to 1.03)
<b>Material Deprivation<sup>d</sup></b>			
One (Lowest)	72 247 (14.4%)	1.23 (1.21 to 1.24)	1.09 (1.08 to 1.10)
Two	52 477 (13.1%)	1.11 (1.10 to 1.13)	1.04 (1.03 to 1.05)
Three (Middle)	44 268 (11.9%)	1.00 [Reference]	1.00 [Reference]
Fourth	33 461 (10.1%)	0.86 (0.85 to 0.87)	0.92 (0.91 to 0.93)
Fifth (Highest)	26 653 (8.4%)	0.71 (0.70 to 0.73)	0.82 (0.80 to 0.83)
<b>Ethnic Concentration<sup>d</sup></b>			
One (Lowest)	9 435 (23.4%)	1.27 (1.25 to 1.3)	1.12 (1.10 to 1.15)
Two	15 272 (20.6%)	1.12 (1.1 to 1.14)	1.06 (1.04 to 1.08)
Three (Middle)	23 119 (18.4%)	1.00 [Reference]	1.00 [Reference]
Fourth	43 565 (14.8%)	0.81 (0.79 to 0.82)	0.88 (0.86 to 0.89)
Fifth (Highest)	13 7715 (9.9%)	0.54 (0.53 to 0.54)	0.70 (0.69 to 0.71)
<b>Educational Qualification</b>			
University degree or higher	71 901 (14.3%)	1.00 [Reference]	1.00 [Reference]
Some university	11 142 (13.8%)	0.97 (0.95 to 0.98)	0.96 (0.95 to 0.98)
Non university qualifications (e.g. college diploma)	36 403 (13.1%)	0.92 (0.91 to 0.93)	0.92 (0.91 to 0.93)
Secondary or less	95 818 (10.4%)	0.73 (0.72 to 0.73)	0.78 (0.77 to 0.79)
No education	15 864 (9.6%)	0.67 (0.66 to 0.68)	0.81 (0.80 to 0.83)
<b>Time Spent in Canada, years</b>			
≥20	56 371 (11.0%)	1.23 (1.21 to 1.26)	1.31 (1.28 to 1.35)
15-19	53 046 (14.0%)	1.57 (1.53 to 1.61)	1.76 (1.72 to 1.8)
10-14	60 633 (13.4%)	1.50 (1.47 to 1.53)	1.66 (1.62 to 1.7)
4-9	53 695 (10.4%)	1.16 (1.14 to 1.19)	1.21 (1.18 to 1.23)
<4	7 383 (8.9%)	1.00 [Reference]	1.00 [Reference]
<b>Canadian Language Ability</b>			
English	119 029 (13.2%)	1.00 [Reference]	1.00 [Reference]
French	74 731 (10.9%)	0.56 (0.53 to 0.59)	0.66 (0.63 to 0.70)
Both	31 305 (10.0%)	1.12 (1.10 to 1.14)	1.06 (1.04 to 1.08)
Neither	6 063 (11.9%)	0.60 (0.59 to 0.60)	0.76 (0.75 to 0.77)

<b>Marital Status</b>			
Married	6 876 (9.2%)	1.00 [Reference]	1.00 [Reference]
Separated, Divorced, Widowed	121 619 (11.7%)	0.78 (0.77 to 0.80)	1.06 (1.04 to 1.09)
Single	102 633 (12.3%)	1.04 (1.04 to 1.05)	1.11 (1.10 to 1.12)
<b>Immigrant Class</b>			
Economic	119 029 (13.2%)	1.00 [Reference]	1.00 [Reference]
Family	74 731 (10.9%)	0.82 (0.82 to 0.83)	0.86 (0.86 to 0.87)
Other	6 063 (11.9%)	0.90 (0.88 to 0.93)	0.96 (0.93 to 0.98)
Refugee	31 305 (10.0%)	0.76 (0.75 to 0.77)	0.95 (0.94 to 0.96)

Total immigrants registered were 231 180 (11.9%)

<sup>a</sup> Adjusted for World Region of Birth, Sex, Residence, Age Category, Income Quintile, Material Deprivation, Ethnic Concentration, Educational Qualification, Time spent in Canada, Canadian language ability, Marital Status, Immigrant Class

<sup>b</sup> Refers to areas with population less than 10 000.

<sup>c</sup> Categorized into fifths of average neighborhood income.

<sup>d</sup> Missing data on 145 466 individuals (1.3% missing)

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**Table 4.** Characteristics Associated with Donor Registration among the Top 5 Countries with the Highest Number of Unregistered Immigrants

Characteristic	Adjusted Prevalence Ratio (95% confidence interval) <sup>a</sup>				
	India	China	Philippines	Pakistan	Sri Lanka
<b>Country</b>					
<b>Sex</b>					
Men	1.01 (0.99 to 1.03)	1.03 (0.99 to 1.06)	0.81 (0.78 to 0.84)	1.09 (1.03 to 1.15)	1.04 (1.00 to 1.08)
Women	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
<b>Residence</b>					
Urban	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Rural <sup>b</sup>	1.09 (0.96 to 1.23)	1.22 (0.98 to 1.52)	1.38 (1.16 to 1.65)	1.41 (1.02 to 1.93)	1.11 (0.83 to 1.48)
<b>Age Category</b>					
16 – 19 years	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
20 – 29 years	1.57 (1.44 to 1.71)	1.64 (1.43 to 1.88)	1.74 (1.55 to 1.97)	2.1 (1.78 to 2.48)	1.87 (1.61 to 2.18)
30 – 39 years	1.69 (1.55 to 1.85)	1.41 (1.21 to 1.63)	1.85 (1.63 to 2.10)	2.1 (1.76 to 2.51)	2.09 (1.79 to 2.44)
40 – 49 years	1.85 (1.69 to 2.02)	1.28 (1.10 to 1.48)	1.44 (1.26 to 1.65)	2.18 (1.82 to 2.61)	1.75 (1.49 to 2.04)
50 – 59 years	1.71 (1.56 to 1.87)	1.17 (1.01 to 1.37)	1.10 (0.96 to 1.27)	2.37 (1.96 to 2.87)	1.44 (1.23 to 1.7)
60 – 69 years	1.40 (1.27 to 1.54)	1.08 (0.92 to 1.28)	0.83 (0.71 to 0.97)	2.56 (2.08 to 3.14)	1.26 (1.06 to 1.49)
70 – 79 years	1.19 (1.07 to 1.32)	0.85 (0.71 to 1.01)	0.54 (0.44 to 0.66)	2.37 (1.83 to 3.09)	1.3 (1.08 to 1.56)
≥ 80 years	0.94 (0.82 to 1.08)	0.58 (0.47 to 0.71)	0.38 (0.29 to 0.49)	2.3 (1.59 to 3.33)	0.94 (0.75 to 1.17)
<b>Income Quintile<sup>c</sup></b>					
First (Lowest)	0.90 (0.87 to 0.94)	1.1 (1.04 to 1.18)	0.90 (0.85 to 0.97)	0.89 (0.80 to 0.98)	0.99 (0.93 to 1.06)
Second	0.95 (0.92 to 0.98)	1.01 (0.95 to 1.06)	0.96 (0.91 to 1.01)	1.04 (0.96 to 1.13)	0.96 (0.92 to 1.01)
Third (Middle)	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Fourth	1.04 (1.01 to 1.07)	1.04 (0.99 to 1.1)	1.05 (0.99 to 1.11)	0.96 (0.89 to 1.04)	1.00 (0.95 to 1.06)
Fifth (Highest)	1.14 (1.10 to 1.18)	1.06 (1.00 to 1.12)	0.98 (0.91 to 1.05)	1.18 (1.08 to 1.30)	1.15 (1.07 to 1.23)
<b>Material Deprivation<sup>d</sup></b>					
First (Lowest)	1.06 (1.02 to 1.09)	0.99 (0.94 to 1.05)	1.11 (1.05 to 1.18)	0.97 (0.89 to 1.05)	1.13 (1.06 to 1.19)
Second	1.00 (0.97 to 1.03)	1.01 (0.96 to 1.07)	1.01 (0.95 to 1.07)	0.98 (0.91 to 1.06)	1.03 (0.98 to 1.08)
Third (Middle)	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Fourth	0.89 (0.86 to 0.92)	0.89 (0.84 to 0.94)	0.93 (0.87 to 0.98)	0.77 (0.70 to 0.85)	0.94 (0.89 to 0.99)
Fifth (Highest)	0.77 (0.74 to 0.81)	0.86 (0.80 to 0.93)	0.93 (0.86 to 0.99)	0.76 (0.68 to 0.86)	0.86 (0.80 to 0.92)
<b>Ethnic Concentration<sup>d</sup></b>					
First (Lowest)	1.02 (0.92 to 1.12)	1.21 (1.04 to 1.41)	1.08 (0.93 to 1.24)	1.16 (0.91 to 1.49)	1.07 (0.87 to 1.32)
Second	1.01 (0.94 to 1.09)	1.16 (1.03 to 1.32)	1.09 (0.98 to 1.22)	0.92 (0.76 to 1.12)	1.07 (0.93 to 1.24)
Third (Middle)	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Fourth	0.91 (0.87 to 0.96)	0.96 (0.88 to 1.05)	0.87 (0.81 to 0.95)	1.07 (0.94 to 1.23)	0.89 (0.8 to 0.99)
Fifth (Highest)	0.82 (0.78 to 0.86)	0.76 (0.70 to 0.82)	0.77 (0.72 to 0.83)	0.88 (0.77 to 0.99)	0.81 (0.74 to 0.89)
<b>Educational Qualification</b>					
University degree or higher	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Some university	0.91 (0.86 to 0.96)	0.87 (0.8 to 0.93)	0.84 (0.79 to 0.91)	1.28 (1.11 to 1.48)	0.88 (0.79 to 0.98)
Non university qualifications (e.g. college diploma)	0.81 (0.78 to 0.83)	0.55 (0.52 to 0.58)	0.82 (0.77 to 0.86)	0.90 (0.84 to 0.97)	0.70 (0.66 to 0.74)
Secondary or less	0.96 (0.93 to 0.99)	0.75 (0.71 to 0.79)	0.78 (0.74 to 0.82)	0.91 (0.84 to 1.00)	0.89 (0.83 to 0.95)
No education	0.71 (0.67 to 0.75)	0.58 (0.52 to 0.65)	0.76 (0.69 to 0.84)	0.92 (0.81 to 1.05)	0.72 (0.66 to 0.79)

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<b>Time Spent in Canada, years</b>					
≥20	1.41 (1.32 to 1.51)	1.78 (1.54 to 2.06)	1.77 (1.61 to 1.95)	2.04 (1.63 to 2.55)	1.48 (1.32 to 1.67)
15-19	2.09 (1.96 to 2.23)	3.57 (3.14 to 4.06)	2.35 (2.15 to 2.57)	2.52 (2.05 to 3.09)	1.83 (1.64 to 2.06)
10-14	1.97 (1.85 to 2.09)	2.92 (2.58 to 3.31)	2.17 (1.99 to 2.37)	2.04 (1.67 to 2.50)	1.87 (1.67 to 2.10)
4-9	1.22 (1.15 to 1.30)	1.37 (1.21 to 1.55)	1.51 (1.39 to 1.65)	1.23 (1.01 to 1.51)	1.19 (1.06 to 1.33)
<4	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
<b>Canadian Language Ability</b>					
English	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
French	0.71 (0.69 to 0.73)	0.73 (0.70 to 0.75)	0.93 (0.88 to 0.98)	0.60 (0.56 to 0.65)	0.77 (0.74 to 0.81)
Both	1.16 (1.04 to 1.29)	0.93 (0.75 to 1.17)	1.60 (1.12 to 2.28)	1.18 (0.86 to 1.63)	1.02 (0.78 to 1.34)
Neither	0.71 (0.69 to 0.73)	0.73 (0.70 to 0.75)	0.93 (0.88 to 0.98)	0.60 (0.56 to 0.65)	0.77 (0.74 to 0.81)
<b>Marital Status</b>					
Married	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Separated, Divorced, Widowed	1.09 (1.01 to 1.18)	1.23 (1.11 to 1.37)	1.08 (0.96 to 1.21)	1.10 (0.90 to 1.34)	0.98 (0.88 to 1.10)
Single	1.12 (1.09 to 1.15)	1.19 (1.14 to 1.25)	0.97 (0.93 to 1.01)	1.24 (1.16 to 1.33)	1.05 (1.01 to 1.10)
<b>Immigrant Class</b>					
Economic	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Family	0.80 (0.78 to 0.82)	0.86 (0.82 to 0.91)	0.84 (0.81 to 0.88)	0.82 (0.76 to 0.88)	0.73 (0.69 to 0.77)
Other	1.04 (0.93 to 1.17)	0.68 (0.60 to 0.76)	1.06 (0.90 to 1.25)	1.33 (1.10 to 1.62)	0.95 (0.86 to 1.05)
Refugee	0.96 (0.89 to 1.04)	0.73 (0.67 to 0.80)	1.33 (0.98 to 1.79)	1.39 (1.28 to 1.51)	0.83 (0.79 to 0.87)
<sup>a</sup> Adjusted for World Region of Birth, Sex, Residence, Age Category, Income Quintile, Material Deprivation, Ethnic Concentration, Educational Qualification, Time spent in Canada, Canadian language ability, Marital Status, Immigrant Class <sup>b</sup> Refers to areas with population less than 10 000. <sup>c</sup> Categorized into fifths of average neighborhood income. <sup>d</sup> Missing data on 145 466 individuals (1.3% missing)					



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3 **Supplemental Tables**  
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5 **Figure S1:** Selection of Participants for Inclusion in the Cross-sectional Study on Deceased Organ Donor Registration  
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7 **Table S1.** Checklist of recommendations for reporting of observational studies using the STROBE guidelines  
8

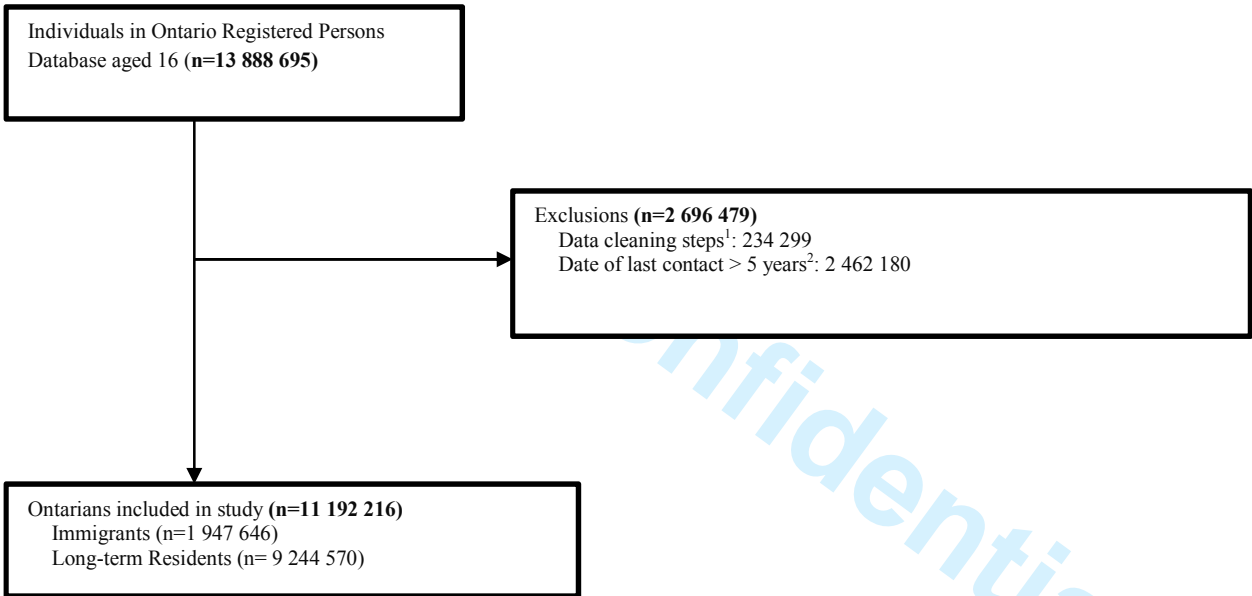
9 **Table S2:** Characteristics associated with Exclusion of at least one organ among Registered Donors (n=2 684 296)  
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11 **Table S3:** Organ and Tissue Exclusion  
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**Figure S1:** Selection of participants for inclusion in the cross-sectional study on deceased organ donor registration



<sup>1</sup>Data cleaning steps included invalid patient identifier, missing sex, non-Ontarian, death date prior to index date  
<sup>2</sup>This exclusion was applied to ensure that the individual was living in Ontario

**Table S1.** Checklist of recommendations for reporting of observational studies using the STROBE guidelines

	Item No	Recommendation	Reported
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	Abstract
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	Abstract
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction
Objectives	3	State specific objectives, including any pre-specified hypotheses	Introduction
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	Methods
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	Methods
		(b) For matched studies, give matching criteria and number of exposed and unexposed	Not Applicable
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Methods
Data sources/measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods
Bias	9	Describe any efforts to address potential sources of bias	Discussion
Study size	10	Explain how the study size was arrived at	Methods, based on availability of the data
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Methods
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Methods
		(b) Describe any methods used to examine subgroups and interactions	Methods
		(c) Explain how missing data were addressed	Not Applicable
		(d) If applicable, explain how loss to follow-up was addressed	Not Applicable
		(e) Describe any sensitivity analyses	Not Applicable
<b>Results</b>			
Participants	13	(a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Methods, Results, Figure S1

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		(b) Give reasons for non-participation at each stage	Methods, Results, Figure S1
		(c) Consider use of a flow diagram	Figure S1
Descriptive data	14	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Essentially Complete
		(c) Summarise follow-up time (e.g. average and total amount)	Not applicable
Outcome data	15	Report numbers of outcome events or summary measures over time	Results, Table 2,3,4
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g. 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Results, Table 2,3,4,
		(b) Report category boundaries when continuous variables were categorized	Table 2,3,4
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses	Table 3, Table S2
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	Discussion
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Discussion
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion
Generalisability	21	Discuss the generalisability (external validity) of the study results	Discussion
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Cover page

**Table S2:** Characteristics associated with Exclusion of at least one organ among Registered Donors (n=2 684 296)

Characteristic	No. Excluded (%)	Prevalence Ratio (95% confidence interval)	
		Unadjusted	Adjusted <sup>a</sup>
<b>World Region of Birth</b>			
Long-term Residents	409 389 (16.7%)	1.00 [Reference]	1.00 [Reference]
<b>Immigrants</b>			
East Asia & Pacific	9 508 (22.8%)	1.36 (1.34 to 1.39)	1.22 (1.19 to 1.24)
Eastern Europe & Central Asia	4 541 (22.5%)	1.35 (1.31 to 1.38)	1.17 (1.14 to 1.20)
Latin America & Caribbean	9 624 (23.5%)	1.41 (1.38 to 1.43)	1.25 (1.23 to 1.27)
Middle East & North Africa	3 986 (20.9%)	1.25 (1.22 to 1.29)	1.11 (1.08 to 1.14)
Other	24 (17.4%)	1.04 (0.72 to 1.5)	1.26 (0.89 to 1.80)
South Asia	15 267 (28.8%)	1.72 (1.7 to 1.75)	1.56 (1.54 to 1.58)
Sub-Saharan Africa	2 074 (22.8%)	1.37 (1.32 to 1.42)	1.25 (1.20 to 1.29)
USA, Australia & New Zealand	2 125 (14%)	0.84 (0.8 to 0.87)	0.83 (0.80 to 0.86)
Western Europe	6 324 (20%)	1.2 (1.17 to 1.22)	1.17 (1.15 to 1.20)
<b>Sex</b>			
Women	30 190 (24.9%)	1.00 [Reference]	1.00 [Reference]
Men	23 283 (21.2%)	0.74 (0.74 to 0.75)	0.78 (0.77 to 0.78)
<b>Residence</b>			
Urban	52 274 (23.3%)	1.00 [Reference]	1.00 [Reference]
Rural <sup>b</sup>	1 199 (17.5%)	0.85 (0.85 to 0.86)	0.98 (0.97 to 0.99)
<b>Age Category</b>			
16 – 19 years	1 313 (28.9%)	1.00 [Reference]	1.00 [Reference]
20 – 29 years	9 281 (29.2%)	1.02 (1.01 to 1.04)	1.00 (0.99 to 1.01)
30 – 39 years	15 365 (26.6%)	0.9 (0.89 to 0.91)	0.87 (0.86 to 0.88)
40 – 49 years	15 278 (22.4%)	0.69 (0.68 to 0.69)	0.67 (0.66 to 0.68)
50 – 59 years	8 120 (18.3%)	0.51 (0.51 to 0.52)	0.52 (0.51 to 0.52)
60 – 69 years	2 796 (17.1%)	0.42 (0.41 to 0.42)	0.43 (0.42 to 0.44)
70 – 79 years	1 006 (17.0%)	0.35 (0.35 to 0.36)	0.37 (0.36 to 0.37)
≥ 80 years	314 (14.6%)	0.3 (0.29 to 0.3)	0.31 (0.30 to 0.32)
<b>Income Quintile<sup>c</sup></b>			
First (Lowest)	10 681 (24.5%)	1.02 (1.01 to 1.02)	0.97 (0.97 to 0.98)
Second	11 128 (23.9%)	0.99 (0.98 to 1)	0.98 (0.98 to 0.99)
Third (Middle)	11 870 (24.0%)	1.00 [Reference]	1.00 [Reference]
Fourth	11 063 (22.4%)	0.99 (0.98 to 0.99)	1.00 (0.99 to 1.00)
Fifth (Highest)	8 731 (20.7%)	0.94 (0.93 to 0.95)	0.99 (0.98 to 1.00)
<b>Ethnic Concentration<sup>d</sup></b>			
First (Lowest)	61 387 (14.7%)	1.08 (1.08 to 1.08)	0.97 (0.96 to 0.98)
Second	81 340 (15.5%)	1.06 (1.06 to 1.06)	0.98 (0.97 to 0.98)
Third (Middle)	89 403 (16.3%)	1.00 [Reference]	1.00 [Reference]
Fourth	104 192 (17.9%)	0.88 (0.88 to 0.89)	1.04 (1.04 to 1.05)
Fifth (Highest)	120 150 (20.9%)	0.50 (0.50 to 0.51)	1.13 (1.12 to 1.14)

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Total number of registered donors excluding at least one organ or tissue were 462 862  
<sup>a</sup> Adjusted for World Region of Birth, Sex, Residence, Age Category, Income, Ethnic Concentration  
<sup>b</sup> Refers to areas with population less than 10 000.  
<sup>c</sup> Categorized into fifths of average neighborhood income.  
<sup>d</sup> Missing data on ethnic concentration on 36 501 individuals (1.3% missing)

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Table S3: Organ and Tissue Exclusion

Number of Registrants that opted-out:										
Organ and/or Tissue:	Other <sup>a</sup>	Western Europe	Eastern Europe & Central Asia South Asia	Middle East & North Africa	Sub-Saharan Africa	East Asia & Pacific	South Asia	USA, Australia and New Zealand	Latin America & Caribbean	Long-term Residents
Kidney	<=5 (3.5%)	287 (0.9%)	354 (1.8%)	446 (2.3%)	205 (2.3%)	1 272 (3.0%)	3654 (6.9%)	94 (0.6%)	921 (2.2%)	24 129 (1.0%)
Heart	<=5 (3.5%)	535 (1.7%)	574 (2.8%)	662 (3.5%)	338 (3.7%)	2 131 (5.1%)	4203 (7.9%)	176 (1.2%)	1 353 (3.3%)	39 326 (1.6%)
Eyes	15 (10.6%)	4 887 (15.4%)	3 554 (17.6%)	2 544 (13.3%)	1 345 (14.8%)	4 993 (12.0%)	5 544 (10.4%)	1 397 (9.2%)	6 380 (15.6%)	255 784 (10.4%)
Bone	8 (5.7%)	1 677 (5.3%)	1 404 (6.9%)	1 750 (9.2%)	863 (9.5%)	4 326 (10.4%)	8 488 (16.0%)	634 (4.2%)	3 850 (9.4%)	121 168 (4.9%)
Liver	<=5 (3.5%)	290 (0.9%)	360 (1.8%)	471 (2.5%)	225 (2.5%)	1 333 (3.2%)	4 194 (7.9%)	108 (0.7%)	971 (2.4%)	25 560 (1.0%)
Lung	<=5 (3.5%)	412 (1.3%)	429 (2.1%)	637 (3.3%)	277 (3.1%)	1 476 (3.5%)	4 612 (8.7%)	150 (1%)	1 043 (2.5%)	39 210 (1.6%)
Skin	11 (7.8%)	3 350 (10.6%)	2 626 (13%)	2 521 (13.2%)	1 253 (13.8%)	5 579 (13.4%)	10 456 (19.7%)	1 234 (8.1%)	5 973 (14.6%)	228722 (9.3%)
Pancreas	<=5 (3.5%)	667 (2.1%)	594 (2.9%)	774 (4.1%)	357 (3.9%)	1 897 (4.5%)	5 920 (11.2%)	204 (1.3%)	1 393 (3.4%)	54937 (2.2%)
Any of the Above	24 (17.4%)	6324 (20%)	4541 (22.5%)	3 986 (20.9%)	2 074 (22.8%)	9 508 (22.8%)	15 267 (28.8%)	2125 (14%)	9624 (23.5%)	409389 (16.7%)
<sup>a</sup> Cell sizes less than 5 are suppressed for privacy reasons.										