



Canadian Blood Services
Société canadienne du sang

Supply of Human Allograft Tissue in Canada Preliminary Data Analysis

October 2009

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Background

The purpose of the National Survey for Supply of Human Allograft Tissue in Canada was to quantify the current supply of allograft tissue from the Canadian tissue banks and to collect information on the characteristics and capabilities of tissue banks. Information was requested on tissue bank functions, donor activity, tissue recovery, processing and distribution activity, staffing, transmissible disease testing, ancillary support and funding. Tissue banks were asked to provide activity data from the 2008 calendar year or the most recent fiscal year's data available. The scope of this survey included human allograft bone, soft tissue, cardiovascular, skin, and ocular tissues. Quebec's tissue banks were not included within the scope of the survey work. Where data is available from Quebec tissue programs, it is included within this report to provide the national perspective.

Purpose:

The purpose of this report is to provide key quantitative activity data from the analysis of the 2008 data to support solution design discussions. A final report will be prepared that will provide detailed information on all responses from each section of the quantitative survey and will also present the findings of the interviews conducted with Canadian tissue programs.

Overview

The survey was sent to tissue programs identified in previous CCDT survey work and from Health Canada's List of Registered Cells, Tissues and Organs (CTO) Establishments. 20 out of 23 active tissue programs completed the survey for an 87% response rate.

The classifications of tissue banks are as follows:

Comprehensive Tissue Banks (CTB) — banks that retrieve/process/distribute two or more distinct tissue types (with the exception of ocular)

Surgical Bone Banks (SSB) — banks that produce bone from surgical/living donors only

Musculoskeletal Tissue Banks — banks that produce bone and soft tissue from surgical and/or cadaveric donors

Eye Banks (EB) — stand-alone eye banks

Tissue Specific Banks (TSB) — banks that deal with one tissue type that is other than surgical bone or ocular tissue

The tissue banks were classified based on the 2008 activity data that was provided within the survey. One surgical bone bank, one tissue specific bank and one musculoskeletal tissue bank did not respond to the survey.

Table 1. Summary of Responses

Tissue Type	No. of Potential Responses	No. of Responses	Response Rate (%)
Comprehensive Tissue Banks	4	4	100
Surgical Bone Banks	8	7	88
Musculoskeletal Tissue Banks	4	3	75
Eye Banks	5	5	100
Tissue Specific Banks	1	2	50
Total	23	20	87

Limitations

It is important that limitations related to the information contained in this report, as well as the methods used to derive this information, are presented.

- Key project stakeholders and representatives from the tissue bank community evaluated the pilot survey prior to finalization. Enhancements were made to the final design and content of the surveys; however, all respondents may not have interpreted each question consistently.
- The data provided by the respondents is subject to any pre-existing limitations or errors in their own record keeping systems/processes.
- In certain cases respondents provided estimates, as the specific data requested was not available.
- In some cases questions were left blank as the data was not available and could not reasonably be estimated.

Donor Activity

Survey respondents reported a total of 4593 donors (1683 living and 2910 cadaveric donors). Of the 2910 cadaveric donors, 2380 (81.8%) were “ocular only” donors recovered by the 8 programs that recover ocular tissue. The remaining 530 donors (18.2%) were multi-tissue donors. Based on the responses provided, approximately 117 of the 2910 (4.0%) cadaveric donors were also organ donors.

In fiscal year 2007-2008, Héma-Québec reported a total of approximately 170 cadaveric donors from which musculoskeletal/cardiovascular and/or skin tissues were recovered¹. There are two ocular banks in Quebec that have recently come under the umbrella of Héma-Québec. No current donor activity data is available from these eye banks. There is one surgical bone bank operating in Quebec that is separate from Héma-Québec. Current data on the number of surgical bone donors in Quebec is not available.

Estimates on the donor activity from the three tissue banks that did not complete the survey are as follows:

- Surgical Bone Donors: 250
- Bone & Soft Tissue Donors: 50

Estimates are based on past survey data, discussions with tissue banks or provincial data.

Supplementing the survey data with the Quebec data and estimations of non-respondents it is estimated that there were 5063 Canadian donors in 2008 (1933 living and 3130 cadaveric donors).

Table 2. Donor Activity by Tissue Type

Tissue Type	No. of Donors	No. of Tissue Banks	% of Tissue Banks that Recover this Type of Tissue
Surgical Bone	1683	13	65%
Ocular Tissue	2670	8	40%
Bone and Soft Tissue	234	8	40%
Cardiac	125	8	40%
Skin	155	6	30%

¹ Héma-Québec 2007-2008 Annual Report.

Table 3 No. of Donors by Tissue Type and Province of Tissue Bank

Province	Surgical Bone (Living Donors)	Ocular Tissue	Bone and Soft Tissue	Cardiac	Skin
British Columbia	383	510	0	0	0
Alberta	671	271	59	16	60
Saskatchewan	219	28	8	12	0
Manitoba	0	111	69	16	42
Ontario	323 ^a	1484	2 ^a	56	0
New Brunswick	87	188	0	0	0
Nova Scotia	0	78	96	25	53
PEI	0	0	0	0	0
Newfoundland	0	0	0	0	0
Total	1683	2670	234	125	155

^a. The three non-responding tissue banks are located in Ontario impacting the number of donors in the surgical bone and bone and soft tissue categories.

Table 4 No. of Donors by Tissue Type and Province of Tissue Bank per Million Population²

Province	Surgical Bone (Living Donors)	Ocular Tissue	Bone and Soft Tissue	Cardiac	Skin
British Columbia	87	116	0	0	0
Alberta	187	76	16	4	17
Saskatchewan	216	28	8	12	0
Manitoba	0	92	57	13	35
Ontario	25 ^b	115	0 ^b	4	0
New Brunswick	116	252	0	0	0
Nova Scotia	0	83	102	27	56
PEI	0	0	0	0	0
Newfoundland	0	0	0	0	0

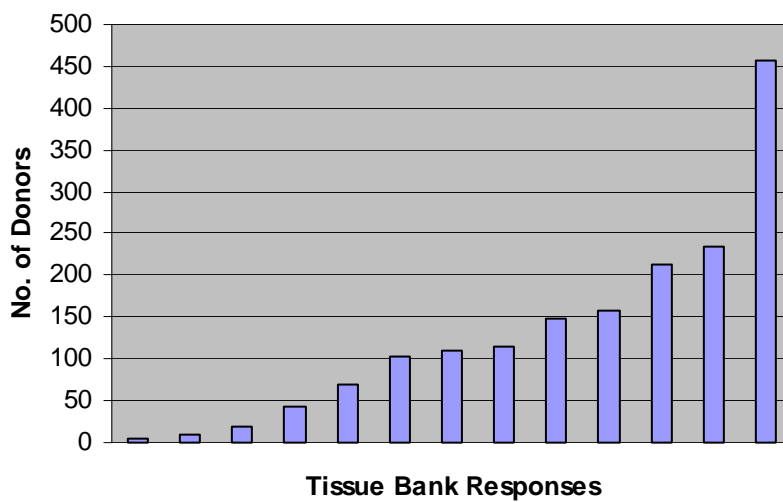
^b. The three non-responding tissue banks are located in Ontario impacting the number of donors in the surgical bone and bone and soft tissue categories.

² Statistics Canada, Population by year, province and territory <http://www40.statcan.gc.ca/l01/cst01/demo02a-eng.htm?sdi=population> 2009-09-06

Observations:

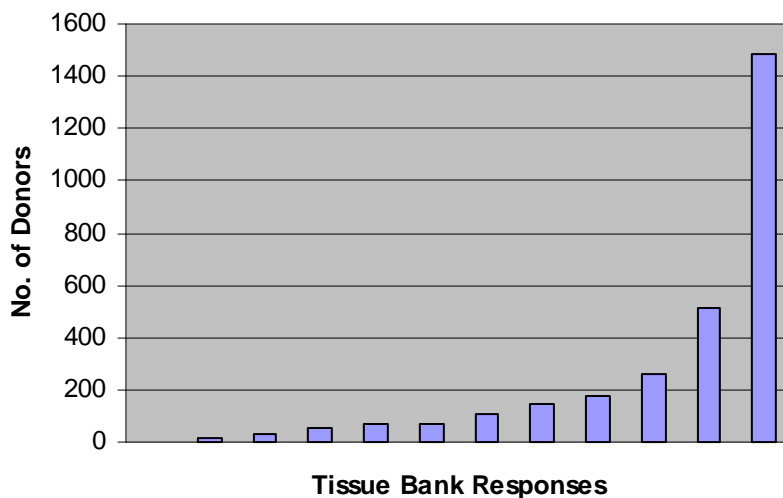
- Adjusting the numbers of donors for population provides insight into the referral, identification and recovery capabilities in each province.
- There are a high number of bone, cardiac and skin donors in Nova Scotia based on the population. However, a small percentage of donors classified as Nova Scotia donors within this report were identified in New Brunswick. Donor identification, screening and consent functions would be performed by the New Brunswick tissue programs for these donors.
- The three provinces with the highest number of ocular donors per population recover ocular tissue for education and research purposes. An analysis of the number of processed allografts (allografts suitable for transplantation) provides a more accurate picture of ocular tissue available for patient use.

Figure 1. Surgical Bone Recoveries from Living Donors



- Average: 129 surgical bone donors/tissue bank

Figure 2 Tissue Recoveries from Cadaveric Donors



- Average: 244 cadaveric donors/tissue bank.
- The two tissue banks with the highest number of cadaveric donors are eye banks.

Tissue Recovery

Table 5. Tissues Recovered

Tissue	No. of Tissues Recovered in 2008
Amniotic Membrane	9
Surgical Bone	1683
Bone and Soft Tissues	3143
Cardiovascular Tissue	249
Ocular Tissues	5300
Skin	N/A ^c
Total	10384

^c Skin is recovered in varying sizes limiting the ability to compare data. Data on skin will be presented in the graft processed and distributed sections.

Table 6. Comparative Analysis of Reporting Banks - Tissues Recovered: 2002 vs. 2008^d

Tissue	No. of Tissues Recovered in 2002	No. of Tissues Recovered in 2008	% Difference
Amniotic Membrane	3	9	+300.0
Surgical Bone	983	952	- 2.5
Bone and Soft Tissues	1841	3054	+65.9
Cardiovascular Tissue	541	237	-56.2
Ocular Tissues	4267	5300	+24.2
Skin	N/A ^c	N/A ^c	N/A ^c
Total	7528	9401	+24.9

^c Skin is recovered in varying sizes limiting the ability to compare data. Data on skin will be presented in the graft processed and distributed sections.

^d For the purposes of this analysis, only data from the tissue banks that provided information for the 2002 survey and the 2008 survey are included. Only one stand-alone surgical bone bank is included in this analysis; six out of the seven surgical bone banks listed in the 2002 report are no longer recovering and banking surgical bone. Surgical bone recovered by the comprehensive, musculoskeletal or tissue specific has been included. All four comprehensive banks provided data in both 2002 and 2008. All tissue banks processing ocular tissue and stand alone eye banks that provided data in 2008 also provided data in 2002. Two musculoskeletal banks and one tissue specific bank provided data in 2008 and also in 2002.

It is not clear from the 2003 Supply of Human Allograft Tissue in Canada – Final Report³ if ocular tissue recovered and used for research and education purposes was included in the recovery numbers. The 2008 tissue recovery data includes tissue recovered for educational and research purposes.

³ Supply of Human Allograft Tissue in Canada, 2003, Canadian Council for Donation and Transplantation

Observations:

- The amount of surgical bone recovered by the comprehensive, musculoskeletal or tissue specific banks has remained stable.
- The increase in bone and soft tissues recovered (+65.9%) can be attributed directly to an increase in tissue recoveries by the four comprehensive banks.
- There is a significant decrease in the number of donors where cardiovascular tissue is recovered (-56.2%).

Tissue Processing

In 2008, one comprehensive bank sent all recovered tissue to the United States for processing. The processing data shown in this section does not include the tissues that were processed in the United States by contract processors. There is no data available on the number of tissues processed in Quebec in 2008.

Table 7. Tissues Processed In Canada

Tissue	No. of Allografts
Ground and Chipped Cancellous Bone	1090
Cancellous Bone	473
Small Structural Grafts	139
Large Structural Grafts	586
Tendons	826
Soft Tissue	93
Cardiovascular Tissue	105
Skin (packages)	749
Ocular	3423 ^e .
Total	7556

^eOcular allografts used for research have been removed from this data. Some of the processed allografts may have been used for educational purposes.

It is important to note that if data was received from the three tissue banks that did not respond, the number of cancellous bone, small and large structural grafts, tendons, and soft tissue allografts processed would change significantly.

Table 8. Comparative Analysis of Reporting Banks - Tissues Processed in Canada: 2002 vs. 2008^f

Tissue	No. of Allografts Processed in 2002	No. of Allografts Processed in 2008	% Difference
Ground and Chipped Cancellous Bone	541	1084	+100.4
Cancellous Bone	678	473	-30.2
Small Structural Grafts	327	139	-57.5
Large Structural Grafts	771	553	-28.3
Tendons	395	783	+98.2
Soft Tissue	342	93	-72.8
Cardiovascular Tissue	289	105	-63.7
Skin	2189	749	-65.8
Ocular	2889	3423	+18.5
Total	8421	7402	-12.1

^f. For the purposes of this analysis, only data from the tissue banks that provided information for the 2002 survey and the 2008 survey are included. All four comprehensive banks provided data in both 2002 and 2008. Processing data from one comprehensive bank is not included as their tissue processing activities are contracted out to tissue processors in the United States. All tissue banks processing ocular tissue and stand alone eye banks that provided data in 2008 also provided data in 2002. Two musculoskeletal banks and one tissue specific bank provided data in both years.

Observations:

- There is only one comprehensive bank that is currently processing ground and chipped bone. This bank is processing over twice the number of ground/chipped bone that they processed in 2002.
- There was a decrease in the number of small structural grafts processed in each of the three comprehensive banks performing processing activities.
- The number of large structural grafts being processed by these three comprehensive banks remained stable. The decrease in large structural grafts (18.2%) can be attributed directly to the processing now occurring in the United States.
- Two comprehensive banks have significantly increased the number of tendons processed contributing to an overall twofold increase.
- The decrease in the numbers of processed cardiovascular tissue is consistent with the decrease in cardiovascular tissue donors.
- The significant decrease in skin processing activities may be attributed in part to the way the data was captured in 2002. In 2002, tissue programs were only asked for the number of "skin grafts" processed. In 2008, the total skin area (cm²) in each package was captured along with the number of packages processed to obtain more detailed data. For the 2008 data, the number of packages processed has been used as the "No. of Allografts" processed.
- If the data on skin allografts is removed from both years, the total number of allografts processed in all other categories increased by 6.8% from 2002 to 2008.

Table 9. No. of Tissues Processed in Canada by Province

Province	Ground and Chipped Cancellous Bone	Cancellous Bone	Small Structural Grafts	Large Structural Grafts	Tendons	Soft Tissue	Cardiovascular Tissue	Skin (packages)	Ocular
British Columbia	0	0	0	0	0	0	0	0	764
Alberta	0	282	9	282	364	42	17	543	415
Saskatchewan	0	0	0	33	43	0	0	0	93
Manitoba	0	0	0	0	0	0	0	0	172
Ontario	0	0	0	23	0	28	42	0	1433
New Brunswick	0	0	0	0	0	0	0	0	200
Nova Scotia	1084	191	130	248	419	23	46	206	346
PEI	0	0	0	0	0	0	0	0	0
Newfoundland	0	0	0	0	0	0	0	0	0
Total	1084	473	139	586	826	93	105	749	3423

Tissue Distribution

The majority of tissue banks distribute primarily within their health region or province. One comprehensive tissue bank is routinely distributing to all 10 provinces.

Table 10. Tissues Distributed by Canadian Tissue Banks for Patient Use

Tissue Type	No. of Allografts distributed by Survey Respondents	No. of Allografts distributed by Héma-Québec ¹ .
Femoral Heads from Surgical Bone	790	0
Ground and Chipped Bone	1040	245
Cancellous Bone	739	36
Small Structural Grafts	201	78 ^f
Large Structural Grafts	663	
Tendons	699	1 ^g
Soft Tissue	183	0
Cardiovascular Tissue	198	33
Skin	317	337
Ocular	3188	0
Amniotic Membrane	148	0
Total	8166	730

^f Héma-Québec's category is "Bone Grafts"; Grafts are not categorized as small or large structural grafts.

^g Héma-Québec began distributing tendons in March, 2008.

Based on tissue processing data from the 2003 Supply of Human Allograft Final Report⁴, the two Quebec eye banks distributed 379 ocular grafts in 2002. The 2006 Evaluation of Surgical Bone Banking and Utilization in Canada⁵ report notes that two surgical bone banks in Quebec released 350 femoral heads into usable inventory. Since there is only surgical bone currently operating in Quebec, we can estimate that between 100-200 femoral heads were distributed within Quebec.

Based on tissue processing data from the 2003 Supply of Human Allograft Final Report⁶, the three banks in Ontario that did not provide 2008 data distributed 1,694 grafts in 2002.

⁴ Supply of Human Allograft Tissue in Canada, 2003, Canadian Council for Donation and Transplantation

⁵ Evaluation of Surgical Bone Banking and Utilization in Canada. 2006, Canadian Council for Donation and Transplantation

⁶ Supply of Human Allograft Tissue in Canada, 2003, Canadian Council for Donation and Transplantation