Canadian Blood Services

BLOOD
PLASMA
STEM CELLS
ORGANS
& TISSUES

# Canadian Eye and Tissue Data Committee Report

## Canadian Eye and Tissue Banking Statistics

2020

Organs & Tissues for Life

Production of this report has been made possible through a financial contribution from Health Canada, and the Provincial and Territorial governments. The views expressed herein do not necessarily represent the views of the Federal, Provincial or Territorial governments.

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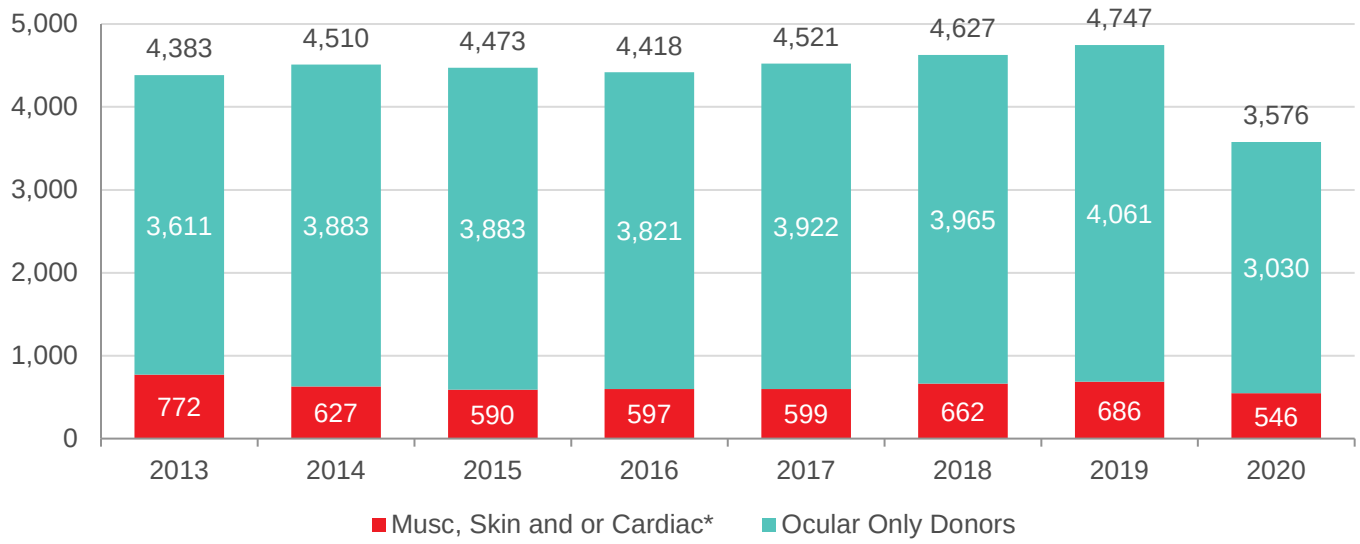
**Comments or questions?**

Comments or questions are welcome and can be sent to **otdt@blood.ca**. All suggestions will be considered for inclusion in future reports.

**This report is accessible online at**
https://professionaleducation.blood.ca

# Executive Summary

## Deceased donors by year




## System Performance Data

Beginning in 2012, Canadian Blood Services with coordination through the Eye and Tissue Data Committee (ETDC), has received data submissions from all Canadian eye and tissue programs. Data definitions were established, and data training delivered to the Canadian eye and tissue community prior to recite of data metrics.

Canadian Blood Services maintains and collates data for review by the ETDC. Each year a summary report is generated. The purpose of this report is to provide information and insights into the Canadian recovery, processing and distribution of ocular and tissue allografts across Canada.

Prospective data collection was initiated in 2012. In 2020, data was submitted from 16 eye and tissue banks and one recovery program representing a census of all Canadian eye and tissue banking activity (results were not available for select metrics for certain programs, as indicated). Data on allografts imported by Canadian tissue banks from the United States was available for the first time in 2016; however, data on allografts imported directly by Canadian hospitals from the United States is not readily available.

## National Results on Key Metrics

In 2020, Canadian eye and tissue banks received 56,335 deceased donor referrals for potential tissue donation, which represents a 3% decrease relative to 2019.Of those approached 55% consented to tissue donation, based on data from 6,709 approaches.

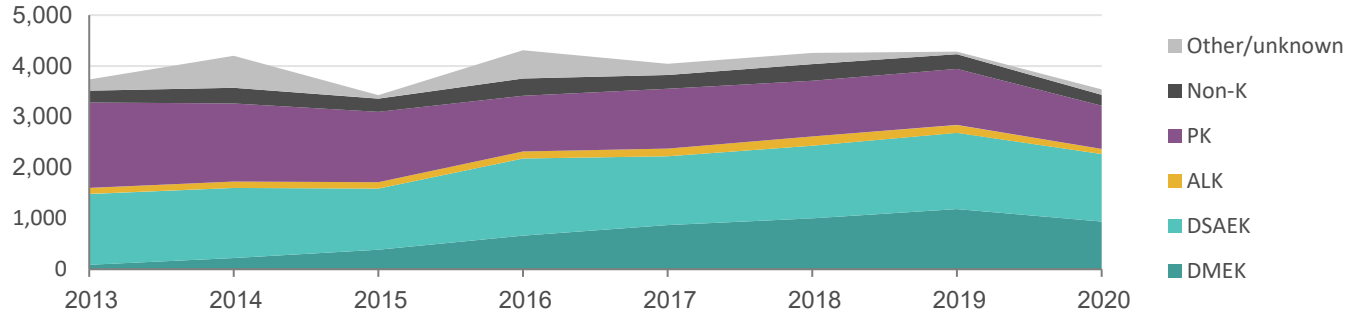
Hospitals were the referring agency for 86% of the potential donors for all deceased donors in 2020, the same percentage as in 2019. The second largest source, accounting for 5% of all referrals in 2020, was extended care facilities such as nursing homes and hospices.

In 2020, tissue was recovered from 3,576 deceased donors, representing a 25% decrease from the previous year. Tissue was recovered from 115 living donors, an equal amount as in 2019.

Results relating to ocular tissues in 2020 saw greatly reduced numbers compared to 2019, with a 25% decrease in the number of overall donors (n=3,457). This corelated to a 16% decrease in ocular tissue produced and released for transplant within 2020, seeing 4,028 corneas released for transplant.

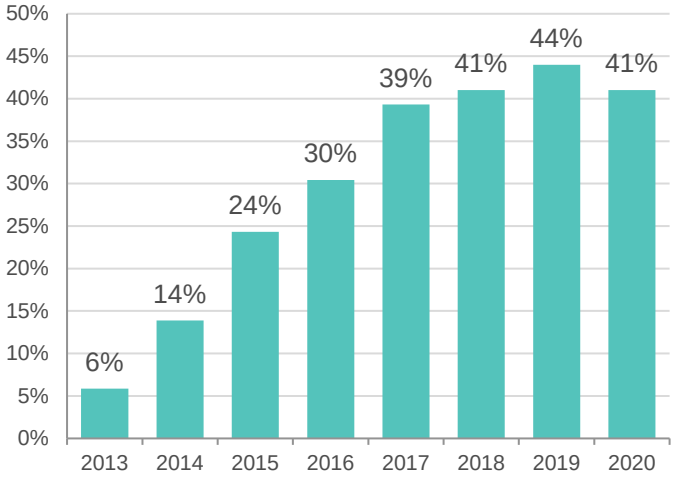
**Results include donors where ocular tissue was also recovered*

## Intermediate-term preserved cornea distribution




Cornea distribution for transplant, including penetrating keratoplasty (PK), endothelial keratoplasty (EK) and anterior lamellar keratoplasty (ALK) were reduced by 18% compared to 2019 distributions, with the precise differences being influenced by the number of cases in which the surgery type was not reported. In 2020, 9% of corneas distributed for transplantation were imported from the United States – an increase from 2019 of 5%.

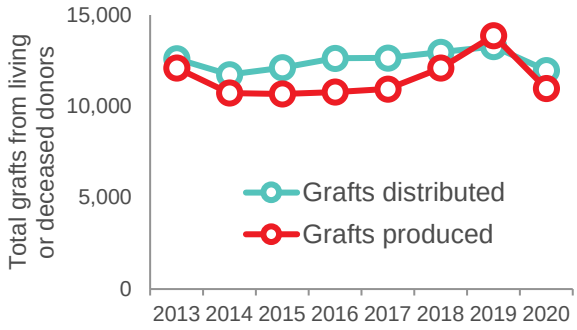
## Proportion of EK performed as DMEK




The demand for DMEK (Descemet's Membrane Endothelial Keratoplasty) has remained high. The total number of corneal grafts used for DMEK procedures decreased by 21% from 2019 levels, which is consistent with the overall reduction in cornea transplants in 2020.

*Results presented on this page reflect minor variations from previous reports due to additional quality assurance reviews and data reconciliation*

## Total musculoskeletal, skin, amnion, and cardiac tissue production and distribution




In 2020, there were 11,723 musculoskeletal, skin, amnion, and cardiac grafts produced and released to inventory nationally with 12,385 being distributed for transplant in total. The production of musculoskeletal, skin, amnion, and cardiac grafts decreased by 16% relative to 2019, while the total number distributed for transplant decreased by 7% from 2019 levels.

## Acknowledgements and Future Directions

This prospective data collection provides all jurisdictions with comprehensive analytics for tissue donation activity, processing productivity and distribution capacity of ocular and tissue grafts within Canada's tissue banking world, allowing the documentation of changes in system performance over the prospectus time frame; 2013-2020.

Canadian eye and tissue programs are to be commended on their leadership and their contributions to the collection and collation of system performance data. This data supports all programs and stakeholders in their valuable efforts to provide the donation and allograft services Canadians require.

## Table of Contents

# 1.0 Introduction

Canadian Blood Services received a mandate from Canadian federal, provincial, and territorial governments in 2008 for organ and tissue donation and transplantation. This mandate encompasses activities that contribute to the development of leading practices, professional education, public awareness, system performance and data and analytics. Aligning with its roles relating to managing the national supply of blood, blood products, stem cells, as well as a cord blood bank and related services for all provinces and territories (excluding Québec), Canadian Blood Services leads and provides support for an integrated, interprovincial system for donation and transplantation for all of Canada.

In 2012 the Canadian tissue community directed Canadian Blood Services to facilitate the development and implementation of national data collection, analysis, and reporting on national tissue donation, production, and distribution activity. This represents a milestone in the development of systematic monitoring of Canadian tissue banking activity. To oversee the collection, management and release of national data, an Eye and Tissue Data Committee (ETDC) was established in 2012; this committee is chaired by members of the tissue community and composed of representatives from each provincial tissue program as well as Canadian Blood Services representatives (see Appendix B). The ETDC encompasses two working groups who provide insight and recommendations to the larger committee in relation to data elements, data definitions (see Appendix A), data collection, data submission, quality assurance and training, collation, analysis and release and publication.

Prospective data collection was initiated in 2012 from all eye and tissue banks operating in Canada (see Appendix C for a list of contributing programs). Canadian Blood Services acts as the repository for the collected data and provides support for data management, analytics, and publication/reporting of results, in addition to providing secretariat and administrative services for the ETDC. This cooperative effort has enabled the development of multiple published products and stakeholder presentations. Results are provided by all Canadian eye and tissue banks operating in eight out of the thirteen provinces and territories and constitute a comprehensive census of tissue banking activity, with limited exceptions. A summary of products produced and or distributed by each eye and tissue banks is detailed. (see Appendix D).

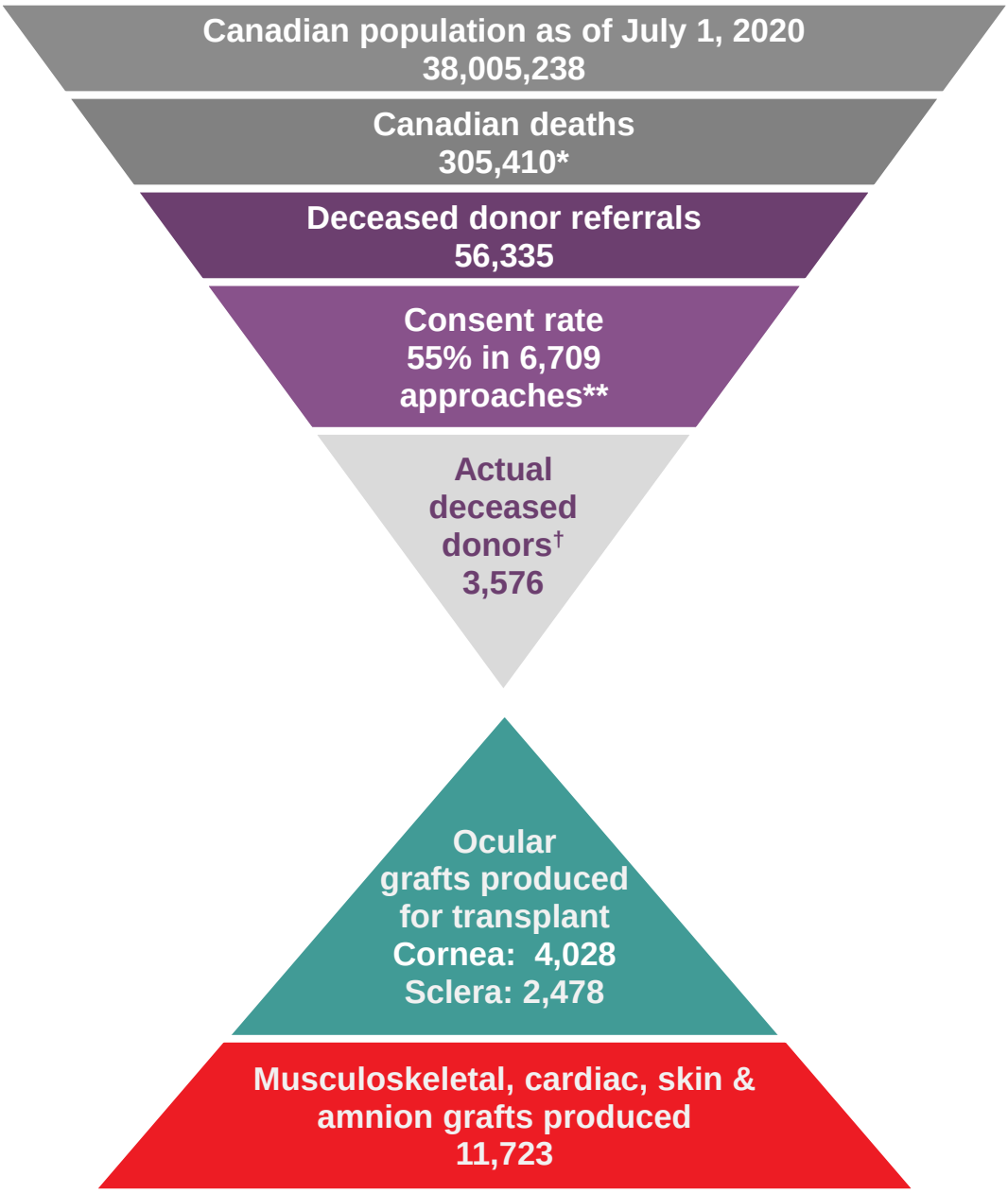
The value of this data to the community was recognized and validated with the 2017 publication *"Development of national system performance metrics for tissue donation, production, and distribution activity"* in the international Journal of Cell and Tissue Banking.

The results presented report on Canadian eye and tissue banking donation, production, and distribution statistics for Canadian eye and tissue banks for January 1 to December 31, 2020 as well as Canadian system activity for 2013 through 2020. This represents the first report for which data is available for seven consecutive years, allowing for insight into provincial and national trends will inform individual tissue bank operations and strategy.

Canadian Blood Services and the Eye and Tissue Data Committee would like to express our sincere appreciation to the members of the Canadian tissue community who participate in this data collection or the time and expertise they provide to the collection and collation of national activity data.

## 1.1 Canadian eye and tissue banks

# 2.0 Canadian view of tissue donation and transplantation, 2020




Population and death data sourced from Statistics Canada.
Chart adapted from the Australian Government, Australian Organ and Tissue Donation and Transplantation Authority, Annual Report 2013-2014, Figure 8: Australia's potential organ donor population.
*Source: Statistics Canada (Table 13-10-0768-01). This data is provisional at time of publication and subject to change,
**9 programs collect data on the number of approaches and consent rate; this data documented a 55% consent rate.
†Refers to donors from whom tissues were recovered following cardiac or neurological death. See Appendix A for definition.

# 3.0 Comparative analysis

## 3.1 Canadian eye and tissue banks

| Type of bank | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|
| Comprehensive tissue banks* | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 |
| Eye banks | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 |
| Musculoskeletal banks | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Skin banks | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Cardiac banks | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Surgical bone banks** | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Recovery*** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Total | 18 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |

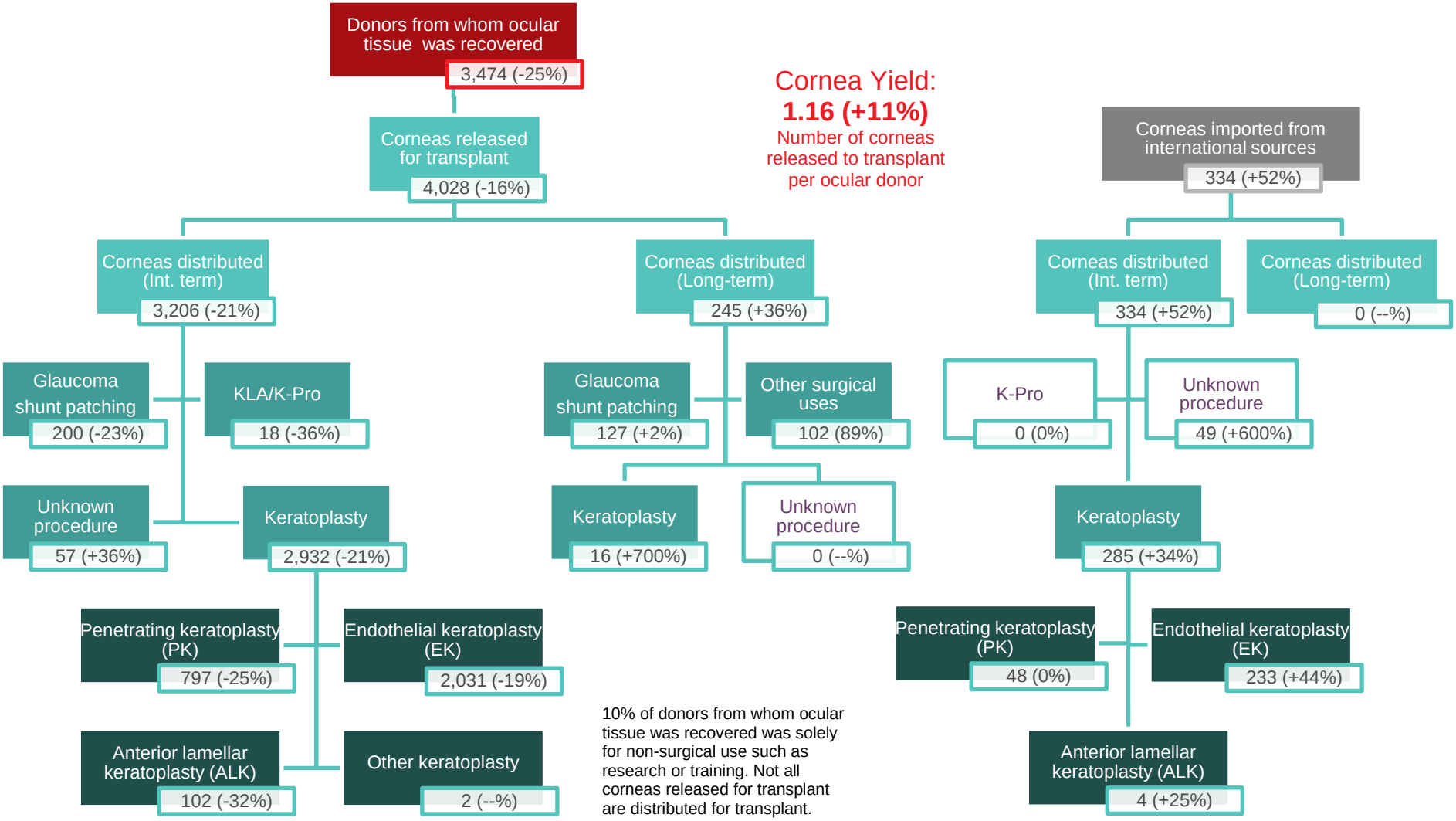
*Comprehensive is defined as recovering and processing more than one tissue type and reporting to a common administration.
**A surgical bone bank is defined as a bank which recovers only surgical bone. Some musculoskeletal and comprehensive banks recover surgical bone.
***A recovery organization provides tissue recovery services but does not process or distribute tissue.

## 3.2 Canadian eye and tissue banking activity

| Total Canadian activity* | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | % Change (2019-2020) |
|---|---|---|---|---|---|---|---|---|---|
| Deceased donor referrals | 41,594 | 45,154 | 46,381 | 45,609 | 50,506 | 53,925 | 57,968 | 56,335 | -3% |
| Total deceased donors from whom tissue was recovered | 4,383 | 4,510 | 4,473 | 4,418 | 4,521 | 4,627 | 4,747 | 3,576 | -25% |
| Donors where ocular tissue was recovered: includes for transplant and for research and training | 4,146 | 4,248 | 4,292 | 4,283 | 4,391 | 4,469 | 4,607 | 3,474 | -25% |
| Deceased donors where bone, cardiac and or skin was recovered | 772 | 627 | 590 | 597 | 657 | 662 | 686 | 546 | -20% |
| Surgical bone donors | 700 | 669 | 549 | 456 | 379 | 186 | 91 | 101 | 11% |
| Total intermediate-term preserved corneas distributed to transplant – keratoplasty and unknown procedure** | 3,504 | 3,891 | 3,162 | 3,969 | 3,820 | 3,926 | 3,991 | 3,323 | -17% |
| Musculoskeletal, skin and cardiac grafts processed and released into inventory from deceased donors | 11,297 | 9,709 | 9,856 | 9,731 | 10,032 | 11,328 | 13,344 | 10,794 | -20% |
| Musculoskeletal and amnion grafts processed and released into inventory from living donors | 718 | 1024 | 822 | 1,050 | 896 | 768 | 530 | 929 | 75% |
| All musculoskeletal, skin, cardiac, and amnion grafts processed and released into inventory (living and deceased donors) | 12,105 | 10,733 | 10,678 | 10,781 | 10,928 | 12,096 | 13,874 | 11,723 | -16% |
| Total musculoskeletal, skin, cardiac, and amnion grafts distributed to transplantation (living and deceased donors) | 12,605 | 11,740 | 12,119 | 12,632 | 12,652 | 12,963 | 13,276 | 12,385 | -7% |
| Total: All eye and tissue grafts produced and released into inventory (living and deceased donors) | 17,602 | 16,570 | 16,241 | 17,366 | 17,412 | 18,222 | 21,627 | 18,613 | -14% |
| Total: All eye and tissue grafts distributed to transplantation inventory (living and deceased donors) | 17,820 | 17,131 | 16,595 | 18,650 | 18,327 | 18,973 | 19,825 | 18,139 | -9% |

*Some minor variation of totals from previous reports due to additional quality assurance reviews and data reconciliation
** Data limitations: Intermediate-term corneas that were distributed with the end use identified as “unknown” was included with the total keratoplasty procedures, as the majority of corneas are used for keratoplasty. The following number of corneas were reported as “unknown”: n=106 (2020). n=349 (2019), n=219 (2018); n=230 (2017); n=555 (2016); n=64 (2015); n=632 (2014); n=220 (2013)

## 3.3 Cornea processing and distribution in 2020, with % change from 2019




10% of donors from whom ocular tissue was recovered was solely for non-surgical use such as research or training. Not all corneas released for transplant are distributed for transplant.

*Some minor variation of totals from previous reports due to additional quality assurance reviews and data reconciliation

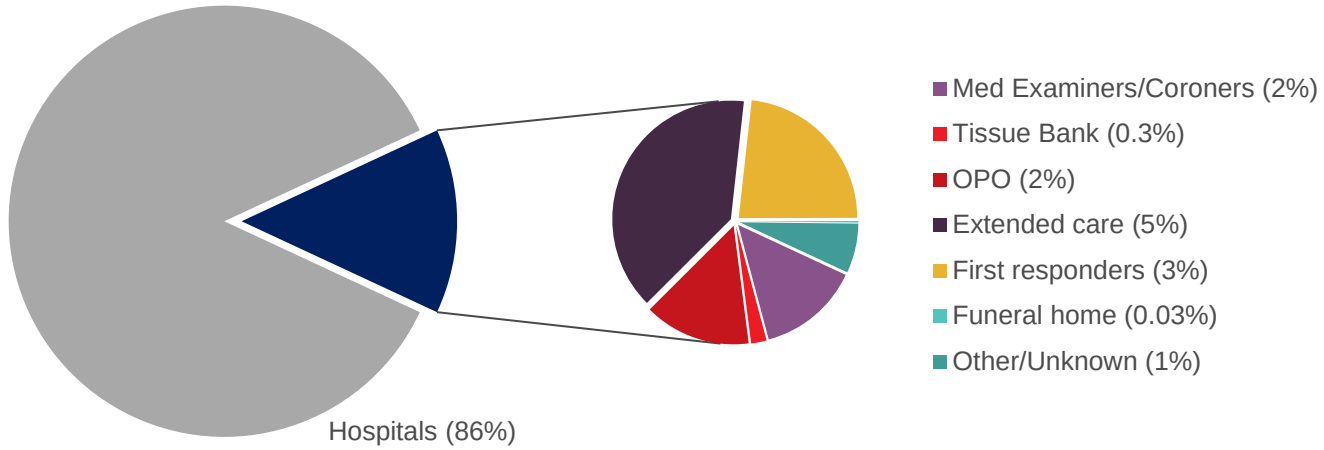
# 4.0 Canadian eye and tissue banking deceased donation activity, 2020

## 4.1 Total donor referrals

A total of 56,335 deaths were identified and referred for initial screening and consideration of tissue donation potential in 2020, a 3% decrease from 2019 (n=57,968) and an 4% increase from 2018 (n=53,925). Approximately 14% of realized donors in 2020 were non-hospital referrals, which is consistent with 2019 and 2018 results.

**Actual donors by source**

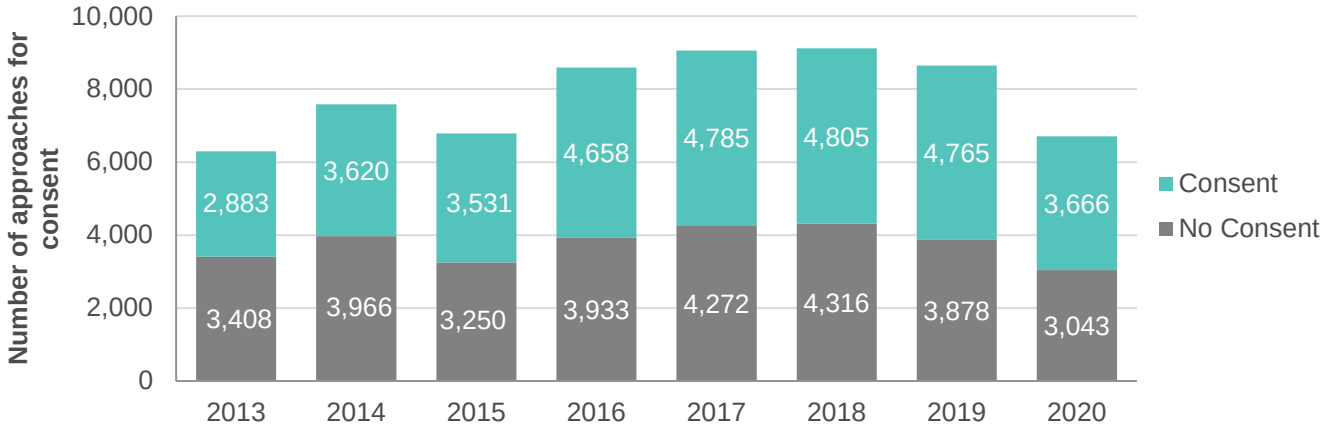
n=3,421



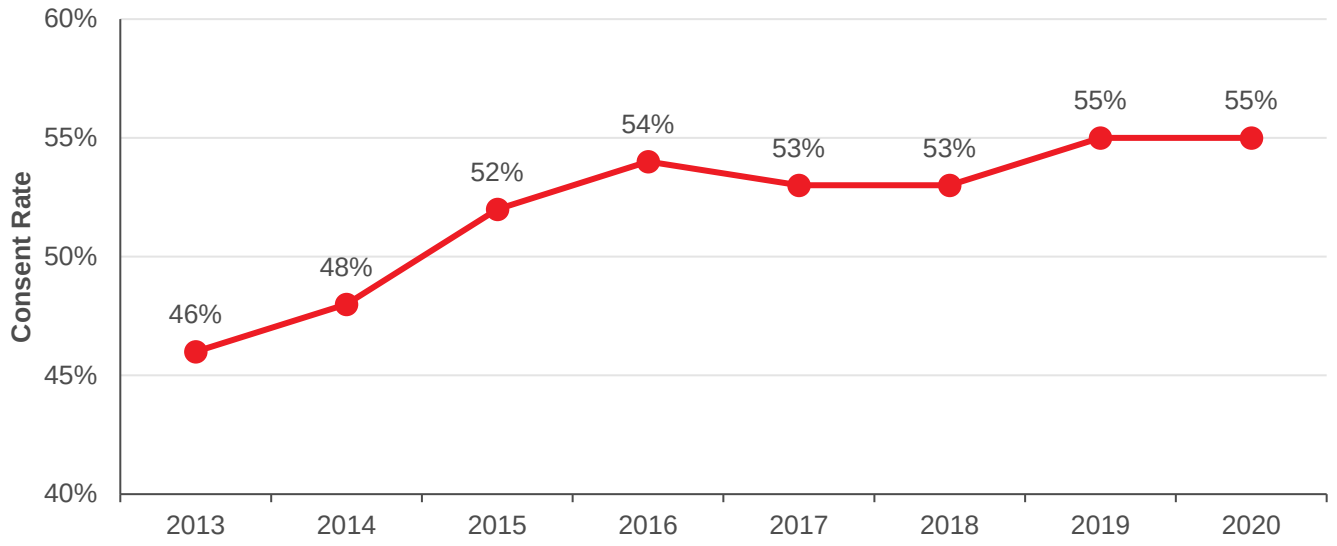

## 4.2 Consent Rate

In 2020, nine programs provided data on 6,709 approaches for deceased tissue donation. This was a decrease of 22% from 2019 (n=8,643). A consent rate of 55% was identified, the same consent rate as in 2019 which remains the highest consent rate to date.

**Approaches and consents for tissue donation (all programs excluding Québec)**



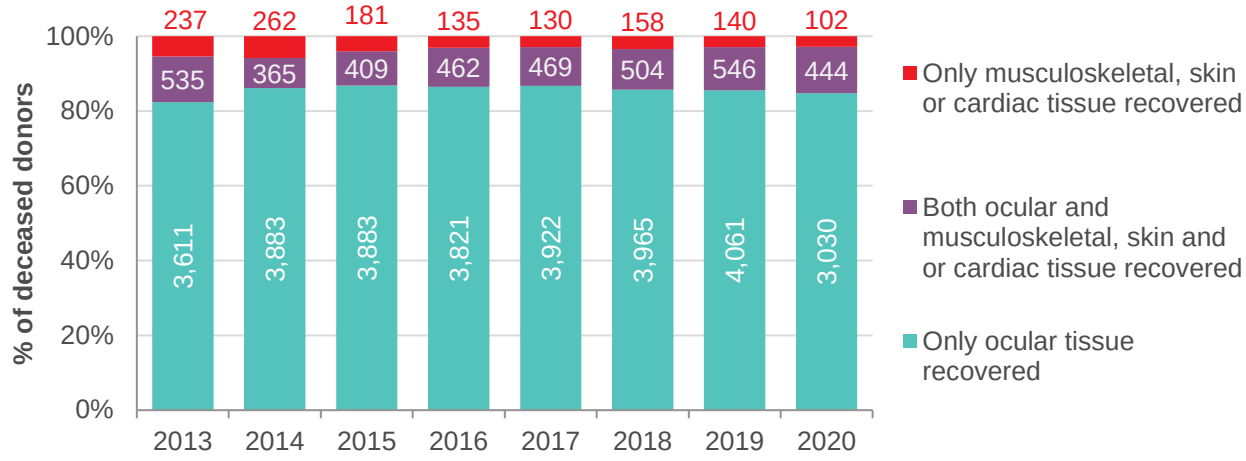
**Consent rate for tissue donation (all programs excluding Québec)**




## 4.3 Deceased donor: national analysis

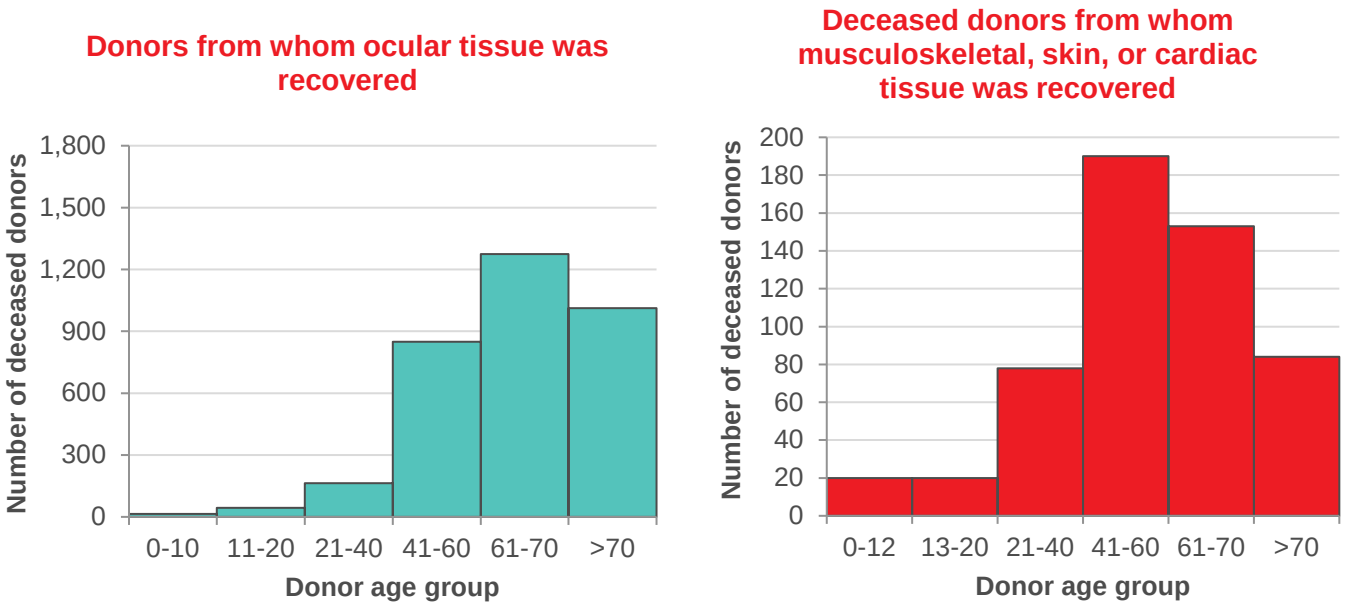
In 2020, there were 3,576 consented deceased donors from whom tissue was recovered in Canada, a decrease of 25% from 2019 (n=4,747) and a decrease of 23% from 2018 (n=4,627). 84.7% of these donors were ocular-only donors, a slight decrease from 2019 (85.5%) and 2018 (85.7%).

**Deceased donors by tissue type**




In 2020, the total number of consented deceased donors from whom tissue was recovered represented the lowest number of donors since data collection began in 2013. Before 2020, national year-to-year variation in deceased donors had been limited, averaging 4,526 donors per year over 2013-2019.

## **Deceased tissue donor age distribution,** 2020

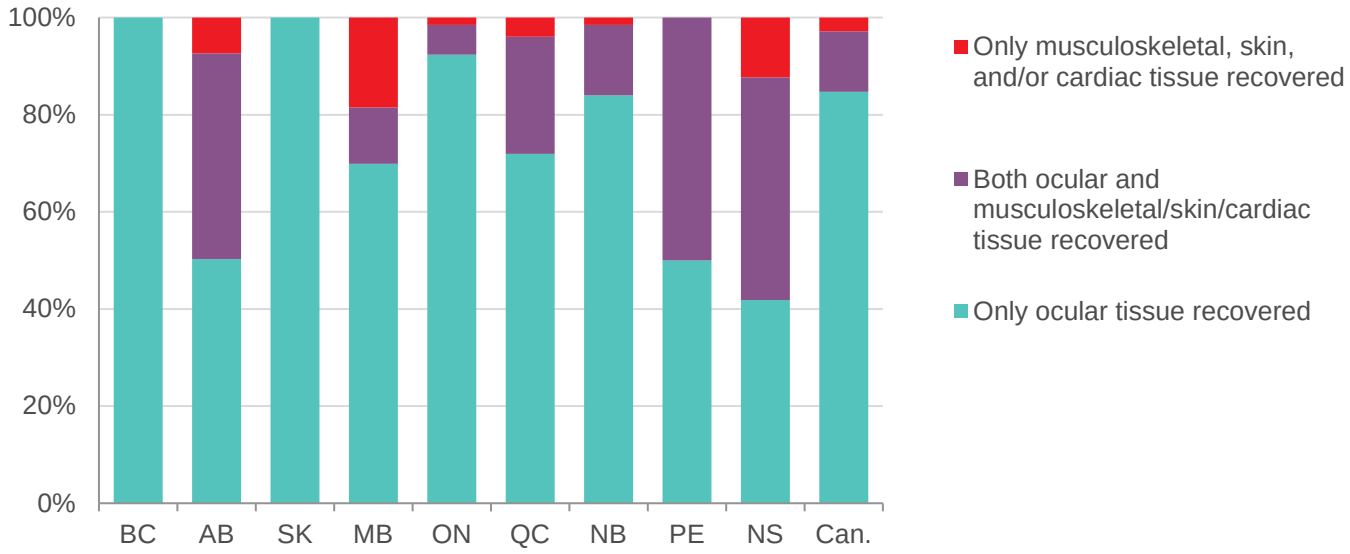



Age data available for 3,458 deceased donors (97% of total)

The age distributions for deceased donors in 2020 are essentially equivalent to the respective age distributions in the previous year.

# 4.4 Deceased donor: 2020 provincial analysis

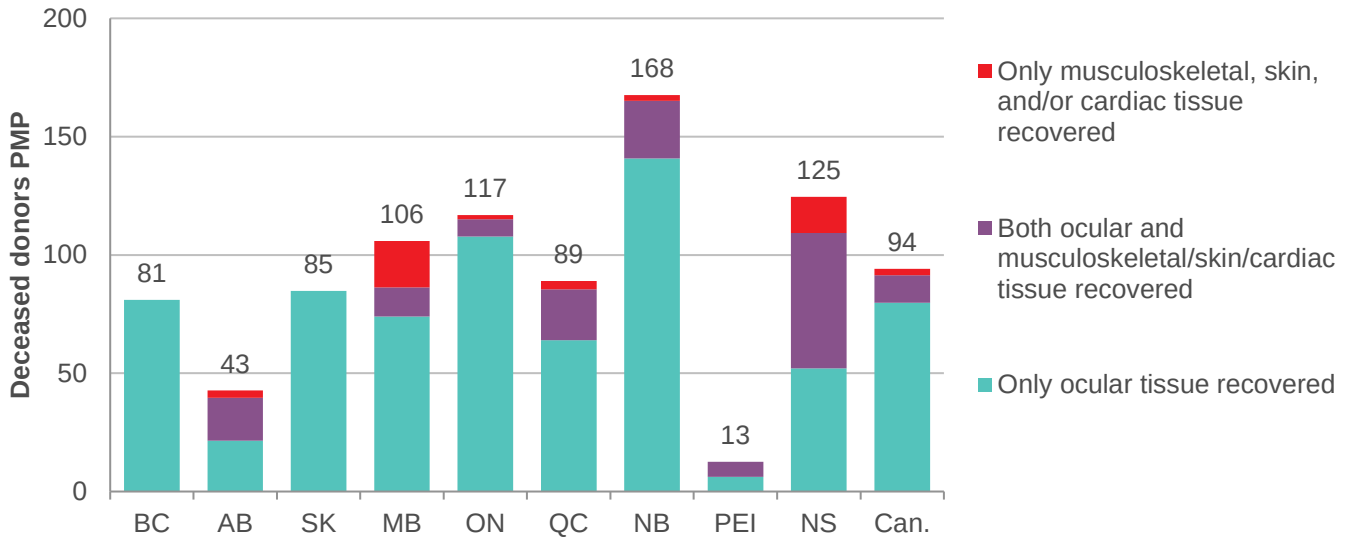
## **Deceased donors by tissue type recovered**




PE results reflect PE donors whose recoveries were performed by the NS program. NB donors whose recoveries were performed by the NS program are included in NB results.

## Total deceased tissue donors

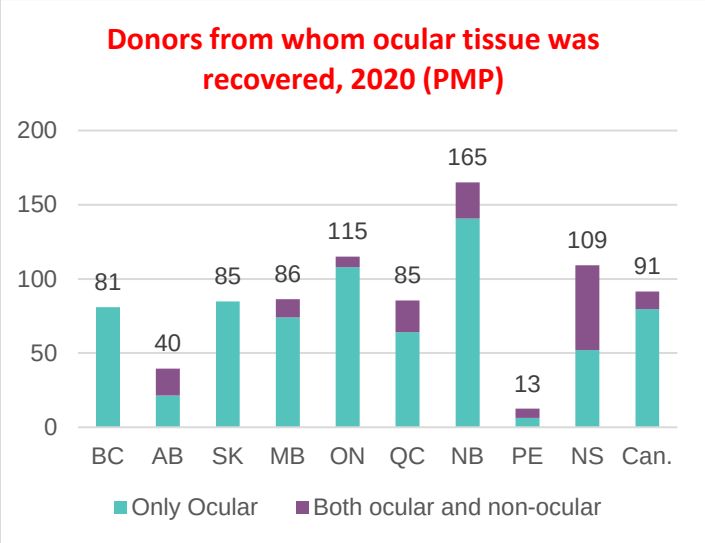
Results per million population (PMP)

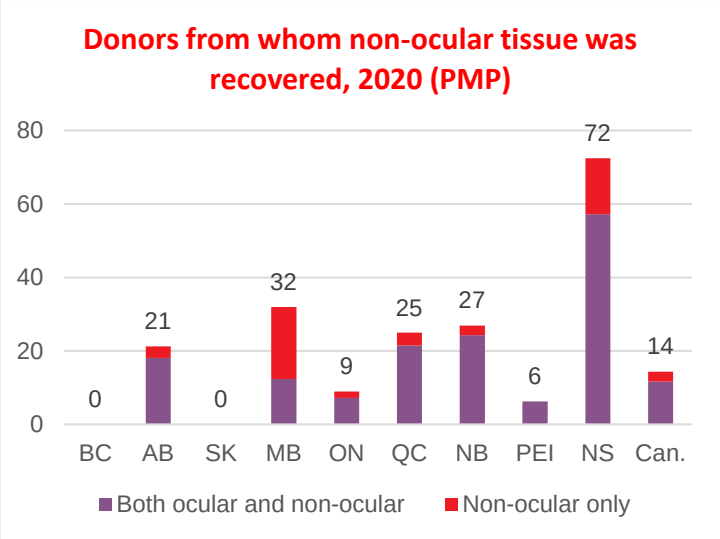



Musculoskeletal, cardiac, and skin tissue is not recovered in BC, SK, or NL. Per million population rates based on Statistics Canada population estimates by province as of July 1, 2020 (Table 17-10-0009-01). PE results reflect PE donors whose recoveries were performed by the NS program. NB donors whose recoveries were performed by the NS program are included in NB results. National rates are based on the entire national population.

## Deceased tissue donors by tissue recovered

Results per million population (PMP)



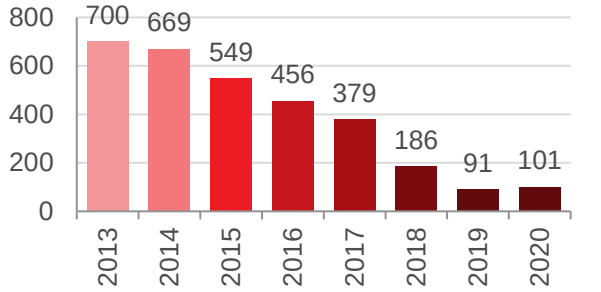

Musculoskeletal, cardiac, and skin tissue is not recovered in BC, SK, or NL. Per million population rates based on Statistics Canada population estimates by province as of July 1, 2020 (Table 17-10-0009-01). PE results reflect PE donors whose recoveries were performed by the NS program. NB donors whose recoveries were performed by the NS program are included in NB results. National rates are based on the entire national population.

# 5.0 Canadian eye and tissue banking living donation activity

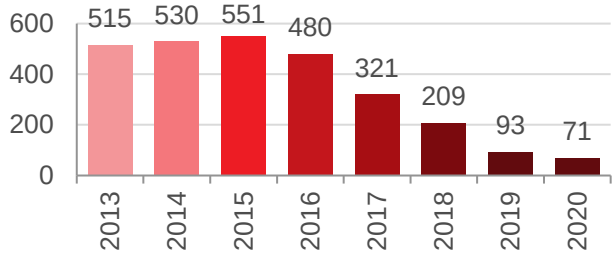
## 5.1 Surgical bone donation

In 2020, the Comprehensive Tissue Centre in Edmonton and the Southern Alberta Tissue Program reported recovering bone from living donors; this involves recovering femoral heads during total hip replacement surgery. In 2020, the number of surgical bone donors increased 11%, in contrast to the previous trend of decreasing living donor bone recovery.

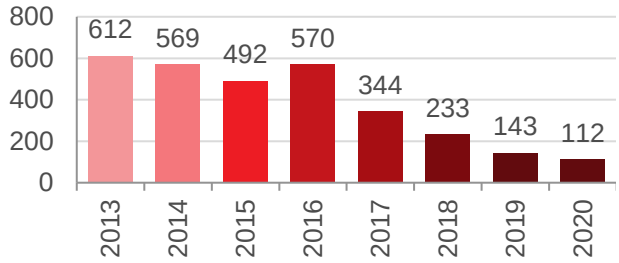
### Surgical bone recoveries (donors)




### Surgical bone released into inventory



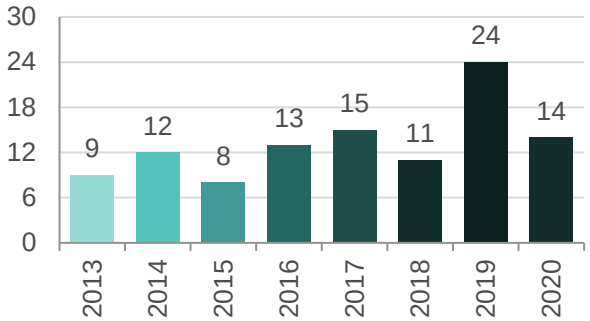

### Surgical bone distributed



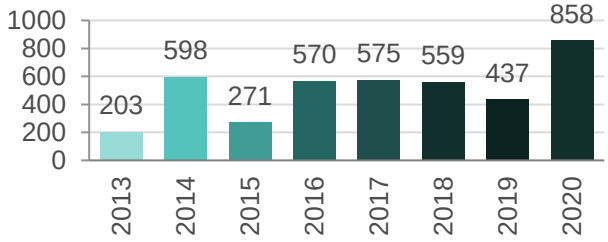

## 5.2 Amnion donation

In 2020, amnion living donation and distribution activity is reduced compared to 2019. However, production of amnion grafts reached the highest level recorded in 2020.

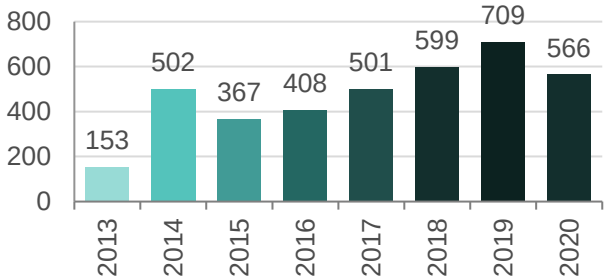
### Amnion donors




### Amnion released into inventory

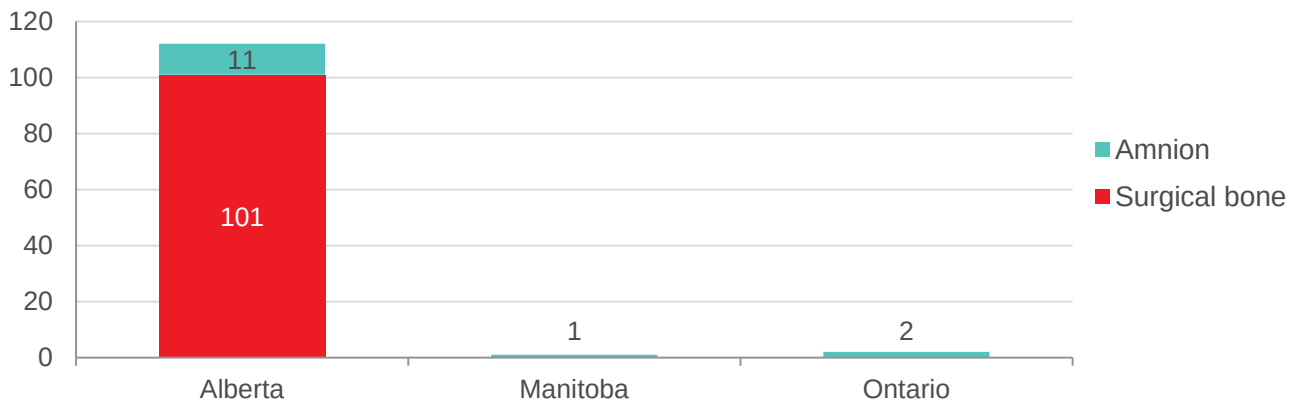



### Amnion distributed

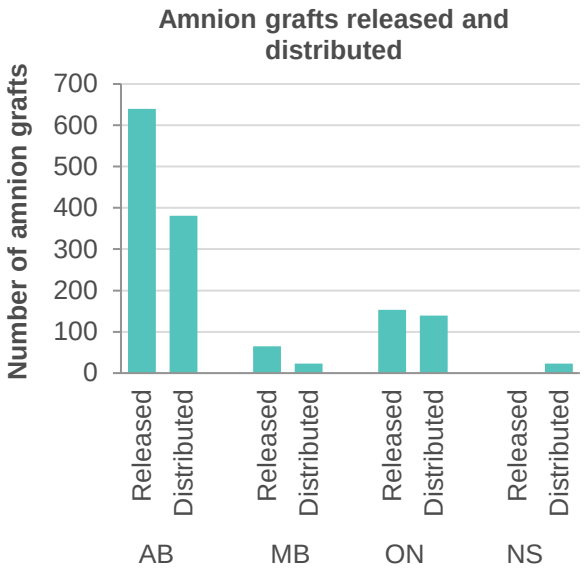


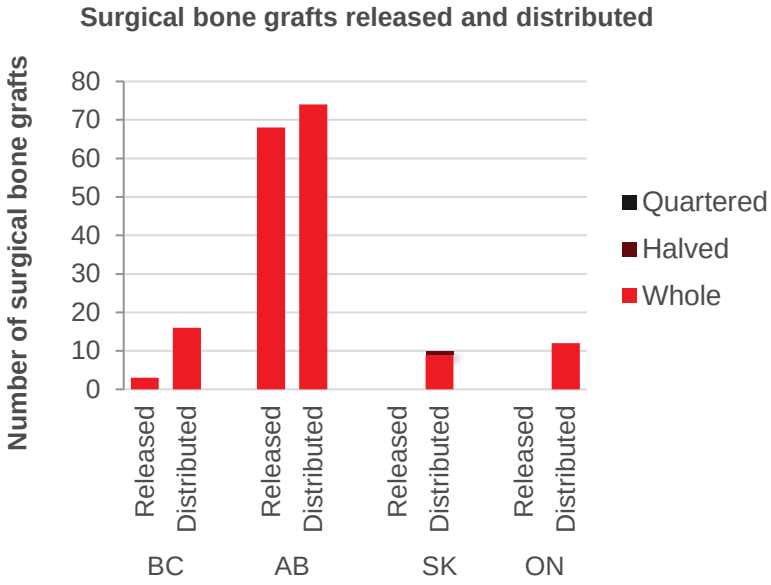
## 5.3 Living donation: 2020 provincial analysis

### Living donors from whom tissue was recovered




### Living donor surgical bone and amnion released and distributed



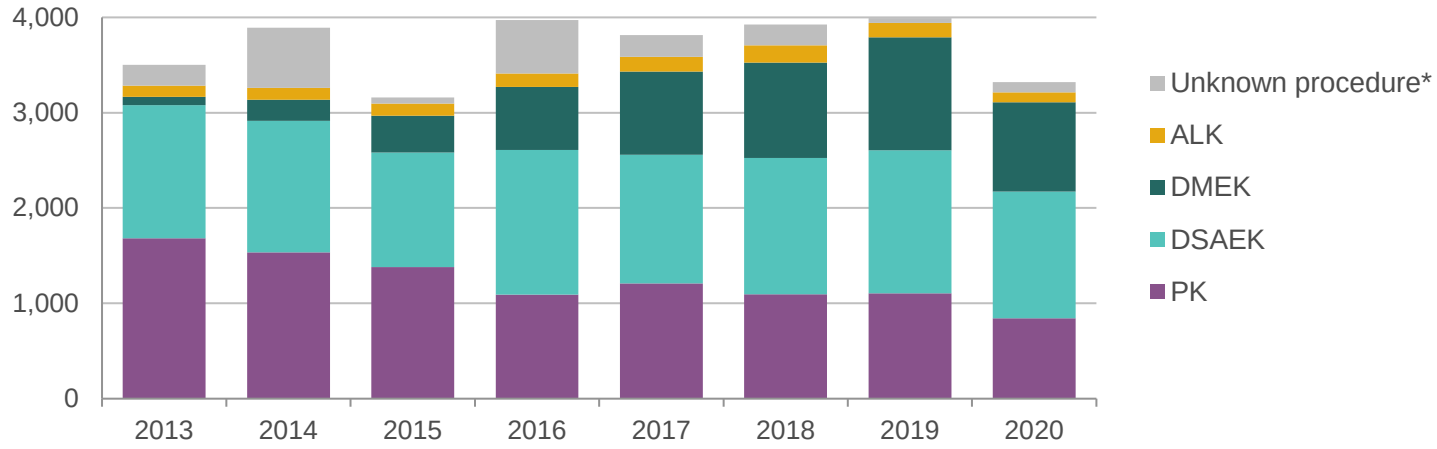



# 6.0 Canadian eye and tissue production and distribution activity, 2020

## 6.1 Total corneas distributed for transplant

In 2020, Canadian eye banks distributed 3,786 corneas for surgical use, including 3,541 intermediate-term preserved corneas of which 3,217 were known to have been utilized for penetrating, endothelial, or anterior lamellar keratoplasty. This represents a 18% decrease from the 3,942 corneas distributed for these types of keratoplasty in 2019. In addition, sixteen long-term preserved corneas sourced in Canada were also distributed for keratoplasty, although the keratoplasty type was not available in these cases. The final use could not be determined for an additional 106 corneas in 2020, an increase from what was seen in 2019 (n=49). It is likely that these were used for keratoplasty, but the procedure type was not recorded. In 2020, 218 intermediate-term preserved corneas were utilized in non-keratoplasty procedures including K-Pro, keratolimbal allografts, and glaucoma shunt patching.

**Intermediate-term preserved cornea distribution for keratoplasty**



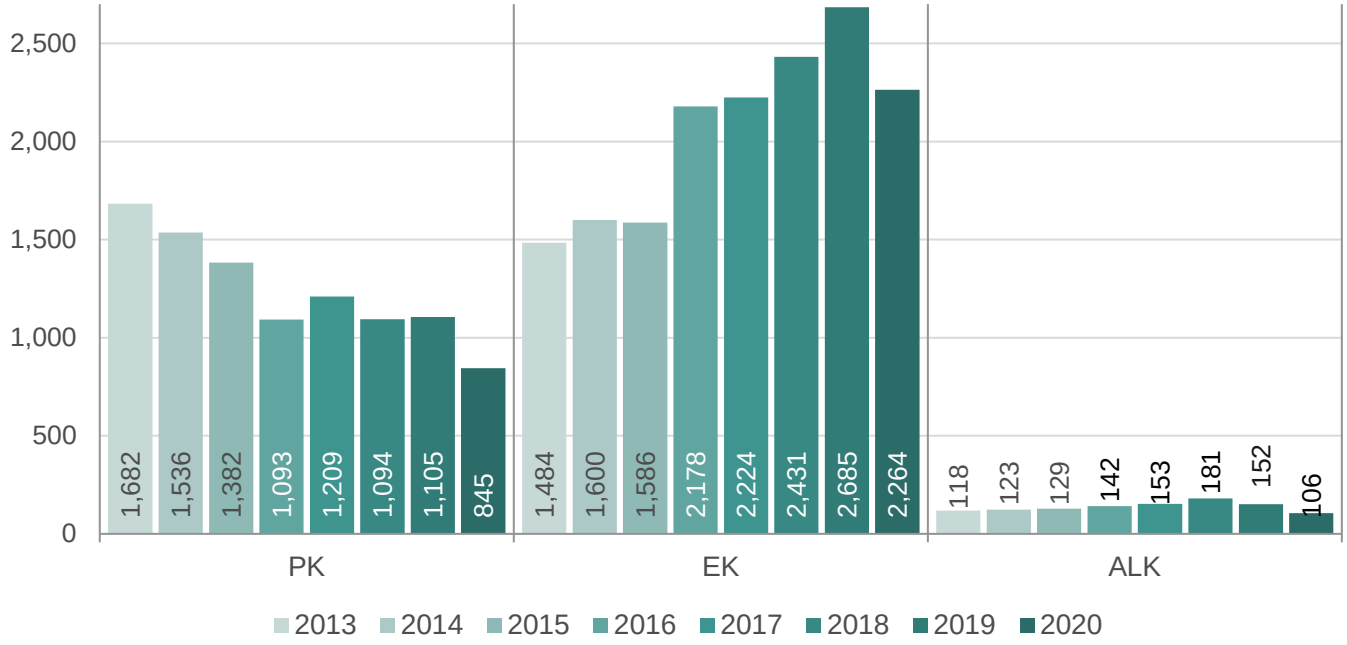

*Unknown cases reflect cornea distributions for which the keratoplasty type was not available, and may include non-keratoplasty procedures
**Some minor variation of totals from previous reports due to additional quality assurance reviews and data reconciliation

**Not shown:**
2020: Two corneas distributed for keratoplasty other than PK, DMEK, DSAEK, or ALK.
2018: One cornea distributed for keratoplasty other than PK, DMEK, DSAEK, or ALK.
2017: Five corneas distributed for keratoplasty other than PK, DMEK, DSAEK, or ALK, including one case in which the cornea was distributed for an EK procedure other than DMEK/DSAEK.
2016: One cornea distributed for keratoplasty other than PK, EK, or ALK.
2015: One cornea distributed for keratoplasty other than PK, EK, or ALK.
2013: One cornea distributed for EK for which specific procedure type could not be determined.

Of all cornea transplants performed in Canada in 2020 for which the keratoplasty type could be determined, 70% were for EK, which continues the increasing trend of keratoplasty being performed as EK. The proportion of EK was 68% in 2019 and 66% in 2018.

In 2020, six Canadian eye banks (Eye Bank of British Columbia, Eye Bank of Ontario, Héma-Québec's Banque d'yeux du Québec & Banque d'yeux du CUO, Eye Bank of Saskatchewan, Nova Scotia's Regional Tissue Bank, and the Lion's Eye Bank in Alberta) provided processing service, with all six providing precutting service for DSAEK. Four centres (the Comprehensive Tissue Centre in Alberta, the Regional Tissue Bank of Nova Scotia, Eye Bank of Ontario, and Québec's Banque d'yeux du Québec & Banque d'yeux du CUO) provided pre-stripping service for DMEK. In remaining regions, the processing is completed by the surgeon in the operating room.

**Intermediate-term preserved cornea transplants by procedure type**




*Some minor variation of totals from previous reports due to additional quality assurance reviews and data reconciliation

**Not shown:**

2020: Two corneas distributed for keratoplasty other than PK, DMEK, DSAEK, or ALK.
2018: One cornea distributed for keratoplasty other than PK, EK, or ALK.
2017: Four corneas distributed for keratoplasty other than PK, EK, or ALK.
2016: One cornea distributed for keratoplasty other than PK, EK, or ALK.
2015: One cornea distributed for keratoplasty other than PK, EK, or ALK.

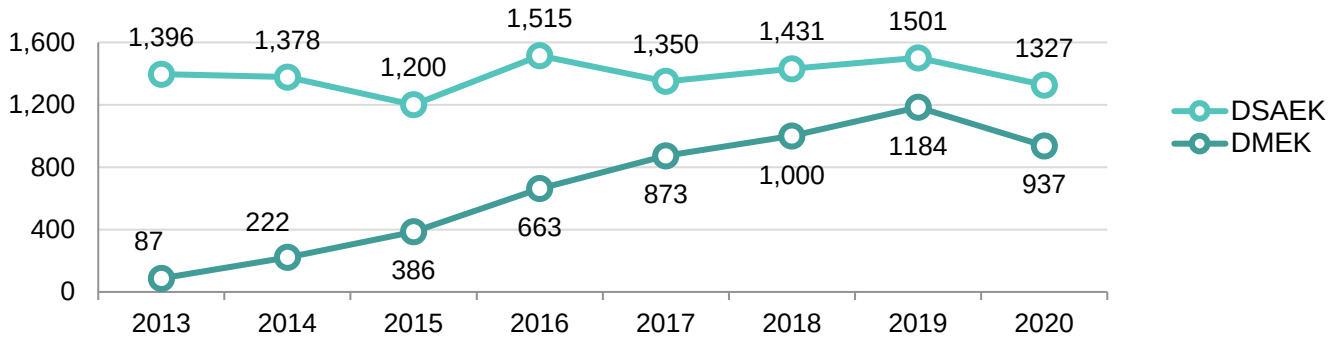
There was a reduction in all types of keratoplasty in 2020; this is consistent with the overall reduction of corneas distributed for all types of surgery. The number of intermediate-term preserved corneas distributed for PK decreased by 24%, corneas distributed for EK decreased by 16%, and corneas distributed for ALK decreased by 30% compared to 2019 levels. This is in contrast to the trends seen between 2015-2019, when PK and ALK were relatively stable and EK was increasing at an average rate of 6% per year.

## 6.2 Types of endothelial keratoplasty

In EK, either the eye bank prepares the corneal tissue prior to surgery, or the surgeon prepares the corneal tissue in the operating room, removing specific layers of the cornea. Preparation or pre-cutting can be done manually (peel) or with a microtome (automated). There are two common methodologies; in Descemet's Stripping (automated) Endothelial Keratoplasty (DSAEK), the prepared (cut) graft is comprised of the donor tissue endothelium, the Descemet's membrane, and a thin, partial layer of the donor tissue's stroma. Descemet's Membrane Endothelial Keratoplasty (DMEK) involves the transplantation of only the Descemet's membrane and endothelial layer of the cornea. The DMEK peel is a more technically challenging procedure than DSAEK and has been reported to provide better post-transplant patient visual acuity, lower rejection rates and faster visual recovery.

The demand for DMEK remains high. In 2020, 41% of corneas known to have been used for EK procedures were used for DMEK.

**Types of endothelial keratoplasty**

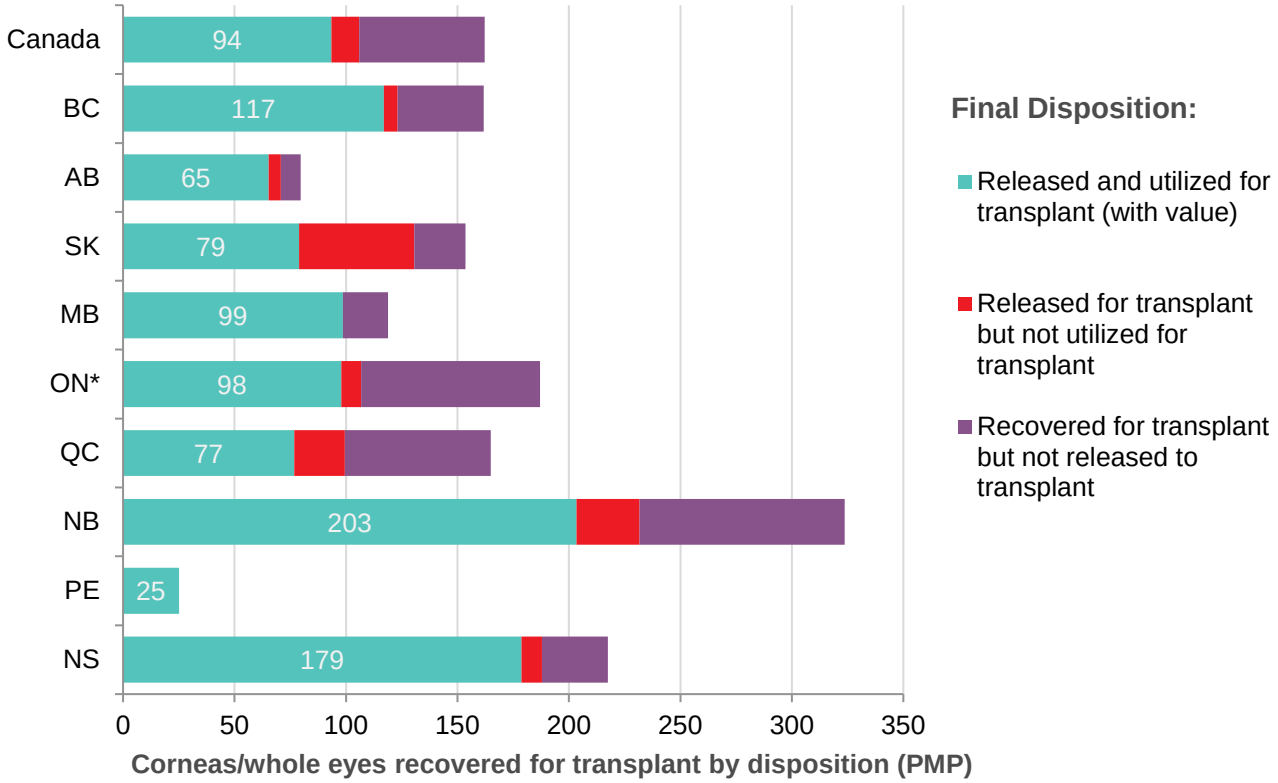



*Some minor variation of totals from previous reports due to additional quality assurance reviews and data reconciliation
Not shown: 1 cornea distributed for EK for which specific procedure type could not be determined (2013). In 2020, 106 intermediate-term corneas were distributed with the end use identified as "unknown" compared to 49 in 2019, 219 in 2018, 230 in 2017,555 in 2016, 64 in 2015, 632 in 2014, and 220 in 2013. The high number of unknowns impacts the acuity of this data.

## 6.3 Ocular tissue production and distribution: 2020 provincial analysis

### Corneas/whole globes recovered with the intention for transplant

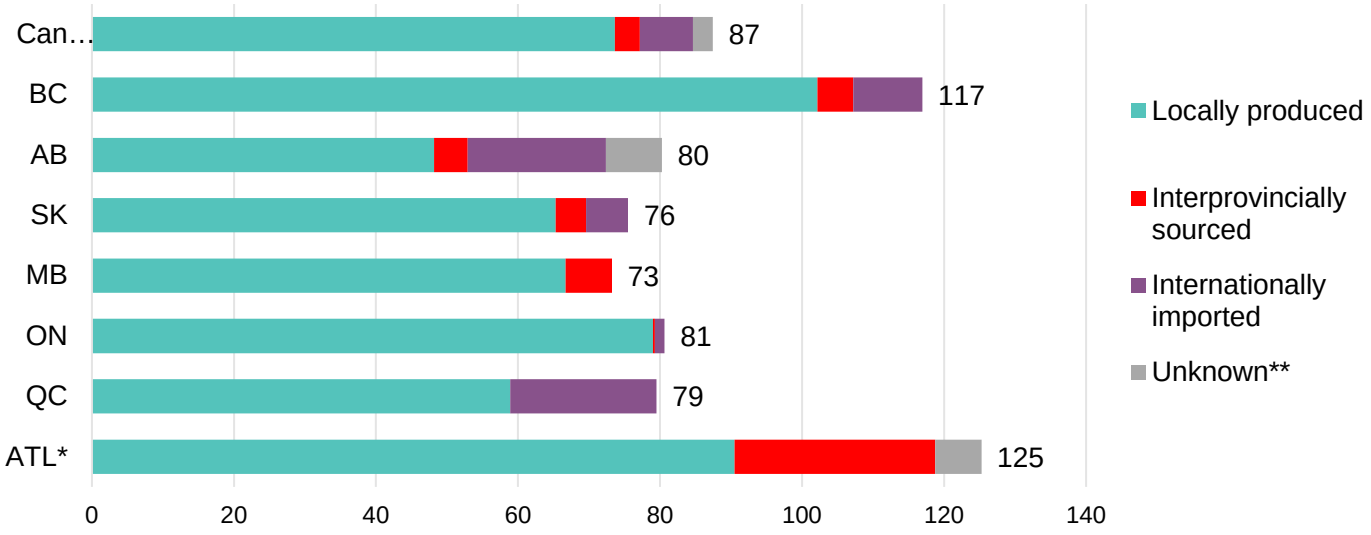
Results per million population (PMP)




*Ontario does not determine intention for transplant prior to recovery; Ontario results reflect all cornea/globe recoveries.
NL donors were at one time processed by the NB program; however, as of the time of this report, NL donor recoveries were not being processed. As such, the NL population is not included in the NB recovery rate. PE results reflect PE donors whose recoveries were performed by the NS program; NB donors whose recoveries were performed by the NS program are included in NB results. Per million population rates based on Statistics Canada population estimates by province as of July 1, 2020 (Table 17-10-0009-01 ). National rate is based on the entire national population, including NL, YT, NT, and NU.

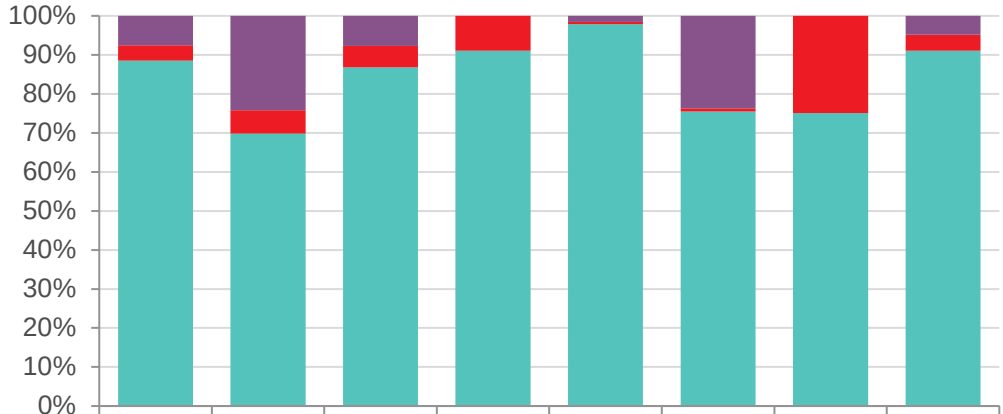
### Intermediate-term preserved corneas distributed for keratoplasty

Results per million population (PMP)




*Atlantic patients are transplanted in Nova Scotia and New Brunswick; rate calculation includes populations of all Atlantic provinces (NS, NB, PE, and NL).
**Unknown cases reflect cornea distributions for which the procedure type was not available and may include non-keratoplasty procedures. Results presented do not include long-term preserved cornea distribution.
Per million population rates based on Statistics Canada population estimates by province as of July 1, 2020 (Table 17-10-0009-01). National rate is based on the entire national population, including NL, YT, NT, and NU.

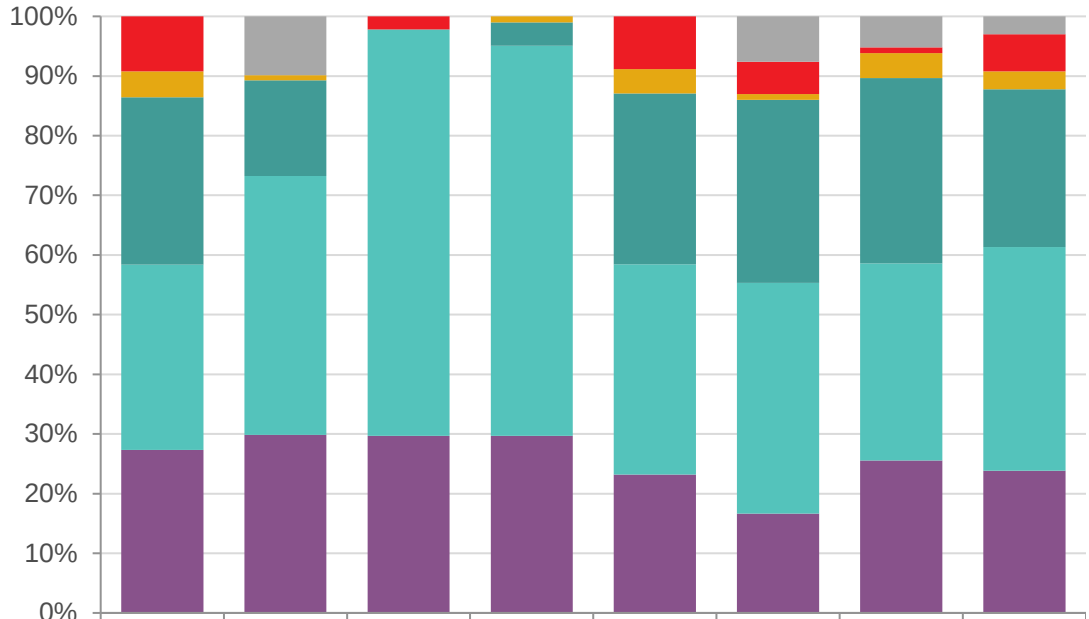
## Source of intermediate-term preserved corneas distributed for surgical use




| | BC | AB | SK | MB | ON | QC | ATL* | Can. |
|---|---|---|---|---|---|---|---|---|
| Imported from another country | 50 | 86 | 7 | 0 | 20 | 171 | 0 | 163 |
| Sourced from another Canadian eye bank | 26 | 21 | 5 | 9 | 8 | 6 | 77 | 138 |
| Local | 587 | 248 | 79 | 92 | 1,273 | 544 | 232 | 3,055 |

* Atlantic patients are transplanted in Nova Scotia and New Brunswick
Corneas sourced from another Canadian eye bank in Alberta include corneas transferred between Alberta eye banks. Results presented do not include long-term preserved cornea distribution.

## Intermediate-term preserved corneas distributed for surgical use by type of surgery




| | BC | AB | SK | MB | ON | QC | ATL* | Can. |
|---|---|---|---|---|---|---|---|---|
| Unknown/Unspecified | 0 | 35 | 0 | 0 | 0 | 55 | 16 | 106 |
| Other** | 61 | 0 | 2 | 0 | 115 | 39 | 3 | 220 |
| ALK | 29 | 3 | 0 | 1 | 53 | 7 | 13 | 106 |
| DMEK | 186 | 57 | 0 | 4 | 373 | 221 | 96 | 937 |
| DSAEK | 206 | 154 | 62 | 66 | 458 | 279 | 102 | 1327 |
| PK | 181 | 106 | 27 | 30 | 302 | 120 | 79 | 845 |
| Total | 663 | 355 | 91 | 101 | 1,301 | 721 | 309 | 3,541 |

*Atlantic patients are transplanted in NS and NB.
**Includes K-Pro, KLA, glaucoma shunt patching, and other surgeries.

## Ocular non-surgical tissue distribution

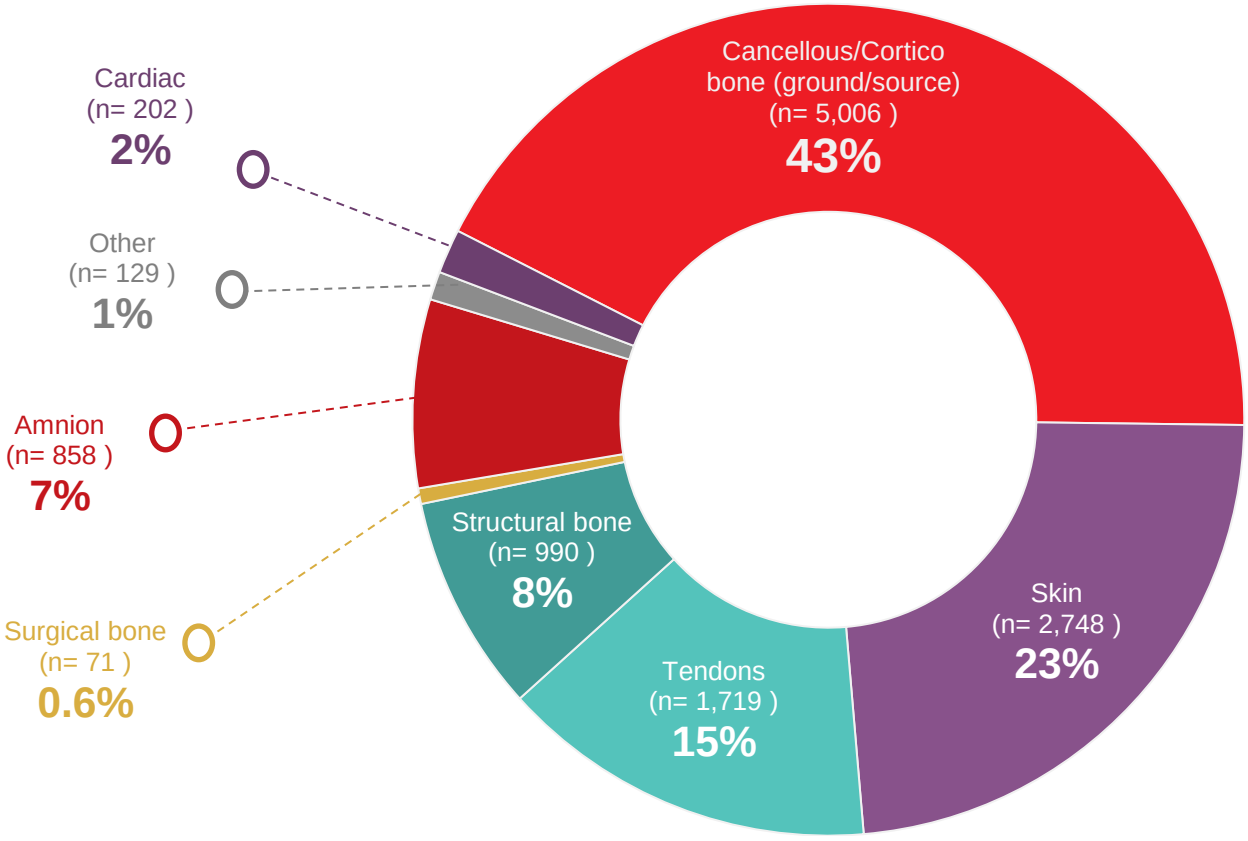
In 2020, there were 2,554 ocular grafts produced and distributed for research and education. Ontario distributed 272 ocular grafts to other Canadian eye banks for education.

| | Produced by your eye bank and distributed for research | | | Produced by your eye bank and distributed for education | | |
|---|---|---|---|---|---|---|
| **Province** | **Within your province** | **To another Canadian eye bank** | **Internationally** | **Within your province** | **To another Canadian eye bank** | **Internationally** |
| **BC** | 8 | 0 | 0 | 86 | 12 | 0 |
| **AB** | 4 | 0 | 0 | 48 | 0 | 0 |
| **SK** | 0 | 0 | 0 | 0 | 0 | 0 |
| **MB** | 0 | 0 | 0 | 2 | 0 | 0 |
| **ON** | 43 | 0 | 0 | 1,747 | 272 | 7 |
| **QC** | 207 | 0 | 0 | 118 | 0 | 0 |
| **ATL*** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Canada** | **262** | **0** | **0** | **2,001** | **284** | **7** |

## 6.4 Musculoskeletal, skin, cardiac, and amnion tissue grafts processed and released to inventory

In 2020, ten tissue banks processed and released 11,723 musculoskeletal, cardiac, skin, and amnion grafts from deceased and living donors into inventory for transplant. 2020 total production decreased by 16% from 2019 (n=13,874).

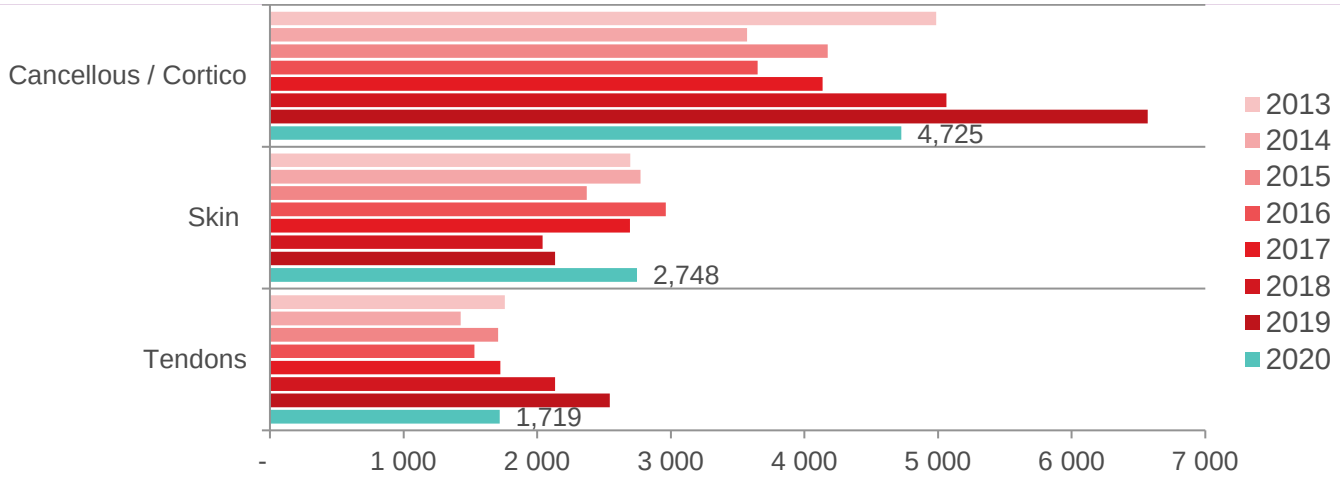
**Grafts processed and released to inventory**



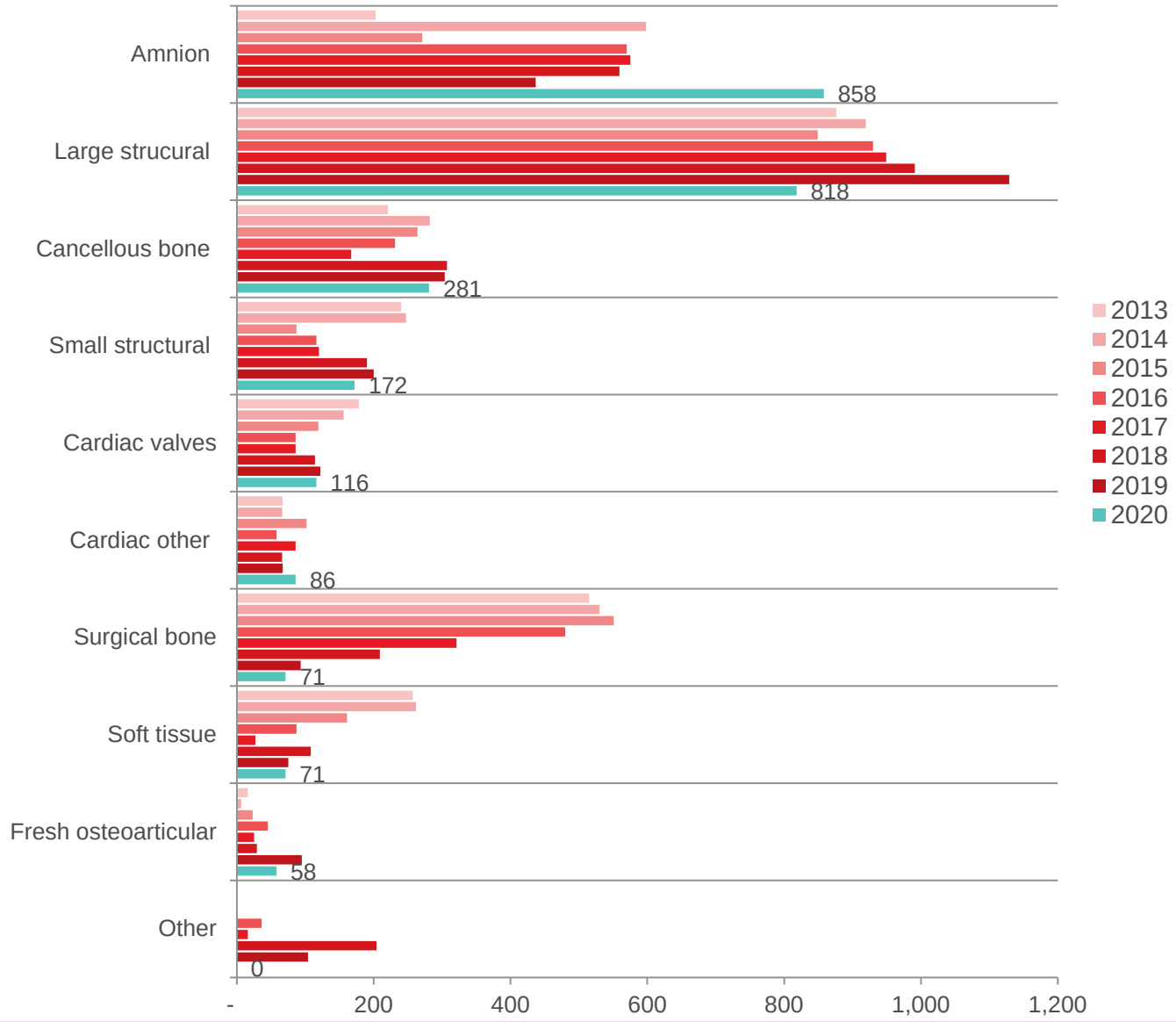

Production and release of musculoskeletal grafts from deceased donors has decreased from 2019, with production of almost all types of tissue decreasing. Cancellous/cortico bone decreased 27%, tendons decreased 33%, and structural bone decreased 25%.

The types of tissue that experienced increased production in 2020 from 2019 were; skin increasing 29%, amnion increasing 96% and cardiac grafts increasing 7%.

## **Number of grafts processed and released to inventory (high volume),** 2013-2020



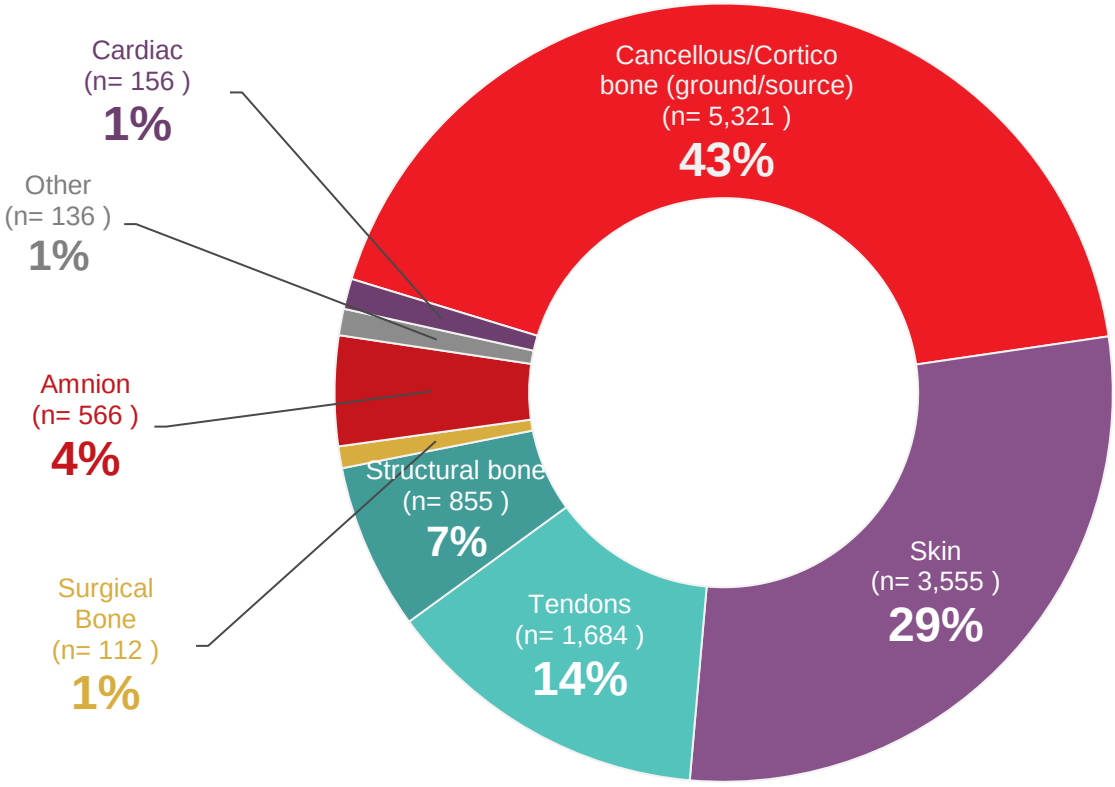

## **Number of grafts processed and released to inventory (low volume),** 2013-2020



## 6.5 Musculoskeletal, skin, cardiac, and amnion tissue grafts distributed to transplant

In 2020, eleven tissue banks distributed 12,385 musculoskeletal, skin, cardiac, and amnion grafts to transplantation, which was a decrease of graft distribution compared to 2019 (n=13,276) and 2018 (n=12,648). While ten banks produce allografts, an eleventh has a relationship with American processors who produce allografts from donors recovered by that bank and return them for distribution.

### Grafts distributed to transplant

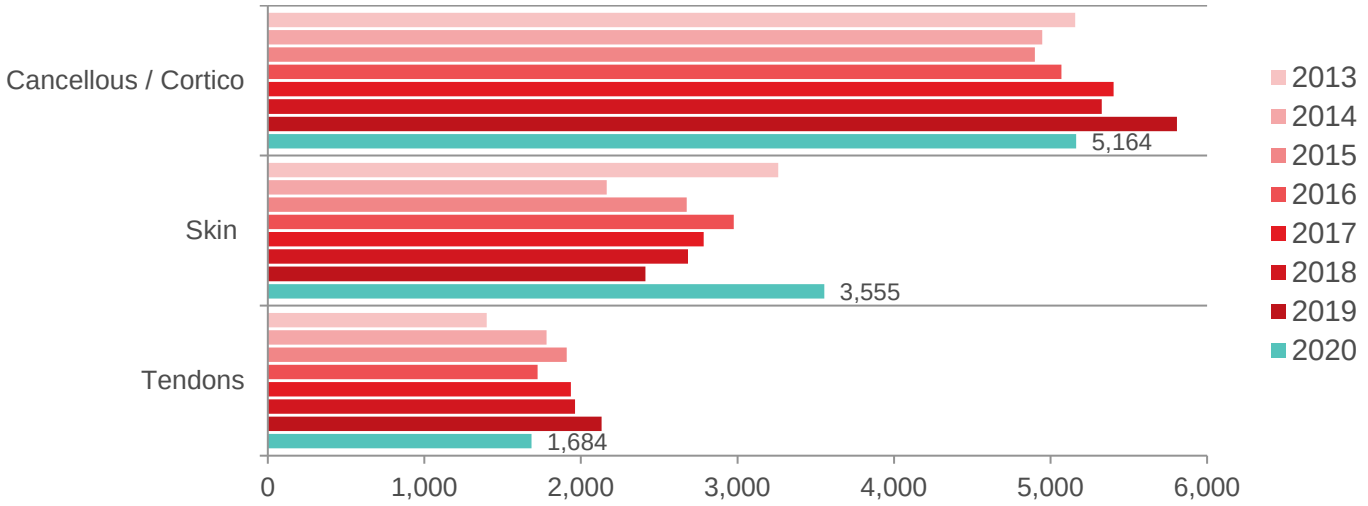



Distribution of musculoskeletal grafts from deceased donors in 2020 decreased 10% from 2019. Almost all types of tissue had a reduction in distribution. Cancellous/cortico bone decreased 12%, tendons decreased 21%, and structural bone decreased 38%.

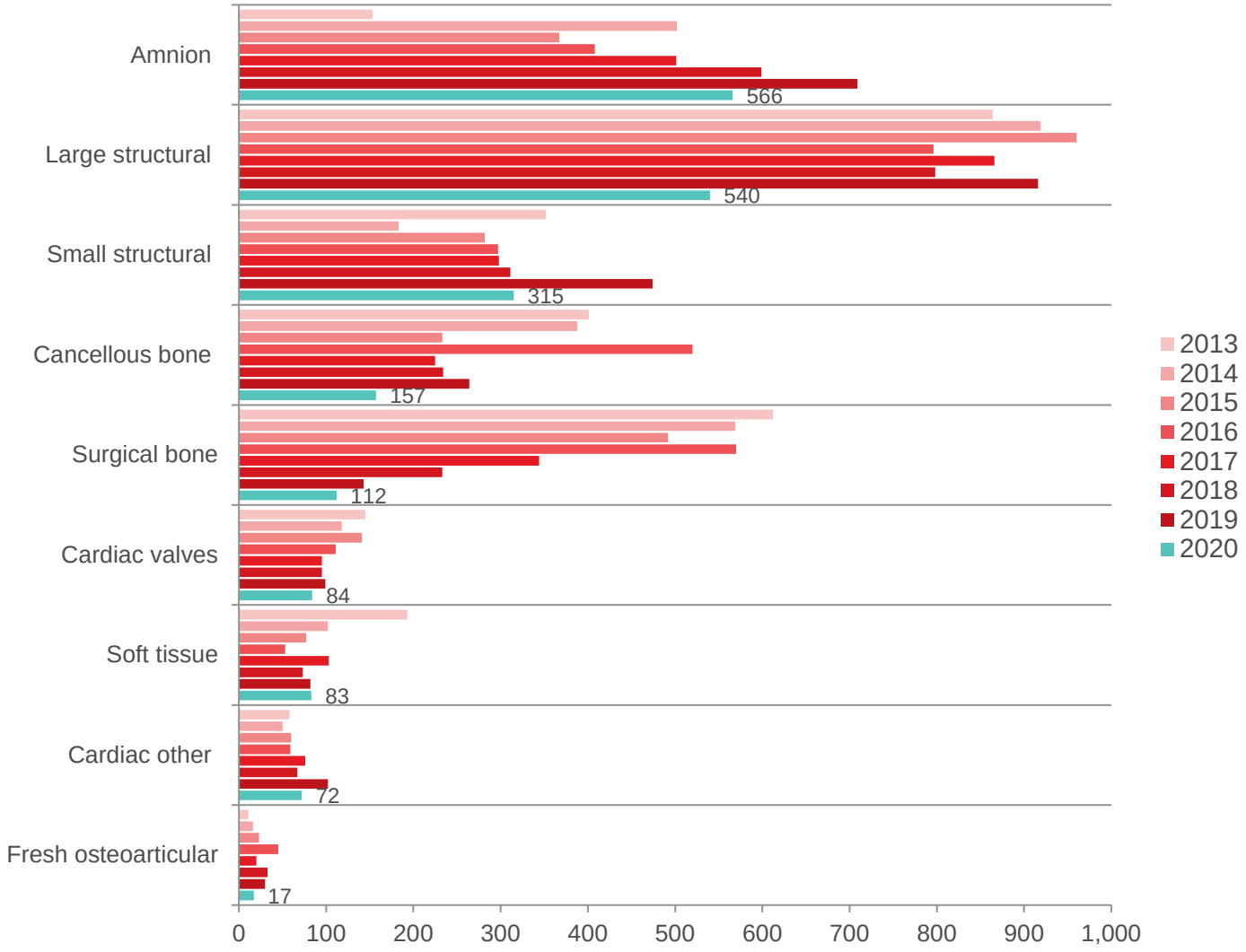
The only type of tissue that had increased distribution was skin, which increased 47% compared to 2019.

Distribution of tissue from living donors also decreased, with amnion distribution 20% below 2019 levels, and surgical bone 22% below 2019 levels.

## Number of grafts distributed to transplant (high volume grafts)



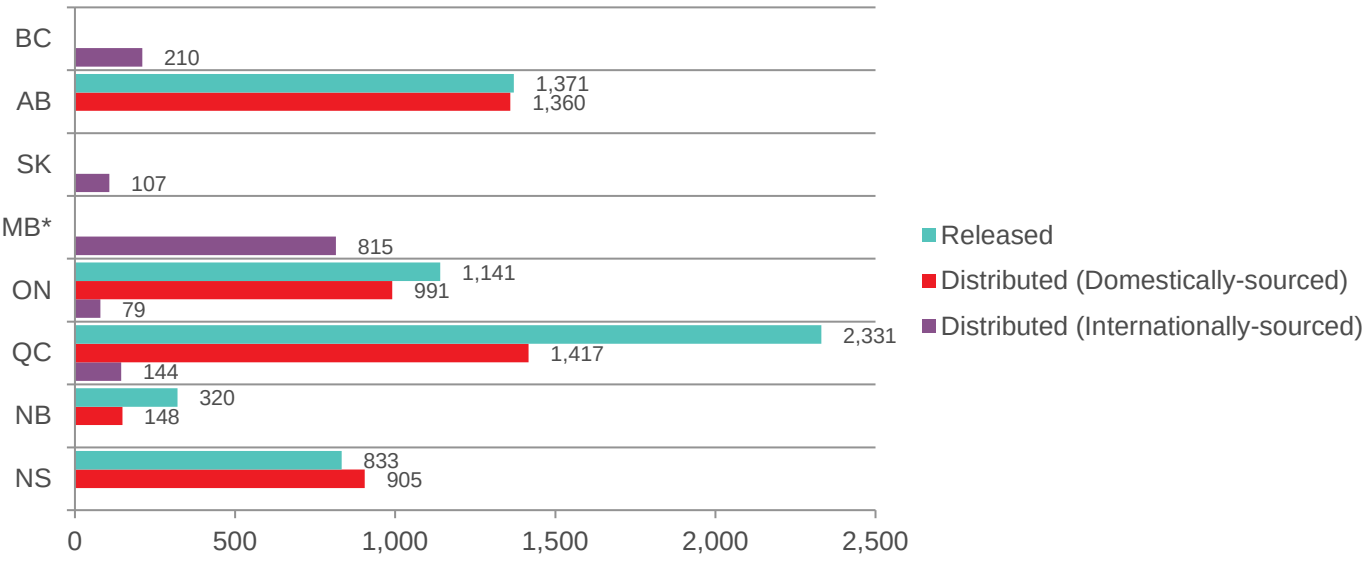

## Number of grafts distributed to transplant (low volume grafts)



## 6.6 Deceased donor musculoskeletal, skin, and cardiac tissue: 2020 provincial analysis

### Musculoskeletal grafts released/distributed for transplant

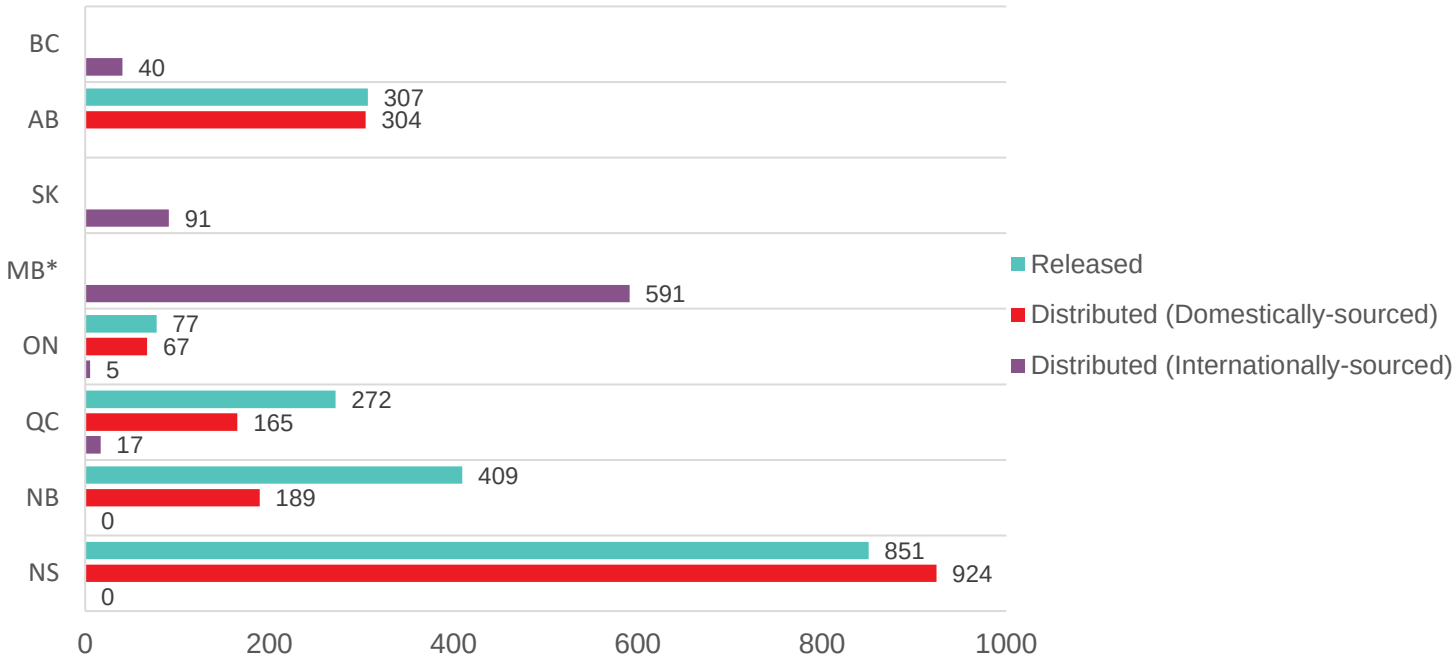
Total count




* Tissue Bank Manitoba is a recovery organization that sends tissues to a US partner organization for processing and receives a proportional quantity of tissue grafts in return for distribution in their province.

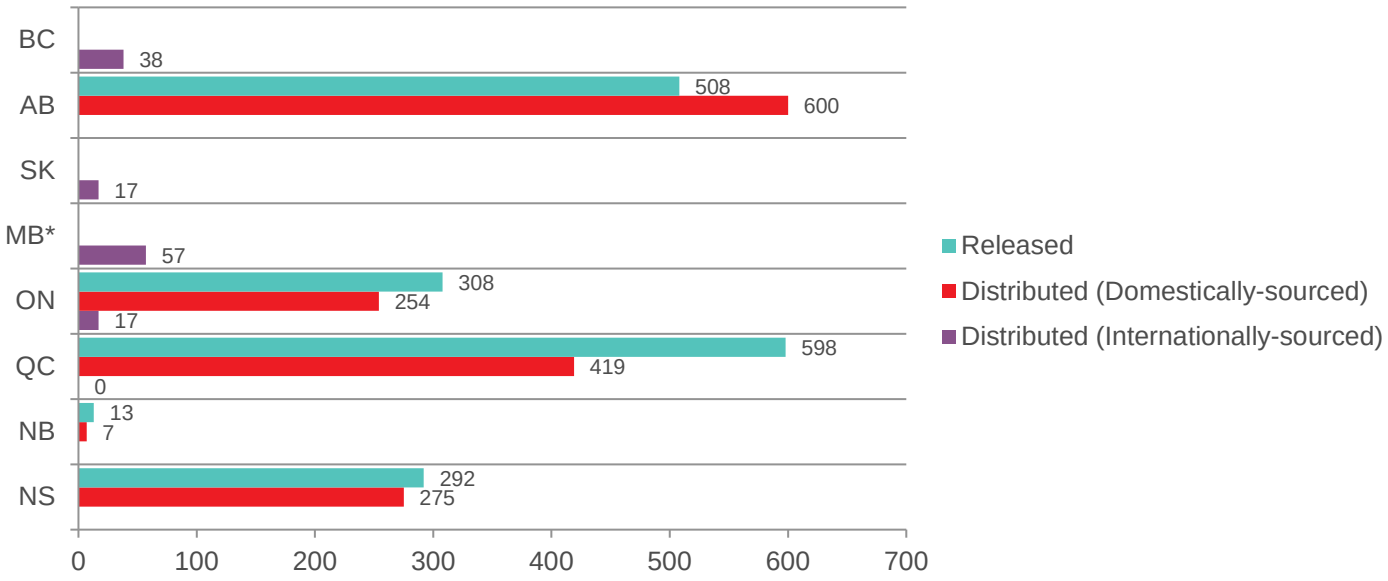
### Musculoskeletal grafts released/distributed for transplant

Results per million population (PMP)



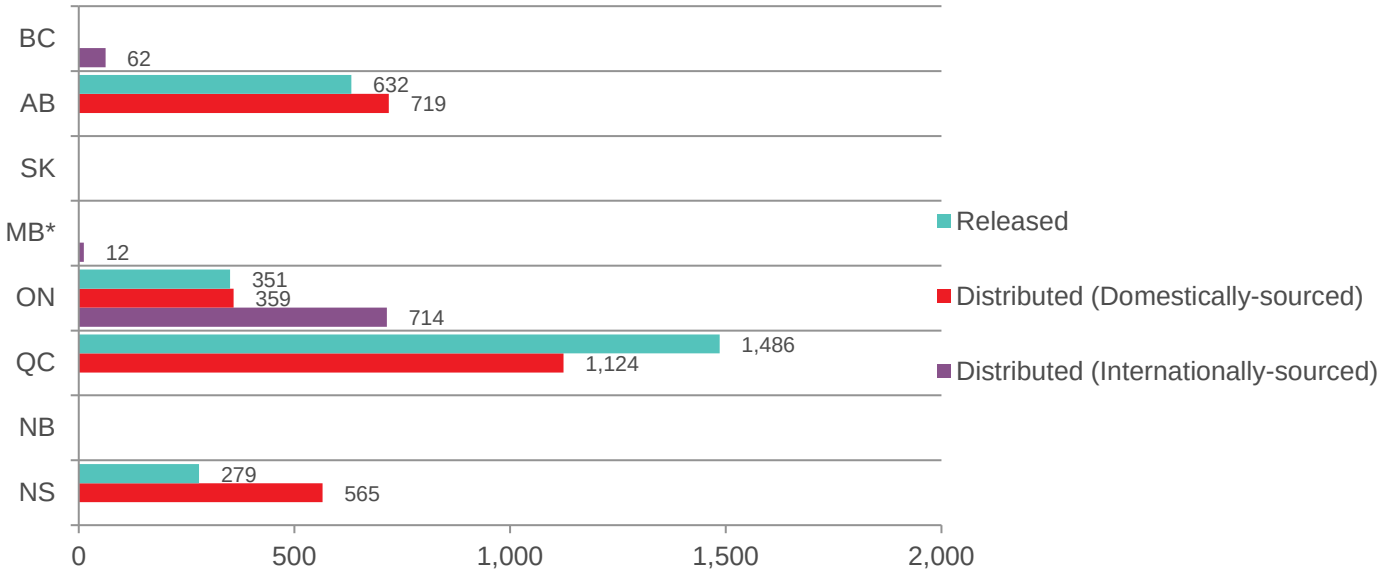

* Tissue Bank Manitoba is a recovery organization that sends tissues to a US partner organization for processing and receives a proportional quantity of tissue grafts in return for distribution in their province.

## Tendon grafts released/distributed for transplant



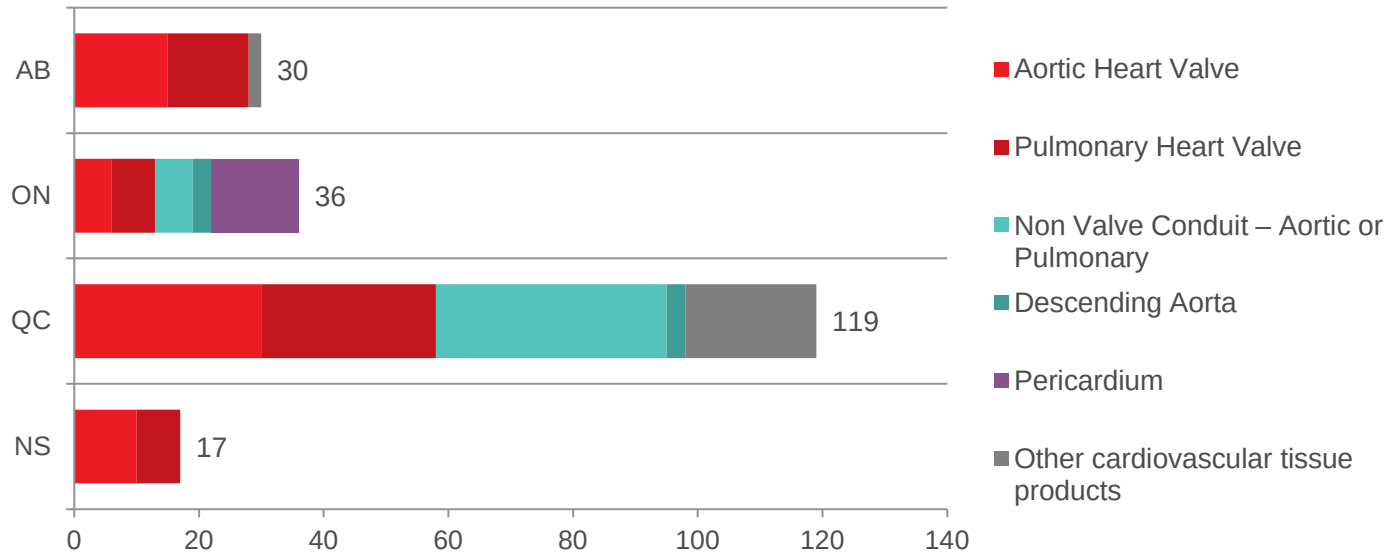

* Tissue Bank Manitoba is a recovery organization that sends tissues to a US partner organization for processing and receives a proportional quantity of tissue grafts in return for distribution in their province.

## Skin grafts released/distributed for transplant

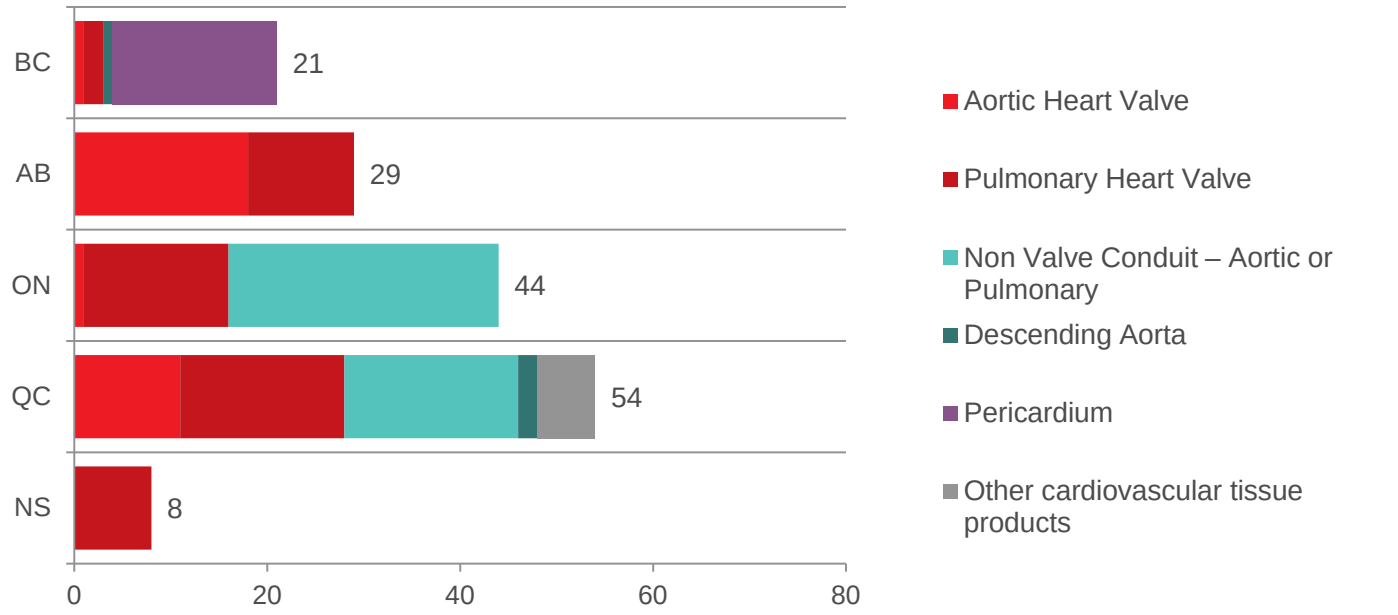



* Tissue Bank Manitoba is a recovery organization that sends tissues to a US partner organization for processing and receives a proportional quantity of tissue grafts in return for distribution in their province.

## Cardiac grafts processed and released for transplant




## Cardiac grafts distributed for transplant



# Conclusion

The year 2020 represents the eighth consecutive year for which the Eye and Tissue Data Committee has collected and reported on key metrics relating to the eye and tissue donation and transplantation system in Canada on a national scale. With the support of eye and tissue banks in Canada, and in collaboration with Canadian Blood Services, this census of Canadian tissue recovery, allograft production and distribution gives visibility to national results and trends to help inform on the operational capacity of individual eye and tissue banks. The ongoing collection of data provides insight on patterns and trends to inform both national and regional strategy, planning, and policy development.

## Impact of the COVID-19 pandemic

The COVID-19 pandemic continues to have a significant impact on the Canadian health care system, including organ and tissue donation and transplantation. Due to a variety of factors, the pandemic caused a substantial reduction in tissue donation and graft production in 2020. The number of deceased donors in 2020 decreased by 25% from 2019, while graft production and distribution fell 16% and 7%, respectively.

Early in the pandemic, it was unknown whether COVID-19 could be transmitted from tissue donors to recipients Corneal grafts were of particular concern given the uncertain risk of transmission associated with the virus being found in conjunctival swabs and tears of COVID-19 patients[2]. Out of an abundance of caution, many programs suspended or modified operations temporarily to minimize risk to patients while safety protocols were developed, and tissue donation fell to a fraction of normal levels. From 2013 to 2019, there were an average of 379 deceased donors reported in the month of April with a range of no fewer than 363 and no greater than397. In April 2020, there were only 56 deceased donors reported. Donation gradually returned to pre-pandemic levels by August 2020, but this period of reduced donation resulted in an overall reduction of 25% in deceased donors for 2020 compared to 2019.

Donor screening procedures were established to mitigate the risk of transmitting COVID-19 infection to tissue graft recipients with some programs also testing all donors for COVID-19, while other programs only tested those donors that were also donating organs. At a minimum, all of the tissue organisations in Canada modified their donation assessment methods to compensate for COVID0-19; thus, resulting in the disqualification of potential donors that otherwise would have been eligible to donate tissues decreasing donor availability. Conversely, at the peak of the pandemic, some transplantation facilities in Canada cancelled or postponed

[2] Sawanta OB, Singh S, Wright RE, Jones KM, Titus MS, Dennis E, Hicks E, Majmudar PA, Kumar A, Mian SI (2021) Prevalence of SARS-CoV-2 in human post-mortem ocular tissues. The Ocular Surface, 19: 322-329. doi: 10.1016/j.jtos.2020.11.002
*See also* Desautels JD, Moshirfar M, Martheswaran T, Shmunes KM, and Ronquillo YC (2020) Risks Posed to Corneal Transplant Recipients by COVID-19-Affected Donors. *Ophthalmol Ther*. 9(3): 371–379. doi: 10.1007/s40123-020-00254-w
*See also* Ang M, Moriyama A, Colby K, Sutton G, Liang L, Sharma N, Hjortdal J,Shun Chiu Lam D, Williams GP, Armitage J, and Mehta JS (2020) Corneal transplantation in the aftermath of the COVID-19 pandemic: an international perspective. *Br J Ophthalmol*. 104(11): 1477–1481. doi: 10.1136/bjophthalmol-2020-317013

elective surgeries to keep hospital resources available for COVID-19 patients. This resulted in fewer transplant surgeries and a reduced need to recover and distribute tissues from donors.

## Continuing high demand for DMEK

The demand for endothelial keratoplasty (EK) remains high, with an eight-year high of 70% of keratoplasty procedures performed as EK in 2020. The proportion of EK performed as DMEK has dropped slightly from a high of 44% in 2019 to 41% in 2020. It would be premature to interpret this as being indicative of the demand for DMEK leveling off, as the pandemic sharply affected production of DMEK tissues. Several programs will begin production of pre-stripped DMEK tissue in 2021, as such, there is an expectation that the proportion of EK as DMEK will continue to increase in the future.

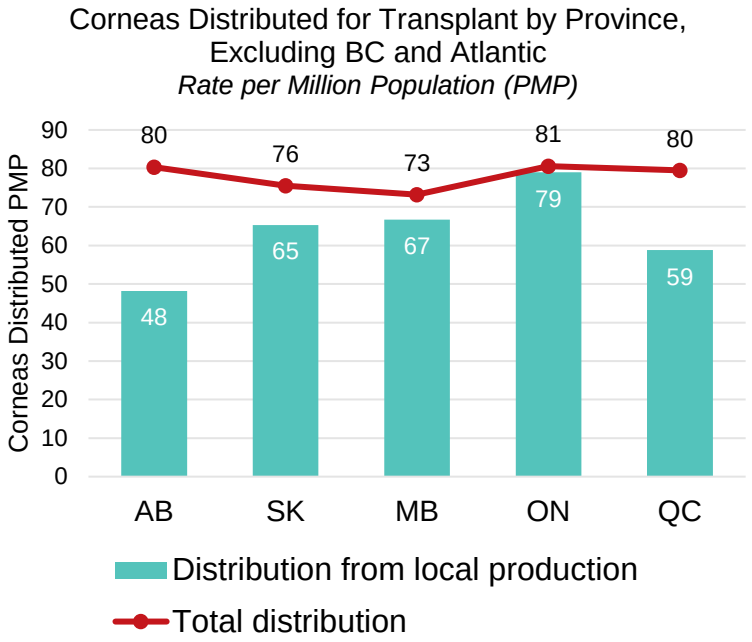
## Need for growth in Canadian eye and tissue donation

All categories of non-ocular tissue grafts (with the exception of skin and amnion) experienced large reductions in distribution in 2020 and overall non-ocular tissue distribution reached the lowest level reported since 2015. Unlike ocular tissue, imported non-ocular tissue grafts in 2020 were down 3% from a seven-year high in 2019. Surgical bone donation from living donors increased 11% from 2019, although the production and distribution of living donor surgical bone grafts decreased in 2020, which is consistent with the trend established over the previous four to five years.

Results suggest that there remain geographic discrepancies in donation, with BC, Alberta, Saskatchewan, and Québec reporting fewer than 89 donors per million population in 2020 and the remaining provinces (with the exception of PEI) reporting 106 donors per million population or more. In keeping with this finding, provinces with low donation rates relied in part on international banks in sourcing ocular grafts for transplant. Similarly, there remains substantial variation across the country in ocular tissue production, ranging from 65 corneas released and utilized for transplant per million population in Alberta (or lower for PEI) to over 200 corneas per million population released and utilized for transplant in New Brunswick and similarly high rates relative to the population in Nova Scotia.

The 2020 aggregate data strongly suggests a continuing reliance on the importation of cornea grafts to meet surgical demands. The global pandemic initially reduced the demand for corneal tissue with tissues sourced internationally also decreasing during the first wave. These reductions were directly attributable to reductions in ocular transplant operations across Canada, as provincial health authorities prioritised health care resources for pandemic responses. In 2020, nine per cent of all corneas used for keratoplasty and other surgeries were imported from outside Canada, compared to five per cent in 2019. Despite this marginal change overall, BC, Alberta, Saskatchewan, Ontario, and Québec were all required to supplement their production with imported corneas to some degree, with Manitoba and the Atlantic supplementing their local production with corneas sourced from other Canadian provinces.

In the past, we have remarked on the disparities between provinces in cornea distribution rates relative to provincial populations. The results in 2020 reveal that there remains considerable variation in the ability to distribute corneas from local production, from Alberta which distributed between 48 and 56 corneas per million population from local production to BC which distributed locally produced corneas at approximately twice that rate. Outside of BC and the Atlantic provinces where production was high per million population the overall level of demand was met by supplementing local production with interprovincial and international supply which was consistent from 73 up to 81 corneas per million population. Taken together, these results suggest that demand for corneal transplantation may have limited regional variability, and it is the differing levels of capacity to recover and produce corneas that is the primary contributor to interprovincial disparities in meeting demands.




Reducing barriers and improving interprovincial cornea sharing could help provinces reduce the dependence on international imports needed to meet demands. This would include investments and improvements in interprovincial planning, communication and real time tissue availability, normalising cost sharing/recovery between provinces as well as the development of formal organizations to support the ocular donation and transplantation community. These key directives represent potentially critical components to attaining a self-sufficient domestic cornea supply, one that is flexible enough to meet the demands of Canadian transplant surgeons in addressing the needs of an increasingly aging population.

The need to capitalize on opportunities for improvement in interprovincial cornea sharing was among the themes that emerged from the Cornea Donation and Transplantation National Consensus Forum, hosted by Canadian Blood Services in February of 2020. This event allowed representatives from eye and tissue banks, health authorities, hospital leadership, transplanting ophthalmologists, organ donation organizations, and several national and international organizations—as well as transplant recipients and donor families—the opportunity to connect and collaborate on the future of cornea donation and transplantation in Canada.[3]

[3] Summaries of the proceedings are available at https://profedu.blood.ca/en/organs-and-tissues/reports/cornea-donation-and-transplantation

Other related themes that were supported at this event include the development of pan-Canadian groups to enable ocular and non-ocular tissue representatives to engage as a community, to share expertise and best practices, and to identify challenges, collaboration opportunities or system improvement priorities. Canadian Blood Services has begun laying the groundwork for the establishment of these groups and is excited to see these initiatives move forward.

## Moving non-ocular tissue data from collection to action

One of the key inferences that has arisen from tissue data collection over the years is the static nature of tissue production and distribution. Through the ever-increasing efforts of individual tissue banks and other related stakeholders, the rate of referral and potential donors has risen year over year, with a 39% increase in referred donors and a 27% increase in consented donors outside of Quebec from 2013 to 2019 (with the exception of 2020 due to the global pandemic); conversely, there have only been marginal increases in the recovery and production (15%) and the distribution (5%) of musculoskeletal, skin, cardiac, and amnion grafts during that period.

The increases in production and distribution for non-ocular tissue cannot be directly correlated to improvements or even gaps within the ecosystem, as non-ocular tissue has no comparable metric like ocular tissue, such as perioperative metrics relating to surgical procedures (delays in access to operating rooms, procedure type and completion, etc.); thus, the data collected only reflects activity in the tissue banking community, not the efficacy of the system itself. Similarly, there is presently a lack of visibility into post-transplant patient outcomes at a national level.

This problem not only exists at the national level but, more prominently, at the provincial levels since non-ocular tissue recovery, production and distribution are tied to invisible demands within the provincial health systems which are not captured in currently accessible metrics, including cases in which surgeons acquire these grafts directly from international sources as well as dimensions of actual unmet need due to delays in access to surgery and the use of less effective alternative therapies. Part of the issue is directly tied to the inability of tissue banks and Canadian Blood Services to comprehensively measure the imported non-ocular tissue amounts coming into the Canadian system. This lack of comparable data has created confusion for provincial health authorities and an uncertainty at the tissue bank level as to what innovation gaps may exist and how to improve the system.

It has been agreed upon by the tissue community at large based on anecdotal evidence that basic tissue production and distribution, of the kind reported in the Canadian Blood Services data reports, needs to be augmented to meet demands, but no direct evidence can be cited to give direction. It is imperative that the non-ocular data collection move to collect data on imported tissue products of all kinds to offer a better understanding of the gaps for non-ocular tissue in Canada. It would also be a great benefit if the tissue community in Canada, including provincial health authorities, were to delineate a set of agreed upon measures of success for non-ocular tissue. Far from being a report card on effectiveness, such metrics would allow provincial tissue banks to set agendas to address their gaps and offer provincial governments a focus to target resources to lessen the gaps where possible.

There is a growing understanding within the tissue community that basic tissue production of musculoskeletal, skin, amniotic tissue and cardiac tissue must be coupled with technological innovation to provide new and better treatments,  yet the community has seen few new innovative products introduced by non-ocular producers in recent years. While eye banks have continually embraced new production methods such as pre-peeled DMEK the non-ocular community appears to be more conservative with respect to adopting new technologies and processes. The advent of ever-increasing proprietary therapies from US tissue banks and medical supply companies places Canadian tissue banks at risk of becoming antiquated. Modern therapies such as demineralized bone products, decellularized soft tissue products, precision manufactured CNC products and innovative production technologies are currently out of reach for non-ocular tissue producers in Canada. The recent pandemic has highlighted the need for medical supply security in Canada. The modern therapies that are being imported are rapidly becoming a standard of care for Canadian surgeons of all disciplines and Canadian tissue banks need to innovate to become relevant and sustainable in the modern ecosystem. As highlighted, data about what types of human tissue products are being imported into Canada will provide a solid basis for guidance to producers and provincial governments on how to address the ever-growing technology gap and create long term plans for supply security of needed non-ocular tissue products.

Without a doubt Canadian tissue banks are capable and ready to step up to the challenges within their environments. The data collected by Canadian Blood Services from 2013 to 2020 shows a robust base across Canada that is willing to move forward to ensure Canadians from coast to coast have access to the most advanced therapies. As a community, Canadian Blood Services has helped to link provincial programs through common language, metrics and best practices. As individual tissue entities examine the data that is published each year, a consensus has formed that we must transform the data into useful tools to modernize our system and address the demands each province faces. Non-ocular tissue presents a significant challenge due to transparency of imported products, proper guiding metrics and technological gaps; however, it is reasonable to assume that with community support we can bridge the gaps and make the Canadian tissue banking system into a model of efficacy and innovation for the future.

# Appendix A:

## Terms, definitions, and abbreviations

**Amniotic membrane**
The innermost layer of the placenta consisting of a thick basement membrane and an avascular stromal matrix. It is used as a graft and as a dressing to facilitate ocular surface reconstruction and to promote healing. Its use in plastic surgery (burns, wound care), orthopedic, dental and general surgery is increasing

**Deep anterior lamellar keratoplasty (DALK or ALK)**
A partial thickness corneal transplant procedure used to treat disease or injury confined to anterior layers of the cornea: the epithelium, Bowman's layer and stroma. DALK is most often used to treat keratoconus and corneal scarring.

**Cancellous/cortical bone**
There are two types of osseous tissue that form bones: cancellous “spongy” bone and cortical “compact” bone. Tissue banks mill/grind bone into cancellous cortical particles or powder which is used to pack bone voids in surgical repairs.

**Cellulose nanocrystals (CNC)**
Also referred to as nanocrystalline cellulose. This is the crystalline form of cellulose, an organic material typically derived from plant-based biomass which has been used for biomedical applications in structural tissue engineering.

**Chipped bone**
Bone that has been processed into morsels; chipped bone is used to pack bone voids in surgical repairs.

**Consent**
Signed documentation of approval to proceed with donation from the donor or legal next of kin.

**Consent (rate)**
The ratio of donors where consent for donation is obtained to the number of donor families approached for consent.

**Deceased donor**
A donor from whom tissue is recovered following cardiocirculatory or neurological determination of death.

**Descemet’s membrane endothelial keratoplasty (DMEK)**
Transplantation of only the Descemet’s membrane and endothelial layer of the cornea. The preparation (processing) of the cornea is done manually. DMEK has been described as a more technically challenging surgical procedure than DSAEK but also has been reported to provide better, post-transplant patient visual acuity, lower rejection rates and faster visual recovery.

**Descemet’s stripping (automated) endothelial keratoplasty (DSAEK)**
A partial-thickness cornea transplant involving the transplantation of donor tissue endothelium, Descemet’s membrane and a thin, partial layer of the donor tissue’s stroma. The preparation (processing) of the cornea is automated utilizing a microtome.

**Distribution**
A process that includes the receipt of a request for tissue, selection and inspection of the appropriate tissue and subsequent shipment and delivery of the tissue to the end user (surgeon) for utilization.

# Appendix A:
continued

**Endothelial keratoplasty (EK)**
A corneal transplant procedure where only a patient's compromised posterior layers of the cornea are removed and replaced by similar posterior corneal layers of a donor cornea. The advent of this procedure occurred in the early to mid-2000s after fifty years of performing penetrating keratoplasty in nearly all corneal transplant surgeries. EK has clearly established itself as the standard of care for patients with endothelial dysfunction. There are a number of types of EK procedures including DSAEK and DMEK. They can be performed manually (peel) or automated (microtome).

**Eye and Tissue Data Committee (ETDC)**
A Canadian committee chaired by members of the tissue community and composed of representatives from each provincial tissue program as well as Canadian Blood Services representatives with the purpose to oversee the collection, management and release of national eye and tissue allograft data.

**Fresh osteoarticular**
Osteoarticular refers to a bone graft that contains a joint surface, such as a knee. Fresh refers to the fact that, in order to preserve viability of joint tissue, the graft is not frozen or cryopreserved. These grafts are refrigerated and usually transplanted within weeks of recovery.

**Keratoplasty**
A surgical procedure, also known as corneal transplantation, where the procedure involves a replacement of abnormal host tissue with healthy corneal tissue from a donor. The replacement of the corneal tissue can either be partial or full depending on the severity of damage in the cornea.

**Living donor**
A donor where tissue is recovered from a live person, such as femoral heads which are recovered during total hip replacements or amnion which is recovered from the placenta in live births.

**Ocular**
A general term which refers to the tissues of the eye which include the cornea and the sclera.

**Penetrating keratoplasty (PK)**
Corneal transplant with replacement of all layers of the cornea but retaining the peripheral cornea.

**Per million population (PMP)**
To provide comparative data donation ratios such as the number of donors per million population - may be presented. For reports generated by the Eye and Tissue Data Committee the numerator - # of donors - refers to the province where the donor was identified and recovered as opposed to the province of the recovery organization.

**Preservation, intermediate-term**
Cornea or corneal section preserved in a solution that maintains cellular and/or ultrastructure viability for 14 days. Intermediate term preservation is currently utilized at 2-8°C storage temperatures. Examples of intermediate term storage media are: Life4°C, Optisol GS, and Eusol.

**Preservation, long-term**
Cornea or corneal section stored in a solution that is designed to maintain tissue ultrastructure for greater than 14 days and up to five years depending on the technique. Viability is not maintained. Examples are ethanol and glycerin preservation. Other media, such as albumin, may be used in conjunction with ionizing radiation to preserve the tissue ultrastructure.

# Appendix A:
continued

**Processing**
The steps taken following recovery to prepare tissue for transplantation. This is essentially a manufacturing process where tissue is manipulated, treated and packaged into forms required by surgeons for interventions and through which quality control and quality assurance processes determine safety and the product release to transplantation. Packaging is considered a type of processing.

**Recovery**
Obtaining tissue from a donor that is intended for use in human transplantation, therapy, research or education. The surgical removal of donated tissue for future processing; recovery generally occurs in an operating room or dedicated recovery suite.

**Referral**
A referral is when a death is referred to a donation organization or tissue bank for consideration or evaluation of donation potential. In some jurisdictions all deaths are referred and in others frontline health professionals may do a pre-screening and only refer deaths which have no obvious contraindications to donation.

**Released to inventory**
Refers to grafts that has been evaluated, and deemed safe and suitable for transplantation, by a medical director, through the appropriate quality review and made available for transplantation. Prior to release grafts in the production process are considered quarantined.

**Sclera**
The sclera is the part of the eye commonly known as the “white”. It forms the supporting wall of the eyeball and is continuous with the clear cornea. Scleral grafts are widely used in ophthalmologic surgery.

**Soft tissue**
A generic term for muscle, fat, fibrous tissue or other supporting tissue matrix. In tissue banking it often refers to fascia lata; the sheets of fibrous tissue enveloping, separating or binding together muscles and organs. Fascia lata is processed into grafts for use in surgical repairs.

**Structural bone**
Structural bone grafts are intended to support weight and are classified into large or small. Large grafts include femurs, fibulas and humerus. Small grafts include sized grafts such as cortical dowels, wedges, and rings.

**Surgical bone**
Femoral heads can be recovered from total hip replacements and evaluated for suitability to transplant. These femoral heads are referred to as surgical bone. Surgeons grind the femoral head in the operating room to produce cancellous powder or particles. With the advent of bank produced pre-packaged cancellous and the increasing regulatory requirements the demand for surgical bone has declined.

**Tendon**
A band of tough, inelastic fibrous tissue that connects a muscle with its boney attachment. Tendons commonly banked for use in sports medicine surgery include Achilles, Patellar and Tibialis.

**Yield**
Yield refers to the number of grafts which are recovered and released (deemed suitable) for transplant per donor. Yield can be affected by contamination, recovery technique, processing technique and donor factors such as age and comorbid diseases.

# Appendix B:

## Eye and Tissue Data Committee membership

| Member | Title | Program |
|---|---|---|
| **Gary Rockl (Chair)** | Tissue Innovation Specialist | Héma-Québec, Québec City, QC |
| **Kimberly Dodds (Vice Chair)** | Director | Tissue Bank Manitoba, Winnipeg, MB |
| **Mike Bentley** | Manager, Transplant Services | Comprehensive Tissue Centre, Edmonton, AB |
| **Ryan Funk** | Senior Tissue Specialist | Southern Alberta Tissue Program, Calgary, AB |
| **Christine Humphreys** | Director | Eye Bank of Canada (Ontario Division), Toronto, ON |
| **Nadya Savoie** | Director | NB Organ and Tissue Program Horizon Health Network |
| **Michelle Bonnier** | Manager, Alberta Health Services | Southern Alberta Organ and Tissue Program, Calgary, AB |
| **Cynthia Johnston** | Quality Leader | Regional Tissue Bank, Halifax, NS |
| **Natalie Smigielski** | Clinical Specialist, Tissue Program | Trillium Gift of Life Network, Toronto, ON |
| **Ellen Sokol** | Deceased Donation Coordinator | Saskatchewan Health Authority Donation Program, Saskatoon, SK |
| **Balram Sukhu** | Director | Mount Sinai Allograft Technologies, Toronto, ON |
| **Alison Halliday** | Senior Technologist | Ontario Professional Firefighters' Skin Bank, Toronto, ON |
| **Roberta Fransishyn** | Acute Care Director, Misericordia Eye Bank | Misericordia Health Centre, Winnipeg, MB |
| **Ivan Yan** | Head Technologist | Eye Bank of British Columbia, Vancouver, BC |

**Canadian Blood Services members**

**Nick Lahaie**
Manager, Information Management, OTDT

**Kyle Maru**
Sr. Data Analyst, Information Management, OTDT

**Bailey Piggott**
Data Analyst, Information Management, OTDT

# Appendix C:

## List of contributing programs

### British Columbia

- Eye Bank of British Columbia, Vancouver
- Island Health Bone Bank, Victoria

### Alberta

- Southern Alberta Tissue Program, Calgary
- Lions Eye Bank of Calgary, Calgary
- Comprehensive Tissue Centre, Edmonton

### Saskatchewan

- Saskatchewan Health Authority Donation Program, Saskatoon

### Manitoba

- Tissue Bank Manitoba, Winnipeg
- Misericordia Eye Bank, Winnipeg

### Ontario

Trillium Gift of Life Network manages the collation and submission of data from Ontario eye and tissue banks including:

- Eye Bank of Canada (Ontario Division), Toronto, Ontario
- The Hospital for Sick Children Tissue Laboratory, Toronto, Ontario
- Ontario Professional Fire Fighters Skin Bank, Toronto, Ontario
- Mount Sinai Allograft Technologies, Toronto, Ontario
- Lake Superior Centre for Regenerative Medicine, Thunder Bay, Ontario

Trillium Gift of Life Network supports tissue recovery and therefore qualifies as a recovery organization.

### Québec

- Héma-Québec, Saint Laurent: Banque d'yeux du Québec & Banque d'yeux du CUO

### New Brunswick

- New Brunswick Organ and Tissue Program; Ocular and Tissue Division, Saint John and Moncton

### Nova Scotia

- Regional Tissue Bank, Halifax

# Appendix D:

## List of products programs produce*

| Canadian eye banks | PK corneas | DSAEK corneas | DMEK corneas | Sclera | Amnion |
|---|---|---|---|---|---|
| Eye Bank of British Columbia | Y | Y | N | Y | N |
| Lions Eye Bank of Calgary | Y | Y | Y | Y | N |
| Comprehensive Tissue Centre (AB) | Y | N | Y | Y | N |
| Saskatchewan Health Authority Donation Program | Y | Y | N | Y | Y |
| Misericordia Eye Bank | Y | N | N | Y | Y |
| Eye Bank of Ontario | Y | Y | Y | Y | Y |
| Héma-Québec | Y | Y | Y | Y | N |
| New Brunswick Organ and Tissue Program | Y | N | N | N | N |
| Regional Tissue Bank (NS) | Y | Y | Y | Y | N |

*as of publication

| Canadian tissue banks | Cancellous bone | Structural bone | Rib or cartilage | Tendon | Fresh osteo | Soft tissue | Cardiac | Skin |
|---|---|---|---|---|---|---|---|---|
| Island Health Bone Bank (BC) (Surgical Bone) | Y | N | N | N | N | N | N | N |
| Southern Alberta Tissue Program | Y | Y | Y | Y | Y | Y | N | Y |
| Comprehensive Tissue Centre (AB) | Y | Y | Y | Y | Y | Y | Y | Y |
| Tissue Bank Manitoba* | Y | Y | Y | Y | Y | Y | N | Y |
| RegenMed (ON) | Y | Y | N | Y | N | Y | N | Y |
| Mount Sinai Allograft Technologies (ON) | Y | Y | N | Y | Y | Y | N | N |
| Hospital for Sick Children, Tissue (ON) | N | N | N | N | N | N | Y | N |
| Ontario Professional Firefighters Skin Bank | N | N | N | N | N | N | N | Y |
| Héma-Québec | Y | Y | N | Y | N | N | Y | Y |
| New Brunswick Organ and Tissue | Y | Y | N | Y | N | N | N | N |
| Regional Tissue Bank (NS) | Y | Y | N | Y | N | N | N | N |

* Relationship with US programs who process MB donors and return tissue for distribution