The legal and policy considerations of transplanting pediatric thymus regulatory T cells as an immunotherapy in Canada

Blake Murdoch
University of Alberta, Canada

Abstract
Regulatory T cells (Tregs) hold promise for cell-based therapies for autoimmunity and transplant rejection. In Canada, the potential collection, short-term banking, and transplantation of pediatric Tregs left over from surgery raise legal and policy concerns. Tregs likely fall under the definitions of “tissue” found in most provincial donation and transplantation statutes. With the exception of Alberta’s Human Tissue and Organ Donation Act, the fundamental distinction between donation of tissue primarily for transplantation and secondary donation of by-products of a medical intervention undertaken for the benefit of the donor is inadequately addressed in Canadian law. Most statutes prohibit transplantation except in accordance with their provisions and do not contemplate living donation by minors under a specific age. Provinces could amend their legislation in order to properly enable the transplantation of by-products like Tregs from infant donors. This process is relatively ethically uncontroversial, so if common research ethics and privacy concerns can be addressed, it should likely be permitted.

Keywords
Donation and transplantation, health law, research ethics, pediatrics, autoimmunity

Received 10 July 2020; Revised 9 September 2020; Accepted 11 September 2020

Corresponding author:
Blake Murdoch, Health Law Institute, Faculty of Law, University of Alberta, 111 89 Ave NW, Edmonton, AB T6G 2H5, Canada.
Email: bmurdoch@ualberta.ca
Background

Based on official estimates, it is likely that more than two million Canadians have a chronic autoimmune disease such as type 1 diabetes, inflammatory bowel disease, psoriasis, rheumatoid arthritis, multiple sclerosis, and others.\(^1\) In addition, approximately 30,000 patients are living with altered immune systems as a result of transplantation (either solid organ or blood and marrow transplant).\(^2\) Poor immune regulation results in pathological immune responses to normal tissues or transplant-related rejection. Current treatments are not curative because they fail to reset immune responses in a way that prevents disease recurrence or rejection. Moreover, current treatments typically suppress all immune responses, putting patients at risk of infection, cancer, and new autoimmune complications, while often failing to control the underlying disease.

Regulatory T cells (Tregs) are a type of white blood cell that regulates immune responses. With their natural immunosuppressive function, Tregs hold promise as a cell-based therapy for prevention and treatment of diseases caused by inappropriate immune tolerance, such as autoimmunity and transplant rejection.\(^3\) A challenge with developing Treg therapy is that availability of these rare cells is limited. To overcome this and other hurdles with the use of Tregs, researchers in Canada have developed methods to isolate these cells from pediatric thymuses for use as a cell-based therapy to prevent or reverse undesired immune responses.\(^4\) Pediatric thymuses are generally

---

1. See, for example, Juvenile Diabetes Research Foundation; Type 1 Diabetes. Available at: https://www.jdrf.ca/who-we-are/type-1-diabetes/ (accessed 4 September 2020); Crohn’s and Colitis Canada: About Crohn’s & Colitis. Available at: https://crohnsandcolitis.ca/About-Crohn-s-Colitis/What-are-Crohns-and-Colitis (accessed 4 September 2020); Canadian Association of Psoriasis Patients: Living with Psoriasis. Available at: https://www.canadianpsoriasis.ca/index.php/en/psoriasis/living-with-psoriasis (accessed 4 September 2020); Arthritis Society: Rheumatoid Arthritis. Available at: https://arthritis.ca/about-arthritis/arthritis-types-(a-z)/types/rheumatoid-arthritis (accessed 4 September 2020); MS: About MS. Available at: https://mssociety.ca/about-ms (accessed 4 September 2020).

2. See Canadian Institute for Health Information: Annual Statistics on Organ Replacement in Canada. Available at: https://www.cihi.ca/sites/default/files/document/corr-snapshot-2019-en.pdf (accessed 4 September 2020); Available at: https://professionaleducation.blood.ca/sites/mpi/files/organ_and_tissue_donation_and_transplantation_-_system_progress_report_2018.pdf (accessed 4 September 2020).

3. L.M.R. Ferreira, Y.D. Muller, J.A. Bluestone, et al., ‘Next-generation Regulatory T Cell Therapy’, Nature Reviews Drug Discovery 18 (2019), pp. 749–769; K.N. MacDonald, J.M. Piret and M.K. Levings, ‘Methods to Manufacture Regulatory T Cells for Cell Therapy’, Clinical and Experimental Immunology 197 (2019), pp. 52–63.

4. R.E. Hoeppli, K.N. MacDonald, P. Leclair, et al., ‘Tailoring the Homing Capacity of Human Tregs for Directed Migration to Sites of Th1-inflammation or Intestinal Regions’, American Journal of Transplantation 19 (2019), pp. 62–76; I.E. Dijke, R.E. Hoeppli, T. Ellis, et al., ‘Discarded Human Thymus Is a Novel Source of Stable and Long-Lived Therapeutic Regulatory T Cells’, American Journal of Transplantation 16 (2016), pp. 58–71; E. Dijke, R. Hoeppli, T. Ellis, et al., ‘Rapamycin Enhances the Suppressive Capacity of Ex Vivo Expanded Regulatory T Cells (Tregs) Isolated From Pediatric Thymus’, Journal of Heart...
removed and discarded in pediatric cardiac surgeries, and the collection and storage of these organs could provide a lasting supply of Tregs for a variety of immunotherapy applications. Given that these thymuses are currently discarded, collection and storage could minimize waste, and improve utility and benefit to others.

The potential collection, short-term banking, and transplantation of pediatric thymus cells leftover from surgery raise several important legal and policy concerns. The interaction of enduring issues with consent and tissue handling with research involving minor donors can be complex. Here these concerns are reviewed in the Canadian legal context, though similar concerns are likely to exist in the tissue frameworks of other international and especially commonwealth jurisdictions, meaning these findings have broad relevance. As will be explored, the existing legislative and policy framework in Canada is potentially fraught with uncertainty as to the legal categorization of such a procedure and its attendant permissibility.

**Treg use in relation to common ethical and legal concerns**

Pediatric thymus donation for the purposes of Treg retrieval would in practice be a form of living “nondirected” donation (donation not made to a specific recipient). Common ethical concerns arising from nondirected living donation, including the potential for undue influence (on financially or otherwise vulnerable donors) or inappropriate compensation (which could commodify organs and tissue), are largely obviated since the proposed donation would only ever happen in the context of a therapeutic surgical intervention for the donor in which the tissue was already to be removed as a clinical waste product. Anonymity of donor and recipient is a common feature of nondirected donation, and given the logistics of the process, there is little reason to believe that such policies would need to change in the context of Treg donation and transplantation.

The question of future recontact and reconsent upon maturity of donors will likely not be a significant concern for the pediatric thymus donation related to Treg transplantation either, because the tissue is unlikely to be stored for longer than a decade—the time it

---

5. K. Hens, C.E. Van El, P. Borry, et al., ‘Developing a Policy for Paediatric Biobanks: Principles for Good Practice’, *European Journal of Human Genetics* 21 (2013), pp. 2–7.

6. Organ Procurement and Transplantation Network, Living Non-Directed Organ Donation, 2015 December. Available at: https://optn.transplant.hrsa.gov/resources/ethics/living-nondirected-organ-donation/ (accessed 24 April 2020); E.S. Woodle, J.A. Daller, M. Aeder, et al., ‘Ethical Considerations for Participation of Nondirected Living Donors in Kidney Exchange Programs’, *American Journal of Transplantation* 10 (2010), pp. 1460–1467.

7. See e.g. M.C. Fortin, M. Dion-Labrie, M.J. Hebert, et al., ‘Are “Anonymous” and “Nondirected” Prerequisites for Living Altruistic Donation? The Views of Transplant Physicians from France and Quebec’, *Social Science & Medicine*, 67 (2008), pp. 147–151; World Health Organization, *WHO Guiding Principles on Human Cell, Tissue and Organ Transplantation, 2010*. Available at: https://www.who.int/transplantation/Guiding_PrinciplesTransplantation_ WHA63.22en.pdf (accessed 27 May 2020).
would take for donors to have an opportunity to reach maturity for the purposes of informed consent. However, if Treg sources were ever able to expand to include tissue from surgeries involving older minors who could become mature minors or even adults while their tissue was still biobanked, reconsent requirements would become highly relevant. In addition, while commercialization of this process and any tissue products created is not the primary focus of current research and clinical application, any such behavior would raise a host of further concerns relating to public trust, consent, conflicts of interest, access, and control.

Even without a commercialization focus, biobanking discarded thymuses engages concerns about tissue ownership interests and the “biorights” discourse that has been ongoing in many jurisdictions. This is the idea that research participants should have “an ongoing right to control their research samples, to benefit directly from the research, and/or to be financially compensated for their contribution.” Although this perspective does not appear to be the majority position based on public perception research, it could complicate the informed consent process when present among parents or guardians of potential minor thymus donors. Canadian transplantation legislation prohibits the sale of tissue and requires gifting and so, while this remains a concern in social discourse that could boil over to legislative change, it is not an immediate concern for ongoing Treg research and therapy.

The key concerns with this method of procuring, expanding, and transferring Tregs are its permissibility and the resulting consent requirements involved pursuant to the various provincial legal frameworks and Canadian research ethics policies governing tissue donation and transplantation.

8. T. Caulfield and B. Murdoch, ‘Genes, Cells, and Biobanks: Yes, There’s Still a Consent Problem’, *Plos Biology* 15(7) (2017), p. e2002654; N.A.A. Giesbertz, A.L. Bredenoord and J.J.M. van Delden, ‘When Children Become Adults: Should Biobanks Re-Contact?’ *Plos Medicine* 13 (2016), pp. 8.

9. T. Caulfield, S. Burningham, Y. Joly, et al., ‘A Review of the Key Issues Associated with the Commercialization of Biobanks’, *Journal of Law and the Biosciences* 1 (2014), pp. 94–110; C. Critchley, D. Nicol and M. Otłowski, ‘The Impact of Commercialisation and Genetic Data Sharing Arrangements on Public Trust and the Intention to Participate in Biobank Research’, *Public Health Genomics* 18 (2015), pp. 160–172.

10. Fortin, Dion-Labrie, Hebert, et al., ‘Are “Anonymous” and “Non-directed” Prerequisites’; B. Daley and E. Cranley, ‘Biorights’ Rise: Donors Demand Control of Their samples’, *Boston Globe*, 10 October 2016. Available at: https://www.bostonglobe.com/metro/2016/10/09/the-rise-biorights-donors-are-demanding-control-and-sometimes-cash-exchange-for-genetic-samples/cBQ2E56cQ81kcITMRM/story.html (accessed 9 July 2020); B. Lau, ‘Patients Are More Aware About Their “Biorights” and Demand to Be Compensated’, *MIMS News*, 22 October 2016. Available at: http://today.mims.com/topic/patients-are-more-aware-about-their—biorights—and-demand-to-be-compensated (9 July accessed 2020).

11. J.L. Cunningham, M. Zanzi, M. Willebrand, et al., ‘No Regrets: Young Adult Patients in Psychiatry Report Positive Reactions to Biobank Participation’, *BMC Psychiatry* 17 (2017), art. 21; S.C. Sanderson, K.B. Brothers, Mercaldo ND, et al., ‘Public Attitudes Toward Consent and Data Sharing in Biobank Research: A Large Multi-Site Experimental Survey in the US’, *American Journal of Human Genetics* 100 (2017), pp. 414–427.
Legal framework governing tissue, donation, and transplantation

Health care falls primarily under provincial jurisdiction in Canada, so organ donation and transplantation legislation vary by province. The provincial statutes differ somewhat in the extent to which they address the legal questions presented by Treg cell transfer. This is not entirely unexpected, as they are already known for their lack of clarity in relation to their application to some ongoing transplant practices such as kidney paired donation. It is likely that the Treg cells derived and expanded from pediatric thymuses would fall under the definitions of “tissue” found in most of these statutes. In addition, exclusionary clauses that exempt certain biological materials like blood and blood constituents from these statutes—exclusions which are key to blood donation—are not worded to exempt thymuses and/or Tregs. Unfortunately, the fundamental distinction between removal and donation of tissue primarily for the sake of transplantation and secondary donation of waste tissues or by-products of a medical intervention undertaken for the benefit of the donor is not consistently or clearly addressed across provincial statutes. These are very different actions from an ethical perspective, given that with the latter there is no additional medical risk to the donor other than that which is attendant to the therapeutic intervention being undertaken.

The Alberta’s Human Tissue and Organ Donation Act 2006 is one exception to the general lack of distinction. It specifically allows a minor’s by-products (“tissue or an organ that is a waste product of a medical procedure”) to be donated “if a consent is given by the minor, if the minor is 16 years of age or over or lives independently of a guardian, or by a guardian.” Therefore, pediatric thymus donation pursuant to cardiac surgery appears to be permissible in Alberta with appropriate informed consent from parents or guardians.

Pursuant to the other statutes that fail to address the noted distinction, the permissibility of Treg use is questionable. Transplantation is defined similarly across provinces, generally speaking as the removal of tissue (or organs) from a human body and implantation into a living human body. Most statutes prohibit transplantation except in accordance with their provisions and do not contemplate living donation by minors or individuals under a specific age. For example, British Columbia’s Human Tissue Gift Act 1996 only enables living donation starting at age 19, if the capacity requirement is

---

12. Constitution Act, 1867 (UK), 30 and 31 Vict, c. 3, reprinted in R.S.C. 1985, Appendix II, No. 5.
13. M. Toews, M. Giancaspro, B. Richards, et al., ‘Kidney Paired Donation and the “Valuable Consideration” Problem: The Experiences of Australia, Canada, and the United States’, Transplantation 101(9) (2017), pp. 1996–2002.
14. B. von Tigerstrom, ‘Human Tissue Legislation and a New Medical Paradigm: Governing Tissue Engineering in Canada’, McGill Journal of Law and Health 8 (2015), pp. S1–S56.
15. Human Tissue and Organ Donation Act, S.A. 2006, c. H-14.5; E. Nelson, ‘Alberta’s New Organ and Tissue Donation Law: The Human Tissue and Organ Donation Act’, Health Law Review 18 (2010), pp. 5–14.
met. Ontario’s Trillium Gift of Life Network Act 2001 is similar, but with a minimum donor age of 16. The tight regulation of living donation by minors is likely because it can be considered unethical where there are serious risks to the donor, as it may not prioritize the donor’s best interests for common forms of living donation like kidney transplantation. 16 Use of waste tissue or by-product donation for transplantation is a distinct case that these statutes fail to adequately address. Appendix 1 (Table 1A) summarizes the provincial legislation’s relevant definitions of tissue and transplantation, as well as relevant provisions regarding living donation, including for minors where addressed. Amendments to provincial legislation enabling minors to donate tissue that are by-products for transplantation would clarify the legal framework.

The question of whether the mere fact that cells from the pediatric thymus will be transplanted triggers the more restrictive paradigm of provincial transplantation legislation is an interesting one. Currently, because the isolation and expansion of Treg cells from donated infant thymus for use in a recipient likely constitutes “tissue transplantation” under most provinces’ statutory frameworks, the practice could be technically prohibited in provinces that do not allow parents and guardians to consent to living donation for infants and other immature minors. This could be an unintended overreach by legislators, as from an ethical standpoint, the practice is arguably more akin to a typical biobanking arrangement and utilizes only waste tissues or by-products, avoiding any of the unnecessary additional risk of harm to the donor that is typically concomitant to living donation.

An alternative legal argument could be made that is not founded in a strict interpretation of the donation and transplantation legislation. This argument, which has not to our knowledge been tested in a Canadian court, is that the Treg cells that exist after isolation and expansion are a different product from the original tissue, as human ingenuity and skill has been applied in the interim. Thus, there would be no transplantation under the provincial statutes, rendering them inapplicable. This argument follows some of the jurisprudential reasoning used in the controversial American Moore v. Regents case that focused on the question of tissue property rights. 17 Specifically, in finding the plaintiff did not have property rights in the cell line derived from the plaintiff’s cells, the court noted that the cell line was no longer merely raw materials but a product of the scientists’ inventive effort. 18 However, this logic has not been applied in Canada for the purposes of exempting the use of clinical discard or by-products from regulation as transplantation. There is also uncertainty as to and criticism of the broad applicability of the Moore principles, and the United Kingdom has effectively rejected them. 19 Yet, it should be

16. Cunningham, Zanzi, Willebrand, et al., ‘No Regrets’; J.K. Workman, C.W. Myrick, R.L. Meyers, et al., ‘Pediatric Organ Donation and Transplantation’, Pediatrics 131 (2013), pp. E1723–E1730.
17. Moore v. Regents of the University of California. 793 P.2d 479 (Cal. 1990).
18. Op. cit.
19. Yearworth v. North Bristol NHS Trust, [2010] 107 BMLR 47, [2009] EWCA Civ 37; B. Capps, ‘Redefining Property in Human Body Parts: An Ethical Enquiry’, in Akira Akabayashi, ed., The Future of Bioethics: International Dialogues (Oxford: Oxford University Press, 2014), p. 235; D.C. Szostak, ‘Something More to the Story Moore v.
noted that Canadian federal regulations governing health products distinguish and more strictly regulate cells that are more than “minimally manipulated,” possibly suggesting there is indeed a transition from tissue to product that provincial donation and transplantation legislation should recognize. In this case, there would be a strong rationale suggesting that the transplantation legislation should not apply. Notably, other forms of clinical discard are already used in research with more typical medical research consents.

Few would question the idea that a liver transplant constitutes the transplantation of an organ and/or tissue, but in reality only a portion of a living donor’s liver is actually used. Therefore, the fact that Treg cells are isolated from the thymus organ does not seem to be instructive as to whether this process has the legal status of tissue transplantation under the noted statutes. The expansion of cells is also not a determinative factor unless none of the original cells are transplanted, in which case a stronger argument could be made that no transplantation occurs. However, even in this case, the expanded cells still have the genetic and other qualities of the original cells from which they divided, arguably remaining connected to the donation. Canadian legal scholars have suggested that tissue contains genetic and other information and thus donors should be afforded similar legal rights of control to those that apply to the use of information. Under this line of argument, one could contend that expanded cells, having much of the same information found in the original sample, are not a different product or entity. This would support the logic that the methodology is indeed transplantation, though broadly accepting this argument would also have serious implications for biorights and the use of clinical discard.

The common law is generally overridden by relevant statutory provisions to the extent that they conflict, and to our knowledge the common law does not directly address donation of by-products by infants. It does set a standard for recognizing the medical decision-making capacity of mature minors that could be relevant in the case of any mature adolescents with potentially useful tissues. However, given that provincial legislation limits donations by minors under age 16 to regenerative tissues “in almost...

Regents of the University of California Two Decades Later’, Journal of Legal Medicine 31 (2010), pp. 443–454.
20. T. Caulfield and B. Murdoch, ‘Regulatory and Policy tools to Address Unproven Stem Cell Interventions in Canada: The Need for Action’, BMC Medical Ethics 20 (2019), art. 51; Safety of Human Cells, Tissues and Organs for Transplantation Regulations, SOR/2007–118.
21. See, for example, I. Solomon, M. O’Reilly, L. Ionescu, et al., ‘Functional Differences Between Placental Micro-and Macrovascular Endothelial Colony-Forming Cells’, Stem Cells Translational Medicine 5(3) (2016), pp. 291–300.
22. U. Ogbogu, S. Burningham and T. Caulfield, ‘The Right to Control and Access Genetic Research Information: Does McInerney Offer a Way out of the Consent/withdrawal Conundrum’, UBC Law Review 47 (2014), pp. 275–292; T. Caulfield and A.L. McGuire, ‘Policy Uncertainty, Sequencing, and Cell Lines’, G3-Genes Genomes Genetics, 3 (2013), pp. 1205–1207.
23. A.C. v. Manitoba (Director of Child and Family Services), 2003 SCC 30.
all cases,” common law is of limited direct use in relation to issues of donor age. Of course, many of the general principles of informed consent are founded in common law disclosure requirements emanating from the jurisprudence of negligence and fiduciary obligation. These require disclosing everything that a reasonable person in the patients’ circumstances would want disclosed, and determining this involves considering both objective factors such as scientific evidence and subjective factors including a patient’s non-idiosyncratic and reasonable beliefs, fears, desires, and expectations. If transplantation statutes do not in fact prohibit the Treg methodology, these principles become relevant to obtaining informed consent in the usual manner that is largely reflected in research ethics policy.

Research ethics requirements

Because much of the procurement and use of pediatric thymus tissue for processing and transplantation is certain to be undertaken through clinical trials, research ethics policy is highly germane to informed consent and biobanking requirements in instances where it is legally permissible. The World Health Organization’s Guiding Principles on Human Cell, Tissue and Organ Transplantation states that living minors should not be donors except under “narrow exceptions allowed under national law.”

The Tri Council Policy Statement [TCPS2] is the most important research ethics policy in Canada, because adherence to it, as overseen by a research ethics board, is a requirement for federal funding. Informed consent must be ongoing under the TCPS2. It espouses a consent approach based on “decision-making capacity” rather than one based on age, to the extent that it does not conflict with the law. In addition, in the case of minors who are unable to assent (assent generally being an agreement to participate in research from a person lacking capacity to give informed consent), such as infants, researchers must seek their assent to continue their participation once they are “able to understand the purpose of the research as well as its risks and benefits.” These research ethics rules would apply to research-based Treg biobanking and transplantation but could be largely irrelevant if the timelines for completion of transplantation are almost always short and precede the development of the donor’s complex language skills and decision-making capacity. The noted common law requirements for disclosure also form part of the TCPS2’s policy for ensuring consent is informed, and these would apply when obtaining consent from parents or guardians. Ongoing consent also includes a

24. Cunningham, Zanzi, Willebrand, et al., ‘No Regrets’.
25. McInerney v. MacDonald, [1992] 2 SCR 138; Reibl v. Hughes, [1980] 2 SCR 880, 1980 CanLII 23 (SCC).
26. Arndt v. Smith, [1997] 2 SCR 539, 1997 CanLII 360 (SCC).
27. Caulfield and Murdoch, ‘Genes, Cells, and Biobanks’.
28. Government of Canada, Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans—TCPS2 2018. Available at: https://ethics.gc.ca/eng/documents/tcp2-2018-en-interactive-final.pdf (accessed 2020 May 8).
29. Capps, ‘Redefining Property in Human Body Parts’.
30. Op. cit.
The right to withdraw from research at any time, and this could at times conflict with the health priorities of a potential Treg recipient or the time, effort, and money spent on procuring, isolating, and expanding the Tregs.31

Notably, there is also a requirement in the TCPS2 to disclose incidental findings “within the limits of consent provided,” and parents and guardians would need to be advised of this and consulted about the topic when providing consent.32 There is “neither national nor international consensus on the treatment of incidental findings in pediatrics,” and reviews of consent forms have noted significant variability in practices.33 Some have suggested that parents’ “right not to know” of significant incidental findings should be overridden if it is in the best interests of the child.34 Given the uncertainty, researchers should consult with potential patients and research ethics boards as needed to develop acceptable policies and disclosures for incidental findings.

Privacy issues with Canadian pediatric biobanking have been delineated by other scholars, including but not limited to concerns relating to access, use and transfer of data and samples, risk of unauthorized access, and the special relationship between donor, parent, and researcher.35 Under the TCPS2, Treg donor privacy must be safeguarded from unauthorized access or disclosure of information, and de-identification of materials should be attempted as much as possible.36

In sum, the research ethics challenges facing Treg research are familiar and reflect the broader ongoing concerns within pediatric biobanking and research.

Conclusions

Based on this review, there appear to be two important hurdles to waste tissue donation and Treg use posited for infant thymuses. The first is the uncertain legal status of the procedure and the fact that it appears to meet the legal definition of tissue transplantation pursuant to provincial legislation. In Alberta, this is likely not a problem, as by-products of minors can be donated with guardian consent regardless of whether the process is defined as transplantation. Navigating the uncertainty in the majority of provinces that do not sufficiently address the permissibility of the process, and may even prohibit it, will require consultation with government and other relevant stakeholders. Practically speaking, it is unclear whether a technically prohibited method such as this would be prevented from

31. Ogbogu, Burningham and Caulfield, ‘The Right to Control and Access Genetic Research Information’.
32. Capps, ‘Redefining Property in Human Body Parts’.
33. E.S. Dove, D. Avard, L. Black, et al., ‘Emerging Issues in Paediatric Health Research Consent Forms in Canada: Working Towards Best Practices’, BMC Medical Ethics 14 (2013), pp. 10.
34. D. Avard, K. Senecal, P. Madadi, et al., ‘Pediatric Research and the Return of Individual Research Results’, Journal of Law Medicine & Ethics 39 (2011), pp. 593–604.
35. E.S. Dove, L. Black, D. Avard, et al., ‘Charting the Privacy Landscape in Canadian Paediatric Biobanks’, Health Law Journal 20 (2013), pp. 1–46.
36. Ogbogu, Burningham and Caulfield, ‘The Right to Control and Access Genetic Research Information’. 
occurring, other than in instances where a research ethics board noted these legal uncertainties and withheld approval. Provinces like British Columbia and Ontario may need to consider amending their respective statutes in order to properly enable the transplantation of by-products like Tregs from infant donors. Because this process is fairly ethically uncontroversial as a therapeutic use of existing clinical discard, one could argue it should be permitted. More broadly, legislative amendments should be made to clearly and comprehensively address and enable ethically uncontroversial uses of clinical discard. The second hurdle includes a bundle of more typical research ethics and policy-based requirements traditional to informed consent for short-term biobanking, and backstopped by supporting law. This should be surmountable with appropriate research planning and research ethics board oversight.

A long-term supply of Tregs from discarded pediatric thymus could be important to the health of many patients through use in immunotherapy to improve outcomes in transplantation and other immune-mediated diseases. It is unfortunate a clinically useful technique may sometimes be impermissible due to potentially unintended consequences of existing legal frameworks, especially if there is no defensible ethical or policy reason for such a restriction. Given one is not apparent, policymakers should strongly consider more clearly delineating the scope and application of provincial donation and transplantation legislation, in a manner that enables Treg transplantation and other ethically sound uses of clinical discard. Moreover, in international jurisdictions where similar technical legal or regulatory problems exist, policy action could also generate improvements in clinical research and ultimately long-term public health.

Acknowledgments
The author thanks Timothy Caulfield, Allison Jandura, Ubaka Ogbogu, Barbara von Tigerstrom, Maeghan Toews, Megan Levings and Sabine Ivison for their helpful input and suggestions. He also thanks Allison Jandura for compiling the table of legislative provisions.

Declaration of conflicting interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The Health Law Institute thanks BioCanRx and the Canadian Donation and Transplantation Research Program for funding this research.

ORCID iD
Blake Murdoch https://orcid.org/0000-0003-4654-1980

Supplemental Material
Supplemental material for this article is available online.

37. Cunningham, Zanzi, Willebrand, et al., ‘No Regrets’.