

Article

## Analysis of the Science and Technology Narrative within Organ Donation and Transplantation Coverage in Canadian Newspapers

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**Abstract:** Organ failure is one cause of death. Advancements in scientific research and technological development made organ transplantation possible and continue to find better ways to substitute failed organs with other organs of biological origin or artificial organs. Media, including newspapers, are one source of information for the public. The purpose of this study was to examine to what extent and how science and technology research and development are covered in the organ transplantation and organ donation (ODOT) coverage of  $n = 300$  Canadian newspapers, including the two Canadian newspapers with national reach (*The Globe and Mail*, *National Post*). The study generated qualitative and quantitative data addressing the following issues: (1) which scientific and technological developments are mentioned in the ODOT coverage; and (2) what issues are mentioned in the coverage of scientific and technological advancements linked to ODOT. We found little to no coverage of many technological and scientific advancements evident in academic and grey literature covering ODOT, and we found little engagement with social and ethical issues already raised about these advancements in the literature. The only area we found to be covered to a broader extent was xenotransplantation, although the coverage stopped after 2002. We argue that the newspaper coverage of ODOT under reports scientific and technological advancements related to ODOT and the issues these advancements might raise.

**Keywords:** organ transplantation; organ donation; science; technology; newspapers

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## 1. Introduction

Organ failure is one cause of death. Advancements in scientific research and technological development (SRTD) made organ transplantation possible [1–6], and SRTD efforts are constantly under way to better the outcome of organ transplantations. The need for replacing failed human organs exceeds available organs from human donors; for example, the various Eurotransplant waiting lists contain over 15,000 people of whom 1451 died in 2011 [7]. The situation is not any better in Canada [8], the USA [9] or China [10]. Therefore, SRTD efforts are also focusing on finding ways to substitute failed organs that do not involve human organs, such as stem cell transplants [11], using organs of non-human origin [12,13], growing organs from human stem cells [14], organ printing [15–18] or the use of artificial organs [19–26] (see also the literature around ears, eyes, knees, neural prostheses, joints, muscles, kidney, liver, cartilage, lungs, discs, pancreas, dental pulp, skin, hippocampus, legs and hands), and for functions, such as speech, which do not mention transplantation [27–49].

Many issues are discussed around organ donation and organ transplantation (ODOT) linked to the different possible sources of organs [50–62]. Academic studies cover various aspects of media and ODOT, including: the impact of social media, such as Facebook, on organ donor registration [63], the effect of entertainment-education programs in Korea on organ donor registration [64], the effectiveness of using reciprocity to motivate organ donations [65], the role of the media in promoting organ donation to Hispanics [66,67], the impact of social representation of organ donation on organ donation campaigns [68], the impact of media on the promotion of the Michigan organ donor registry [69], the use of mass media campaigns to change health behavior [70], a meta-analytic review of communication campaigns to promote organ donation [71] and the results of the ISHLT/FACT poll that gave evidence on how to improve organ donation [72]. No study has looked at ODOT media coverage through science and technology narratives.

The purpose of this study was to examine to what extent and how SRTD is covered in the ODOT coverage of  $n = 300$  Canadian newspapers, including two Canadian newspapers with national reach (*The Globe and Mail*, *National Post*). The study generated qualitative and quantitative data addressing the following issues: (1) which scientific and technological developments are mentioned in the ODOT coverage; and (2) what issues are mentioned in the coverage of scientific and technological advancements linked to ODOT.

## 2. Methods

### 2.1. Analytical Framework

We used a framing analysis [73] to investigate the coverage of SRDT within ODOT covering newspaper articles. Structural [74], content [75] and issue-specific framing [76,77] are three ways of framing. We were interested in how SRTDs linked to ODOT are covered within the content of ODOT coverage. Our content analysis focuses on how the communicator (the newspaper) frames SRTDs as

they relate to ODOT. Persuasion is one media effect and encompasses the message, who is used as a source and the “persuadability of media consumers” [78]. The question is what the reader will be persuaded of after reading the SRTD coverage within ODOT covering newspaper articles?

## 2.2. Data Source and Data Analysis

### 2.2.1. Stage 1

To generate qualitative data, we downloaded relevant data from two Canadian newspapers with national scope (*The Globe and Mail*; *National Post*). We searched *The Globe and Mail* and *National Post* for the term “organ” in the title. All relevant articles ( $n = 258$  for *The Globe and Mail* and  $n = 177$  for the *National Post*) were downloaded as PDF files on 6 May 2013, and imported into ATLAS.ti<sup>®</sup>, a qualitative data analysis software. We then read all of the articles performing a hermeneutical keyword coding, while keeping in mind the research questions. For any given source, at least two authors performed the coding to increase reliability, and differences were resolved through discussion. Once coding was finished, we used ATLAS.ti<sup>®</sup> to generate the frequency of certain themes (quantitative data) and a list of quotations containing searched key words (qualitative data).

### 2.2.2. Stage 2

To generate quantitative data on the SRTDs we found mentioned in Stage 1 within and outside ODOT articles, we searched two databases. We accessed 300 Canadian newspapers published between 1977–2014 through the ProQuest database, “Canadian newsstand complete,” which we accessed through the University of Calgary library (10 March 2014). We accessed the *National Post* from 1998 (the first time the newspaper was published) to 2014 through the “Canadian newsstand complete”. We accessed *The Globe and Mail* through two databases accessible through the University of Calgary library (10 March 2014); we used the *ProQuest Historical Newspapers: The Globe and Mail (1844–2010) database* to gain all of the articles from the first time organ transplant and organ donation were mentioned (1963) to 2009, and for the years of 2010–2014, we accessed *The Globe and Mail* through the “Canadian newsstand complete”.

We employed two different search strategies to gain the hit counts for the SRTDs. To obtain quantitative data of the mentioning of Stage 1-identified SRTD’s in ODOT articles, we searched the databases in two steps. The first step identified all articles in the databases that contained the terms “organ transplantation” or “organ donation” in the full text. These articles were then searched in the second step for the SRTDs that we identified in Stage 1, and the results were recorded in 10-year sections to show a historical timeline of mentioning of the SRTDs within the ODOT-mentioning articles (Tables A1–A3 at end of article after the references). To gain quantitative data on how often the SRTDs mentioned in ODOT articles analyzed in Stage 1 were mentioned outside of ODOT articles, we simply searched all of the databases for the appearance of the SRTDs identified in Stage 1 in the full text of articles, not limiting ourselves to ODOT articles (Tables A1–A3 at end of article after the references).

### 2.3. Limitations

Although our study provided some quantitative data for  $n = 300$  English language Canadian newspapers, it did not cover French language newspapers from Canada. The qualitative content analysis focused only on two Canadian newspapers with national reach. We also did not cover other media types. Given the sources we investigated, our results cannot be used to generalize our findings, whether for the whole of Canada, North America or beyond.

## 3. Results

### 3.1. What Technologies Are Mentioned?

Tables A1–A3 (at end of article after the references) suggest a disconnect in all Canadian newspapers covered between the reporting of scientific and technological advancements that are applicable to ODOT and the actual coverage of such scientific and technological advancements within newspaper articles that cover ODOT. Tables A1–A3 suggest further that certain SRTD topics are only covered for a certain time span. Terms linked to the use of animal organs for transplants, such as xenotransplantation, and terms, such as animal organs, animal, baboon, pig and sheep, are covered much less of not at all in the last 10 years. Technologies represented by the terms clon\* and “stem cell” are two other examples that have seen a precipitous fall in appearance.

### 3.2. What Issues Are Mentioned in Relation to Scientific and Technological Advancements?

As to which issues are discussed related to SRTD covered in ODOT articles, the following were found.

#### 3.2.1. Terms Ability, Abilities and Able

No article uses the terms “abilities” or “ability” to characterize a given scientific or technological advancement. As for the term “able”, a 1987 *Globe and Mail* article states “that an NMR scanner was able to detect increased muscle thickness in hearts that were being rejected by the body’s immune system” [79]. Other articles cover the genetically-engineered protein CTLA4Ig as a immunosuppressive with less side effects [80] and that injecting a human gene into a pig’s fertilized egg generates a protein in an animal that enables the human body to better accept animal organs [81] (see also [82]). In the *National Post*, a 2008 article states that a new method for refurbishing lungs should be able to increase the usability of lungs from 10% to 15% to 50%–60% [83]. In the article, containing the term scien\*, the term “able” is not linked to any scientific or technological product or process.

#### 3.2.2. Term Ethic\*

Ethics is covered in the *Globe and Mail* in relation to reproductive technologies focusing on therapeutic cloning and selling of eggs and sperm, organ gathering procedures and black market problems, as well as animal organ transplant (whereby safety issues are seen as ethical ones) [84]. One article covers the growth of a new heart and states that there might be ethical issues without saying what they are [85]. As for the *National Post*, the term ethics has been showing up

around websites matching donors and recipients for live organ transplant [86] and animals growing human organs [87]. In both cases, the ethical issues are not explicitly stated.

As for the articles containing the term *scien\**, two *Globe and Mail* articles cover animal organ transplantation [84,88] and one article covers replacement hearts [85]. As for the *National Post*, the only issue covered is xenotransplantation [87,89].

### 3.2.3. Term Cost

Only two articles mention cost and a technology in the same paragraph. One 1980 article in the *Globe and Mail* compares the cost of an organ transplant with a technology to be used, “The cost of transplanting a kidney is \$5000. The cost of dialysis, for one year, is \$20,000 to \$30,000 and that’s strictly medical costs” [90]. One 2001 article in the *National Post* states that a new drug “ISAtx247 can be administered in smaller doses, is significantly less toxic and three to five times more potent than cyclosporine, suggesting the drug has the potential to improve a patient’s quality of life, which could also decrease health care costs” [91].

As for the articles in *The Globe and Mail* containing the term *scien\**, one mentions the cost of kidney dialysis [92], and another article compares the cost of transplant *versus* dialysis [93]. No articles in the *National Post* contained this term.

### 3.2.4. Term Risk

As for risk, four articles in the *Globe and Mail* and two in the *National Post* cover risk in relation to technologies. One *Globe and Mail* article credits the appearance of the drug cyclosporine as one factor for an increase in heart transplants due to a decrease in risk [94]. Another article highlights the advantage of NMR technology, “[a]t present, heart graft recipients must undergo at least eight biopsies (unpleasant procedures in which tiny samples of heart tissue are removed using an instrument inserted in the jugular vein) during the first three months after their operation. Five out of eight of the potentially dangerous biopsies could be replaced with risk-free NMR procedures” [79]. Some look into the risk of xenotransplantation, whereby some highlight ways to decrease risk [81], while others considered what are seen as risks [87]. As for the *National Post*, one 2002 article gives voice to the notion that xenotransplantation should not be performed till all the health risks are known [95], while another article highlights that bladders grown from one’s own cells and implanted reduces the risk of rejection [96].

As for how the term “risk” is used in the articles that mention *scien\** and are linked to a scientific/technological product or process, five articles cover risk in relation to xenotransplantation in the *Globe and Mail*, and one covers the risk of cyclosporine, an anti-rejection drug. As for the *National Post*, the only topic linked to risk in the context of ODOT is xenotransplantation, with one 2002 article stating, “Informed Canadians tended to conclude that the risks of xenotransplantation were greater than the benefits because of health risks and the scientific uncertainty surrounding these risks” [97].

### 3.2.5. Terms Law, Legislation and Guideline

As for the law and technology, only one *Globe and Mail* article covers it. “Those who want to change the law point out that we have often altered the rules on who’s alive and who isn’t. Technology

produced some of the changes, as when the stethoscope (no heartbeat) replaced a hand mirror held to the nostrils (no breath)” [98]. One *National Post* article comments on using the Internet to match donors and recipients [86]. As for the term “law” used in the articles that mention scien\*, none of the articles are linked to a scientific/technological product or process related to ODOT.

For the term “guidelines”, one 1995 and one 1998 *Globe and Mail* article mention U.S. guidelines related to xenotransplantation [84,99]. One 2001 *National Post* article covers Health Canada guidelines for xenotransplantation [100]; another article from 2012 covering the issue of being legally dead states, “The article also suggested that the guidelines abandoned “time-honored” safeguards, such as not declaring brain death until anticonvulsants, sedatives or other drugs that can bring about a death-like state have drained completely from the system” [101]. As for the term “guidelines” used in the articles that mention scien\*, two articles in the *Globe and Mail* are linked to xenotransplantation [84,99]. As for the *National Post*, one article looks at the use of people whose hearts have stopped but still have brain functions as organ donors [102].

As for how the term “legislation” is used in the articles that mention tech\*, “legislation” is used once in a 2002 *National Post* article about a government-sponsored report on xenotransplantation stating, “Moreover, the report says Canadians want “stringent and transparent legislation and regulations” to be enacted to ensure xenotransplantation—if it ever is allowed—is governed cautiously” [103].

As for how “legislation” is used in the articles that mention scien\*, it is used in the same article from the *National Post* as stated above covering a government-sponsored report on xenotransplantation [103].

### 3.2.6. Term Concern

As for concerns, one *Globe and Mail* article states that concerns with heart transplants could be addressed with synthetically-/in dish-grown heart [85], and two others focused on xenotransplantation as a means to address the concern of the bad organ donation ratio in Canada [84,104]. The article in the *National Post* also focused on xenotransplantation [95]. As for how “concern” is used in the articles that mention scien\* and are linked to a scientific/technological products or processes applicable to ODOT, xenotransplantation is mentioned in one *Globe and Mail* article [84] and one *National Post* article [95].

### 3.2.7. Term Problem

Issues that are voiced around the term problem in the *Globe and Mail* include: problems with xenotransplantation [99], ethical problems with growing hearts (without saying what the ethical problems are) [85], one mentioning of a specific drug that has the potential of solving one problem of organ transplantation (organ rejection) [80], another listing various solutions to the problem of organ rejection [105] and a third stating that xenotransplantation could decrease the problem of organ rejection [84]. In the *National Post*, one article highlights the problem of cryopreserving whole organs [106], problems with xenotransplantation [87] and cyclosporine [91]. As for how the term “problem” is used in the articles that mention scien\* and are linked to a scientific/technological products or processes in ODOT, the *Globe and Mail* mentions aspects of xenotransplantation [99]. One

article highlights the improvement in transplantation science, which is nearly irrelevant due to a shortage of organs [107], and another article focuses on the use of the protein, CTLA4Ig, to deal with rejection problems [80]. The *National Post* had one article highlighting xenotransplantation as an approach to resolve rejection problems [89], one on problems with cryopreservation [106] and one with the problem of harvesting “organs for transplant from people whose hearts have stopped but are not yet brain dead” [108].

### 3.2.8. Term Potential

The term potential is linked to potential problems of xenotransplantation [84] in the *Globe and Mail*. The *National Post* mentions ovary freezing as a potential breakthrough [106], the potential of pigs related to xenotransplantation [109], the potential health risks of xenotransplantation [103], the potential of a drug called ISAtx247 to replace cyclosporine, which would decrease the number of side effects in organ anti-rejection drugs [91], and using one’s own cells to grow bladders as a potential milestone to solve organ shortages [96]. One article states, “The British Columbia Transplant Society expects the demand for organ transplants in Canada to double by 2005 as the mortality rate continues to drop and more potential transplant candidates are sustained through technology” [110]. As for how “potential\*” is used in articles that mention scien\* and are linked to a scientific/technological product or process, one article in the *Globe and Mail* mentions that xenotransplantation could potentially cause diseases and have a potential dark side [84], and another article states that growing hearts “is also a chance for biomedical companies to get in on the ground floor of a potentially profitable business” [85]. In the *National Post*, the potential health risks of xenotransplantation [103,111], ovary freezing as a potential breakthrough [106] and using one’s own cells to grow bladders as a potential milestone to solve organ shortages [96] are mentioned.

### 3.2.9. Term Decision

Two articles in the *Globe and Mail* and two in the *National Post* cover the term “decision” in relation to a technology. One *Globe and Mail* article states about animal-human transplants, “A lot of the decisions of bio-technology are really decisions that affect all of us and these decisions are made by the so-called experts,” said Edna Einsiedel, professor of communications studies at the U of C and organizer of Saturday’s forum” [112]. Another covers the use of GPS to keep track of organs in transit, “The device also records and transmits data every 10 seconds on temperature, flow-rate, vascular resistance, and pressure to support surgical decisions” [113]. In the *National Post*, both articles cover xenotransplantation, with one article stating, “But on Monday, Graham Bulfield, director of the Roslin Institute in Edinburgh, said, “While xenotransplantation [organ transfer from one species to another] has raised a number of well-publicized issues such as possible infection with pig viruses, these were not the basis for the decision to refocus funding.” He said the reasons were commercial, not questions of safety” [114]. The second states, “Once a staple of science fiction, xenotransplantation is now considered a few years away. Last week, Health Canada announced a 14-month public consultation on the issue, promising that the public would have input into policy decisions” [111]. As for how “decision” is used in articles that mention scien\*, no article was found in the *Globe and Mail* and only one article was found in the *National Post* that covers xenotransplantation [114].

### 3.2.10. Terms Awareness, Need and Education

The terms awareness, need and education are not used in combination with a technology or science, to just mention three terms that one might have expected.

## 4. Discussion

According to Entman, “frames call attention to some aspects of reality while obscuring other elements, which might lead audiences to have different reactions” [115], and frames in a news text are “really the imprint of power—it registers the identity of actors or interests that competed to dominate the text” [115]. Our study reveals a puzzling disconnect between ODOT coverage and the coverage of scientific and technological advancements used in ODOT; for example, the *National Post* had  $n = 79$  articles that covered the technological advancements of artificial hearts. However, only  $n = 3$  ODOT articles covered artificial hearts (Table A2). Similarly,  $n = 499$  articles covered artificial hearts in *The Globe and Mail* in general, with the first article being from 1937. However, only  $n = 7$  ODOT articles mention artificial hearts (Table A1). Finally, the same discrepancy is evident for the  $n = 300$  newspapers from the *Canadian newsstand complete database*;  $n = 81$  ODOT articles versus  $n = 2725$  of non-ODOT articles that contain the term “artificial heart”. The same puzzling disconnect can be observed with other ODOT-linked scientific and technological advancements. We say puzzling because although it is known that newspapers are influenced by their environment, including ownership, funding, need for circulation, advertisement revenue and the readers preference for reading like-minded news [116–137], this should not hinder the coverage of ODOT-linked scientific and technological advancements within ODOT-covering articles, as the public is interested in this area and the topic should therefore fit funder and advertiser expectations. A lively discourse exists around how to report on scientific and technological advancements and how to increase the interest of the public in science and technology [138–141]; indeed, in the field of nanotechnology, the term “democratizing nanotechnology” is used to indicate the need to involve the public early on [142–145]. Although the newspapers cover scientific and technological advancements, including the ones relevant and applicable to ODOT, this reporting is not linked to ODOT. As a result, readers interested in ODOT do not gain much insight in ODOT-related scientific and technological advancements. The issue is not only about the lack of coverage, but that our content analysis of the ODOT articles that covered scientific and technological advancements found very few issues, whether positively or negatively raised. Even if issues were raised, for example in relation to xenotransplantation, the coverage of these issues used general statements without much elaboration. Furthermore, our findings indicate that for the three scientific and technological advancements covered most, xenotransplantation, cloning and stem cells, the peak of interest has passed. Indeed, very few articles covered these three areas in the last eight years. As for xenotransplantation, this might be due to a 2002 report on a public consultation on xenotransplantation released by the Canadian Public Health Association [146] and presented to Minister Rock responsible for Health Canada at that time. The report states, “In accordance with its mandate, the Public Advisory Group makes the following recommendations on xenotransplantation based on input from Canadians: 1. That Canada not proceed with xenotransplantation involving humans at this time as there are critical issues that first need to be resolved” [146].

## 5. Conclusions

Our findings that a disconnect seems to exist between the scientific and technological development of ODOT-relevant products and processes and the coverage of such advancements within the ODOT coverage of the newspapers have several implications for groups involved in ODOT. Numerous campaigns endeavor to increase the availability of organs [71]. The first campaign was in 1978 according to a *Globe and Mail* article [90], with articles stating that organ shortages will continue until the attitudes of people change [147] and that other campaigns, such as the ones discouraging drunk driving, cut down on the availability of brain-dead people as organ donors [148]. One *Globe and Mail* article states that public education campaigns do work [149] and that the problem is elsewhere, but it still states, “Canada’s organ donation rate, 15 per one million population, is one of the lowest in the developed world” [149]. The *National Post* also mentions in various articles that campaigns are under way with a 2012 article stating, “Months into the latest national campaign to recruit desperately needed organ donors, a legal scholar is arguing that new guidelines for declaring people brain dead and eligible for organ harvesting likely violate the Charter of Rights and Freedoms” [150]. Given that campaigns are still ongoing, we suggest that the campaigns themselves have to consider changes that would include education on scientific and technological developments by writing foresight bulletins to alert people and get people involved in the governance of emerging scientific and technological developments. Currently, the newspaper coverage is not linking scientific and technological developments to ODOT. Therefore, campaigns could include social media sites where technological development updates are posted.

In general, the SRTD linked to ODOT discourse is another example, albeit a surprising one, of the inadequacy of newspaper coverage.

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## Author Contributions

Gregor Wolbring generated and supervised the research project. Jennifer Cheung did the research. Gregor Wolbring and Jennifer Cheung wrote the article.

## Conflicts of Interest

The authors declare no conflict of interest.

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**Table A2.** Hit counts of keywords in the *National Post* 1998–2014.

<b>Keyword</b>	<b>All Together 1998–2014 ODOT Related</b>	<b>1998–1999</b>	<b>2000–2009</b>	<b>2010–2014</b>	<b>All Together without Confined to ODOT</b>
Tissue	73	10	48	15	3496
Scien*	48	5	30	13	50,076
Tech*	35	4	24	7	77,787
Dialysis	30	5	19	6	465
Clon*	14	2	11	1	2698
Pig	13	2	10	1	3490
Mech*	12	1	5	6	17,237
Transgenic	8	1	7	0	206
Artificial	7	0	4	3	4732
Embryo	7	1	6	0	687
Sheep	4	1	3	0	3014
“Stem cell”	4	0	4	0	785
Baboon	3	0	3	0	92
“Artificial heart”	3	0	1	2	79
Xenot*	1	0	1	0	25
“Mechanical heart”	1	0	0	1	13
Prosthetic	0	0	0	0	448
Bionic	0	0	0	0	190
“Tissue engineering”	0	0	0	0	26
“Animal organ”	0	0	0	0	13
“Artificial kidney”	0	0	0	0	11
“3-D print”	0	0	0	0	2
“Artificial ear”	0	0	0	0	2
“Artificial organ”	0	0	0	0	0

**Table A3.** Hit counts of keywords in the complete Canadian newsstand from 1980 to 2014.

Keyword	Terms Linked to ODOT 1980–2014	Before 1980	1980–1989	1990–1999	2000–2009	2010–2014	Terms not Linked to ODOT 1980–2014
Tissue	3345	4	160	481	1843	857	112,481
Scien*	2810	3	210	714	1567	316	1,230,517
Tech*	1368	1	134	333	761	140	1,408,265
Animal	858	1	62	261	448	46	463,062
Clon*	509	1	10	114	374	14	54,862
Artificial	462	1	82	125	207	48	122,434
Mech*	460	1	54	87	242	78	406,426
Pig	398	1	19	151	213	13	81,958
Sheep	245	0	7	81	143	12	94,482
“Stem cell”	232	0	0	7	189	36	13,995
Embryo	211	0	8	52	142	9	11,855
Xenot*	201	0	0	81	117 (last one 2004)	2	505
Baboon	128	0	21	86	19 (last 2006)	1	2469
“Animal organ”	96	0	6	52	38 (last 2006)	0	140
“Artificial heart”	81	0	23	18	30	11	2725
Transgenic	61	0	0	33	27	0	1908
Dialysis	46	0	4	4	36	2	331
“Mechanical heart”	42	0	4	3	24	11	708
Prosthetic	22	0	0	3	13	6	10,217
“Tissue engineering”	12	0	0	2	3	5	519
Bionic	11	0	2	0	8	1	4796
“Artificial organ”	8	1	2	0	4	1	72
“Artificial ear”	1	0	1	0	0	0	46
“3-D print”	0	0	0	0	0	0	35
“Artificial kidney”	0	0	0	0	0	0	0