

Organ and tissue donation from poisoned patients in the emergency department: A Canadian emergency physician survey

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CLINICIAN'S CAPSULE

What is known about the topic?

Patients who die from poisoning are potential organ or tissue donors but may represent an under-referred population.

What did this study ask?

Do Canadian emergency physicians under-refer patients who die from poisoning for organ or tissue donation, and what characteristics influence referral rates?

What did this study find?

In a simulated context, poisoned patients were under-referred as potential organ or tissue donors, and both environmental and clinician characteristics influenced rates.

Why does this study matter to clinicians?

Understanding factors that affect donor referral may decrease the morbidity and mortality for patients waiting for organ or tissue donation.

poisoning were referred for organ or tissue donation, compared with 92% in a non-poisoning scenario. Poisons associated with lower referrals included sedatives, acetaminophen, chemical exposure, and organophosphates. A total of 175 physicians completed the demographic survey (11.9%). Characteristics associated with increased referrals included previous referral experience, donation training, donation support, >10 years of service, urban practice, emergency medicine certification, and male gender.

Conclusions: Scenarios involving poisoning were referred less often when compared with an ideal scenario. Because poisoning is not a contraindication for referral, this represents a potential source of donors. Targeted training and referral support may help improve donation rates in this demographic.

RÉSUMÉ

Objectif: Le dépistage des patients susceptibles de faire des dons d'organes ou de tissus est une compétence fondamentale des médecins d'urgence. En 2015, 4631 personnes au Canada étaient inscrites sur des listes d'attente en vue d'une transplantation et 262 d'entre elles sont mortes durant ce temps. Le taux de don au Canada est inférieur à la moitié de celui enregistré dans des pays comparables; il faut donc élaborer des stratégies permettant d'accroître le nombre de donneurs. Les patients qui succombent à une intoxication peuvent constituer un bassin sous-utilisé de dons. L'étude décrite ici porte sur les pratiques et les perceptions des médecins quant à l'admissibilité des patients décédés par intoxication à des dons d'organes ou de tissus.

Méthode: Il s'agit d'une enquête transversale, unidirectionnelle, menée parmi les membres de l'Association canadienne des médecins d'urgence (n = 1471) invités à y participer. On leur a présenté 20 scénarios, et les médecins devaient indiquer s'ils considéraient les patients en question comme des donneurs potentiels d'organes ou de tissus. Les résultats sont exprimés sous forme descriptive, et des associations ont été établies entre les données démographiques et la pratique des demandes de dons d'organes.

ABSTRACT

Objectives: Screening for organ and tissue donation is an essential skill for emergency physicians. In 2015, 4,631 Canadians were on a waiting list for a transplant, and 262 died while waiting. Canada's donation rates are less than half of comparable countries, so it is essential to explore strategies to improve the referral of donors. Poisoned patients may be one such underutilized source for donation. This study explores physician practices and perceptions regarding the referral of poisoned patients as donors.

Methods: In this cross-sectional unidirectional survey, 1,471 physician members of the Canadian Association of Emergency Physicians were invited to participate. Physicians were presented with 20 scenarios and asked whether they would refer the patient as a potential organ or tissue donor. Results were reported descriptively, and associations between demographics and referral patterns were assessed.

Results: Physicians totalling 208 participated in the organ or tissue donation scenarios (14.1%); 75% of scenarios involving

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Résultats: Au total, 208 médecins (14,1 %) ont indiqué leur choix dans les scénarios de dons d'organes ou de tissus. Une demande de dons a été faite dans 75% des scénarios comportant une intoxication contre 92% de ceux n'en comportant pas. Les substances associées à des taux inférieurs de demande de dons étaient les sédatifs, l'acétaminophène, les produits chimiques et les organophosphates. Cent soixante-quinze médecins (11,9%) ont rempli la section sur les données démographiques. Les caractéristiques associées à une demande accrue de dons comprenaient une expérience antérieure de ce type de demande, une formation sur les dons, du soutien en la matière, une expérience de travail supérieure à

10 ans, la pratique en milieu urbain, un certificat en médecine d'urgence et le sexe masculin.

Conclusions: Les scénarios comportant une intoxication ont fait moins souvent l'objet de demandes de dons d'organes ou de tissus que le scénario idéal. Comme les intoxications ne sont pas une contre-indication aux demandes de dons, les patients concernés constituent une source potentielle de donneurs. Ainsi, une formation ciblée sur le sujet et du soutien dans le processus de demande pourraient accroître le taux de don dans ce groupe de la population.

Keywords: organ donation, tissue donation, poison, toxicology

INTRODUCTION

Organ and tissue donation is a critical part of treatment for a variety of both acute and chronic illnesses. Unfortunately, the supply of available tissue and organs is far outweighed by the demand.^{1,2} In 2015, 4,631 individuals were on a waiting list for organ transplant in Canada, and 262 died prior to receiving a transplant. In addition to a limited number of eligible donors, the supply of organs and tissue for donation is further exacerbated by missed potential donors.³ The Canadian donation program receives approximately 500 donors per year.⁴ Considering the number of Canadians who die while waiting, there is a very real morbidity and mortality associated with every missed donation. The effect of missed donors also includes significant economic impact because only three additional donors can save the healthcare system more than \$1 M,⁵ intangible psychological costs to families who were not able to facilitate an individual's desire to become a donor,⁶⁻⁸ and a failure to improve the quality of life for patients who would have received the donation. As such, any missed donor is a sentinel event, and necessary steps should be taken to avoid it.

Although organ and tissue donations have traditionally come from individuals who die from trauma, sudden cardiac death, or intracerebral bleeding, advances in medical and safety technology have reduced rates from these causes while the demand for donors has increased.^{9,10} In response, the medical community has explored other potential donors. Individuals who die from poisoning have served as one such source, and, as of 2013, 1% of donors in Canada came from this demographic.¹¹ Although there are limited reports regarding the use of organ and tissue donation from poisoned patients, success has been described following

exposure to a wide range of toxins.¹²⁻¹⁷ In addition, Canadian organ donation guidelines do not specifically exclude poisoned patients as potential donors. For tissue donation, many regions such as Ontario and British Columbia require that all in-hospital deaths be referred,^{18,19} whereas others such as Nova Scotia, Alberta, and Quebec do have contraindications for referral, but poisonings are not one of the contraindications.^{20,21} As such, poisoning should not be a deterrent when considering a potential organ or tissue donor. Despite this, there is some indication that poisoned patients may not be considered as often when compared with other causes of death, but little evidence exists outside expert opinion, and no Canadian studies have been done to explore this issue.^{22,23}

The limited referral rate for organ or tissue donors is multifactorial and complicated by several factors in the case of poisoning. The determination of brain death is difficult in this setting, and the decision to refer is heavily influenced by practitioner comfort and the substance involved in the poisoning. The greatest influence, though, is insufficient knowledge regarding inclusion criteria and the donation process.²⁴⁻²⁸ In Canada, front-line clinicians such as emergency physicians are often responsible for initial screening of potential donors and subsequent activation of the donation network. Any failure at this stage to recognize a patient as a potential donor effectively excludes that individual. To determine whether poisoned patients are appropriately recognized as potential donors, this study explores decisions to refer this population in a simulated context and compares referral decisions to physician characteristics. This will provide information to determine whether poisoned patients are a potentially under-referred population by emergency physicians and to evaluate sources of bias surrounding the eligibility of this demographic.

METHODS

Study design and sample

In this cross-sectional unidirectional survey study, all active, affiliate, resident, and pediatrician members of the Canadian Association of Emergency Physicians (CAEP) were invited to participate (n = 1,471). An invitation was sent via their registered email account asking to complete an online survey. The survey was delivered using an online tool, Opinio™, and consisted of three parts: organ donation scenarios, follow-up questions, and demographics. This study was reviewed and approved by the Nova Scotia Health Authority Research Ethics Board (Study No. 1013656).

Survey tool

The survey tool consisted of 10 cases that were drafted by the research team, each presenting two scenarios with a decision to refer or not to refer for organ or tissue donation. The cases were pilot tested for content, structure, and validity with the research team and a small group of local physicians and residents.

Participants were unaware of the objective to explore organ or tissue donation in the context of poisonings. As such, of the 20 individual decisions to refer or not refer, 10 related directly to organ or tissue donation in the context of poisonings and the other 10 scenarios dealt with other circumstances surrounding organ or tissue donation. One scenario provided an ideal situation for organ or tissue donation that was used as a control. The survey and scenarios can be found in the Supplementary Material.

Follow-up questions and demographics

The survey included a range of follow-up questions and demographics to explore factors influencing the decision to refer or not refer for organ or tissue donation. Four follow-up questions included perceived barriers to organ or tissue donation, formal organ or tissue donation training, a history of referring for organ or tissue donation, and the presence of organ or tissue donation support at the participant's hospital. Six demographic questions included primary practice setting, certification, province, years of practice, gender, and whether the participants had indicated on government identification their intention to be an organ or tissue donor.

Recruitment

Participation was voluntary. An invitation email was sent to all eligible physicians by the CAEP administrator, which included a weblink to the survey. The survey was open for 39 days with a reminder email sent at 14 days. As an incentive, participants were given the opportunity to provide their email address to be entered in a draw for one of four \$25.00 gift cards.

Data collection and analysis

Survey responses were downloaded from Opinio™ into Microsoft Excel™. The data were analysed descriptively for demographics, and comparisons were made between control referral rates and key demographics. To calculate comparisons between the control and poisoning scenarios, as well as characteristics of physician groups, total referrals were summed for scenarios involving a poisoning (scenarios 2, 4a, 5a, 6a, 7, 7a, 9, 9a, 10, 10a), and comparisons were made using odds ratios and 95% confidence intervals (CI). Descriptive statistics, odds ratios, *p*-values, and confidence intervals were calculated using IBM SPSS, and results were reviewed by the Department of Mathematics and Statistics at Dalhousie University.

RESULTS

Response rate and demographics

Overall response rate for the donation scenarios was 208/1471 (14.1%) and 175/1471 (11.9%) for the demographics survey; 83 (47.4%) respondents were male; 118 (67.4%) indicated that they worked in a large, urban hospital; 32 (18.3%) indicated a membership with the Canadian College of Family Physicians (CCFP), 63 (36.0%) with CCFP with a certification in emergency medicine (EM), and 52 (30.0%) with the Royal College of Physicians and Surgeons of Canada (RCPSC); 104 (59.4%) participants indicated <10 years of service; 43 (24.6%) had previous organ donation training; 116 (66.2%) had referred for donation in the past; 111 (63.4%) had donation support available; and 143 (81.7%) indicated on government identification their own intent to be a donor. A summary can be found in Table 1.

Of the participants who indicated having donation support, 77 (69%) indicated having an organ donation coordinator, 45 (41%) a screening tool or

Table 1. Demographic information (N = 175)

	N (%)
Gender:	
Male	83 (47.4%)
Other/prefer not to say	22 (12.6%)
Practice location:	
Large, urban, academic hospital	93 (53.1%)
Remote or rural hospital	35 (20.0%)
Large, urban, non-academic hospital	25 (14.3%)
Small urban hospital	25 (14.3%)
Certification:	
CCFP (EM)	63 (36.0%)
RCPSC	52 (30.0%)
CCFP	32 (18.3%)
Other	25 (14.3%)
ICU/Critical Care	3 (1.7%)
Province or territory of practice	
Ontario	69 (39.4%)
Quebec	67 (38.3%)
British Columbia	29 (16.6%)
Nova Scotia	19 (10.1%)
Alberta	18 (10.3%)
Manitoba	10 (5.7%)
New Brunswick	6 (3.4%)
Newfoundland and Labrador	6 (3.4%)
Saskatchewan	3 (1.7%)
Northwest Territories	1 (0.6%)
PEI	1 (0.6%)
Years of service:	
<5	72 (41.1%)
5-10	32 (18.3%)
10-20	36 (20.6%)
>20	35 (20.0%)
Has indicated intention to be a donor on driver's license or health card	143 (81.7%)
Has referred for organ or tissue donation in the past	116 (66.2%)
Has donation support available at hospital	111 (63.4%)
Previous organ donation training	43 (24.6%)

ICU = intensive care unit, PEI = Prince Edward Island.

guideline, and 8 (7%) a human resources coordinator. Other less commonly indicated resources included phone consults or designated nurses.

Organ or tissue donation referral in poisoned patients

The survey included 10 scenarios that explored organ and tissue donation in the context of poisonings. Excluding incomplete scenario responses, this resulted in a total of 1,871 decisions to refer or not refer, and referral was chosen in 1,404 or 75.0% (95% CI [73.0%, 77.0%])

Table 2. Referral rates by scenario

Scenario	Referral (%)
Control	92.4%
8a	92.4%
Poisoning related	
7	91.9%
5a	89.5%
6a	89.4%
7a	77.3%
10	73.5%
9a	65.6%
2	64.5%
9	63.6%
10a	51.9%
4	44.3%
Non-poisoning related	
6	84.7%
4a	82.3%
5	81.8%
1a	73.8%
8	72.3%
3	59.2%
3a	50.3%
1	41.3%
2a	31.8%

of cases. This compared with a control scenario where 170 or 92.4% (95% CI [91.1%, 93.7%]) referrals were made. Using an odds ratio, this indicates that Canadian emergency physicians were 4.0 (95% CI [2.3, 7.0]) times more likely to make referrals in the control scenario as compared with scenarios involving a poisoning.

Organ or tissue donation referral by a specific poison

In scenarios presenting an overdose involving a prescription agent, 117 (63.6%) physicians referred for organ or tissue donation. Referral rates for other common agents included acetaminophen 143 (77.3%), carbon monoxide 171 (91.9%), non-prescription or recreational drugs 129 (64.5%), resuscitation medications 171 (89.5%), unknown chemical exposure 133 (73.5%), and organophosphate exposure 94 (52%). A full summary of referral rates by scenario can be found in Table 2.

Organ or tissue donation by demographic and geographic

Participants who worked in an urban centre were 3.8 (95% CI [2.8-5.1]) times more likely to refer for potential

donation in the setting of poisoning when compared with non-urban centres. Likewise, those with the RCPSC or CCFP (EM) certification were 3.6 (95% CI [2.8-4.7]) times more likely to refer when compared to CCFP members. Male participants were 2.2 (95% CI [1.7-3.0]) times more likely to refer when compared with female participants. Participants with more than 10 years of practice were 2.1 (95% CI [1.6-2.7]) times more likely to refer when compared with those with less than 10 years of practice. Participants who had referred for organ or tissue donation in the past were 4.3 (95% CI [3.2-5.8]) times more likely to refer. Physicians working in an environment with organ or tissue donation support were 3.9 (95% CI [2.9-5.2]) times more likely to refer. Those who had attended organ or tissue donation training in the past were 2.6 (95% CI [2.0-3.5]) times more likely to refer; and, finally, those participants who had indicated their own desire to be a donor on government identification were 5.8 (95% CI [4.2-8.0]) times more likely to refer. A summary can be found in Table 3.

Practice location was significantly correlated with other demographics. Physicians working in a large, urban hospital were 12.1 (95% CI [5.7-25.6]) times more likely to have available donation support, 4.3 (95% CI [2.2-8.4]) times more likely to have referred in the past, 43 (95% CI [15.6-123.5]) times more likely to have EM certification, and 3.4 (95% CI [1.5-7.5]) times more likely to have signed government identification indicating their own intention to be a donor.

Provinces with enough participation to calculate an odds ratio with statistical significance included British Columbia and Ontario. In British Columbia, physicians were 4.7 (95% CI [1.4-15.9]) times more likely to refer in the control scenario when compared with poisoned patients. In Ontario, physicians were

3.3 (95% CI [1.2-9.3]) times more likely to refer in the control scenario as compared with poisoned patients. A summary for each region can be found in Table 4.

Perceived barriers to organ or tissue donation

Participants had the opportunity to select from a list of potential barriers to organ or tissue donation, and some barriers were selected more often than others ($p < 0.0001$). The most common barrier was clinician familiarity with the referral process ($n = 113$). Other notable barriers included that the deceased patient's wishes were unknown ($n = 87$), the physician's failure to identify or refer potential donors ($n = 78$), and lack of time to discuss donation with the family ($n = 76$). Barriers uncommonly selected included negative attitudes towards organ or tissue donation among clinicians ($n = 6$), the perception that clinicians will provide suboptimal care to potential donors ($n = 16$), and racial, ethnic, or religious perspectives on organ donation

Table 4. Odds ratio for referral of non-poisoned patients by region

Province or territory	Participants	Odds	
		ratio	95% CI
Ontario	69	3.3	1.2-9.3
East (New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland/Labrador)	32	11.6	1.6-86.1
Prairies (Alberta, Saskatchewan, Manitoba, Northwest Territories, and Nunavut)	32	6.6	1.6-28.3
West (British Columbia and Yukon)	29	4.7	1.4-15.9
Quebec	13	1.9	0.4-8.9

CI = confidence interval

Table 3. Odds ratio of organ or tissue donation referral in poisoned patients by physician characteristic

Physician characteristic	Comparison	Odds ratio	95% CI
Urban practice location	Rural practice location	3.8	2.8-5.1
Emergency Medicine certification	No Emergency Medicine certification	3.6	2.8-4.7
Male	Female	2.2	1.7-3.0
>10 years of practice	<10 years of practice	2.1	1.6-2.7
Previous referral experience	No previous experience	4.3	3.2-5.8
Donation support available	No support available	3.9	2.9-5.2
Previous organ or tissue donation training	No previous training	2.6	2.0-3.5
Indicated intention to donate on identification	Has not indicated intention to donate	5.8	4.2-8.0

CI = confidence interval

Barrier ($\chi^2 = 162$; $p = <0.0001$)	N
Lack of clinician familiarity with the referral process	113
Deceased wishes unknown	87
Failure to identify/refer potential donors	78
Lack of time to discuss donation with the patient's family	76
Health professional's reluctance to approach the topic of donation	69
Difficulty declaring brain death or breath death diagnosis not confirmed	66
Deceased expressed intent to not be a donor	65
Relatives refused permission for organ donation	65
Lack of supports for referral process	64
Logistical problems	60
Racial, ethnic, and/or religious perspectives on organ donation	31
Perception that clinicians will provide "suboptimal care" to potential donors	16
Negative attitudes towards organ or tissue donation among clinicians	6

($n = 31$). A summary of these findings can be found in Table 5.

DISCUSSION

By comparing the demographics of physicians deciding to refer or not refer poisoned patients for organ or tissue donation, we can explore factors that may affect referral rates. This is important because bias has been shown to significantly impact clinical decision-making and can lead to costly errors such as missed organ donation.²⁷ For example, poisoned patients may be associated with characteristics such as chronic viral illnesses or other high risk behaviors that predispose clinicians to exclude them as potential organ or tissue donors.²⁸ Because the presence of chronic viral illness or other active disease processes may be a contraindication for tissue donation in some Canadian provinces,^{20,21} clinicians should be careful that an inappropriate association between these characteristics does not influence a referral decision in an isolated poisoning context.

Physicians who indicated working in large hospitals having EM certification or male gender were associated with higher referral rates of poisoned patients. Being aware of relatively non-modifiable factors such as these allows physicians to identify biases or trends and is a first step in mitigating their effect.²⁹ There are many strategies that have been developed to reduce the effect

of bias, ranging from decision tools to cognitive strategies. Examples include focusing on patient characteristics independently of other attributes or attempting to view a situation from a different perspective.³⁰ These strategies have yielded some success in reducing biased decision-making, and so exploring one's own attitudes, values, and risk factors for under-referral may have a significant effect on donation rates.

Non-modifiable characteristics do not exist in isolation of other, modifiable, characteristics. Although working in a large, urban hospital was associated with a higher referral rate, physicians in this context were also more likely to indicate having access to valuable donation support, having referred in the past and to have signed government identification indicating their own intention to be a donor. Therefore, when attempting to mitigate the effects of non-modifiable factors, other related characteristics can be targeted.

Physicians indicating on government identification their own intention to be a donor, when compared with those who did not, were 5.8 times more likely to refer potential donors in the poisoned context. This contrasts with only 2.8% of participants indicating that they thought that negative attitudes towards organ or tissue donation among clinicians presented a significant barrier to donation. This supports the theory that clinicians' values can have a significant impact on their decision-making, that they are often unaware of these biases, and that becoming aware of these biases is an important first step to improving decision-making in clinical contexts.

Level of training, both in organ and tissue donation as well as the RCPSC or CCFP (EM) certification, significantly affected one's decision to refer. In addition, clinician familiarity with the referral process was identified as the most common barrier to successful organ or tissue donation. This illustrates that knowledge surrounding the donation process is critical for improving overall referral rates for organ donation, supporting the lack of familiarity with donation policy and process has been shown to decrease successful organ referrals by 25% to 50%.^{28,31} Although most healthcare providers recognize the urgent need for donation, significant misconceptions in eligibility exist, and only a small minority have engaged in dedicated donation training.^{2,32} In our study, 34.5% of participants indicated no prior training, and Canadian medical students have been found to have only a limited knowledge of organ donation.³³ In addition, it is important to stress that refresher training is necessary

to prevent decay of medical knowledge and skills, and that the effect of education is highly dependent on the time since training.³⁴ This offers institutions an opportunity to implement new or reinforcing training programs, which may improve donation rates even if primary training exists.

Finally, our study also illustrates the importance of available donation support for clinicians. Physicians with available support were 3.9 times more likely to refer poisoned donors. The reasons for this are likely multifactorial. Emergency departments are often busy and unpredictable environments are not conducive to prolonged or sensitive discussions such as decisions regarding organ or tissue donation. Correspondingly, the lack of time to discuss donation was selected in our survey as one of the most common barriers encountered in the emergency department. As such, in addition to providing information and support, donation professionals may play an important role in the experience of families considering donation, because less than half of families approached by clinicians provide consent.³⁵ This stresses the importance of trained individuals serving in multiple roles in the donation process, including being available to support emergency physicians in the department.³⁶

LIMITATIONS

Although this was a national survey, it was limited to emergency physicians registered with CAEP. Participants varied significantly in clinical setting, stage, and type of training, and operated under a wide range of health authorities with different policies and procedures. Although our response rate was significantly powered for our calculations, it may not represent Canadian emergency physicians as a whole due to response or selection biases as evidenced by the high organ or tissue donation referral rate in our survey. In addition, although we were able to look at multiple demographics individually, some of these demographics are interrelated (i.e., larger centres also have a greater likelihood of organ and tissue donation support). Finally, this study was looking at physician decisions to refer in a survey context, and it is unclear how well this correlates with actual clinical decision-making.

CONCLUSION

This study demonstrates that, in a simulated setting, Canadian emergency physicians under-refer patients

who die from poisoning as possible organ or tissue donors and identifies potential methods to improve these rates. By examining characteristics that put clinicians at risk for under-referral of organ or tissue donors, becoming aware of potential biases, improving the knowledge base of physicians, and implementing programs that support the organ and tissue donation process, we may have the opportunity to improve these rates and reduce morbidity and mortality for Canadians requiring organ or tissue donation.

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SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit <https://doi.org/10.1017/cem.2018.43>

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