

Annual variation of body donor registrations in New Zealand

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SUMMARY

The success of body donation programmes relies on donor generosity and effective donor recruitment strategies. Knowledge of donor registration behaviour may therefore facilitate the success of existing programmes by increasing the efficacy of donor advertising or awareness campaigns. Annual donor registration patterns have not previously been examined, therefore this study investigated whether donor registrations varied over the calendar year at one body donation centre in New Zealand. An audit of 10 years (2000-2010) body donor registration data from the Otago School of Medical Sciences (University of Otago, Dunedin, New Zealand) body donation programme was undertaken. Variables examined included birthday, date of registration initiation (first contact with department), and date when the registration process was completed. Data were assessed using descriptive statistics, then analysed by Chi² (categorical) and t-test (continuous) with $P < 0.05$. A total of 1352 individuals registered (mean 68.3 years). There was a significant difference in the month people initiated registration (16% in August) and the month in which people completed registration. In relation to donors' birthdate, there was no difference in donor birth month or the day donors first contacted the department. Results indicate certain high-frequency periods during the year in which southern New Zealand inhabitants are more likely to register as body donors, with significantly more registrations initiated and completed during August. Data did not relate significantly to individuals' birthdays or Christian religious holidays, thereby indicating

that these did not overly influence an individuals' decision to donate. These findings suggest targeting donor programme advertising or recruitment to different months may be useful.

Key words: Body donation – Donor recruitment – Donor registration – Donation programme – Body donor

INTRODUCTION

Human cadavers are an invaluable resource for teaching and researching anatomy in the medical sciences (Aziz et al., 2002; Cornwall and Stringer, 2009; Cornwall, 2011; Cornwall et al., 2012). Despite the ongoing requirement for human tissue in teaching and research, access to human cadavers is often problematic (Boulware et al., 2004; Sehrlil et al., 2004; Garment et al., 2007; Halperin, 2007; Gunderman, 2008; Gangata et al., 2010; Anyanwu et al., 2011; Oxley da Rocha et al., 2013), with the consequence that both teaching and research programmes at institutions become affected. Some institutions have even stopped donor programmes, only to later reinstate them when the level of students' anatomical understanding became adversely affected (Rizzolo and Stewart, 2006).

The success of body donation programmes therefore affects how anatomical teaching and research may proceed in many institutions, and yet despite the prevalence of body donation programmes, relatively little is known about the characteristics of body donor populations. A recent prospective study has highlighted similarities in donor characteristics between donor cohorts from different countries (Cornwall et al., 2012). Such

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similarities include donors being generally 'blue collar' workers with altruistic tendencies that see them give frequently to charity (Cornwall et al., 2012). In addition, researchers have also found that donors frequently have a friend or relative who has also donated (Fennel and Jones, 1992; McClea and Stringer, 2010; Anteby et al., 2012; Cornwall et al., 2012), and are highly likely to be in a long-term relationship (Bolt et al., 2010; Anteby et al., 2012; Cornwall et al., 2012).

Even with the information provided in recent studies, there are still many important aspects of the characteristics and behaviour of body donor population that remain unexamined. As yet there is no information on the characteristics of donor registration behaviour, such as when people choose to initiate and complete the process of registering as body donors. This study aims to explore the temporal relationships of donor registration behaviour in order to identify whether patterns exist within the body donor population. Such information could lead to a better understanding of donor populations, and may assist in the development of improved donor recruitment strategies.

MATERIALS AND METHODS

The body donor registration data from the Otago School of Medical Sciences (University of Otago, Dunedin, New Zealand) bequest programme between 2000 and 2010 was audited. Information extracted included donor birthdate, date of registration initiation (first contact with department), and date when the registration process was completed. The data were assessed with descriptive

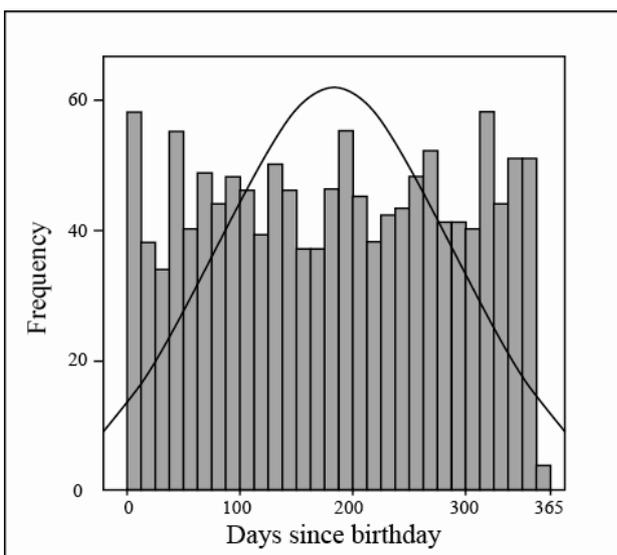


Fig. 1. Histogram indicating registrations in relation to days since birthday for body donor registrants 2000-2010. Data takes birthday as day 0. The overlying Gaussian curve indicates overall distribution in relation to registration time compared to actual birthday.

statistics and analysed by Chi square (categorical) and t-test (continuous) with $P < 0.05$ using the Stata statistical software package (v12, StataCorp, College Station, TX). Analysis included comparison of dates for registration initiation and registration completion against individual donor birthday and against the calendar year.

RESULTS

In total 1352 individuals registered as potential body donors over the ten-year period (mean age 68.3 years). Chi-square analysis indicated a significant difference in the month people initiated registration and the month in which people completed registration, with August being the highest month for both initiation and completion (Table 1). The lowest months for initiation were July and December with 4.9% and 4.6% of registration initiations respectively, while July was also the lowest month for registration completion (5.5%). Overall, August and September accounted for just over one quarter of donor registration initiations (26%), while August, September and October had nearly one third (32%) of the completed registrations. Analysis by t-test showed no difference in overall donor birth month frequency or the day donors first contacted the department in relation to their birthday (Fig. 1), and no significant difference between the total number of registrations in the first and second half of the year.

DISCUSSION

Previous studies have examined the demographic characteristics of body donors in an effort to understand more about the body donor population (Fennel and Jones, 1992; Richardson and Hurwitz, 1995; Dluzen et al., 1996; Lagwinski et al., 1998; Labuschagne and Mathey, 2000; Shirlir et al., 2004; McClea and Stringer, 2009; Bolt et al., 2011a; Bolt et al., 2011b; Cornwall et al., 2012; Halou et al., 2013). However, this is the first study to examine the temporal patterns in donor registration behaviour. The study specifically addressed dates of body donor initiation and completion of the registration process in order to determine whether consistent patterns of behaviour exist amongst this population in relation to their timing to register as body donors. Results indicate that certain trends exist in body donor registration behaviour in southern New Zealand. Such information may be useful for directing donor recruitment periods or the advertisement of donor programmes to those months that may provide higher donor registrations.

Analysis of the data showed patterns of registration behaviour that were significantly different between the months of the year for both registra-

tion initiation and registration completion. It is difficult to analyse these results in this specific context, as there are no previous studies with which to compare these data. It is worth considering how the location and annual variations observed may contribute to the outcomes, especially in relation to how these variables have been shown to affect human behaviour in other scenarios.

The increased donor registration rate observed in August corresponds with the transition into spring, and is at the end of a prolonged period of decreased daylight hours (www.weatheronline.co.nz). The location of the body programme is geographically situated at 45 degrees south, far towards the southern end of New Zealand, and the city has fewer daylight hours than the majority of the country. Studies have demonstrated that the levels and production of such chemicals as serotonin and melatonin in the brain is significantly higher during spring, when the sunlight hours start to increase, indicating that neurochemistry may play a role in temporal patterns of behaviour (Lambert et al., 2002; Wirz-Justice, 2006). Other evidence of temporal patterns being related to mood and behaviour include studies that indicate suicide rates are at their highest annually at the start of spring (Hakko et al., 1998; Petridou et al., 2002; Postolache et al., 2010; Hiltunen et al., 2011), indicating not only mood alterations but the performance of drastic decisions that involve significant or extreme behaviour. Changes in neurochemistry that occur at the onset of spring may therefore influence and contribute to the decision-making

process of body donors that initiate their registration at this time. However, any such effect in the body donor population remains speculative at this time. A further investigation of how alterations in an individuals' neurochemistry may relate to acts of altruistic behaviour, as observed in the act of becoming a body donor, is required to clarify whether such effects occur in this population and if they contribute to body donors' decision-making process.

The months with the lowest number of registration initiations were July (4.9%) and December (4.6%) (Table 1). It is perhaps unsurprising that December has a low number of total registration initiations, as in New Zealand the major school, university, and public holiday period is over the Christmas period. Many individuals take their main holidays over December and January, with most businesses closing in mid to late December and re-opening in mid-January. It is therefore possible that this figure reflects the fact that individuals are often preoccupied with the build-up to Christmas and the key holiday season, and the fact that most businesses, including the university, will not be operating at full capacity until mid to late January. This means that any task initiated in the month prior to Christmas will likely take much longer to complete, a point that may preclude individuals from starting the registration process at this time. It is difficult to reconcile the low number of registration initiations with the month of July, although this month is generally one of the coldest, and follows directly on from the period of the winter solstice and the shortest day (22 June). It may be possible that the changes in donor regis-

Table 1. Number of total body donor registrations by month for 2000-2010 tabulated for registration initiation and registration completion. Asterisk denotes records did not show the first dates of contact for 32 individuals, therefore accounting for the difference between the total 'initiated' and 'completed' data.

	Total no. registration initiation	%	Total no. registration completion	%
Jan	97	7.4	83	6.1
Feb	102	7.7	109	8.0
Mar	103	7.8	129	8.8
Apr	103	7.8	98	7.2
May	131	9.9	125	9.2
June	97	7.4	105	7.8
July	64	4.9	74	5.5
Aug	217	16.4	172	12.7
Sept	125	9.5	134	9.9
Oct	108	8.1	127	9.4
Nov	112	8.5	103	7.6
Dec	61	4.6	106	7.8
Total	1320*	100	1352	100

tration behaviour related to this month are linked to the changes in neurochemistry similar to those suggested above that occur at the onset of spring and the increase in daylight hours (Lambert et al., 2002; Wirz-Justice, 2006). However, such a link remains unexplored and speculative in nature. Similarly, there is the possibility that winter illness in older individuals may engender thoughts of dying and stimulates planning of after-death events, though this hypothesis is also untested.

Data analysis indicated that there was no significant relationship between registration initiation or registration completion and birthday, either by frequency (number of birthdays per month) or by the date (individuals' date of registration as a function of date of birthday) of the birthday (Fig. 1). Therefore, the number of birthdays per month for donors showed no pattern in terms of overall frequency, and the birthday of registrants was not related to the date of their own registration. The random nature of the distribution suggests Christian religious holidays or other key European festivals did not overtly influence this donor populations' decision to donate. This suggests that the nature of body donation registration is not significantly affected by these personal events that may involve close family interaction or occasions of direct personal significance such as birthdays, Christmas, or Easter. This is interesting, given the act of body donation is very often a family decision, and is discussed with family before the decision to donate is made (McClea and Stringer, 2009; Bolt et al., 2010; Bolt et al., 2011a; Cornwall et al., 2012), thereby making it a measured and intensely personal decision that is intimately related to family relations. In respect to the act of becoming a body donor, the results also dismiss the notion that within the donor population some star signs are perhaps more altruistic than others (<http://astrolibrary.org/>). However, while the distribution of birthdays throughout the year in this sample of donors has been shown to be normal, there are no available data to indicate whether the birthdays of the general population of New Zealand are normally distributed, and thus provide comparative data to enable further analysis of donor traits.

CONCLUSION

Body donor registrations show annual variation in southern New Zealand, with highest registration in the month of August. Results indicate there may be key periods during the year in which body donors are more likely to register with bequest programmes, which may assist in the planning of promotion and exposure of body donation programmes. Such information is of importance to institutions looking to maintain existing body donation programmes, or those examining the pos-

sibility of establishing their own donor programme. It is unclear what may cause such temporal patterns in donor registrations. Further exploration of annual data from other centres, especially from the northern hemisphere, could help expand on this data and contribute towards hypothesis development that may explain the trends observed in this study.

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REFERENCES

- ANTEBY M, GARIP F, MARTORANA PV, LOZANOFF S (2012) Individuals' decision to co-donate or donate alone: an archival study of married whole body donors in Hawaii. *PLoS ONE*, 7: e42673. DOI:10.1371/journal.pone.0042673.
- ANYANWU GE, UDEMEZUE OO, OBIKILI EN (2011) Dark age of sourcing cadavers in developing countries: A Nigerian survey. *Clin Anat*, 24: 831-836.
- ASTROLIBRARY WEBSITE [Internet] Available from: <http://astrolibrary.org/> Accessed 19 June, 2013.
- AZIZ MA, MCKENZIE JC, WILSON JS, COWIE RJ, SYLVANUS AA, DUNN BK (2002) The human cadaver in the age of biomedical informatics. *Anat Rec*, 269: 20-32.
- BOLT S, EISINGA R, VENBRUX E, KUKS JBM, GERRITS PO (2011a) Personality and motivation for body donation. *Ann Anat*, 193: 112-117.
- BOLT S, VENBRUX E, EISINGA R, GERRITS PO (2011b) Anatomist on the dissecting table? Dutch anatomical professionals' views on body donation. *Clin Anat*, DOI: 10.1002/ca.21215.
- BOLT S, VENBRUX E, EISINGA R, KUKS JBM, VEENING J, GERRITS PO (2010) Motivation for body donation to science: more than an altruistic act. *Ann Anat*, 192: 70-74.
- BOULWARE E, RATNER LE, COOPER LA, LAVEIST TA, POWE NR (2004) Whole body donation for medical science: a population-based study. *Clin Anat*, 17: 570-577.
- CORNWALL J (2011) The diverse utility of wet dissections and plastinated specimens in teaching gross anatomy in New Zealand. *Anat Sci Educ*, 4: 269-274.
- CORNWALL J, PERRY G, LOUW G, STRINGER MD (2012) Who donates their body to science? An international, multicenter, prospective study. *Anat Sci Educ*, DOI: 10.1002/ase.1278.
- CORNWALL J, STRINGER MD (2009) The wider im-

- portance of cadavers: Educational and research diversity from a body bequest program. *Anat Sci Educ*, 2: 234-237.
- DLUZEN DE, BRAMMER CM, BERNARD JC, KEYSER ML (1996) Survey of cadaveric donors to a body donation program: 1978-1993. *Clin Anat*, 9: 183-192.
- FENNELL S, JONES DG (1992) The bequest of human bodies for dissection: a case study in the Otago Medical School. *NZ Med J*, 105: 472-474.
- GANGATA H, NTABA P, AKOL P, LOUW G (2010) The reliance on unclaimed cadavers for anatomical teaching by medical schools in Africa. *Anat Sci Educ*, 3:174-183.
- GARMENT A, LEDERER S, ROGERS N, BOULT L (2007) Let the dead teach the living: The rise of body bequeathal in 20th-century America. *Acad Med*, 82: 1000-1005.
- GUNDERMAN RB (2008) Giving ourselves: the ethics of anatomical donation. *Anat Sci Educ*, 1: 217-219.
- HAKKO H, RÄSÄNEN P, TIIHONEN J (1998) Seasonal variation in suicide occurrence in Finland. *Acta Psychiatr Scand*, 98: 92-97.
- HALOU H, CHALKIAS A, MYSTRIOTI D, IACOVIDOU N, VASILEIOU PVS, XANTHOS T (2013) Evaluation of the willingness for cadaveric donation in Greece: A population-based study. *Anat Sci Educ*, 6: 48-55.
- HALPERIN EC (2007) The poor, the black, and the marginalized as the source of cadavers in United States anatomical education. *Clin Anat*, 20: 489-495.
- HILTUNEN L, SUOMINEN K, LONNQVIST J, PARTONEN T (2011) Relationship between daylength and suicide in Finland. *J Circadian Rhythms*, 9: 1-12.
- LABUSCHAGNE BCJ, MATHEY B (2000) Cadaver profile at University of Stellenbosch Medical School, South Africa, 1956-1996. *Clin Anat*, 13: 88-93.
- LAGWINSKI M, BERNARD JC, KEYSER ML, DLUZEN DE (1998) Survey of donor application files: 1978-1993. *Clin Anat*, 11: 253-262.
- LAMBERT GW, REID C, KAYE DM, JENNINGS GL, ESLER MD (2002) Effect of sunlight and season on serotonin turnover in the brain. *Lancet*, 360: 1840-1842.
- MCCLEA K, STRINGER MD (2010) The profile of body donors at the Otago School of Medical Sciences - has it changed? *NZ Med J*, 123: 9-17.
- OXLEY DA ROCHA A, TORMES DA, LEHMANN N, SCHWAB RS, CANTO RT (2013) The body donation program at the Federal University of Health Sciences of Porto Alegre: A successful experience in Brazil. *Anat Sci Educ*, 6: 199-204.
- PETRIDOU E, PAPADOPOULOS FC, FRANGAKIS CE, SKALKIDOU A, TRICHOPOULOS D (2002) A role of sunshine in the triggering of suicide. *Epidemiology*, 13: 106-109.
- POSTOLACHE TT, MORTENSEN PB, TONELLI LH, JIAO X, FRANGAKIS C, SORIANO JJ, QIN P (2010) Seasonal spring peaks of suicide in victims with and without prior history of mood disorders. *J Affect Disord*. 121: 88-93.
- RICHARDSON R, HURWITZ B (1995) Donors' attitudes towards body donation for dissection. *Lancet*, 346: 277-279.
- RIZZOLO LJ, STEWART WB (2006) Should we continue teaching anatomy by dissection when ...? *Anat Rec B New Anat*, 289: 215-218.
- SEHIRLI ÜS, SAKA E, SARIKAYA Ö (2004) Attitudes of Turkish anatomists toward cadaver donation. *Clin Anat*, 17: 677-681.
- WEATHERONLINE WEBSITE [Internet]. Available from: <http://www.weatheronline.co.nz/weather/maps/city/Dunedin>. Accessed 23 May, 2013.
- WIRZ-JUSTICE A (2006) Biological rhythm disturbances in mood disorders. *Int Clin Psychopharm*, 21: S11-S15.