Executive Summary

This portfolio has examined the organ donation rates in Australia and provided recommendations to improve organ donation rates, with initial analysis and proposals based on the Australian Capital Territory. Through primary research involving a quantitative analysis of public perceptions of organ donation, it was determined that there is a lack of education in the current population on organ donation. This was used to develop two design initiatives; the first involving educative pamphlets developed by health professional liaison to be distributed across the state, and the secondary involving advertisements to encourage education and discussion of organ donation. Through a systems analysis of these techniques planning techniques and target projections for the project were used to estimate that the entire project can finish within 15 months, and the project will reach its 'breakeven' point one year after it has been completed. Analysis of the human factors involved gave insight into the religious and ethnic sensitivity that is relevant to organ donation, and safety and risk analysis allowed for measures to be determine to reduce the risk of harm to those involved in the initiative.

Contents:

1- Introduction

Organ Donation

Organ donation is the process of surgically removing an organ or tissue from a person, the organ donor, and placing it into another person, the recipient (The Cleveland Clinic Foundation, 2013). An organ donor may be living or deceased, which involves differing processes and precautions, however since there is more opportunity for organ donation from a deceased donor, this report will focus primarily on organ donation after death.

In Australia, there are two ways in which death can be defined; one is termed 'Cardiac Death' in which the heart has stopped beating and breathing has permanently stopped, the other termed 'Brain Death' in which there is a permanent loss of brain function. (ODATWA, 2011)

There are a number of complexities involved in organ donation, including the fact that only a small percentage of deceased are viable for organ donation. Additionally organs must be extensively screening to test if the organs are viable and to find an appropriate recipient (Organ and Tissue Authority, 2014d). In spite of these many factors, Australia has one of the most successful transplant outcomes in regards to survival rates of recipients and the number of organs that are transplanted from donors (Organ and Tissue Authority, 2014a).

Problem Scope

Despite being ranked second most liveable country in the world (Human Development Reports Office, 2015), Australia has one of the lowest organ donation rates of the developed world, ranking 22nd in the world in 2014, with only 16 organ donors per million population. This in comparison to the world leader in organ donation, Spain, with 35.7 organ donors per million. (Organ and Tissue Authority, 2014c)

Preliminary research into the reasons behind these low statistics were revealing, with statistics from the Organ and Tissue Authority which report that 69% of Australians are will to become organ and tissue donors. However, legislation in Australia dictates that the family (or next of kin) of every potential donor will be asked to confirm the donation decision of the patient before donation commences. The permitting of the family to refuse is essential to ensure a negative stigma is not generated toward organ donation, although less than 60% of families give consent for organ and tissue donations to go ahead. (Organ and Tissue Authority, 2014c)

This initial exploration indicates that an analysis of Australians' perceptions and knowledge of organ donation is necessary to determine the causes of these consent rates. This portfolio will aim to identify causes of low patient and familial consent rates through primary and secondary research. The data collected will be used to design and recommend initiatives that aim to increase organ donation rates in Australia which will be analysed using a systems engineering approach to optimise the proposed solution.

2- Qualitative and Quantitative Research

Due to initial research detailed in Section 1, I decided to carry out a primary research study in the form of a survey to gather mainly quantitative data on perceptions of organ donation and consent.

2.1 - Research Scope

A research question for my research was necessary due to the potentially large scope of the problem involving organ donation rates in Australia. By using background knowledge that has been previously introduced with the theme of medicine, topic of organ donation and key focus on organ donation rates in Australia, I determined the research question:

"What are the public's perceptions on organ donation?"

This was an appropriate research question as helped give direction to the type of questions in included in the survey and was realistically broad for the main aims of my research:

- To determine how informed the public is on organ donation and the processes involved

- To determine the public's opinions toward organ donation in regards to themselves as well as loved ones.

2.2 - Survey

As the purpose of the survey is to gather broad data on the perceptions of the public rather than specific opinions, surveys are ideal for this research. The survey was kept concise, with minimal written responses to increase response rates. The survey was shared via social media and through other networking channels. As the demographics of social media do not generate an even spread of demographics, some other channels were used to distribute the survey to demographics that were initially underrepresented in the results. These channels included email correspondence and networking of social groups.

2.2.1 - Ethics

As the survey was completed by the population, the research had to be conducted in an ethical manner in order to ensure that the data was viable. This was done by ensuring that participants were informed of what the research was for, and that any information shared was anonymous and would only be used for the purposes of the survey. This was upheld with the handling of the data. A gender inclusive option was also given for the demographics section of the survey.

2.2.2 - Data Collation

The survey was completed using a google form, which collated the quantitative data online, and was then transferred into an excel spreadsheet. This was then verified by another student to ensure accuracy. Percentages and rankings were calculated using excel.

Qualitative data involved reviewing responses to determine opportunities to group the data, and developing a coding scheme to categorise the data. This was mostly simple as there were obvious commonly worded responses for both questions and the responses were generally short. There were some unique responses that were given their own category.

2.2.3 - Results

The results of the survey were positive, with 92 respondents taking part, and some good feedback was able to be collected. For a comprehensive report on the results of the survey, please contact the author via email.

Registered Organ Donor

In regards to being a registered organ donor, 52% of respondents answered yes with 14% answering not sure. This is much less than the 69% of the population that are registered organ donors (Organ and Tissue Authority, 2014c), which is likely due to the demographic spread. The high percentage of participants who answered 'Not Sure' or 'No' may indicate that a many young adults require more education and awareness on organ donation. The two most common reasons by far for becoming an organ donor were that it can help others or give others a chance at life (33 responses), and that there was 'No need for my organs after death' (22 responses). The most common reason by far for not being a registered organ donor was 'Haven't gotten around to it,' or slight variation of that.

Discussion of Donation with Family

A promising 80% of respondents have discussed organ donation with their family to some extent, with 64% answering yes and 16% answering somewhat. Compared to the 64% that had discussed organ donation, a higher percentage (70%) answered yes when asked if their family was aware of their preferences, indicating that to some extend the participants' families assume their organ donation preferences even if it has not been discussed. Most of the participants thought their family members agreed with their organ donation, with the modal score of 5 at 70% choosing 5/5 (absolutely) and 12% marking 4. The mean answer for this question was 4.5, and no participants recorded 1.

45% of participants were not aware that family members had to give consent for organ donation, even if the deceased had given consent prior to death, with the most commonly chosen answers for why being: family was not aware of deceased's organ donation preference, the family thought it was against their beliefs (regardless of beliefs of deceased) and timing of the request was unsuitable.

When asked if the family has to pay for the medical costs of donation, 59% responded with the correct answer of yes, with the remaining 41% answering not sure. Similarly, when asked if the patient can have an open casket if they are an organ donor, 64% responded correctly with Yes, with 34% unsure and 2% no. In response to the question, *'Can families of organ donors receive information or correspondence from patients who have benefitted from the donation'*, 51% responded with not sure, followed by 25% who marked the correct answer – Yes, however any information shared is anonymous. 12% of respondents thought that yes, the family can receive details about the recipient, and 12% said no information is allowed to be shared.

Finally, when asked if a person can choose who their organs will be donated to after they have passed away (directed donation), 66% responded with no, 28% said yes, but only in specific circumstances and 6% said yes.

2.2.4 - Error Types

In order to ensure this data is reliable and accurate, an analysis of the errors in the data and the extent to which they influence results was necessary for this survey. Please contact the author for a copy of the distributed survey questions and responses.

- Sample error: responses for demographics questions indicated that the distribution of demographics across the sample was not representative of the population, with an overrepresentation of young adults (particularly females) and an underrepresentation of the elderly. However, this was to be expected from the mode of distribution that was used for the survey, due to the audience that social media gathers. The distribution of the sample should be considered when reviewing the results of the survey.
- All quantitative responses of the survey were included in the results to reduce coverage error. Some qualitative responses were excluded due to them being irrelevant to the topic/question.
- Making majority of the questions compulsory reduced non-response error.
- Response error may have been present in the question regarding reasons behind families denying consent, as there was no 'Other' option, so some people may have chosen inaccurately.
- Non-response error was present in some of the non-required fields, particularly reasons why/why not an organ donor, however this was supplementary information and not essential for the purposes of the research.
- Response error due to respondents intentionally incorrectly answering to achieve a more socially desirable results may have been present, however this wav avoided to the best of my ability by reminding respondents that the survey was anonymous and having it online.
- Coding of qualitative data may have presented an area of error, however the similarity of common answers made it easy to identify trends and categories.

2.3 - Summary of Insights of Research

This research was very informative and revealed a large amount of information about perceptions of organ donation.

From the results of the survey, I concluded that the sample demographic was undereducated about organ donation, which could be addressed by the design proposal. This included information on how to register, what this means in the case of death and the process the family goes through. In particular, many of the participants were not aware family could veto organ donation, and many of the feedback comments were against this protocol.

Another area of research that was reviewed as a secondary source was a study completed by the Organ and Tissue Authority (OTA) into Family Experiences of Organ and Tissue Donation, commenced in 2013. The study aimed to "Provide evidence-based insight into the experiences of families who have been asked to consider organ and tissue donation in a hospital setting." This included quantitative and qualitative data from surveys and interviews completed by families who had an experience with organ donation who both consented to and declined donation. Further information on the survey can be found in the Further Reading-Section 8 of the report. (Organ and Tissue Authority, 2013)

The secondary research contain a large amount of information, which was difficult to summarise to determine key areas to target for improvement. In conjunction with the Pareto Principle, it was identified that only 10-20% of respondents for most queries regarding their donation experience had a negative response or were unsure. This indicates that a small percentage of the population is likely behind the low rate of family consent (60%). Additionally, results seemed to indicate that education of the family in regards to preference of the deceased, types of death prior to organ donation, and further information about organ donation is an important factor. (Organ and Tissue Authority, 2013) Design proposals could include education of the population and encouragement to discuss organ donation with family members. This may help alleviate much of the confusion and misunderstanding some families experience in the face of tragedy and trauma and assist with achieving more positive outcomes.

3- Design Proposals

From the results of initial investigation as well as primary and secondary research, two design proposals were formed to increase the amount of Australians who are registered organ donors and to address the low consent rates of family members;

1. **Education**: this will involve a multi-tiered process to improve knowledge on organ donation.

The first will involve distribution of information to households about organ donation on areas including:

- discussing organ donation with family and why it is important
- types of death in which organ donation can occur
- how to register for organ donation
- things your family will need to know in the case that they have to provide consent
- where to find more information on organ donation and where to find support services

The second will involve investment in social media advertisements to inform the younger generation on organ donation. These will be small but effective advertisements that encourage raising organ donation with your loved ones and how to register for organ donation. Links on where to find more information will be included.

Both of these resources will provide information on where to find more information, and support services that are available. It is hoped that increasing the education of the population on organ donation will help reduce confusion and misunderstanding of the process in the event of a traumatising loss and help family's make an informed decision.

2. **Improving positive perceptions of organ donation**

    a. Encouraging anonymous correspondence between recipients and donors
    b. Improving the number of families who receive information from the donor agency informing of how many people have been helped as a result of donation.

This will be at the discretion of the donor family. This proposal is based on the secondary research, detailed in Section 2.3 of the report, which demonstrated that the above two support services made the family feel better about their decision to donate.

It should be noted that Proposal 2 is not included in many of the following systems analysis techniques due to the nature of the proposal. The following analysis focuses on aspects of Proposal 1 in terms of informative pamphlets and advertisements.

4 - Human Factors

4.1 - Social and Cultural Perspectives of Organ Donation

Any advancements or improvements to the current organ donation system must be considerate of associated ethical implications, and account for the beliefs and values of different cultures. This is particularly important for this portfolio due to the personal and emotional nature of the topic, as well as the fact that Australia is a culturally diverse nation.

The 2011 census revealed that the most common religion in Australia was Christianity (61%), with 22% reporting no religion and 9% 'Not stated.' The most common non-Christian religion was Buddhism, followed by Islam, Hinduism and Judaism and other religions (ABS, 2012). The beliefs of these religious regarding organ donation were researched, as well as their views on death (particularly brain death), with the beliefs and values summarised below:

- Most major denominations of the Christian faith appear to endorse both living and deceased transplantation, with some smaller denominations leaving it to the discretion of the individual. (Oliver et al. 2010)
- Buddhists believe that the deceased should be treated with respect, and some believing that the body should remain undisturbed for days. However principles around selflessness lead to differing opinions among scholars with some more or less opposed and some leaving it up to the individual.
- Under Islam, any violation of the human body (living or dead) is forbidden. However, saving a life is also placed very highly, and a religious ruling by the Muslim Law Council in 1996 stated that organ transplantation is in keeping with Islam (ABS, 2012). For many it is still a personal choice, with differentiating verdicts in regards to donating 'major' or 'minor' organs (Rizvi, 2006).
- Hinduism is very strongly for organ donation and anything which sustains life is promoted within the Hindu culture (Oliver et al., 2010).
- The Jewish faith avoid any unnecessary interference with the body after death, with burial within 24 hours. Some scholars are strictly anti-organ donation due although saving lives is a key value in Judaism and saving a life is placed above anything else. Overall, there are varying opinions on transplants and what is seen as life-saving. (Oliver et al., 2010)

Additionally, some religions request directed donation whereby the donor or donor's family direct the organs to a group of recipients with specific age, gender, ethnicity or religion (or absence of) (Oliver et al., 2010). However, it is not ethically acceptable for conditions to be placed on the donations of organs in Australia (NHMRC, 2016). This may result in some families denying donation.

Aboriginal and Torres Strait Islanders (ATSI) are another significant ethnic group present in Australia, of which death is a very culturally sensitive topic, and procedures following death must be very delicately handled. Traditions vary amongst communities and it is recommended that cultural guidance should be sought from an ATSI Liaison Officer, Health Worker or ATSI Cultural Practice Coordinator. The lack of trust between ATSI and non-ATSI people means that any suggestion of disturbing or interfering with the body after death is often associated with highly emotional reactions from family and friends. (Queensland Health, 2015)

The other major ethnicity in Australia is Asians, which are increasing in population in Australia. Similar to some religions, compassion is one of the main teachings in Asian tradition, which indicates that culturally, Asians should be generally accepting of organ donation. However, more traditional Asian teachings are against organ donation, believing that removal of organs violates the sanctity of deceased. This is likely due to a variety religious influences including Confucianism, Taoism, Buddhism, Hinduism and Shintoism. Buddhism, Confucianism, Taoism all somewhat dictate that the body is sacred and should not be disturbed, however more modern interpretations is the compassion is the key. Therefore, much like many religious views, the verdict is largely up to the specific beliefs of individuals and families. (Tai, 2009)

4.2 - Safety and Risk Perspectives

Whilst medical procedures are involved in the process of organ donation, these will not be considered in a safety and risk analysis of the proposed design solutions as the proposals do not involve any alteration of medical procedures or protocols involving medical staff. As the proposed initiatives involve education and communication, physical risks are minimal. However, due to the sensitive nature of the topic, there are risks to mental health and therefore personal safety may be an issue. Note that this is in reference to the safety of the donor family. No notable risks to other involved parties have been identified at this stage.

Mental health risks could be:

- Low level Distress and sadness
- Moderate distress provoking depression or anxiety
- High level of distress provoking severe depression and anxiety

All risks are identified and evaluated for likelihood and consequence in Table 4.2.

		Likelihood				
		Rare	Unlikely	Possible	Likely	Almost Certain
Consequence	Catastrophic					
	Major	Operating vehicle while upset				
	Moderate		High level distress			
	Minor			Moderate distress	Low level distress	
	Insignificant			Fainting		

Table 4.2: Risk Matrix – Evaluating the risks involved in proposed initiatives

Now that risks have been identified and evaluated for severity and risk, it can be observed that the design proposals are relatively low risk as they do not involve any high (orange) or very high (red) level risks.

In regards to the moderate (yellow) risks, there are three risks associated with mental health, as seen above, which can be minimised by reducing the chance of the risk and reducing the severity. Reducing the chance of the risk, in the case of education (proposal 1) would involve consulting with psychologists and other mental health professionals on how to structure and phrase informative pamphlets or advertisements. This could include a warning message so that people are aware of the content before they begin reading. In the case of improving perceptions (proposal 2), families of donors can chose whether or not they receive information about the recipient, and how they would like to. They should be made aware that it is an entirely optional process. Reducing the severity of distress can be done by including support networks that can be contacted if people do get distressed by reading the materials such as help lines or information on pathways to receive more in depth psychological counselling and support. The other risks that involve more personal safety are difficult to reduce as they involve controlling the environment of the donor family member. The family

member(s) can be encouraged to be surrounded by support systems and loved ones if they are likely to become distraught when reading the material.

4.3 - Queueing Perspectives

Queueing can be considered for Proposal 2, in regards to how donor centres prioritise when to call donor families after the recipient has received the organ, and how many operators are required. This is an extremely time sensitive process, as contacting the family too soon may be compound the grief and make the situation worse, whereas if it is too late it may bring up memories they have moved past already.

In regards to the timing of incoming information about recipients and resultant outgoing calls to be made, it should be relatively simple to manage the queue as there are less donor families than recipients (organ and tissue donations from one person can go to multiple recipients). According to donatelife.gov 435 organ donors contributed organs and tissues to 1241 recipients in 2015 (Organ and Tissue Authority, 2014b). Based on these calculations, less than two families of organ donors need to be contacted per day, indicating 1-2 operators should be making outgoing calls at any given time. This is accurate even if multiple calls should be made to a family and calls last an upper limit of 1 hour. Whilst only one operator may be necessary based on these calculations, 2 operators would be beneficial as the subject matter of the calls is likely to be mentally and emotionally straining. However, this is for outgoing calls only, and further operators (1-2) should be considered for incoming calls from families to answer queries, or relay how to contact support services.

Prioritising calls should be based on a) when the donor passed away, b) when the information about the recipient(s) was received and c) any indication the family has made about how soon they would like to hear news about the recipient(s) after death. A system should be established that ranks pending calls on each of these factors and allocates a day/days when the family should be contacted.

4.4 - Summary of Insights

Most major religions have varying interpretations in regards to organ donation. Christians and Hindus are supportive of organ donation or leave it to the discretion of the individual. Buddhism, Islam, and Judaism all can be interpreted on either side of the argument, and therefore is it largely dependent on specific denominations or the beliefs of the individual. The education initiatives can take these beliefs into account by ensuring that the population is aware that religious beliefs are wholly respected in the case where organ donation consent is queried. Aboriginals and Torres Strait Islanders must be treated with extreme delicacy regarding all issues surrounding death. Therefore it would be beneficial if these informative packages contained ample warning about the contents so as not to provoke negative perceptions from the Aboriginal community toward organ donor. Liaising with an ATSI officer may help ensure that this is carried out effectively. Risk factors involving mental health safety can be reduced by involving mental health professionals to format written informative materials and ensuring individuals are aware of support systems available at any stage. Due to the low number of organ donors, queuing calls to be made to donor families and ensuring there is enough operators is a relatively simple process and 1-2 operators is ideal, with calls prioritised according to a) time since donor passed, b) time since information was received about recipient(s) and c) wishes of family.

5 - Planning Analysis and Target Projections

This section of the portfolio aims to establish the stages and timeline of the project. This will then be used to analyse costs involved over each stage and hence determine total costs of the project. This will then allow a goal to be established in order for the project to breakeven or be 'profitable.' These goals will be used to establish long term planning goals for the project, and measures if organ donation rates are to decrease in the future of the project using a process control chart.

5.1 - Planning Approaches

This education initiative involved distribution of pamphlets on organ donation to inform the public of common misconceptions of organ donation and encourage discussion of organ donation. The processes involved will be as follows:

1. **Coordinating team:** a team of people will be appointed to head the project. This will involve liaising officers from a variety of fields (medical, government, economic, marketing) that will be in charge of differing sections and stages of the project as well as a team leader to ensure the project is staying on schedule and within budget. **Time:** Hiring – 2 months, Team planning – 1 month
2. **Consultation and development**: this stage will involve consultations with a variety of medical professionals including transplant surgeons and nurses, organ donor coordinators. This information, as well as some analysis of secondary research will form the basis of information to be included in the pamphlet. The main coordinating team will then organise this information to be used for the pamphlet. **Time**: Consultation – 3 months, Collation – 1 month
3. **Design**: Mental health professionals such as grief counsellors and psychologists will be consulted to assist in constructing cautions about the pamphlet contents as discussed in section 4.2 and 4.4 of the portfolio. Visual and graphical design artists will be appointed to construct the pamphlet in a visually appealing manner.
   Time: Consultation of mental health professionals– ½ month, Design – 1 ½ months
4. **Production**: once the pamphlet has finished construction and refinement, it will be printed. At the time of the 2011 Census there were 93, 397 families (households) in Australia (Chief Minister and Treasury, 2012). Therefore 100,000 pamphlets for households will be printed in a multi-stage process. This stage may also involve trial runs to determine if the imagined design is realistically feasible.
   Time: Acquisition of Printing Services – 1 wk., Printing and Packing – 2 months
5. **Distribution:** Once the pamphlets are printed and packaged, they will be distributed via a mass mail drop over several stages. Remaining pamphlets will be distributed to medical centres.
   Time: Distribution - 2 months
   Total Time: 14.5 months (est. dates, 1 Jan 2017 – 15 March 2018).

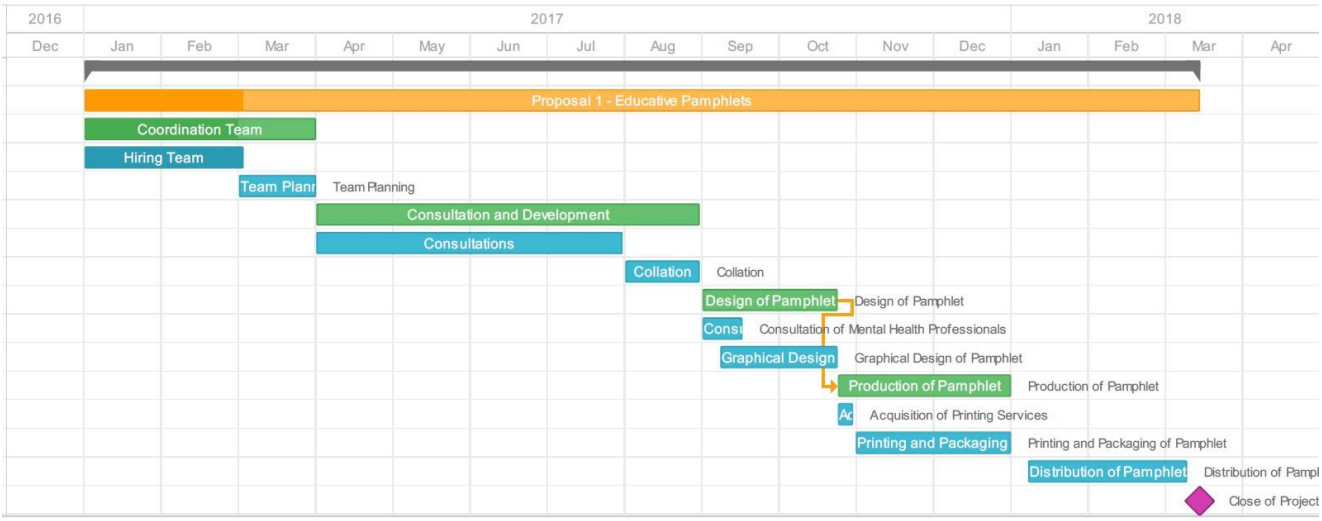

Figure 5.1a – Gantt Chart of Proposal 1 – Education Pamphlets

The second state of the education initiative involving advertisements to encourage discussion of organ donation and increase organ donors will involve the following stages:

1. **Coordinating team:** a team of people will be appointed to head the project. This will involve liaising officers from a variety of fields (design, marketing, and medical) that will be in charge of differing sections and stages of the project as well as a team leader to ensure the project is staying on schedule and within budget. **Time:** Hiring – 1 months, planning – 1 month
2. **Design of advertisement**: visual design experts and marketing personnel will be appointed to construct an advertisement aimed at the target audience (young adults) for social media sites. This stage may involve conceptualizing multiple designs and presenting them to a focus group to receive feedback before the final advertisement(s) are determined.
   Time: Initial designs: 2 months, Focus group and redesign: 2 months

3. **Distribution of advertisement:** advertisement slots will be purchased as determined by the marketing personnel
   Time: 1 month
   Total Time: 7.5 months (estimated dates; 1 Jan 2017 – 15 Aug 2017). See Figure 5.1b below.

Figure 5.1b – Gantt Chart of Proposal 2: Educating Advertisements

5.2 - Life-cycle Costing

This section of the portfolio will discuss the life-cycle costing of Proposal 1 involving a two-fold plan to educate the population on organ donation and encourage discussion of organ donation. A costing analysis of each of these stages will now be estimated based on ballpark figures.

Stage	Costs Involved	Estimated cost
All	Hiring and payment of coordinating team (ten professionals, including project manager).	Hiring - $50,000 Payment - $1,000,000
1 – Coordinating team	Planning stages of project (determining distribution of resources, personnel, constructing timeline, etc.)	$10,000
2 – Consultation and development	Consulting transplant surgeons, nurses, donor coordinators, donor agencies.	$300,000
	Collating information	$10,000
3 - Design	Consulting grief counsellors, psychologists	$50,000
	Secondary research analysis	$20,000
	Visual and graphic design liaison	$50,000
4 - Production	Hiring printing press/factory cost, Press operator personnel hire, Printing Material (ink, paper, etc.), Packaging	$20,000 (Web and Print Design, 2012)
	Trial runs & possible redesign	$10,000
5 - Distribution	Postage costs	$90,000 (Australia Post, 2016)
	Distribution personnel	$5000
		Total: $1, 615, 000 .

Table 5.2a – Cost breakdown of each stage of Proposal 1 – Education; distribution of informative pamphlets.

The initiative involving advertisements to encourage education and discussion of organ donation will now undergo a costing estimate to complete a life-cycle costing of ballpark figures.

Stage	Costs Involved	Estimated Cost
All	Hiring and payment of coordinating team (five professionals, including project manager).	Hiring - $10,000 Payment - $500,000
1 - Design	Visual design personnel	$50,000
	Marketing personnel	$50,000
	Research: focus group	$10,000
	Redesign and finalization	$20,000
2 - Distribution	Advertisement purchase	$150,000 (Facebook, 2016)
	Long-term redesign and maintenance	$100,000
		Total: $890,000 .

Table 5.2b – Cost breakdown of each stage of Proposal 1 – Education; Advertisements on organ donation via social media.

Many of these figures are estimated ballpark figures (±50%). Therefore the estimated costs for the pamphlets is **$2million** and **$1.2million** for the advertisements.

Now that cost expenditure for the proposal has been determined, the total life-cycle costing of the project can be analysed. The costs involved in this analysis will not only involve economic gains and deficits as the aims of the project are to increase organ donation and therefore save human lives. Therefore the statistical value of a human life will also be used to quantify the benefits involved in increasing number of lives saved through the initiatives. It is an estimate based on a variety of empirical studies, economic theory, international research and practice of the "Financial value society places on reducing the average number of deaths by one." In December 2014 the Australian Government an estimate on the value of a statistical life was $4.2m and the value of a statistical life year was $182,000 (in 2014 AU dollars). (Office of Best Practice Regulation, 2014)

Last year, of the 70% of Australians who are registered organ donors, there were 435 deceased organ donors who donation 1483 organs and saved 1241 lives (Organ and Tissue Authority, 2016). If it is estimated that 'life saved' results in (on average) at least ten more years of living; then the statistical value of the 'saved life' = 182,000 * 10 = $1.82m. Therefore the number of lives to be saved by organ donation in order to 'profit' from the proposal is 3,200,000/1,820,000 = 1.75 lives. There were 13054 registered donors per life saved last year, therefore to increase the number of lives saved by 1.75, there must be 22845 more registered donors. This is approximately 6% of Canberra. Assuming that 70% of ACT are organ donors and the number of people under 18 is 18% (ABS, 2014), this leaves 12% of the population who are not registered organ donors.

Therefore half of the people in ACT who are not current organ donors and within the appropriate age bracket must become registered organ donors in order for this venture to breakeven (21,500 people). If more than 6% of ACT become organ donors then the proposal will be 'profitable.' This seems feasible, given the amount of people that the project is aimed to reach. In addition, this may increase the amount of families who give consent from 60% which will also assist in the initiative being 'profitable.'

5.3 - Process Control

This section will use the goals established in the previous section to determine upper and lower limits of organ donation to establish projections for future goals of the system. This will include counteractive measures should the system continue to fall below the lower limits. This is an important stage in the planning of the project as the Proposal 1 is somewhat of a short term initiative to initially boost organ donation rates and Proposal 2 is a potentially long term goal to help maintain those rates.

As determined in Section 5.2, the goal for this project is to increase organ donation in ACT from 70% to 76%, therefore 76% will be the desired mean organ donation rate over time. As an increase over this limit is a positive outcome, the upper limit (UL) will be 80%. If the organ donation rate continues above this limit for an extended period, the coordinating team should investigate factors for these high rates so that they may continue and be used for future initiatives, such as those that could be implemented for other states. The lower

limit will be 73%, as this is half way between the current rate and the desired rate. If the organ donation rates fall below this limit, advertisements should be increased and/or improved. A second lower limit will be set at 70%, and if organ donation rates fall below this limit, a second distribution of pamphlets should be additionally seriously considered.

A process control chart has been constructed as seen in Figure 5.3 below, with the data points projections based on the timeline of the project. Each data point represents

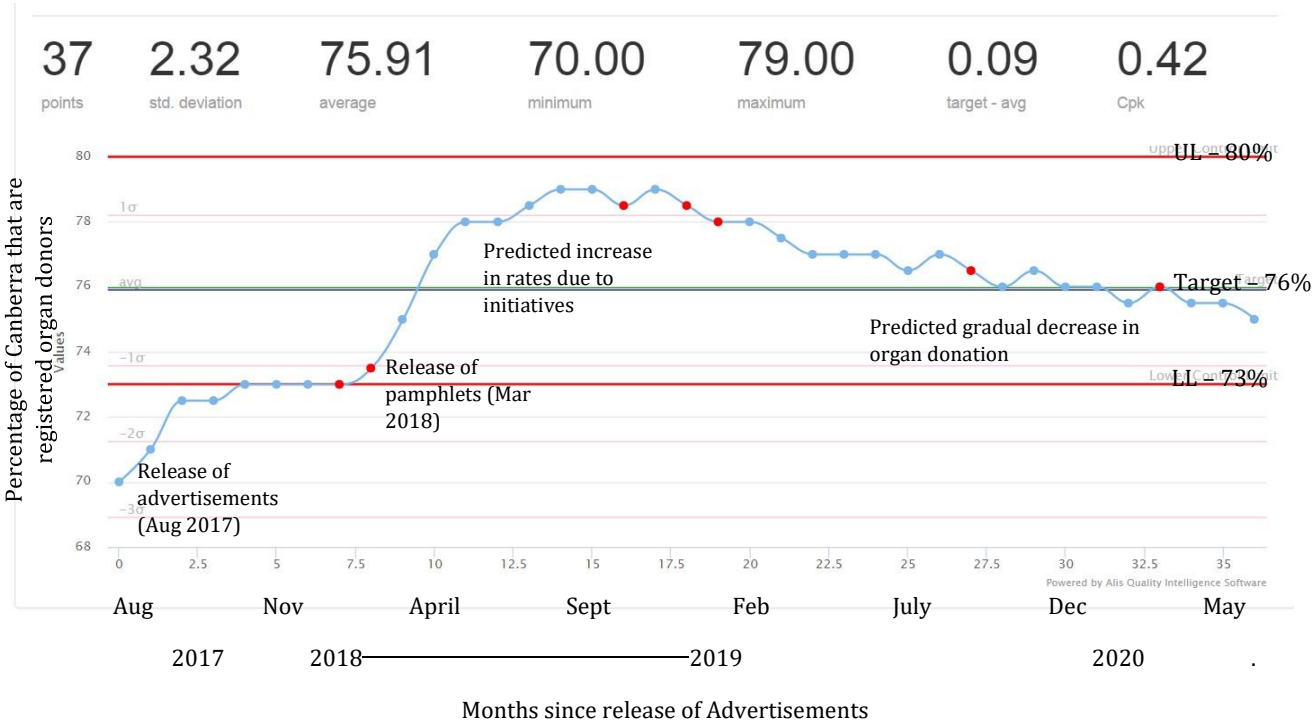

Figure 5.3 – Process Control Chart for Projected organ donation rates after Proposal 1 is implemented

Using a process control chart I have made predictions as to the organ donation rates in ACT due to the introduced initiatives (Figure 5.3). From my estimations, approximately 2 years after the release of the pamphlets it is likely that a resurgence of advertisements will be required. 4-5 years is a suitable estimate for when pamphlets or similar may be considered to boost organ donation rates, though it is hoped the lower-cost advertisements will maintain close to the desired average.

5.4 - Summary of Insights

An estimated timeline and projected goals for the new system have now been established. The two elements of Proposal 1 – Education involving informative pamphlets and advertisements are estimated to take 14.5 months and 8.5 months, respectively. The stages involved in each have been broken down to determine costs involved, with a sum budget for Proposal 1 of $3.2million. To achieve a breakeven or 'profitable' initiative, the value of a statistical life was used to determine that organ donation rates in ACT must increase by 6%, which was determined to be a reasonable goal, given the scope of the proposal. Upper and lower bounds for the future goals were established and measures in the case of moving out of those bounds were determined. An estimated trend of organ donation rates were modelled using a process control chart to demonstrate the anticipated increase and decrease in rates over the time period during and after the initiative.

6 – Project Efficiency and Improvements

This section of the report aims to analyse the efficiency of the proposed system compared to the current system in regards to cost effectiveness and number of organs donated.

6.1 - Payback Period

The life-cycle costs of the current system and the new system including proposed initiatives were determined and compared to determine when the improved system will begin to benefit the system.

The costs as opposed to expenses of organ donation were revealed to be 'profitable' last year. The annual report over 2014-15 from the Organ and Tissue Authority stated that the total expenses of organ donation are approximately $40million per year (OTDTA, 2015). Additionally, 1241 lives were saved through organ donation from deceased donors last year (Organ and Tissue Authority, 2016).

Therefore given the value of a statistical life at $182,000 per year, and assumed 'lives saved' increases on average 10 years then the 'return' on organ donation last year was approximately:

= 182,000 * 10 * 1241

= $2,258,620,000 ($2258.62million)

Which means that organ donation is actually a 'profitable' endeavour in regards to saving human lives.

Therefore 'profits' (P, in millions) of organ donation over time (t, years) can be approximated by the linear equation (assuming constancy over time in expenses and lives saved):

$$P = 2218.62t \qquad (1)$$

Where 2218.62 = profits – expenses = 2258.62 – 40.

For the proposed system, it is assumed that the $40million in expenses remains constant. However, as discussed in section 5.2, the expected increase in lives saved = +1.75. Therefore projected 'return' on organ donation due to the new system can be calculated:

= 182,000 * 10 * (1241+1.75)

= $2,261,805,000 (2261.805million)

Therefore a linear equation can be similarly constructed, where 3.2 is the initial expenses of the project.

$$P = 2221.805t - 3.2 \qquad (2)$$

Equation (1) and (2) can be graphed to visualise how profits will change over the first two years of the project. Hence the following graph (Figure 6.1) is a sketch (not to scale) to demonstrate an indicative point of intersection:

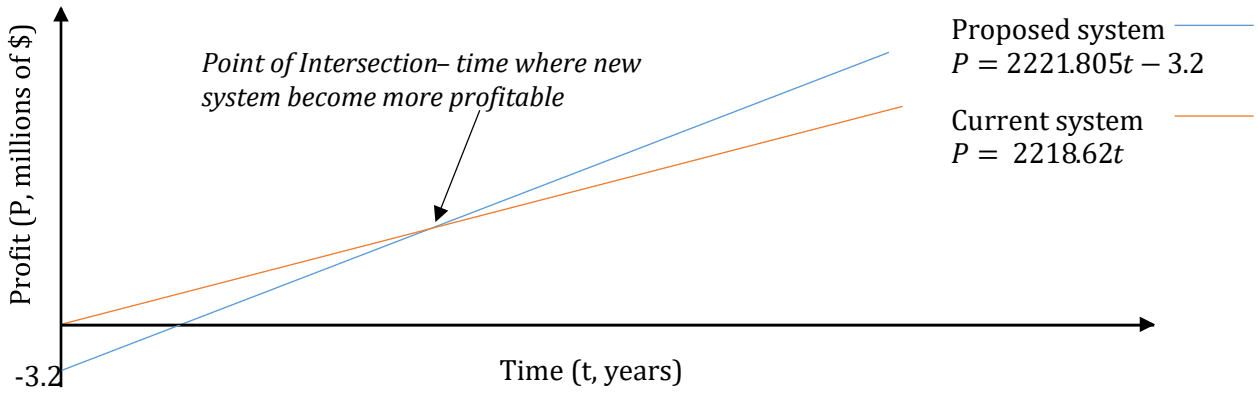

Figure 6.1–Payback Period Sketch: Proposed System vs Current System (not to scale)

The point of intersection between the two equations can be determined using simultaneous equations: $2221.805t - 3.2 = 2218.62$ Which can be solved to find the time at which the two equations intersect:

$$\boldsymbol{t = 1.005\ years}$$

Therefore, **1 year and 2 days** after the initiative is complete the project will be more 'profitable' then the current system.

6.2 - Energy Efficiency

This section will analyse the current 'efficiency' of organ donation waiting lists and compare to the projected efficiency under the proposed system. Due to the availability of statistics, this section will assume that the proposed initiative is for the entirety of Australia, and therefore donor statistics will reflect the entire population rather than only ACT. The Annual Donation and Transplantation Activity Report gives statistics about patients on waiting lists for solid organ transplantation in 2014. For the purposes of this portfolio it will be assumed that these statistics are relatively constant. The report cites that in 2014 there were 3017 patients listed on the waiting list for solid organ transplantation (heart, lungs, kidneys, liver, intestine and pancreas), with 48% (1444 patients) on the waiting list at the start of the year and 52% (1573 patients) added during the year. Of these, 38% received a transplant, 2% died on the list, 9% were removed from the list and 51% were active on the list at the end of the year (OTDTA, 2015). From this information, we can construct a Sankey Diagram of the inputs and outputs of the organ donation wait list (Figure 6.2a):

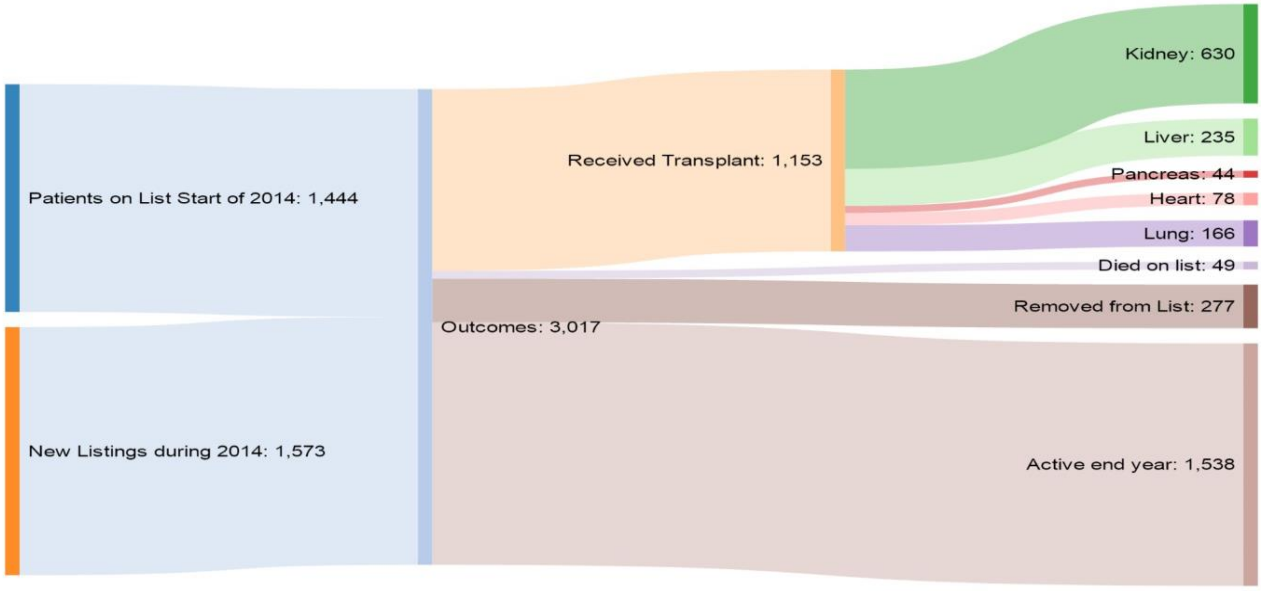

Figure 6.2a – Sankey Diagram of Current System Organ Donation

As shown in the above figure, there were only slightly less people active at the end of the year than were added during the year. The inputs for the system = 3017, with outputs at the end of the year = 1479, giving an efficiency of 49.02%. The proposed system will increase number of organ donors by 6%, thereby increasing the number of transplant patients by 6%. The resulting Sankey diagram is seen below in Figure 6.2b.

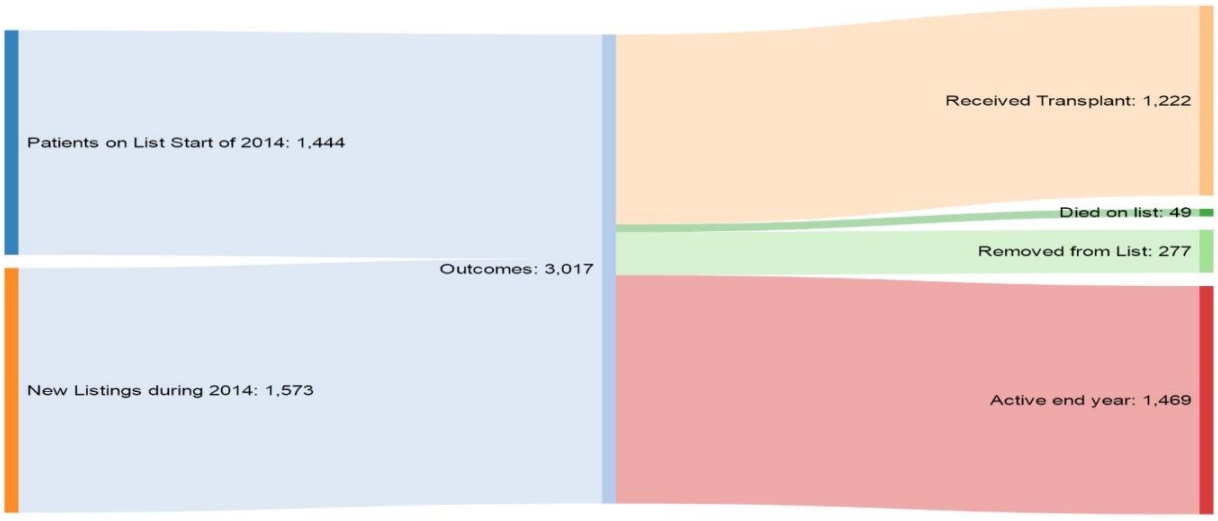

Figure 6.2b – Sankey Diagram of Proposed System Organ Donation

From this, the number of patients who received a transplant was increased by 6% (69 patients), however it should be noted that this hypothetical increase in donors may also result in less deaths. The inputs of the system remained the same with outputs increasing to = 1548. Therefore the proposed system would have an efficiency of 51.31%, increasing organ donation 'efficiency' by 2.29%.

6.3 - Summary of Insights

This section of the portfolio has revealed that if the proposed system follows through with target projections, it will be more profitable than the current system in slightly over 1 year after its implementation. Additionally, an efficiency breakdown and analysis has revealed that if the new system was implemented across Australia, it would increase organ donation 'efficiency' by over 2%.

7 - Final Recommendations and Key Findings

- Research revealed the sample demographic was undereducated about organ donation, and generally families were satisfied with the process of procuring organ donation consent after the death of a loved one
- A small percentage of the population may be the cause of the relatively low family organ donation consent rates

The research gave sufficient information to develop two design proposals. The first involving education through informative pamphlet distribution and social media advertisements, focusing on the Australian Capital Territory. The second involved improving experiences and perceptions of organ donation through support services. Proposal 1 is primarily analysed and evaluated in the portfolio. A systems analysis of the design proposals revealed the following:

- Most religions prevalent in Australia are either encouraging of organ donation or have a difference of opinion regarding the matter. This is also the case for Asian ethnicities
- Deaths involving Aboriginal and Torres Strait Islanders must be treated with extreme caution and care
- Development and distribution of informative pamphlets on organ donation are aimed to take 14.5 months over the whole project with a budget of $2million
- Design and distribution of advertisements to social media on organ donation are estimated to take 8.5 months until publishing with a budget of $1.2million
- In order for the project to breakeven, the number of organ donors in ACT must increase by 6%. This is feasible given 12% of the eligible population in ACT are not currently registered
- The average goal for ACT organ donation registration after implementation of the project will be 76% with a lower bound of 73%. If the registration rate falls below this rate, counteractive measures will be taken.
- It is estimated it will take just over 1 year for the proposed system to be more profitable than the current system.
- If the project is initiated over the entirety of Australia, it is estimated that it will increase organ donation 'efficiency' by 2%.

8 – Further Reading

National Study of Family Experiences of Organ and Tissue Donation Wave 1 2013 | Organ and Tissue Authority.

Ethical guidelines for organ transplantation from deceased donors 2016. |National Health and Medical Research Council.

8 - References

Australia Post, (2016). *Stamp prices - Australia Post*. [online] Auspost.com.au. Available at: http://auspost.com.au/parcels-mail/stamp-prices.html.

Australian Bureau of Statistical (ABS), (2014). *Australian Demographic Statistics, Jun 2014*. [online] Abs.gov.au. Available at: http://www.abs.gov.au/ausstats/abs@.nsf/0/1CD2B1952AFC5E7ACA257298000F2E76?OpenDocument.

Australian Bureau of Statistics (ABS), (2012). *2011 Census Media Release - Religion*. [online] Abs.gov.au. Available at: http://www.abs.gov.au/websitedbs/censushome.nsf/home/CO-61.

Chief Minister and Treasury, (2012). *2011 Census Fact Sheets | Families in the ACT*. Australian Government | Chief Minister and Treasury Directorate ACT Government.

Facebook, (2016). *How Much Do Facebook Ads Cost?*. [online] Facebook for Business. Available at: https://www.facebook.com/business/learn/how-much-facebook-ads-cost.

Human Development Reports Office, (2015). *Human Development Report 2015 | United Nations Development Programme*. [online] Hdr.undp.org. Available at: http://hdr.undp.org/en.

National Health and Medical Research Council (NHMRC), (2016). *Ethical guidelines for organ transplantation from deceased donors*. Australian Government | National Health and Medical Research Council.

ODATWA, (2011). *Brain Death*. [online] Odatwa.org.au. Available at: http://www.odatwa.org.au/faq's-resources/brain-death.

Office of Best Practice Regulation, (2014). *Best Practice Regulation Guidance Note | Value of statistical life*. Australian Government | Department of Prime Minister and Cabinet.

Oliver, M., Woywodt, A., Ahmed, A. and Saif, I. (2010). Organ donation, transplantation and religion.*Nephrology Dialysis Transplantation*, 26(2), pp.437-444.

Organ and Tissue Authority, (2013). *National Study of Family Experiences of Organ and Tissue Donation Wave 1*. Australian Government | Organ and Tissue Authority.

Organ and Tissue Authority, (2014a). *About Transplantation*. [online] Donatelife.gov.au. Available at: http://www.donatelife.gov.au/discover/about-transplantation.

Organ and Tissue Authority, (2014b). *About Us*. [online] Donatelife.gov.au. Available at: http://www.donatelife.gov.au/about-us.

Organ and Tissue Authority, (2014c). *Facts and Statistics*. [online] Donatelife.gov.au. Available at: http://www.donatelife.gov.au/discover/facts-and-statistics.

Organ and Tissue Authority, (2014d). *Organ Donation Process*. [online] Donatelife.gov.au. Available at: http://www.donatelife.gov.au/organ-donation-process-0.

Organ and Tissue Authority, (2016). *2015 a record year for organ and tissue donation and transplantation in Australia*. [online] Donatelife.gov.au. Available at: http://www.donatelife.gov.au/2015-record-year-organ-and-tissue-donation-andtransplantation-australia-0.

Organ and Tissue Donation and Transplant Authority (OTDTA), (2015). *Annual Report 2014-2015*. Australian Government | Organ and Tissue Donation and Transplant Authority.

Oxford Dictionary, (2016). *Altruism Definition - Oxford Dictionary*. [online] Oxford Dictionaries | English. Available at: https://en.oxforddictionaries.com/definition/altruism.

Queensland Health, (2015). *Sad News, Sorry Business | Guidelines for Caring for ATSI through Death and Dying*. State of Queensland | Queensland Health.

Rizvi, S. (2006). *Islamic Views on Organ Donation and Transplantation*. [online] AlIslam.org. Available at: https://www.al-islam.org/articles/islamic-views-organ-donationtransplantation-sayyid-muhammad-rizvi.

Tai, M. (2009). An Asian Perspective on Organ Transplantation. *Tzu Chi Medical Journal*, [online] 21(1), pp.90-93. Available at: http://www.sciencedirect.com/science/article/pii/S1016319009600173.

The Cleveland Clinic Foundation, (2013). *Organ Donation Facts & Info | Organ Transplants | Cleveland Clinic*. [online] My.clevelandclinic.org. Available at: http://my.clevelandclinic.org/health/treatments_and_procedures/hic_Organ_Donation_and_Transplantation.

Web and Print Design, (2012). *Graphic Designers - Design, Branding, Cheap Printing Melbourne & QLD Australia*. [online] Web and Print Design. Available at: http://www.webandprint.com.au/print-design-and-printing.html