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**Effects of community-based interventions on rates of organ donor registration: a
systematic narrative review**

Keywords

Organ donation; donor registration; psychological interventions; behaviour change
interventions; systematic review

ABSTRACT

Background: The demand for organ donation is increasing worldwide. One possible way of increasing the pool of potential posthumous donors is to encourage more members of the general public to join an organ donor registry.

Objective: A systematic review was conducted to investigate the effectiveness of psychological interventions designed to increase the number of individuals in the community who register as organ donors.

Methods: PsycINFO and PubMed databases were searched. No date limits were set.

Randomized and non-randomized controlled trials exploring the effects of community-based interventions on organ donor registration rates were included. Methodological quality was assessed using the ‘Quality Assessment Tool for Quantitative Studies’.

Results: 24 studies met the inclusion criteria; 19 studies found a positive intervention effect on registration. Only eight studies were assessed as having reasonable methodological robustness. A narrative synthesis was conducted. Factors influencing registration rates include providing an immediate registration opportunity and using brief interventions to challenge misconceptions and concerns about organ donation.

Discussion: Community based interventions can be effective at increasing organ donor registrations amongst the general public. Factors that may increase effectiveness include brief interventions to address concerns, and providing an immediate registration opportunity. Particular consideration should be paid to the fidelity of intervention delivery.

Protocol Registration Number: CRD42014012975.

INTRODUCTION

Background

The decision to register as an organ donor is influenced by various demographic and psychological factors, as summarised in a recent theoretical review.¹ However, the evidence is not always clear-cut. One review of cross-sectional surveys found that demographic predictors of donation attitudes and self-reported donor behaviour included education levels, socioeconomic class, religious beliefs, age, and gender.² In contrast, a meta-analysis of demographic factors found that only education and religion were significant predictors of donation attitudes and behaviours, and that gender, ethnicity, and marital status were not related to these outcomes.³ Despite this, there is some evidence that messages about organ donation should be culturally sensitive.⁴

The relationship between organ donation beliefs, attitudes, and behaviours is complex. Organ donation is generally considered an altruistic act, but people appear to hold ambivalent attitudes.⁵ Religious beliefs are both positively and negatively correlated with

positive donation attitudes and behaviours.¹ Misconceptions about the organ donation process, such as mistrust of the medical system or uncertainty about religious teachings, appear to negatively influence attitudes.⁶ Another key concern is the need to maintain body integrity, which is also negatively associated with donation attitudes.^{2,6} Beyond the cognitive level, negative emotional factors, particularly fear and disgust, are barriers to registration. This has been referred to as the ‘ick factor’⁷ and these emotional responses have been shown to distinguish between registered and non-registered potential donors.⁸

Interventions to increase donation rates generally fall into two areas. The first area focuses on healthcare professionals involved in approaching the deceased’s next-of-kin, and seeks to improve donation rates at this level.^{9,10} Relatives’ decisions to agree or decline donation are influenced by their own knowledge and attitudes towards transplantation, knowledge of the deceased’s wishes, and the timing and nature of the donation request from clinicians.^{11,12} Indeed, the various approaches adopted by healthcare professionals may account for some of the observed within-country variations.¹³

The second set of interventions focuses on encouraging the general population to register as donors. These are generally designed to influence knowledge, beliefs, and intentions to overcome barriers to registration. Some interventions have been specifically targeted at minority ethnic groups,^{14,15} as these groups are often underrepresented on organ donor registries. Interventions that increase knowledge and challenge misconceptions have had some success in improving rates of pro-donation attitudes and behavioural intentions.⁴ However, people’s ambivalence towards organ donation may reduce their motivation to seek additional information.⁵ As a change in attitudes and intentions does not necessarily lead to behaviour change, it is important to identify interventions that lead to changes in actual registration rates.

Previous systematic reviews of organ donation have focused on potential predictors of attitudes towards organ donation,^{1,2} the importance of next-of-kin beliefs,¹ and demographic and psychological differences between registered and non-registered potential donors.³ A meta-analysis of communication interventions examined intervention effects on combined outcome measures (including attitudes, registration, and conversations with family), but did not report any quality assessment of included studies.¹⁶ One review also explored how communication messages might be better designed, by taking account of psychosocial factors.¹ Whilst this review provides useful theory-based insights, many of the studies included only explored the effects of interventions on attitudes or intentions. To date, no review has focused on community-based interventions that seek to influence actual registration as a potential organ donor.

Objective

The objective of this review was therefore to assess the effectiveness of psychological interventions (i.e. those designed to influence knowledge, beliefs, and/or intentions about organ donation) by focusing on studies that measured organ donor registration rates, rather than just changes in psychological constructs. A search of The Cochrane Library, SCOPUS, DARE, and the NICE website (<http://www.evidence.nhs.uk>) established that no systematic review has already addressed this question.

METHOD

The protocol for this review was registered on the PROSPERO database; the registration number is CRD42014012975.

Inclusion Criteria for Subject-Studies

Studies were included in the review only if they met the below criteria. Inclusion criteria were developed using the PICOCS acronym,¹⁷ as recommended by The Centre for Research and Dissemination (2009)¹⁸. Only studies published in English were included. No date restrictions were set.

Participants. Members of the general public, not already registered as an organ donor.

Intervention. Community-based, designed to influence beliefs, knowledge, and/or intentions in order to increase registration rates as a posthumous solid organ donor; not interventions targeted at healthcare professionals, patients awaiting transplants, or families of potential donors. Studies aimed at increasing either living donation or blood donation were excluded.

Comparator. Either another intervention, or no intervention.

Outcome measures. Actual behaviour (i.e. percentage rates of signing donor card or equivalent) whether objectively or subjectively measured. Studies were excluded if no measure of registration was reported and only changes to knowledge, beliefs etc. were reported.

Context. Delivered in community to general population; no restrictions set regarding exact setting, country, or mode of delivery.

Study design. Randomized controlled trials (RCT) and non-randomized controlled trials (CT).

Search Strategy and Screening

Electronic databases (PsycINFO and PubMed) were searched during February 2015 using the following search string: organ AND (donat* OR transplant* OR procur* OR regist*) AND (intervention OR education*) AND (trial OR experiment*). Using the symbol * allows all variants of the word ending to be retrieved.

Titles and abstracts of articles retrieved from databases were screened against the inclusion criteria, to determine the population, outcome measures, and study design. Any studies not excluded were then sourced for full-text reading. Reference lists of any articles deemed eligible for inclusion after full-text reading were also reviewed. Potential articles were then sourced for screening and full-text reading where appropriate; this process continued until no new articles were identified.

Data Extraction

Data extraction was completed by SG and independently confirmed by MC; any discrepancies were discussed and amendments agreed. Data extracted included study setting, number of participants, and details of the intervention and any control conditions. Details of how registration rates were measured and summaries of main findings were recorded. The reviewers calculated odds ratios wherever possible, based upon data available in the articles.

Assessment of Study Quality

Initially, assessment was to be made based on the CONSORT statement,¹⁹ which should provide enough information to judge RCTs.²⁰ However, given the complexity of many public health interventions,¹⁸ and the inclusion of CTs in the review, the Quality Assessment Tool for Quantitative Studies²¹ was selected for assessing methodological quality. It has been recommended for assessing all quantitative studies²² and includes an assessment of intervention fidelity. The Quality Assessment Tool for Quantitative Studies²¹ requires studies to be classified as ‘weak’ if two or more sections are rated ‘weak’, ‘moderate’ if only one section is ‘weak’, and ‘strong’ if no sections are ‘weak’. It should be noted that the tool encourages assessments to be made based on information reported in articles; reviewers are instructed to not make inferences about the authors’ intentions.

One section of the Quality Assessment Tool for Quantitative Studies covers ‘data collection methods’, and asks whether data collection tools were valid and/or reliable. Although self-report measures of donor status can arguably be considered valid and reliable, self-report measures are vulnerable to respondent biases. Therefore, the tool was adapted to distinguish between studies that used objective and subjective measures; objective data collection tools were rated ‘strong’, whilst self-report measures were rated ‘moderate’. A decision was also taken to include the intervention integrity ratings when determining the global rating.

Studies were independently assessed by each reviewer. Ratings were then compared, and discrepancies discussed until agreement reached. Studies rated ‘strong’ or ‘moderate’ contributed more significantly to the findings of the review, than studies rated ‘weak’.¹⁷

RESULTS

A total of 493 articles were identified from electronic searching; a review of reference lists of articles included after full-text reading identified 23 additional articles. No duplicates were identified, so a total of 516 abstracts were retrieved for screening. Following abstract review, 480 articles were excluded. After sourcing the remaining 36 articles for full-text reading, 15 were excluded as follows: three articles did not report interventions, three articles did report interventions but did not report on registration outcomes, eight articles reported interventions but had not included a sufficient comparator group, and one article was an RCT protocol. This resulted in 21 articles meeting the inclusion criteria. Of these, one article reported two studies¹⁵ and another reported three studies.²³ The review therefore assessed 24 studies. (See Figure 1 for study flowchart).

Study Characteristics

Extracted data relating to key study characteristics are reported in Table 1. Although some studies were described as RCTs, after applying the assessment tool all studies were judged to be CTs. In some cases, it was apparent that random allocation of participants had not taken place, but in others a lack of reporting regarding randomization procedures meant it was not possible to tell. Given the nature of the interventions, double or triple blinding was not practical.

The majority of studies were conducted in the USA; four other studies were conducted in European countries. Populations targeted were varied. Most studies recruited from the wider general public; five studies targeted specific ethnic groups.^{14,15-study2,29,31,40} Several studies only reported percentages for registration rates, rather than numbers, as data analysis took place on government-collected population-level data.²⁴⁻²⁷ Nine studies did not report participant numbers by condition, but for the studies that did, participants were roughly equal across intervention and comparator groups.

Study Quality

Details of the study assessments are shown in Table 2. Nine studies used a self-report measure of organ donor registration; fifteen reported an objective measure of registration. Participant demographics were taken at baseline in most studies and the majority appeared to control for this in their analysis. Two studies were assessed as ‘strong’,^{27,28} and six were assessed as ‘moderate’;^{14,15-study1,30,32,33,41} 16 studies were assessed as ‘weak’. As the majority of studies were therefore potentially at higher risk of bias, the reviewers decided not to conduct a meta-analysis. Additionally, comparator groups were varied: interventions were either compared to no intervention at all, practice as usual, or alternative interventions. The narrative synthesis below is therefore based predominantly on findings from the eight studies

rated ‘moderate’ or ‘strong’, although findings from studies rated ‘weak’ was also integrated where findings were consistent with other studies.

Attrition rates were commented on in around half the articles. Among those that did comment, four reported less than 20% attrition,^{27–30} five reported between 21% and 40% attrition,^{14,31–34} and four reported more than 40% attrition.^{35–38}

Intervention Integrity

Various interventions were described; all sought to increase registrations by manipulating knowledge, beliefs, and/or intentions about organ donation. Most were delivered directly to the target population, but some involved training people who could influence individuals’ decision-making.

Intervention integrity varied across the studies (see Table 2). Some studies reported interventions in reasonable detail, but others did not. Only five studies^{15-study1,15-study2,30,39,41} commented on efforts to judge the consistency of the intervention delivery.

Effects on Registration Rates

Of 24 studies reviewed, 19 reported an increase in registration as a result of the intervention, but not all effects reached statistical significance. Additionally, rates of increase varied substantially. In studies reporting population-level interventions, a small percentage increase would still have a large impact on registration rates. For smaller interventions, however, registration rates would need to be larger for the intervention to be meaningfully effective; for example, one relatively resource-intensive local-level intervention resulted in only 4.8% of participants registering,²⁹ compared to another that resulted in 86% of participants registering.^{15-study2}

A lack of significant difference between experimental groups in three studies,^{14,23-study1,23-study2} may be because these studies only compared different organ donation interventions, and did not include a ‘no intervention’ control group. Two studies did not report inferential statistics for the intervention effect.^{31,40} One study reported lower registration amongst participants who received a ‘Theory of Planned Behaviour’ version of the intervention questionnaire, compared to control participants who received no attitudinal manipulation, although participants who received a third variant of the intervention questionnaire did show increased registration.²⁸

Most studies reported the primary outcome as a percentage; odds ratios and 95% confidence intervals were therefore calculated, based on data available in the published articles (see Table 3). In a few cases, odds ratios could not be calculated, either because the control group returned 0% registration, or because total sample numbers were not reported.

Narrative Synthesis

Key findings from the studies are presented below. Studies are grouped according to their key manipulations, but there was overlap; the categories that follow are not mutually exclusive.

Increasing knowledge and correcting misconceptions. Most interventions aimed to increase registration by improving participants’ knowledge; facts were presented about organ donation and the process of becoming a donor.^{14,15-study1,27,30,32,33,41} These ‘educational’ interventions sought to address commonly held misconceptions or fears. For example, one study presented a video to driving licence and identification card applicants at DMV offices.³⁰ The video showed people with diverse demographic characteristics discussing

concerns around donation, such as the belief that religions may oppose it, or mistrust of the medical system.

Participants across interventions were often exposed to personal stories from donor recipients, donor family members, or those waiting for a transplant; this exposure could be either direct (face-to-face) or indirect (stories relayed via videos or websites). The majority of these ‘educational’ interventions appeared reasonably successful, despite differences in locations and methods of delivery.

Three studies reported face-to-face interventions. One study used “town hall” style forums, where participants listened to a presentation by an “expert panel”, consisting of donor recipients, donor families, and clinicians.^{15-study1} Another study was workplace-based, and featured people affected by organ donation attending intervention sites; participants were also encouraged to speak to family members about organ donation.³² The third face-to-face intervention took place within DMV offices and included promotional material to increase knowledge.²⁷ The intervention also involved having tables staffed by volunteers affected by organ donation, and training of staff members to raise the topic of donation with licence applicants.²⁷

Four studies reported interventions that did not involve face-to-face contact to present ‘educational’ material. In one study, participants were presented with organ donation information via a website,⁴¹ while in another study, households were mailed brochures and questionnaires about organ donation.³³ Another study used a brief iPod video to address common concerns about organ donation; the video was shown to people attending DMV offices, who were then asked by staff if they wished to register.³⁰ The fourth study specifically aimed to improve knowledge and address emotional concerns amongst African Americans.¹⁴ Written and visual material designed for this target population was distributed to participants to take home. This study found no significant increases in registration

compared to the control group; however, control participants had access to currently used organ donation promotional materials, meaning intervention materials appeared comparable, rather than superior to, existing materials.

Manipulating attitudes, intentions, and emotions. Not all studies used an ‘educational’ approach. One study specifically aimed to elicit an emotional response, by manipulating levels of anticipated regret.²⁸ Registrations were highest amongst participants who received the anticipated regret manipulation, compared with two control groups. Additionally, anticipated regret mediated the intention-registration relationship.

Another study explored the effects of additional training for staff at DMV offices,²⁷ where DMV clerks are expected to ask applicants to consider joining the organ donor registry. Results showed that by increasing pro-donation attitudes and behavioural intentions amongst DMV clerks, significant increases in registrations were achieved during the intervention period. However, follow-up eight months after the intervention ended revealed that effects were not maintained, suggesting continued efforts may be needed to sustain higher registration rates.

Raising salience and providing registration opportunities. A large study in Sweden compared registration rates in three residential areas:³³ one area was only exposed to mass-media campaigns, households in another area only received brochures about donation, whilst a third area whose households received brochures was also exposed to the mass-media campaign. Registration rates in the mass-media only area did not change compared to population registration rates across Sweden. In contrast, in the two areas where households received brochures, registration rates were significantly increased. Interestingly, there was no significant difference in rates between these two areas, regardless of whether or not

households were exposed to the mass-media campaign. This suggests the effects may result from being provided with a convenient opportunity to register, especially as the mass-media campaign alone did not increase registration rates compared to the rest of Sweden.

Only one study explicitly compared the provision of an opportunity to register immediately with a delayed opportunity; significant effects on registration rates were reported.^{15-study1} However, where immediate registration opportunities were provided to intervention and control groups, there were still differences, indicating that other factors (such as emotions and attitudes) can be manipulated to increase likelihood of registration.^{27,28,30,41} Nonetheless, the differences between immediacy and non-immediacy conditions^{15,33} indicate that provision of a registration opportunity should be considered in any intervention.

Location. An apparently successful approach was to target individuals who attended government offices for vehicle licencing. All five studies that intervened in these locations reported significant increases in registrations.^{24–27,30} Although three of these studies were rated ‘weak’ overall,^{24–26} they described large-scale interventions, targeting whole populations. These positive results support the findings from two similar studies, rated as ‘strong’²⁷ and ‘moderate’³⁰ respectively. Interventions targeted at individuals attending DMV offices are inevitably going to exclude certain sections of society; nonetheless, this group of studies suggests population-level interventions can impact on registration rates.

Reports of Potential Harm

Only two studies mentioned potential for harm. One study reported no adverse effects.³⁰ Another study that compared the effects of three different questionnaires, reported potential harms from one comparator condition, which resulted in fewer registrations than the

main control condition.²⁸ This highlights the importance of high quality trials, to ensure interventions do not inadvertently reduce registration rates.

DISCUSSION

The purpose of the review was to establish whether psychological interventions delivered direct to the general population were effective at increasing organ donor registrations. Overall, most studies reported increased registrations following an intervention, but methodological quality and effect sizes varied. Studies included represented a range of interventions, targeting either knowledge levels, beliefs about donation, and/or intentions to donate, and were delivered to various population samples. Additionally, even where there was an intervention effect, registration rates were not always very high; those designing and evaluating interventions should be mindful that some apparently resource-intensive interventions delivered comparatively small increases in registration. An assessment of cost-effectiveness might be a useful addition to future studies as part of the overall evaluation of these interventions.

The elements that seemed effective at increasing registrations were providing an immediate opportunity to register as an organ donor whilst the issue was still salient, and addressing concerns and misconceptions in a clear, yet brief manner, just prior to making a decision about organ donation. Indeed, it has been argued that influencing attitudes may be the wrong focus; efforts should be targeted at the so-called “passive-positives”,⁵ who are favourable towards donation, but have not yet registered, by reducing barriers to action. As attitudes towards organ donation are already generally positive, it may be more important to simply provide a registration opportunity.⁵

Targeting DMV offices appears an effective way of increasing registrations, by accessing large parts of the population, but will also inevitably exclude certain sections of

society. Raising pro-donation attitudes amongst staff at DMV offices may increase registration, but it is likely that refresher training would be needed to maintain any effects.

Future interventions should be sensitive to the context in which they are delivered, and should build on areas identified as contributing to increased registration. Better study design should, however, be employed; studies should ideally use objective measures of registration, as well as ensure any baseline differences are controlled for. Consideration should be given as to how intervention fidelity can be optimized, especially if the intervention is being delivered to staff or community leaders, who are then required to pass on key messages. Attempts should also be made to measure intervention fidelity; although some variation is to be expected, to what extent this might undermine intervention effects should be acknowledged and explored in future research.

Increasing registration rates is therefore possible through community-based interventions, but this is just one aspect of increasing the availability of potential donor organs. Another key moment is the decision made by next-of-kin. Organ donation registries can aid this decision-making process, as, by registering, an individual can make a clear statement about their wishes. When uncertainty about the deceased's wishes regarding their organs was removed, families were more likely to consent to donation.¹² Effective interventions to encourage people to join organ donor registries are needed to support the growing global trends for solid organ transplantation.

Limitations

Methodological quality varied, making it difficult to assess the contribution of some studies to the evidence base. Despite a large proportion of the studies being rated as 'weak', the review did however identify some consistent findings across the studies. After completing the assessments, it was decided not to conduct a meta-analysis, due to the possibility of risk

of bias in the data from those studies rated 'weak'. Furthermore, due to resource issues, the scope of this review did not include searching for 'grey' literature, or unpublished studies, which could potentially limit the findings of this review. Although results were generally suggestive of increased registration rates, confounding variables were not always controlled for effectively. In some cases, intervention fidelity was questionable.

All but four studies were conducted in the USA; whilst this may limit the generalizability of the findings, it also highlights the need for future research to explore the effects of similar interventions in other countries. Perhaps the small group of countries where this research has taken place may be partially explained by legislation; as donor registration rates are generally already very high in countries with an opt-out system, efforts should rightly be focused on increasing registration in countries where registration is opt-in. Nonetheless, there were many countries with opt-in systems that were not represented in the studies reviewed.

Conclusions

Evidence from this review suggests interventions can be effective at increasing organ donor registrations amongst the general public. Influencing factors include providing an immediate registration opportunity, and using brief interventions to challenge misconceptions and concerns about organ donation. Particular consideration should be paid to intervention fidelity and how this is reported.

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Figure 1. PRISMA Flowchart showing number of studies identified through searching and final number of studies included and excluded from review

Table 1. Characteristics of Studies Included in the Review

Authors, Year	Setting & participants	Intervention	Control / comparator	Objectively	
				measured outcome?	Main findings
Alvaro <i>et al.</i> , 2011 (Study 1) ¹⁵	"Town halls", USA (<i>n</i> = 2 per city): Chicago (churches), Miami (local organizations) & Phoenix (universities). 211 individuals: self-selected responders to adverts for OD forum	Immediacy: OD forum, followed by distribution of donor registration forms & collection at end of session (<i>n</i> = 104)	Non-immediacy: OD forum, followed by distribution of donor registration forms & participants asked to mail donor forms later; SAE-envelope provided (<i>n</i> = 107)	Yes	Significantly higher rates of registration in immediacy (40.4%) compared to non-immediacy condition (10.3%).
Alvaro <i>et al.</i> , 2011 (Study 2) ¹⁵	"Swap meet" (flea market) popular with Hispanics, Arizona, USA. Info. booths erected over 8	Immediacy: booth erected with info. about OD & opportunity for registration - two large banners saying 'Register Here!' & 'Register	Non-immediacy: booth erected with same info. material & opportunity for registration, but banners carried phrase 'Donate Life'	Yes	Significantly higher rates of registration in immediacy (86%) compared to non-immediacy condition (54%).

	consecutive weekends.	Now!', intended to advertise	(<i>n</i> = 69)		
	156 members of public	the immediate opportunity to			
	who entered OD booth	register (<i>n</i> = 87)			
Andrews <i>et al.</i> , 2012 ⁴⁰	African-American churches, South-East Michigan, USA (<i>n</i> = 22). 1254 individuals completed baseline survey, recruited through community events held in church	'Peer Leaders' from churches trained in OD educational programme, who subsequently delivered programme to congregations at various church events (<i>n</i> = unknown; intervention offered to whole congregation at 11 churches)	As intervention, except 'Peer Leaders' trained in healthy living educational programme (<i>n</i> = unknown; intervention offered to whole congregation at 11 churches)	Yes	211 verified registrations: 163 from intervention churches & 48 from comparison churches. Only 19 verified registrations could be tied to individuals who completed baseline surveys. No. not reported for total participants receiving intervention. No statistical analysis reported.
Arriola <i>et al.</i> , 2010 ¹⁴	Churches in South East USA (<i>n</i> = 9). 452 individuals recruited; 337 completed 1-year follow-up survey	Distribution of <i>Project ACTS</i> videotapes, written materials, donor card & other items magnets with project logo; to be taken home & reviewed by participants during following year. Reminders sent to	Distribution of donor card, publicly available written materials & items such as pens & bookmarks; also advised OD videos could be borrowed from church library. For review at home	No, self-report.	No significant differences between ctrl. (48.8%) & intervention (46.9%) conditions for being indentified as donor on driving licence. No significant differences between ctrl. (24.7%) & intervention (24.0%) conditions for being indentified as donor on donor

		participants throughout year to	& reminders sent as		card.
		review materials ($n = 4$	intervention ($n = 5$ churches;		
		churches; $n = 250$ individuals)	$n = 202$ individuals)		
Arriola <i>et al.</i> , 2013 ³¹	Community outreach workers ($n = 19$) conducted group sessions, USA. 585 individuals (between 7 & 73 recruited by each outreach worker); 509 completed 1-year follow up survey	<i>Project ACTS II</i> materials - revised versions of DVD & educational pamphlet from <i>Project ACTS I</i> , ($n = 283$); 2 conditions: materials distributed to be watched at home, or viewed & discussed in group setting	<i>Project ACTS I</i> materials ($n = 302$); 2 conditions: materials distributed to be watched at home, or viewed & discussed in group setting	No, self-report.	Main effect of time for intervention (<i>ACTS I</i> vs. <i>ACTS II</i>), but not condition on 'readiness to donate' score. Main effect of time & condition for setting (group vs. home), plus a significant time x condition interaction. 'Readiness to donate' score was composite measure of actual registrations and intentions to register, but outcomes were grouped for statistical analysis, so effects on actual registration unclear.
Birkimer <i>et al.</i> , 1994 (Study 1) ²³	Group educational sessions, unnamed university, USA. 146 undergraduate students	2 groups. Both received info. about OD, attitude measures about OD & take-home form with donor card & instructions	As for intervention groups except ctrl. individuals received an info. page containing a message about	Yes	No significant differences in signing rates between 3 groups (both intervention groups 44% signed, ctrl. group 38%).

		for signing driver's licence. 1 group also received family discussion guide about OD. ($n =$ unknown)	nutritional value of red meat, instead of about OD ($n =$ unknown)		
Birkimer <i>et al.</i> , 1994 (Study 2) ²³	Group educational sessions, unnamed college & university, USA. 233 college students & 71 university students	1 st group received materials as Study 1; 2 nd group not given info., but asked to think about signing as organ donor for 2 minutes. Half of each group also asked to discuss OD with family; other half instructed not to discuss with others. College & university students ($n =$ unknown)	Session 1 & 2. As in Study 1: individuals received info. about red meat, but instead of pre- & post-test questions about OD, attitude measures were about red meat consumption. College students only ($n =$ unknown)	Yes	College students: 0% registration in ctrl. group, compared to 19% in 'info' group & 26% in 'thinking' group. Both intervention groups significantly different from ctrl. group, but not each other. University students: 14% registration in intervention group, but no ctrl. group amongst university participants.
Birkimer <i>et al.</i> , 1994 (Study 3) ²³	Group educational sessions, unnamed college, USA. 260 college students (1/3 in	3 interventions. TMT 1 = OD info.; TMT 2 = OD info., plus instruction to set a date to decide whether or not to sign	No ctrl. group, but 2 types of sign up sheet (1 specified regular contact with family & 1 did not) and 2 types of	Yes	No significant differences in signing rates between 3 groups: TMT 1 = 26%, TMT 2 = 34%, TMT 3 = 40%.

	each condition)	up & write this down confidentially; TMT 3 = as TMT 2, but to write date on postcard to be handed to experimenter, to be later mailed to participants.	consent form (1 specified “organ donation research” & 1 specified “health issues research”). 2x2x3 design (signup sheets x informed consent x treatment)		
Harrison <i>et al.</i> , 2008 ²⁴	DMV offices in a southern state, USA. All individuals who attended DMV offices, numbers not reported	Training all 76 DMV clerks in 8 counties of state, prior to new OD register introduction. Training included info. about OD, communication strategies for talking to public about OD & new register.	4 counties of state, plus rest of state; no intervention	Yes	Intervention counties had a mean registration rate of 37%, compared to 23% in ctrl. counties (& 28% in rest of state).
Harrison <i>et al.</i> , 2010 ²⁵	SOS branch offices, Michigan, USA. All individuals who attended SOS offices, numbers not reported	3 counties (approx. 12.5% of population). Stage 1 (over 2 mths): mass media camp. (radio adverts & billboard posters), POD materials in	Rest of state population; no intervention	Yes	During camp. intervention counties registered 14,672 new donors, compared to 6,600 in rest of state. All 3 intervention counties registration rates increased from baseline approx. 200%

		SOS offices. Stage 2 (next 2 mths): as Stage 1, plus volunteers in SOS offices. Stage 3: POD materials only.			during Stage 1, & approx. 300% during Stage 2. State-wide registration rates increased approx. 5% & 9% during these times.
Harrison <i>et al.</i> , 2011 ²⁶	SOS branch offices, Michigan, USA, with additional focus on African Americans. All individuals who attended SOS offices, numbers not reported	2 counties. Stage 1 (over 2 mths): mass media camp. (radio adverts & billboard posters), POD materials in SOS offices. Stage 2 (next 2 mths): as Stage 1, plus volunteers in SOS offices. Stage 3: POD materials only.	Rest of state population – received no intervention, but was a state-wide camp. during Stage 2 organised by Michigan OPO.	Yes	During camp. intervention counties registered 38,951 new donors, compared to 49,670 in rest of state. Both intervention counties registration rates increased from baseline 178% during Stage 1, & 357% during Stage 2. State-wide registrations increased approx. 4% & 160% during these times.
Morgan <i>et al.</i> , 2002 ³⁵	2 worksites of large, national delivery corporation, USA, with approx. 16,000 individuals. 10% (stratified by occ. class)	Mass-media site: in-house newspaper articles, intranet homepage, billboards on nearby roads, radio adverts, educational sessions, OPO volunteer-staffed info. tables,	Ctrl. site: no intervention materials (<i>n</i> = unknown, but at least 149 post-test surveys relate to ctrl. site)	No, self-report	Significantly more participants reported having signed a donor card at intervention site (52%) compared to ctrl. site (39%).

	sample pre- ($n = 798$) & post-test ($n = 552$) surveys	($n =$ unknown, but at least 401 post-test surveys relate to intervention site)			
Morgan <i>et al.</i> , 2010 ³⁶	45 companies, across various industries; 15 worksites in each condition, New Jersey, USA. 3,528 individuals completed both pre- & post-test surveys	10 week camp., 2 conditions. Low-intensity condition: brochures about OD, OD registry card, adverts & newsletter stories about OD. High-intensity condition: as low-intensity, plus project staff & volunteer-staffed info. tables ($n =$ unknown)	Ctrl. site: no materials received before post-test survey; received modified camp. afterwards ($n =$ unknown)	Yes & no (two measures)	Significant differences in self reported signing of donor card amongst surveyed samples: ctrl. (42.8%), low-intensity (45.9%), high-intensity (49.7%). Report <1% of employees in low-intensity & approx. 6% of employees in high-intensity conditions returned new registrations; nothing reported for ctrl. No statistical analysis reported.
Morgan <i>et al.</i> , 2011 ³⁷	6 universities, across USA; 2 sites per condition. 8% of	2 conditions. Mass-media condition: adverts in university newspapers & on	Ctrl. sites: received no intervention materials ($n =$ unknown)	No, self-report	No significant difference in increase in registrations between ctrl. (5%) & mass-media only (6%) conditions.

	faculty, staff, administrators & students sampled; 4426 pre- & 3546 post-tests completed. 1131 individuals completed both pre- & post-tests	billboards on nearby roads, radio announcements & post-cards about OD. Mass-media +interpersonal communication condition, as above, plus outreach events with OPO volunteers (<i>n</i> = unknown)			Significantly greater increase in registrations in mass-media + interpersonal communication condition (12%), compared to both other conditions.
O'Carroll <i>et al.</i> , 2011 ²⁸	UK-wide survey, plus opportunity to register as organ donor online. 286 healthy adults, general public with UK residency	Online survey: AR variant = as TPB variant, with additional questions to assess levels of AR (<i>n</i> = 98)	2 online surveys. Ctrl. variant, exploring factors influencing decision to register (<i>n</i> = 94). TPB variant, as ctrl. plus extra TPB items (<i>n</i> = 94)	No, self-report	AR intervention resulted in significantly greater proportion of registrations (21.8%), in relation to both comparator conditions (Ctrl. = 13%; TPB = 7.9%).
Quinn <i>et al.</i> , 2006 ³²	Corporations (<i>n</i> = 12) with multiple worksites (<i>n</i> = 40), Chicago, USA. 754 employees	Basic: 1-hr programme: OD presentation, testimonials from recipient & relative of posthumous donor, advice on registration (<i>n</i> = 254).	Ctrl.: routine 1-hr programme; participants provided with brochures on a range of health-related topics, including OD (<i>n</i> =	No, self-report	Basic & enhanced interventions resulted in significantly greater rates of change in registration (29% & 31% respectively), compared to ctrl. (17%).

		Enhanced: as basic, plus encouragement to persuade family to register ($n = 288$).	213)		
Resnicow <i>et al.</i> , 2010 ²⁹	Hair salons, Michigan, USA ($n = 52$). 2789 individuals, salon clients	Usual care with added OD component. Stylists ($n = 34$) instructed to address OD in at least 2 of 4 'health chats' with each client ($n = 1370$)	Usual care: stylists ($n = 34$) gave info. about nutrition, exercise, diabetes & kidney disease in a series of 4 'health chats' ($n = 1419$)	Yes	68 registrations (4.8%) in intervention group, compared with 29 registrations (2%) in ctrl. group.
Rodrigue <i>et al.</i> , 2012 ²⁷	DMV offices, Florida, USA ($n = 30$)	Usual practice, plus additional OD materials, staff training & volunteer-staffed info. tables within DMV offices ($n = 15$)	Usual practice: passive display of OD materials, staff instructed to ask individuals if they wish to register as a donor ($n = 15$)	Yes	Monthly aggregated percentage of drivers registered as donors rose from baseline by 10% in intervention group, compared with 1% in ctrl. group.
Sanner <i>et al.</i> , 1995 ³³	Targeted households in Orebro & Gothenberg, Sweden. 20,000 households, plus all Gothenberg for camp.	<i>Camp. A:</i> training various professionals, exhibitions, adverts for donor cards in pharmacies, newspapers & on local television. <i>Camp. B:</i>	Whole population of Sweden excluding areas receiving one of the 3 interventions.	No, self-report	Twice as many respondents in areas that received Camp. B (5% pre-test, 12% post-test) & C (3% pre-test, 13% post-test) signed donor cards, compared to area that received Camp. A, & rest of

	A. Pre- & post-test measures from samples of each group ($n = 1400$ for each condition; 700 pre-test & a different 700 post-test)	brochure sent to households ($n = 10,000$) including 2 donor cards, in Orebro. <i>Camp. C</i> : brochure sent to households ($n = 10,000$) including 2 donor cards, in Orebro			Sweden (both unchanged at 5%).
Siegel <i>et al.</i> , 2008 ³⁹	Kiosks in 4 settings: hospitals, libraries, universities, community colleges, Tucson, Arizona, USA ($n = 16$; 4 kiosks in each location type)	Posters placed in kiosks. Posters delivered 4 types of 'Appeal', using 4 'Exemplar' variations. Kiosks had registration-dedicated computer. Only completed registrations recorded; total no. of visits not known.	4x4x4 design (64 conditions): each 'Appeal' & 'Exemplar' counterbalanced across each location = 16 messages, each rotated through locations over 8 weeks; each variant displayed in 2 of each location type	Yes	421 individuals registered. Tests of main effects significant for each variable ('Appeal', 'Exemplar' & Location). Some variable levels were more effective: counterargument most effective form of 'Appeal' & excuse format most effective form of 'Exemplar'. Hospitals & libraries resulted in more registrations.
Thornton <i>et al.</i> , 2012 ³⁰	BMV branches, Ohio, USA ($n = 12$). 952 applicants visiting	Video viewed on iPod outside BMV branch prior to entering for application, usual practice	Usual BMV practice, staff expected to ask individuals if they wish to register as	Yes	Intervention participants significantly more likely than ctrl. participants to consent to OD, (84% vs. 72%)

	BMV branch	continues inside ($n = 443$)	organ donor ($n = 509$)		
Vinokur <i>et al.</i> , 2006 ⁴¹	Websites about OD ('The Journey') & common-cold; 490 high school students, Michigan, USA.	2 groups directed to OD website. 1 group pre- & post-test measures ($n = 152$). Other group only post-test measures ($n = 179$).	1 group directed to common-cold website, answered pre- & post-test measures ($n = 159$).	Yes	Participants who viewed 'The Journey' more likely to contact registry (21.8%) than those who viewed common-cold website (15.7%); unclear from methods whether this contact always resulted in actual registration.
Winkel, 1984 ³⁴	Survey, over 2 weeks around Free University, Amsterdam, The Netherlands. 1012 surveys issued to students to complete at home; 651 returned (230 excluded; already donor card holders)	2 exp. conditions: long-form survey plus either 'conventional' ($n = 96$) or 'refutational' ($n = 97$) info. about OD. Included donor registration form	2 variations of ctrl. survey; one version asked no questions about negative behavioural consequences. No info. about OD provided. Included donor registration form ($n = 228$)	No, not cross checked to registry	No. of applications from 'refutational' condition (40%) significantly more than ctrl. (27%), but not significantly more than 'conventional' (34%; also not significantly different from ctrl.)
Winkel & Huismans,	Survey 'over a few weeks' in Weesp, The	Exp. group received survey, donor registration form &	Ctrl. group received survey & donor registration form	No, not cross	Registrations higher in exp. than ctrl. condition. Participants grouped by high

1986 ³⁸	Netherlands. 400+ surveys issued to members of public to complete at home; 202 returned	info. folder about OD focused on 'refutational' messages, challenging misconceptions about OD (<i>n</i> = unknown)	only (<i>n</i> = unknown)	checked to registry	or low 'denial of responsibility'. No significant difference between ctrl. (14%) & exp. (29%) for those with low denial; significantly more registrations in those with high denial in exp. condition (35%) compared to ctrl. (0%).
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Abbreviations. Approx. = approximately; AR = anticipated regret; BMV = Bureau of Motor Vehicles; Camp. = campaign; Ctrl. = control; DMV = Department of Motor Vehicles; Exp. = experimental; Hr = hour; Info. = information; Mths = months; No. = number; Occ. = occupational; OD = organ donation; OPO = organ procurement organization; POD = point-of-decision; SOS = Secretary of State; TPB = Theory of Planned Behaviour

Table 2. Quality Assessment of Studies Included in the Review

Authors, Year	Selection bias	Study design	Confounders	Blinding	Data collection methods	Withdrawals & drop-outs	Intervention integrity	Analyses	
								Appropriate (Yes / No / Unable to determine)	Global rating
Alvaro <i>et al.</i> , 2011 (Study 1)	Weak	Strong	Strong	Moderate	Strong	Strong	Strong	Yes	Moderate
Alvaro <i>et al.</i> , 2011 (Study 2)	Weak	Strong	Weak	Moderate	Strong	Weak	Weak	Yes	Weak
Andrews <i>et al.</i> , 2012	Weak	Strong	Weak	Moderate	Strong	Weak	Weak	Unable to determine	Weak
Arriola <i>et al.</i> , 2010	Moderate	Strong	Moderate	Moderate	Moderate	Moderate	Weak	Yes	Moderate
Arriola <i>et al.</i> , 2013	Weak	Strong	Strong	Moderate	Moderate	Weak	Weak	Yes	Weak
Birkimer <i>et al.</i> , 1994 (Study 1)	Moderate	Strong	Weak	Moderate	Strong	Weak	Weak	Yes	Weak
Birkimer <i>et al.</i> , 1994	Moderate	Strong	Weak	Moderate	Strong	Weak	Weak	Yes	Weak

[illegible]

Vinokur <i>et al.</i> , 2006	Strong	Strong	Strong	Moderate	Moderate	Weak	Strong	Yes	Moderate
Winkel, 1984	Weak	Strong	Moderate	Moderate	Moderate	Moderate	Weak	Yes	Weak
Winkel & Huismans, 1986	Weak	Strong	Strong	Moderate	Moderate	Weak	Weak	Yes	Weak

Table 3. Calculated Odds Ratios and 95% Confidence Intervals (CI)

Authors, Year	Odds ratio	Lower 95% CI	Upper 95% CI
Alvaro <i>et al.</i> , 2011 (Study 1)	5.90	2.76	12.60
Alvaro <i>et al.</i> , 2011 (Study 2)	5.23	2.63	10.41
Andrews <i>et al.</i> , 2012	N/A	N/A	N/A
Arriola <i>et al.</i> , 2010			
Licence	1.08	0.62	1.88
Card	1.04	0.54	1.98
Arriola <i>et al.</i> , 2013	N/A	N/A	N/A
Birkimer <i>et al.</i> , 1994 (Study 1)	1.28	0.73	2.26
Birkimer <i>et al.</i> , 1994 (Study 2)	N/A	N/A	N/A
Birkimer <i>et al.</i> , 1994 (Study 3)			
Treatment 2	1.47	0.80	2.70
Treatment 3	1.90	1.04	3.46
Harrison <i>et al.</i> , 2008	1.97	1.06	3.65
Harrison <i>et al.</i> , 2010	N/A	N/A	N/A
Harrison <i>et al.</i> , 2011	N/A	N/A	N/A
Morgan <i>et al.</i> , 2002	1.69	0.97	2.97
Morgan <i>et al.</i> , 2010			
High-intensity	1.32	0.76	2.30
Low-intensity	1.13	0.65	1.98
Morgan <i>et al.</i> , 2011			
Mass-media + inter-personal	2.59	0.88	7.65
Mass media only	1.21	0.36	4.11
O'Carroll <i>et al.</i> , 2011			
Anticipated Regret	1.87	0.88	3.96
Theory of Planned Behaviour	0.57	0.23	1.46

Quinn <i>et al.</i> , 2006			
Enhanced	2.19	1.12	4.30
Basic	1.99	1.01	3.93
Resnicow <i>et al.</i> , 2010	2.47	0.46	13.17
Rodrigue <i>et al.</i> , 2012	11.00	1.38	87.64
Sanner <i>et al.</i> , 1995			
Campaign B	2.59	0.88	7.65
Campaign C	2.84	0.97	8.29
Siegel <i>et al.</i> , 2008	N/A	N/A	N/A
Thornton <i>et al.</i> , 2012	2.04	1.02	4.07
Vinokur <i>et al.</i> , 2006	1.50	0.73	3.07
Winkel, 1984			
Refutational	1.80	0.99	3.27
Conventional	1.39	0.76	2.55
Winkel & Huismans, 1986			
Low Denial	2.51	1.23	5.11
High Denial	N/A	N/A	N/A

Note. Odds ratios reported represent relative likelihood that a participant in the intervention condition registered as an organ donor.