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# A Randomized Evaluation of Loss and Gain Frames in an Invitation to Screening for Type 2 Diabetes

## Effects on Attendance, Anxiety and Self-rated Health

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## Abstract

A randomized controlled trial in two general practices in Cambridgeshire compared the effect of loss and gain framed messages in an invitation to screening for type 2 diabetes on uptake and subsequent anxiety and self-rated health. High risk individuals aged 40–69 years were randomized to receive loss ($n = 57$) or gain ($n = 59$) framed screening invitations. A postal questionnaire was sent to all participants, including non-attenders, after six weeks. There were no significant differences in attendance, mean state anxiety, self-rated health or illness representation between the loss and gain frame arms. Framing of information in diabetes screening invitations does not influence uptake.

## Keywords

- *anxiety*
- *attendance*
- *diabetes*
- *framing*
- *screening*

# Introduction

DIABETES is increasingly common and creates a substantial burden of suffering and cost (Wild, Roglic, Green, Sicree, & King, 2004). A growing body of evidence suggests that earlier detection and treatment of hyperglycaemia and related metabolic abnormalities may be beneficial. There has been continuing improvement in the detection and management of cardiovascular disease risk factors including diabetes in UK primary care (Campbell, Roland, Middleton, & Reeves, 2005), a phenomenon enhanced by the Quality and Outcomes Framework system of remuneration for general practitioners (Doran et al., 2006). However, many of those with type 2 diabetes remain undiagnosed (Forouhi et al., 2006; Harris, Hadden, Knowler, & Bennett, 1987), and the delay from disease onset to diagnosis may exceed 10 years (Harris, Klein, Welborn, & Knuiman, 1992). When patients are diagnosed, 25 per cent have established retinopathy (UKPDS, 1990), half already have clinical evidence of diabetic tissue damage (UKPDS, 1990) and many exhibit additional established cardiovascular risk factors (Harris, 1993). Recent trial data have highlighted the benefits of early intensive treatment in individuals with recently diagnosed diabetes (Holman, Paul, Bethel, Matthews, & Neil, 2008). Findings from a controlled trial on the psychological impact of screening for type 2 diabetes suggest that there are limited harms associated with screening (Eborall et al., 2007b). Diabetes therefore meets many of the criteria for suitability for screening (Wareham & Griffin, 2001).

An important uncertainty concerning the cost-effectiveness of screening is how to maximize uptake. Screening can only be cost-effective if there is sufficient uptake. One of the factors influencing uptake is the nature of the invitation (Banks et al., 1995). It is not clear how best to invite people to screening for diabetes so as to maximize attendance, and minimize adverse consequences. Studies of attendance for screening for other conditions have examined the effects of message framing (according to Prospect Theory) (Banks et al., 1995; Detweiler, Bedell, Salovey, Pronin, & Rothman, 1999; Lauver & Rubin, 1990). Two ways of framing could be derived from Prospect Theory: loss frame (highlighting the possible losses due to not attending) or gain frame (emphasizing the possible gains of attending) (Tversky & Kahneman, 1981). Studies and theory suggest that loss frames are more likely to enhance risk-seeking behaviours, such as screening (Detweiler et al., 1999; Edwards, Elwyn, Covey, Matthews, & Pill, 2001; Lauver & Rubin, 1990; Rothman & Salovey, 1997). However, it is not known how the type of invitation would influence screening uptake for diabetes, and whether psychological outcomes such as self-rated health and anxiety might be affected.

This study reports results from a randomized trial undertaken during the pilot phase of a large-scale trial of a stepwise screening programme for diabetes (Lauritzen et al., 2000) (NCT 00237549). In order to develop effective invitations that will maximize uptake of screening, we aimed to compare the effect of loss vs gain message framing on screening uptake and subsequent anxiety and self-rated health.

# Method

## *Participants and study design*

Two general practices in the Cambridgeshire area were approached and agreed to participate. Practice A is a rural practice in a market town near Huntingdon in Cambridgeshire with a practice list of 7800 patients. Practice B is an urban general practice in central Cambridge, with a practice list of 9537 patients. Both practices serve relatively affluent populations and receive few deprivation payments. The Index of Multiple Deprivation (IMD) for Practice A was 11.4, and 12.7 for practice B (compared to the average English practice IMD of 25.6). Eligible participants were those aged 40–69 without known diabetes who were identified as being at high risk of having undiagnosed type 2 diabetes using the previously validated Cambridge risk score (Griffin, Little, Hales, Kinmonth, & Wareham, 2000). This risk tool combines information routinely collected in primary care including age, sex, family history, body mass index and information on prescription of steroids and antihypertensive drugs, to predict the presence of undiagnosed diabetes. The complete data required to calculate the risk score were recorded in the practice computer files for 3792 of the 5844 people (65%) who met the inclusion criteria for the study. We randomly selected 1280 participants from this group using SPSS (v. 9.0.1) and selected those with a risk score of $\geq 0.19$ (approximately the top 25 per cent), to comprise the study sample ($N = 355$). The study sample was then randomized in a 2 to 1 ratio into non-invited (238) and invited (116) groups. The invited group was further randomized to receive loss (59) or gain (57) framed invitations. The analyses presented in this article refer solely to the 116 people

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who were invited to attend a screening appointment using loss or gain framed invitations.

## Procedure

Those who attended for their screening appointment underwent a step-wise procedure in order to confirm the presence or absence of diabetes. Details of the procedure have been described elsewhere (Park, Simmons, Prevost, & Griffin, 2008). The thresholds for fasting and two-hour glucose in this study were based on those recommended by the World Health Organization in 1999 for diagnosis and screening using capillary glucose testing (Puavilai, Chanprasertyotin, & Sriphrapradaeng, 1999).

Six weeks after the last contact (either test or invitation), a postal questionnaire containing items measuring anxiety (Marteau & Bekker, 1992), self-rated health (Kerbel, Glazier, Holzapfel, Yeung, & Lofsky, 1997) and illness representation (Leventhal, Nerenz, & Steele, 1984) was sent to all participants, including non-attenders. As most screening studies only assess immediate effects of invitation we chose to evaluate effects over a longer time period (Shaw, Abrams, & Marteau, 1999). A freepost return envelope was included with the questionnaire, and repeat duplicate questionnaires were sent to those who did not return the questionnaires at four and eight weeks after the first batch was sent. An overview of the study is shown in Fig. 1.

## Loss and gain framing

Loss and gain framed messages for the invitations were developed and piloted in interviews with a small group of patients and health professionals who were selected purposively for convenience from the practice staff and patient lists. Following a short explanation of the nature of loss and gain framed messages, interviewees were asked to separate and rank 10 messages into loss framed messages, gain framed messages and neutral framed messages. These messages were drawn from a total of 25 examples designed around the issue of inviting people to screening for type 2 diabetes, based on previous studies of message framing using Prospect theory (Lauver & Rubin, 1990; Rothman & Salovey, 1997). All messages were scored and those with the highest rank for correct recognition were used in the invitations. All invitation letters were designed to contain one framed (loss or gain) and one neutral framed message, where a neutral framed message was one that carried relevant information about screening for diabetes but would not be perceived as having loss or gain framing (Fig. 2).

## Questionnaire measurements

The anxiety level of participants was measured using the short six-item form of the Spielberger State-Trait Anxiety Inventory (STAI), which has been shown to correlate well ($r > 0.9$) with the results of the longer questionnaire from which it was derived (Marteau & Bekker, 1992), which in turn is associated with indicators of anxiety (VanDercar, Greaner, Hibler, Spielberger, & Bloch, 1980). The participants were also asked about their self-rated health on a five-point Likert scale: 'In general, compared to other people your age, would you say your health was: 5 = excellent, 4 = very good, 3 = good, 2 = fair, 1 = poor? This question was previously used in a study of screening for gestational diabetes (Kerbel et al., 1997). The final part of the questionnaire was the Illness Perception Questionnaire (IPQ), which consisted of 50 statements assessing the participant's illness representations of diabetes (Weinman, Petrie, Moss-Morris, & Horne, 1996). The IPQ expands the five basic components of illness representations outlined by Leventhal et al. (1984). The questionnaire was derived from the most accurate measure of illness representations available at the time (Moss-Morris et al., 2002; Weinman et al., 1996) and has so far shown excellent internal consistency and test–retest reliability in its various components (Rees, Fry, Cull, & Sutton, 2004). This measurement of illness representation was included to understand better why people do and do not come to screening, and how screening affects their view of diabetes and their own health.

## Statistical analysis

Differences in attendance rates (the principal outcome) between the invited groups were summarized with exact 95 per cent confidence intervals and $p$-values using StatXact software (version 2.1). The association between attendance and sex and other baseline predictors, and their moderating effects with frame were assessed using exact binary logistic regression (LogXact Software version 4.0). State anxiety and illness perceptions scores were assessed for internal consistency using Cronbach's alpha. The short form six-item state-trait inventory measure was scaled to have the same range of 20 to 80 as the original longer form. The unpaired $t$-test was used to compare mean state anxiety and mean illness representations between groups, and the Mann-Whitney U (MWU) test was used to compare self-rated health, rated on a five-point scale,
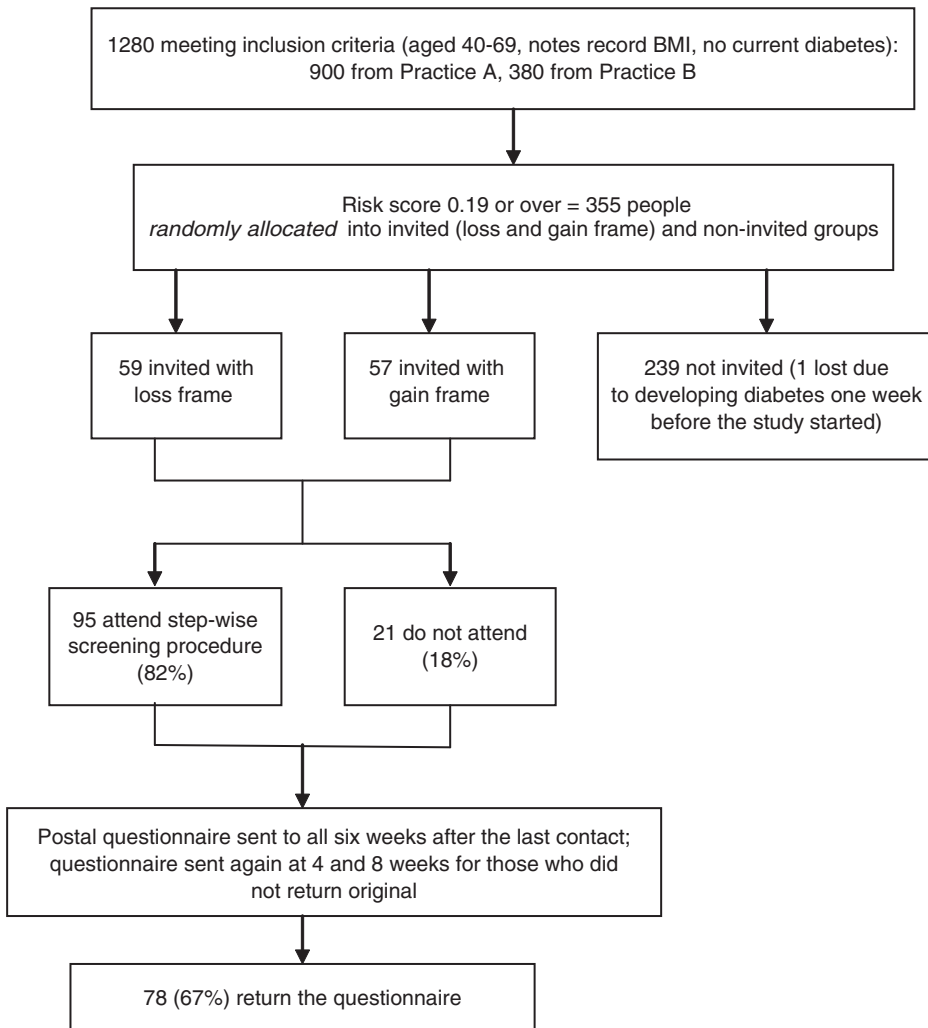
*Figure 1*. Study overview.

between groups. All tests were two-sided and assessed using the 5 per cent level of statistical significance. SPSS software (version 12.0) was used unless otherwise stated. A sample size of 120 invited per arm, and 70 returning a questionnaire, would allow 80 per cent power to detect a 20 per cent difference in attendance rate (70% versus 90%) and an eight-point difference in mean state anxiety (SD 12) at the 5 per cent level of significance (nQuery version 4.0 software).

The study was approved by Cambridge LREC (00/071). Participants gave written consent prior to joining the study.

## Results

Baseline characteristics for participants randomized to loss and gain frame invitations are shown in Table 1. The randomization was successful in producing comparable groups. Two-thirds of the patients invited for screening were men and one-third women, reflecting the fact that male sex confers an increased risk for having prevalent undiagnosed diabetes. Participants were aged 58 years on average. Sixty-five per cent of the sample was obese and 36 per cent were prescribed anti-hypertensive medication.

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LOSS FRAME

    • If you have diabetes but are not detected
      early, your diabetes may lead to more
      complications.

GAIN FRAME

    • If your diabetes is detected early, you can
      receive early and more effective treatment.

NEUTRAL FRAME

    • A simple blood test is the best way to
      detect diabetes.
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*Figure 2.* Loss, gain and neutral frame messages used in the screening invitation letter.

*Table 1.* Baseline characteristics for participants randomized to loss and gain frame invitations. All values are n (%) unless otherwise indicated

| Baseline characteristics | Gain frame invitation | Loss frame invitation |
|---|---|---|
| All respondents (%) | 57 (49%) | 59 (51%) |
| Females (%) | 18 (32%) | 22 (37%) |
| Mean age in years (SD) | 57.6 (7.7) | 59.0 (7.0) |
| General Practice | | |
| Practice A (%) | 44 (77%) | 46 (78%) |
| Practice B (%) | 13 (23%) | 13 (22%) |
| BMI > 30 kg/m² (obese) | 35 (61%) | 40 (68%) |
| Prescribed anti-hypertensive medication | 19 (33%) | 23 (39%) |

## Influence of framing on attendance

Out of the 116 patients invited to screening, 95 (82%) attended the initial appointment. Those who attended for the screening did not significantly differ from those who did not attend in baseline characteristics, although attenders were more likely to have been prescribed either antihypertensive or steroid medication (52% (49/95) compared to 24% (5/21) respectively, p-value = .02). There was no significant difference in attendance rate between the loss frame group (81%, 48/59) compared with the gain frame group (82%, 47/57) (difference: 1.1%; 95% CI: –15.3% to 19.7%, $p = .88$). There was a significant interaction effect on attendance between sex and frame invitation ($p = .04$). Attendance was higher in men invited using the loss frame (89%, 33/37) compared to the gain frame (77%, 30/39), and in women invited using the gain frame (94%, 17/18) compared to the

loss frame (68% (15/22). Age, obesity and prescription of anti-hypertensive medication did not moderate any frame relationship with attendance.

## Influence of framing on anxiety, self-rated health and illness representation

The response rate to the questionnaire was 67 per cent. Responders were not significantly different from non-responders with respect to baseline characteristics. The effect of framing on anxiety, self-rated health and illness representation is shown in Table 2. The state-anxiety inventory measure showed good internal consistency (Cronbach's alpha = 0.81) in the 76 responders having complete item data. Mean anxiety score was 37.6 (SD 12.2). Those invited using the loss frame had a higher mean anxiety score (40.0 versus 35.4) than those invited using the gain frame, but the difference was not statistically significant ($p = .10$). There was no significant difference in self-rated health (MWU $p = .77$), with good or better health reported by 72 per cent of gain frame and 76 per cent of loss frame participants. The IPQ sub-scales showed a range of internal consistency (Cronbach's alpha 0.38 to 0.90). The alpha values were lowest for the timeline cyclical and treatment control sub-scales, with alphas of

*Table 2.* Association between framing and anxiety, self-rated health and illness representations. All values are means (SD)

| | Gain frame invitation (n=39) | Loss frame invitation (n=38) | P-value |
|---|---|---|---|
| STAI anxiety (range 20–80)[a] | 35.4 (13.0) | 40.0 (11.0) | .10 |
| Self-perceived health (range 1=Poor to 5=Excellent)[b] | 2.95 (0.83) | 3.00 (0.90) | .77 |
| Illness representation subscales; (range 1 to 5)[a] | | | |
| Acute/chronic illness | 4.02 (0.43) | 3.88 (0.52) | .23 |
| Cyclic illness | 3.00 (0.45) | 2.99 (0.41) | .89 |
| Consequences | 3.20 (0.51) | 3.30 (0.43) | .39 |
| Personal consequences | 3.62 (0.43) | 3.73 (0.46) | .34 |
| Treatment control | 3.63 (0.39) | 3.57 (0.42) | .55 |
| Emotional representations | 2.53 (0.75) | 2.63 (0.54) | .56 |
| Illness coherence | 3.08 (0.76) | 3.12 (0.91) | .84 |

*Notes*: [a] Groups compared using unpaired *t*-test
[b] Groups compared using the Mann-Whitney U test

0.40 and 0.38 respectively. There were no significant differences between groups in illness representation sub-scales.

Sensitivity analyses indicated that there was no significant difference in questionnaire response between those who attended screening (68%) and those who did not (62%) ($p$ = .61). Neither the response rate nor anxiety was significantly predicted by age, sex, obesity or prescription of anti-hypertensive medication (data not shown). There was no difference between loss and gain frame groups in the number testing positive at initial screening (54% vs 36% respectively, $p$ = .08) or the number diagnosed with diabetes (7% vs 4% respectively, $p$ = .43).

## Discussion

This study has demonstrated that a stepwise screening programme for type 2 diabetes in primary care is acceptable for both patients and practitioners. This is supported by qualitative work with GPs and practice nurses (Eborall, Davies, Kinmonth, Griffin, & Lawton, 2007a; Whitford, Lamont, & Crosland, 2003). Screening uptake was high (82%). There was no significant difference in attendance rate between the loss and gain frame groups, though attendance was higher in men invited using the loss frame and in women invited using the gain frame. This apparent interaction between sex and message framing has not been reported previously and may have been a chance finding. We suggest that this merits future investigation in screening programmes inviting men and women; quantitative results should perhaps be stratified by gender. Higher levels of anxiety were seen in the loss frame group although this was not statistically significant and may have been a chance finding, or explained by the study sample size. There were no significant differences in self-rated health or in illness representation sub-scales between the two groups. The loss and gain framing of information did not differ in its emotional impact on the recipients. Together with the lack of difference in attendance, our results suggest that the framing of information made little difference to the participants despite careful development of the invitations.

Our findings do not support the limited literature in this field. A meta-analysis of four studies of the effect of loss and gain framed information on risk-seeking behaviour found an overall significant effect of improved attendance for loss framed messages

(Edwards et al., 2001). Although our study was a similar size to previous trials and was conducted in a representative population pertinent to the question under consideration, we found no framing effect. Most trials in this field are based on screening studies for various cancers. Diabetes screening may not be seen as a risk-seeking behaviour since 'no symptoms' may be understood as 'no problems' (Murphy & Kinmonth, 1995), and diabetes may be perceived as much less of a threat than cancer. It is possible that diabetes screening is viewed by members of the public as a low-demand health activity, especially by those potential participants prescribed anti-hypertensive medication who may be used to attending regularly their local surgery for monitoring and prescriptions. Alternatively, other moderators than 'risk' may be more important in explaining the effectiveness of framed health messages (O'Keefe & Jensen, 2006). For example, in a study of the effects of message framing on mammography utilization, perceived risk did not sufficiently distinguish between those who did and did not obtain a mammogram (Banks et al., 1995). In addition, our very high uptake rate (82%) may represent a ceiling effect, where no difference between loss and gain frames could be observed due to the lack of heterogeneity. We cannot exclude the possibility that message framing might influence uptake of screening in groups with lower levels of attendance. While there was no difference in anxiety between groups at six weeks, we cannot rule out the possibility that there was a difference in anxiety between framing groups immediately after the last contact. Those investigating future screening programmes might consider assessing different time points for follow-up of anxiety, self-rated health and illness representation.

Although the difference in anxiety scores between loss and gain frame invites was not statistically significant, (40.0 compared to 35.4 respectively), the higher score is close to a clinical diagnosis of anxiety according to ICD-10 (STAI score 42 or more). Indeed, 28 per cent of the gain frame group reported a mean anxiety score of 42 or more compared with 41 per cent of those invited using a loss frame. Raised anxiety about diabetes may be an adverse consequence of screening but it may also encourage participants to change their behaviour to improve their health. Since both framing messages led to an overall high attendance and the loss framed messages were associated with slightly higher levels of anxiety, albeit non-significantly, the gain framed invitation developed in this study has been taken

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forward for use in the ADDITION Cambridge study (Lauritzen et al., 2000) and might be applicable in future studies or programmes of screening for chronic diseases.

This study had several methodological strengths. The lack of a difference in attendance between loss and gain framed invitations in this study is unlikely to be due to chance or bias as the randomized design produced similar groups and group allocation was concealed from the nurses recording attendance. Further, we achieved a reasonable questionnaire response rate and validated measures were used throughout. There was no difference in baseline characteristics between attenders and non-attenders (aside from prescription of antihypertensive and steroid medication), indicating that the effect of response bias was likely to be small. The study sample was population-based. However, it might not have been completely representative of the background population of the general practices since participants were selected for having complete data for calculating the risk score, and only constituted 65 per cent of the possible eligible population from both practices. In addition, the study was conducted in just two general practices, and the IMD scores indicated that the practices served less deprived communities than the average English practice. However, the study population was similar to the general population of England and Wales for age, sex and BMI as assessed by the Health Survey for England in 1994 (Dong, Hedges, Lampe, & Taylor, 1996). The questionnaire in this study was applied at only one point in time to the participants, which has the advantage of avoiding the potential accommodation effect of repeat questionnaires seen in previous work (Johnstone, 1999). Single questionnaire testing is also more convenient for participants, as well as less costly, than repeat questionnaires. However, the disadvantage of single testing by questionnaire is that it is not possible to quantify the change in outcome by measurement of individuals before and after the exposure, and only assess between group differences. We chose to evaluate effects over six weeks as most screening studies only assess the immediate effects of invitation (Shaw et al., 1999).

Finally, it is worth considering the questionnaire measurements themselves. For the illness perception questionnaire, it is uncertain how applicable a questionnaire designed for use in a population with a relevant disease is to a mostly disease-free group. The sub-scales of the IPQ had mixed internal consistency as defined by Cronbach's alpha values, ranging from 0.38 to 0.90. However, it did not differ substantially from the current more widely used version (Weinman et al., 1996). Also, the STAI anxiety questionnaire only measures state rather than trait anxiety, that is the person's anxiety at the time rather than their general level of anxiety. An assessment of trait anxiety might have been useful in ascertaining that the raised levels of anxiety were not normal for those in whom it was observed (and thus may have been caused by the screening process). However, the participants were distributed at random into the groups, and therefore any confounders (including trait anxiety) can be assumed to have been evenly distributed between the groups, as were other baseline covariates.

## Conclusion

This article describes the first randomized controlled study to assess the effect of loss vs gain message framing on diabetes screening uptake and subsequent anxiety and self-rated health. The study showed no difference in attendance due to message framing, or in anxiety, self-rated health or illness representation sub-scales between the two groups. We observed an interaction between sex and message framing, but this is the first observation of its kind. High attendance may have been seen even without using invitations specifically developed to maximize uptake; results may have been different in other population samples. It remains unclear whether early treatment of diabetes is beneficial and produces sufficient improvement in long-term health outcomes to justify the economic costs of screening. Results from the ADDITION study (Lauritzen et al., 2000) will help to answer this question.

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