

A Large Scale Examination of Textual Behavioral Nudges on Uptake Rates of Medical Checkups

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Abstract

Using a large scale field study ($n = 113,048$) held in Israel together with Maccabi Healthcare Services (MHS), we revisit the effect of some of the most widely used message framings on uptake rates of different medical checkups. Our frames include: gains, losses, doctor recommendation, implementation intentions and empowerment. MHS invited members aged 50-74, via email or as a text message, to take preventive medical actions that are recommended for them by the ministry of health, depending on their medical history, gender and age. The campaign was intended to increase uptake rates of mammography, HPV, abdominal aortic aneurysm, fecal occult blood test and pneumococcal vaccination. Our main finding is a null result: No effect of message framing on uptake rates was observed. We report two secondary suggestive findings: (1) shorter subject lines are positively correlated with opening rates, and (2) emails seem to outperform text messages in terms of overall success rates. Our findings shed light on the on-going discussion and mixed evidence that appeared in the health related behavioral interventions literature over the past 30 years.

Keywords: Field Experiment, Nudge, Cancer Screening, Mammography, Framing, FOBT.

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Successful preventive care requires high uptake rates of early detection tests. Increasing these rates at relatively low costs is one of the more pressing challenges faced by public health officials. Over the past three decades, behavioral insights have been used in order to nudge individuals and increase compliance rates with healthcare recommendations. One common tool used in this line of research is *message framing*, i.e., the content of textual messages sent out by healthcare providers. Understanding the effectiveness of different types of messages on patients' adherence with health recommendations is of great importance as recently shown in relation to Covid-19 vaccination uptake rates [1]. In this large scale field study, we re-examine some of the most influential and commonly used messages in this literature.

We make use of a massive digital customer reach out campaign that was held in Israel in 2020-2021 by Maccabi Healthcare Services (MHS) health maintenance organization. MHS contacted members aged 50-74, and invited them to take preventive medical actions according to their age, medical history, recently performed tests and guidelines of the Israeli Ministry of Health. The campaign targeted the following medical checkups: Mammography (for women), HPV (human papillomavirus, for women), abdominal aortic aneurysm screening (for men above the age of 65), fecal occult blood test (FOBT) and pneumococcal vaccination (for members above the age of 65).

We randomly assigned members who participated in this campaign into one of six groups that consisted of the control (received an informative message that was used prior to this campaign) and five treatments that received the following frames: Positive outcomes (gain frame), Negative outcomes (loss frame), doctor recommendation, implementation intentions and empowerment.

The first two messages are based on prospect theory [7, 8], which incorporates the idea that losses loom larger than gains. Over the past three decades, dozens of studies have examined the effect of these types of frames on different medical outcomes. Results have been rather mixed and these have led to an important and ongoing discussion regarding the use of this theory in this context (see [3, 14] for systematic reviews). Our third frame includes a doctor's recommendation which has also been extensively examined and discussed in the literature, especially with respect to cancer screenings [5, 6]. Implementation intentions, our fourth frame, is a method that generates a link between potential outcomes (in our study these are the results of the recommended tests) and reactions (steps to be taken after results are received). Such links in critical situations have been shown to facilitate individuals in reaching their health goals [4]. It has been used in different medical contexts, such as influenza vaccination [11, 15], colorectal cancer screenings and FOBT for which some studies reported positive effects [12, 13] while others found no effect at all [9]. Our last frame is meant to generate empowerment, which emphasizes the individuals' responsibility to take care of their own health. Thus far, it has shown potential to increase breast and cervical cancer screening rates [2, 10]. Given the wide use of these types of frames alongside the controversies regarding their usefulness, our study allows for a unique examination of their performance in a large scale field study.

1 Methods

Messages were sent out by email. In the case that there was no valid email in the registry of MHS, the message was sent by a text message (SMS). Members were randomly assigned to one of six types of frames mentioned above. Following the initial contact, if the member scheduled an appointment or performed the recommended checkups, they did not receive any further messages. If they did not comply with the recommendation, they received reminders that followed the same framing theme that appeared in their initial message. The first reminder was sent out two days after the first message, but only in the case that the first message was sent via email and was not opened. The second and third reminders were sent out two and four weeks after the initial message, respectively (+/- a day or two if the reminder was supposed to be sent out on the weekend). For mammography, HPV and abdominal aortic aneurysm (which we call “screenings”) we collected data regarding scheduled appointments (not actual performance). For FOBT and pneumococcal vaccine (which we call “lab tests”), we collected data regarding actual performance (they do not require scheduling). Message contents are available in the Supporting Information (SI) appendix. A total of 129,070 MHS members participated in this study out of which 113,048 were included in our analysis. The data cleaning process is described in detail in the SI appendix.

This research has been approved by the Helsinki Committee of MHS (study number 0099-20-MHS), and by the Ethical Research and the Protection of Human Participants Committee, The Faculty of Social Sciences, University of Haifa (approval number 369/21). Approvals included a waiver of consent. Identifying information was not shared with the researchers. The study’s design and analysis plan was pre-registered on the AEA RCT Registry and its unique identifying number is: AEARCTR-0006317.

2 Results and Discussion

Table A.1 in the web appendix (see <https://dx.doi.org/10.13140/RG.2.2.24785.40808>) shows that the treatment arms were well balanced on all observable demographics.

We start off by reporting the effectiveness of the different frames for members who opened one of their emails (including reminders) or clicked on the link in one of the text messages that they received within 45 days from the initial contact date (67,772 members, roughly 60%). Since each message may have included more than one medical action, a success is considered to be a case in which a member scheduled an appointment to at least one of their recommended checkups. Following the criteria set by MHS, the time frame considered for measuring a success was 14 days from the last contact date for screenings, 30 days for FOBT and 60 days for pneumococcal vaccine.

The first two columns in Table 1 report success rates (conditional on opening one of the messages) by treatment arms. There are no significant differences in success rates across treatments for screenings and for lab tests. Chi-squared tests do not allow to reject the

Treatment	Compliance		Message Opening	
	Screenings	Labs	Subject Line [words]	Open Rates
Control	14.1%	23.6%	8	63.4%
Gain	13.9%	23.3%	15	58.6%
Loss	12.9%	23.5%	14	55.3%
Recommendation	13.1%	24%	11	63.2%
Implementation Intentions	14.1%	23.4%	16	61.1%
Empowerment	14.1%	23.8%	14	55.7%

Table 1: Compliance rates, length of subject line and opening rates by treatment.

null hypothesis that treatments and compliance rates are independent (p -value=0.3746 for screenings and p -value=0.8801 for lab tests). Table A.2 in the web appendix (<https://dx.doi.org/10.13140/RG.2.2.24785.40808>) includes logistic regressions with various controls that further support this null result.

We report two secondary results of interest, both of which are only suggestive and require further experimentation in order to substantiate.¹ First, messages with shorter subject lines, have higher opening rates (see Figure 1 and the two columns on the right in Table 1). We find a significant difference ($p < 0.001$) between the opening rates of the two treatments with the shortest subject lines (8 and 11 words) and the two treatments with the longest subject lines (15 and 16 words). Given the fact that there is no effect of frames on appointment scheduling/actual performance, we believe that this pattern suggests that shorter subject lines, rather than the subject line’s content, increases the likelihood of opening a message (see the SI appendix for more information).

Finally, we compare the effectiveness of the media channel through which messages were sent (69,777 members received emails and 43,271 received text messages). Since there was no random assignment to media channels (text messages were only sent to those with no valid email address in the registry of MHS) we hold this analysis for subgroups of the population with similar demographics. As far as opening rates are concerned, we find significant differences favoring emails for every subgroup (Table A.4 in the web appendix available at <https://dx.doi.org/10.13140/RG.2.2.24785.40808>). Conditional on opening, however, text messages have a significant edge for 8 out of 10 subgroups (Table A.5 in the web appendix). The overall effectiveness, i.e., unconditional success rate, of each channel shows that emails outperform text messages and significantly so for all subgroups (Table

¹These were not included in our pre-registration analysis plan as they were not part of our main interest. Nonetheless, we report them since they concern the digital nature of the campaign, and digital communication is likely to become the predominant channel through which HMOs and providers contact their members.

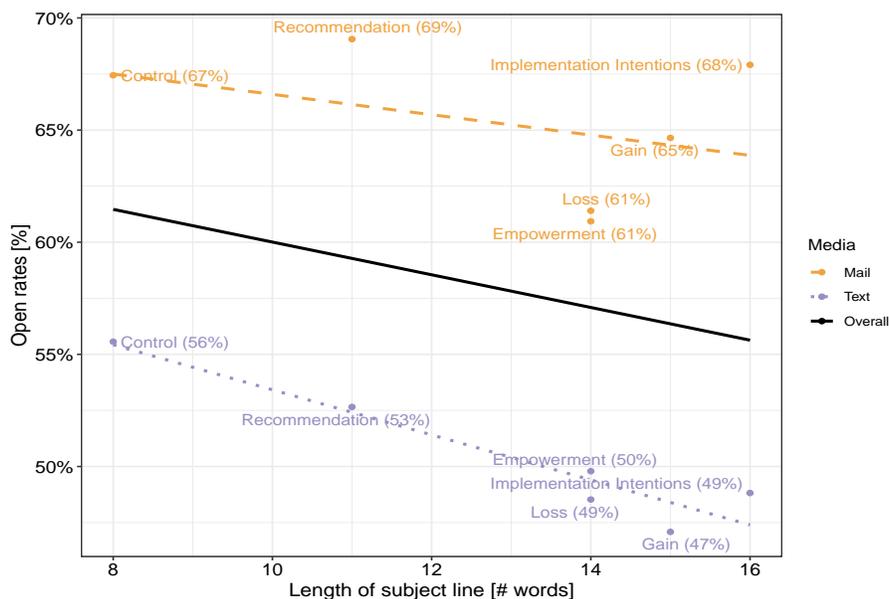


Fig. 1: Open rates as a function of subject line length, with a linear regression fit for mail (dashed line), text messages (dotted line), and overall (solid line).

A.6 in the web appendix). We conclude that the high opening rates of emails compared to text messages is the driving force behind the increased overall probability of adherence to message content in our large scale study. Nonetheless, the fact that no random assignment into media channel was held, prevents us from drawing firm conclusions on this matter as there may be *unobserved* characteristics that are unbalanced across groups and may be driving this result (more on this finding in the SI appendix).

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