**Title:**

Optimizing Facebook Ads for Research Recruitment: An Experiment and Online Survey with Military Veterans

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**Abstract**

Background

Prior research has demonstrated the feasibility of recruiting research participants through Facebook ads, but less is known about the effectiveness of Facebook ads in reaching military veterans. This study tested the effectiveness of 15 ads in reaching this target population.

Methods

Facebook ads requesting participation in an online health survey ran for six weeks in 2017. Using a full 3x5 factorial design, ads varied imagery (person taking a survey; veteran with his family; soldiers marching) and headlines informed by different principles (social norms; altruism; empowerment; incentive; and sharing). Reliable and valid self-report tools were used to screen for mental health problems (PC-PTSD, AUDIT-C, PHQ-2, and DSI-SS). Outcomes were impressions, click-through rate (CTR), survey completion, and cost per survey completed. Negative binomial models incorporating the full factorial design were used to compare image and headline main effects and interactions on each outcome.

Results

Overall, advertisements produced 827,918 impressions and 9,527 clicks (CTR=1.20%). Seven hundred and ten individuals were eligible for the survey, and 587 completed the survey (83% response rate). One hundred ninety-three participants (33%) had never been enrolled in the VA, and 322 (55%) had not used VA health care services in the prior year. Participants frequently screened positive for current mental health problems, including PTSD (52%), problematic drinking (51%), major depression (28%), and suicidality (22%). Total ad expenditure was $11,427, yielding an average cost per completed survey of $19.47.

The soldiers marching image performed best in terms of generating impressions, ad clicks, and reactions, but not survey participation. “Sharing” and “incentive” headlines had higher survey participation than social norms (p < 0.001 and p = 0.008, respectively). Half of survey participants (n=285) were recruited by just 2 of the 15 ads: soldiers marching with an “incentive” headline and “sharing” headline. These two ads were also the most cost effective, at $4.88 and $5.90 per participant, respectively. Among veterans with current suicidal ideation, the survey-taking image performed better than the soldiers marching image (p=0.007).

Conclusions

Facebook ads are effective in rapidly and inexpensively reaching military veterans, including those at-risk for mental health problems and suicidality, and those not receiving VA healthcare. Ad image and headlines may be usefull to help optimize effectiveness of ads for particular target populations.

**Introduction**

Social media is increasingly recognized as a useful venue to recruit participants in research studies. Studies have suggested that recruitment via social media platforms, especially Facebook, may be faster, cheaper, and easier than traditional methods of recruitment from settings such as hospitals and clinics.[Admon L JMIR 2016; Adam LM JMIR 2016] Nonetheless, evidence-based recruitment strategies and best practices on social media are unclear, and studies often do not provide comparisons of particular advertising approaches [Topolovec-Vranic J JMIR 2016; Batterham PJ Intl J Methods Psychiatric Res 2014; Ramo DE Nicotine and Tobacco Res 2010; Ramo DE Internet Interventions 2014; Kapp JM J Cancer Educ 2013; Pedersen ER JMIR Res Protocol 2015; Platt T JMIR Public Health and Surveillance 2016]. To assess the effect of Facebook ads on engagement, it is helpful to conceptualize a spectrum of outcomes, ranging from general exposure (e.g., “impressions” which are the number of times a post is displayed to users) to initial interaction (e.g., link clicks) to implementation (e.g., enrollment in a research study) [Platt T JMIR Public Health and Surveillance 2016].

For research related to mental health, getting beyond traditional recruitment methods and settings may be especially important tool to reach individuals who are hard-to-reach, unengaged in health care, or at risk for suicide. This may be particularly true among military veterans. About 40% of veterans who served in Iraq or Afghanistan (also know as OEF-OIF veterans) have never accessed VA health services[U.S. Department of Veterans Affairs. Reports on Veterans’ Health Data - Public Health [Internet]. http://www.publichealth.va.gov/epidemiology/reports/index.asp], and an estimated 78% of veterans who die by suicide do not access VA health services [Basham C Suicide Life Threat Behav 2011]

The primary aim of this study was to determine the feasibility of recruiting military veterans to research studies through Facebook ads. Our secondary goals included understanding what kinds of veterans are likely to be reached and what ad features are most relevant to engaging veterans.

**Methods**

*Participants*

The target population for the survey was U.S. military veterans of the Operation Enduring Freedom-Operation Iraqi Freedom (OEF-OIF) service era (September 2001- present), hereafter referred to as Iraq and Afghanistan era veterans. To be eligible, individuals needed to be age 18 or older, and been on active duty in the U.S. Armed Forces after September 2001 but not presently. We excluded individual who completed surveys in less than five minutes, had a duplicate or multiple survey responses, or incorrectly answered a military-related ‘insider knowledge’ question (to reduce chance of online survey mis-representation)[Pedersen ER JMIR Res Protocol 2015; Kramer J Int J Methods Psychiatr Res 2014] Survey participation was defined as those respondents who both reached the end of the online survey and were not excluded based on the above quality control measures.

*Ad campaign*

Facebook offers myriad options related to placement and targeting of ads, and we utilized the same parameters for all ads. Ads were run simultaneously, to identical audiences, with the same ad budget, and for the same duration of time. Ads ran for a total of 45 days between January 13th, 2017 and March 18th, 2017, except for one ad that was briefly deactivated by Facebook for technical reasons. Ads were exclusively placed in the News Feed on computers, ad placement was optimized per Facebook’s algorithm for clicks, meaning that ads were automatically shown to users who Facebook anticipated would click at the highest rates, in a targeting process adjusted by actual clicks during the campaign. Each ad was placed in a separate “ad set” to allow comparison across ads.

Study ads were broadly targeted at Facebook users in the United States of any age or gender who were characterized by Facebook as having at least one of a variety of veteran-related characteristics. These included, for example, having an interest in “United States Armed Forces” or “Supporting Our Veterans”, belonging to the “Military or Veterans (US)” industry, or having a “Veterans in home” home composition. Text above the ad image indicated that veterans who served between 2001 and 2017 were needed for an “online health survey.”

We designed a total of 15 ad variations in a 3x5 factorial design, with three images (a person taking a survey on a tablet device; a veteran with his family; and soldiers marching) varied against five headlines. Ad images are illustrated in **Figure 1**. Headlines were informed by behavioral economics and other principles and consisted of the following five brief messages:

1. **Altruism** (Andreoni, 1990): “Will you help us improve care for veterans?”
2. **Empowerment** (Avey, Luthans, & Youssef, 2010): “You can tell us how to design new health programs for veterans.”
3. **Incentive** (Dolan et al., 2012): “You can win a new 7.9” 16 GB iPad Mini 4 with Retina Display!”
4. **Social norms** (Cialdini, 2007): “Hundreds of veterans are participating in this survey. Will you join them?”
5. **Sharing** (Oeldorf-Hirsch & Sundar, 2015): “Will you share this with one veteran you know?”

Ads were hosted by Facebook page’s affiliated with Oregon Health & Science University (OHSU) and linked to an online survey. In order to calculate survey participation and other outcomes by ad, we constructed separate URLs to the online survey for each ad. Prospective participants initially completed an online consent and eligibility screener. Eligible, consented participants then completed the full online survey. All study procedures were approved by the institutional review board of OHSU.

*Measures*

Facebook automatically tabulates a variety of performance metrics, or measures of ad engagement. In this study, we examined:

* **Impressions**: the total number of times that the ad is presented to any Facebook user.
* **Clicks**: the number of times that a user clicks on either the link embedded in the ad, or the name of the Facebook page from which the ad originates.
* **Click-through rate (CTR)**: the number of clicks divided by impressions.
* **Reactions**: the total number of ‘Likes’ or other Facebook reactions (‘Love’, ‘Haha’, ‘Wow’, ‘Sad’, ‘Angry’) generated by an ad.

Sample characteristics were drawn from the online survey, which included questions about sociodemographic characteristics, military history, social media use, and interest in social media-based interventions Two items from the National Survey of Veterans were used to assess VA health service use, one item on enrollment in the VA and one on use in the last 12 months [National Survey of Veterans. 2010. National Center for Veterans Analysis and Statistics, U.S. Department of Veterans Affairs. Retrieved from http://www.va.gov/vetdata/docs/SurveysAndStudies/AppendixAQuestionnaires.pdf].

To screen for mental health problems, reliable and valid self-report tools were used. For PTSD, we used the Primary Care PTSD Screen for DSM-5 (PC-PTSD), a five-item scale assessing past-month symptoms of a lifetime traumatic event. A score of three or higher on the PC-PTSD indicates a positive screen (Prins et al., 2016). For alcohol misuse, we used the Alcohol Use Disorders Identification Test Alcohol Consumption Questions (AUDIT-C), a three-item scale on frequency and intensity of drinking. An AUDIT-C score of four or higher for men, or three or higher for women, indicates a positive screen for problematic drinking (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). For major depression, we used the Patient Health Questionnaire-2 (PHQ-2), a two-item scale on anhedonia and depressed mood in the previous two weeks. A score of two or higher on the PHQ-2 indicates a positive screen (Kroenke, Spitzer, & Williams, 2003). For suicidality, we used the Depressive Symptom Inventory Suicidality Subscale (DSI-SS), a four-item scale on suicidal ideation within the past two weeks (Joiner, Pfaff, & Acres, 2002). A score of two or higher on the DSI-SS indicates a positive screen in a population-based sample (von Glischinski, Teismann, Prinz, Gebauer, & Hirschfeld, 2016).

*Statistical analysis*

Participants were defined as not enrolled in VA health care if their response to the question “Have you ever been enrolled in VA health care?” was “No” or “Don’t know”. Participants were defined as have not used VA health care in the last year if their response to the question “In the past 12 months, did you use any VA health care services?” was “No” or “Don’t know” or if they were classified as not enrolled in VA health care. Demographic variables were compared by ad text and image for participants in the analytic sample using Pearson’s chi-square test, or ANOVA for age. All outcomes were modeled as negative binomial counts. Image, headline, and the interaction were included as independent factors. The model for clicks and CTR included an offset for the number of impressions; the model for reactions included an offset for the number of clicks.

**Results**

*Overall Ad Campaign*

Over the 45 days of the advertising campaign (**Figure 2**), the Facebook ads produced 827,918 impressions (with each Facebook user who saw any ad receiving an average of 2.04 impressions) and 9,527 clicks (click-through rate 1.20%).There were 1,329 complete responses to the eligibility screener, of which 711 met eligibility criteria, and 605 completions of the online survey (85% response rate). Eighteen responses were excluded from analysis based on quality control measures (10 took less than 5 minutes, two claimed nonexistent pay grades, and six were duplicate responses), which left a final sample of 587. Total ad expenditure was $11,427, yielding an average cost per analyzed survey of $19.47.

*Characteristics of the Sample*

Characteristics of survey participants are described in **Table 1**. Their mean age was 40 years. Eighty-one percent were male, and 81% were white and non-Hispanic. Sixty-one percent of participants had served only in the Iraq and Afghanistan era, and 73% had been deployed in support of OEF-OIF. Forty-nine percent served in the Army.

One hundred ninety-three participants (33%) had never been enrolled in the VA, and 322 (55%) had not used VA health care services in the prior year. Participants frequently screened positive for current mental health problems, including PTSD (52%), problematic drinking (51%), major depression (28%), and suicidality (22%).

*Associations Between Ad Characteristics and Demographic Characteristics*

Gender of respondents varied by ad text, χ2 (4, N= 583) = 10.67, p = 0.03, with sharing and empowerment messages having a higher proportion of women. Age varied by text (F(2, 585) = 11.84, p < 0.01) and image (F(2, 585) = 10.09, p < 0.01), with the soldiers marching image and incentive text attracting the youngest respondents and the survey-taking image and altruism and social norms texts attracting the oldest. Service era varied correspondingly, with the soldiers marching image (χ2 (2, N= 585) = 9.90, p < 0.01) and incentive text (χ2 (4, N= 585) = 22.03, p < 0.01) attracting a higher proportion of respondents who had only served during the OEF-OIF era. Race, ethnicity, education, military branch, and deployment in OEF-OIF did not vary significantly by ad text or image.

*Associations Between Ad Characteristics and Ad Engagement*

There was a main effect for ad image across multiple ad engagement outcomes, including impressions, click-through rates, and reactions, but not survey participation. In terms of both impressions and click-through rates, the soldiers marching image performed better than the survey-taking and family images (p<0.001 for all comparisons). In addition, the soldiers marching image generated significantly more reactions than the survey-taking (p=0.001) and family (p<0.001) images. However, there were no significant differences by ad image in terms of survey participation.

There was also a main effect for ad headlines on ad engagement outcomes. Specifically, the sharing headline was associated with more impressions than the incentive (p = 0.045) and empowerment (p=0.004) headlines; more reactions than the altruism (p=0.004) and empowerment (p=0.014) headlines; and higher survey participation than the social norms headline (p<0.001). In addition, the social norms headline was associated with higher click-through rates than the incentive (p<0.001), altruism (p<0.001), and empowerment (p=0.001) headlines.

Among veterans with current suicidal ideation (n=132), the probability of survey participation ranged from an estimated 15% to 47% across the 15 ad variants (**Table 2**). The survey-taking image performed better compared to the soldiers marching (p=0.007) ad. Among veterans not enrolled in the VA (n=195), the probability of survey participation ranged from an estimated 17% to 45% across the 15 ad variants (**Table 2**). There were no statistically significant differences in recruitment of non-enrolled veterans by ad image or headline.

*Survey Participation and Ad Cost*

Two of the 15 ad versions generated fully half (n=285) of the participants (**Table 3**). These were the ads containing the image of soldiers marching with either the incentive or sharing headline. Consequently, these two ads were most cost effective, at $4.88 and $5.90 per participant, respectively. Results were similar when examining individuals who completed the online eligibility screener, regardless of whether they were eligible or completed the full survey

**Discussion**

*Key Findings*

Our study provides growing evidence that Facebook ads are a potentially powerful tool to recruit research subjects. Our study demonstrates the feasibility of recruiting a relatively broad target population (i.e., recent military veterans) as well as subpopulations that can be hard-to-reach and are of heightened interest to many stakeholders (i.e., veterans who are experiencing current suicidal ideation or have not enrolled in VA health care). Although we were not specifically targeting groups such as suicidal veterans, our results suggest that we were successful in reaching individuals who were not simply ‘healthy and happy’. Indeed, the burden of probable mental health problems was striking in this sample, as indicated by high rates of screening positive for active PTSD (52%), problematic drinking (51%), major depression (22%) and even suicidal ideation (22%). We engaged participants in enrollment in this online survey at a rapid clip (nearly 600 participants in 6 weeks), and at an overall cost of less than $20/participant, results that are comparable with prior studies[Whitaker C JMIR 2017; Topolovec-Vranic J JMIR 2016].

An important novel component of this study was the examination of what ad features are most likely to result in participation in engagement with the ad. Our results suggest that what ad features work best depend on the particular part of the engagement spectrum being measured as the outcome. For instance, when looking at the lower end of the engagement spectrum (e.g., impressions and clicks), the image of soldiers or headlines containing a social norms message were relatively effective.

Yet results were dissimilar when examining likelihood of survey participation by individuals with active suicidality. Put another way, it may be that among military veterans, the image of a solider is a ‘hook’ but this may not translate into an advantage when the ultimate goal is research study participation among individuals most at-risk for mental health problems.

Prior research has identified messages that are preferred by individuals with suicidal ideation being recruited into a research study [Whiteside U JMIR 2014]. Our results expand on that work by showing variation in objective recruitment outcomes based on ad messages and images among individuals with elevated rates of psychiatric symptoms. One possible reason for the association between survey participation and the survey-taking image (which showed an iPad) may have to do with cognitive differences and attentional biases among individuals with suicidality, given prior research on attentional biases among individuals with active psychopathology [Yiend J J Cognition Emotion 2010].

*Limitations and Future Directions*

As with all studies, there are limitations to the current work. Our results may not generalize to non-veteran populations, or even all military veterans, because we focused on recent-era veterans. As participation in this study only involved a one-time online survey, it is not clear if the same strategies would be effective for treatment engagement, or engagement in research requiring a higher burden (e.g., intervention or longitudinal cohort study). Finally, it is possible that individuals perceived our ads in ways different than hypothesized (e.g., the “survey-taking” image could have been perceived as that of “computer technology”).

*Conclusions*

Taken together, our study findings suggest that Facebook ads are an effective medium for identifying, reaching, and recruiting military veterans. Stakeholders as varied as health system administrators and public health officials can use our study results to inform efforts to reach veterans disconnected from the health care system or at risk for suicidal ideation.

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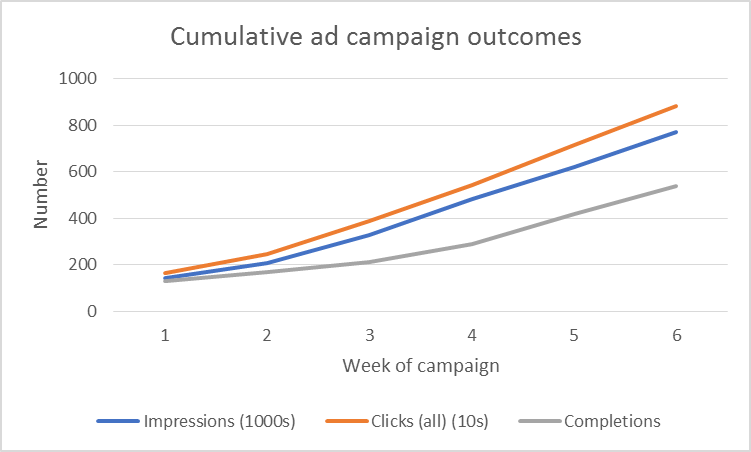
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**Figure 1: Sample Facebook Ads Illustrating the Three Different Ad Images (Survey-Taking, Family, and Soldiers Marching)**

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**Figure 2: Cumulative ad campaign outcomes over time**



**Table 1: Descriptive Characteristics of All Survey Participants (N=587)**

|  |  |  |
| --- | --- | --- |
| **Characteristic** | **n or mean** | **% or**  **(SD)** |
| *Demographics and Military History* | | |
| Age, years | 40.0 | (12.0) |
| Gender, male | 474 | 80.8 |
| Racial or ethnic minority | 110 | 18.9 |
| Deployed to Iraq or Afghanistan | 426 | 72.7 |
| Education |  |  |
| High school diploma or less | 34 | 5.8 |
| Some college, or vocational degree | 250 | 42.6 |
| College degree or greater | 303 | 51.6 |
| Marital status |  |  |
| Single, never married | 112 | 19.1 |
| Divorced, separated, or widowed | 111 | 18.9 |
| Married or living as married | 363 | 62.0 |
| Facebook use frequency |  |  |
| Every few weeks or less often | 14 | 2.4 |
| Weekly or a few times a week | 47 | 8.0 |
| Daily or more often | 524 | 89.6 |
| *Clinical Characteristics* | | |
| Positive depression screener1 | 164 | 27.9 |
| Positive PTSD screener2 | 267 | 45.5 |
| Positive alcohol misuse screener3 | 243 | 41.4 |
| Positive suicidal ideation screener4 | 132 | 22.5 |
| *VA Health Service Use* | | |
| Not enrolled | 193 | 32.9 |
| Not used in last year | 322 | 54.9 |

1. PHQ-2 score ≥ 3
2. PC-PTSD-5 score ≥ 3
3. AUDIT-C score ≥ 4 (men) or ≥ 3 (women)
4. DSI-SS score ≥ 2

**Table 2: Predicted Probabilities of Suicide Ideation and Non-Enrollment in VA Health Care Among Survey Participants**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Image** | **Headline** | **Suicidal ideation1** | **95% CI** | **Not enrolled in VA** | **95% CI** |
| Survey | Altruism | 0.28 | 0.12-0.52 | 0.28 | 0.12-0.52 |
| Survey | Empowerment | 0.25 | 0.03-0.76 | 0.25 | 0.03-0.76 |
| Survey | Incentive | 0.45 | 0.25-0.66 | 0.50 | 0.29-0.71 |
| Survey | Sharing | 0.32 | 0.20-0.47 | 0.30 | 0.18-0.44 |
| Survey | Social Norms | 0.19 | 0.07-0.41 | 0.18 | 0.07-0.40 |
| Family | Altruism | 0.22 | 0.06-0.58 | 0.33 | 0.11-0.67 |
| Family | Empowerment | 0.50 | 0.27-0.73 | 0.25 | 0.10-0.51 |
| Family | Incentive | 0.20 | 0.08-0.43 | 0.30 | 0.14-0.53 |
| Family | Sharing | 0.15 | 0.06-0.35 | 0.38 | 0.22-0.58 |
| Family | Social Norms | 0.23 | 0.08-0.52 | 0.38 | 0.17-0.66 |
| Marching | Altruism | 0.19 | 0.08-0.39 | 0.23 | 0.11-0.43 |
| Marching | Empowerment | 0.16 | 0.06-0.36 | 0.28 | 0.14-0.48 |
| Marching | Incentive | 0.17 | 0.12-0.24 | 0.37 | 0.30-0.45 |
| Marching | Sharing | 0.22 | 0.15-0.30 | 0.33 | 0.25-0.41 |
| Marching | Social Norms | 0.25 | 0.15-0.37 | 0.33 | 0.22-0.46 |

1. DSI-SS score ≥ 2

**Table 3: Matrix of 15 Facebook Ad Variants with Ad Engagement Outcomes**

