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**Authors**

Chittamuru, Deepti
Daniels, Ryane
Sarkar, Urmimala
et al.

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# A Quasi-RCT Evaluating Values-Based Message Frames for Type-2-Diabetes Prevention Among Facebook Audiences: Divergent Values or Common Ground?

**Deepti Chittamuru**[a], **Ryane Daniels**[b], **Urmimala Sarkar**[c], **Dean Schillinger**[d]

[a]Public Health Department, School of Social Sciences, Humanities and Art, University of California Merced, Merced, USA, 5200 N. Lake Rd, Merced, CA 95343 USA

[b]Center for Vulnerable Populations, Zuckerberg San Francisco General Hospital and Trauma Center, University of California San Francisco, San Francisco, USA, 1001 Potrero Ave, 1311, San Francisco, CA, 94110 USA

[c]Division of General Internal Medicine and Center for Vulnerable Populations, Zuckerberg San Francisco General Hospital and Trauma Center, University of California San Francisco, San Francisco, USA, 1001 Potrero Ave, 1319, San Francisco, CA, 94110 USA

[d]Division of General Internal Medicine and Center for Vulnerable Populations, Zuckerberg San Francisco General Hospital and Trauma Center, University of California San Francisco, San Francisco, USA, 1001 Potrero Ave, SFGH 10, 1320A, San Francisco, CA 94110 USA

## Abstract

**Objective:** To effectively confront the Type-2-Diabetes (T2D) epidemic, policymakers and the public need to problematize T2D less as a medical and more as a social problem. An award-winning T2D prevention campaign was harnessed to determine the most successful ways of framing ads on Facebook. Hypothesis: There would be variation in the effectiveness of adframes across audiences.

**Methods:** Six parallel RCTs (participants N=203156) were conducted across 6 disparate audience segments defined through the Facebook ads manager tool. We exposed them to 11 values-based ad frames (10- to 15-word appeals). Engagement was measured by rates of ad (video) views, unique link clicks and donations to the campaign.

**Results:** Contrary to our hypothesis, we observed remarkable consistency across target audiences. Ad frames that ranked highly with most audiences included Entertainment and Emotional Appeal; Defiance Against Authority Appeal; Second-Hand Smoke/Environmental Appeal; and to a lesser extent, Common Enemy/War Metaphor Appeal.

**Conclusion and Practice Implications:** Across disparate segments of society, there appears to be a set of common values that public health communication initiatives can tap into to catalyze

Corresponding Author at: Deepti Chittamuru, PhD, Postdoctoral Research Fellow, Public Health Department, School of Social Sciences, Humanities and Arts, University of California Merced, 5200 N. Lake Rd, Merced, CA 95343, Tel: 215-480-7006, dchittamuru@ucmerced.edu.

a more inclusive movement to confront the T2D epidemic through policy, systems and environmental approaches.

## Keywords

Health Literacy; Health Campaigns; Adolescent; Type 2 Diabetes Mellitus; Prevention Research; Values-Based Messaging; Message Framing; Health Knowledge; Health Attitudes; Social Marketing

## 1. Introduction

Over the last two decades, the prevalence of type 2 diabetes (T2D) has rapidly escalated in the US, with a mean prevalence among adult minority populations of 14.3%[1]. Although Type 2 diabetes has historically been coined as "adult-onset" diabetes, it is now affecting youth and young adults in epidemic proportions[2], increasing by over 30% in youth aged 10–19 years between 2001 and 2009[3]. Over the last decade, rates have tripled in American Indian, doubled in African American, and increased 25% to 50% in Asian, Pacific Islander, and Hispanic youth[4].

In order to reverse this trajectory, it is widely recognized that both policymakers and the general public need to problematize T2D less as a medical and more as a social problem[5–7]. Finding avenues to successfully convey a socioecological perspective on the root causes of T2D to broad segments of the population who are not part of the public health subculture represents a challenging imperative for changing the social and environmental conditions that drive the epidemic[8]. Prior research has suggested that this shift in disease construct may be particularly unacceptable for more individually- and behaviorally-minded segments of the population[9,10]. This study seeks to understand the effects of different kinds of values-based or emphasis message frames on a variety of Facebook (FB) audiences exposed to video content from an award-winning Type 2 Diabetes prevention public health literacy campaign, *The Bigger Picture* (TBP) (www.thebiggerpictureproject.org), that features youth artists describing the epidemic in socio-ecologic terms[11]. Prior research in selected populations has shown these videos to be effective in changing diabetes discourse[12,13].

Values-based or emphasis frames are brief narratives that call attention to qualitatively different, yet potentially relevant, considerations or aspects of a larger message with an aim to better resonate with or persuade an audience[14,15]. Framing, when done efficaciously, can increase engagement with the message[15,16], identification with the message[15], argument strength[15], and persuasiveness, i.e. intention to adopt the behavior advocated by the message[15,17]. When message framing is not done effectively, however, it can backfire and lead to greater resistance to the message[15]. To encourage FB audiences to view the videos, we developed ad frames that tapped into different values believed to be aligned with FB audience sub-types. We hypothesized that there would be significant variation in the effectiveness of distinct ad frames in engaging audience sub-types, i.e. some ad frames would perform very well with some audiences and not well with others.

## 2. Methods

Six parallel RCTs (total participants N=203156) were conducted across six unique audience segments with seven ad frame conditions tested for each audience, using two TBP videos (advertisements) each (Figure A). The audiences were defined through the FB ads manager tool (Appendix A). The parallel RCTs were implemented over an 8-week period between Dec 17, 2018 and Feb 11, 2019. The Institutional Review Board at the BLINDED FOR REVIEW approved this study.

Using split sampling, one minute videos from *The Bigger Picture* diabetes prevention campaign - "Empty Plate"[18] by Anthony Orosco and "Monster"[19] by Liliana Perez and Rose Bergman – represented our ads, and were framed with eleven different types of messages and displayed on Facebook (FB) as advertisements. *Empty Plate* features a young Latino male calling out the injustice of being a farmworker in California's Central Valley while living in a food desert, while *Monster* features two young women - Hispanic and White – who describe the challenges of their fathers' draining manual labor work leading to addiction to heavily marketed and highly caffeinated sugary drinks. Figure B shows an example of one of the ads, including a screen shot from the Empty Plate video, a message frame, and links, as displayed on FB. Table A lists and describes the ad frames.

Our inclusion criteria required that all FB participants be located in the US, 18 years old or more and have a FB account. FB aggregate user data were employed to generate 6 targeted samples generated by the standard FB ads manager tool (target N~5,000 per audience). We named the audiences: Young Adults, Social Justice Interest, Nutrition Enthusiasts, Public Health Interest, Philanthropist, and Conservatives (Appendix A). Since the study was anonymous, we have no additional variables describing the participants in each audience segment.

We developed and applied eleven unique ad frames – consisting of 10–15 word appeals – nine of which employed values-based communication theory[20]: *Entertainment & Emotional Appeal*; *Common Enemy/War Metaphor Appeal*; *Second-Hand Smoke Equivalent/Environmental Appeal*; *Defiance Against Authority*; *Play on Genetics*; *Play on Personal Responsibility*; *Protecting Friends and Family*; *Social/Racial Justice Appeal*; *Healthcare Costs/ Tax Burden Appeal*; and two which served as a non-values-based comparators: *Information/Facts & Figures* and *Direct Behavioral Appeal.*

Because we hypothesized that some frames would be more appropriate for certain audiences based on values alignment, not all eleven ad frames were tested with all audiences (Appendix B). As a result, for each of the six unique audiences, we tested seven of the eleven ad frame messages, yielding forty-two possible combinations ad frames and audiences (Appendix B). Within each audience segment, each of the 7 ad frames was presented to a quasi-randomized sample of ~5,000 individuals each (Figure A). Since FB ads manager does not have a randomization feature, we attempted to randomize audiences by birth month: each of the 7 ads was exposed to FB members in that audience segment based on their birth month. We used April-October so as to exclude months that would be adjacent to the campaign dates and could introduce bias in overall FB viewing rates.

Three frames - *Entertainment & Emotional Appeal, Defiance Against Authority* and *Common Enemy/War Metaphor Appeal* - were tested with all audiences. *Secondhand Smoke Equivalent/Environmental Appeal* was tested with five audiences: Social Justice Interest, Nutrition Enthusiasts, Public Health Interest, Philanthropists, and Conservatives. *Social/Racial Justice* and *Facts and Figures* frames were tested with five audiences: Young Adults, Social Justice Interest, Nutrition Enthusiasts, Public Health Interest, and Philanthropists. *Healthcare Costs/Economic and Tax Burden* frame was tested with four audiences: Social Justice Interest, Public Health Interest, Philanthropists/Donors, and Conservatives. *Play on Personal Responsibility* frame was tested with Conservatives and Nutrition Enthusiasts. *Protect Family & Friends* and the *Direct Behavioral Appeal* frames were only tested with Young Adults. The *Play on Genetics* frame was tested only with Conservatives.

## 2.1 Measures

Our three main outcomes were (a) Video Views, (b) Unique Link Clicks to *The Bigger Picture* website and (c) Donations to *The Bigger Picture* project.

**Video Views—**Video Views was defined as the total number of times the video was played at 50% of its length, i.e. 30 seconds, as is standard in the evaluation of social media campaigns[21] and includes plays that skipped to this point. This may include views from people who played half of the video from the beginning and may or people who skipped to the 50% point and played the video from there. In sensitivity analyses, we examined alternative viewing cut-points of 25% and 75%, as well as video views at 3-seconds. We chose to report the 50% (30-sec) video views in all analyses because we believed that is the minimum length of time needed to understand the message well and because it is an accepted outcome in social media communication research[21].

**Unique Link Clicks—**Unique Link Clicks was defined as the total number of unique people who, in response to the ad's framing message, performed at least one link click taking them to the landing page of *The Bigger Picture* campaign.

**Donations—**Donations was defined as the total number of unique people who clicked on the donation link and donated to *The Bigger Picture* campaign in response to the ad's framing message. This link did not require accessing *The Bigger Picture* website or viewing the video, as it could be accessed directly from the FB ad (Figure B). We present numbers of donations only, not donation amounts.

## 2.2 Statistical Analytic Approach

Our primary objective was to determine the relative effectiveness of different values-based ad frames within each audience so as to determine the most effective frames for each audience. Relatedly, we were interested in evaluating whether there were some common values that can be tapped into across audiences. We used ANCOVA to compare ad frames both within each audience segment and between audience segments, adjusting for reach of the campaign within each ad frame/audience combination.

As an additional sensitivity analysis, because we tested two different videos within each cell, to determine whether observed effects were attributable to the ad frame vs. the video, we tested for interactions between video and ad frame for each audience. All analyses were conducted using SAS v.10.

## 3. Results

Based on the total budget associated with the FB ad credits, for each of the forty-two ad frame/audience combinations, the FB ads manager reached a mean of 4837.05 unique individuals (SD=643.18). For each ad frame/audience combination, this number of exposed individuals served as our denominator for our outcomes of interest.

Table B reports the Least-Squared Means for all three outcomes, i.e. video views, unique link clicks and donations, adjusted for the reach of each frame within each audience (each experimental condition).

### Video Views

Overall, across the forty-two ads and associated ad frames, the mean number of unique individuals who viewed at least 50% of the video was 197.24 (SD=64.21), yielding a rate of views of 4.1%. The mean 3-second view rate was 25.9%, Mean(SD)=1248.14 (234.15). Three ad frame messages -- *Common Enemy/War Metaphor Appeal; Entertainment & Emotional Appeal;* and *Second Hand Smoke Equivalent/Environmental Appeal* --- appeared to be consistently most effective in stimulating video views across all exposed audiences with the exception of the Young Adult audience. *Social/Racial Justice* and *Facts and Figures* generally appeared least effective in stimulating video views. Sensitivity analyses using 3-second, 25% and 75% cut points yielded similar results.

### Unique Link Clicks

Overall, across the forty-two ads and associated ad frames, the mean number of unique people who performed at least one link click to the landing page of *The Bigger Picture* campaign was 123.74 (SD=49.38), yielding a unique link click rate of 2.6%. Similar to video views, three ad frames -- *Entertainment & Emotional Appeal*; *Defiance Against Authority Appeal*; and *Second Hand Smoke Equivalent/Environmental Appeal* --- appeared to be consistently most effective in stimulating link clicks across all exposed audiences except Young Adults. *Social/Racial Justice* and *Facts and Figures* generally appeared least effective.

### Number of Donations

Overall, across the forty-two ads and associated ad frames, the mean number of unique people who donated was 93.76 (SD=42.31), yielding a donation rate of 1.9%. Similar to other outcomes, three ad frames -- *Defiance Against Authority Appeal*; *Entertainment & Emotional Appeal*; and *Second Hand Smoke Equivalent/Environmental Appeal* -- appeared to be consistently most effective in stimulating donations across all audiences, while *Social/ Racial Justice* and *Facts and Figures* generally appeared least effective.

Additional sensitivity analyses showed that the outcomes were not statistically significantly different by video type, suggesting that the ad frame type, not the video content, primarily drove results reported above.

### 3.1 Variation in Outcomes within Audience:

Ad frame type did not have a statistically significant effect on any outcome within the Young Adult or Public Health audiences. Within Social Justice Interest there was a significant effect of ad frame type on number of video views $[F(6, 6) = 4.74, p=0.04]$ and unique link clicks $[F(6, 6) = 5.45, p=0.03]$. Within Philanthropists there was a significant effect of ad frame type on number of video views $[F(6, 6) = 14.69, p=0.002]$ and donations $[F(6, 6) = 7.90, p=0.01]$. Within Nutrition Enthusiasts there was a significant effect of ad frame type on number of video views $[F(6, 6) = 8.04, p=0.01]$ and unique link clicks $[F(6, 6) = 8.85, p=0.009]$ and donations $[F(6, 6) = 13.38, p=0.003]$. Within Conservatives there also was a significant effect of ad frame type on number of video views $[F(6, 6) = 4.18, p=0.05]$ and unique link clicks $[F(6, 6) = 4.81, p=0.04]$ and donations $[F(6, 6) = 11.74, p=0.004]$.

## 4. Discussion and Conclusions

### 4.1 Discussion

A significant body of health communication literature recommends recognizing differences in audiences and developing frames and messages tailored to specific audience segments. [22–24] Communication research, however, also suggests that identifying values common to many or most audience segments can be a viable alternative to market segmentation[20]. Creating and disseminating a set of values-based messages that resonate with many segments of society is a potentially more effective and efficient strategy for advancing public health goals, particularly for health topics known to be characterized by divisive discourse, such as the root causes of T2D.

We found some evidence to support our hypothesis that, within each audience, there would be variation by ad frame type. Contrary to our hypothesis, however, we observed remarkable consistency across audiences with respect to specific values-based ad frames that were most or least associated with engagement. Ad frames that consistently ranked highly with most audiences included *Defiance Against Authority Appeal*; *Entertainment & Emotional Appeal*; and *Second Hand Smoke Equivalent/Environmental Appeal*, and to a somewhat lesser extent, *Common Enemy/War Metaphor Appeal*. Ad frames that consistently ranked in the bottom for audience engagement audience included *Facts and Figures* (with the exception of Young Adults), *Social/Racial Injustice* and *Healthcare Costs/ Tax Burden Appeal*.

### 4.2 Conclusion

There is some prior research on values-based communication to support our findings. Studies in tobacco[25] and obesity[26,27] have demonstrated that messages that tap into the values of (a) autonomy, self-determination and defiance against authority[26,27] and (b) making environments safe for others (especially children)[28,29] can shift individual and communal attitudes and policy-related discourse towards those more aligned with public health objectives and enhance public health literacy[30]. Other research has shown that

appealing to emotion-based values can engage individuals with health-related content. That framing the diabetes epidemic as a common enemy by using a military metaphor also appeared to be associated with greater number of ad views across numerous audience segments is somewhat surprising, given prior research that such framing can be counter-productive[31,32]. Our study also confirms prior research that fact-based and behavioral messages may be less effective[22] relative to certain types of values-based messaging.

While our quasi-experimental study exposed a very large sample of FB users and unique audience subtypes to a large number of value-based messages within ad frames, it was limited by our inability to (a) capture individual participant data to assess predictors of engagement, (b) determine whether video views mediated donations, (c) assess whether the population characteristics within each audience segments created by the FB ad manager tool are representative of their actual characteristics and (d) ensure that some types of individuals in one audience segment might not be represented in another segment. Further, the lack of significant differences in ad frames within the Young Adult audience, and the fact that we did not test the ad frame of *Protecting Friends and Family* with other audiences, precludes any firm conclusions regarding relative effectiveness of any ad frames for this audience, and of this value-based framing across other audiences. Finally, overall engagement in our study was somewhat higher than that reported by other such studies.[33] For this and other reasons, we cannot determine whether our findings are generalizable to other types of T2D prevention campaigns, to other health conditions, or to other communication media.

### 4.3 Practice Health Implications

Social determinants of health are major drivers of the T2D epidemic and disparities borne by people of color, particularly children of color[1]. To address this epidemic, T2D needs to be problematized as a social problem rather than as a medical problem[5–7]. Our parallel trials suggest that a broad range of social media users appear to engage with socio-ecologically oriented, diabetes-related public health content at relatively high rates when a specific set of values-based frames are offered that (a) call out threats to personal autonomy by corporate interests, (b) appeal to the injustice of exposing children and youth to unhealthy environments, (c) provide entertainment and emotional resonance and, to a lesser extent, (d) define the drivers of T2D as a common enemy. These findings suggest that, across disparate segments of US society, there may be a set of common values that public health communication initiatives can tap into in order to problematize TD2 as a function of social determinants of health. Our study provides both new insight and encouragement to those interested in creating common ground to catalyze a broader and more inclusive movement to confront the T2D epidemic through policy, systems and environmental change.

## Acknowledgments

# Appendix

## Appendix A

List of Audience Types and Corresponding Audience Descriptions

| S. No | Audience Type | Defined Population[*] | Total Eligible Sample Size |
|---|---|---|---|
| 1 | Young Adults | **Location:** United States<br>**Age:** 18–25 | 35,000,000[*]<br>[*]With 7 ads and 2 split videos, about 2.5 million Young Adult would be eligible for exposure to each unique FB ad |
| 2 | Social Justice | **Location:** United States<br>**Age:** 26 – 65+<br>**Interests:** Human rights, Anti-corporate activism, Community issues, Pedagogy of the Oppressed, Educational equity, Racial equality, Social justice, Liberalism, Women's rights, Gender equality or Anti-discrimination | 52,000,000[*]<br>[*]With 7 ads and 2 split videos, about 3.714 million people would be eligible for exposure to each unique FB ad |
| 3 | Public Health/ Healthcare | **Location:** United States<br>**Age:** 26 – 65+<br>**Interests:** Physician specialty sub-types, Public health, United States Public Health Service, Internal medicine, Clinical nutrition, Mental health counselor, Licensed practical nurse, Social work, Health system, Dental public health, Pharmacist, Nutritionist, Licensed professional counselor, Community health worker, Emergency medical services, Emergency medical technician, Master of Social Work, Optician, U.S. Pharmacist, Family therapy, Emergency medical responder, School social worker, nurse case manager, Health care, Mental health professional, The Institute for Clinical Social Work, Nursing, Clinical psychology, Community Health Systems,<br>**Industry:** Healthcare and Medical Services | 2,400,000[*]<br>[*]With 7 ads and 2 split videos, about 170,000 people would be eligible for exposure to each unique FB ad |
| 4 | Philanthropists/ Humanitarians | **Location:** United States<br>**Age:** 26 – 65+<br>**Language:** English (US)<br>**Interests:** Humanitarianism, Philanthropy or Charity and causes | 9,000,000[*]<br>[*]With 7 ads and 2 split videos, about 642,000 people would be eligible for exposure to each unique FB ad |
| 5 | Nutrition Enthusiasts | **Location:** United States<br>**Age:** 26 – 65+<br>**Language:** English (US)<br>**Interests:** Organic food, Health food, Healthy Lifestyles, Living Healthy, Organic farming or Farmers' market | 32,000,000[*]<br>[*]With 7 ads and 2 split videos, about 2.3 million people would be eligible for exposure to each unique FB ad |
| 6 | Conservatives | **Location:** United States<br>**Age:** 26 – 65+<br>**Language:** English (US)<br>**Interests:** Fox News Channel, Individualism, Capitalism or Free market,<br>Politics: US politics (conservative) | 5,100,000[*]<br>[*]With 7 ads and 2 split videos, about 364,000 people would be eligible for exposure to each unique FB ad |

[*] Note: see Facebook Ad Manager tool for more details https://www.facebook.com/business/tools/ads-manager

# Appendix B

Matrix of Audience Type By Frame

| Frame # | GROUP A Young Adults | GROUP B Public Health | GROUP C Philanthropists/ Humanitarians | GROUP D Conservatives | GROUP E Nutrition Enthusiasts | Group F Social Justice |
|---|---|---|---|---|---|---|
| 1 | **PFF:** Your Friends & Family aren't safe. Wanna be a Superhero? Check this out. | **SHSE:** The war on tobacco turned when we discovered that second hand smoke kills kids. Now kids are getting Type 2 diabetes. Is there a second hand smoking gun in Type 2? Watch this. | **SHSE:** The war on tobacco turned when we discovered that second hand smoke kills kids. Now kids are getting Type 2 diabetes. Is there a second hand smoking gun in Type 2? Watch this. | **SHSE:** The war on tobacco turned when we discovered that second hand smoke kills kids. Now kids are getting Type 2 diabetes. Is there a second hand smoking gun in Type 2? Watch this. | **SHSE:** The war on tobacco turned when we discovered that second hand smoke kills kids. Now kids are getting Type 2 diabetes. Is there a second hand smoking gun in Type 2? Watch this. | **SHSE:** The war on tobacco turned when we discovered that second hand smoke kills kids. Now kids are getting Type 2 diabetes. Is there a second hand smoking gun in Type 2? Watch this. |
| 2 | **DAA:** A modern David and Goliath story: **Can Big Poetry actually beat Big Soda and Big Ag?** Check this out. | **DAA:** A modern David and Goliath story: **Can Big Poetry actually beat Big Soda and Big Ag?** Watch this. | **DAA:** A modern David and Goliath story: **Can Big Poetry actually beat Big Soda and Big Ag?** Watch this. | **DAA:** A modern David and Goliath story: **Can regular kids beat Big Soda and Big Ag?** Watch this. | **DAA:** A modern David and Goliath story: **Can Big Poetry actually beat Big Soda and Big Ag?** Watch this. | **DAA:** A modern David and Goliath story: **Can Big Poetry actually beat Big Soda and Big Ag?** Check this out. |
| 3 | **SRJ:** Young Lives Matter: Join the movement to defend ourselves and our health. Check this out. | **SRJ:** Young Lives Matter: Watch this and join the movement to defend our kids from the forces behind the Type 2 diabetes epidemic. | **SRJ:** Young Lives Matter: Watch this and Join the movement to defend our kids from the real forces behind the Type 2 diabetes epidemic | **PG:** That Type 2 Diabetes is in the genes is Fake News. **Find out the real truth behind the diabetes epidemic.** Watch here. | **SRJ:** Young Lives Matter: Watch this and join the movement to defend our kids from the forces behind the Type 2 diabetes epidemic. | **SRJ:** Young Lives Matter: Watch this and join the movement to defend low-income youth from the real forces behind the Type 2 diabetes epidemic |
| 4 | **EE:** A Star is Born: Watch how this young artist is saving our communities. | **EE:** A Star is Born: Watch how this young artist is saving our communities. | **EE:** A Star is Born: Watch how this young artist is saving our communities. | **EE:** A Star is Born: Watch how this young farmer is saving our communities. | **EE:** A Star is Born: Watch how this young artist is saving our communities. | **EE:** A Star is Born: Watch how this young artist is saving our communities. |
| 5 | **DB:** Avoid diabetes by watching this dope video. | **HC:** Want healthcare to be more affordable? 1 in 5 dollars spent on healthcare in the US is due to diabetes. Watch how these young people are trying to change this stat. | **HC:** Want healthcare to be more affordable? 1 in 5 dollars spent on healthcare in the US is due to diabetes. Watch how these young people are trying to change that stat. | **HC:** If we didn't have a diabetes epidemic, your taxes would be a lot lower. In fact, it would be like getting a raise of more than 3%. Watch how these young people are trying to make that happen. | **PPR:** We all want to do our best to stay healthy. But what if we didn't have the option to make good choices? Help these kids have the opportunity to get healthy by watching this. | **HC:** Want healthcare to be affordable for all? 1 in 5 dollars spent on healthcare in the US is due to diabetes. Watch how these young people are trying to change that. |
| 6 | **FF:** Type 2 diabetes was once known | **FF:** Type 2 diabetes used to be known | **FF:** Type 2 diabetes used to be known as | **PPR:** We all want to make our own | **FF:** Type 2 diabetes used to be known | **FF:** Type 2 diabetes was once known |

| Frame # | GROUP A Young Adults | GROUP B Public Health | GROUP C Philanthropists/ Humanitarians | GROUP D Conservatives | GROUP E Nutrition Enthusiasts | Group F Social Justice |
|---|---|---|---|---|---|---|
| | as "adult-onset" diabetes. Now nearly 1 in 100 youth have it. Crazy. Find out why now it's affecting you and your friends, and learn what you can do about it. | as "adult-onset" diabetes. Now nearly 1 in 100 kids have it. Watch how these young people are fighting to end Type 2. | "adult-onset" diabetes. Now nearly 1 in 100 kids have it. Watch this and support young people in proclaiming "NoNewType2!" | choices. But what about when we have no choice? Help these kids have the right choices to make by watching this. | as "adult-onset" diabetes. Now nearly 1 in 100 kids have it. Watch how these young people are fighting to end Type 2. | as "adult-onset" diabetes. Now nearly 1 in 100 youth have it. Find out why it's affecting youth, and how society must change. |
| 7 | **CE:** During the Iraq/ Afghanistan War, about 1,650 of our American soldiers lost a limb in combat. During that same period, over 1 million regular Americans lost a limb to diabetes. Watch how young people are fighting back. | **CE:** During the Iraq/ Afghanistan War, about 1,650 of our American soldiers lost a limb in combat. During that same period, over 1 million regular Americans lost a limb to diabetes. Watch how young people are fighting back. | **CE:** During the Iraq/Afghanistan War, about 1,650 of our American soldiers lost a limb in combat. During that same period, over 1 million regular Americans lost a limb to diabetes. Watch how young people are fighting back. | **CE:** During the Iraq/ Afghanistan War, about 1,650 of our American soldiers lost a limb in combat. During that same period, over 1 million regular Americans lost a limb to diabetes. Watch how young people are fighting back. | **CE:** During the Iraq/ Afghanistan War, about 1,650 of our American soldiers lost a limb in combat. During that same period, over 1 million regular Americans lost a limb to diabetes. Watch how young people are fighting back. | **CE:** During the Iraq/ Afghanistan War, about 1,650 of our American soldiers lost a limb in combat. During that same period, over 1 million regular Americans lost a limb to diabetes. Watch how young people are fighting back. |

Note: Frames or cells colored in green were tested with all audiences; Frames or cells colored in orange were tested with only 5 of the 6 audiences; Frames or cells colored in red were tested with only 4 of 6 audiences; Frames or cells colored in blue were tested with only 2 of 6 audiences; and uncolored frames or cells were tested with only 1 of 6 audiences. The frame names associated with each abbreviation in the cells are listed below.

**CE:** Common Enemy/War Metaphor; **DAA:** Defiance Against Authority; **EE:** Entertainment & Emotional; **SHSE:** Second Hand Smoke Equivalent/Environmental

**FF:** Information/Facts and Figures; **SRJ:** Social/Racial Justice; **HC:** Healthcare Costs/ Tax Burden Appeal; **PPR:** Play on Personal Responsibility

**PG:** Play on Genetics; **PFF:** Protect Family and Friends; **DB:** Direct Behavioral Appeal

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**Highlights**

- Type 2 diabetes (T2D) is affecting American youth of color in epidemic proportions

- To address this epidemic it needs to be framed as a social - not medical - problem

- Values based message frames make public health literacy campaigns more effective

- Diverse segments of US public may respond to a common set of values-based frames

- Such shared message frames could improve impact of public health literacy campaigns
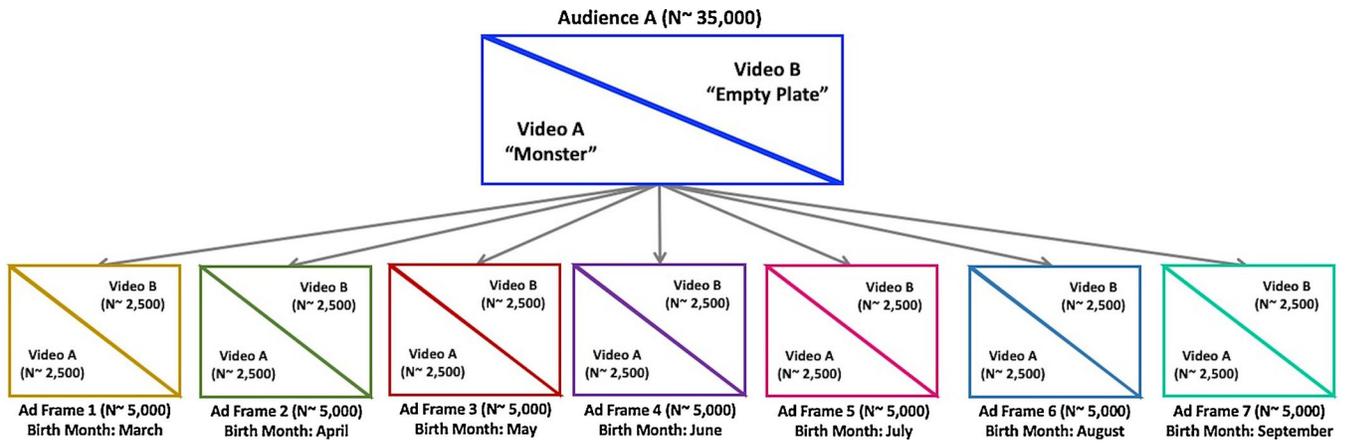
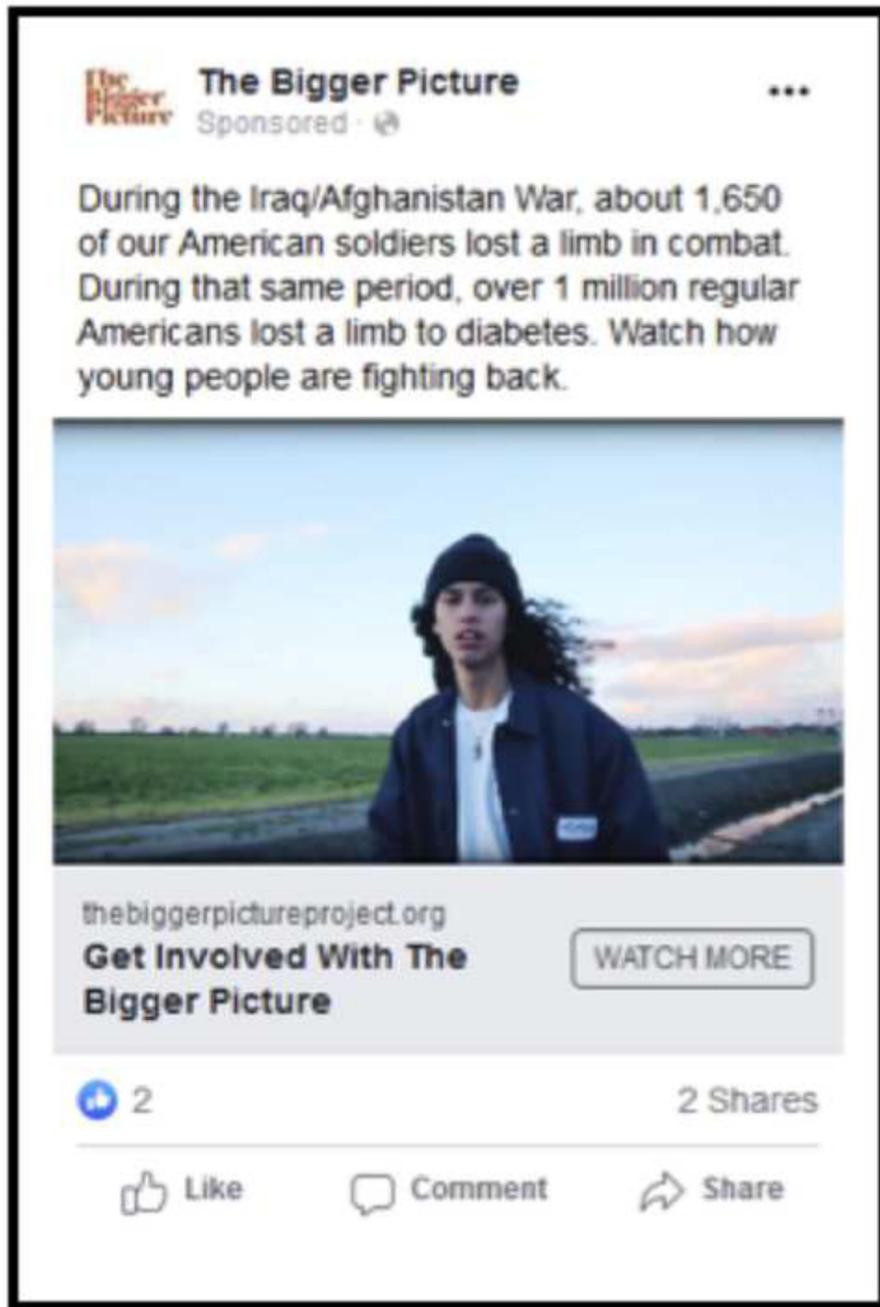**Figure A: CONSORT diagram for Quasi-RCT of exposing different ad frames to each audience segment***

*This design was replicated across 6 audience segments: Young Adults, Social Justice, Public Health, Philanthropist, Nutrition Enthusiasts, Conservatives. See Appendix A for more specifics on audiences. United States, December 2018-February 2019.

**Figure B:**

Screenshot of Example Facebook Advertisement Featuring the Empty Plate Video and the Common Enemy/War Metaphor Message Frame

**Table A:**

List of Frame Names and Associated Messages

| S. No | Values-Based Frame Name | Message |
|---|---|---|
| 1 | CE: Common Enemy/War Metaphor | During the Iraq/Afghanistan War, about 1,650 of our American soldiers lost a limb in combat. During that same period, over 1 million regular Americans lost a limb to diabetes. Watch how young people are fighting back. |
| 2 | DAA: Defiance Against Authority | A modern David and Goliath story: Can Big Poetry actually beat Big Soda and Big Ag? Watch this. |
| 3 | EE: Entertainment & Emotional Appeal | A Star is Born: Watch how this young artist is saving our communities. |
| 4 | SHSE: Second Hand Smoke Equivalent/Environmental Appeal | The war on tobacco turned when we discovered that second hand smoke kills kids. Now kids are getting Type 2 diabetes. Is there a second-hand smoking gun in Type 2? Watch this. |
| 5 | FF: Information/Facts and Figures | Type 2 diabetes used to be known as "adult-onset" diabetes. Now nearly 1 in 100 kids have it. Watch how these young people are fighting to end Type 2. |
| 6 | SRJ: Social/Racial Justice Appeal | Young Lives Matter: Watch this and join the movement to defend our kids from the forces behind the Type 2 diabetes epidemic. |
| 7 | HC: Healthcare Costs/Tax Burden Appeal | Want healthcare to be more affordable? 1 in 5 dollars spent on healthcare in the US is due to diabetes. Watch how these young people are trying to change this stat. |
| 8 | PPR: Play on Personal Responsibility | We all want to make our own choices. But what about when we have no choice? Help these kids have the right choices to make by watching this. |
| 9 | PG: Play on Genetics | That Type 2 Diabetes is in the genes is Fake News. Find out the real truth behind the diabetes epidemic. Watch here. |
| 10 | PFF: Protect Family and Friends | Your Friends & Family aren't safe. Wanna be a Superhero? Check this out. |
| 11 | DB: Direct Behavioral Appeal | Avoid diabetes by watching this dope video. |

**Table B:**

Least Squared Means of the Main Outcomes by Ad Frame Name Within Each Audience Type Adjusted for Reach

**Video Views**

| AD FRAME | CE LSMean (SE) | DAA LSMean (SE) | EE LSMean (SE) | SHSE LSMean (SE) | FF LSMean (SE) | SRJ LSMean (SE) | HC LSMean (SE) | PPR LSMean (SE) | PG LSMean (SE) | PFF LSMean (SE) | DB LSMean (SE) | Average Across All Ad Frames Within Audience |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AUDIENCE** | | | | | | | | | | | | |
| Young Adults | 33.30 (4.99) | 30.57 (7.56) | 30.55 (8.92) | - | **65.90 (17.69)** | **39.64 (5.14)** | - | - | - | 31.74 (9.24) | **59.30 (10.91)** | 38.97 (5.27) |
| Social Justice | **129.47 (11.81)** | 101.47 (11.50) | **112.88 (11.84)** | **165.93 (11.82)** | 83.79 (16.13) | 92.07 (11.25) | - | - | - | - | - | 110.78 (5.16) |
| Public Health | **108.99 (5.10)** | **95.04 (5.24)** | 91.61 (5.20) | **106.94 (6.33)** | 80.39 (5.11) | 87.03 (5.25) | 95.99 (5.10) | - | - | - | - | 98.02 (5.30) |
| Philanthropist | **125.37 * (5.29)** | **117.30 (5.26)** | **100.50 * (5.25)** | **144.02 ** (5.32)** | **82.81 ** (5.26)** | **105.06 * (5.28)** | **98.44 * (5.25)** | - | - | - | - | 111.00 (5.14) |
| Nutrition Enthusiasts | **139.65 * (5.82)** | 114.28 (5.72) | **123.65 (5.70)** | **130.00 (6.14)** | 103.57 (5.77) | 101.34 (5.71) | - | 96.49 * (5.81) | - | - | - | 113.26 (5.24) |
| Conservative | **123.53 (4.03)** | 115.69 (7.21) | **126.40 (11.41)** | **138.92 (8.27)** | - | - | 102.80 (8.47) | 85.93 (8.55) | **125.73 (8.45)** | - | - | 119.67 (5.27) |

**Unique Link Clicks**

| AD FRAME | CE LSMean (SE) | DAA LSMean (SE) | EE LSMean (SE) | SHSE LSMean (SE) | FF LSMean (SE) | SRJ LSMean (SE) | HC LSMean (SE) | PPR LSMean (SE) | PG LSMean (SE) | PFF LSMean (SE) | DB LSMean (SE) | Average Across All Ad Frames Within Audience |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AUDIENCE** | | | | | | | | | | | | |
| Young Adults | 17.31 (3.10) | 21.14 (4.70) | 21.99 (5.55) | - | **26.65 (11.01)** | 17.10 (3.20) | - | - | - | **23.73 (5.75)** | **28.58 (6.79)** | 21.71 (4.71) |
| Social Justice | 75.80 (9.49) | **76.87 (9.24)** | **109.33 (9.51)** | **117.81 (9.50)** | 47.31 (12.96) | 64.97 (9.04) | 60.91 (9.13) | - | - | - | - | 78.71 (4.61) |

| AD FRAME | CE LSMean (SE) | DAA LSMean (SE) | EE LSMean (SE) | SHSE LSMean (SE) | FF LSMean (SE) | SRJ LSMean (SE) | HC LSMean (SE) | PPR LSMean (SE) | PG LSMean (SE) | PFF LSMean (SE) | DB LSMean (SE) | Average Across All Ad Frames Within Audience |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Public Health | 53.52 (7.04) | **56.92 (7.22)** | **68.70 (7.17)** | 53.02 (8.73) | 35.84 (7.05) | 45.47 (7.24) | **54.03 (7.04)** | - | - | - | - | 53.22 (4.73) |
| Philanthropist | 73.97 (6.26) | **74.77 (6.22)** | **81.20 (6.22)** | **84.56 (6.29)** | 52.40 (6.22) | 65.49 (6.25) | 54.61 (6.22) | - | - | - | - | 69.70 (4.59) |
| Nutrition Enthusiasts | 73.10 (6.28) | **95.98 (6.17)** | **110.01\* (6.15)** | 74.28 (6.62) | 63.20\* (6.23) | 61.80\* (6.15) | - | 66.13\* (6.26) | - | - | - | 77.21 (4.68) |
| Conservative | 55.53 (7.11) | **86.67 (7.06)** | **89.82 (7.16)** | **81.09 (7.09)** | - | - | 52.74 (7.26) | 55.96 (7.33) | 68.19 (7.24) | - | - | 70.67 (4.71) |
| **Donations** | | | | | | | | | | | | |
| **AUDIENCE** | | | | | | | | | | | | |
| Young Adults | 8.22 (3.77) | **10.81 (5.71)** | 8.92 (6.74) | - | **26.02 (13.37)** | 7.86 (3.88) | - | - | - | 7.49 (6.99) | **25.67 (8.25)** | 12.79 (4.14) |
| Social Justice | 54.45 (9.79) | 58.46 (9.54) | **82.44 (9.82)** | **96.45 (9.80)** | 40.17 (13.37) | 46.50 (9.33) | 48.02 (9.43) | - | - | - | - | 60.59 (4.06) |
| Public Health | 38.51 (7.34) | **41.92 (7.54)** | **51.78 (7.48)** | 42.09 (9.11) | 28.72 (7.35) | 35.45 (7.55) | 39.52 (7.34) | - | - | - | - | 40.57 (4.16) |
| Philanthropist | **56.93 (4.29)** | 55.82 (4.26) | **63.98 (4.26)** | **68.95\* (4.31)** | 37.79\* (4.26) | 48.61 (4.28) | 38.42\* (4.26) | - | - | - | - | 53.08 (4.04) |
| Nutrition Enthusiasts | 57.49 (4.73) | **73.68 (4.65)** | **89.86\*\* (4.63)** | 58.43 (4.99) | 44.23\*\* (4.69) | 45.11\*\* (4.63) | - | 47.21\*\* (4.72) | - | - | - | 58.74 (4.12) |
| Conservative | 38.74\* (4.41) | **69.16\* (4.39)** | **68.81 (4.44)** | **70.78\* (4.40)** | - | - | 37.08\* (4.51) | 42.02 (4.55) | 56.40 (4.49) | - | - | 55.51 (4.14) |

Note: Video Views defined as having watched at least 50% of the video i.e. 30-seconds; the top three means for each outcome within each audience are bolded.

* These are frames with at least one statistically significant pairwise comparison at p<0.05 level within the specified audience for the specified outcome

** These are frames with at least one statistically significant pairwise comparison at p<0.01 level within the specified audience for the specified outcome

CE: Common Enemy/War Metaphor; DAA: Defiance Against Authority; EE: Entertainment & Emotional Appeal; SHSE: Second Hand Smoke Equivalent/Environmental Appeal FF: Information/Facts and Figures; SRJ: Social/Racial Justice; HC: Healthcare Costs/Tax Burden Appeal

**PPR:** Play on Personal Responsibility; **PG:** Play on Genetics; **PFF:** Protect Family and Friends; **DB:** Direct Behavioral Appeal