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Randomized Trial Evaluating Targeted Photographic Health Communication Messages in Three Stigmatized Populations: Physically-disabled, Senior, and Overweight/Obese Individuals

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Abstract

The homophily principle, that perceived similarities among people produce positive reactions, is a cross-cultural, global phenomenon. The prediction that photographs depicting models similar to the target population improve health communication was tested. Three nationally-representative

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Disclosure Statement

Ms. Buller is owner of Klein Buendel, Inc., which owns and markets the *Real Health Photos* stock image site. Dr. Bettinghaus, Ms. Liu, Mr. Fullmer, and Dr. Buller receive a salary from Klein Buendel, Inc. Dr. Andersen, Dr. Slater, Dr. Henry, and Ms. Fluharty have no disclosures.

samples (n=1,796) of adults who are disabled, seniors, or considered overweight/obese were selected from GfK's Knowledge Panel[®]. Participants read a message promoting physical activity and improved diets and responded to assessments of behavioral intentions, outcome and self-efficacy expectations, and identification. Photographs from a stock photograph service versus photographs created for the research project to match the three populations, *Real Health Photos (RHP)*, were included in the message. Structural equation modeling confirmed that *RHP* which matched the population increased behavioral intentions mediated by identification ($p<0.05$) in the physically-disabled and overweight/obese samples. Messages with only half of the matched *RHP* images had these same positive indirect effects ($p<0.05$). Matched visual images in health messages improved effectiveness by capitalizing on the homophily and identification processes. Health educators should leverage this hardwired, evolutionary, biological phenomena that extends to health status as well as race and ethnicity. For optimal effects, not all persons shown need to be homophilous to the target audience, reducing logistical difficulties in showing diverse persons of various types.

Keywords

Health Communication; Photographs; Identification; Underserved Populations

Introduction

Health communication researchers are constantly searching to find new and effective ways of fostering healthy lifestyles. Of particular concern is how to reach underserved groups with effective health messages. Progress has been made in tailoring and targeting health messages to racial and cultural minorities (Buller et al., 2018; Huang & Shen, 2016; M. W. Kreuter, Lukwago, Bucholtz, Clark, & Sanders-Thompson, 2003; Rimer & Kreuter, 2006), but less progress has been made in creating messages for underserved populations with particular health needs (Buller, Bettinghaus, Buller, Liu, & Fluharty, 2015), including people with disabilities (Rimmer & Rowland, 2008), who are elderly (hereafter called "seniors") (Cameron et al., 2009; Ory, Kinney Hoffman, Hawkins, Sanner, & Mockenhaupt, 2003), and who are obese (R. Puhl, Peterson, & Luedicke, 2013). Moreover, these three underserved groups are grossly underrepresented in popular media images and are often stigmatized so that they have to deal with prejudice and ostracization compared to people without obvious stigmas. The special problems of identity and exclusion for stigmatized individuals were described in Goffman's (1963) classic book, *Stigma: Notes on the management of a spoiled identity*. Classic stigmas, according to Goffman, comprise bodily abnormalities including those associated with disabilities like blindness or use of a wheelchair, obesity, and various changes that accompany aging. Goffman indicates reactions to these stigmas are reflexive and embodied, and thus visually recognizable to any observer. Stigmas result in social isolation, low esteem, and result in increased morbidity and mortality (Pachankis et al., 2018; Pantell et al., 2013).

Decades of research has shown that people with disabilities are stigmatized, branded, and considered an outgroup (Braithwaite, 1996; Goffman, 1963; Goldberg, 2017; Thompson & Seibold, 1978), avoided visually (Thompson, 1982), isolated (Braithwaite, 1990, 1996),

suffer from disease avoidance even when they have no disease (Park, Faulkner, & Schaller, 2003), and may constitute a different culture than able-bodied people (Braithwaite, 1990; Braithwaite & Braithwaite, 1997). Moreover, the stigma faced by disabled people is an independent determinant of poor health (Goldberg, 2017). People with disabilities are infrequently featured in any media (Rimmer, 2005), and uncommon in stock art images (Buller et al., 2015; Buller, Bettinghaus, & Liu, 2010). Buller et al. (2010), found that <1% of stock art depicted individuals with visible disability, <1% represented people who are obese, and only 3% showed seniors. Additionally, many people with disabilities have additional health needs and challenges due to their disability and may be homebound or have limited mobility (Braithwaite, Waldron, & Finn, 1999). Not surprisingly, people with disabilities are conspicuously absent from public fitness and recreation facilities (Rimmer, 2005).

People with obesity face problems similar to those with disabilities. They are stigmatized, avoided, and excluded (Pearl, 2018; R. M. Puhl & Heuer, 2009), underrepresented and negatively stereotyped in the media (Ata & Thompson, 2010; Gollust, Eboh, & Barry, 2012), and infrequently depicted in stock art images on the Internet (Buller et al., 2010). Indeed, recent research demonstrates that people on television, particularly women, are depicted as increasingly thin. When people who are obese are portrayed they are depicted as inarticulate, unintelligent, and the target of ridicule (Mastro & Figueroa-Caballero, 2018). Obesity is increasing and people who are obese are at risk for a variety of diseases and shortened life expectancies (Pi-Sunyer, 2009), which should be an important focus of health communication messages and campaigns.

Research on improving health for seniors is imperative because aging is associated with numerous diseases and the senior population is growing in size in many countries including the United States (Jin, Simpkins, Ji, Leis, & Stambler, 2015). Moreover, seniors are negatively stereotyped and underrepresented in both mainstream media and social media (Edström, 2018; Fraser, Kenyon, Lagace, Wittich, & Southall, 2016; Kelly, Watson, Pankratova, & Pedzeni, 2016; Levy, Chung, Bedford, & Navrazhina, 2014; Ye & Ward, 2010) and relatively uncommon in photographs on the Internet (Buller et al., 2010).

Increasingly, communication researchers are recognizing that the visual image offers a promising path to promote healthy lifestyles. Visual, nonverbal cues are a primary, powerful feature in persuasion (Moriarty, 1994; Segrin, 1993). These cues bear a direct relationship with their referent and have an automatic validity in terms of meaning (Andersen, 2008; Joffe, 2008). A picture of a dying young refugee does not require verbal explanation, it communicates iconically, cross-culturally, and directly. Emotional reactions, attitude change, and virtual presence can result from visual images alone, requiring little cognitive activity but nonetheless producing behavioral changes (Buck, Anderson, Chaudhuri, & Ray, 2004; Chaudhuri & Buck, 1995; Joffe, 2008; Messaris, 1997; Niederdeppe, Bu, Borah, Kindig, & Robert, 2008; Richards & Hample, 2016; Zillman, 2006). A source's appearance may be especially persuasive for individuals with low need for analytic cognition (Perlini & Hansen, 2001) and low literacy (Houts, Doak, Doak, & Loscalzo, 2006).

It is a global, cross-cultural phenomenon that humans gravitate to and are influenced by people similar or homophilous to themselves. Considerable research on the homophily principle has shown that perceived similarities among people increase interaction and promote attitude and behavior change (Haun & Over, 2013; Rogers, 2003). The homophily principle is a primary foundation of Diffusion of Innovations Theory (Rogers, 2003) and operates for a variety of personal and social characteristics (Alstott, Madnick, & Velu, 2014; Andersen & Kibler, 1978; Andersen & Todd-Mancillas, 1978). Rogers (2003) indicated that homophily between a receiver and a change agent or change agency is vital to quality communication and message acceptance. "An obvious principle of human communication is that the transfer of ideas occurs most frequently between two individuals who are similar or homophilous" (p. 19). Likewise, homophily plays an important role in Social Cognitive Theory; people are most likely to learn vicariously from the observed outcomes of the behavior by models that are similar to them (Bandura, 1986). Recent research has shown a biological predisposition to identify with others that are similar to oneself (Richards & Hample, 2016). A source's persuasiveness is increased if he/she is similar to a receiver through the processes of identification (McPherson, Smith-Lovin, & Cook, 2001; Richards & Hample, 2016; Rogers, 2003) and emotional engagement, (Monge & Contractor, 2003; Rogers, 2003), leading people to emulate the behavior of homophilous sources. Prior research has demonstrated that visual images employed in culturally-targeted health messages are effective in increasing attention, familiarity, identification, and compliance with health messages (Houts et al., 2006; Kreuter et al., 2003). Research has shown that verbal messages targeted to the particular needs of at-risk populations are especially effective (Dijkstra, de Vries, & Roijackers, 1998; Kreuter, Farrell, Olevitch, & Brennan, 2000; Kreuter et al., 2003) across a range of interventions especially for underrepresented groups (Keller & Lehman, 2008; Krebs, Prochaska, & Rossi, 2010; Kreuter et al., 2003; Noar, Benac, & Harris, 2007). However, prior research on homophily has primarily focused on demographic differences such as race, ethnicity, and gender.

The current study, by contrast, focuses on three populations that are underserved, at-risk for health issues, and often stigmatized: people with disabilities, seniors, and adults who are obese. It is hypothesized that inclusion of these groups in targeted, visual images accompanying health messages will make these messages more effective.

Hypothesis 1:

A health communication message will be more effective (i.e., create stronger behavioral intentions to increase physical activity and eat a healthy diet) when incorporating photographs that match the target population than photographs that do not match the population in disability, age, or weight.

Hypothesis 2:

The effectiveness of photographs that match the population on disability, age, or weight will be mediated by identification with persons in the photographs (i.e., matched photographs will increase identification relative to unmatched photographs and increased identification will be associated with greater behavioral intentions).

Research Question:

Does the influence of matched photographs in health messages differ based on the relative amount of matched photographs, that is all photographs matched or half photographs matched on disability, age, or weight?

Methods

Participants

Participants were comprised of three separate stratified samples of adults who are physically disabled (n= 694), senior (aged 65 or older, n=523), and overweight/obese (n=579) drawn by GfK from its Knowledge Panel® (see CONSORT diagram in Figure 1). These three underserved groups each have unique health challenges, experience health disparities, are often stigmatized, and have observable physical characteristics that uniquely identify them visually (Dutta & Kreps, 2013; Puhl & Heuer, 2009). Inclusion criteria were being 18 or older, in the panel in August 2013, able to read English, and consenting. The sample size was drawn to achieve power of 80% at a 10% change in behavioral intentions. GfK created its panel to ensure it was representative of the U.S. population (GfK Inc., 2013) and avoided Internet access issues by providing computer/Internet access to all panel members. When enrolled in the Knowledge Panel®, GfK pre-determined panel members' age; GfK screened panel members for physical disability and weight (i.e., overweight/obese was defined as body mass index [BMI] ≥ 30) for this study. The sample for physically-disabled individuals was filled first because it was the rarest (i.e., provided affirmative answer to, "Do you now have any health problem that requires you to use special equipment such as a cane, wheelchair, electric scooter, braces, or crutches? [include occasional use]"). Remaining quotas for overweight/obese and senior categories were filled in that order. Each participant was selected to represent a single sub-population, in the order quotas were filled (see above). Only one member of a household was sampled. Participants completed an online consent form and were paid an incentive equal to \$5.00.

Experimental Design and Procedures

Participants were enrolled in a 3 (photographs) $\times$ 3 (target population) factorial design. Each of the three target populations was pre-determined and interviewed through GfK's electronic survey system, taking just over 15 minutes. For each of the three samples, participants were randomly assigned to one of the three photographic conditions and researchers were blind to condition. A brief pretest was completed by the participants followed by presentation of the experimental health message containing the photographs. After reading the message, participants completed posttest outcome items. Next, they were again presented with the same experimental message so they could re-examine the photographs and text when responding to questions measuring theoretic mediators. Mediators were assessed following outcomes to avoid the chance that presentation of the mediator measure would prime the behavior intention assessments.

Experimental Message and Photographs

Eight photographs were embedded in a verbal health message, with consistent text and format across all conditions and samples. Three visual versions of the experimental message were created for each target population, one per experimental condition: (1) eight stock

photographs (non-*Real Health Photos [RHP]* condition), (2) four stock photographs and four *RHP* (half *RHP* condition), and (3) eight *RHP* (all *RHP* condition). The experimental message contained eight photographs (1-2 per page; approximately 3" × 4" horizontal or vertical layout), four depicting adults engaged in physical activity (2 male and 2 female models) and four showing adults engaged in healthy dietary behavior (2 male and 2 female models), constituting 21% of the message layout. Photographs were selected from either standard stock photographs available from a major stock photography service (*iStock Photo*) or a stock photography collection created by the research team that matched the six populations, named *RHP*. A previous evaluation of stock photography services established that stock photographs lacked diversity and primarily displayed young, attractive, healthy, and affluent-appearing persons (Buller et al., 2010). Eight stock photographs were selected by the researchers depicting models typically found in stock photograph services. All models were young and non-Hispanic whites, and appeared affluent and fit. None of these models matched participants on physically disabled, older age, or weight; to control for gender matching, half of the photographs depicted female and half male characters.

The *RHP* collection of photographs of the three target populations was developed by recruiting and photographing individuals diverse in socioeconomic levels in a variety of settings from homes to parks to clinics engaged in physical activity, healthy dietary behaviors (i.e., shopping, cooking, and eating healthy) or medical examinations. Photographs were taken by professional photographers; photographs had to meet pre-established quality criteria equivalent in quality to stock photographs. To select photographs, ten participants from each target population (n=30) reviewed 24 *RHP* depicting persons from their population selected by the authors: (a) six photographs of females being physically active (defined as lifestyle physical activity); (b) six photographs of females with food; (c) six photographs of males being physically active; and (d) six photographs of males with food. Each photograph was evaluated on five Likert-type questions about the similarity of the person in the photograph to the sub-population and six Likert-type questions about the quality of the photograph. Scores were averaged and the two highest-ranked photographs in each activity/gender group were selected. Another highly-ranked photograph was selected if the highest-ranked photographs contained the same model or similar activities. Each selected *RHP* matched only a single population characteristic (i.e., disability, age, and weight). Gender was controlled by displaying half female and half male models.

The health message was formatted into a full-color five-page newsletter article layout with 1684 words, seven call-out boxes, and two data tables. Content covered full pages with 12-point condensed type and half-inch margins in 8.5" × 11" format. The text promoted engaging in at least 150 minutes of physical activity per week with muscle strengthening activities and eating foods low in carbohydrates, fat, and sugar, using content from U.S. Department of Health and Human Services, National Institutes of Health, and Centers for Disease Control and Prevention websites.

Measures

The pretest assessed baseline physical activity (how physically active are you [5-point scale of not at all to extremely]; have you been regularly physically active in the past 6 months

[yes, no]), diet (how many servings of fruits and vegetables do you eat each day), smoking status (smoke cigarettes every day, some days, not at all but in the past, not at all or never smoked), and health status (5-point scale from poor to excellent).

Two primary outcomes were measured at posttest – intentions to increase moderate to vigorous physical activity and to improve diet by decreasing intake of high fat, high sugar, and high carbohydrate foods – immediately after participants read the experimental message on 5-point likelihood scales (1=extremely unlikely, 5=extremely likely) (see items and internal consistency reliability in Table 1). Meta-analysis has shown that behavioral intentions are a strong predictor of actual behavior (Webb & Sheeran, 2006). Secondary outcomes suggested by Social Cognitive Theory as predictors of behavior change were also assessed at posttest (see items and internal consistency reliability estimates in Table 1). Multi-item scales assessed positive outcome expectations, negative outcome expectations, and self-efficacy expectations for increasing physical activity and for improving diet were identified in principal components factor analysis. (Buller et al., 2018) Identification with persons in the photographs, the predicted theoretic mediators of matching photographs to the target populations, was measured using 7-point bi-polar adjective questions, adapted from published scales (Andersen & Todd-Mancillas, 1978; Slater & Rouner, 2002) (see items and internal consistency reliability estimate in Table 1). GfK provided demographic information on participants (Table 2).

Statistical Analysis

Structural equation modeling using Mplus was used to analyze the direct and indirect effects of *RHP* (i.e., treatment group) on primary outcomes (i.e., intentions) as well as on the theoretic mediator of identification with characters in photographs (mediator) and secondary outcomes of self-efficacy and outcome expectations (mediator) (see Figure 2) (Hayes & Preacher, 2014; Hayes, Preacher, & Myers, 2011). First, *RHP* and non-*RHP* groups were compared to test the prediction that *RHP* would improve message effectiveness (i.e., increase behavioral intentions) (H1) and do so through greater identification (H2). Next, half *RHP* and non-*RHP* groups were compared to examine the research question on the amount of matched photographs needed to achieve benefits of *RHP*. Analyses were performed separately within each population as replicates to examine the generalizability of the effect of *RHP*. Separate models were estimated for each primary outcome (i.e., intention to increase physical activity, and improve their diet).

Results

Profile of the Sample

The overall sample was evenly split on gender, over half had a college degree or education beyond high school; nearly a quarter were a racial/ethnic minority; a third were employed; and half had an annual income below \$50,000. Most were married, but only 1 in 5 had a child living in the home (average household size exceeded 2 persons). The majority lived in metropolitan areas, with the largest number of participants residing in the South and the least in the Northeast. Overall, 79% had Internet access when entering the panel. See Table 2 for the profile of the sample. There were several demographic differences among the samples of

participants who were physically-disabled, senior, and overweight/obese (Table 2). Seniors were oldest, had the lowest education, most likely to be white, non-Hispanic, live in smaller households, own their homes, not have children in the home, not be employed, or not have Internet access. Physically-disabled participants had the lowest income, were least likely to be married, and had the highest Internet access. Participants who were overweight/obese had the highest incomes and were most likely to be employed.

Overall Comparison of non-RHP versus RHP Conditions (H1 and H2)

Tables 3 and 4 present the results of the structural equation models. In all models, the direct effect of *RHP* on both behavioral intentions was non-significant comparing non-*RHP* to *RHP* conditions, failing to support Hypothesis 1. Instead, *RHP* had a significant, indirect effect on intentions to increase physical activity and improve diet through identification and attitude in the samples of individuals who were physically-disabled and overweight/obese, supporting Hypothesis 2. *RHP* increased participants' identification with the persons in the photographs and this increased identification in turn produced more favorable attitudes toward physical activity and healthy diet, which in turn led to greater intentions to increase physical activity and improve diet.

The failure to support H2 among seniors appeared to occur because this sample did not identify more with characters in the photographs when all of the photographs were *RHP* images. Another difference among the three samples was that the *RHP* had a second indirect effect on behavioral intention to improve diet among the physically-disabled participants directly through improved attitudes, bypassing identification with the characters in the photographs.

Comparison of No-RHP versus Half RHP (RQ)

The indirect influence of *RHP* on both behavioral intentions by way of increased identification and improved attitudes was supported in the comparison of half *RHP* to no-*RHP* condition in all three samples (Tables 3 and 4). However, once again, the physically-disabled participants also showed an indirect effect of the half *RHP* on behavioral intention to improve diet mediated only by improvements in attitudes.

Discussion

This study focusing on three populations that often experience stigma due to their physical characteristics (i.e., physical disability, older age, and obesity) highlighted the power of visual images and the homophily principle in health communication. Visually portraying persons with similar stigmatized physical characteristics to message recipients improved message effectiveness (Kreuter et al., 2003). Sources and messages that are homophilous with receivers have been shown to increase personal relevance and effectiveness of health messages (Centola, 2011; Kim, Koniak-Griffin, Flaskerud, & Guarnero, 2004; Wiehagen et al., 2007; Woodruff, Talavera, & Elder, 2002). This study further demonstrates that health messages with greater photographic homophily or similarity with an audience from a change agency (in this case message from U.S. Department of Health and Human Services, National Institutes of Health, and Centers for Disease Control and Prevention) promotes message

identification and behavioral intentions to adopt healthy behaviors. Physical appearance of models in the *RHP* provided meaning for message recipients that influenced attitudes about (Andersen, 2008; Gibson & Zillmann, 2000; Gollust et al., 2012; Houts et al., 2006; Saguy & Gruys, 2010; Zillman & Brosius, 2000) and affective reactions to the health messages (Buck et al., 2004; Chaudhuri & Buck, 1995; Joffe, 2008; Messaris, 1997; Niederdeppe et al., 2008; Zillman, 2006).

This study supports the addition of a nonverbal, visual component to the existing approaches to tailoring and targeting of health messages. Matching of verbal, non-visual message content to recipients' characteristics (i.e., tailoring) has improved message effectiveness in past studies (Dijkstra et al., 1998; Keller & Lehman, 2008; Krebs et al., 2010; Kreuter et al., 2000; Kreuter & Wray, 2003; Noar et al., 2007). The present results showed that like tailoring verbal information in health messages (Forehand & Deshpande, 2001), matching visual information (i.e., photographs of "real" people from the same social group) is an important driver of message effectiveness. Future health messages that employ photographic or other visual content such as videos should benefit from including images that resemble their target audience. The present results also confirmed identification was the explanatory mechanism by which matching of photographic images to message recipients enhanced persuasive power (McPherson et al., 2001; Rogers, 2003). Identification should emotionally engage recipients and motivate them to be receptive to information they receive on new behaviors and enact new behaviors they witness being performed by the similar-appearing sources (Monge & Contractor, 2003; Rogers, 2003). Identification may be especially influential when distinctive characteristics that are relevant to the self-identity of recipients are depicted in visual images (Forehand & Deshpande, 2001; Forehand, Deshpande, & Reed, 2002; McGuire & Padawer-Singer, 1976). Physical features that define individuals with physical disabilities, older age, and obesity are visually notable.

Homophily and resulting identification is likely a hardwired, evolutionary, biological phenomenon across species and cultures and a proxy for interpersonal familiarity (Christakis & Fowler, 2014; Fu, Nowak, Christakis, & Fowler, 2012; Haun & Over, 2013; Richards & Hample, 2016). This may explain why the effects replicated across the populations and health behavior intentions. Support for the fundamental nature of this homophily process was also obtained in a similar experiment matching photographs to three racial/ethnic minority groups (i.e., African Americans, Hispanics, and Native Americans) (Buller et al., 2018), suggesting that visual identification with health communication models is a robust principle. Across six distinct populations in these two studies the favorable effects of *RHP* were at most moderate in size. Moreover, they occurred by matching photographs on just a single characteristic, so it would be useful to test whether matching on additional features would increase the size of this effect. Health communication practitioners should carefully consider the selection of visual images when designing health communication and these data provide empirical evidence for recommending the use of photographs depicting characters with similar physical characteristics to message recipients.

For this study, the authors created the *RHP* stock photograph library of "real" individuals who were physically disabled, older, and obese to produce the experimental messages (see www.realhealthphotos.com). The largest stock photography libraries mostly depict

attractive, young, and affluent-appearing individuals (Buller et al., 2010), which may be counter-productive with some target populations when included in health messages. There is evidence that people may not seek help from highly-attractive sources because identification is low (Nadler, Shapira, & Ben, 1982). Unfortunately, health communication practitioners may find it difficult to locate sufficient images of target populations that have uncommon physical characteristics such as physical disabilities.

The findings testing the half-RHP condition have some interesting implications. From a practical point of view, it may not be necessary to match all photographs to target populations or create entirely different communications for every population. Including at least *some* photographs depicting the target population may stimulate identification, and enhance persuasion. Seniors in particular may react better when older persons are depicted within a diverse age distribution. Perhaps seniors dislike older age to be highlighted or to feel segregated. These results suggest if the health communication messages depict an ensemble of characters with various physical features, some of which match each major target population, the message may be just as effective which would make health communication more cost-effective.

It is curious that among physically-disabled participants' behavioral intentions were influenced by the *RHP* not only through the homophily principle (i.e., identification) but also directly through changes in attitudes. Perhaps this group encounters so few photographic depictions of "real" disabled individuals that it created a strong positive affective reaction that influenced attitudes, separate from its influence on identification. Another possibility is that the depictions stimulated other processes such as modeling that affected attitudes. In our study of racial/ethnic minorities, the Native American sample, the smallest minority population, behaved differently (i.e., being influenced primarily when all *RHP* were included), suggesting that some target populations may react in unique ways to visual images, beyond the homophily principle.

The study had several strengths and limitations. Strengths included that the hypotheses were grounded in a strong theoretical principle and the findings were replicated in three large samples from a high-quality national panel providing sufficient statistical power (Ioannidis, 2005). The randomized, between-subjects design avoided threats to internal validity. Limitations of the study included the fact that participants represented just one group regardless of other characteristics. These other characteristics were allowed to freely vary and were treated as a random error in sample classification in the analysis. The samples appeared to be well educated but several participants had lower incomes, especially individuals who were physically disabled. Also, a quarter of participants were in a racial/ethnic minority group and we found that in a companion study, photographs depicting characters of similar race/ethnicity increased identification and behavioral intentions (Buller et al., 2018). Moreover, this was a short duration study with self-report assessments of instant reactions and behavioral intentions not actual behavior that could be biased by social desirability and demand effects. The measures of physical activity and diet may not have been equivalent, which is why they were analyzed separately. Also, some participants with low health literacy may not have understood the distinction between fruits and vegetables, high fat, and high carbohydrate foods and participants may have varied in their access to

fruits and vegetables. Also, the depth of message processing was not controlled so participants may have only skimmed the message. Additional studies with multiple messages, repeated exposure, and behavioral outcomes should be conducted to describe the full potential of the homophily principle in health messages.

The aphorism that “a picture is worth a thousand words” encapsulates the power of the visual image in communication. This appears to be true for health communication for underserved populations with physical characteristics that often stigmatize and ostracize them and make them feel excluded. Visual images that are inclusive of these stigmatized people may be a promising method for reaching these populations. The *RHP* image collection capitalized on the power of visual images to increase health communication impact through the fundamental principle of homophily.

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FIGURE 1:
Consort Diagram for Trail - Physically-Disabled, Seniors, & Overweight/Obese Samples

FIGURE 2: Illustration of Structural Equation Model Estimated
Key to Paths Modelled in Structural Equation Modelling

Direct Effects:

α_1 : Path coefficient relating the independent variable (X = Treatment) to the first step mediator (M₁ = Identification).

α_2 : Path coefficient relating the independent variable (X = Treatment) to the second step mediator (M₂ = Attitude).

α_3 : Path coefficient relating the first step mediator (M₁ = Identification) to the second step mediator (M₂ = Attitude).

β_1 : Path coefficient relating the first step mediator (M₁ = Identification) to the dependent variable (Y = Intention), adjusted for the independent variable (X = Treatment).

β_2 : Path coefficient relating the second step mediator (M₂ = Attitude) to the dependent variable (Y = Intention), adjusted for the independent variable (X = Treatment).

τ' : Direct effect of independent variable (X = Treatment) on dependent variable (Y = Intention)

Indirect Effects:

Indirect effect through M_1 : $\alpha_1\beta_1$

Indirect effect through M_2 : $\alpha_2\beta_2$

Indirect effect through M_1 and then M_2 : $\alpha_1\alpha_3\beta_2$

Total indirect effect: $\alpha_1\beta_1+\alpha_2\beta_2+\alpha_1\alpha_3\beta_2$

Table 1.**Multi-item Scales Assessing Primary and Secondary Outcomes and Theoretical Mediators**

Intentions	
Physical Activity (Cronbach's alpha=0.65) <ul style="list-style-type: none"> • How likely are you to do 150 minutes of moderate to vigorous physical activity each week over the next month? • How likely are you to be more physically active in the next month than you have been in the past 6 months? 	Diet (Cronbach's alpha=0.87) <ul style="list-style-type: none"> • How likely are you to eat healthy in the next month by reducing high-fat foods? • How likely are you to eat healthy in the next month by reducing high-sugar foods? • How likely are you to eat healthy in the next month by reducing high-carbohydrate foods? • How likely are you to make changes to your diet that will improve your health?
Positive Outcome Expectations	
Physical Activity (Cronbach's alpha=0.80) <ul style="list-style-type: none"> • Physical activity makes me feel better. • Physical activity gives me a sense of personal accomplishment. • Physical activity will aid in weight control. • If I increase my physical activity, I expect to be happier. • If I increase my physical activity, I expect to have more self-respect. 	Diet (Cronbach's alpha=0.86) <ul style="list-style-type: none"> • Eating healthy makes my mood better, in general. • Eating healthy gives me a sense of personal accomplishment. • Eating healthy increases my energy. • If I improve my diet, I expect to enjoy life more. • If I improve my diet, I expect to feel self-confident.
Negative Outcome Expectations	
Physical Activity (Cronbach's alpha=0.59) <ul style="list-style-type: none"> • Physical activity makes me extremely tired. • Doing physical activity is boring. • I experience a lot of pain when I am physically active. • When I am physically active, I become resentful of those that are more fit than me. 	Diet (Cronbach's alpha=0.65) <ul style="list-style-type: none"> • Eating healthy is boring. • I still have cravings for junk food when I eat healthy. • Healthy foods like fruits and vegetables just don't fill me up. • Finding healthy foods is inconvenient and hard to do.
Self-efficacy Expectations	
Physical Activity (Cronbach's alpha=0.72) <ul style="list-style-type: none"> • If I increase my physical activity, I expect to have control of my overall health. • I feel I have control over my physical activity levels. • How certain are you that you can be physically active? • How confident are you that you can do moderate or vigorous intensity physical activity for at least 10 minutes a day? 	Diet (Cronbach's alpha=0.70) <ul style="list-style-type: none"> • If I improve my diet, I expect to be in control of my health. • I feel that I have control over the changes I make to my diet. • How certain are you that you can eat healthy foods such as those that are low in fat, sugar, and carbohydrates. • How confident are you that you will be able to improve your diet in the future.
Identification with Persons in Photographs (Cronbach's alpha=0.93)	
<ul style="list-style-type: none"> • I cannot/can relate to them. • I see them as different/similar from me. • They do not look like/look like me. • I do not feel/feel connected to them. 	

Table 2:

Demographic Profile of the Sample

Demographics	Physically-Disabled Adults	Seniors	Overweight/Obese Adults	Overall
N	694	523	579	1796
Age [*] (std. dev.)	57.58 (15.54)	72.34 (6.28)	51.44 (15.81)	59.90 (15.98)
Education [*]				
Less than high school	9.8%	12.1%	8.8%	10.1%
High school	30.4%	32.7%	28.7%	30.5%
Some college	34.6%	25.2%	34.0%	31.7%
Bachelor's degree or higher	25.2%	30.0%	28.5%	27.7%
Race and Ethnicity [*]				
White, Non-Hispanic	73.6%	84.7%	73.4%	76.8%
Black, Non-Hispanic	13.4%	4.6%	12.3%	10.5%
Other, Non-Hispanic	1.0%	2.7%	1.7%	1.7%
Hispanic	9.2%	5.7%	10.5%	8.6%
More than one race, Non-Hispanic	2.8%	2.3%	2.1%	2.4%
Gender				
Female	49.6%	48.4%	49.2%	49.1%
Male	50.4%	51.6%	50.8%	50.9%
Head of Household [*]				
No	14.8%	5.4%	17.8%	13.0%
Yes	85.2%	94.6%	82.2%	87.0%
Household Size [*] (std. dev.)	2.41 (1.38)	1.94 (0.89)	2.62 (1.51)	2.34 (1.33)
Income [*]				
Less than \$25,000	30.3%	17.2%	20.1%	23.2%
\$25,000 - \$49,999	26.2%	30.0%	24.7%	26.8%
\$50,000 - \$99,999	29.0%	33.3%	33.3%	31.6%
\$100,000 or more	14.5%	19.5%	21.9%	18.4%
Marital Status [*]				
Married or living with partner	56.6%	65.0%	63.2%	61.2%
Widowed/Divorced/Separated	28.5%	30.6%	18.0%	25.7%
Never married	14.9%	4.4%	18.8%	13.1%
MSA Status				
Non-Metro	15.3%	17.0%	16.2%	16.1%
Metro	84.7%	83.0%	83.8%	83.9%
Region				

Demographics	Physically-Disabled Adults	Seniors	Overweight/Obese Adults	Overall
Northeast	18.9%	17.6%	19.2%	18.6%
Midwest	23.5%	22.9%	22.8%	23.1%
South	34.6%	37.1%	36.4%	35.9%
West	23.0%	22.4%	21.6%	22.4%
Ownership Status of Living Quarters *				
Rent	31.8%	16.6%	24.9%	25.2%
Own	68.2%	83.4%	75.1%	74.8%
Have Kids under 18 Years Old? *				
No	81.3%	95.0%	70.5%	81.8%
Yes	18.7%	5.0%	29.5%	18.2%
Current Employment Status *				
Not working	70.5%	86.6%	45.6%	67.2%
Working	29.5%	13.4%	54.4%	32.8%
Household Internet Access *				
No	14.7%	27.2%	23.8%	21.3%
Yes	85.3%	72.8%	76.2%	78.7%

* indicates statistically significant difference across the three subsamples ($p < 0.05$).

Table 3.

Path Coefficients and Indirect Effects from Multiple-Step Mediation Analysis Comparing Non-RHP vs. RHP and Half/Half on Behavioral Intentions Related to Physical Activity by Subsample

Path Coefficients	Physically-disabled Adults			Seniors			Overweight/Obese Adults		
	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value
β_1 ($M_1 \rightarrow Y$)	0.08 (0.05)	0.08 (0.04)	0.081	-0.03 (0.05)	-0.03 (0.05)	0.536	0.04 (0.05)	0.04 (0.05)	0.388
β_2 ($M_2 \rightarrow Y$)	0.73 (0.06)	1.35 (0.14)	<0.001	0.89 (0.09)	1.66 (0.19)	<0.001	0.63 (0.06)	1.28 (0.14)	<0.001
α_3 ($M_1 \rightarrow M_2$)	0.23 (0.04)	0.12 (0.02)	<0.001	0.26 (0.04)	0.14 (0.02)	<0.001	0.15 (0.04)	0.07 (0.02)	0.001
τ_1 ($X_1 \rightarrow Y$) [*]	0.01 (0.10)	0.00 (0.08)	0.957	0.08 (0.11)	0.07 (0.09)	0.445	0.08 (0.10)	0.06 (0.08)	0.436
α_{11} ($X_1 \rightarrow M_1$) [*]	0.65 (0.09)	0.55 (0.08)	<0.001	0.21 (0.11)	0.17 (0.09)	0.053	0.52 (0.10)	0.43 (0.09)	<0.001
α_{12} ($X_1 \rightarrow M_2$) [*]	-0.19 (0.10)	-0.08 (0.04)	0.048	-0.01 (0.09)	0.00 (0.04)	0.946	0.03 (0.10)	0.01 (0.04)	0.772
τ_2 ($X_2 \rightarrow Y$) [*]	-0.04 (0.09)	-0.03 (0.08)	0.677	0.15 (0.11)	0.12 (0.09)	0.168	0.08 (0.10)	0.07 (0.08)	0.411
α_{21} ($X_2 \rightarrow M_1$) [*]	0.51 (0.09)	0.43 (0.08)	<0.001	0.47 (0.10)	0.38 (0.09)	<0.001	0.59 (0.10)	0.49 (0.09)	<0.001
α_{22} ($X_2 \rightarrow M_2$) [*]	-0.06 (0.09)	-0.02 (0.04)	0.540	-0.15 (0.09)	-0.07 (0.04)	0.085	-0.03 (0.10)	-0.01 (0.04)	0.786
Indirect Effects	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value
$\alpha_{11}\beta_1$ ($X_1 \rightarrow M_1 \rightarrow Y$)	0.05 (0.03)	0.04 (0.03)	0.091	-0.01 (0.01)	-0.01 (0.01)	0.555	0.02 (0.02)	0.02 (0.02)	0.394
$\alpha_{12}\beta_2$ ($X_1 \rightarrow M_2 \rightarrow Y$)	-0.14 (0.07)	-0.11 (0.06)	0.051	-0.01 (0.08)	0.00 (0.07)	0.946	0.02 (0.06)	0.02 (0.05)	0.772
$\alpha_{11}\alpha_3\beta_2$ ($X_1 \rightarrow M_1 \rightarrow M_2 \rightarrow Y$)	0.11 (0.03)	0.09 (0.02)	<0.001	0.05 (0.03)	0.04 (0.02)	0.068	0.05 (0.02)	0.04 (0.02)	0.007
$\alpha_{21}\beta_1$ ($X_2 \rightarrow M_1 \rightarrow Y$)	0.04 (0.03)	0.03 (0.02)	0.096	-0.02 (0.03)	-0.01 (0.02)	0.540	0.02 (0.03)	0.02 (0.02)	0.393
$\alpha_{22}\beta_2$ ($X_2 \rightarrow M_2 \rightarrow Y$)	-0.04 (0.07)	-0.03 (0.05)	0.540	-0.14 (0.08)	-0.11 (0.07)	0.088	-0.02 (0.06)	-0.01 (0.05)	0.786
$\alpha_{21}\alpha_3\beta_2$ ($X_2 \rightarrow M_1 \rightarrow M_2 \rightarrow Y$)	0.09 (0.02)	0.07 (0.02)	<0.001	0.11 (0.03)	0.09 (0.03)	0.001	0.06 (0.02)	0.05 (0.02)	0.005

Key to Variables Modelled:

X_1 : RHP vs. non-RHP

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X₂: Half RHP vs. non-RHP

M₁: Identification with people in the photographs

M₂: Attitude towards physical activity

Y: Intention to improve physical activity

[†] Standardized coefficient for binary predictors was standardized with respect to the outcomes only.

* Covariates controlled in the models: Current physical activity level, smoking status, general health status, number of servings of fruits and vegetables per day, age, education, gender, and income.

Table 4.

Path Coefficients and Indirect Effects from Multiple-Step Mediation Analysis Comparing Non-RHP vs. RHP and Half/Half on Behavioral Intentions Related to Healthy Diet by Subsample

Path Coefficients	Physically-disabled Adults			Seniors			Overweight/Obese Adults		
	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value
β_1 ($M_1 \rightarrow Y$)	0.06 (0.04)	0.05 (0.04)	0.200	0.03 (0.05)	0.03 (0.04)	0.466	0.07 (0.05)	0.06 (0.04)	0.172
β_2 ($M_2 \rightarrow Y$)	0.60 (0.04)	0.83 (0.07)	<0.001	0.71 (0.05)	1.05 (0.11)	<0.001	0.53 (0.05)	0.80 (0.09)	<0.001
α_3 ($M_1 \rightarrow M_2$)	0.39 (0.04)	0.28 (0.03)	<0.001	0.28 (0.05)	0.17 (0.03)	<0.001	0.26 (0.05)	0.16 (0.03)	<0.001
τ_1 ($X_1 \rightarrow Y$) [*]	0.05 (0.09)	0.04 (0.08)	0.619	-0.11 (0.10)	-0.08 (0.07)	0.259	-0.07 (0.10)	-0.05 (0.08)	0.469
α_{11} ($X_1 \rightarrow M_1$) [*]	0.64 (0.09)	0.55 (0.08)	0.000	0.21 (0.11)	0.17 (0.09)	0.052	0.52 (0.10)	0.43 (0.09)	0.000
α_{12} ($X_1 \rightarrow M_2$) [*]	-0.41 (0.10)	-0.25 (0.06)	0.000	0.07 (0.10)	0.03 (0.05)	0.496	-0.05 (0.11)	-0.03 (0.05)	0.642
τ_2 ($X_2 \rightarrow Y$) [*]	0.09 (0.09)	0.07 (0.07)	0.296	-0.14 (0.10)	-0.10 (0.07)	0.154	-0.05 (0.10)	-0.04 (0.08)	0.619
α_{21} ($X_2 \rightarrow M_1$) [*]	0.51 (0.09)	0.43 (0.08)	<0.001	0.46 (0.10)	0.38 (0.09)	<0.001	0.59 (0.10)	0.49 (0.09)	<0.001
α_{22} ($X_2 \rightarrow M_2$) [*]	-0.23 (0.09)	-0.14 (0.06)	0.015	-0.08 (0.10)	-0.04 (0.05)	0.438	-0.04 (0.11)	-0.02 (0.06)	0.729
Indirect Effects	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value
	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value	Standardized Regression Coefficient [†] (S.E.)	Unstandardized Regression Coefficient (S.E.)	p-value
$\alpha_{11}\beta_1$ ($X_1 \rightarrow M_1 \rightarrow Y$)	0.03 (0.02)	0.03 (0.02)	0.208	0.01 (0.01)	0.01 (0.01)	0.495	0.03 (0.03)	0.03 (0.02)	0.186
$\alpha_{12}\beta_2$ ($X_1 \rightarrow M_2 \rightarrow Y$)	-0.14 (0.06)	-0.20 (0.05)	<0.001	0.05 (0.07)	0.04 (0.05)	0.496	-0.03 (0.06)	-0.02 (0.04)	0.643
$\alpha_{11}\alpha_3\beta_2$ ($X_1 \rightarrow M_1 \rightarrow M_2 \rightarrow Y$)	0.12 (0.03)	0.12 (0.03)	<0.001	0.04 (0.02)	0.03 (0.02)	0.068	0.07 (0.02)	0.05 (0.02)	0.001
$\alpha_{21}\beta_1$ ($X_2 \rightarrow M_1 \rightarrow Y$)	0.04 (0.03)	0.02 (0.02)	0.212	0.02 (0.02)	0.01 (0.02)	0.472	0.04 (0.03)	0.03 (0.02)	0.184
$\alpha_{22}\beta_2$ ($X_2 \rightarrow M_2 \rightarrow Y$)	-0.25 (0.06)	-0.11 (0.05)	0.017	-0.06 (0.07)	-0.04 (0.05)	0.439	-0.02 (0.06)	-0.02 (0.04)	0.729
$\alpha_{21}\alpha_3\beta_2$ ($X_2 \rightarrow M_1 \rightarrow M_2 \rightarrow Y$)	0.15 (0.03)	0.10 (0.02)	<0.001	0.09 (0.03)	0.07 (0.02)	0.001	0.08 (0.02)	0.06 (0.02)	<0.001

Key to Variables Modelled:

X_1 : RHP vs. non-RHP

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X₂: Half RHP vs. non-RHP

M₁: Identification with people in the photographs

M₂: Attitude towards diet

Y: Intention to improve diet

[†] Standardized coefficient for binary predictors was standardized with respect to the outcomes only.

* Covariates controlled in the models: Current physical activity level, smoking status, general health status, number of servings of fruits and vegetables per day, age, education, gender, and income.