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ORIGINAL PAPER

Adults' Reaction to Public Health Messaging: Recall, Media Type, and Behavior Change Motivation

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Abstract

This paper focuses on effective messaging practices identified in data collected after 10 years of implementing a gain-framed messaging campaign encouraging healthier behaviors in middle-aged and older adults. In Study 1, we measured message recall and intended health behaviors in an intercept survey of 733 adults. Binary logistic regression indicated that women were more likely than men to report intent to change behavior. Recalling messages from billboards or fliers was associated with a lower likelihood of intended behavior change, and media type was associated with intended behavior for those who saw the message online (reducing screen time) or on television (increasing physical activity and ceasing smoking). Study 2 focused on adult generational differences in response to the campaign and types of media used to access information. Data from an intercept survey of 604 clients at agencies serving low-income adults were segmented into three age groups: under 35, ages 35–54, and ages 55+. Recall and reaction to campaign materials differed by age group, and the influence of life stage factors and health costs varied across age groups. Television and newspapers were most frequently reported by the oldest group, and social media and online news/blogs were most frequently chosen by the youngest group. Campaign response of adults older than age 35 aligned with goals of improving health behaviors. Together, these studies indicate that diffuse messaging strategies may raise overall awareness, and targeted strategies may be more influential in motivating behavior change. Influential factors and media should be differentially leveraged to target different age cohorts of adults.

Keywords Gain-framed messaging · Adult · Communications media · Age differences · Health behavior

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Introduction

Obesity is a complex phenomenon, with contributing factors at all levels of the social ecological model (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015), and the obesity epidemic is a concern across much of the United States. In the state of Missouri, adult obesity rates have continued to rise over the past 25 years, and as of 2018, 35.0% of adults in the state were obese according to self-reported height and weight (Warren et al., 2019). The prevalence of obesity was highest among middle-aged and older adults, with the greatest percentage of people who were obese (39.7%) in the group ages 45–64 years. Missouri's mortality rates are above the national average for cardiovascular disease, end-stage renal disease, and chronic obstructive pulmonary disease (Centers for Disease Control & Prevention, 2021), all of which are chronic diseases complicated by obesity.

Campaign Development and Implementation

In response to these obesity-related public health challenges, public health practitioners developed a coordinated messaging campaign for adults ages 45 and over, based on evidence that messaging campaigns can be effective in producing positive changes in health behaviors at the population level (Snyder et al., 2004). The development of the *Live Like Your Life Depends On It* (LLYLDOI) message campaign began in 2007 in response to Missouri's trends in chronic diseases, which included adult obesity. This campaign was a joint effort between agencies operating at the local, regional, and state levels, as well as other organizational partners that were interested in chronic disease prevention among middle-aged and older adults (Missouri Deparment of Health and Senior Services, 2021). The campaign was developed in alignment with the Health Belief Model (Skinner et al., 2015), and employed a gain-framed messaging strategy to reinforce self-efficacy in the target audience (Hensel & Cameron, 2007; Rothman et al., 2006). Gain-framed messaging strategies focus on the benefits for a target audience of complying with a health message, and are thought to be more effective than loss-framed messaging for general preventive behaviors (Arendt et al., 2018; Fetter et al., 2019; Gallagher & Updegraff, 2012). For example, *Live Like Your Life Depends On It* focuses on healthy aging rather than susceptibility to chronic age-related health conditions such as diabetes, cancer, and heart disease. The LLYLDOI campaign conveyed this message using a variety of media methods, including posters, fliers, billboards and other signage, and radio and television PSAs. Focus groups guided the development and testing of these marketing messages. The campaign goals were (1) to increase adoption of recommended dietary and physical activity behaviors; (2) to increase prevention and control behaviors; and for partnering organizations, (3) to promote these messages in a coordinated manner statewide (Missouri Deparment of Health and Senior Services, 2021). In the early stages of

the campaign (2008), approximately 25% of the target audience reported seeing or hearing the LLYLDOI campaign (Homan et al., 2010).

It is important for a communication campaign to effectively target the intended audience, to use communication methods that they frequently access, and to communicate a message that resonates with them (Lefebvre, 2011). Because of these considerations, a continual re-examination of the target audience is necessary for a messaging campaign to be most effective. Since the development and testing of LLYLDOI in 2007, a new cohort of Missourians has aged into the target audience segment of those ages 45 and over. These younger middle-aged adults may have different information needs or behavior-change motivators than existed at the time of the campaign's development. For example, passage of the Affordable Care Act of 2010 (P.L. 111–148) occurred after LLYLDOI was first implemented, and may have affected the extent to which individuals consider health care costs in motivating behavior change. It is important to consider that the campaign may have been tailored to a particular cohort (age 45+ in 2007), as opposed to those who are of a particular age (ages 45+ in general).

Individuals are also able to interact with the media market in more interactive ways since the message was first developed. For example, emerging technologies such as social media and online news are increasingly being used to connect people with information. National polls have indicated that digital divides that mark technology adopters from non-adopters continue to exist based on several factors such as age, income, community type, and education (Anderson & Perrin, 2017; Fang et al., 2019). Access to technology continues to improve, with the majority (67%) of seniors able to access the internet, and at least half have broadband access in their homes (Anderson & Perrin, 2017). Internet access also remains slightly lower for those with lower incomes, of racial or ethnic minorities, or who live in rural areas (Perrin & Duggan, 2015). At the same time, the prominence of other forms of media, such as television and cable service, has continued to decrease in the US, particularly among younger generations (Taylor & Wang, 2010).

Study 1

Study 1 had two objectives. First, we wanted to determine whether adults were able to successfully recall the campaign message. Second, we wished to assess the association between campaign message recall and respondents' motivation to engage in healthy behaviors after 10 years of campaign activity.

Method

A total of 830 non-institutionalized adults ages 18+ completed an anonymous intercept survey in 2016 at approximately 100 sites across Missouri serving low-income audiences. Data collection staff spent between one and two hours at each site and approached clients in waiting areas to invite them to participate in the survey. Participants were adults able to read and write in English. We purposely included

adults under the age of 45 to examine age as a variable in our results. We excluded responses with missing or invalid data for age ($n = 6$), gender ($n = 14$), or race/ethnicity ($n = 13$). We also excluded responses that were missing data for ZIP code or reported a ZIP code that was not in Missouri ($n = 64$) because those respondents may not have been exposed to the LLYLDOI campaign activities.

The final sample consisted of 733 respondents age 18-90 (see Table 1). The University of Missouri Campus Institutional Review Board approved this study as a quality improvement project.

Table 1 Respondent characteristics and recall of selected messages

Variable	*n*	Affirmative Responses	%	95% CI	
				LL	UL
Respondent characteristic	733				
Male		165	22.7	19.9	25.5
Identified as racial and/or ethnic minority		152	20.9	18.1	23.8
Age (mean years)		48.3	-	47.3	49.4
Partially-aided recall message	733				
Number of messages recognized (mean; 0-8)		4.3	-	4.1	4.4
Messages assessed:					
Eat More Fruits and Veggies		582	79.4	76.4	82.3
Eat Smart		552	75.3	71.9	78.3
Live Like Your Life Depends On It		524	71.5	68.1	74.6
Five a Day		457	62.3	58.8	65.8
Move More		349	47.6	44.1	51.3
Healthy Schools, Healthy Communities		270	36.8	33.2	40.7
Don't Sit, Be Fit		264	36.0	32.5	39.5
We Stock Healthy So You Can Shop Healthy		136	18.6	15.9	21.5
Aided recall measures	634				
Number of images recognized (mean; 1-4)		1.13	-	1.07	1.2
Media type:					
Poster		244	38.5	34.5	42.5
Billboard		172	27.1	23.6	30.5
Flier or brochure		93	14.7	12.0	17.6
Facebook or social media		75	11.8	9.1	14.5
Television		67	10.6	8.1	13.0
Radio		38	6.0	4.3	8.0
Number of media types recalled (mean; 1-6)		1.1	-	1.0	1.2
Target behaviors					
Make healthier food choices	697	613	87.9	85.5	90.4
Be more physically active	665	482	72.5	69.2	75.9
Reduce screen time	630	334	53	49.1	56.8
Stop smoking	575	231	40.2	36.4	44.5

CI Confidence interval, *LL* lower limit, *UL* upper limit

We used an electronic tablet and Qualtrics software (Qualtrics, 2016) to assess participants' recall of the LLYLDOI message (Bauman et al., 2001). Data collection staff read the survey instructions to the participant: *This is a short survey. It asks about messages you may have seen about making healthy choices. You might also think of these as saying or slogans. Sometimes they are called PSAs. This is not a test. There are no wrong answers. Your participation is voluntary. You may choose to end the survey at any time.* Participants completed the instrument independently, although data collection staff were available to assist if needed. Our instrument included four main questions: (1) an unaided recall question: *Think of some messages or slogans you have heard or seen. Are any of them about health or nutrition? Please list up to six health or nutrition messages you can think of*; (2) a partially-aided recall question: *Have you seen or heard any of the following messages? (LIST OF EIGHT MESSAGES; order randomized*); and (3) an aided recall question: *Have you ever seen or heard the message: Live Like Your Life Depends On It?* In the aided recall question, those indicating *yes* or *maybe* viewed four images used in the campaign, identified images of the message(s) they saw, and the format(s) in which they observed them (*billboard*, *television*, *radio*, *Facebook or social media*, *flier or brochure*, or *poster*). (4) We asked all participants to indicate (*yes*/*no*) whether the LLYLDOI message helped them to engage in each of four behaviors: *Make healthier food choices*; *Be more physically active*; *Spend less time watching TV, using the computer, or playing video games*; and *Stop smoking*. The mean survey completion time was 6.25 min ($SD = 7.79$).

We conducted binary logistic regression to test the association between exposure to campaign materials and respondents' likelihood of reporting motivation to change behavior. Participant demographic characteristics and media formats constituted independent variables, and each behavior was the dependent variable in one of the four models (Hosmer et al., 1997). We used IBM SPSS 24 for data analysis (IBM Corp., 2016).

Results

Respondents provided a total of 2555 unaided recall messages, a mean of 3.4 messages per respondent (95% CI = 3.33, 3.63). A total of 120 participants (out of 733) listed the LLYLDOI message (16.4%; 95% CI = 13.7, 19.2), which constituted 4.6% of all messages named during unaided recall (95% CI = 0.03, 0.05). In the partially aided recall question, LLYLDOI was recognized by the majority of respondents, 71.5% (see Table 1). Respondents who recognized the LLYLDOI message in the aided recall question most frequently reported encountering the LLYLDOI message on posters, billboards, and fliers or brochures; radio was the least frequently indicated.

Table 2 presents our analysis of the behavioral models. Neither age nor identification as a racial or ethnic minority was related to the likelihood of reporting the LLYLDOI message promoted behavior change. Males had a lower likelihood of indicating the LLYLDOI message promoted behavior change with the exception of smoking cessation, which produced no gender differences. Those who recalled

Table 2 Logistic regression results for exposure to campaign materials and intent to change targeted behaviors

Variable	Make healthier food choices			Be more physically active			Reduce screen time			Stop smoking		
	OR	95% CI		*OR*	95% CI		*OR*	95% CI		*OR*	95% CI	
		LL	UL		LL	UL		LL	UL		LL	UL
Age	0.99	0.98	1.01	1.00	0.98	1.01	0.99	0.98	1.00	0.99	0.98	1.00
Sex[a]	0.33***	0.18	0.58	0.40***	0.26	0.61	0.55**	0.36	0.84	1.01	0.65	1.57
Race/ethnicity[b]	1.67	0.82	3.39	1.27	0.79	2.03	1.22	0.80	1.87	1.28	0.82	1.99
Billboard[c]	0.45*	0.25	0.83	0.47***	0.31	0.72	0.54**	0.37	0.81	0.50**	0.32	0.79
Television[c]	1.47	0.54	4.05	2.33*	1.09	4.96	1.79	0.95	3.35	2.77**	1.47	5.22
Radio[c]	0.73	0.25	2.14	0.91	0.40	2.08	1.05	0.50	2.23	0.88	0.40	1.95
Social media[c]	0.82	0.35	1.94	0.99	0.54	1.81	2.10*	1.18	3.76	1.75	0.99	3.09
Flier[c]	0.35**	0.19	0.67	0.54*	0.33	0.88	0.66	0.42	1.04	0.95	0.60	1.51
Poster[c]	1.09	0.61	1.94	1.07	0.72	1.59	1.09	0.76	1.56	0.84	0.57	1.23
n	610			581			550			496		

OR odds ratio, *CI* confidence interval, *LL* lower limit, *UL* upper limit

[a] 0=female, 1=male

[b] 0=White non-Hispanic, 1=identified as a racial and/or ethnic minority

[c] 0=did not report, 1=reported observing the marketing message in this media format

*p <.05. **p <.01. ***p<.001.

billboards were less likely to connect LLYLDOI with each of the health behaviors. Similarly, fliers or brochures were associated with a decreased likelihood of connecting LLYLDOI with healthy food choices or being more physically active. Those who recalled seeing the message on Facebook or social media indicated a greater likelihood to be motivated to reduce screen time. Those recalling seeing the LLYLDOI message on television were more likely to be encouraged to be more physically active or to stop smoking. The addition of aided image recognition did not improve model fit for any of the models and is not presented.

Discussion of Study 1

The long-term comprehensive LLYLDOI messaging campaign resulted in high recognition of the campaign message and images through partially-aided recall, although lower recognition was associated with unaided recall of the message. Although some of the most frequently named media venues (billboards and fliers/brochures) contributed to overall message recognition, they were not associated with motivation to engage in the targeted health behaviors studied. Our billboards and fliers were often implemented at a number of locations where people engaged in multiple activities (e.g., driving, walking, shopping, and receiving health services), and perhaps competed with other messages.

Our study provided some evidence that media modes that conflicted with the targeted behavior change were effective in motivating individuals to make behavior changes. Specifically, messages delivered via television were associated with an increased likelihood of motivation to be physically active, and messages that were attributed to social media were associated with a higher likelihood of wanting to reduce screen time. This conflict between media mode and targeted behavior change suggests that incorporating marketing techniques based on concepts such as cognitive dissonance (Ong et al., 2017) may be useful to increase the effectiveness of health communications and warrants further research. Additionally, examination of possible priming effects due to complimentary messaging, environmental supports for healthy behaviors, or pre-existing motivation to engage in health behavior change, would better support an examination of the relationship between message mode, setting, and individual factors (Westerwick et al., 2017).

Study 2

Three aims guided Study 2. First, it was important to assess our target audience's response to the messaging to determine whether it was still well-received and resonated with them as compared to younger adults. Our second purpose was to assess whether the messaging was understood by the target audience in a way that aligned with campaign goals, and to identify additional factors that motivated this audience to engage in healthier lifestyle behaviors. Finally, this study assessed the access and use of various media modes by the target audience.

Method

Data collection procedures for Study 2 followed those used in Study 1, except participants received a $5 gift card in compensation. We recruited a total of 604 adults ages 19-93 (M = 46.6 years, SD = 15.4). In order to facilitate age-group comparisons, we divided the sample into three age groups: Group 1 included ages 18–34; Group 2 included ages 35–54, and Group 3 included ages 55 and older. The sample was predominantly White non-Hispanic (n = 511; 84.6%), and female (n = 497; 82.3%). Approximately 10.3% of the sample (n = 62) identified as Black or African American, and 31 respondents (5.1%) identified as another racial group(s) or declined to disclose their race. Nine participants (1.5%) identified as Hispanic or Latino. The University of Missouri Campus Institutional Review Board approved this as a quality improvement project.

The project team developed an initial set of questions that were aligned with project goals. We then piloted the instruments and protocol with members of the target audience prior to data collection. This ensured that data collection procedures were consistent across collection sites, and that the questions were easily understood by prospective respondents. Participants responded to a series of questions (rated from 1=very negative to 5 = very positive) that gauged their overall impression of the slogan, *Live Like Your Life Depends On It*. Subsequently, participants viewed

images of the campaign poster and billboard, and the respondent indicated whether he or she recalled seeing that message (yes/no). They were also asked about their overall impression of the campaign billboards and posters on a scale of 1 (dislike it a lot) to 5 (like it a lot).

All participants, including those who did not recall the message, indicated whether the LLYLDOI message would influence their behavior (yes/no) in four areas: making healthier food choices, being more physically active, quitting smoking, and consuming less alcohol. We chose these four domains based on the strategic or programmatic priorities of the partners coordinating the messaging campaign. In addition, participants responded on a scale of 1 (not important) to 3 (very important) to several potential factors that might motivate them to make healthier lifestyle choices: (1) their children, (2) their significant other, (3) their parents, (4) reduced insurance premiums, and (5) reduced medical bills. Regarding media interactions, participants reported how frequently they accessed the Internet, on a scale of 1 (1–3 days per month or less) to 4 (every day); they also viewed a randomized series of six media formats (radio, television, social media, newspaper, online news or blogs, and Internet radio), and ranked them in order of how frequently they used them.

We assessed dependent variables for normality, primarily by examining descriptive statistics and histograms. Most variables were negatively skewed (ranging between -2.82 and -0.55), and we selected nonparametric tests for analysis because the data did not meet the assumptions for normality. We collected data in 2015 and analysed it in 2018 using IBM SPSS 24 (IBM Corp., 2016).

Results

We assessed whether recall of campaign materials or behavior change motivation varied by age group using the chi square test of independence (see Table 3). We found significant differences for billboard recall and recall of either the billboard or poster, and we found no significant differences when testing for recall of the poster alone. Our results also indicated that respondents' reports differed by age group as to the message's influence on behavior change for making healthier food choices, quitting smoking, and consuming less alcohol. For each of these three behaviors, members of Group 3 were more motivated by the message than members of Group 1; Group 2 did not differ from either Group 1 or Group 3.

We present our findings pertaining to age group differences in participants' response to the LLYLDOI messaging campaign, factors they perceived to positively influence a healthier lifestyle, and media use in Table 4. We used the Kruskal-Wallis test as an omnibus test for group differences (Maxwell & Delaney, 2003) and followed with pairwise comparisons using Dunn's procedure when the omnibus test was significant (Dunn, 1964). Respondents' initial impression of the LLYLDOI message was similarly positive across the three age groups. We found significant effects for age group for participants' reactions to the billboards and the posters. Effect size calculations used to suggest the observed differences between age groups were small to moderate in range (Cohen, 1988; Rosenthal & Rosnow, 2007). Regarding factors that may motivate healthier behavior changes,

Table 3 Campaign recall and behavior change motivation; analysis by age groups

	Age groups						
	Group 1 < 35 years		Group 2 35-54 years		Group 3 55+ years		
Campaign recall	*n*	%	*n*	%	*n*	%	X^2
Billboard	59[a]	39.3	116[a,b]	44.8	110[b]	56.4	10.967**
Poster	23	15.3	39	15.1	33	16.9	0.315
Either billboard and/or poster	64[a]	42.7	121[a,b]	46.7	120[b]	61.5	14.669***
Behavior change affected							
Make healthier food choices	75[a]	50.0	167[a,b]	64.5	137[b]	70.3	15.464***
More physically active	104	69.3	196	75.7	151	77.4	3.186
Quit smoking	48[a]	32.0	106[a,b]	40.9	92[b]	47.2	8.100*
Consume less alcohol	49[a]	32.7	114[a,b]	44.0	92[b]	47.2	7.920*
One or more total changes	115	76.7	210	81.1	166	85.1	4.005
Total *n*	150		259		195		

Note. Respondents were 604 low-income adults ages 18-90. Chi square test of independence, *df*=2; items with different superscripts are significant at $p<.05$

*$p<.05$. **$p<.01$. ***$p<.001$.

we found significant effects for age in four of the five influences assessed: children, parents, reduced insurance premiums, and reduced medical bills. We observed no differences between the two youngest groups; all significant differences were between the older two groups or the oldest and youngest group, and these age group differences had small to moderate effect sizes. We found no significant differences in the frequency of grocery store visits. In terms of media use, we observed a significant age group difference in reported frequency of Internet access, with moderate effect sizes in the pairwise comparisons between age groups. We found age group differences in reported frequency of use in four of the six media types assessed, with small to large effect size differences between age groups.

Finally, Fig. 1 depicts participants' mean relative ranking of the six media types we assessed in our study. We used Friedman's test (Pereira et al., 2015) to determine whether there were overall differences in which media participants used the most, and found a significant overall effect, $X^2(5) = 601.701$, $p < .001$. Subsequent Wilcoxon signed ranks tests then identified which rankings were significantly different, using a Bonferroni correction to control for Type I error across multiple tests (Pereira et al., 2015). Television was the most frequently used type of media for the entire sample and for both Groups 2 and 3; Group 1 ranked social media as the most frequently used. Group 2 used newspaper, Internet radio, and online news or blogs the least often, and there were no significant differences observed for these three media types for this group. Group 3, the oldest group, used social media and newspapers with similar frequency, and reported using Internet radio the least of the six media types.

Table 4 Age Group Comparisons in Response to Campaign, Motivating Factors, and Media Use

	Omnibus Test for age group differences							Pairwise comparisons					
	Group 1 < 35		Group 2 35-54		Group 3 55+			1 vs. 2		2 vs. 3		1 vs. 3	
	M	*SD*	*M*	*SD*	*M*	*SD*	*H*	*z*	*d*	*z*	*d*	*z*	*d*
Response to campaign													
Initial impression of message	4.23	0.85	4.36	0.64	4.43	0.62	3.28						
Overall reaction to billboard	4.16	0.73	4.23	0.72	4.43	0.63	13.91***	0.96		2.93**	0.30	3.46**	0.40
Overall reaction to poster	3.86	1.05	4.17	0.81	4.32	0.69	16.91***	2.84*	0.33	1.60		4.08***	0.52
Motivating factors													
Influence on a healthier lifestyle													
Children	2.84	0.51	2.86	2.86	2.74	0.60	9.20**	0.54		2.95**	0.06	2.07	
Significant other	2.79	0.51	2.71	0.61	2.62	0.71	4.70						
Parents	2.48	0.64	2.37	0.73	2.01	0.92	27.54***	1.23		4.19***	0.44	4.82***	0.60
Reduced insurance premiums	2.19	0.76	2.38	0.68	2.49	0.68	14.43***	2.36		1.8		3.80***	0.41
Reduced medical bills	2.37	0.73	2.53	0.61	2.66	0.58	16.57***	2.07		2.39*	0.21	4.05***	0.44
Frequency of grocery store visits	3.87	0.98	4.02	0.97	3.94	0.96	3.26						
Media use													
Frequency of internet access	3.80	0.61	3.66	0.75	3.23	1.19	29.15***	1.73		4.01***	0.44	5.13***	0.60
Frequency of media use (rank)													
Radio	3.11	1.53	2.94	1.51	2.98	1.58	1.33						
Television	2.79	1.52	2.31	1.45	2.05	1.56	32.31***	3.40**	0.32	2.84*	0.17	5.68***	0.48
Social media	2.18	1.34	3.02	1.63	3.57	1.53	67.52***	5.21***	0.57	3.76***	0.35	8.21***	0.97
Newspaper	5.10	1.11	4.28	1.40	3.52	1.33	104.75***	5.70***	0.65	5.54***	0.55	10.22***	1.29
Online news or blogs	3.89	1.44	4.06	1.47	4.07	1.38	2.39						
Internet radio	3.94	1.59	4.38	1.66	4.81	1.50	29.42***	3.13**	0.27	2.82*	0.27	5.42***	0.56
Total *n*	150		259		195								

Note. Respondents were 604 low-income adults ages 18-90. Kruskal-Wallis test used for omnibus analysis, *df*=2. Pairwise comparisons used Dunn's test for multiple comparisons with Bonferroni correction; effect sizes are only displayed for statistically significant comparisons

*p <.05. **p <.01. ***p <.001.

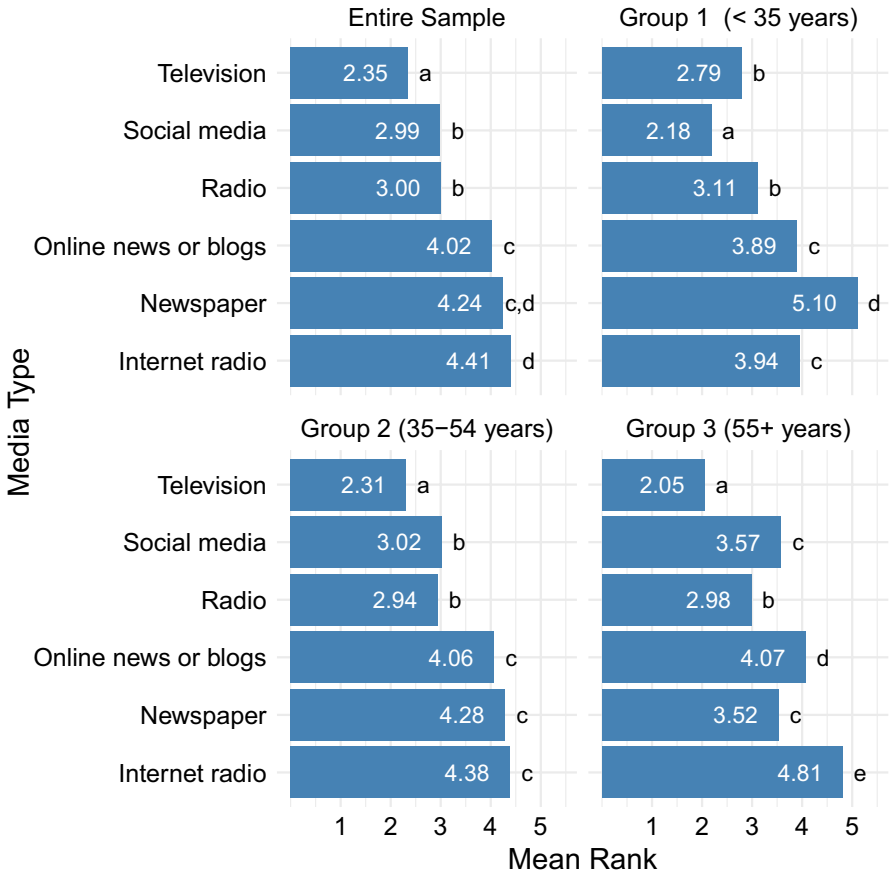

Fig. 1 Respondents' mean ranking of frequency of media use, by age group and media type *Note.* Respondents ranked six media types based on the frequency they used them, ranked on a scale of 1 (most frequent) to 6 (least frequent). Respondents were 604 low-income adults ages 18-90 (Group 1, $n = 150$; Group 2, $n = 259$; Group 3, $n = 195$). Within each group, differences in rankings were assessed via Wilcoxon signed ranks tests; items with different subscripts are statistically different, $p < .05$ (Bonferroni correction)

Discussion of Study 2

Study 2 provided evidence that the LLYLDOI messaging campaign was well-received by the target audience, and that the message itself resonated with them. The results of this study indicated that respondents' recall of our campaign message had increased substantially since the prior campaign evaluation data were collected in 2008, a year after launch of the campaign. In the initial 2008 evaluation study, approximately 25% of respondents recalled seeing or hearing campaign messaging (Homan et al., 2010), whereas data from our current study indicated that half of all adults who responded in 2015 recalled seeing a campaign billboard or poster.

Furthermore, a greater percentage of participants in the oldest age group recalled the materials as compared to participants in the youngest age group, with the middle age group not being significantly different from either the youngest or oldest age groups. Members of the older age groups had more positive reactions to the posters and billboards used in the campaign. The oldest age group represents the target audience when the LLYLDOI messaging campaign materials were developed, and these findings suggest the materials and campaign strategy were effective in targeting and resonating with adults in the older two age groups. From that perspective, the message developed eight years earlier remained relevant to those aging into the middle group.

A second purpose of study was to assess whether respondents' understanding of the campaign message aligned with campaign goals of improving dietary quality and physical activity behaviors, as well as prevention and control behaviors. Overall, approximately 80% of respondents indicated that the campaign materials supported them in making at least one of the behavior changes assessed. This is consistent with similar research on the effects of messaging campaigns in supporting intended behavior changes (Boles et al., 2014), and provides support for the use of gain-framed messaging strategies (Arendt et al., 2018; Wansink & Pope, 2015). Furthermore, these results indicate that the messaging strategies used in our campaign successfully supported older adults to make changes in the areas of food choices, tobacco use, and alcohol consumption; these were all key target areas of the campaign for this audience.

We found several age group differences for reported influences on living a healthier lifestyle. The influences measured in our study reflected life stage components and health cost components. Influences tied to life stages, such as children and parents, were most salient for the youngest two age groups (Group 1 and Group 2). Health cost influences, such as reduced insurance premiums and reduced medical bills, were stronger for the older two groups (Group 2 and Group 3). A related issue is the teasing apart of whether the high recall rates reflect a response to campaign messaging and materials, or whether adults are simply more primed to attend to these issues as they age. Younger adults are more likely to enjoy good health and may not engage in routine or ongoing medical care. Additionally, some of them may not be responsible for obtaining their own medical insurance, due to either being on a parent's plan or Medicaid.

The third aim of this study was to assess which media adults in different age groups were using regularly, which is crucial information in designing messaging and other strategies to reach them. Overall, television was the most frequently used form of media in this sample, followed by social media and radio; for the general adult population, messaging using these modes of communication could have a larger primary reach than online news or blogs, newspapers, or internet radio. Our study also found, however, that there were age differences for the types of media used most frequently by respondents. Specifically, social media and internet radio were more highly ranked by the youngest respondents, and television and newspapers were more highly ranked by oldest respondents. These results are consistent with prior work indicating that the digital divides are shrinking, yet digital disparities remain for seniors and those in rural areas (Perrin & Duggan, 2015). The results of our study, however, found that nearly all respondents had at least some

online presence. Most of the older adults in this study, a predominantly rural sample, accessed the Internet multiple times a week. These results are consistent with previous work that indicated viewing a television as a tangible necessity is positively correlated with age, whereas smart phones and mobile technologies are negatively correlated with age (Taylor & Wang, 2010). Because of these issues, media preferences should be important considerations when targeting age-specific adult audiences.

General Discussion

In sum, the research presented here supports the assertion that marketing approaches and gain framed messaging can be valuable strategies to promote health (Evans et al., 2008; Fetter et al., 2019; Gallagher & Updegraff, 2012; Zahid & Reicks, 2018). A broad array of communication outlets is important in raising the overall awareness of a campaign message, especially in target populations with a large age range. The ability to increase motivation to change behaviors, however, appears to be stronger when the message is presented in the context of the negative behavior one is encouraging to change. For example, when messages were presented on television and participants presumably were inactive while watching, respondents reported greater motivation to be active. This finding creates an opportunity for researchers and practitioners to examine other contexts in which this might also occur. For example, would messages delivered on mobile platforms such as through social media also be effective in helping individuals curb screen time or increase physical activity? Collectively, these data will inform future message development and dissemination strategies.

Limitations

Our studies relied on recruitment of participants at sites that serve low-income audiences to serve as a proxy for participant income rather than collecting self-reported income data. Regardless, the clientele at these locations is a key target audience for the LLYLDOI messaging campaign, and this process provided valuable information to guide further communications strategy with our audience.

Analyses conducted as part of the data screening process indicated that the populations served by sites in urban areas differed from those in rural areas, insofar as the sample recruited from urban areas exhibited a greater degree of racial diversity than those responding from rural areas. This is consistent with the greater proportion of people who are racial and ethnic minorities in Missouri's urban locations in comparison to its rural areas (Missouri Census Data Center, 2021). Many racial or ethnic minority subgroups are younger than the White, non-Hispanic majority population. Minority status is frequently linked to health disparities, particularly among low-income populations (Williams et al., 2016). Reaching vulnerable audiences can be difficult, and the issues that make them difficult to reach may not be the same for different minority subgroups. It is not known whether this messaging campaign had differential effects for various minority subgroups in the state. Future work involving

qualitative or ethnographic approaches can be particularly valuable in understanding the information needs and preferences of underserved audiences (Brennan et al., 2015), particularly when there are power inequities or a lack of trust.

Measurement decisions also may have affected the conclusions that can be drawn from these data. For example, being able to compare an individual's relative ranking of the importance of behavioral influences could have strong implications for targeted communication efforts (Lefebvre, 2011). The individuals in our study, however, did not rank whether one source was more influential than others. Our focus was to determine whether the behavioral influences differed for various age groups rather than relative to other influences. It is also not known the degree to which social desirability and respondent bias may have affected responses about message recognition or the degree of influence of a particular factor.

One of the challenges in the analysis for this campaign is in part due to its widespread promotion by multiple agencies: no clear behavioral objective is tied to the campaign itself. Rather, the behaviorally-agnostic LLYLDOI message is one that a broad array of partners can endorse, whether their interests are in improving dietary quality, increasing participation in recommended health screenings, tobacco cessation, or other health promotion behaviors. Our study was conducted at sites where nutrition education occurs, and dietary quality and physical activity messages were salient to the respondents in this sample. If the sample was drawn from other sites, it is possible that some of the other behaviors would have been more prominent.

Implications for Research and Practice

Practitioners are often challenged to use educational methods and modes of delivery that are current and relevant to their target audiences. For example, delivery models that incorporate messaging and other emerging technologies were predicted to be one of the top ten "hottest" areas of nutrition research for 2020 (Hackman et al., 2014). Our research helps to inform some considerations for practitioners to use in engaging in these areas, such as greater reliance on more established communication channels (i.e., television and newspapers) when targeting older respondents, and more frequent engagement with younger adults by using emerging media channels such as social media and blogs. One limiting factor, however, is that the communications infrastructure is not consistent across all areas; not only are rural counties more likely to have poor broadband connectivity, rural residents are also likely to have higher rates of obesity, chronic disease, and preventable hospitalizations (Federal Communications Commission, 2021). Evidence from our study indicates that low-income adults have internet access, but it does not reveal where they have access or what quality it is; these are also important considerations for practitioners who may wish to incorporate digital strategies in their public health interventions. The increasing online presence of older adults has important implications for both research and practice, in terms of learning what brings them to the Internet, what they do there, and how they appraise the truth and value claims of the information they find there. Although digital divides are shrinking in terms of Internet access, much less is known about disparities in individuals' technology skills or the effects

that technologies have on people and their interactions (Scheerder et al., 2017). These are important considerations for practitioners who not only ought to consider whether their clients are able to access information on a particular media platform, but also whether they know how to access it, as well as any secondary effects associated with these abilities or lack thereof.

The results of our study indicate that the issues influencing behavior differed across age groups; messages tapping into issues that are salient to a specific age group via a communication channel they frequently use may be particularly powerful. Although messaging campaigns have been shown to be successful in evoking behavior change (Snyder et al., 2004), more work needs to be done to determine optimal dosage effects for converting behavioral intentions into change, particularly when they are part of a multi-level or complex intervention. Additionally, messaging and intervention strategies that begin to move away from traditional communication modes and toward digital health interventions or other emerging technologies require different expertise to adequately design, implement, and evaluate these efforts (Gough et al., 2017; Murray et al., 2016; Patrick et al., 2016).

Conclusions

Gain-framed health messaging is successful at motivating target audiences to engage in behavior change. By collecting data from the target audience about evolving issues that motivate behavior change, which media they use, and the context in which they remember and are motivated by messages, further strategies can be developed to support targeted behavior changes.

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Data Availability The data that support the findings of this study are available from the corresponding author (KK) on reasonable request.

Declarations

Conflict of Interest The authors have no conflicts of interest to declare.

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