RAPID COMMUNICATION

Promoting Fruit and Vegetable Intake through Messages Tailored to Individual Differences in Regulatory Focus

Amy E. Latimer, Ph.D. · Pamela Williams-Piehota, Ph.D. ·
Nicole A. Katulak, B.S. · Ashley Cox, M.A. · Linda Mowad, R.N. ·
E. Tory Higgins, Ph.D. · Peter Salovey, Ph.D.

Abstract

Background Researchers must identify strategies to optimize the persuasiveness of messages used in public education campaigns encouraging fruit and vegetable (FV) intake.

Purpose This study examined whether tailoring messages to individuals' regulatory focus (RF), the tendency to be motivated by promotion versus prevention goals, increased the persuasiveness of messages encouraging greater FV intake.

Method Participants ($n=518$) completed an assessment of their RF and were randomly assigned to receive either prevention- or promotion-oriented messages. Messages were mailed 1 week, 2 months, and 3 months after the baseline interview. Follow-up assessments were conducted 1 and 4 months after the baseline assessment.

Results Regression analyses revealed that at Month 4, the messages were somewhat more efficacious when congruent with participants' RF.

Conclusion RF may be a promising target for developing tailored messages promoting increased FV intake, and particularly for encouraging individuals to meet FV guidelines.

Keywords Psychological tailoring · Regulatory focus · Health communication · Persuasion · Cancer Information Service

A. E. Latimer · P. Williams-Piehota · N. A. Katulak · A. Cox · P. Salovey (✉)
Department of Psychology, Yale University,
P.O. Box 208205, New Haven, CT 06520-8205, USA
e-mail: peter.salovey@yale.edu

A. E. Latimer (✉)
School of Kinesiology and Health Studies, Queen's University,
69 Union Street,
Kingston, ON, Canada K7L 3N6
e-mail: amy.latimer@queensu.ca

P. Williams-Piehota
RTI International,
3040 Cornwallis Road, Research Triangle Park,
NC 27709-2194, USA

L. Mowad
National Cancer Institute's Cancer Information Service,
Yale Cancer Center,
55 Church Street, Suite 400,
New Haven, CT 06510-3014, USA

E. T. Higgins
Department of Psychology, Columbia University,
New York, NY 10027, USA

Introduction

Several public education campaigns launched to increase fruit and vegetable (FV) intake have met with limited success (e.g., [1]). For example, despite the efforts of the 5 A Day for Better Health Program to encourage the consumption of at least five servings of FV per day, the majority of Americans fail to meet this recommendation [2]. The impact of large-scale education campaigns hinges on a number of factors including the persuasiveness of the message and the effectiveness of the message delivery process [3]. To maximize the success of future campaigns, researchers must isolate specific strategies for optimizing message impact and delivery. The current study examines the *efficacy* of tailoring messages to individual differences in information processing styles with the objective of developing an approach for enhancing message persuasiveness.

The social intelligence theory of personality [4] posits that information processing styles and competencies distinguish individuals from each other more so than global personality traits. Thus, tailoring messages to these stable differences may be a particularly effective strategy for increasing the persuasiveness of health messages. Preliminary evidence suggests that tailoring messages to an individual's regulatory focus, a dispositional characteristic influencing information processing styles, may enhance the efficacy of a message [5–7].

Regulatory focus (RF) is the dominant motivational system driving individuals' goal-directed behavior [8]. People adopt a prevention or promotion focus because it reflects a chronic motivational style. Promotion-focused individuals (promoters) are motivated by advancement and accomplishment. They work toward goals in a manner that ensures the presence of positive outcomes (e.g., they eat FV to maximize health benefits) [7]. Prevention-focused individuals (preventers) are motivated by security needs. They work towards a goal in a manner that ensures the absence of negative outcomes (e.g., they eat FV to avoid illness). According to theory [8], health messages should be maximally persuasive when congruent with individuals' RF because they make people "feel right" about their actions.

Existing literature provides some support for this suggestion. In a field-based study examining the effects of messages encouraging participation in physical activity among inactive adults, messages congruent with dispositional RF led to greater participation in physical activity than incongruent messages [5]. Moreover, the effectiveness of messages encouraging dental flossing among college students was greatest when messages were congruent with the recipients' chronic tendency to orient their behavior towards achievement- or avoidance-type goals [6]. These studies were short term (1–2 weeks) and encouraged behaviors other than FV intake. The effectiveness of RF-tailored messages encouraging FV intake has been examined in a laboratory setting. Individuals who received messages promoting FV intake congruent with a RF consumed more servings of FV 1 week after message exposure compared to individuals who received a message incongruent with their RF [7].

The experiment described here extends the findings from these short-term studies to examine the efficacy of tailoring messages to dispositional RF over a 4-month period in a field setting. We tested a congruency hypothesis. Specifically, we hypothesized that (a) when given a promotion-focused message, promoters would consume more servings of FV and be more likely to meet FV guidelines than preventers and (b) when given a prevention-focused message, preventers would consume more servings of FV and be more likely to meet FV guidelines than promoters.

## Materials and Methods

Participants

Five hundred and eighteen participants (376 women, 142 men) were recruited from the National Cancer Institute's (NCI) Cancer Information Service (CIS). The CIS is the NCI's link to the American public (i.e., cancer survivors and their family and friends), interpreting and explaining research findings in a clear understandable manner and providing personalized responses to specific questions about cancer [9]. Participants accessed the CIS by calling a toll-free number. The sample size of 518 was adequate to detect the small effects observed in previous CIS research with a power of .80 [10]. All participants were 18 years of age or older ($M=50.36$, $SD=14.38$) and reported FV intake below the NCI's 5 A Day guideline ($M=2.68$, $SD=1.08$). The majority was white (83.8%) and had completed at least some college (75.1%). RF scores ranged from −8 to 18 (possible range −15 to 21 with a mean of 6.34; $SD=3.90$) suggesting that the sample was predominantly promotion-oriented. Self-reported exclusion criteria included: (a) being a cancer survivor, (b) being terminally ill, (c) undergoing testing for a potential cancer diagnosis, and (d) following a physician-prescribed diet limiting FV intake.

Eligible callers who agreed to participate in the study ($n=518$) were randomized to either the promotion ($n=264$) or prevention ($n=254$) message conditions (refer to Fig. 1). Between-groups comparisons using analyses of variance (ANOVAs) for continuous data and chi-squares for categorical data revealed no significant differences in demographic characteristics, knowledge of the 5 A Day guideline, RF, or FV intake between message conditions, suggesting that randomization was successful, ps>.05. At Month 1, none of the baseline characteristics distinguished between participants lost to attrition and those who completed the 1-month interview. At Month 4, participants who were male, unfamiliar with the guideline at baseline, and had a stronger promotion-oriented RF were more likely to drop out than participants who were female (52.1% versus 41.2%, χ^2 (1, $n=518$)=4.96, $p<.05$), familiar with the guideline at baseline (48.7% versus 38.8%, χ^2 (1, $n=506$)=4.99, $p<.05$) and had a stronger prevention-oriented RF ($M=6.71$, $SD=3.69$ versus $M=6.04$, $SD=4.03$; F(1, 514)=3.86, $p=.05$). Loss to attrition at Months 1 and 4 was not associated with message condition.

Procedure

At the end of regular service, the CIS Information Specialists invited all potentially eligible callers (i.e., individuals who had not met any of the exclusion criteria during the service call) to answer questions regarding their eligibility for a

Fig. 1 Flow of participants through the study. Follow-up assessments occurred 1, 2, and 4 months after the baseline interview. The Month 1 and 4 follow-ups were telephone interviews. The Month 2 follow-up was a mailed survey that included a manipulation check item. Overall attritions rates were 31.3% at Month 1, 48.3% at Month 2, and 44.2% at Month 4
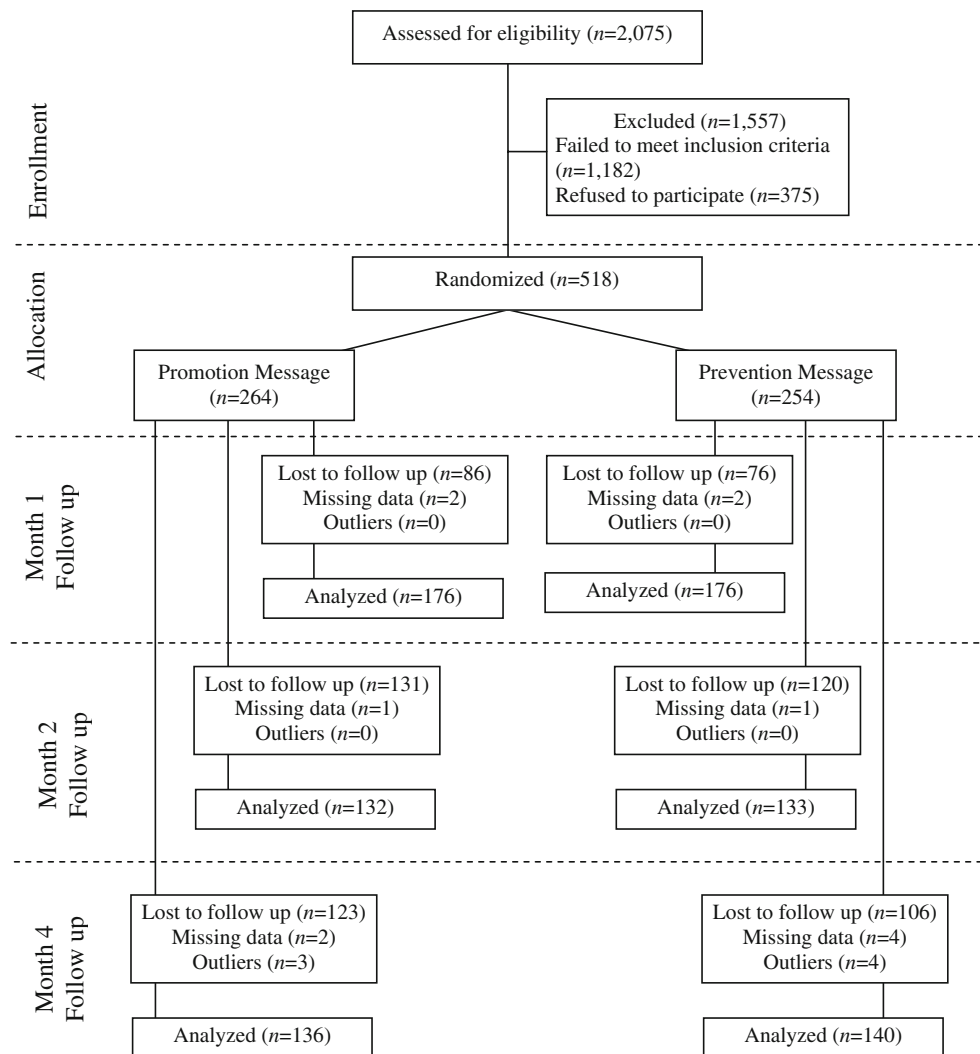
research study examining strategies to improve the quality of health messages. Participants deemed eligible for the study were invited to complete a brief telephone interview immediately and three follow-up interviews over the next 4 months. After consenting, participants completed a 7-min telephone interview. During this interview, knowledge of the 5 A Day guideline, baseline covariates (servings of FV at baseline, intentions, and self-efficacy), and RF were assessed by the CIS Information Specialists. CIS supervisory staff completed weekly quality assurance checklists evaluating interview administration. No deviations from the protocol affecting data quality were noted.

Following the interview, participants were randomly assigned, regardless of their prevention or promotion orientation, to either the promotion or prevention message condition by a coin toss conducted by a research assistant. Participants were mailed tailored materials corresponding to their random assignment 1 week (week 1=letter, pamphlet, refrigerator notepad, and pen), 2 months (Month 2=letter,

booklet, and refrigerator magnet) and 3 months (Month 3=letter, tip card, and recipe cards) after the baseline interview. The message content and tailoring approach of the materials are described in Table 1. In addition to the tailored materials, the Month 2 package contained a questionnaire including the manipulation check item and a pre-addressed stamped envelope. Participants who returned the questionnaire received a $10 honorarium. Research assistants blind to message condition contacted participants to conduct brief follow-up telephone interviews 1 and 4 months after baseline (Month 1 and Month 4), which included FV intake and intervention implementation measures.

Measures

Regulatory Focus

Chronic RF was assessed using the Regulatory Focus Questionnaire (RFQ) [11]. The RFQ is an 11-item measure

Table 1 Samples of the content of the tailored messages

Promotion-focused messages	Prevention-focused messages
• Optimize your health: Eat 5 to 9 FV every day.	• Protect your health: Eat 5 to 9 FV every day.
• Take the 5 to 9 challenge. It's a goal you can meet!	• Eat 5 to 9 A Day—it's what everyone ought to do!
• Add chopped green peppers, mushrooms, and onions to your scrambled eggs or omelet—they add fiber, which promotes optimal colon function.	• Add chopped green peppers, mushrooms, and onions to your scrambled eggs or omelet—they add fiber, which helps to prevent colon cancer.
• When you're in a hurry, have a quick and healthy breakfast.	• When you're in a hurry, don't skip a healthy breakfast.
• Bring a small box of raisins or a can of juice to have in the car, driving your serving count closer to your 5 to 9 goal	• Bring a small box of raisins or a can of juice to have in the car to ensure you're meeting the 5 to 9 guideline.
• Get revved up in the morning with FV.	• Relax in the morning with FV.
• FV provide nutrients, fiber, and substances like antioxidants that promote health.	• FV provide nutrients, fiber, and substances like antioxidants that help guard against the threat of disease.
• So, achieve the 5 to 9 goal every day to look and feel your best.	• Meet the 5 to 9 guideline every day to protect your health.
• Promote your health: Eat more FV today!	• Prevent disease: Eat more FV today!

Note. The core information (e.g., definition of serving sizes, ways to address barriers to FV intake, recipes, and recipe resources) was consistent across the message conditions. In each message condition, the presentation of this information was tailored in accordance with RF theory (8). The promotion messages highlighted accomplishment and achievement and focused on goal pursuit to achieve benefits. The prevention messages emphasized safety and security concerns and focused on goal pursuit to avoid costs.

of participants' subjective history of promotion and prevention successes and failures (e.g., "How often did you obey rules and regulations that were established by your parents?"). Items were rated on a 5-point scale (1=*never/ certainly false*; 5=*very often/certainly true*). The separate 6-item promotion and 5-item prevention subscale scores demonstrated somewhat low internal consistency (promotion α=.59, prevention α=.69). To remedy this problem, the item with the smallest item-to-total correlation was deleted from each subscale. This 9-item RFQ exhibited improved internal consistency (promotion α=.67, prevention α=.73). RF was determined by subtracting the prevention subscale scores from the promotion subscale scores, as in past research [11]. Theory and empirical evidence suggest that the RFQ is a measure of individuals' dispositional RF [11] resistant to short-term change and manipulation from a RF message intervention [5].

Baseline Covariates

At baseline, *FV intake* was assessed using a 1-item measure. Participants were provided with a definition of serving sizes (i.e., a medium-sized apple, 1/2 cup of chopped vegetables or fruit, or half a cup of juice) and asked how many servings of FV they eat in an average day. This single-item measure has been validated against the 7-item summary questions from the Block food frequency questionnaire [12]. Intentions and self-efficacy also were assessed at baseline for use as covariates. Intentions and self-efficacy are important behavioral determinants that influence the likelihood of behavior change [13]. *Intentions* were measured by asking participants if they intended to eat more FV in the future (1=*disagree a lot*; 5=*agree a lot*). *Self-*

efficacy was determined by asking participants how confident they were that they could eat more FV every day (1= *not confident*; 5=*completely confident*). This single-item approach to assess covariates is consistent with previous CIS-based interventions (e.g., [10]) and was a necessary means of keeping the baseline interview within the 7-min time period allotted by the CIS for research conducted during service calls.

Process Evaluation

The *manipulation check* item, "Did the booklet focus more on preventing disease or more on promoting your health?" (1=*mostly on disease*; 5=*mostly on health*), was administered at Month 2 to verify the prevention versus promotion orientation of the print materials. *Intervention implementation* (i.e., whether participants received and attended to the informational intervention) was assessed at Months 1 and 4 by asking participants to rate how much of the materials they had read (1=*none*; 5=*all*). *Knowledge* of the 5 A Day guideline measured at Months 1 and 4 also was assessed as an indicator of intervention implementation. Participants responded to the open-ended item, "How many servings of FV do you think a person should eat each day for good health?" Consistent with the guideline in effect at the time of the study, responses were coded as either correct (≥5 servings) or incorrect (<5 servings).

FV Intake

At Months 1 and 4, FV intake was assessed using a 7-item food frequency measure [14]. Participants were reminded of the serving size definitions provided at baseline and were

asked how often over the last month they consumed: (a) 100% orange or grapefruit juice, (b) other juices, (c) salad, (d) French fries or fried potatoes, (e) baked, broiled, or mashed potatoes, (f) vegetables (not including salad or potatoes), and (g) fruit (not including juices). After omitting French fries and fried potatoes, participants' responses were summed to create an index of daily FV intake. This scale has been used extensively with samples of CIS callers (e.g., [10, 15]). From this index, participants were classified as either meeting or failing to meet the 5 A Day guideline which was in effect at the time of this study.

Analyses

Separate hierarchical regression analyses for continuous dependent variables and logistic regression analyses for dichotomous dependent variables were conducted to examine the effects of RF-tailored messages on the process and behavioral outcomes. In each regression model, the main effects for experimental condition and RF were entered followed by the interaction term (Experimental Condition× RF). In the models predicting behavioral outcomes, baseline covariates were entered as the first step. Prior to conducting these analyses, RF was zero-centered [16] and experimental condition was dummy-coded (prevention message=0, promotion message=1). A restructured regression equation to test the simple effects for each experimental condition was calculated to provide a conservative interpretation of significant Experimental Condition×RF interactions. In this efficacy analysis, only data from participants reached for follow-up were included in the analysis. An efficacy analysis strategy was used because this was the first long-term evaluation of a relatively new message tailoring approach. According to Flay [17], when developing new treatments, an efficacy analysis is a necessary first step. Once efficacy is established, only then should research move to examine effectiveness. Extreme values (±3 SD from the mean) on the 7-item food frequency questionnaire were removed from analyses [18].

Results

Process Evaluation

The overall hierarchical regression model was significant for the *manipulation check* $\left(R^2_{\text{adjusted}} = .20, F(3, 261) = 22.15, p > .01 \right)$. A main effect for experimental condition emerged ($\beta = .45$, $p < .01$); the promotion message was rated as being health-focused ($M = 3.99$, SD=1.05), whereas the prevention message was rated as being disease-focused ($M = 2.89$, SD=1.14), as expected. These findings suggest that the booklets were appropriately tailored to RF. In the *interven-*

tion implementation assessment, it was determined that 82.0% of participants reached at the Month 1 follow-up (269 participants out of 328) reported reading at least some of the mailed materials, and 95.1% of participants (272 participants out of 286) did so at Month 4. Neither the main effects for message condition and RF nor their interaction was significant at either of the follow-up time points. Finally, separate logistic regression analyses on *knowledge* at Months 1 and 4 revealed that message congruency did not differentially affect knowledge of the 5 A Day guideline.

FV Intake

The overall hierarchical model predicting Month 4 FV intake was significant, $R^2_{\text{adjusted}} = .09$, $F(6, 269) = 5.37, p < .01$. Controlling for covariates (servings of FV at baseline, intentions, and self-efficacy) and main effects (experimental condition and RF), the Experimental Condition× RF interaction, $\left(R^2_{\text{change}} = .02, \beta = .21, p < .05 \right)$, emerged as a unique predictor of behavior. Overall, as indicated by the significant interaction term in the regression model, the efficacy of the messages increased as congruency with RF increased. The interaction is depicted in Fig. 2. A more conservative analysis looking at the two types of messages separately revealed trends in the predicted direction (ps≤.13). Main effects for experimental condition, RF, and their interaction were not significant at Month 1.

Meeting the Guideline

A logistic regression analysis predicting whether participants met the 5 A Day guideline at Month 4 controlling for the covariates (servings of FV at baseline, intentions, and self-efficacy) revealed a significant Experimental Condi-
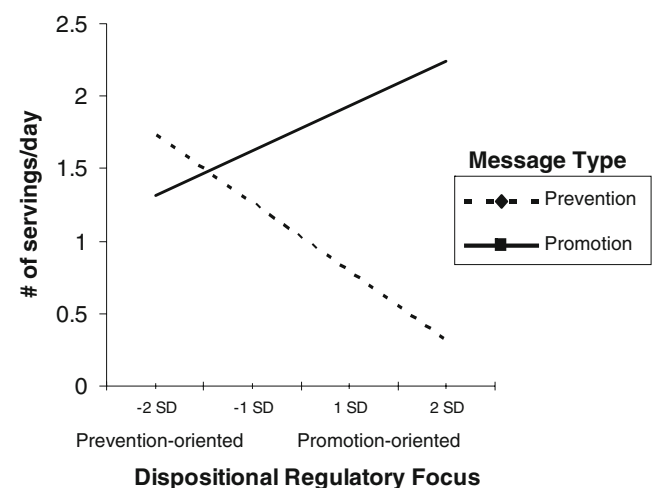
Fig. 2 The message type experimental condition by regulatory focus interaction predicting fruit and vegetable intake at Month 4. The *lines* were plotted using unstandardized beta weights (promotion B=0.05; prevention B=−0.09)

tion×RF interaction, OR=1.21, 95% CI: 1.04–1.41, Wald= 6.32, p=.01. Two restructured logistic regression equations indicated a trend consistent with the congruency hypothesis. In the promotion-focused message condition, individuals who were increasingly promotion-focused were somewhat more likely to meet the 5 A Day guideline than preventers, OR=1.09, 95% CI: 0.99–1.19, Wald=3.23, p =.07. In the prevention-focused message condition, participants who were increasingly prevention-focused were somewhat more likely to meet the guideline than promoters, OR=.89, 95% CI: 0.79–1.01, Wald=3.14, p=.08. The logistic regression model was not significant at Month 1.

Discussion

The efficacy of the promotion-focused messages for encouraging FV intake tended to increase as RF became predominantly promotion-oriented. Moreover, the efficacy of the prevention-focused message tended to increase as RF became predominantly prevention-oriented. The study findings indicate RF may be a promising construct for developing tailored messages encouraging FV consumption, particularly for motivating individuals to meet dietary recommendations for FV intake.

The impact of the messages on FV intake was examined two ways—both as a continuous variable (overall intake) and as a dichotomous variable (meeting the recommendations— yes/no). Across both variables, the pattern of findings was consistent with the hypothesis. However, support for our congruency hypothesis appeared strongest for the dichotomous variable. The simple restructured regression equations predicting whether participants met the recommendations approached significance, ps<.08. These findings suggest that the goal of meeting a dietary guideline and increasing intake should be considered as associated but still distinct behaviors. Indeed, it is possible to increase FV intake and still fail to meet recommendations. Alternatively, once individuals meet a recommendation, they may not be motivated to continue to increase their FV intake beyond the recommended minimum.

The current study encouraged both behaviors using slightly different tailoring approaches, however. In the messages related to *meeting the recommendation*, both the goal and means of goal pursuit were tailored. The promotion message encouraged readers to "*achieve the 5 to 9 goal* [goal] *for optimal health* [means]" whereas the prevention message encouraged readers to "*meet the 5 to 9 guideline* [goal] *to protect their health* [means]." In the message encouraging increased FV intake, only the means of goal pursuit and not the goal itself were tailored. For example, the promotion message emphasized "*eating more FV* [goal] *for optimal health* [means]", whereas the

prevention message emphasized "*eating more FV* [goal] *to protect health* [means]." By tailoring the goal *and* the means of goal pursuit, the messages encouraging participants to meet recommendations may have been more efficacious in creating congruency, thereby generating stronger support for the congruency hypothesis.

It is also possible that the distinct behaviors might have resonated differently with promoters and preventers. Given their orientation toward safety and responsibility, preventers may have been particularly motivated to meet the recommendation and subsequently stopped trying to increase FV intake once the recommendation was satisfied. Given their orientation toward advancement, promoters might have been particularly motivated to increase FV intake to the highest level possible—coincidentally meeting the recommendation. Thus, creating messages that emphasize meeting a dietary guideline for preventers and increasing FV intake among promoters might be a means of optimizing message persuasiveness.

The current study also underlines the importance of repeated message exposure for increasing message impact. This experiment is the first to demonstrate the effects of RF tailoring in a longer-term, field-based study. Interestingly, tailoring effects emerged at Month 4 but were not evident at Month 1. The lack of effect at Month 1 was surprising because the effects of RF-tailored messages on behavior have been demonstrated previously in short-term studies [5–7]. The follow-up period in these short-term studies, however, ranged from 1 to 2 weeks and messages were delivered at baseline ensuring that all participants received the message. In the current study, all messages were delivered through the mail, precluding the opportunity to ensure message exposure. The lack of short-term effect might be attributable to lack of message exposure; 18% of participants reported having read very little or none of the message at Month 1, but only 5% failed to read the messages at Month 4. Moreover, consistent with our findings, it may be that, for tailored messages to be impactful in an intervention lasting longer than a couple of weeks, multiple exposures to tailored materials are required [19]. Indeed, studies that utilize more intervention exposures have been more effective in motivating health behavior change than those that do not [19]. Future research might examine whether delivering additional messages early in the intervention, including at baseline, maximizes short-term intervention effects.

Future research should examine whether RF tailoring is comparable and compatible with other commonly used approaches such as tailoring to stages of change [20]. In a recent meta-analysis of the effects of tailored health messages [19], effect sizes ranging from r=.01 to .18 were reported for interventions promoting FV intake using messages tailored to stage of change. The effect size of

our approach is comparable ($r = .14$) and thus may be an alternative or even a complementary approach to tailoring to stages of change. Research is needed, however, to compare directly the effects of RF tailoring to other tailoring strategies. These experiments also should compare the effectiveness of RF-tailored messages and generic messages. Indeed, generic messages would serve as a rigorous standard for comparison [19]. Nonetheless, with evidence that tailored messages are more effective than generic and targeted messages [19], it seems reasonable to expect an advantage of the RF-tailored message would emerge.

In the future researchers also should take heed to address the limitations of the current study related to the characteristics of the participant sample. For example, typical of CIS callers [5], the majority of the sample had a promotion orientation (i.e., 60% of the sample had a predominant promotion focus). This predominant promotion orientation may underlie the pattern of findings depicted in Fig. 2 in which the promotion message appears to have a relative advantage for the majority of participants. Figure 2 reveals that the advantage of the prevention message only emerges for individuals with RF scores 1.5 standard deviations below the mean. Although this value seems extreme, because the mean RF score falls within the promotion-orientation range, a value 1.5 below the mean actually represents a weak to moderate prevention orientation only. Evidence supporting the utility of the prevention message for encouraging FV intake would likely emerge in a sample with a greater range of RF scores.

Also, participants in the current study were motivated information seekers who were relatively well educated, non-Hispanic white, and female, thus limiting the generalizability of the study findings. Participant attrition rates were high. High attrition is a common concern in CIS-based research [10]. Many of the participants were caring for a sick or dying relative for whom they initially contacted the CIS. For these individuals, self-care activities (e.g., eating a healthy diet) and extraneous duties (e.g., participating in research) are likely a low priority [21], thus highlighting an interesting dilemma. In failing to engage in self-care activities, healthy CIS callers are an ideal target for a proactive intervention. Furthermore, demonstrating change in a sample of individuals managing a number of serious life events could speak to the intervention's efficacy. However, the high attrition rates are problematic and potentially bias the study findings. The study should be replicated in a different sample using effectiveness analyses to confirm the robustness of the findings.

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