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The impact of cultural exposure and message framing on oral health behavior:

Exploring the role of message memory

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Abstract

Background. Health messages are more effective when framed to be congruent with recipient characteristics, and health practitioners can strategically decide on message features to promote adherence to recommended behaviors. We present *exposure to United States (U.S.) culture* as a moderator of the impact of gain- vs. loss-frame messages. Since U.S. culture emphasizes individualism and approach orientation, greater cultural exposure was expected to predict improved patient choices and memory for gain-framed messages, whereas individuals with less exposure to U.S. culture would show these advantages for loss-framed messages.

Methods. 223 participants viewed a written oral health message in one of three randomized conditions: gain-frame, loss-frame, or no-message control, and were given ten flosses. Cultural exposure was measured with the proportions of life spent and parents born in the U.S. At baseline and one week later, participants completed recall tests and reported recent flossing behavior.

Results. Improved patient decisions (increased flossing) and memory maintenance during the week were each predicted by congruent cultural exposure and message frame (e.g., low cultural exposure and loss frame). Incongruent messages led to the same flossing as no message. Memory retention did not explain the flossing effect.

Limitations. Flossing behavior was self-reported. Cultural exposure may only have practical application in either highly individualistic or collectivistic countries.

Conclusions. In healthcare settings where patients are urged to follow a behavior, asking basic demographic questions could allow medical practitioners to intentionally

communicate in terms of gains or losses to improve patient decision making and adherence.

The impact of cultural exposure and message framing on oral health behavior: Exploring
the role of message memory

The American Dental Association recommends flossing every day to promote oral health (ADA, 2013), but fewer than half of United States (U.S.) adults floss daily (ADA, 2008). Promoting adherence to medical recommendations with printed messages is a practical and relatively inexpensive intervention to influence health behaviors. Message effectiveness depends on patient characteristics and message content (e.g., Sherman, Uskul, & Updegraff, 2011), but previous work does not provide applied tools to help practitioners determine communication choices in the healthcare setting. Governmental health organizations request that culture be considered in the design of health messages (e.g., Centers for Disease Control, 2008; National Cancer Institute, 2008; National Institute of Dental and Craniofacial Research, 2003), yet it is also unclear how to measure culture within diverse populations for use in message design. The present study makes three advances. First, in an ethnically diverse sample of young U.S. adults we test the effectiveness of framed health messages with a message medium that is easily designed and disseminated in the healthcare context (brochures). Second, we present a new measure of *cultural exposure*, a construct designed for diverse populations, and examine its interaction with message frame in predicting self-reported flossing. Third, we evaluate the impact of cultural exposure and message frame on the ability to recall message content, and test whether memory retention is associated with increased health behavior.

Message Frame and Patient Characteristics

People respond differently to health messages that emphasize gains vs. losses (e.g., Uskul, Sherman, & Fitzgibbon, 2009; Rothman & Salovey, 1997). While the prevention vs.

detection function of behaviors has a small influence on people's responses to framed messages (Gallagher & Updegraff, 2012), individual differences of the recipient have a larger influence in predicting the effect of framed messages (Rothman & Updegraff, 2010; Updegraff, Brick, Emanuel, Mintzer, & Sherman, 2014). One key characteristic is motivational orientation: how much people are motivated by seeking positive outcomes compared to avoiding negative outcomes (Carver & White, 1994). Motivational orientation moderates which frame is more effective across a number of health domains, including smoking (Shen & Dillard, 2009), acceptance of an HPV vaccine (Gerend & Shepherd, 2007), and oral health behavior (Sherman, Updegraff, & Mann, 2008). In oral health, relatively approach-oriented people are more persuaded by gain-frame messages (e.g., "If you floss your teeth regularly, you will have healthier teeth and gums") whereas relatively avoidance-oriented people are more persuaded by loss-frame messages (e.g., "If you don't floss regularly, the health of your teeth and gums is at risk"), as shown by increases in flossing behavior, flossing self-efficacy, and intentions to floss (Mann, Sherman, & Updegraff, 2004; Sherman, Mann, & Updegraff, 2006).

Cultural background affects cognition, motivation, and emotion at all levels, from basic pattern perception to affective responses of social actions (Heine, Lehman, Markus, & Kitayama, 1999; Markus & Kitayama, 1991; Nisbett, Peng, Choi, & Norenzayan, 2001). Integrating cultural perspectives to improve health communications requires identifying psychological characteristics that vary between cultural groups and examining whether health messages framed to match those characteristics are more effective (Sherman et al., 2011). For example, people from collectivistic cultures such as Japan are more motivated by avoiding losses than pursuing gains (e.g., Hamamura & Heine, 2007), perhaps due to the pressure to maintain face (social reputation) and be a valued member of their family, groups, and society. Collectivistic individuals are sensitive

to losses and vigilant to reputation threats because face is hard to gain but easily lost, and a group's reputation can be easily damaged (Heine et al., 1999). In contrast, members of more individualistic cultures such as the U.S. are more sensitive to gains, individual distinction, and self-promotion (Heine et al., 1999). Although individuals differ in approach and avoidance motivations within countries, the overall balance also varies between cultures (Norenzayan & Heine, 2005), reflecting differences in chronic motivational orientations (Hamamura & Heine, 2007; Lee, Aaker, & Gardner, 2000). Framing oral health messages to be congruent with recipient culture leads to higher effectiveness: individualist White British participants indicated more flossing intentions after receiving gain-frame messages, and collectivist British Chinese participants showed more flossing intentions after loss-frame messages (Uskul et al., 2009).

Cultural Exposure

We focus on a related cultural dimension: the extent to which people are exposed to the U.S., which is relatively individualistic and approach-oriented. We present the novel construct of *cultural exposure*, the extent to which people are integrated into a host country (in this case, the U.S.), relative to other cultural experiences. We hypothesize that cultural exposure will interact with message frame to determine the effectiveness of persuasive health messages, similar to previous research comparing East-West ethnicities. Key advantages of the present approach are that cultural exposure can be measured for all ethnic groups and is practical for use in healthcare settings. The U.S. is highly individualistic and approach-oriented (Heine et al., 1999), so we hypothesize that gain-frame persuasive messages will be congruent and lead to decisions to floss for individuals with high cultural exposure to the U.S. Loss-frame messages will be more effective for people with lower cultural exposure to the U.S. who are more collectivistic and avoidance-oriented (Hamamura, Meijer, Heine, Kamaya, & Hori, 2009; Hofstede, 2001),

particularly those from Asian and Latino cultures, which form the largest contemporary immigrant groups in the U.S. (Camarota, 2012; Passel & Cohn, 2012).

Cultural exposure is an objective, demographic measure calculated by the mean of two proportions: life spent in the U.S. and how many of one's parents were born in the U.S. (see Method for calculation). The first component approximates how much an individual has been exposed to U.S. culture in their lifetime relative to other cultural influences, and the second component indexes how much parental influence stems from U.S. vs. other cultures (Greenfield, 1994). This extends work on generational status (Taylor et al., 2004) that focused on the family level and did not include individual history.

Cultural exposure has advantages compared to previous scales: it does not rely on subjective interpretation or judgments (see Ryder, Alden, & Paulhus, 2000), and should therefore be less sensitive to situational factors, experimental demand, or reference group effects (a problem where individuals compare themselves to different reference groups in cross-cultural research; Heine, Lehman, Peng, & Greenholtz, 2002). Cultural exposure is easily measured for any individual and is feasible for use in the healthcare context, unlike acculturation scales that must be written to anchor questions between two specific cultures. A recent study examined cultural exposure and message frame congruency using videos that emphasized the importance of flossing, and more flossing over six months was observed for those receiving congruent messages (i.e., high U.S. cultural exposure with gain-frame or low U.S. cultural exposure with loss-frame; Sherman et al., under review).

The present study advances beyond previous work by 1) testing the effectiveness of an easily disseminated printed message; 2) examining the effect of congruency on memory retention

and the relation between memory and behavior; and 3) evaluating the congruency effect on oral health behavior over one week among young adults who are provided flosses.

Hypotheses

H1: Gain-frame messages will increase flossing among individuals high in cultural exposure to the U.S., and loss-frame messages will increase flossing among individuals low in cultural exposure to the U.S., compared to incongruent messages and no message.

A secondary goal is to evaluate memory as both an outcome and a mechanism of the key effect in H1 (as suggested by Mann et al., 2004). Memory represents what information is available for cognition over time, so memory is a strong candidate for causing the heightened effectiveness of congruent health messages. For example, the MODE model (Fazio & Towles-Schwen, 1999) posits that attitudes readily accessible from memory will better predict behavior than less accessible attitudes. Also, health messages that are framed to be congruent with approach-avoidance orientation are processed more systematically (Rothman & Updegraff, 2010). Individuals elaborate more on congruently framed messages, and message effectiveness is higher when congruently framed messages present strong evidence (Updegraff, Sherman, Luyster, & Mann, 2007). Therefore, we expect that participants who receive congruent (vs. incongruent) health messages will have better recall (see Higgins & Tykocinski, 1992 on recall and health messages). In line with this claim, memory recall was improved for culturally congruent messages in two non-health studies (Hamamura et al., 2009).

H2: Individuals high in cultural exposure to the U.S. who receive a gain-frame message, and individuals low in cultural exposure to the U.S. who receive a loss-frame message, will have better memory retention for the health message compared to incongruent messages.

A third goal is to test whether increased memory for congruent messages leads to the improvement in health behavior. Because cultural congruency is expected to increase engaged information processing and elaboration, it could also lead to an increased accessibility of flossing-related thoughts that cause an increase in flossing behavior.

H3: The cultural congruency effect on flossing will be mediated by increased memory retention.

Methods

Participants

Two hundred twenty-three undergraduates participated for course credit, $M(SD)$ age=20.1(3.29) years; 62.8% female; 41.3% Caucasian, 17.4% Latino American, 15.7% African American, 15.7% Asian American, 1.4% Native American, 7.2% other ethnicity, and 1.3% declined to answer (see Table 1). Recruitment occurred at two universities, one Midwestern and one Western, to increase ethnic and cultural diversity. The study was approved by the Human Subjects Review Boards of both universities. Participants were randomly assigned to condition: gain-frame ($n=75$), loss-frame ($n=76$), or no message control ($n=72$). U.S. cultural exposure varied from .002-1, $M(SD)=0.73(0.34)$. At baseline (in the laboratory) and the one-week follow-up (online), participants reported their flossing behavior and completed recall memory tests on a computer. At the conclusion of the first session, participants were given ten individually wrapped flosses to enable flossing regardless of home supplies.

Measures and Stimuli

Oral health messages. Two oral health brochures were developed (gain-frame: 628 words, loss-frame: 646 words) to convince individuals to brush and floss their teeth (see Supplementary Materials). Each black-and-white tri-fold brochure had a professional layout with images and text (adapted from American Dental Association, 2013), and was

ostensibly produced by the American Dental Society as indicated by several logos. The brochure contained six sections: "Your Teeth," "Your Breath," "Plaque," "Your Gums," "Your Cardiovascular System," and "How to Floss Correctly." Across brochure types, the same content was presented with different frames. For example, the gain brochure read: "A consistent routine of brushing and flossing maintains the health of your teeth and gums," while the loss brochure read: "An inconsistent routine of brushing and flossing hurts the health of your teeth and gums." Each brochure contained 18 framed statements and 20 unframed statements, e.g., "To floss your teeth, take about 18 inches of floss in your hand." Participants were invited to keep the brochure.

Recall. Following a 10-minute figure-drawing delay task (adapted from Christianson, Loftus, Hoffman, & Loftus, 1991), participants took a surprise recall memory test and were asked to type all the statements they remembered, one per box. Eighteen boxes were provided, and participants made a substantive effort, spending $M(SD)=5.92(3.73)$ minutes on free recall (recorded with survey software). Next, participants were shown the six section headers and were provided five blank boxes per cue for additional cued recalls.

Recall coding. Two trained coders, unaware of condition or participant characteristics, coded each recalled statement for accuracy, frame, and the matching brochure statement (statement ID). Recalls were coded as accurate when they retained accurate facts. Recall frame was coded as gain, loss, unframed (if the original statement was framed, but the recall was not), or control. Statement ID allowed the removal of duplicate recalls. For recalls that combined statements, credit was given for both statements when coders agreed on accuracy, frame, and statement ID for both. Coding reliability (intraclass correlation) for statement ID was very good,

baseline $r=.93$, follow-up $r=.90$; reliability was also good for frame, baseline $r=.80$, follow-up $r=.87$. Accuracy was rated dichotomously, and most recalls were rated "accurate" (94%). Cohen's kappa is typically used to assess inter-rater reliability with dichotomous ratings, but it has well-known problems for uneven category base rates. Therefore, Gwet's AC1 (Gwet, 2002) was used to calculate inter-rater reliability for the accuracy, and inter-rater reliability was also good (baseline AC1=.93; follow-up AC1=.87). A blind and independent third coder resolved all discrepancies. Correct recalls from the free and cued tests were summed for overall recall frequency and accuracy. See Table 1.

Cultural exposure. Participants were asked: "How long have you lived in the United States? (in years)." Years were divided by age to yield the proportion of life spent in the U.S. Then, participants were asked: "How many of your parents were born in the United States?" (0, 1, or 2). This value was divided by two so that both components reflected a proportion from 0 (low exposure to U.S. culture) to 1 (high exposure). The components were correlated $r=.48$, and were averaged together to yield cultural exposure. By ethnicity, Caucasians had the highest cultural exposure to the U.S.: $M(SD)=.93(.19)$, followed by African Americans: $.88(.27)$, Latino Americans: $.58(.20)$, Asian Americans: $.51(.28)$, and Other: $.42(.38)$. See Table 1.

Motivational orientation. The Behavioral Inhibition and Behavioral Approach Scales (Carver & White, 1994) measured approach orientation (BAS; Cronbach's $\alpha=.80$) and avoidance orientation (BIS; $\alpha=.75$). Motivational orientation (MO) was calculated by ($MO=BAS-BIS$), such that $MO>0$ represented a relative approach orientation (Mann et al., 2004; Sherman et al., 2006). Cultural exposure was uncorrelated with MO, r_s

BAS=.04, BIS=.04, MO=.00, $p \geq .36$, consistent with a recent study (Sherman et al., under review). See Discussion.

Demographics. Participants reported demographics including age, gender, and ethnicity, for which participants were asked: "What is your racial/ethnic background?" and selected from: White/Caucasian, African American, Asian American, Hispanic/Latino, Native American, and Other. See Table 1.

Previous flossing. Flossing behavior was measured before the manipulation with a single item (Davidson, Rams, & Andersen, 1997): "In general, how often do you floss your teeth?", measured from 1 (*Never*) to 7 (*Two or more times per day*). See Table 1.

Exploratory. Participants completed measures assessing additional constructs, including brushing frequency (one question); flossing self-efficacy, perceived value, and enjoyment (10 questions); flossing intentions (one question); individualism (16 questions); and perceived susceptibility for oral health problems (five questions; see Supplementary Analyses). There were no significant correlations with cultural exposure nor any main effects or interactions with these variables, and they are not discussed further.

Follow-up: Self-reported flossing and recall. After one week, participants received a study reminder by email, were contacted by phone after three days if they had not responded, and completed a questionnaire online. Nine participants (4%) failed to complete the follow-up. Participants first reported how many times in the past week they flossed their teeth, measured by integers between 0 and "14+," in addition to an exploratory item measuring brushing frequency. Participants then repeated the free and cued recall tests from baseline. Finally, participants also completed an exploratory measure of intentions to schedule a dental appointment. There were no significant main effects or interactions with intentions.

Sampling method. In the interest of transparent sampling methods (Simmons, Nelson, & Simonsohn, 2011), all measures and conditions are described above, and all sampled participants are described. The first data collection period ($n=154$) lasted 10 weeks (one quarter). This was inadequate for the desired statistical power, so collection was extended for the remainder of the following quarter ($n=79$). Confirmatory hypotheses were tested after data collection ended.

Analytic plan. H1 was evaluated with a hierarchical linear regression predicting flossing behavior from frame and cultural exposure (CE), with motivational orientation and its interaction with frame entered in the second step to isolate the unique contribution of CE. To highlight practical implications, a logistic regression further evaluated who flossed at recommended rates between individuals who received a matching, mismatching, or no message. H2 involves memory retention across one week and was tested with generalized estimating equations (GEE), an extension of the generalized linear model for regressions with repeated outcomes that allows for correlated outcomes and reduces Type I errors compared to using separate regressions for each outcome period. GEE was used to predict memory retention over time as a function of CE and frame. H3 was evaluated with a Sobel-Goodman test of memory decay mediating the effect of message congruency on flossing. Age, gender, and ethnicity (dummy-coded with the most numerous group, Caucasian, as reference) have previously predicted flossing behavior (e.g., Updegraff et al., 2014), so these variables were retained as covariates in each analysis to avoid cohort effects and better isolate the effect of CE.

Results

Self-reported flossing. First, we examined whether receiving a congruent (vs. incongruent) message led to increased self-reported flossing. A hierarchical linear regression predicted flossing from frame condition and cultural exposure (CE; continuous) with age,

gender, ethnicity, and previous flossing as covariates (see Table 2). In Step 1, prior flossing was the only significant covariate, $B=.58$, $SE=.08$, $p<.001$. Two main effects emerged. First, individuals who read a loss-frame message, $M(SD)=5.64(.37)$, reported flossing more during the week than those who read a gain-frame message, $M(SD)=5.16(.37)$; $B=4.46$, $SE=1.61$, $p=.006$. Second, low-CE individuals flossed more, $M(SD)=6.23(.47)$, compared to high CE, $M(SD)=4.87(.36)$; $B=-4.98$, $SE=1.58$, $p=.002$. These main effects were qualified by the predicted two-way interaction, $B=5.10$, $SE=1.90$, $p=.008$, $\eta^2=.06$ (see Figure 1). CE was entered as a continuous variable, and because CE was peaked at 1 (54.7% of cases) and ranged down to .002, contrasts were created at high CE (1) and low CE (the average of non-1 values: .45). High-CE participants who received a gain-frame message flossed somewhat more, $M(SD)=5.20(.50)$, than those who received a loss-frame message, $M(SD)=4.55(.48)$; $B=-.93$, $SE=.66$, $p=.16$. Low-CE participants who saw a loss-frame message flossed significantly more, $M(SD)=7.29(.67)$, compared to those who saw a gain-frame message, $M(SD)=5.13(.59)$; $B=13.9$, $SE=3.48$, $p<.001$.

In sum, H1 was supported, especially among low-CE individuals, with a directional but not significant contrast among high-CE individuals. To examine whether this interaction was driven by motivational orientation (MO), in the next regression step MO and its interaction with message frame were included as predictors. There was no main effect, nor was there a significant interaction of MO with frame, $ps\geq.31$. As hypothesized, the interaction between CE and frame remained significant, $B=4.97$, $SE=1.92$, $p=.01$, $\eta^2=.05$ (see Table 2).

Because there is an objective threshold of recommended flossing (daily), the next analysis predicted who was flossing at recommended levels. Additionally, we tested the effect of congruent and incongruent conditions relative to no message. Congruent conditions ($n=75$) were either those with $CE\leq.45$ who received a loss-framed message, or those with $CE=1$ who received

a gain-framed message; the remaining participants saw incongruent messages ($n=76$). In a logistic regression using age, gender, ethnicity, and prior flossing as covariates, a congruency effect was observed on flossing at recommended rates, $\chi^2(7)=55.6, p<.001$. Planned contrasts showed that participants who received a congruent message were more likely to floss at recommended rates, 44.0%, $SE=4.86$, than those who read an incongruent message, 28.4%, $SE=4.45$, odds ratio (OR)=2.94, $SE=1.43, p=.03$. Incorporating the control condition, congruent participants were also more likely to floss at recommended levels, 44.3%, $SE=5.03$, than those in the incongruent and no-message groups combined, 30.7%, $SE=3.27$; $OR=2.39, SE=0.93, p=.03$. In addition, the likelihood of flossing at recommended levels was the same between incongruent participants, 29.6%, $SE=4.37$, and control, 34.4%, $SE=4.38$; $OR=0.68, SE=0.34, p=.44$.

Statement memory. Memory for the health message was measured at baseline and after one week, enabling the test of memory retention for the health message. Using GEE (see Analytic Plan), no main effects were significant, $ps \geq .13$. In order to probe interactions, the dummy variable of ethnicity was dropped (Dawson & Richter, 2006). There was an unpredicted two-way interaction between time and frame, $B=-2.52, SE=1.08, p=.02$, reflecting that loss-frame participants had more memory decay between baseline, $M(SE)=6.83(.27)$ statements recalled, and follow-up, $M(SE)=4.22(.27)$, than gain-frame participants, baseline $M(SE)=6.89(.27)$, and follow-up $M(SE)=4.69(.28)$.

This effect was qualified by the predicted three-way interaction of frame, cultural exposure, and time, $B=3.98, SE=1.35, p=.003$ (see Figure 2). For high-CE individuals, memory decayed over time for both gain- (slope $\neq$ zero $B=-1.49, SE=.44, p=.001$) and loss-frame (slope $\neq$ zero $B=-3.23, SE=.42, p<.001$) conditions, and memory decayed more in the loss- than gain-frame condition (difference in simple slopes $B=1.74, SE=.61, p=.004$). For low-CE individuals,

memory decayed over time for both gain- (slope $\neq$ zero $B=-2.83$, $SE=.38$, $p<.001$) and loss-frame (slope $\neq$ zero $B=-2.05$, $SE=.45$, $p<.001$) conditions, and the slope representing decline in memory was steeper for gain-frame although not significantly, $B=-.78$, $SE=.59$, $p=.19$. In sum, H2 received support among high-CE individuals, who retained better memory over one week after a gain-frame message, and directional (but not significant) support among low-CE individuals who received a loss-frame message.

Mediation. Memory was unrelated to self-reported flossing, so H3 was rejected. Using age, gender, ethnicity, and prior flossing as covariates in a Sobel-Goodman test, memory decay did not predict flossing, $B=.39$, $SE=.72$, $p=.58$. The congruency of message frame and cultural exposure had independent effects on memory and self-reported flossing. Please contact the first author with requests for data.

Discussion

This study provides three advances in understanding persuasive communication for culturally diverse populations. First, this study explored a message medium (brochure) that is typical for the healthcare context being studied (e.g., dentist offices) and can be easily adapted and distributed by healthcare professionals. Second, it introduced the novel, practical index of cultural exposure (CE) and showed that strategically matching culture to message frame can improve patient decisions about oral health (H1) and message memory for health recommendations (H2). Third, it demonstrated that the content of congruent health messages are better remembered, and showed that recall does not explain the behavior effect (H3).

The hypotheses were generally supported, although the congruency effect on flossing was driven more by individuals with lower cultural exposure (H1) and the congruency effect on memory was driven more by individuals with high cultural exposure (H2). Participants who

received an incongruent message flossed equivalently to participants who received no message, which reinforces the importance of considering patient characteristics during communication. A key advance was finding the congruency effects with a simple, demographic measure of culture in an ethnically diverse sample. Dental disease is largely preventable, but not all groups within the U.S. have the information or ability to engage in oral health promotion (U.S. Department of Health and Human Services, 2000). The inclusion of African Americans, Latino Americans, and Asian Americans extends the generalizability of cultural congruency findings, and identifying effective messages for these groups is a step towards addressing racial and ethnic oral health disparities (National Institute of Dental and Craniofacial Research, 2003).

There was a strong advantage of loss-frame messages among individuals low in U.S. CE. A loss-frame advantage on behavior was also shown among a large sample of U.S. adults (Sherman et al., under review). This loss-frame advantage challenges long-standing beliefs about how health messages should be framed to encourage adherence to preventative health behaviors such as flossing. A recent meta-analysis showed that gain-frame messages are slightly more effective than loss-frame messages for encouraging preventative behaviors in general (Gallagher & Updegraff, 2012). However, past research in message framing has been conducted almost exclusively in individualistic countries: a meta-analysis reviewed 95 studies and found that only one sample was from a collectivistic country (Taiwan; Gallagher & Updegraff, 2012). Our results suggest that loss-frame messages may be more effective than gain-frame messages for individuals low in U.S. CE, and for collectivistic populations (c.f., Pakpour, Yekaninejad, Sniehotta, Updegraff, & Dombrowski, 2014).

Motivational orientation (MO) did not mediate the cultural congruency effect. This was surprising, because the congruency predictions for CE arise from theory that also predicts

congruency effects for MO. There are several possible explanations. One is that the BIS-BAS measure requires awareness and conscious reflection, and some individuals may be unable or unwilling to report their motivations. We recently completed a feasibility pilot to evaluate the logistics of delivering framed health messages in dental clinics and offices in central California. We administered a validated scale of U.S. acculturation of Hispanics to participants who spoke at least some Spanish (Marin, Sabogal, Marin, Otero-Sabogal, & Perez-Stable, 1987), and found that CE correlated with Hispanic acculturation at $r(32) = .62, p < .001$. As expected, CE appears highly related to U.S. acculturation in Latinos, and this provides convergent validity for CE. The behavior effect in the main study was driven by a loss-frame advantage for individuals with low CE. It is possible that the key construct behind this effect is not exposure to U.S. culture but exposure to a common feature of the other cultures in our sample (e.g., collectivism, as the majority of low CE participants were also from collectivistic cultures, reflecting the most numerous immigrant groups to the U.S.; see Camarota, 2012).

We suggest that future work further explore which psychological variables are associated with CE. Prior work using prevention/promotion as an index of MO (Lockwood, Jordan, & Kunda, 2002) found that regulatory focus, an alternative construct of individual difference motivation to BIS-BAS, mediated the culture by frame interaction on flossing intentions (Uskul et al., 2009). Therefore, measures of regulatory focus may be better suited than BIS-BAS to capture individual differences related to the exposure to U.S. relative to other cultures. The above pilot study sets up future work to uncover the relationship between CE and well-described individual differences such as acculturation and prevention/promotion focus.

The main study also found that message congruency led to improved memory retention across one week, and tested whether message memory was a mediator of the congruency effect

on flossing behavior. Despite the logic for how memory drives behavior, there are several possible explanations for the lack of mediation. First, memory may not be a mechanism of the congruency effect; congruency may lead to a cascade of effects on cognition and behavior. Second, behavior might be driven less by memory for the content of the message than the overall memorability of the health message. The third explanation is operational. As a self-report measure, successful memory recall requires conditions beyond the presence of underlying semantic memory such as task motivation and conscious processing. Other types of memory tests that rely less on these conditions (e.g., recognition tests) may yet reveal associations with behavior.

Limitations. First, we predicted that CE would interact with framed health messages to determine effectiveness because the U.S. is highly individualistic, and low-CE individuals in our sample mostly came from relatively collectivistic cultures (i.e., East Asia, Latin America). Therefore, CE may only be useful for determining message frame in countries that are either highly individualistic or collectivistic, and where the predominant immigrant groups differ on these dimensions. CE may be less informative for a recent U.S. immigrant from Northern Europe, a relatively individualistic place. CE may also be a poor measure for Native Americans, who have high exposure to the U.S. but are generally collectivistic (Fryberg & Markus, 2003). For these groups we suggest consulting other framing moderators such as perceived susceptibility (Updegraff et al., 2014). Second, it is unclear based on the present research how to optimally frame medical communications for individuals with moderate CE. Third, the measure of ethnicity was confounded with race and did not separate White and non-White Hispanics. Fourth, self-reported flossing behavior could have introduced measurement error through social

desirability bias or inaccurate memory, although this would not explain the observed interaction patterns.

Conclusions. Cultural exposure is simple to measure, calculate, and use in healthcare contexts, and has now predicted differential message frame effectiveness in two independent samples of diverse U.S. citizens (the present study and Sherman et al., under review). These findings inform medical decision making in two ways. First, health practitioners can use strategic communication to improve message effectiveness (e.g., Abhyankar, Summers, Velikova, & Bekker, 2014). In healthcare settings where patients are urged to perform (or not perform) a behavior, asking two questions about cultural exposure would allow medical practitioners to strategically describe the consequences of a behavior primarily in terms of gain or loss. Second, patients who receive congruent messages appear to decide on better health behaviors. In practice, we suggest cultural exposure could be measured at patient intake and used to inform provider communication during the patient session.

Being aware of cultural characteristics can help practitioners promote oral health behaviors in diverse populations. Cultural congruency leads to improved memory as well as greater adherence, and these two effects appear independent. Almost any health suggestion can be framed in terms of gains or losses, and framing can be employed in any medium (speech, text, video, etc.). We encourage oral health professionals to adapt and use our brochures, and hope that sharing these materials informs the development of strategic health messages in other health areas. In sum, strategic framing choices in health communication can improve patient decisions and behaviors.

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References

- Abhyankar, P., Summers, B. A., Velikova, G., & Bekker, H. L. (2014). Framing options as choice or opportunity: Does the frame influence decisions? *Medical Decision Making*, 34(5), 567–582. doi:10.1177/0272989X14529624
- American Dental Association. (2008). *The public speaks up on oral health care: an ADA and Crest/Oral-B survey*. GFK Roper Public Affairs & Media. Retrieved from www.crest.com/ada-webcast/surveyfindings.pdf
- American Dental Association. (2013). Flossing. Retrieved October 16, 2014, from <http://www.mouthhealthy.org/en/az-topics/f/flossing>
- Camarota, S. A. (2012, July 20). Immigrants in the United States, 2010: A profile of America's foreign-born population. Retrieved June 16, 2014, from <http://cis.org/2012-profile-of-americas-foreign-born-population>
- Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS scales. *Journal of Personality and Social Psychology*, 67, 319–333.
- Centers for Disease Control. (2008). *Promoting healthy parenting practices across cultural groups: A CDC research brief*. Retrieved from <http://safesupportivelearning.ed.gov/resources/promoting-healthy-parenting-practices-across-cultural-groups-cdc-research-brief>
- Christianson, S.-Å., Loftus, E. F., Hoffman, H., & Loftus, G. R. (1991). Eye fixations and memory for emotional events. *Journal of Experimental Psychology: Learning*, 17(17), 693–701. doi:10.1037/0278-7393.17.4.693

- Davidson, P. L., Rams, T. E., & Andersen, R. M. (1997). Socio-behavioral determinants of oral hygiene practices among USA ethnic and age groups. *Advances in Dental Research*, 11(2), 245–253.
- Dawson, J. F., & Richter, A. W. (2006). Probing three-way interactions in moderated multiple regression: Development and application of a slope difference test. *Journal of Applied Psychology*, 91(4), 917–926. doi:10.1037/0021-9010.91.4.917
- Fazio, R. H., & Towles-Schwen, T. (1999). The MODE model of attitude-behavior processes. In S. Chaiken & Y. Trope (Eds.), *Dual process theories in social psychology* (pp. 97–116). New York: Guilford Press.
- Fryberg, S. A., & Markus, H. R. (2003). On being American Indian: Current and possible selves. *Self and Identity*, 2(4), 325–344. doi:10.1080/714050251
- Gallagher, K. M., & Updegraff, J. A. (2012). Health message framing effects on attitudes, intentions, and behavior: a meta-analytic review. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine*, 43(1), 101–116. doi:10.1007/s12160-011-9308-7
- Gallagher, K. M., Updegraff, J. A., Rothman, A. J., & Sims, L. (2011). Perceived susceptibility to breast cancer moderates the effect of gain- and loss-framed messages on use of screening mammography. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, 30(2), 145–152. doi:10.1037/a0022264
- Gerend, M. A., & Shepherd, J. E. (2007). Using message framing to promote acceptance of the human papillomavirus vaccine. *Health Psychology*, 26, 745–752.

Greenfield, P. M. (1994). Independence and interdependence as developmental scripts:

Implications for theory, research, and practice. In P. M. Greenfield & R. R. Cocking (Eds.), *Bridging Cultures, Readings 4bk Set: Cross-Cultural Roots of Minority Child Development* (1 edition.). Hillsdale, N.J: Psychology Press.

Gwet, K. (2002). *Kappa statistic is not satisfactory for assessing the extent of agreement between raters* (No. 1). Gaithersburg, MD: STATAXIS Consulting.

Hamamura, T., & Heine, S. J. (2007). Approach and avoidance motivations across cultures. In *Handbook of approach and avoidance motivations* (A. J. Elliot.). Mahwah, NJ: Erlbaum.

Hamamura, T., Meijer, Z., Heine, S. J., Kamaya, K., & Hori, I. (2009). Approach-avoidance motivation and information processing: cross-cultural analysis. *Personality and Social Psychology Bulletin*, 35(4), 454–62.

Heine, S. J., Lehman, D. R., Markus, H. R., & Kitayama, S. (1999). Is there a universal need for positive self-regard? *Psychological Review*, 106, 766–794.

Heine, S. J., Lehman, D. R., Peng, K., & Greenholtz, J. (2002). What's wrong with cross-cultural comparisons of subjective Likert scales?: The reference-group effect. *Journal of Personality and Social Psychology*, 82(6), 903–918.

Higgins, E. T., & Tykocinski, O. (1992). Self-discrepancies and biographical memory:

Personality and cognition at the level of psychological situation. *Personality and Social Psychology Bulletin*, 18(5), 527 –535. doi:10.1177/0146167292185002

Hofstede, G. (2001). *Culture's Consequences: Comparing Values, Behaviors, Institutions and Organizations Across Nations* (2nd edition.). Thousand Oaks, Calif.: SAGE Publications, Inc.

- Lee, A. Y., Aaker, J. L., & Gardner, W. K. (2000). The pleasures and pains of distinct self-construals: the role of interdependence in regulatory focus. *Journal of Personality and Social Psychology*, 78, 1122–1134.
- Lockwood, P., Jordan, C. H., & Kunda, Z. (2002). Motivation by positive and negative role models: Regulatory focus determines who will best inspire us. *Journal of Personality and Social Psychology*, 83, 854–864.
- Mann, T. L., Sherman, D. K., & Updegraff, J. A. (2004). Dispositional motivations and message framing: A test of the congruency hypothesis in college students. *Health Psychology*, 23, 330–334.
- Marin, G., Sabogal, F., Marin, B. V., Otero-Sabogal, R., & Perez-Stable, E. J. (1987). Development of a short acculturation scale for Hispanics. *Hispanic Journal of Behavioral Sciences*, 9(2), 183–205. doi:10.1177/07399863870092005
- Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review*, 98(2), 224.
- National Cancer Institute. (2008). *Making health communication programs work*. National Institutes of Health. Retrieved from <http://www.cancer.gov/cancertopics/cancerlibrary/pinkbook/page6>
- National Institute of Dental and Craniofacial Research. (2003). A plan to eliminate craniofacial, oral, and dental health disparities.
- Nisbett, R. E., Peng, K., Choi, I., & Norenzayan, A. (2001). Culture and systems of thought: Holistic versus analytic cognition. *Psychological Review*, 108(2), 291–310. doi:<http://dx.doi.org.proxy.library.ucsb.edu:2048/10.1037/0033-295X.108.2.291>

- Norenzayan, A., & Heine, S. J. (2005). Psychological universals: What are they and how can we know? *Psychological Bulletin*, 131(5), 763–784.
- Pakpour, A. H., Yekaninejad, M. S., Sniehotta, F. F., Updegraff, J. A., & Dombrowski, S. U. (2014). The effectiveness of gain- versus loss-framed health messages in improving oral health in Iranian secondary schools: A cluster-randomized controlled trial. *Annals of Behavioral Medicine*, 47(3), 376–387. doi:10.1007/s12160-013-9543-1
- Passel, J. S., & Cohn, D. (2012). U.S. foreign-born population: How much change from 2009 to 2010? Retrieved from <http://www.pewhispanic.org/2012/01/09/u-s-foreign-born-population-how-much-change-from-2009-to-2010/>
- Rothman, A. J., & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: The role of message framing. *Psychological Bulletin*, 121, 3–19.
- Rothman, A. J., & Updegraff, J. A. (2010). Specifying when and how gain- and loss-framed messages motivate healthy behavior: An integrated approach. In G. Keren (Ed.), *Perspectives on Framing* (pp. 257–278). London: Psychology Press / Taylor & Francis.
- Ryder, A. G., Alden, L. E., & Paulhus, D. L. (2000). Is acculturation unidimensional or bidimensional? A head-to-head comparison in the prediction of personality, self-identity, and adjustment. *Journal of Personality and Social Psychology*, 79(1), 49–65.
- Shen, L., & Dillard, J. P. (2009). Message frames interact with motivational systems to determine depth of message processing. *Health Communication*, 24(6), 504–514. doi:10.1080/10410230903104897
- Sherman, D. K., Brick, C., Binning, K. R., Mintzer, R. E., McCully, S. N., & Updegraff, J. A. (under review). Culture and health communication: The role of cultural exposure in health message framing.

- Sherman, D. K., Mann, T. L., & Updegraff, J. A. (2006). Approach/avoidance motivation, message framing, and health behavior: understanding the congruency effect. *Motivation and Emotion*, 30(2), 165–169. doi:10.1007/s11031-006-9001-5
- Sherman, D. K., Updegraff, J. A., & Mann, T. (2008). Improving oral health behavior: A social psychological approach. *The Journal of the American Dental Association*, 139(10), 1382.
- Sherman, D. K., Uskul, A. K., & Updegraff, J. A. (2011). The role of the self in responses to health communications: A cultural perspective. *Self and Identity*, 10, 284–294.
- Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science*, 22(11), 1359–1366. doi:10.1177/0956797611417632
- Taylor, S. E., Sherman, D. K., Kim, H. S., Jarcho, J., Takagi, K., & Dunagan, M. S. (2004). Culture and social support: who seeks it and why? *Journal of Personality and Social Psychology*, 87(3), 354–362. doi:10.1037/0022-3514.87.3.354
- Updegraff, J. A., Brick, C., Emanuel, A., Mintzer, R. E., & Sherman, D. K. (2014). Message framing for health: Moderation by perceived susceptibility and motivational orientation in a diverse sample of Americans. *Health Psychology*.
- Updegraff, J. A., Sherman, D. K., Luyster, F. S., & Mann, T. L. (2007). Understanding how tailored communications work: The effects of message quality and congruency on perceptions of tailored health communications. *Journal of Experimental Social Psychology*, 43, 248–256.
- U.S. Department of Health and Human Services. (2000). *Oral health in America: A report of the Surgeon General (executive summary)*. Rockville, MD: U.S. Department of Health and

Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health.

Uskul, A. K., Sherman, D. K., & Fitzgibbon, J. (2009). The cultural congruency effect: Culture, regulatory focus, and the effectiveness of gain- vs. loss-framed health messages. *Journal of Experimental Social Psychology*, 45(3), 535–541.

Table 1. *Demographic and analytic variables by condition.*

<i>N</i> =223	Gain	Loss	No message
<i>N</i>			
Total	75	76	72
Female	48	50	42
Caucasian	30	30	32
African American	13	12	10
Latino American	14	12	13
Asian American	9	14	12
Other	9	8	5
<i>M(SD)</i>			
Age	20.1 (3.29)	19.7 (1.45)	19.5 (1.40)
Cultural exposure	.73 (.34)	.77 (.29)	.74 (.32)
Motivational orientation	.08 (.52)	.10 (.48)	.15 (.49)
Flossing at baseline	4.16 (3.69)	2.97 (3.29)	3.31 (3.08)
Flossing at one week	5.69 (3.76)	5.38 (3.74)	4.83 (2.82)
Recalled statements at baseline	6.47 (2.29)	6.79 (2.31)	n/a
Recalled statements at one week	3.56 (2.82)	3.36 (2.52)	n/a

Table 2. *Hierarchical linear regression on self-reported flossing over one week by message frame, cultural exposure, and covariates.*

<i>n</i> =130	Step 1	Step 2
	Unstandardized <i>B</i> (<i>SE</i>)	
Age	-.17 (.10)	-.15 (.10)
Female	-.43 (.57)	-.40 (.62)
African American	.79 (.72)	.84 (.75)
Asian American	-.78 (.93)	-.83 (.93)
Latino American	.40 (.81)	.53 (.83)
Past flossing	.58 (.08)***	.57 (.08)***
Loss frame	4.46 (1.61)**	4.43 (1.62)**
Cultural exposure	-4.98 (1.58)**	-4.79 (1.60)**
Loss frame × Cultural exposure	5.10 (1.90)**	4.97 (1.92)**
Motivational orientation (MO)		-.66 (.80)
Loss frame × MO		1.09 (1.07)

Note. ** $p \leq .01$, *** $p \leq .001$

Note. The reference group for ethnicity was the most numerous (Caucasian).

Figure 1. *Self-reported flossing behavior by cultural exposure and message frame, with age, gender, ethnicity, and previous flossing as covariates (Step 1 in Table 2).*

Figure 2. *Memory decay as a function of cultural exposure, message frame, and time, with age, gender, ethnicity, and previous flossing as covariates (Step 1 in Table 2).*

Supplementary Materials

The gain- and loss-frame brochures are below, followed by supplementary analyses.

There are many reasons
to brush and floss
your teeth.

Here, we tell you how
brushing and flossing
your teeth can
improve your health.

1

For questions related to the study, please use the following contact information:

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Dental Health

Your Teeth

Are you brushing and flossing daily? Brushing and flossing are keys to a life-long smile. A consistent routine of brushing and flossing maintains the health of your teeth and gums. Regular brushing and flossing prevents stains on your teeth caused by food and beverages, making your smile white and beautiful. Additionally, brushing and flossing removes bacteria from your mouth—when removed, these bacteria are unable to wear away at your teeth.

Your Breath

Flossing regularly leads to fresh breath! According to dentists, the most reliable way to promote great breath, in addition to consistent brushing, is to floss your teeth regularly. Experts at the ADA report that “flossing your teeth daily removes particles of food in the mouth, which gets rid of bacteria and causes great breath.”

Plaque

Daily flossing keeps plaque from building up in your mouth. Plaque is a film that forms to your teeth and is made up of sugars and bacteria. Plaque is constantly growing in your mouth from food, beverages, and even your own saliva. When plaque builds up on your teeth and between your gums, it can cause cavities, gum irritation, and gum disease.

Your Gums

Regular flossing can prevent gum disease like gingivitis and periodontitis. In gingivitis, the milder form of gum disease, infection leads to chronic inflammation—gums are swollen, red, and sometimes bleeding. This is because of the bacteria sitting between the gums. In periodontitis, the more severe form of gum disease, the infection affects the bones that support the teeth, leading to tooth loss. Treatment for gum disease can be very costly, but if you floss daily, you can avoid expensive gum surgery.

Healthy Gums

Periodontitis

Your Cardiovascular System

Consistent flossing can even keep your body healthy! The bacteria that cause gum disease release toxins that can circulate around the body—meaning that gum disease can affect the health of your whole body, including your heart. Scientists are finding that there is an important connection between oral health and heart health. In a recent study published in the *International Journal of Cardiology*, researchers found that people who had suffered a recent heart attack had noticeably worse oral health than people who had not. This study suggests a link between the health of your teeth and gums and your risk for heart attacks. A recent report in the *Journal of Clinical Periodontology* found a startling relationship: the more severe people's gum disease, the thicker and harder the walls of their arteries. Thus, scientific evidence suggests that flossing daily can decrease your risk for heart disease.

How to Floss Correctly

When you floss correctly, your gums can stay healthy. To floss your teeth, take about 18 inches of floss in your hand. Wrap the floss around the middle fingers of both your hands and then use your thumbs and index fingers to direct the floss. Use a gentle sawing motion to guide the floss between your teeth. When the floss reaches the gumline, carefully slide the floss between the gum and tooth. Hold the floss tightly against the tooth. Next, gently scrape the side of the tooth. Then, move the floss to the tooth on the other side and gently scrape the side of that tooth.

If you floss often and correctly, flossing should be painless. One problem that people encounter when starting to floss is that it hurts and their gums bleed. When you floss every day, flossing won't hurt and your gums will no longer bleed. It is also important to go slowly. If you slow down when flossing, then you won't hurt yourself and your gums will feel much better after you floss.

If you brush and floss regularly,
say hello to a healthy smile
and great breath!

Your Teeth

Are you not brushing and flossing daily? If you're not, then your smile may not last your lifetime. An inconsistent routine of brushing and flossing hurts the health of your teeth and gums. Not brushing and flossing leaves stains on your teeth caused by food and beverages, making your smile yellow and ugly. Additionally, not brushing and flossing leaves bacteria in your mouth—if not removed, these bacteria are able to wear away at your teeth.

Your Breath

Not flossing regularly leads to bad breath! According to dentists, the most reliable way to produce bad breath, in addition to not brushing, is to not flossing your teeth regularly. Experts at the ADA report that "if you don't floss your teeth daily, particles of food remain in the mouth collecting bacteria, which causes bad breath."

Plaque

Not flossing allows plaque to build up in your mouth. Plaque is a film that forms to your teeth and is made up of sugars and bacteria. Plaque is constantly growing in your mouth from food, beverages, and even your own saliva. When plaque builds up on your teeth and between your gums, it can cause cavities, gum irritation, and gum disease.

Your Gums

Not flossing can increase your risk for gum disease like gingivitis and periodontitis. In gingivitis, the milder form of gum disease, infection leads to chronic inflammation—gums are swollen, red, and sometimes bleeding. This is because of the bacteria sitting between the gums. In periodontitis, the more severe form of gum disease, the infection affects the bones that support the teeth, leading to tooth loss. Treatment for gum disease can be very costly, and if you don't floss daily, you may need expensive gum surgery.

Healthy Gums

Periodontitis

Your Cardiovascular System

Inconsistent flossing can even hurt your body! The bacteria that cause gum disease release toxins that can circulate around the body—meaning that gum disease can affect the health of your whole body, including your heart. Scientists are finding that there is an important connection between oral health and heart health. In a recent study published in the *International Journal of Cardiology*, researchers found that people who had suffered a recent heart attack had noticeably worse oral health than people who had not. This study suggests a link between the health of your teeth and gums and your risk for heart attacks. A recent report in the *Journal of Clinical Periodontology* found a startling relationship: the more severe people's gum disease, the thicker and harder the walls of their arteries. Thus, scientific evidence suggests that not flossing daily can increase your risk for heart disease.

How to Floss Correctly

When you don't floss correctly, your gums will not stay healthy. To floss your teeth, take about 18 inches of floss in your hand. Wrap the floss around the middle fingers of both your hands and then use your thumbs and index fingers to direct the floss. Use a gentle sawing motion to guide the floss between your teeth. When the floss reaches the gumline, carefully slide the floss between the gum and tooth. Hold the floss tightly against the tooth. Next, gently scrape the side of the tooth. Then, move the floss to the tooth on the other side and gently scrape the side of that tooth.

If you floss irregularly or incorrectly, flossing can be painful. One problem that people encounter when starting to floss is that it hurts and their gums bleed. When you do not floss every day, flossing can hurt and cause your gums to bleed. It is also important to go slowly. If you go too fast when flossing, then you will hurt yourself and your gums will feel sore after you floss.

If you don't brush and floss regularly,
say hello to a yellow smile
and bad breath!

Supplementary Analyses

Perceived susceptibility. Perceived susceptibility to illness also interacts with message frame to predict self-reported flossing behavior (Updegraff et al., 2014). In the current study, the interaction of susceptibility and message frame was added to the model predicting flossing behavior to ensure that the findings regarding cultural exposure were not attributable to perceived susceptibility. The interaction between susceptibility and message framing trended towards significance, $B=-1.05$, $SE=.68$, $p=.13$; the direction of the pattern and effect size are comparable to other demonstrations in higher power samples (Gallagher, Updegraff, Rothman, & Sims, 2011; Updegraff et al., 2014). Among those high (+1SD) in perceived susceptibility, the loss frame, $M=6.31$, $SE=.60$, led to somewhat greater flossing than the gain frame, $M=5.91$, $SE=.57$; $p=.12$; however, among those low (-1SD) in perceived susceptibility, the gain frame, $M=4.48$, $SE=.57$, led to the same flossing rate as the loss frame, $M=4.88$, $SE=.53$; $p=.53$. As hypothesized, the interaction between cultural exposure and message framing remained significant, $B=5.10$, $SE=1.91$, $p=.01$.

Cultural exposure factors. The careful reader may wonder about the relative contribution of the cultural exposure components (life spent and parents born in U.S.). In our young sample (mean age=20.1 years), proportion of life spent in the U.S. showed a significant interaction with message frame on self-reported flossing in Step 2 of the main regression, $B=11.6$, $SE=2.98$, $p<.001$. In a separate regression, the interaction between parental birthplace and frame trended towards significance in the predicted direction, $B=1.98$, $SE=1.18$, $p=.10$. However, in another recent study using cultural exposure, parental birthplace by itself showed a significant interaction with message frame on flossing, but life spent in the U.S. did not (Sherman et al., under review). Note the other sample was age-diverse, with a mean age of 45.

Consider a child who moves to the U.S. At college age, their childhood in another country heavily affects the proportion of their life spent in the U.S. However, as they age, the time abroad carries less sway in the composite of cultural exposure. The observed difference between these findings and those from Sherman et al. (under review) reinforces the utility of using both questions together in the composite of cultural exposure, in order to sensitively index cultural exposure across populations diverse in age.