When Numbers Make You Feel: the Impact of Round Versus Precise Numbers on Preventive Health Behavior

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We show that exposing people to round (vs. precise) numbers in a preventive health message or even an unrelated context can increase their likelihood of adopting preventive health behaviors. We further show that the impact of round versus precise numbers on preventive health behavior is driven by affective reactions.

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EXTENDED ABSTRACT

Prevention is better than cure—this adage has shaped the US healthcare spending, with about 75% of healthcare expenditure spent on preventive care (Begley 2013). Many health problems can be avoided through simple preventive actions. Policy makers are, therefore, keen on understanding how preventive health messages can be made more persuasive (Gerend and Shepherd 2007). To make messages more persuasive, preventive health messages often incorporate numerical cues, such as the probability with which a preventive action can reduce a health risk (Reyna et al. 2009). The current research makes a novel prediction that incorporating numerical cues that appear round (e.g., 15.00%) versus precise (e.g., 15.23%) can increase people’s likelihood of adopting preventive behaviors.

Research shows that round numbers are more easily processed than precise numbers, in part because people are more frequently exposed to round numbers in everyday language (Kettle and Häubl 2009; Wadhwa and Zhang 2015). Moreover, research on affective decision-making suggests that exposure to fluent stimuli is likely to engage the default affective system, leading people to rely on their intuitive, affective reactions while making decisions (Alter et al. 2007). Drawing upon this logic, we propose that exposure to round numbers should lead people to rely on their more intuitive, affective reactions, compared with exposure to precise numbers.

Following from the idea that stronger affective reactions can motivate preventive health behaviors (Loewenstein et al. 2001; Sinaeur, Heath, and Cole 2005), we further hypothesize that when numerical cues in preventive messages are presented in a round (e.g., 15.00%) versus a precise (e.g., 15.23%) format, people are more likely to adopt preventive behaviors. We examine this hypothesis across five studies.

Study 1A

Study 1A examines our primary hypothesis—round numerical cues should increase preventive behavioral intention, compared to precise numerical cues.

This study was conducted in two stages. In the first stage, 200 US participants were presented with a health message featuring an obese person. The only difference between conditions being the probability numbers (see below):

- **30.00% (vs. 31.57%)** of the US population suffer from obesity today.
- **15.00% (vs. 15.29%)** of deaths in the US were caused by obesity.

Eat Healthy!

Twenty-four hours after being exposed to the message, participants were emailed the second survey. 156 participants (48.1% women, \(M_{age} = 31.7\)) completed the second survey. In this second survey, participants first reported the number of unhealthy, as well as healthy food items they had consumed in the past 24 hours. Participants then listed all the items with approximate portion size they had consumed in the last 24 hours. Our main dependent variable was the amount of unhealthy eating participants had engaged in 24 hours, subsequent to the preventive health message exposure.

Results and Discussion

We measured the amount of unhealthy eating in the following two ways. First, a linear regression analysis conducted on the number of unhealthy food items participants reported eating revealed that those exposed to round numbers consumed significantly less unhealthy food items (\(M=1.90\)) than those exposed to precise numbers (\(M=2.65\); \(t(154) = -2.91, p<.004\)). While, these participants also reported consuming a slightly higher number of healthy food items (\(M=4.65\)), than those in the precise number condition (\(M=4.08\)), this difference was not significant (\(t(154)=1.30, p=.20\)).

Second, to further examine if round versus precise numbers impacted unhealthy eating behaviors, we recruited 202 independent coders from the same population to rate the food items. Each coder was assigned to rate the food items listed by 15 to 16 participants on an 8-point scale (1=very unhealthy, 8=very healthy). We computed an unhealthy eating score (reverse-coded) by averaging the ratings of all the food items each participant had consumed. An ANOVA conducted on this score revealed that those exposed to round numbers had a lower unhealthy eating score (\(M=3.97\)) than those exposed to precise numbers (\(M=4.28\), \(t(154)=-2.29, p=.02\)). Study 1A shows that presenting obesity-related risks using round versus precise numbers in a health message reduced participants’ unhealthy food consumption.

Study 1B

This study, conducted in two stages, sought to conceptually replicate study 1A in the context of water consumption. In the first stage, 260 US participants were presented with a health message featuring a man and a woman suffering from flu. The only difference between conditions being the probability numbers:

- **20.00% (vs. 20.37%)** of the US population suffered from flu last year.

**The number of people being hospitalized due to flu complication has increased by 40.00% (vs. 40.21%).**

**Drinking water frequently can reduce the risk of getting flu.**

Drink More Water!

Twenty-four hours later, participants were emailed the second survey. Out of the 260 participants recruited in the first stage, 184 (45.1% women, \(M_{age} = 33.9\)) completed the second survey. In this second survey, participants reported the number of glasses of water and the number of times they had consumed water in the last 24 hours on a 21-point scale (ranging from 1 to 20+; 20+ was coded as 21). Finally, participants indicated how many glasses of water and how many times they generally consumed water in one day (excluding the last 24 hours) using the same 21-point scale items (ranging from 1 to 20+). Our main dependent variable was the change in water consumption from the regular water consumption, in 24-hours subsequent to message exposure.

Results and Discussion

We first computed the change in the number of glasses of water participants drank by subtracting the number of glasses of water they
usually consumed from the number of glasses they drank subsequent to being exposed to the preventive message. A linear regression revealed that those exposed to round numbers showed a significant increase in the number of glasses of water they drank ($M=0.55$), compared with those exposed to precise numbers ($M=-0.01$; $t(182)=2.23$, $p=.03$). Further, one-sample $t$ tests confirmed that the increase (0.55) in number of glasses of water consumed in the round number condition was significantly different from zero ($p=.002$), whereas the change (-0.01) in the precise number condition was not ($p=.95$).

Similarly, a linear regression revealed that participants in the round number condition showed a significant increase in the number of times they drank water ($M=0.68$) than those in the precise number condition ($M=-0.29$; $t(182)=2.73$, $p=.007$). One-sample $t$ test confirmed that the increase (0.68) of number of times water was consumed in the round number condition was significantly different from zero ($p=.007$), whereas the change (-0.29) in the precise number condition was not ($p=.26$). Study 1B provides further support for the round number hypothesis in the context of flu.

**Study 2**

We measured actual behavior in the current study. Participants were exposed to a dental hygiene message, which encouraged them to floss to avoid gum diseases. We measured the time participants spent on flossing. 202 participants recruited from a major university in Singapore (62.4% women, $M_{age}=21.3$) were randomly assigned to either the round or the precise number condition. Participants were shown a message related to gum diseases. This message, which incorporated a gender-neutral picture of an individual suffering from bleeding gum, indicated gum disease related risk estimates as either precise or round numbers:

- **60.00%** (vs. **60.41%**) of people in Singapore suffer from gum diseases leading to swollen and painful gums.

Gum diseases could increase the risk of losing teeth by **40.00%** (vs. **40.37%**).

**Flossing Helps Prevent Gum Diseases.**

Subsequently, participants were given an opportunity to floss their teeth. Participants were asked to pick up envelopes carrying individual floss sticks, a paper glass and napkins. Unbeknownst to the participants, we recorded the time participants took for flossing. Two participants reported not being able to floss due to their braces. Another ten participants did not pick up the flossing materials and missed this part of the task. Data from these 12 participants could not be used, leaving us with a total sample of 190 participants.

**Results and Discussion**

Due to the large variation in the flossing time measure, we first examined the data for outliers. Based on the three SD above or below the mean criterion (McClelland 2000), we identified and removed an outlier (>3.5 SD above the mean) prior to further analyses. A linear regression revealed that participants spent longer time flossing their teeth after reading the gum disease message with round numbers ($M=58.38$ seconds), compared with those who read the gum disease message with precise numbers ($M=46.58$ seconds; $t(187)=2.02$, $p=.045$). This study replicated the round number effect using actual behavioral measures.

**Study 3**

The degree to which affective reactions can drive behaviors depends on whether people trust their feelings would direct them in the right direction (Lee, Amir, and Ariely 2009). Affective reactions are more likely to drive behaviors when people believe trusting their affective reactions would help them make the right decision. In this study, therefore, we explicitly manipulated participants’ situational trust in their feelings. We predicted that when participants’ trust in feelings is high, exposure to round numbers in a preventive message should increase the likelihood to engage in preventive behaviors. In contrast, when participants’ trust in feelings is low, impact of round numbers on preventive behavioral intentions should get attenuated.

The study followed a 2 (number: round vs. precise) × 2 (trust in feelings: high vs. low) between-subjects design. 345 US participants (47.0% women, $M_{age}=34.8$) completed the study. One participant reported being below age 18 and thus data from this participant was removed prior to any analyses. Another participant who took approximately 24 hours to complete the experiment was removed from further analyses. A post-hoc check revealed that including these two participants’ data do not change our results.

Participants were informed that the first part of the experiment sought to understand how people use feelings when making a decision. In this task, participants were asked to recall and describe either a situation in which they followed their feelings and it was the right thing to do (high-trust in feelings) or a situation in which they followed their feelings and it was the wrong thing to do (low-trust in feelings; adapted from Lee et al. 2009). Fifty-seven participants did not indicate any experience, and thus data from these participants could not be used for analyses. Additionally, five other participants responded to the question in non-English languages and thus were removed prior to any analyses. Removing these participants left us with a total sample of 286 participants.

Subsequently, in a purportedly unrelated study, participants read the following scenario (adapted from Sinaeur et al. 2005) with the only difference across conditions being the probability number:

You have just finished eating your dinner. While watching the evening news on TV, you find out that eating chicken may expose you to the human variant of Bird Flu. According to the recent report, one type of vaccination was recently launched in the US, which can reduce the chance of getting this disease by **60.00%** (vs. **60.41%**).

Participants were asked to indicate their intention to take the vaccination on a nine-point scale (1=very unlikely, 9=very likely).

**Results and Discussion**

An ANOVA revealed a significant two-way interaction between the number exposure and the trust in feelings ($F(1,282)=5.44$, $p=.02$; see Figure 1) factors. Follow up analyses reveal that in the high-trust in feelings condition, participants indicated a higher intention to take the vaccination when the numerical cues presented in the message were round ($M=5.56$), than when those cues were precise ($M=4.68$; $t(282)=2.15$, $p=.03$). However, in the low-trust in feelings condition, this effect of number on the intention to take the vaccination was eliminated ($M_{round}=4.90$ vs. $M_{precise}=5.38$; $t(282)=-1.33$, $p=.25$).

**Study 4**

This study examines the reliance on affective reactions conceptualization in two ways: 1) We argue that if round versus precise numbers lead people to focus on their affective reactions, then incidental exposure to round versus precise numbers in an unrelated task could also subsequently increase people’s affective behavioral intention and 2) we examine the role of reliance on affective reactions in moderating this effect.

In this study, 483 US participants (60.2% women, $M_{age}=35.3$) were randomly assigned to one of the two number conditions. Participants engaged in eight consecutive trials of a number sorting task, which asked them to sort four different images of numbers in an as-
cending order of the physical size of the images. Participants sorted either round number images (e.g., 10.00, 60.00) or precise number images (e.g., 10.32, 63.74). The time participants spent on the task did not differ between conditions ($F(1, 125) = 0.86, p = .40$). A pretest with 42 participants indicated that the image sorting task was perceived to be equally difficult ($M_{\text{round}} = 2.17$ vs. $M_{\text{precise}} = 1.85, F(1, 41) = 3.7$) and effortful ($M_{\text{round}} = 4.32$ vs. $M_{\text{precise}} = 4.43, F(1, 41) = 0.84$) between the two conditions.

Subsequently, participants read a purportedly unrelated preventive message featuring a picture of an obese person, accompanied by the following message: “Increasing numbers of the US adults suffer from obesity today. Eat Healthy!”

Participants then indicated their likelihood of avoiding eating anything unhealthy for dinner that day (1=very unlikely, 9=very likely). We then measured negative affective reactions by asking participants two questions: “How worried do you feel about becoming overweight or obese?” (1=not at all worried, 9=very worried) and “How concerned do you feel about becoming overweight or obese?” (1=not at all concerned, 9=very concerned; $\alpha = .96$).

**Results and Discussion**

First, a linear regression analysis revealed that participants were more likely to avoid eating unhealthy after being exposed to round ($M=5.89$) versus precise ($M=5.43; t(481)=2.24, p = .026$) numbers.

Next, we examined if number condition impacted the degree to which affective reactions predicted intention to avoid unhealthy eating. In order to do so, we computed an interaction term between number factor and affective reaction. Our analysis (process model 1; Hayes 2013) revealed a significant two-way interaction between the number exposure manipulation and affective reaction ($b=.21; t(479)=2.51, p = .01$). In the round number condition, negative affective reactions significantly predicted intention to avoid unhealthy eating ($b=.26; t(479)=4.45, p = .0001$). However, in the precise number condition, negative affective reactions did not predict intention to avoid unhealthy eating ($b=.05; t(479)=0.86, p = .39$).

**General Discussion**

Simple preventive actions, such as getting immunized, avoiding unhealthy eating etc., could prevent many health problems and their associated costs. Across different settings using both intentional and behavioral measures, this research shows that exposure to round versus precise numbers can lead people to respond more affectively and thereby increase people’s likelihood to adopt preventive behaviors. These findings contribute both to literature on numerical cognition and affective decision making.

Access to health-related information has never been easier. Whether it is understanding more about effectiveness of different medical treatments or the risks associated with getting a disease, people can now easily access information through online and offline sources. Much of this information is presented numerically. Our findings show that a simple strategy of expressing such numerical information using round (vs. precise) numbers can increase adoption of preventive behaviors, thereby reducing health risks and ultimately saving lives.

**REFERENCES**


