



## Estimating the impact of different cigarette package warning label policies: The auction method

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### Abstract

The study estimated the reduction in demand associated with implementing cigarette package warning labels that contain imagery illustrating the consequences of smoking. The experimental auction method was used, wherein adult smokers in Mexico ( $n=89$ ) placed separate bids on two packs of cigarettes: one with a text-only warning label and the other with a warning label that included text and a graphic image. Differences in the values attributed to each pack were assessed using *t*-tests and multivariate regression. The pack with the graphic image had a mean attributed value which was 17% lower (\$3.21 pesos) than the pack with the text-only warning, and this difference remained statistically significant within subgroups defined by sociodemographics, amount of smoking, number of quit attempts, and levels of perceived smoking risks. In the multivariate model, the difference in attributed values was greater among females than males, but no such differences were found for other sociodemographic or smoking-related variables. The consistently lower value that smokers attributed to cigarette packages with the graphic warning label indicates that these labels are likely to reduce cigarette demand.

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*Keywords:* Graphic warning labels; Cigarette packaging; Experimental economics; Tobacco; Adult smokers; Risk communication

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## 1. Introduction

Warning labels on cigarette packages can help countries address the World Health Organization Framework Convention on Tobacco Control's (WHO-FCTC) guiding principle that "every person should be informed of the health consequences, addictive nature, and mortal threat posed by tobacco consumption and exposure to tobacco smoke." (WHO, 2003) Awareness of the health risks of smoking appears to motivate smoking cessation (Romer & Jamieson, 2001), and according to theories of health communication (IOM, 2002; Kotler, Roberto, & Lee, 2002; Strahan et al., 2002), cigarette packages appear to be ideal media for transmitting messages regarding these risks. First, these messages reach the desired target audiences of smokers and those interested in smoking. Second, the timing of message exposure is good, taking place at cigarette purchase and at the moment of smoking. Third, smokers are exposed to the messages frequently. Someone who smokes a pack a day, for example, could be exposed to the warnings 20 times a day, 7300 times a year. Fourth, different messages can be printed on different packs in order to guard against a reduction in effectiveness over time that results from habituation to messages (USDHHS, 1989). Finally, policies can mandate that the tobacco industry bear the costs of printing the warning labels, making this communication strategy extremely cost-effective compared to other educational efforts, such as mass media health promotion and counteradvertising campaigns.

In order to ensure that smokers and others attend to warning labels, the WHO-FCTC states that warning labels "should be 50% or more of the principal display areas but shall be no less than 30% of the principal display areas" and "may be in the form of or use pictures or pictograms." Graphic messages on warning labels appear more effective than text-only messages in engaging smokers and promoting quitting (Hammond, Fong, MacDonald, Cameron, & Brown, 2003; O'Hegarty et al., 2006; Strahan et al., 2002). The evidence is strongest when comparing data from Canada, which was the first country to implement graphic warnings, with data from countries where labels contain only text. For example, Canadian smokers' report higher levels of noticing and processing warning labels (i.e., thinking about smoking risks and quitting due to reading labels) than smokers in the US, Australia, the UK, and Mexico (Hammond, Fong, McNeil, Borland, & Cummings, 2006; Thrasher, Hammond, Fong, & Arillo-Santillan, 2007). Furthermore, cross-country comparisons of longitudinal data suggest that the impact of graphic warnings on smokers is more sustainable over time than text-only messages, which appear to "wear out" more quickly as smokers habituate to them (Hammond et al., 2007). The use of images to express the consequences of smoking may be a particularly effective educational strategy where a sizeable proportion of the population is not literate and, therefore, unlikely to attend to or understand text-based warnings. Finally, graphic warning labels appear to be an important source of information regarding health risks for non-smokers (Hammond, Fong, McNeil et al., 2006), which may lead to increased pressure to quit from smokers' social network members. As the scientific evidence has accumulated, more and more countries have mandated the inclusion of graphic imagery on cigarette warning labels (e.g., Australia, Brazil, Canada, Chile, Singapore, Thailand, Uruguay, and Venezuela), with other countries soon to follow (e.g., Belgium and New Zealand).

The current study aimed to evaluate the potential impact of graphic warning labels among adult Mexican smokers. The random  $n$ th price auction method from experimental economics was used to determine whether adult smokers perceived a cigarette pack with a graphic warning label to be less valuable than a cigarette pack that contained the text-only warning that is currently in force in Mexico. A lower perceived value for cigarettes with graphic warnings than for "normal" cigarettes would signify weaker demand, which, according to standard economic theory, should translate into reduced

consumption (Rousu, Huffman, Shogren, & Tegene, 2004a; Shogren, Margolis, Koo, & List, 2001). Finally, we assessed whether sociodemographics and smoking-related variables (e.g., perceived risks of smoking, recent quit attempts, quantity of cigarettes consumed per day) were associated with differences in the perceived value of cigarette packs with and without graphic warning labels.

## 2. Methods

### 2.1. Auction method

Data were collected with the experimental economics method of the random  $n$ th price auction (Rousu et al., 2004a; Rousu, Huffman, Shogren, & Tegene, 2004b; Shogren et al., 2001), which is used to reveal private preferences and evaluations of commodities, particularly one commodity over another or the same commodity with different characteristics. According to this method, participants are initially given enough money to compensate for their time and to provide them with more than enough money to pay the “store-price” for the commodities of interest. Bidding on the commodity takes place anonymously, and once all bids are placed, they are arranged in rank order of the amount bid. Auction “winners” are determined by randomly selecting a number between 2 and the number of participants in the auction. For instance, if the number 5 is randomly selected, then the four highest bidders will buy the product for the amount associated with the 5th highest bid. Because the price is randomly determined, even bidders who attribute low or moderate values to the product have a chance to win the auction. Moreover, both insincere over- and underbidding are more likely to lead to a loss, whether due to purchasing a product one does not really want or not purchasing a desired product at a price that the participant deems reasonable.

Perhaps the most important advantage of the auction method concerns its ability to separate what people say they would pay for a product from what they will actually pay (Rousu et al., 2004b). All participants receive a level of monetary compensation that is higher than the cost of the products for which they will bid, thereby alleviating concerns that participants will not have enough money to enter a bid. Indeed, as described above, the auction attempts to engage bidders at all points along the demand curve. Unlike with methods that employ hypothetical scenarios, participants make decisions that have “true” financial impact. The auction winners pay for the product, just as they would in the marketplace.

Although the auction method comes closer to simulating market transactions than hypothetical scenarios, this method also offers the advantage of allowing greater control over transaction conditions than in studies of naturally occurring market transactions. For instance, auction studies can be designed to assess differences in participants’ evaluations of two products that vary only with regard to a single characteristic. This level of experimental control allows for participant evaluations of products that only vary in terms of their labels, as in studies of products that contain different percentages of genetically modified organisms (Rousu et al., 2004a,b) and cigarettes with different levels of nicotine (Monchuk, Rousu, Shogren, Nonnemaker, & Kosa, 2007). As such, the method is particularly suitable for studying the impact of graphic warning labels in the absence of other changes to cigarettes themselves or to cigarette pack design.

A final key advantage of the auction method concerns the ability to extrapolate findings in order to estimate the impact of introducing a new product. In theory, the method is “demand revealing,” with lesser perceived value for a product signifying weaker demand, and weaker demand translating into lower levels of consumption (Rousu et al., 2004b; Shogren et al., 2001).

## 2.2. Participants and sample size

Eligible study participants were 18 and older, had smoked more than 100 cigarettes in their lifetimes, had smoked at least one cigarette in the last month, and did not self-report being pregnant. Recruitment of participants occurred through fliers, emails, and informal contacts with smokers at two hospital worksites, two academic departments in a public university, and two groups of workers at an industrial worksite. Each participant attended one “auction group” comprised of 9 to 20 participants.

## 2.3. Data collection and procedures

Before the study began, all participants read and signed an informed consent document, were given \$50 pesos (approximately USD\$5.00), and were asked to fill out a short questionnaire. Thereafter, the auction was explained. A lottery tumbler was used to determine the  $n$ th price by selecting one of the balls that were consecutively numbered from 2 up to the total number of participants in the group. A short quiz was then given to help ensure participant understanding of the auction. Two practice auction rounds were then conducted, one with a candy and another with a package of cookies. Before each round, participants were told that only one of the two rounds would be randomly selected as the auction for which “winners” would actually pay for and receive the product. Economic theory predicts an individual may reduce her bid if she thinks she might win multiple products (List & Lucking-Reiley, 2000). By only allowing one round to be binding, we prevented the possibility of participants winning both products, even though the products in the practice round were relatively cheap. More importantly, the practice rounds simulated the subsequent rounds that involved cigarette packs, which otherwise may have been more vulnerable to underbidding due to lack of familiarity with the auction procedure, particularly the selection of only one of two rounds as binding. After the second practice round was conducted, a participant was asked to blindly select one of two ping pong balls, each of which represented one of the two rounds. Once the binding practice round was selected, the winners from that round were asked to come to the front of the room to pay for and receive their product.

The above protocol was then replicated for two subsequent rounds that involved cigarette packs with and without the warning label that contained graphic imagery. In each round, a pack of Marlboro red cigarettes was auctioned, with the only difference between the packs being the high-quality graphic design sticker placed over the warning label space, which occupied 50% of the back of the cigarette pack. For the pack with a text warning only, the sticker had the same font type, font size, and one of the three rotating messages (i.e., “Smoking is a cause of cancer and emphysema”) that were on Mexican cigarette pack warning labels (see Fig. 1). The other warning label was adapted from those proposed for the European Union, 60% of which showed a close-up of a man with a cancerous mass on the outside of his neck and accompanying text that stated “Smoking can cause a slow and painful death”. Previous research indicated that this image was amongst the most effective warning label images in prompting Mexican smokers to think about quitting (Thrasher et al., 2006). To control for ordering effects, the order of presenting the pack with the text-only warning or with the graphic warning was randomly assigned and alternated within each relatively homogeneous group. In other words, the order of presentation was randomly selected for the first group of university students, hospital workers, and industrial workers, whereas the order of presentation was switched for second group within each of these populations. After both auction rounds were finished, one of the two rounds was randomly selected as binding in order to help ensure that participants would not decrease their bids in order to pay for two packs of cigarettes. The winners of the binding round were then asked to pay for and receive their cigarette pack.





Fig. 1. Cigarette packages with warning labels that contain text only and that contain graphic imagery.

#### 2.4. Measures

Before the method was explained and auction rounds conducted, participants responded to a short survey regarding sociodemographics (i.e., sex, age) and smoking behavior (i.e., quantity of cigarettes smoked each day, and the time since their last quit attempt). Survey questions also assessed perceived risks of smoking, asking about the percentage of smokers who, over the course of their lives, will develop lung cancer and other illnesses, such as heart attacks, with response formats indicating percentages with 10% increments. Finally, participants were asked to assess the danger of exposure to cigarette smoke for non-smokers (i.e., not dangerous; a little dangerous; moderately dangerous; very dangerous). Participants' responses to the survey were anonymous, but contained an identification number that was linked to the sheets of paper that they used to record their bids for each product.

#### 2.5. Data analysis

Data analysis involved a series of paired, one sample *t*-tests to determine: 1) significant differences in mean prices attributed to the cigarette packs with and without graphic warning labels; 2) variation in the extent of differences between values attributed to the cigarette packs within particular sociodemographic, smoking behavior, and perceived risk groups. With adequate random allocation of groups to different experimental conditions, differences in means should be sufficient to determine treatment effects because confounding variables are randomly distributed across experimental conditions (Pedhazur & Pedhazur Schmelkin, 1991). However, given the relatively small number of groups and possible differences in group composition due to recruitment methods, we also examined differences in potential confounding variables across the two

Table 1  
Mean bids (Mexican Pesos<sup>a</sup>) for cigarettes with and without a graphic image warning label

		Mean cigarette pack bid <sup>a</sup>		Paired <i>t</i> -test
		With image	Without image	
Entire sample ( <i>n</i> =89)		\$15.22	\$18.43	<0.0001
Sex	Male ( <i>n</i> =48)	\$15.67	\$17.22	0.0423
	Female ( <i>n</i> =41)	\$14.70	\$19.84	0.0001
Age	19–23 ( <i>n</i> =44)	\$15.81	\$18.93	0.0027
	24–55 ( <i>n</i> =44)	\$14.64	\$17.96	0.002
Quantity cigarettes per day	5 or less ( <i>n</i> =42)	\$14.43	\$17.34	0.0017
	6 to 10 ( <i>n</i> =32)	\$15.34	\$18.89	0.0125
	More than 10 ( <i>n</i> =16)	\$17.05	\$20.38	0.0435
Last quit attempt	Never ( <i>n</i> =29)	\$15.64	\$19.04	0.0216
	>1 year ( <i>n</i> =11)	\$14.80	\$15.81	0.2786
	<year but not now ( <i>n</i> =28)	\$16.25	\$20.12	0.0046
	Now ( <i>n</i> =20)	\$13.43	\$16.68	0.0054
Perceived lung cancer risk in smokers	0–29% ( <i>n</i> =22)	\$15.61	\$18.77	0.0172
	30–49% ( <i>n</i> =35)	\$16.28	\$19.87	0.0032
	>50% ( <i>n</i> =31)	\$13.58	\$16.52	0.0179
Perceived heart attack risk in smokers	0–29% ( <i>n</i> =22)	\$13.33	\$18.27	0.0016
	30–49% ( <i>n</i> =35)	\$17.15	\$19.90	0.0129
	>50% ( <i>n</i> =31)	\$14.18	\$16.62	0.036
Perceived danger of ETS for non-smokers	None to moderate danger ( <i>n</i> =20)	\$17.35	\$19.91	0.0368
	Very dangerous ( <i>n</i> =68)	\$14.75	\$18.19	0.0001
Order of pack presentation	1st auction for pack with image ( <i>n</i> =46)	\$16.25	\$17.24	0.0872
	1st auction for pack without image ( <i>n</i> =43)	\$14.12	\$19.70	0.0001

<sup>a</sup> Prices shown are in Mexican Pesos, for which the exchange rate at the time of the study was around \$10.80 Mexican Pesos to \$1.00 US dollar.

experimental conditions of first evaluating the cigarette pack with the image vs. first evaluating the cigarette pack without the image. Finally, both bivariate and multivariate regression models were estimated, regressing individual-level differences in bids given to each pack on the other variables of interest.

### 3. Results

The study population was comprised of 54% males (*n*=48) and had an average age of 27.6 years old (range=19–55). Almost half of the population smoked 5 or less cigarettes a day (*n*=42), 35% (*n*=32) smoked between 6 and 10 cigarettes, and 18% (*n*=16) smoked more than 10 cigarettes a day. When asked about their last quit attempt, 23% (*n*=20) were currently trying to quit, 32% (*n*=28) were not currently doing so but had tried to quit in the past year, 12% (*n*=11) had attempted to quit more than a year ago, and 33% (*n*=29) said they had never attempted to quit. Groups were relatively evenly divided between those who first bid on the cigarette pack with the image (*n*=46) and those who first bid on the cigarette pack without the image (*n*=43). Pearson chi-square tests indicated that the only statistically significant difference between these two groups involved greater perceived risk of heart attacks in the group for which the cigarette pack with the image was presented first (*p*=0.045).

Paired *t*-tests were used to examine differences in the mean bids for packs with and without the graphic warning label, revealing consistently lower perceived value for the pack with the graphic warning label

Table 2

Bivariate and multivariate adjusted regression of difference scores for bids on cigarette packs with and without graphic warning labels

	Bivariate B (SE)	Multivariate B (SE)
Female (vs. male)	3.60 (1.46)*	3.45 (1.65)*
Age	−0.03 (0.09) <sup>ns</sup>	−0.02 (0.09) <sup>ns</sup>
Quantity cigarettes per day	0.29 (1.00) <sup>ns</sup>	1.92 (1.13) <sup>ns</sup>
Last quit attempt	0.12 (0.65) <sup>ns</sup>	−0.06 (0.65) <sup>ns</sup>
Lung cancer risk	−0.15 (0.99) <sup>ns</sup>	0.76 (1.23) <sup>ns</sup>
Heart attack risk	−1.22 (0.98) <sup>ns</sup>	−1.25 (1.27) <sup>ns</sup>
ETS danger	0.89 (1.82) <sup>ns</sup>	1.38 (1.91) <sup>ns</sup>
Order of pack presentation	−4.59 (1.43)**	−4.15 (1.57)**

\* $p < 0.05$ ; \*\* $p < 0.01$ ; ns = not statistically significant.

(see Table 1). The overall mean difference in bids was \$3.21 Mexican pesos, a difference that was consistently replicated across groups segmented by age, the daily number of cigarettes smoked, and level of perceived health risk for smokers and non-smokers. This difference was also replicated across three of the four categories used to classify last quit attempt; however, a \$1.00 peso difference was not statistically significant among those who had tried to quit a year or more ago. Both females and males attributed lower values for the package with the graphic label, and the differences in both groups were statistically significant although it appeared greater for females (\$5.14,  $p = 0.0001$ ) than for males (\$1.55,  $p = 0.042$ ). The order in which the packs were presented seemed to influence bids, since a large difference in perceived values was found when participants bid second on the pack with the graphic warning (\$5.58,  $p = 0.0001$ ), whereas a smaller, marginally statistically significant difference was found when this pack was bid upon first (\$1.01,  $p = 0.087$ ). Finally, an independent samples  $t$ -test was conducted on the difference in the bids that participants placed on just first cigarette package that was auctioned to their group. The difference of \$3.45 pesos (\$16.25 vs. \$19.70) was statistically significant ( $p = 0.01$ ) and comparable to the difference we found when examining individual bids for both cigarette packages.

A difference score was derived by subtracting the bids for the pack with the graphic image from the bids for the pack with the text-only warning. Results from bivariate regression of this variable on other study variables indicated a statistically significant relationship only for female sex ( $\beta = 3.60$ ,  $SE = 1.46$ ,  $p = 0.016$ ) and the order in which the packs were presented ( $\beta = -4.59$ ,  $SE = 1.43$ ,  $p = 0.002$ ). A multivariate model was also estimated, regressing the difference score on all study variables (see Table 2). As with the bivariate results, the only statistically significant independent variables were sex ( $\beta = 3.45$ ,  $SE = 1.65$ ,  $p = 0.04$ ) and the order in which the packs were presented ( $\beta = -4.15$ ,  $SE = 1.55$ ,  $p = 0.010$ ).

#### 4. Discussion

The results from this study indicate that adult smokers in Mexico appear to attribute a lower value to cigarette packs with warning labels that contain graphic images relative to packs with warnings that contain only text. Moreover, this lower perceived value was relatively consistent across groups defined by sociodemographics, amount of daily smoking, number of quit attempts, and levels of perceived smoking risks. The pack with a graphic image had a mean attributed value which was \$3.21 pesos lower than the

normal pack with the text warning, representing a 17% reduction in perceived value. This lower value is theoretically equivalent to the reduced demand associated with introducing this graphic warning label, which would translate into a fairly profound reduction in tobacco consumption. Nevertheless, extrapolation from this study to broad-scale population impact may not be merited, particularly since smokers appear to habituate to warning labels (USDHHS, 1989), even though the habituation effect appears to take longer for graphic warnings (Hammond et al., 2007). The initial shock of this “new” product characteristic may nevertheless influence smokers before they become desensitized.

Bivariate and multivariate results mostly suggested that the perceived lower value of the pack with the graphic warning was independent of age, smoking behavior, and perceived risks of smoking. Such characteristics had previously been found to influence differences in the values attributed to cigarettes with different levels of nicotine, suggesting that some subsets of adult American smokers were not influenced by these product characteristics (Monchuk et al., 2007). The current study implies that the impact of graphic warning labels would be felt across most all subpopulations we studied. Even though the difference in perceived value was greater among females than among males, it appeared significant in both groups. This finding should be considered in light of other studies indicating that females are more concerned than men about health (Grogan, 2006) and the health effects of smoking (Hammond, Fong, Zanna, Thrasher, & Borland, 2006), and that women view graphic warning labels as more effective than men (Koval, Aubut, Pederson, O’Hegarty, & Chan, 2005; O’Hegarty et al., 2006).

We also found an ordering effect across experimental conditions. In particular, first presenting the pack with the graphic warning led to a smaller, only marginally significant difference in value between this pack and the pack without the graphic warning (difference=\$1.01,  $p=0.087$ ). Those who bid on the packs with the image first may have been unable to forget the image once they turned toward bidding on the pack with the text warning. Indeed, when the pack with the text warning was presented second, the mean value attributed to this normal pack was \$2.46 pesos less than the value attributed to this same pack when it was presented first. Moreover, when the pack with the text warning was presented first, its mean attributed value (\$19.70) was much closer to the average price of a Marlboro pack in Mexico at the time of the study (\$20 to \$21). If the effect of the warning label image carries over to packs with text-only warnings, policy makers may consider rotating warning labels with and without images. Future studies may consider whether this strategy would have equal, lesser, or greater impact than mandating that all warning labels contain graphic images. Although our study evaluated only one graphic and one textual warning label, the auction method could be extended to examine the relative impact of a range of cigarette pack characteristics, including different combinations of graphic images, textual warnings, and ways of labeling tobacco constituents.

A key limitation to this study concerned its use of a convenience sample of smokers who generally knew one another within each group. As such, the results may not generalize to the Mexican population. However, purposive selection of groups in three different settings enabled data collection from a generally wide range of population segments across a relatively small number of groups. Moreover, although participants within each group were generally known to one another, rules against speaking to one another helped ensure the anonymous, relatively independent nature of their bids. Future studies may consider conducting auctions with groups of randomly selected smokers; however, the difficulty of coordinating the logistics for these groups may nevertheless favor the random selection of sites within which auction participants are sought.

The study methodology may have triggered demand characteristics or socially desirable responding, leading participants to ascribe lesser value to the cigarette pack with the image in order to comply with their perceptions of study goals. However, the ordering effect we found suggests that the opposite tendency may



also have occurred, with participants reducing their bids for the “normal” cigarette package to align it with the first bids they placed on the package with the graphic warning. Moreover, we found a comparable, statistically significant mean difference when we examined just the bids made for the first cigarette pack presented to each group (\$16.25 vs. \$19.70 pesos,  $p=0.01$ ), and this difference was comparable to the overall mean difference that we found (i.e., \$3.45 vs. \$3.21). In future studies, concerns about triggering demand characteristics might be addressed through random assignment of people or groups to each condition, while only auctioning one pack type. Furthermore, the cigarette pack auction could be embedded within a sequence of auctions for other kinds of products, so that the pack does not stand out as much. The present study went some way toward this ideal by conducting two preliminary auctions involving other products (i.e., candy and cookies); however, no other auction rounds preceded or followed the cigarette auctions.

Another potential limitation concerns the different text for each of the two warning labels under consideration. The text that accompanied the graphic image may have had a stronger impact than the text-only message, thereby explaining at least some of the difference in perceived value. Given the prominence of the graphic image, it is unlikely that the differences found could be explained only by the textual differences across the warning labels. A better assessment of the relative contribution of textual elements would have involved auctions for cigarette packs that included the exact same textual elements. However, we selected the graphic warning label for this study based on prior research that indicated its potential efficacy among adult Mexican smokers (Thrasher et al., 2006), which we did not want to compromise by changing the text. As such, the results from the present study should be viewed as testing the enhancement of textual elements (e.g., making font bigger), changing the text message, and including a prominent graphic image.

Auction studies are “demand revealing” in principle, but the experimental conditions do not exactly correspond to “real” market transactions. Nevertheless, the auction method better simulates market transactions than hypothetical economic scenarios (e.g., “How much would you pay for  $X$ ?”) (Rousu et al., 2004b). The method may offer similar advantages over other studies that have evaluated graphic warning labels before they enter the marketplace by asking smokers’ assessments of potential label effectiveness using both quantitative (O’Hegarty et al., 2006) and qualitative methods (O’Hegarty, Pederson, Yenokyan, Nelson, & Wortley, 2007; Thrasher et al., 2006). The auction method is a rapid, low-cost, theory-based direct assessment technique that can complement, or perhaps even replace, other more involved methods for determining which warning labels are most likely to effectively reduce consumption.

As signatories of the WHO-Framework Convention on Tobacco Control contemplate implementation of different warning label strategies, the auction method may be useful in suggesting the content, imagery, size, and format of graphic warnings that are most likely to reduce cigarette consumption. The relative ease of illustrating and understanding differences in perceived value may prove compelling in efforts to convince policy makers of the efficacy of particular warning label proposals. Even among those countries that have already implemented graphic warnings, the method could be used to test new messages, images, and listings of product ingredients that could be implemented in the future in order to mitigate “wear out” and habituation to existing messages.

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