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Emotional images on cigarette warning labels affect smokers' brains and behavior

First fMRI study to look at the effects of graphic warning labels on smokers

PHILADELPHIA – When a federal appeals court ruled in 2012 that graphic cigarette warning labels were unconstitutional, it said that the selected images “did not convey any warning information at all” and were “unabashed attempts to evoke emotion (and perhaps embarrassment) and browbeat consumers into quitting.”

But a new study suggests that using emotionally evocative images such as rotting teeth and a diseased lung is important in making the warning labels more memorable and effective in conveying the risks of smoking.

The study, led by researchers at the Annenberg Public Policy Center (APPC) and the Perelman School of Medicine, both at the University of Pennsylvania, is the first to report the use of functional magnetic resonance imaging (fMRI) to study smokers’ brain response to graphic warning labels. The researchers found that warnings with more powerful images produced greater activation in parts of the brain that register emotional memory and fear. The more emotional labels also proved more memorable and were associated with greater reduction in the urge to smoke than the less emotional labels.

The findings suggest “that emotional imagery in graphic warning labels is an integral factor in the labels’ memorability” and “contributes to their public health impact,” according to the authors of the study, which was published online in Tobacco Control.

Emotional images prove more memorable

The fMRI study reported results from 19 smokers who were shown 24 pictorial warning labels. In previous testing by the FDA, 12 of those labels were judged to produce a high “emotional reaction” while 12 were at the low end of the scale. The more emotional labels show images such as a corpse and a man blowing smoke through a tracheotomy hole; the less emotional labels show images such as tombstones and an oxygen mask. Another 12 scrambled images were used as controls.

Daniel D. Langleben, M.D., an associate professor of psychiatry at the Perelman School of Medicine’s Center for the Study of Addiction, a distinguished research fellow at APPC, and the principal investigator on the project, said, “This study shows that the more scary pictures reduce craving, which means you can’t separate scary from effective. The emotional effects and behavioral effects may be inseparable.”
The study found that the pictorial warning labels with more emotional content produced a greater response in the limbic system, brain structures associated with emotions, such as fear. These structures also encode experiences into longer-term memory, an effect that was apparent in the greater ability of smokers to recognize the more emotional warnings after a delay.

Smokers were tested on their recognition of the labels 20 minutes after being shown them. An-Li Wang, Ph.D., a senior researcher at APPC and lead author of the study, said that the findings reported in Tobacco Control are preliminary, and a study to determine the longer-term effects of the labels is underway. “Memory is a gateway to a long-term behavioral change,” she said, “and we look forward to testing that prediction in our ongoing research.”

“You want warning messages to be memorable,” said APPC associate director Daniel Romer, Ph.D., a co-author of the study. “This study shows that the emotional impact of the more graphic labels has an educational benefit that supports public health.”

**Challenges in the courts**

The Tobacco Control paper addressed concerns raised by the U.S. courts over the pictorial warning labels, which are required in more than 70 countries, from Canada (2001) to the Philippines (2015). Congress mandated the use of the graphic warning labels in 2009, but the Food and Drug Administration’s proposed labels were later deemed unconstitutional by a federal appeals court, which ruled that the FDA’s evidence of the effectiveness of the labels was insufficient to overcome the commercial speech rights of the tobacco companies that filed suit.

The Tobacco Control paper follows a prior study led by Dr. Wang and others at the University of Pennsylvania showing that the more emotional warning labels dampen the brain’s response to smoking cues such as the image of a lit cigarette. That electroencephalography study, published in the February 2015 issue of Addiction Biology and published *previously online*, showed that exposure to the more emotional labels lessened smokers’ attention to smoking cues and reduced their craving for cigarettes.

Additional authors of the fMRI study, which was supported by APPC and the National Institute on Drug Abuse, were Mario Giorno, at APPC, and Steven B. Lowen of the Department of Psychiatry, Harvard Medical School.

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