



ILLUSTRATION BY MATTHEW HOLLISTER

men). In 2003, the ACS estimated that excess weight could account for one in seven cancer deaths among men and one in five among women in the United States.

Since 2003, the evidence linking body weight and cancer has grown stronger. One of the most comprehensive efforts to examine this relationship came from the World Cancer Research Foundation and the American Institute for Cancer Research in Washington DC. At UCL, Marmot led a team of 21 scientists to review some 7,000 related studies, and again found a convincing link between excess weight and many cancers. They found a link between excess body fat and a variety of cancers. They recommended that people strive to be as lean and active as possible, and that they avoid sugary drinks.

Researchers have yet to fully understand how being overweight can cause cancer. The mechanism likely depends on the type of malignancy. For example, abdominal fat presses on the stomach, causing acid to splash up into the oesophagus. That acid leads to tissue damage, which can lead to oesophageal cancer. Oestrogen, produced by fat cells, appears to play a role in endometrial cancer and breast cancer in postmenopausal women. "Obese women have about three times the circulating level of oestrogens as lean women," says Walter Willet, a prominent nutrition researcher at Harvard University.

Obesity can also cause the body to become less responsive to insulin. To compensate, the pancreas churns out more of this potent growth factor. Researchers posit that excess insulin can cause cancer cells to proliferate. Diabetics treated with the drug metformin, which lowers insulin levels, appear to have a lower risk of many cancers, including pancreatic and breast. It is unclear, however, whether metformin's anti-cancer activity is related to insulin<sup>2</sup>.

Recent research has confirmed the complementary effect: losing weight can make a person less prone to cancer. Researchers in Sweden, for example, tracked two groups of 2,000 overweight men and women and found that bariatric surgery cuts the risk of cancer in women by 42% (ref. 3). Another study found that gastric bypass cut the risk of developing cancer by 24% and the risk of dying of cancer by 46% (ref. 4). (In both studies, this trend held only for women, not men, which suggests weight loss may have a particularly large impact on breast and endometrial cancers<sup>5</sup>.)

Regular exercise can cut cancer risk as well—and not just because it often leads to reduced weight<sup>6</sup>. "We've been able to tease out the individual effects of being physically active versus being overweight," says Christine Friedenreich, a cancer epidemiologist and leader of population health research at University of Calgary in Canada. One theory is that active people tend to digest food faster. "Being physically active may decrease

## LIFESTYLE

# Breaking the cancer habit

*It's the simple things in life that sometimes mean the most to people—and do the most good.*

BY CASSANDRA WILLYARD

**D**rug companies spend billions of dollars developing high-tech therapies to deploy against cancer. Yet millions of people still die of the disease each year. Preventing cancer appears to be a far simpler proposition. The most effective steps to curb cancer are low-tech: get people to stop smoking and lose weight. Smoking, long known to be a risk factor, and obesity, more recently recognized as one, together account for roughly half of all cancer cases. But as anyone who has tried to kick the habit or lose a few pounds knows, both steps are easier said than done.

To have a real impact on cancer, health officials need to address the "causes of causes of cancer," says Michael Marmot, an epidemiologist at University College London (UCL). That means finding new ways to curb smoking and obesity. "Simply telling people not to get fat is not very effective," says Marmot. Policies that

make unhealthy lifestyles more inconvenient and expensive, while making healthier ones easier and cheaper, can have a large impact. So can medical interventions. For example, researchers are developing new ways, such as the nicotine vaccine, that might help smokers quit for good.

## EAT LESS, MOVE MORE

Many studies in the past couple of decades have examined the impact of dietary factors on cancer risk (see The omnivore's labyrinth, page S22). How much we eat may be as important as what we eat. But overeating may be more important than choosing the right foods. In a study that followed 900,000 adults for 16 years, researchers at the American Cancer Society (ACS) found a significant association between body mass index and higher mortality owing to cancers of the oesophagus, colon, liver, gallbladder, pancreas, kidney, breast (in women), uterus, cervix, ovary, prostate and stomach (in

the chance of any carcinogenic products that happen to be going through the colon to have contact with the mucosal lining," she explains. Similarly, better lung function in fit individuals could limit their exposure to airborne carcinogens. Hormones might also be a factor. Friedenreich and her colleagues found that postmenopausal Canadian women who walked for about three hours a week had lower oestrogen levels after a year than sedentary women<sup>7</sup>.

## HEALTHY INFLUENCES

Providing consumers with better nutritional information may help them choose a more nutritious diet and avoid the obesity that raises their cancer risk. Toward that end, David Katz, director of the Yale-Griffin Prevention Research Center, has developed an algorithm for ranking foods according to their overall healthiness. The formula, NuVal, accounts for ingredients including salt, vitamins, saturated fat, fibre, sugar, cholesterol, protein, as well as overall calorific value. It assigns each food a score between one and a hundred<sup>8</sup>. The higher the value, the healthier the food (pineapple 99, butter cookie 1). According to Katz, NuVal has been used to score more than 90,000 foods.

Economic incentives can also change nutritional behaviour. In January 2011, Wal-Mart, the largest grocer in the United States, pledged to lower the price of fruits and vegetables, cut salt and sugar content in packaged foods, and stop selling any foods containing trans fats within the next five years.

In 2010, the US Department of Agriculture launched a pilot study to see if cutting the price of fruit and vegetables would prompt low-income families to eat more of them and reduce their consumption of less healthy foods. The 1,500 participating families will get 30 cents added to their food benefit card balance for every dollar they spend on fruits and vegetables. The study is set to begin in late 2011 and wrap-up in 2013.

An alternative strategy would be to tax unhealthy foods, like soda and sugary sports drinks. Denmark already has such a tax. "They put a very high tax on sugar-sweetened beverages, a medium tax on diet beverages, and no tax on water and low-fat milk," says Barry Popkin, a nutritionist at the University of North Carolina's Interdisciplinary Center for Obesity.

A study published in February 2011 hints that taxing the unhealthy foods might be the best approach. Researchers at the State University of New York at Buffalo recruited 42 mothers to shop at a simulated supermarket stocked with pictures of everything from whole wheat bread to bananas to carbonated sweet drinks. Each participant was given \$22.50 and asked to select a week's worth of food. During five 'shopping trips', the researchers manipulated the prices of the foods, first charging prices comparable to a local grocery store, then lowering the price of healthy foods by 12.5% to 25%, and then hiking the prices of unhealthy foods by roughly the same amount. Result: raising the price of junk food lowered the total calories purchased. Healthy food subsidies, on the other hand, increased the total amount of fat, protein and carbohydrates bought. The participants spent the money saved to buy junk food<sup>9</sup>.

Neither taxes nor subsidies will end the obesity epidemic. But just because an intervention doesn't lead to weight loss doesn't mean it's a dud, says Katz. He compares obesity to a flood. Each intervention, he says, is a sandbag in a much-needed levee. "No one of them by itself can stop the flood," he says. "Only when we've done enough of these things in enough places will they add up to be a levee that's higher than the floodwaters."

Smoking still accounts for a third of all cancer deaths. And tobacco, unlike most foods, is addictive. So kicking the habit often requires medical intervention.

Most over-the-counter smoking-cessation

therapies, such as the nicotine patch and nicotine gum, curb the symptoms of withdrawal by providing small doses of nicotine. Alternative strategies aim to make smoking less addictive. Varenicline, for example, a drug approved in 2006 and marketed as Chantix, partially binds to the nicotine receptor in the brain. It is designed to block nicotine, and also to partially activate the receptor. The idea is to prevent smokers from getting a rush if they smoke, but to give them enough dopamine to help curb cravings. And NicVax, an anti-smoking vaccine in phase III trials, prompts the body to raise an immune response against nicotine. "When someone smokes, the antibody attaches itself to the nicotine molecule," says Dorothy Hatsukami, a specialist in tobacco addiction at the University of Minnesota's Masonic Cancer Center. Bound together, the two molecules are too large to penetrate the blood brain barrier. "It reduces the level of nicotine that can enter the brain at any one time," says Hatsukami, who is leading one of the NicVax trials.

Anti-smoking regulations could have an even greater impact on cancer. In 2009, US lawmakers gave the Food and Drug Administration (FDA) unprecedented power to regulate tobacco. The FDA now prohibits all flavourings, with the exception of menthol, and requires tobacco product manufacturers to register their products with the FDA. The statute also gives the FDA the power to limit the amount of nicotine in tobacco products. In theory, the agency could cut nicotine to levels that would "render the products less or non-addictive," says Clifford Douglas, a tobacco control specialist who heads the University of Michigan Tobacco Research Network. Such a restriction could have an enormous impact. "If one wants to cut seriously into the tobacco epidemic, they must deal with nicotine." Local regulations can play a role as well. Cities all over the world have banned smoking in bars and restaurants, but some are going a step further. In February 2011, city councillors in New York City voted to ban smoking in public parks, beaches and boardwalks.

With respect to both obesity and smoking, part of the battle involves convincing people that much cancer is, in fact, avoidable. That could prove challenging, Marmot says. "I think most people think cancer is an act of God or Darwin."

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## RISK AND REWARD

Through diet and exercise, individuals can take some control over their susceptibility to cancer.

