

Symposium on ‘Nutrition: getting the balance right in 2010’

Session 4: Getting balanced nutrition messages across Communicating actionable nutrition messages: challenges and opportunities

Jeanne P. Goldberg* and Sarah A. Sliwa

The Friedman School of Nutrition Science and Policy at Tufts University, 150 Harrison Avenue, Boston, MA 02111, USA

As long as health communications have existed in the USA, Americans have faced the task of sorting the agenda of the source from the advice it provides. That task has become more complicated as advances in the science of nutrition and the technology used to present it have heightened the complexity of nutrition communications. Getting consumers to adopt a healthier diet has been a protracted undertaking with limited successes along the way. The obesity epidemic has added urgency to this discourse: not only do we need to eat better, but most of us also need to eat less. This paper reviews the dynamics that have made the communication of accurate and actionable health behaviour information an ongoing challenge, and outlines strategies for moving ahead. It considers the interplay of four sets of factors: the evolutionary nature of the science on which recommendations are based; the many sources of communication about that science; the agendas or motivations of each source; and finally the multifaceted nature of consumers, the recipients of these communications. Communication alone has not been, and will not be, sufficient for consumers to adopt the behavioural changes endorsed by experts. Broad environmental interventions coupled with individual skills development will need to be part of the process. Ultimately, it is the consumer who decides what is for dinner. Media literacy will play a critical role in building consumer efficacy in sorting fact from fiction in order to select food for a healthful diet.

Nutrition: Communications: Behaviour: Change

Health communication in the USA traces its origins to the Reverend Cotton Mather, a minister who began preaching at the North Church in Boston in the late 17th century. A participant in the Salem witch trials, Mather is often linked to the hanging of innocent women considered to be witches⁽¹⁾. However, he was also interested in medicine and worked with Dr Zabdiel Boylston on the development of a smallpox vaccine. Convinced of its benefits in controlling the deadly disease, Mather used his pulpit to urge parishioners to get vaccinated. Unfortunately, there are no records of just how many followed his advice to *engage in a single behaviour with demonstrated effectiveness to protect against a disease to which they most surely felt susceptible*. Modern health communications students might view this as an early application of the Health Belief Model to influence individual behaviour⁽²⁾. In recent times,

health educators have advocated strongly for the use of theoretical models in the design and implementation of effective communications⁽³⁾.

Nutrition recommendations became the province of early preachers a century later. Sylvester Graham, a Presbyterian minister, described as an ‘American dietary reformer,’ believed that a vegetarian diet cured alcoholism and sexual urges⁽⁴⁾. Appealing to the chronic dyspepsia of his time, Graham boasted that his bread, first prepared in 1829, was made from ‘unsifted’ flour and free from chemical additives, such as alum and chlorine⁽⁴⁾. His hypothesis, which pre-dated our understanding of nutrients found in bran, was that lost bulk diluted the health of our diets⁽⁴⁾. Graham had a strong influence on Dr John Harvey (J.H.) and Will Keith (W.K.) Kellogg, brothers best known for the cereal company that bears their name. The brothers

Abbreviation: USDA, US Department of Agriculture.

*Corresponding author: Professor Jeanne P. Goldberg, fax +1 617 636 3727, email Jeanne.goldberg@tufts.edu

developed cereal flakes in 1896 as a bread substitute for John Harvey's patients at his Battle Creek sanatorium⁽⁵⁾. W.K., the more entrepreneurial, saw an opportunity to compete with C.W. Post, who manufactured Grape Nuts and was viewed as Kellogg's chief rival⁽⁶⁾. W.K. added sugar to corn flakes and pursued an aggressive marketing campaign^(4,6). By appealing to taste first, and then health, the Kellogg's brand took off. Since then, the essential nature of taste before health has been a continuous challenge to those who urge Americans to consume more healthful diets.

From these beginnings, the intertwining of nutrition information and misinformation has frustrated scientists, health providers, communicators, and most importantly, consumers. This paper traces the evolution of nutrition communication in the USA and its effect on behaviour from just before the turn of the 20th century, when the federal government first began advising Americans how to eat, until now. It considers the interplay of four sets of factors: the evolutionary nature of the science; the many sources of communication about that science; the agendas or motivations of each source; and finally the complex nature of consumers, the recipients of these communications. It seeks to explain how the interplay of these factors has made the communication of sound, timely, information to improve consumer health an ongoing challenge. While the paper's goal is to discuss applications in the United States, many of the issues addressed are relevant to European readers.

Why changing behaviour is so difficult

Nutrition science is evolutionary not revolutionary

In an ideal world, evidence based knowledge that derives from scientific inquiry would inform all communication about recommended dietary behaviours. If that was the case, specific dietary guidance to the public would come from a respected authority *only* when there was solid scientific agreement on a given nutrition topic. Ancillary messages from other sources would augment that advice with consistent actionable behaviours. That scenario is both impractical and highly unlikely. As we will discuss, even recommendations that appear most solidly grounded in scientific evidence may be modified as a result of continued scientific inquiry, technological innovations and re-evaluation of past observations.

The case of dietary behaviours and CVD illustrates the problem. A link between diet and atherosclerosis was first observed in rabbits in 1904⁽⁷⁾. More than 50 years later, the relationship between diet and serum cholesterol levels was widely accepted. The first guidance for the public was not released until 1977, when the US Senate Select Committee on Nutrition and Human Needs recommended that Americans limit the percentage of kJ (kcal) from total and saturated fat and their cholesterol intake⁽⁸⁾. In 1980 recommendations for dietary modification to reduce the risk of CVD and stroke in the population were articulated in the first *Dietary Guidelines for Americans* written by an expert panel appointed by the US Department of Agriculture (USDA) and the US Department of Health,

Education, and Welfare, later renamed Health and Human Services⁽⁹⁾. Lack of consensus among the authors of that document is reflected in the consumer booklet:

‘There is controversy about what recommendations are appropriate for healthy Americans.’

Dietary Guidelines for Americans 1980⁽⁹⁾

But for the US population as a whole, the authors concluded that a reduction in intake of total fat, saturated fat and cholesterol was sensible. Controversy was acknowledged in a similar statement five years later⁽¹⁰⁾, but by 1990, the guideline for consumers seems to reflect a growing consensus:

‘Most health authorities recommend an American diet with less fat, saturated fat and cholesterol.’

Dietary Guidelines for Americans 1990⁽¹¹⁾

The basic concepts of dietary fat recommendations have changed relatively little over the last 30 years, although subtle modifications to the language of the Guidelines reflect evolving thinking among scientists. For example, the 1990 guideline, which recommends limiting fat to 30% of total kJ (kcal), reflects the belief that restricting total fat would also lead to a reduction in saturated fat. With growing evidence that the types of fat mattered, thinking began to shift^(12–14). In 2000, the Dietary Guidelines Advisory Committee concluded that ‘the scientific evidence does not support assigning first priority to a diet low in fat’⁽¹⁵⁾. The guideline communicates this shift by encouraging a ‘moderate’ rather than ‘low’ fat intake.

Two things had become clear. First, to limit total fat intake, consumers had turned to ‘low fat’ products which often were *not* lower in total kJ (kcal) than their full fat counterparts. In fact, excessive consumption of these products was associated with undesirable weight gain⁽¹⁶⁾.

‘... Low fat doesn't always mean low calorie,’ the 2000 guidelines warned. ‘Sometimes, extra sugars are added to low-fat muffins or desserts, for example, and they may be very high in kJ (kcal).’⁽¹⁷⁾

Second, substitution of highly refined carbohydrates had undesirable effects on serum lipid levels in some individuals^(18–20). The 2005 Dietary Guidelines acknowledge these observations by endorsing an increased intake of whole grains. They also emphasise the undesirable effects of *trans* fatty acids on cardiovascular health⁽²¹⁾.

The most recent Dietary Guidelines Advisory Committee has now delivered its recommendations to the USDA and US Department of Health and Human Services. These are currently being translated into the 2010 Dietary Guidelines⁽²²⁾. The language in the report reflects an increasing focus on the type, rather than overall fat content of the diet⁽²²⁾.

The committee suggests that consumers first try to limit their intakes of saturated fat to 10% of total kJ (kcal) and gradually cut back to 7%, acknowledging the gap between current consumer behaviour and the scientifically desirable goal⁽²²⁾. The 2010 report singles out a reduction in solid fat, along with added sugars, estimated to provide 35% of total kJ (kcal), as an effective way to achieve a ‘badly

needed' reduction in energy intake⁽²²⁾. This increased emphasis on reducing saturated fat reflects the high level of concern over the energy imbalance that is leading to the obesity crisis in the US. Unfortunately, few consumers know how many kJ (kcal) they consume, let alone the percentage of those kJ (kcal) that comes from saturated fat⁽²³⁾.

The example of dietary fat recommendations is replayed in more specific recommendations to prevent hypertension, certain cancers, osteoporosis and other chronic diseases. These are generally articulated by a committee of experts, with careful attention to the science that underlies them, for consumers, who typically do not choose the foods they eat with an eye to prevention of one or more specific diseases, or to chronic disease prevention in general⁽²⁴⁾.

Talking to consumers about nutrition: many voices, many perspectives

The fundamental purpose of nutrition science and the policies derived from it is to influence consumer behaviour. That requires persuasive communication. The problem is that communication comes from multiple sources, often with different perspectives, different biases and different agendas. This communications web includes all levels of government, non-profit groups and advocacy organisations, the media, the food and beverage industries and consumers themselves. Each group has its own perspective on topics relevant to them.

Scientists

The primary career goal for most scientists is to contribute to the evidence base in their area of expertise and to stimulate discussion among peers. As a group, they enjoy a high level of credibility with the public. Many are excellent communicators and choose to explain their research to the public through popular books, in speaking engagements and other media appearances, and, more recently, through social media channels. As long as the science they present has gone through peer review and is presented in the context of the larger body of evidence on the topic that is fine. A problem can occur when individuals who may or may not have recognised credentials position themselves as authorities and speak to the public with information and advice that is not evidence-based and may even be inaccurate. Guidance on that issue was considered important enough that it was addressed directly in a set of guidelines intended for those involved in the communication of science, including scientists themselves⁽²⁵⁾.

Academic institutions

Academic institutions seek to increase exposure of research conducted by the scientists who work there, while at the same time, maintaining credibility. As government funding has shrunk, concern over industry-funded research in academic settings has grown. There is a perception that it is more likely to be biased than the research supported by the government and non-profit foundations^(26,27). There is also debate around the role of academic–university

partnerships in shaping research agendas, and about how these relationships should be developed and disclosed^(28–30). Although most universities have conflict of interest guidelines, they vary widely⁽³¹⁾. Recently published guidelines include specific guidance for public communication of research findings and funding sources, acknowledging the importance of providing accurate information to the public⁽³²⁾.

Medical journals

Journals want to publish cutting edge, peer review research. The more successful they are, the higher their impact, the larger the subscription base and the better their advertising revenues^(33–35). To promote the research they publish, they use press releases, and, in some cases, video news releases to help journalists cover stories they believe will be of interest to their viewers/listeners. The *New England Journal of Medicine* does not issue press releases. Instead, it sends embargoed copies to eligible reporters several days before subscribers receive it^(36–38). That gives journalists time to research and prepare more accurate reports, and maximise the number of articles published in that journal that are covered by the media. The effect of this approach on accuracy of reporting does not appear to have been evaluated systematically. Nor do we know the extent to which the decision by a journal to issue press releases for specific articles affects consumer understanding.

The US Government

The US government, mainly through the USDA has provided nutrition information to consumers since the late 19th century. Communications that focused on a nutritionally balanced diet in periods of scarcity during the world war served two agendas: maintaining the health of civilians throughout rationing, and diverting energy dense foodstuffs for the war effort. USDA communications have continued to serve multiple agendas: in addition to having the largest budget for nutrition education and outreach, the department regulates a huge share of our food production system.

The USDA's role in communication of health information has sometimes appeared to be in conflict with its role in agricultural production. Periodically, USDA communications that appear to favour large commodity production have engendered cries of bias from watchdog organisations and individuals who saw tension between agricultural policy and public health interests. This possible conflict has sometimes raised serious questions about USDA judgments⁽³⁹⁾. In 1991, when the USDA released the Food Guide Pyramid graphic, designed to communicate key messages of the 1990 Dietary Guidelines, a *New York Times* headline paraphrased an old saw to reflect its view that the recommendations were biased to encourage more beef consumption: 'Are cattlemen across the country now guarding the hen house?'⁽⁴⁰⁾ Media influence was so powerful that the graphic was abruptly withdrawn for further study⁽⁴¹⁾.

A similar incident occurred when the Dietary Guidelines 2000 were released. In that year, the Dietary Guidelines Advisory Committee recommendation on sugar read:

'Choose beverages and foods that limit your intake of sugars'⁽¹⁵⁾

The version for public dissemination read (italics authors' own)

'Choose beverages and foods to *moderate* your intake of sugars'.⁽¹⁷⁾

Again, there were cries that lobbyists for sugar and sugary foods and beverages had prevailed to allow language sounding more accepting of sugar. The media focused on the question of whether the government was 'soft' on sugar⁽⁴²⁻⁴⁴⁾. The furore faded, but more important, the effect of the language change on consumers was small. In 2005, Americans were consuming triple the amount of sugar recommended⁽⁴⁵⁾. Analysis of National Health and Nutrition Examination Surveys data from 1999 to 2006 show an average consumption of 15.8% of kJ (kcal) from added sugar compared to just over 10% in the late 1970s⁽⁴⁶⁾.

Non-profit and advocacy organisations

Non-profit organisations engage in consumer communication for many reasons, chief among them to influence policy and public opinion, and behaviour. They must also maintain their own visibility in order to raise funds to sustain their organisational missions.

Advocacy organisations. The Center for Science in the Public Interest, an advocacy organisation, has two missions, 'to conduct innovative research and advocacy programs in health and nutrition, and to provide consumers with current, useful information about their health and well-being'⁽⁴⁷⁾. As a watchdog agency, it plays an active role in communicating critical perspectives on issues such as the Dietary Guidelines. Center for Science in the Public Interest staff scrutinise each new edition for signs that recommendations reflect biases, particularly towards large agricultural groups and food producers who may have lobbied hard to modify one recommendation or another. The fact that the Center for Science in the Public Interest receives revenue primarily from newsletter subscriptions and private donations, none of them from industry, is intended to reassure the public that they are 'unbiased.'

The Center for Science in the Public Interest has been extremely successful both in direct communication with the public through their newsletter and in the effective use of mainstream media outlets. Some communications appear balanced. Their Nutrition Policy Brief with the headline 'Most Companies Replace the Trans Fat with Healthier Fats' is a good example⁽⁴⁸⁾. At other times, they are intentionally provocative. Headlines such as the 1994 'Heart Attack on a Plate', used to describe fettucine alfredo, offer an early example of an approach they have continued to use and one which attracts considerable media attention. A recent Nutrition Newsletter that ranked the 'Ten Worst and Best Foods' described a Grands! line of cinnamon roll as 'Burial Grands ... My heart to

yours ...'⁽⁴⁹⁾. The 2010 X-Treme Food Awards that described the topping on one dish as the 'coup de grease'⁽⁵⁰⁾ received coverage in major news outlets across the country, among them the Wall Street Journal, USA Today and ABC News. While these stories are widely covered by the media and raise awareness of the organisation, their contribution to consumer understanding of nutrition and their effect on consumer behaviour are difficult to quantify.

Other non-profit organisations. Another broad group of non-profits, with specific health and diet-related missions, includes organisations such as the American Heart Association and the American Cancer Society. These organisations which must maintain a level of public exposure to sustain the donations that support their work, issue and promote guidelines for diets that may be similar but not identical in language to those of the government (and therefore a source of confusion to consumers). The American Heart Association partners with industry to endorse for a fee, through a logo, food products they judge to be compatible with their own guidelines. How this affects consumer behaviour is unknown, but critics of the program questioned the appropriateness of the endorsement on heavily sugared cereals^(51,52). Since publication of the American Heart Association consensus statement on sugars⁽⁵³⁾, fewer cereals are listed among those carrying the 'Heart Check'. Again the extent to which consumers are influenced by the logo or confused by statements that seem to be in some conflict with more general guidelines is not known.

The food and beverage industries

Finally, there is the food industry, which uses multiple communication channels to sell products. Their mission is to achieve profitable growth through products that align with the public interest; for example food safety, health and nutrition, environmental sustainability, and promote innovation⁽⁵⁴⁾. By producing and promoting the majority of foods found on supermarket shelves, industry plays a pivotal role in shaping our food decisions, desires and demands. Industry responds to each edition of the Dietary Guidelines with new and reformulated products to address recommendations while generating revenue. (In 1996, industry's low-fat reformulations peaked: 2076 new reduced fat and low-fat products were introduced⁽⁵⁵⁾. Introductions slumped by the late 1990s due to declining consumer interest and market saturation⁽⁵⁵⁾. The 2005 Dietary Guidelines recommendation to 'make half your grains whole' was met with product reformulations and introductions, as well as promotions through the Whole Grain Council⁽⁵⁶⁾.) It is not the intent of this paper to focus on the intrinsic qualities of the products that appear (and disappear) each year. Rather, we raise the question of when, whether, and how is it appropriate to promote foods that may contain compounds shown to have specific health benefits.

Vague promises of better nutrition have been an essential part of advertising and promotional materials since the early 20th century⁽⁴⁾. Capitalising on the great discoveries of essential nutrients, food manufacturers began to sell foods nutrient-by-nutrient, a strategy that remains active

today. A 1925 Grape Nuts advertisement in the Ladies Home Journal claimed that 'It is a nourishing food, giving your body dextrins, maltose and other carbohydrates for heat and energy; . . . protein for muscle and body-building; and the essential vitamin-B, a builder of the appetite'⁽⁵⁷⁾. In the 1950s the makers of Wonder Bread[®], an enriched and fortified product, boasted that it could 'build strong bodies eight ways,' a reference to the eight essential nutrients it contained⁽⁵⁸⁾. Advertisements listed the benefits of these nutrients. Approximately 10 years later, the number of nutrients had grown to twelve and Wonder was marketed as ' . . . the bread that helps build strong bodies 12 ways'⁽⁵⁹⁾.

The growing recognition that compounds in foods might protect against one disease or another increased the power of nutrition to sell products. In 1984, Kellogg's decided to ignore a 40-year-old US Food and Drug Administration regulation on health claims on food labels. They obtained a National Cancer Institute endorsement of their claim that 'eating high-fiber foods along with certain other dietary practices 'may reduce your risk of some kinds of cancer,' and that All-Bran was a 'natural high-fiber cereal'. Short-term effects on cereal sales were dramatic⁽⁶⁰⁾. Packaging, promotion and advertising contained a single message that consumers could easily understand and act on.

The US Food and Drug Administration did not pursue legal action against Kellogg's, perhaps because the claims were not seen as misleading⁽⁶¹⁾. However, the company's aggressive sales tactic set in motion a policy-making process, intended to protect consumers from unsubstantiated health claims, that has led to a series of regulations that specify what can and cannot be said on food packages⁽⁶²⁾. Ironically, there are signs that consumers are confused by these statements^(61,63,64) and likely to see a claim as part of a health 'halo' surrounding a product⁽⁶⁵⁾.

Vast amounts of research, often supported by the food industry, continue to explore the role of isolated compounds in health promotion. This research, important to advancing our understanding of the science of food and nutrition, might not be done if it were not of interest to the food industry. Communication of research findings can be highly successful, at least in the short term, in selling foods and beverages. Reporting results of single studies, even before the research has been peer reviewed, with no clear picture of the larger context, may foster confusion and ill-informed choices.

Consumers learn from the media that lycopene in tomatoes may reduce the risk of prostate cancer^(66,67) (only to learn later that this link is not robust⁽⁶⁸⁾); lutein in spinach may cut the risk of degenerative eye disease^(69,70); and resveratrol found mainly in red wine may prevent vascular disease⁽⁷¹⁻⁷⁴⁾. Press releases that promote findings from these studies help ensure that results find their way into mainstream media. The translation and communication of these messages tends to be that one or another compound or food is 'good for you' or 'bad for you.' Tomatoes, almonds, walnuts, pomegranate juice and even red wine, all the subject of recent research, can fit within a healthful diet⁽²¹⁾. However, the selection of any one of these and countless other 'super' foods for special promotion outside the context of a healthful diet is

questionable⁽⁷⁵⁾. This type of communication overwhelms consumers. It may even add up to a message to 'eat more'.

The 'Media'

The media landscape has changed dramatically over the past 15 years and continues to evolve rapidly. Media today include a heterogeneous collection of channels through which to communicate with consumers. Scientists and other health professionals concerned with the influence of communications on consumer confusion about nutrition and health often point to 'the media' as responsible for inaccurate reporting leading to consumer confusion. Several things are often overlooked in this criticism. First, journalists can report only information provided to them and thus, the source(s) rather than the messengers may be responsible for much of the consumer confusion. Second, many scientists, often with their own biases, communicate directly to consumers. It is unrealistic to expect consumers to understand the difference between evidence that is balanced and that which is not.

Third, the 'news hole,' on air time or print space, has been shrinking steadily as fewer people buy newspapers and magazines and rely less on television for nightly news⁽⁷⁶⁾. Between 1995 and 2008, the percentage of individuals who sought nutrition information on the Internet climbed from 3 to 24%, and now ranks third, after television and magazines, and ahead of newspapers⁽²⁴⁾.

Fourth, the introduction of new technologies has accelerated the pace of communication, making it difficult, and sometimes impossible, for journalists to take the time to investigate a study and conduct the level of inquiry required to report it accurately. News coverage is continuous and there is a constant demand for something 'new'. Fewer and fewer news outlets have medical and health reporters on staff to cover very complex topics. Instead, science news is reported by generalists who cover many topics and do not have the background to understand the context of a particular journal article or meeting presentation. Overlaid on this time pressure is the demand by many news organisations that media coverage be sensational to capture its share of the viewer/listener/reader market. All of these factors suggest that increasingly constrained communicators may be more likely to depend on single sources and on information provided through press releases and wire services.

Finally, mainstream use of the Internet has greatly diminished the ability of gatekeepers to filter information. A unique feature of nutrition communication is that everyone eats and therefore has expertise on the topic. Those who wished to do so have always communicated their dietary insights. Now, the Internet has enabled 'citizen journalism' to expand exponentially⁽⁷⁷⁾, raising the challenge for individuals to sort nutrition facts from fiction.

In a recent study of web site content, 110 sites identified by popular search engines (using the terms 'nutrition + diet') were compared to forty websites randomly selected from healthfinder.gov, a government portal, for content quality. Those identified by search engines scored significantly lower ($P < 0.0001$) than those chosen from healthfinder.gov⁽⁷⁸⁾. Sites identified by search engines were

easier to navigate ($P < 0.001$), and had higher usability ($P < 0.0001$)⁽⁷⁸⁾, suggesting that web pages that are the easiest to find and to use may, in fact, not be communicating accurate content. It has also been shown that lay Internet users often base perceptions of credibility on website design and layout⁽⁷⁹⁾.

Somewhat inconsistent with this perception is the observation that consumers say that the sources of the information they use most frequently are the ones they trust the least. A 2008 survey by the American Dietetic Association found that registered dietitians and nutritionists were ranked most credible by nearly 80% of those surveyed. Physicians (61%) and nurses (57%) came next. In contrast, the most frequently used sources were television, magazines and the Internet. Yet only 14% of those who depended on television, 25% of those who used magazines and 22% of those who used the Internet, rated those sources as highly credible⁽²⁴⁾. These findings are consistent with more general findings about Americans' opinion of information they obtain from mass media⁽⁷⁷⁾.

The power and the problem of press releases

Press releases have been and continue to be widely used by virtually all players in the nutrition communication process. The mode of transmission has changed over time, but the purpose has remained constant, quite simply to generate interest. Press releases increase the chance of getting media coverage and they shape subsequent reporting^(80,81). In one recent study, more than one third of US health news stories seemed to rely solely or largely on press releases⁽⁸²⁾.

Publicity associated with a recently published study of the effects of high-fructose corn syrup on rats is a case in point. In recent years, high-fructose corn syrup has become a polarising ingredient. Reports of studies of how it is metabolised by the body have confused understanding of its role in a healthful diet and obscured the more fundamental issue of excess sugar consumption. In March 2010, a paper in *Pharmacology, Biochemistry and Behavior*⁽⁸³⁾ gained attention across academic list servers, in major US newspapers, and on popular blogs. The study had serious design flaws and it is reasonable to believe that it attracted attention because Princeton University issued a press release entitled 'A sweet problem: Princeton researchers find that high-fructose corn syrup prompts considerably more weight gain'⁽⁸⁴⁾. A content analysis of media coverage of the article found that few authors went beyond the press release to include details from the journal article, much less to put the findings into the context of the considerable body of research in human subjects⁽⁸⁵⁾.

A recent study of press releases from the top twenty academic medical centers in the United States found that investigators routinely request press releases to promote their work and are regularly involved in editing and approving them⁽⁸⁰⁾. At all twenty centers, media coverage is an important measure of their success, and most report the number of 'media hits' to the administration. Of the ninety-five releases about primary human research, 77%

provided study size and most quantified the main finding in some way; 47% used at least one absolute number, the most transparent way to represent results. However, only 17% of the human studies were either randomised trials or meta-analyses, while 40% reported on studies with small samples, uncontrolled interventions, primary surrogate outcomes, or unpublished meeting reports⁽⁸⁰⁾. Fewer than half provided relevant limitations. Nearly 30% of the releases were rated as exaggerating study findings and one in four investigator quotes were judged to overstate research importance⁽⁸⁰⁾.

The media: headlines v. content

If the press release is often the first link in the communication chain that sets the tone for talking to the public about nutrition issues, the headlines that follow have a lot to do with how consumers view a story. The problem is that headlines, which are commonly not written by the same person that provides the content, are designed to be provocative enough to capture a reader's attention. Consumers generally do not know this. In fact, the story may well be more balanced than its title suggests. The butter v. margarine story illustrates how media headlines and coverage of the science that follows can shape attitudes among consumers and politicians alike.

Scientists saw 'the trans fat story' as evolving science. Consumers saw it as the butter v. margarine debate, an example of scientists providing confusing, seemingly duplicitous advice. When the 1980 Dietary Guidelines were released, consumers were advised to choose soft margarine and to:

'Limit your intake of butter, cream, hydrogenated margarine, shortening and coconut oil and foods made from such products.'⁽⁹⁾

Unfortunately, to create a butter-like texture, margarines were produced with *trans* fats, which found their way into an increasing number of processed foods. In the early 1990s evidence emerged to suggest that *trans* fats in margarine and other processed foods had a similar physiologic effect to that of butter^(14,86–88). In the 2000 Dietary Guidelines, consumers were advised to limit their intake of *trans* fatty acids⁽¹⁷⁾. By 2005, the advice to limit *trans* fatty acids had become a key recommendation⁽²¹⁾ and in 2006, labelling of *trans* fatty acids on the Nutrition Facts panel of packaged foods became mandatory. The communication of newer knowledge of *trans* fats was reported with what can fairly be described as 'sensationalism.' The effect on consumer attitudes was profound.

'The feeling of being ripped off is acute, says Steve Barnett, a principal with Global Business Network . . . People are saying 'I've spent 10 years eating this stuff I don't like and for what?'

Wall Street Journal, Thursday 24 June, 1993⁽⁸⁹⁾

The subject was covered intensively by the media over the 15 years that the science was evolving, often with highly

provocative headlines and in some cases, in equally provocative text:

- 1990: 'Margarine may boost cholesterol. (*Wall Street Journal*)⁽⁹⁰⁾
'Say it ain't so, oleo. (*Time Magazine*)⁽⁹¹⁾
- 1995: 'Butter bites back and gets respect' (*The New York Times*)⁽⁹²⁾
- 1999: 'Proposal would label per-serving amount of "phantom fat"' (*USA Today*)⁽⁹³⁾
FDA calls for listing 'Stealth Fat' on labels (*The New York Times*)⁽⁹⁴⁾
- 2003: The hidden fat: Some scientists have known about the dangers of trans fats for more than two decades. What took the government so long? (*The Washington Post*).⁽⁹⁵⁾
- 2006: A dangerous fat and its risky alternatives (*The New York Times*).⁽⁹⁶⁾

Consumers may, if they read beyond the first paragraph, and even to the end of the article get the complete and accurate story. An editorial entitled 'Diet Roulette' that appeared in the *New York Times* following the publication of an article in the *American Journal of Public Health* illustrates the point. The copy contained such phrases as:

'... they (Americans) now learn that margarine may also be *lethal* Researchers blame trans fats for more than 30,000 deaths each year'

It is not until the final paragraph that the editorial provides the critical balance:

'... those who eat lots of margarine should not take the latest findings as an excuse to return to butter The best advice ... remains what it has always been: Cut back on all kinds of fats. Less fat almost always means less trans fat as well.'

The outrage generated through articles with headlines and content like this was ultimately effective in driving both policy action and industry reformulation. The message that science evolves was lost in communication.

Getting consumers to adopt healthy lifestyle behaviours: the challenges

For nearly 70 years, dietary advice to consumers focused on groups of foods with nutritionally similar profiles. This advice was captured in recommendations such as the Basic Seven Food Groups and later by the Basic Four⁽⁹⁷⁾. With growing recognition of the role of nutrition in health promotion and disease prevention, dietary guidance shifted to a nutrient-based approach and recommendations such as those for dietary fat and cholesterol. Considerable data suggest that this approach has not served as a powerful influence on consumer knowledge or, more importantly their behaviour, in the desired direction. Studies of consumer understanding of the dietary guidelines for dietary fat over time illustrate the limited progress made in helping consumers develop the knowledge and skills they need in order to make informed choices.

Qualitative research conducted for the 1985 Dietary Guidelines found that not one participant could define fat, saturated fat or cholesterol⁽⁹⁸⁾. Other studies found that consumers remained confused about healthy versus unhealthy fat and about which foods contain which⁽⁹⁸⁻¹⁰⁰⁾. Even when participants were able to correctly recall fat recommendations, they did not feel they knew how to 'get there'⁽⁹⁹⁾.

In focus groups, conducted to prepare for the 2000 Guidelines, consumers said they preferred direct messages. Some were confused by the term 'balance' and by words that seemed too permissive, like 'enjoy'⁽¹⁰⁰⁾. Communications research conducted roughly 5 years later found that familiarity with healthy eating messages did not translate into understanding; some terms remained unclear even though they were 'heard before'⁽¹⁰¹⁾. The 2005 Dietary Guidelines attempted to address the gaps in comprehension and behaviour by changing the intended audience. These guidelines specified that the document was designed for 'policy makers, healthcare providers, nutritionists and nutrition educators,' acknowledging that translation to actionable messages for consumers would depend on the expertise of those who understand consumer behaviour⁽¹⁰¹⁾.

Data from the National Health and Nutrition Examination Surveys and the Continuing Surveys of Food Intakes by Individuals show a decrease in *percentage* of energy from fat over time^(22,102,103). However, *total* grams of fat have been on the rise^(22,102) and greatly exceed recommended intake⁽²²⁾. Average daily energy intake has continually increased since the advent of Dietary Guidelines⁽¹⁰⁴⁻¹⁰⁶⁾, a trend that has influenced the content of subsequent editions. Consumers do not know how many kJ (kcal) they consume or how many they should consume⁽²³⁾. Moreover, a recent national survey found that nearly 30% of consumers had 'never heard' of the Dietary Guidelines and another 48% 'knew very little about them'⁽²³⁾. This makes recommendations about fat as a percentage of total kJ (kcal) rather meaningless. Some experts insist that the 2010 Dietary Guidelines champion a food-based approach⁽¹⁰⁷⁾.

The latest report from the 2010 Dietary Guidelines Advisory Committee differs from earlier versions in significant ways. The first of its four broad recommendations is to 'reduce the incidence and prevalence of overweight and obesity of the US population by reducing overall calorie intake and increasing physical activity⁽²²⁾'. In contrast to previous versions that have addressed the importance of achieving and maintaining a healthy weight, the 2010 edition addresses the obesity epidemic directly. It recommends a shift to a more plant-based diet, and a reduction in added sugars and solid fats⁽²²⁾. To narrow the gap between actual and recommended behaviours for Americans will require broad environmental changes⁽¹⁰⁸⁻¹¹⁰⁾, agricultural changes⁽¹¹¹⁾ and innovative approaches to changing individual behaviours that acknowledge the major determinants of food intake behaviours. Given the increased awareness of linkages between diet and environmental sustainability, it is likely that nutrition messages will become even more complex in years to come.

A fundamental problem is that taste is the primary determinant of what foods most people choose to eat most of the time^(112–115). While it is possible to modify taste preferences for individual foods, as has happened in the gradual shift from whole to lower-fat and fat-free milk^(106,116–118), or to increase consumption of a particular food like broccoli, when consumers are told that it is protective against certain cancers⁽¹¹⁹⁾, dietary changes that require the wholesale cultivation of new tastes are challenging.

For most individuals, health is third or fourth in the hierarchy of individual food choice decision-making^(112,113). In the American Dietetic Association Trends survey, 73% of the respondents said they did not want to give up the foods they like and nearly 80% said they were satisfied with the way they eat⁽²⁴⁾. Only 43% cited a lack of nutrition knowledge as a reason for not doing more⁽¹²⁰⁾. Given the overwhelming evidence that American diets are too high in energy, saturated fat and added sugars, there is clearly a mismatch between dietary recommendations for health and individual attitudes and behaviours. We need more effective ways to persuade consumers that ‘good for you’ foods taste good, can be cost-effective to purchase, and convenient to prepare. Interventions rooted in behaviour-change theory have a critical role to play in advancing these efforts.

The cost of food and the convenience of preparing it interfere with efforts to persuade consumers to change their dietary patterns. One in four believes that it costs more to eat healthfully⁽¹²¹⁾ and 63% said that price played a major role in purchase of a product for the first time⁽¹²²⁾. This sensitivity to price has only increased as an economic recession has compelled consumers to pursue cost-savings strategies^(23,123,124). The increased popularity of turkey burgers is an example where convenience, taste and concerns about health converge⁽¹²⁵⁾, one that can serve as a model for encouraging shifts in eating behaviour.

At the time of the 1969 White House Conference on Food, Nutrition, and Health, Dr Jean Mayer, the chairman, famously called Americans a nation of nutritional illiterates. While change in ‘nutrition literacy’ among Americans is not monitored systematically, it is realistic to assume that, if asked, most Americans can provide a generally accurate description of a ‘healthy diet’ even if they do not understand the differences among fatty acids or even how many kJ (kcal) they should consume. When it comes to dietary details, many report that they are ‘confused,’ and attribute that confusion to their perception that scientists are always changing their minds^(126,127).

An alternate explanation is that the perception of confusion is exaggerated. The disconnect between recommendations and individual choices may be due, in part, to cognitive dissonance, or the conflict over behavioural choices^(128–130). That is, much of the evidence that promotes healthier food choices is in conflict with natural preferences for energetically dense foods. When advised to select foods or diets that conflict with their natural preferences, individuals face two options. One is to ignore the advice. The alternative is to adopt the dietary recommendations being suggested. Those who choose the latter

option, only to find that evidence for that option needs to be modified, often become frustrated.

Opportunities for best practices

There is an unprecedented urgency to the task of motivating American consumers to eat less and to eat differently. This paper has outlined some of the major communication challenges that have limited progress towards that goal in the 30 years since the first set of Dietary Guidelines were issued, and has explored the role of many of the players in the communication of nutrition information. The question remains: how best to use the power of communication to promote healthful consumer behaviours?

Scientists can contribute by taking the time to explain their research in language that journalists can understand, including all press releases that are issued to promote their work. Working together, scientists and press offices in academic institutions have an opportunity to balance the accuracy of the science they promote with language that informs accurate reporting and draws favourable attention to the institution.

Non-profit organisations should accept the challenge of preserving their own identity within the context of the messages of the Dietary Guidelines. Advocacy organisations must continue to play a role in helping to ensure a level communication playing field.

Experts have recommended that industry and government work together to advance the health of American consumers, both in terms of new products and in ways to communicate about them. For consumers who depend heavily on packaged foods, understanding nutrition labels is critical to making informed choices. Front-of-pack labelling, while not discussed specifically in this paper, can provide a major opportunity to assist consumers with making quick yet informed food choices; however, this approach has not yet proven to influence dietary behaviour⁽¹³¹⁾. The White House Task Force on Childhood Obesity has recommended developing a ‘standard system of nutrition labelling for the front of packages’, as well as uniform standards and definitions around marketing to children⁽¹⁰⁹⁾. This report outlines a series of recommendations intended to create environmental changes that make it easier for children to eat healthfully and to be active.

The government, in cooperation with other partners, has the opportunity to communicate behavioural information to consumers in language they understand and accept. That will require extensive consumer research as well as changes in the advisory groups the government convenes. These committees should routinely include experts in consumer communication to avoid creating gaps between the language of the guidelines and the consumer’s ability to comprehend them and to modify behaviour if necessary:

‘... members are typically not consumer experts. Neither are they experts in the qualitative methods required to design educational materials that effectively communicate desired messages. If advice from relevant experts ... were available more readily, debate over the wording of messages would be more informed, and the

text for the final consumer booklet likely would be improved.'

The Dietary Guidelines 2000 Advisory Committee Report⁽¹⁵⁾

Finally, it must be acknowledged that consumers will need to take responsibility for their own diets and those of their families. In addition to the environmental and economical challenges mentioned, a major barrier is the widespread lack of skills in food preparation⁽¹³²⁾. If we are to improve the diets of consumers, we will need to find creative ways to provide them with the intellectual tools they need to understand the most important elements of a healthful diet and the skills they need to purchase and prepare it. Communication alone will not affect behaviour change.

Acknowledgements

No financial support was received for the preparation of the paper. The authors have no conflicts of interest to declare. J. P. G. and S. A. S. participated equally in the preparation of the manuscript.

References

- Best M, Neuhauser D & Slavin L (2004) 'Cotton Mather, you dog, dam you! I'll inoculate you with this; with a pox to you': smallpox inoculation, Boston, 1721. *Qual Saf Health Care* **13**, 82.
- Champion VL & Sugg Skinner C (2008) Chapter 3: The Health Belief Model. In *Health Behavior and Health Education: Theory, Research, and Practice*, 4th ed., pp. 45–65 [K Glanz, BK Rimer and K Viswanath, editors]. San Francisco, CA: Jossey-Bass.
- Rothman AJ (2004) 'Is there nothing more practical than a good theory?': why innovations and advances in health behavior change will arise if interventions are used to test and refine theory. *Int J Behav Nutr Phys Act* **1**, 11.
- Deutsch RM (1961) *The Nuts Among The Berries*, 1st ed. New York: Ballentine Books.
- Kellogg Company (2010) Kellogg Company History, Timeline. Available at <http://www.kelloggshistory.com/timeline.html>
- Carson G (1957) *Cornflake crusade*. New York: Rinehart.
- Dock W (1958) Research in arteriosclerosis – the first fifty years. *Ann Ital Med Int* **49**, 699.
- Food and Nutrition Information Center (2008) *Dietary Guidelines for Americans: A Historical Overview*. Beltsville, MD: National Agricultural Library USDA; available at <http://www.nal.usda.gov/fnic/pubs/bibs/gen/DGA.pdf>
- United States Department of Agriculture, United States Department of Health and Human Services (1980) Nutrition and Your Health: Dietary Guidelines for Americans 1980. Home and Garden Bulletin No. 232. Washington, DC: United States Department of Agriculture, United States Department of Health and Human Services.
- United States Department of Agriculture, United States Department of Health and Human Services (1985) Nutrition and Your Health: Dietary Guidelines for Americans 1985. Home and Garden Bulletin No. 232. Washington, DC: United States Department of Agriculture, United States Department of Health and Human Services.
- United States Department of Agriculture, United States Department of Health and Human Services (1990) Nutrition and Your Health: Dietary Guidelines for Americans 1990. Home and Garden Bulletin No. 232. Washington, DC: United States Department of Agriculture, United States Department of Health and Human Services.
- Hu FB, Stampfer MJ, Manson JAE *et al.* (1997) Dietary fat intake and the risk of coronary heart disease in women. *N Engl J Med* **337**, 1491.
- Hu FB, Stampfer MJ, Manson JAE *et al.* (1999) Dietary saturated fats and their food sources in relation to the risk of coronary heart disease in women. *Am J Clin Nutr* **70**, 1001.
- Willett WC, Stampfer MJ, Manson JE *et al.* (1993) Intake of *trans* fatty acids and risk of coronary heart disease among women. *Lancet* **341**, 581–585.
- Dietary Guidelines Advisory Committee (2000) The Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2000; available at <http://www.health.gov/dietaryguidelines/dgac/>
- Chanmugam P, Guthrie JF, Cecilio S *et al.* (2003) Did fat intake in the United States really decline between 1989–1991 and 1994–1996? *J Am Diet Assoc* **103**, 867–872.
- United States Department of Agriculture, United States Department of Health and Human Services (1990) Nutrition and Your Health: Dietary Guidelines for Americans 2000. Home and Garden Bulletin No. 232. Washington, DC: United States Department of Agriculture, United States Department of Health and Human Services.
- Ludwig D (2000) Dietary glycemic index and obesity. *J Nutr* **130**, 280.
- Liu S, Willett W, Stampfer M *et al.* (2000) A prospective study of dietary glycemic load, carbohydrate intake, and risk of coronary heart disease in US women. *Am J Clin Nutr* **71**, 1455.
- Starc T, Shea S, Cohn L *et al.* (1998) Greater dietary intake of simple carbohydrate is associated with lower concentrations of high-density-lipoprotein cholesterol in hypercholesterolemic children. *Am J Clin Nutr* **67**, 1147–1154.
- United States Department of Agriculture, United States Department of Health and Human Services (2005) Dietary Guidelines for Americans, 2005. Home and Garden Bulletin No. 232. Washington, DC: United States Department of Agriculture, United States Department of Health and Human Services.
- Dietary Guidelines Advisory Committee (2010) Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010; available at <http://www.cnpp.usda.gov/DGAs2010-DGACReport.htm>
- IFIC Foundation (2010) Food and Health Survey: Consumer Attitudes toward Food Safety, Nutrition and Health. Available at <http://www.foodinsight.org/Content/3651/2010FinalFullReport.pdf>
- American Dietetic Association (2008). Nutrition and You: Trends 2008. Report of Results. Available at <http://www.eatright.org/Media/content.aspx?id=7639>.
- Fineberg HV & Rowe S (1998) Based on an advisory group convened by the Harvard School of Public Health and the International Food Information Council Foundation, Improving Public Understanding: guidelines for communicating emerging science on nutrition, food safety and health. *J Natl Cancer Inst* **90**, 194–199.
- Greenberg D (2003) Conference deplores corporate influence on academic science. Speakers argue that corporate funds should be separated from science to prevent undue influence. *Lancet* **362**, 302.

27. Lesser L, Ebbeling C, Gozner M *et al.* (2007) Relationship between funding source and conclusion among nutrition-related scientific articles. *PLoS Med* **4**, 41.
28. Cope MB & Allison DB (2009) White hat bias: examples of its presence in obesity research and a call for renewed commitment to faithfulness in research reporting. *Int J Obes* **34**, 84–88.
29. Atkinson R & Macdonald I (2010) White hat bias: the need for authors to have the spin stop with them. *Int J Obes* **34**, 83.
30. Angell M (2000) Is academic medicine for sale? *New Engl J Med* **342**, 1516.
31. Cho MK, Shohara R, Schissel A *et al.* (2000) Policies on faculty conflicts of interest at US universities. *J Am Med Assoc* **284**, 2203–2208.
32. Rowe S, Alexander N, Clydesdale FM *et al.* (2009) Funding food science and nutrition research: financial conflicts and scientific integrity. *J Nutr* **139**, 1051–1053.
33. Garfield E (1994) Science: The Thomson Reuters Impact Factor. Available at http://thomsonreuters.com/products_services/science/free/essays/impact_factor/
34. Seglen P (1997) Why the impact factor of journals should not be used for evaluating research. *Br Med J* **314**, 497.
35. Garfield E (2006) The history and meaning of the journal impact factor. *J Am Med Assoc* **295**, 90–93.
36. Vanchieri C (1989) New England Journal of Medicine and Reuters near agreement on embargo. *J Natl Cancer Inst* **81**, 562.
37. Kassirer J & Angell M (1994) Violations of the embargo and a new policy on early publicity. *New Engl J Med* **330**, 1608.
38. The New England Journal of Medicine (2010) Embargo Policy. Available at <http://www.nejm.org/page/media-center/embargo-agreement>
39. Sugarman C (1991) Catering to cows and consumers; is the USDA caught in a conflict of interest? *The Washington Post*, 5 June 1991.
40. Burros M (1991) Are cattlemen now guarding the henhouse? *The New York Times*, 8 May 1991.
41. Nestle M (2003) *Politics Versus Science: Opposing the food pyramid, 1991–1992*. *Food Politics*. Berkeley and Los Angeles: University of California Press. p. 51–66.
42. No One ‘Caved In.’ Sugar Guidelines Adhere to Science. *Washington Dateline*, 2000.
43. Dietary Guidelines (2000) Industry Unites to Fight Sugar Limits. *Politics and Policy*.
44. McKinney J (2000) Sugar Industry in Uproar. Baton Rouge, LA: The Advocate.
45. Wells H & Buzby J (2008) Dietary assessment of major trends in US food consumption, 1970–2005. Economic Research Service, US Department of Agriculture.
46. Welsh J, Sharma A, Abramson J *et al.* (2010) Caloric sweetener consumption and dyslipidemia among us adults. *J Am Med Assoc* **303**, 1490.
47. Center for Science in the Public Interest (2009) Mission Statement. Available at <http://www.cspinet.org/about/mission.html>.
48. Center for Science In The Public Interest (2010) Most companies replace *trans* fat with healthier fats, study finds. Available at <http://www.cspinet.org/new/201005261.html>.
49. Nutrition Action Healthletter Archives (2009) Center for Science in the Public Interest. Available at <http://www.cspinet.org/nah/archives.html>
50. Hurley JL & Liebman B (2010) Xtreme Eating 2010. Nutrition Action Health Letter [serial on the Internet]; available at <http://www.cspinet.org/nah/articles/xtreemeating2010.html>
51. Nestle M (2007) Food company sponsorship of nutrition research and professional activities: a conflict of interest? *Public Health Nutr* **4**, 1015–1022.
52. American Heart Association (2010) Heart-Check Mark Nutritional Criteria. Available at http://www.heart.org/HEARTORG/.../NutritionCenter/HeartSmartShopping/Heart-Check-Mark_UCM_300914_Article.jsp
53. Johnson RK, Appel LJ, Brands M *et al.* (2009) Dietary sugars intake and cardiovascular health: a scientific statement from the American Heart Association. *Circulation* **120**, 1011–1020.
54. Grocery Manufacturers Association of America (2010) The Association of Food, Beverage and Consumer Products Companies: About GMA. Available at <http://www.gmaonline.org/publicpolicy/index.cfm>
55. Gallo A (1999) Fewer food products introduced in last 3 years. *Food Review* **22**, 27–29; available at <http://www.ers.usda.gov/publications/foodreview/sep1999/frsept99f.pdf>
56. Center for Nutrition Policy and Promotion (2007) CNPP Fact Sheet No. 2: Trends in Dietary Fiber in the U.S. Food Supply; Sales of Grain Products. p. 5. Available at <http://www.cnpp.usda.gov/Publications/FoodSupply/FiberFact-Sheet.pdf>
57. Post Cereal Company (1925) Vintage Grape Nuts Ad from The Ladies Home Journal.
58. Continental Baking Company International (1953) In Just 7 Days Help Your Child Start Growing Again With Wonder Bread! The Bread That Helps Strong Bodies Grow 8 Ways! The Milwaukee Sentinel. Section 8.
59. Fletcher P (2005) Wonder Bread Struggles to Stay Afloat. NPR; available at <http://www.npr.org/templates/story/story.php?storyId=5070425>
60. Levy A & Stokes R (1987) Effects of a health promotion advertising campaign on sales of ready-to-eat cereals. *Public Health Rep* **102**, 398.
61. Hasler C (2008) Health claims in the United States: an aid to the public or a source of confusion? *J Nutr* **138**, 1216S.
62. Food and Drug Administration. Claims That Can Be Made for Conventional Foods and Dietary Supplements (2003, 2006); available at <http://www.fda.gov/food/labelingnutrition/labelclaims/ucm111447.htm>
63. Garretson JA & Burton S (2000) Effects of nutrition facts panel values, nutrition claims, and health claims on consumer attitudes, perceptions of disease-related risks, and trust. *J Public Policy Mark* **19**, 213–227.
64. Williams P (2005) Consumer understanding and use of health claims for foods. *Nutr Rev* **63**, 256–264.
65. Mitka M (2003) Food fight over product label claims: critics say proposed changes will confuse consumers. *J Am Med Assoc* **290**, 871.
66. Damrosch B (2004) The Well-Red Vegetable Post. *The Washington Post*, 30 December; Section H:07.
67. Hellmich N (2007) Can 14 ‘super foods’ rescue our health? *USA Today*, 18 March 2004.
68. Bakalar N (2007) Lycopene as Cancer Blocker? Review Says Evidence Is Scant. *The New York Times*, 27 July 2007, Section F6.
69. Szabo L (2004) Plant foods to the rescue. *USA Today*, 11 August 2004.
70. Good for You. *The Washington Post*, 7 April 2004, F04.
71. Sinclair D & Komaroff AL (2006) Can we slow aging? A compound found in red wine may extend the human life span. A report from the front lines. *Newsweek*, 11 December 2006, p. 80.
72. Wade N (2006) Yes, red wine holds answer. check dosage. *The New York Times*, 2 November 2006, A:1.

73. Pontin J (2007) An age-defying quest (red wine included). *The New York Times*, 8 July 2007; Business/Financial 3.
74. Wade N (2008) New hints seen that red wine may slow aging. *The New York Times*, 4 June 2008; A1.
75. Freeland-Graves J & Nitzke S (2002) Position of the American Dietetic Association: total diet approach to communicating food and nutrition information. *J Am Diet Assoc* **102**, 100.
76. The State of the News Media (2010) An Annual Report on American Journalism – Overview. Available at http://www.stateofthemediamedia.org/2010/overview_key_findings.php
77. The State of the News Media (2010) An Annual Report on American Journalism. Available at <http://www.stateofthemediamedia.org/2010/>
78. Sutherland L, Wildemuth B, Campbell M *et al.* (2005) Unraveling the web: an evaluation of the content quality, usability, and readability of nutrition web sites. *J Nutr Educ Behav* **37**, 300–305.
79. Meric F, Bernstam E, Mirza N *et al.* (2002) Breast cancer on the world wide web: cross sectional survey of quality of information and popularity of websites. *Br Med J* **324**, 577.
80. Woloshin S, Schwartz LM, Casella SL *et al.* (2009) Press releases by Academic Medical Centers: not so academic? *Ann Intern Med* **150**, 613.
81. Woloshin S & Schwartz LM (2002) Press releases: translating research into news. *J Am Med Assoc* **287**, 2856.
82. Schwitzer G (2008) How do US journalists cover treatments, tests, products, and procedures? An evaluation of 500 stories. *PLoS Med* **5**(5), 700–704.
83. Bocarsly ME, Powell ES, Avena NM *et al.* (2010) High-fructose corn syrup causes characteristics of obesity in rats: increased body weight, body fat and triglyceride levels. *Pharmacol Biochem Behav* **97**(1), 100–106.
84. Parker H (2010) A sweet problem: Princeton researchers find that high-fructose corn syrup prompts considerably more weight gain. Available at <http://www.princeton.edu/main/news/archive/S26/91/22K07/>
85. Sliwa SG & Goldberg JP (2010) Content Analysis of Media Coverage of ‘A Sweet Problem’ Press Release and Associated Journal Article [Qualitative analysis].
86. Mensink R & Katan M (1990) Effect of dietary *trans* fatty acids on high-density and low-density lipoprotein cholesterol levels in healthy subjects. *N Engl J Med* **323**, 439–445.
87. Judd J, Clevidence B, Muesing R *et al.* (1994) Dietary *trans* fatty acids: effects on plasma lipids and lipoproteins of healthy men and women. *Am J Clin Nutr* **59**, 861–868.
88. Wood R, Kubena K, O’Brien B *et al.* (1993) Effect of butter, mono- and polyunsaturated fatty acid-enriched butter, *trans* fatty acid margarine, and zero *trans* fatty acid margarine on serum lipids and lipoproteins in healthy men. *J Lipid Res* **34**, 1–11.
89. Deveny K (1993) Health Doubts Cut Into Margarine Sales. *The Wall Street Journal*, 24 June 1993, Section B1, B10.
90. Bishop JE (1990) Margarine may boost cholesterol. *The Wall Street Journal*, 16 August 1990; Section B:1.
91. Time. Say It Ain’t So, Oleo! 27 August 1990; available at <http://www.time.com/time/magazine/article/0,9171,970996,00.html>
92. Butter Bites Back and Gets Respect (1995) *The New York Times*, 22 March 1995; Section C1.
93. Rubin R (1999) Proposal would label per-serving count of ‘phantom fat’. *USA Today*, 15 November 1999.
94. Stolberg SG (1999) F.D.A. Calls for Listing ‘Stealth Fat’ On Labels. *The New York Times*, 13 November 1999; Section A11.
95. Weinraub J & Writer WPS (2003) The hidden fat: some scientists have known about the dangers of *trans* fats for more than two decades. What took the government so long? *The Washington Post*, 10 September 2003; Section F01.
96. Mason M (2006) A dangerous fat and its risky alternatives. *The New York Times*, 10 October 2006; Section F5.
97. Davis C & Saltos E (1999) Chapter 2: Dietary recommendations and how they have changed over time. In *America’s Eating Habits: Changes and Consequences*, pp. 33–50 [E Frazao, editor]. Washington, DC: Economic Research Service/USDA.
98. Achterberg CL (1994) Qualitative Research: what do we know about teaching good nutritional habits? *J Nutr* **124**(9 Suppl.), 1808S–1812S.
99. Prospect Associates (1995) *Dietary Guidelines Focus Group Report*. Rockville, MD: United States Department of Agriculture Center for Nutrition Policy and Promotion.
100. Geiger CJ (2001) Communicating Dietary Guidelines for Americans: Room for improvement. *J Am Diet Assoc* **101**, 793–797.
101. US Department of Health and Human Services (2005) Toolkit for Health Professionals: Consumer Communication Research Findings and Application. Washington, DC: US Department of Health and Human Services.
102. Wright J, Kennedy-Stephenson J, Wang C *et al.* (2004) Trends in intake of energy and macronutrients – United States, 1971–2000. *JAMA* **291**, 1193–1194.
103. Horn L (2010) Development of the 2010 US Dietary Guidelines Advisory Committee Report: Perspectives from a Registered Dietitian. *J Am Diet Assoc* **110**(11), 1638–1645.
104. Nielsen S, Siega-Riz A & Popkin B (2002) Trends in energy intake in US between 1977 and 1996: similar shifts seen across age groups. *Obesity* **10**, 370–378.
105. Briefel R & Johnson C (2004) Secular trends in dietary intake in the United States. *Annu Rev Nutr* **24**, 401–431.
106. Farah H & Buzby J (2005) US food consumption up 16 percent since 1970. Amber Waves. Available at <http://www.ers.usda.gov/AmberWaves/November05/Findings/usfoodconsumption.htm>.
107. Mozaffarian D & Ludwig DS (2010) Dietary guidelines in the 21st Century – a time for food. *J Am Med Assoc* **304**, 681–682.
108. McLeroy KR, Bibeau D, Steckler A *et al.* (1998) An ecological perspective on health promotion programs. *Health Educ Q* **15**, 351–377.
109. White House Task Force on Childhood Obesity (2010) White House Task Force on Childhood Obesity Report To The President. Solving the Problem of Childhood Obesity within a Generation. Available at http://www.letsmove.gov/pdf/TaskForce_on_Childhood_Obesity_May2010_FullReport.pdf
110. Story M, Kaphingst KM, Robinson-O’Brien R *et al.* (2008) Creating healthy food and eating environments: Policy and environmental approaches. *Annu Rev Public Health* **29**, 253–272.
111. Krebs-Smith SM, Reedy J & Bosire C (2010) Healthfulness of the US Food Supply: little improvement despite decades of dietary guidance. *Am J Prev Med* **38**, 472–477.
112. Finkelstein E, French S, Variyam JN *et al.* (2004) Pros and cons of proposed interventions to promote healthy eating. *Am J Prev Med* **27**, 163–171.
113. Glanz K, Basil M, Maibach E *et al.* (1998) Why Americans eat what they do: taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *J Am Diet Assoc* **98**, 1118–1126.
114. Stewart H, Blisard N & Jolliffe D (2006) Let’s Eat Out: Americans Weigh Taste, Convenience, and Nutrition. Economic Information Bulletin. EIB 19:16. Available at <http://www.ers.usda.gov/publications/eib19/eib19.pdf>

115. Dock W (1960) Diet and atherosclerosis: significance of exceptions that test the rule. *Am J Clin Nutr* **8**, 206–208.
116. Cavadini C, Siega-Riz AM & Popkin BM (2000) US adolescent food intake trends from 1965 to 1996. *Arch Dis Child* **83**, 18–24.
117. Popkin B, Haines P & Reidy K (1989) Food consumption trends of US women: patterns and determinants between 1977 and 1985. *Am J Clin Nutr* **49**, 1307.
118. Putnam J, Allshouse J & Kantor L (2002) US per capita food supply trends: more calories, refined carbohydrates, and fats. *Food Rev USDA* **25**, 2–15.
119. Lucier G (1999) Broccoli: super food for all seasons. *Agricultural Outlook*. Washington, DC: Economic Research Service/USDA.
120. Pirovano T (2010) U.S. Healthy Eating Trends Part 3: Eating Healthy Doesn't Have to Cost More. Nielsen Wire [updated 28 January 2010; 14 July 2010] Press Release; available at <http://blog.nielsen.com/nielsenwire/consumer/u-s-healthy-eating-trends-part-3-eating-healthy-doesn%E2%80%99t-have-to-cost-more/>
121. Food Marketing Institute (2006) *Shopping For Health 2006: Making Healthy Eating Easier*. Arlington, VA: Food Marketing Institute.
122. Food Marketing Institute (2007) *U.S. Grocery Shopper Trends 2007*. Arlington, VA: Food Marketing Institute.
123. Food Marketing Institute (2008) FMI Grocery Shopper Trends (2008): Economic Concerns Shaping How Consumers Shop, Cook and Dine. FMI Grocery Shopper Trends 2008. Food Marketing Institute [Press Release]; available at http://www.fmi.org/news_releases/index.cfm?fuseaction=mediatext&id=935
124. Food Marketing Institute (2009) *Grocery Shopper Trends (2009): Recession changing consumers shopping behavior at the supermarket*. Arlington, VA: Food Marketing Institute; available at http://www.fmi.org/news_releases/index.cfm?fuseaction=mediatext&id=1064
125. Morrison R, Buzby J & Wells H (2010) Guess who's turning 100? Tracking a century of American eating. Amber Waves, March 2010; available at <http://www.ers.usda.gov/amberwaves/march10/features/trackingacentury.htm>
126. Angell M & Kassirer J (1994) Clinical Research – what should the public believe? *New Engl J Med* **331**, 189.
127. Rowe S (2002) Communicating science-based food and nutrition information. *J Nutr* **132**, 2481S.
128. Cummings WH & Venkatesan M (1976) Cognitive dissonance and consumer behavior: a review of the evidence. *J Mark Res* 303–308.
129. Egan LC, Santos LR & Bloom P (2007) The origins of cognitive dissonance. *Psychol Sci* **18**, 978.
130. Lea E & Worsley A (2007) The cognitive contexts of beliefs about the healthiness of meat. *Public Health Nutr* **5**, 37–45.
131. Sacks G, Rayner M & Swinburn B (2009) Impact of front-of-pack 'traffic-light' nutrition labelling on consumer food purchases in the UK. *Health Promot Int* **24**, 344–352.
132. Lichtenstein AH & Ludwig DS (2010) Bring back home economics education. *J Am Med Assoc* **303**, 1857.